FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE OUTRIGGER TELESCOPES PROJECT

VOLUME II

Mauna Kea Science Reserve, Island of Hawai'i

National Aeronautics and Space Administration
Universe Division
Science Mission Directorate
Washington, DC

February 2005

This page intentionally left blank.

VOLUME II: APPENDICES

A REFERENCE CORRESPONDENCE A-1

B SECTION 106 NATIONAL HISTORIC PRESERVATION ACT MEMORANDUM OF AGREEMENT B-1

C BURIAL TREATMENT PLAN C-1

D WĒKIU BUG MITIGATION PLAN D-1

E WĒKIU BUG MONITORING PLAN E-1

F CONSTRUCTION BEST MANAGEMENT PRACTICES PLAN F-1

G COMMENTS ON THE DRAFT EIS G-1

This page intentionally left blank.

APPENDIX A

REFERENCE CORRESPONDENCE

This page intentionally left blank.

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
RAYMOND M. JEFFERSON
DEPUTY DIRECTOR
MARY LOU KOBAYASHI
ADMINISTRATOR
OFFICE OF PLANNING

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-10393

February 26, 2004

Mr. Carl B. Pilcher
Keck Observatory Program Scientist
Astronomy and Physics Division
Office of Space Science
National Aeronautics and Space Administration
Headquarters
Washington, D.C. 20546-0001

Dear Mr. Pilcher:

Subject: Request for Clarification of Coastal Zone Management (CZM) Federal Consistency Applicability for the Keck Outrigger Telescopes Project at the W.M. Keck Observatory Site, Mauna Kea Science Reserve, Island of Hawaii

This responds to your request dated February 12, 2004, for confirmation that a CZM federal consistency review is not required for the proposed Keck Outrigger Telescopes Project at the W.M. Keck Observatory Site, Mauna Kea Science Reserve, Island of Hawaii. In our previous letter dated October 3, 2000, we confirmed that a CZM federal consistency review of the project by the Hawaii CZM Program was not required on the basis that: the National Aeronautics and Space Administration's (NASA) role in the project was only to provide congressionally-appropriated funding for the project; NASA was not the entity responsible for on-site construction of the project; NASA would not be the signatory of any of the required construction and/or operating permits; and NASA would not be the entity responsible for operation of the project. Because NASA's role in the project is exactly the same as previously proposed, our confirmation letter dated October 3, 2000, is still valid.

It should be noted that our October 3, 2000, confirmation that a CZM federal consistency review was not required, specifically addressed the implementation of the project itself and did not address whether a CZM federal consistency review was required for the preparation of a Federal Environmental Assessment. The preparation of a Federal Environmental Impact Statement does not necessarily require CZM federal consistency review, because a Federal agency's federal consistency obligations under the Coastal Zone Management Act are independent of those required under NEPA. This is clarified in 15 CFR 930.37 – *Consistency Determinations and National Environmental Policy Act (NEPA) Requirements*.

This confirmation is not an endorsement of the project nor does it convey approval with any other regulations administered by any other agency. Thank you for your cooperation in complying with Hawaii's CZM Program. If you have any questions, please call John Nakagawa of our CZM Program at (808) 587-2878.

Sincerely,

Mary Lou Kobayashi

Mary Lou Kobayashi
Administrator

c: Planning Department, County of Hawaii

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Ecoregion
300 Ala Moana Boulevard, Room 3-122
Box 50088
Honolulu, Hawaii 96850

RECEIVED
APR 2 2
DIRECTOR
INSTITUTE FOR AST

APR 24 2000

In reply refer to: MSR

Robert McLaren, PhD.
Institute for Astronomy
University of Hawaii at Manoa
2680 Woodlawn Drive
Honolulu, HI 96822

Re: Wekiu Bug Mitigation Plan for the W. M. Keck Observatory, Outrigger Telescope Project at Mauna Kea, Hamakua District, Hawaii

Dear Dr. McLaren:

The U.S. Fish and Wildlife Service (Service) has reviewed the December 1999, Wekiu Bug Mitigation Plan for the W. M. Keck Observatory, Outrigger Telescope Project at Mauna Kea, Hamakua District, Hawaii. The project sponsor is the Institute for Astronomy (IfA). The proposed Wekiu Bug Mitigation Plan (WBMP) was specifically prepared by Pacific Analytics L. L. C. to address potential problems that might arise during the construction and operation of the Outrigger telescopes. It also includes a longer-range monitoring component that will be important in assessing factors that may affect the life cycle and population growth of the wekiu bug. The recommendations of the report will be included in the Final Environmental Assessment (EA) for the W. M. Keck Observatory, Outrigger Telescope Project and will be attached to the Conservation District Use Application (CDUA). The proposed project site is entirely located on ceded land owned by the State of Hawaii and managed by the IfA, an affiliate of the University of Hawaii. The Service offers the following comments for your consideration.

As the WBMP acknowledges, the summit area of Mauna Kea is home to a unique Hawaiian ecosystem. Several endemic lichens, ferns, and arthropods including a lycosid spider (*Lycosa* sp.), a moth species belonging to the genus *Agrotis*, and the wekiu bug (*Nysius wekiuicola*) are found on Mauna Kea and nowhere else in the world. Furthermore, as the WBMP acknowledges, it is possible that construction and operation of the Outriggers could have a deleterious impact on the wekiu bug population. We are pleased that the IfA is committed to do no harm to the wekiu bug population during the proposed construction and operation of the Outriggers. Currently, the wekiu bug is a candidate for Federal listing under the Endangered Species Act. To the best of our knowledge, no other federally endangered, threatened, or candidate species, significant wetlands, or other Federal trust resources occur in the immediate summit area of the proposed project site.

The Service supports the recommendations in the WBMP to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor use. The Service also supports the proposed designation of a Natural and Cultural Preserve Area consisting of over 10,760

acres and its permanent preservation as described in the Mauna Kea Science Reserve Master Plan. We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to wekiu bug habitat.

The Service supports Recommendations IV-1 through IX-3 and requests they be incorporated into the W. M. Keck Observatory, Outrigger Telescope Project final EA. The final EA should identify any of the recommendations that will not be included in the project due to engineering and seismic considerations and include an explanation of the rationale for this decision. The final EA should also include a discussion of the cumulative impacts to wekiu bug habitat within Pu'u Hau Oki crater from the Subaru and Keck observatory sites. Furthermore, the final EA should discuss the best options for dealing with snowfall on the road leading to the observatory. Graded snow and the dust it captures are likely to impact surrounding wekiu bug habitat if not handled properly.

Since astronomy development began on the summit in 1963, only two formal on-site arthropod studies have been conducted. Since 1963, an estimated 25% of the potential wekiu bug habitat has been lost due to astronomy development. Recent studies have corroborated incidental observations that wekiu bug populations have declined. The Service supports the recommendation to include ongoing monitoring of the wekiu bug as a component of the W. M. Keck Observatory, Outrigger Telescope Project. However, we request that the final EA for the project specifically describe a long-term biological monitoring program that will be implemented. The monitoring program should be designed to provide the project sponsor with inferences about ecological changes and the impacts of the project and its management strategies on natural resources within the reserve. The Service would be happy to review the components of a specific program for monitoring the wekiu bug and other resources, when it is available.

The Service appreciates the opportunity to comment on the WBMP, and we look forward to reviewing the W. M. Keck Observatory, Outrigger Telescope Project final EA, when it is available. If you have any questions regarding these comments, please contact Fish and Wildlife Entomologist Mike Richardson by telephone at (808) 541-3441 or by facsimile transmission at (808) 541-3470.

Sincerely,

For Paul Henson
Field Supervisor
Ecological Services

cc: Mr. Michael Buck, DOFAW
Mr. John Giffin, DOFAW

BEN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

TIMOTHY E. JOHNS, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JANET E. KAWELO

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES
ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

May 3, 1999

MAY 07 1999

Dr. Robert A. McLaren, Interim Director
Institute for Astronomy
University of Hawaii at Manoa
2680 Woodlawn Drive
Honolulu, Hawaii 96822

LOG NO: 23155
DOC NO: 9903PM07

Dear Dr. McLaren:

SUBJECT: Request for Historic Preservation (Chapter 6E, HRS) and National Historic Preservation Act (Section 106) Review --W.M. Keck Observatory Outrigger Telescope Project in the Mauna Kea Science Reserve, Ka`ohe, Hamakua, Hawaii Island TMK: 4-4-15:09

Thank you for your letter of March 17, 1999 and the opportunity to review and comment on the Draft Environmental Assessment (DEA) prepared for the proposal to add four to six 1.8-meter "outrigger" telescopes around the two existing 10-meter Keck telescopes located on Pu`u H[illegible] Oki.

Before discussing our review of the DEA, two aspects of the review process need clarification. First, the DEA and your letter correctly indicate that the project needs to comply with Section 106 of the National Historic Preservation Act (NHPA) because federal funds are being used for the project. Your letter, however, asks that we coordinate our review with the Advisory Council on Historic Preservation (ACHP). According to the Section 106 regulations, it is technically the responsibility of the federal agency, in this case NASA, to determine the effect of a project on historic properties and to consult with the State Historic Preservation Office on its determination. The agency may designate another party, such as IFA, to execute its responsibility. We suggest that you or NASA review our comments on the DEA and, if you agree, submit the recommended determination to our office for our official comment. We would be glad to provide you with any information you need on the Section 106 process. Second, your letter asks us to review the finding of "no significant impact" proposed by the DEA. We do not review determinations of this sort because, if we understand correctly, this assessment considers a combination of factors, issues, and subject matters that are beyond our expertise and jurisdiction. Our assessment of effect in the following discussion conforms with our standard review process and we ask that it be incorporated in the final Environmental Assessment.

The DEA proposes that IFA will be requesting a "no effect" determination for the construction of the outrigger observatories when applying for the appropriate permits. To support this finding, the DEA cites past studies and a compliance letter to argue that no historic properties are present in the project area. It notes that no cultural remains were found on Pu`u Hau Oki in a 1982 reconnaissance survey of the summit cones[1] and no sub-surface remains were reported during the construction of the Keck I or Keck II observatories. It concludes that Pu`u Hau Oki appears to be of no particular cultural significance because ethnographic information compiled in conjunction with the 1982 survey did not attribute any particular significance to the *pu`u*.[2] Finally, the DEA cites a "no effect" assessment received from the State Historic Preservation Office (SHPO) for the establishment of optical test sites on Pu`u Hau Oki (Ltr. Wilson to McLaren, June 30, 1998).

As a point of clarification, the first archaeological reconnaissance of Pu`u Hau Oki actually took place in 1981 when a portion of the cinder cone was surveyed as one of the five alternative locations for the proposed Kitt Peak National Observatory data collecting facilities (Ltr. McCoy to Jeffries, June 9, 1981). A third reconnaissance survey of another part of Pu`u Hau Oki was undertaken in 1990 when the 5.1 acre Subaru Observatory site was surveyed[3]. No archaeological sites were found in either of these surveys.

As you are aware, we are currently reviewing historical, ethnographic, and archaeological information on Mauna Kea in the process of preparing an historic preservation plan for the Science Reserve which includes the summit region. During this process, we have come to believe that the cluster of cinder cones which merge and collectively form the summit of Mauna Kea is an historic property and that this single landscape feature probably bore the name Kukahau`ula. This single landscape feature is now called Pu`u Hau Oki, Pu`u Kea, and Pu`u Wekiu. Several lines of evidence lead us to the conclusion that the cluster of cones is an historic property. These will be discussed in more detail in documents being prepared for the preservation plan. The first line of evidence indicating the cultural and historical importance of the summit is that, at a minimum, some portion of the summit cluster bore the name Kukahau`ula who appears as a character in recorded Hawaiian traditions and as a figure in legends about Mauna Kea[4]. As a character in traditional histories and genealogies, he is the husband of Lilinoe and is named as an *`aumakua* (family deity) of fishermen. A descendant. Pae, was known as an exceptional fisherman whose bones were coveted for fishhooks by the paramount chief Umi. In one legend, Kukahau`ula is cast in a more fanciful role as the suitor and husband of Poliahu, the deity of snow and, poetically, his name is said to allude to the pink hue that can be seen reflecting from the snow-covered summit. Lilinoe plays a similar role in the mountain's traditions in that she appears both as a traditional character and a mythical

---

[1] McCoy, P. "Archaeological Reconnaissance Survey." In *Cultural Resources Reconnaissance of the Mauna Kea Summit Region*. Manuscript, Anthropology Department, Bernice P. Bishop Museum, 1982.
[2] McEldowney, H. "Ethnographic Reconnaissance Survey" In *Cultural Resources Reconnaissance of the Mauna Kea Summit Region*. Manuscript, Anthropology Department, Bernice P. Bishop Museum, 1982.
[3] Robbins, J. and H Hammatt. Archaeological Reconnaissance for the Proposed Japanese National Large Telescope, Maunakea, Hawaii. Manuscript prepared by Cultural Surveys Hawaii for MCM Planning, 1990.
[4] Kamakau, S.M. *Ruling Chiefs of Hawaii*. Honolulu: Kamehameha School Press, 1961:215-17. Poepoe, J.M. "Kamehameha I, Ka Nai Aupuni o Hawaii, K Liona o ka Moana Pakipika." *Ka Nai Aupuni*, 1906:April 30. Poepoe, J.M. Bishop Museum Genealogy Book 13:20, B.P. Bishop Museum Library. Taylor, E.A. "Ku-Kahau-ula and Poliahu" *Paradise of the Pacific*, Vol. 44(7):12-15, 1931.

figure[5]. She is, however, even more frequently associated with the summit region of Mauna Kea. In addition to being the wife of Kukahau`ula in some traditions, she is said to have been buried near the summit and is called the "woman of the mountain." One tradition has her being an ancestor of the illustrious Mahi family who served as warriors and attendants to the paramount *ali`i* of Hawaii Island. In legends, Lilinoe becomes the embodiment of fine mist, the literal meaning of her name, and as such is the companion or sister of Poliahu.

The names Kukahau`ula and Lilinoe are both attributed to cinder cones in the summit region: Kukahau`ula to the summit and Lilinoe to a cone immediately to the southeast of the summit cluster. These names, along with that of Waiau, appear on the earliest reliable map in 1884 and are repeated in the next survey of the summit region in 1891 and 1892[6]. Kukahau`ula is given as the name of "the highest peak" even earlier in 1873 land boundary testimonies[7]. Of all the place names in the summit region, these three are applied the earliest and most consistently to specific landmarks on the mountain. In compiling the 1892 map of Mauna Kea, W.D. Alexander refers to these as "genuine native names[8]." The place name Poliahu appears in traditions and native testimonies as being applied to a trail, spring, pond, and cave[9], but it is not consistently applied to a single and identifiable landscape feature until 1892 when W.D. Alexander proposes attaching this name to "a nameless peak" in honor of the demigoddes, Poliahu, who figures in the tale of Laieikawai[10].

While the association between the summit and Kukahau`ula is sufficiently clear, it is not as clear which specific topographic features at the summit are encompassed by the name. The conclusion drawn here that Kukahau`ula, and thus its association with a significant individual and character, probably applied to the entire summit cluster relies on four major arguments. First, use of the name Pu`u o Kukahau`ula in the boundary testimonies and in subsequent

---

[5] Kamakau, S.M. *Ruling Chiefs of Hawaii.* Honolulu: Kamehameha School Press, 1961:215-17, 285. Poepoe, J.M. "Kamehameha I, Ka Nai Aupuni o Hawaii, Ka Liona o ka Moana Pakipika." *Ka Nai Aupuni,* 1906:April 30. Poepoe, J.M. Bishop Museum Genealogy Book 13, page 20, B.P. Bishop Museum Library. Haleole, S.N. "The Hawaiian Romance of Laieikawai.". In *33rd Annual Report of the Bureau of American Ethnology,* Edited by M.W. Beckwith, (1919):480. Taylor, E.A. "Ku-Kahau-ula and Poliahu" *Paradise of the Pacific,* Vol. 44(7):12-15, 1931 Fornander, A. *Fornander Collection of Hawaiian Antiquities and Folk-lore.* Translated and edited by T.G. Thrum. Memoirs of the Bernice P. Bishop Museum, 1919:269. Westervelt, W.D *Legends of Gods and Ghosts.* Boston: H. Ellis, 1915:56.

[6] Lyons, C.J. "North Side of Mauna Kea, Information Sketch." Register Map 1210, Survey Office, State of Hawaii, 1884 to 1891. Lyons, C.J. "Kaohe and Humuula, Hawaii." Register Map 1891, Survey Office, State.of Hawaii, 1891. Alexander, W.D. "Summit Peaks of Mauna Kea." Register Map 1860, Survey Office, State of Hawaii, 1892. Baldwin, E.D. Field Book 323:55, Survey Office, State of Hawaii, 1891.

[7] Boundary Commission Books for Hawaii, Microfilm in Archives of Hawaii, Vol. B:35.

[8] Preston, E.D. "Determination of Latitude, Gravity, and the Magnetic Elements at Stations in the Hawaiian Islands, Including a Result for the Mean Density of the Earth, 1891, 1892. In *Report of the Superintendent of the U.S. Coast and Geodetic Survey for the Fiscal Year Ending June 30, 1893, Part II.* Washington: Government Printing Office, 1895:596.

[9] Kamakau, S.M. *Ruling Chiefs of Hawaii.* Honolulu: Kamehameha School Press, 1961:16. Poepoe, J.M. "Kamehameha I, Ka Nai Aupuni o Hawaii, Ka Liona o ka Moana Pakipika." *Ka Nai Aupuni,* 1906:April 30. Boundary Commission Books for Hawaii, Microfilm in Archives of Hawaii, Vol. B:40, 1873.

[10] Preston, E.D. "Determination of Latitude, Gravity, and the Magnetic Elements at Stations in the Hawaiian Islands, Including a Result for the Mean Density of the Earth, 1891, 1892. In *Report of the Superintendent of the U.S. Coast and Geodetic Survey for the Fiscal Year Ending June 30, 1893, Part II.* Washington: Government Printing Office, 1895:596.

notes of field surveys[11] indicates that the name was applied, at a minimum, to the cinder cone (i.e., *pu`u*) as a whole and not just to the highest peak or what would generally be considered the summit in English usage. Second, on the early survey maps (i.e., 1884 to 1891 and 1891), the name Kukahau`ula is written to the east of the cluster of cones and is not immediately associated with a particular point. In contrast, the highest point on the mountain on these maps is labeled the "summit" and "summit cone" and the triangulation marker on the northeastern peak of the cluster is labeled "Mauna Kea."

The third argument is that place names attributed to the summit cluster are relatively modern because these cones were not differentiated by name until after the 1920s. The name Pu`u Kea, the northeastern part of cluster, first appears in 1937 when commemorative names, such as Macrae, Douglas and Goodrich, were given to other unnamed cones. The names Pu`u Wekiu for the southernmost cone in the cluster and Pu`u Hau Oki for the westernmost cone were recorded by Forester L.W. Bryan in the 1920s and were officially adopted by the Advisory Committee on Geographic Names in 1974[12]. Another factor suggesting the relatively modern origin of these three names is that all are highly descriptive in nature, particularly in contrast to those older names which tend to be associated with traditional or legendary characters. Pu`u Hau`Oki literally means "frosty peak," Pu`u Kea means "white peak," and Pu`u Wekiu means "summit peak." Finally, from most angles of approach, these three named cones or peaks have the appearance of a single, although uneven and complex, landscape feature. It is only after a more thorough examination of this feature that one, if so inclined, would begin to differentiate particular cinder slopes with their associated crater features. Most early historic accounts of visits to the summit essentially describe the summit as a single feature with some parts being higher than others. This is also reflected in the early survey maps which, through hatch marks, depict the cluster of cones as a single unit. At this time, it can not be known with certainty how Hawaiians during the early historic period and their predecessors would have viewed the cluster or what purposes they may have had to make and name particular distinctions within the cluster. Given the unified appearance of the cluster and the prominence of the name Kukahau`ula, however, it seems reasonable, if not probable, that this name applied to this entire landscape feature, including that which is now called Pu`u Hau Oki.

Another line of evidence indicating the summit cluster was of particular and singular significance can be drawn from the archaeological data. The distribution of known shrine locations essentially radiates, at various distances, outward from the base of the summit cluster. This suggests that the summit cluster could have been the central focus of ritual observances and that part of these observances was to avoid or stop short of this central feature. This is further supported by there being no records, with one possible exception (i.e., a 1935 photograph of a slab and stone mound at the summit peak[13]), of shrines on the summit cluster. The practice of avoiding or staying outside that area of greatest significance is common in many religious observances recorded throughout the world. Thus the summit cluster could have been a focal point of the presumably long journey to the summit region. Avoidance of the summit, or the summit region as a whole, for fear of the spiritual nature of

---

[11] Boundary Commission Books for Hawaii, Microfilm in Archives of Hawaii, Vol. B:35, 1873. Baldwin, E.D. Field Book 323:55, Survey Office, State of Hawaii, 1891.

[12] Bryan, L.W. Letter to Libert K. Landgraf, December 31, 1973, Department of Planning and Economic Development. Mark, Shelley. Memorandum to Members of Advisory Council on Geographic Names, March 13, 1974, Department of Planning and Economic Development.

[13] Bryan, E.H. *Mauna Kea Here We Come: The Inside Story of an Scientific Expedition.* Honolulu: Privately Published, 1979:35.

this area may be one explanation for the number of times native Hawaiian guides refused or found excuses not to accompany early historic visitors to the summit. In discussing his tour of Hawaii Island in 1823, missionary William Ellis noted that he was told "numerous fabulous tales relative to its [Mauna Kea] being the abode of the gods, and none ever approach its summit..."[14]

Given our conclusion that Pu`u Hau Oki is part of an historic property, we believe the proposed construction of four to six outrigger telescopes on the site of the W.M. Keck Observatory will have an "adverse effect" both on this historic property and on the summit region which we believe is eligible for inclusion in the National Register as an historic district. In the historic preservation plan we will also be proposing that the summit region of Mauna Kea is eligible for inclusion in the National Register of Historic Places as an historic district because it encompasses a sufficient concentration of historic properties (i.e.. shrines, burials and culturally significant landscape features) that are historically, culturally, and visually linked within the context of their setting and environment. Tentatively the boundaries of this district will coincide with the extent of the glacial moraines and the crest of the relatively pronounced change in slope that creates the impression of a summit plateau surrounding the cinder cones at or near the summit (i.e., generally the area above the 11,600 to 12,000 foot contour). The cluster of cones forming the summit, including Pu`u Hau Oki, would be a contributing property to this district. We believe, however, that these "adverse effects" can be mitigated if appropriate measures are adopted. To be in compliance with the Section 106 regulations, these mitigation measures need to be stipulated in a signed Memorandum of Agreement (MOA). The MOA should also address those activities occurring at the stockpiling area which could affect, indirectly, the surrounding areas which are also part of the historic district.

The MOA should be relatively easy to prepare as the DEA has already proposed many of the measures we would find appropriate, including those to be executed during the construction phases and those designated as long-range plans. Descriptions of these measures would need to be slightly reworded to explain how these actions would specifically curtail any further degradation of the summit *pu`u* or the historic district. For example, appropriate measures would include those proposed to stabilize the cinder cone slopes, control the accidental dispersal of debris during and after construction, determine the disposition of excavated material which cannot be reused on site, minimize the visibility of the outrigger observatories within the summit region as well as from a distance, and reduce noise during construction and operation of the observatories. In the case of Puu Hau Oki, mitigation should focus on measures that would prevent or minimize those actions that would further deteriorate the structural and visual integrity (i.e., shape and contour) of the cinder cone and its crater.

The history of the project site given on page VI-1 indicates that 34 feet of earth was removed from the top of the site during the construction of the Keck I telescope. We would concur that this alteration effectively precludes the presence of burials. What isn't clear is the exact history of the 71,700 square feet, apparently the site of Keck II, which was left "in its natural state." The description says that this area was leveled during the construction of Keck II. The process of leveling this area or covering it with excavated material from the Keck I site would not necessarily preclude the possibility of burials because they could lie at moderate depths below the natural surface. The specific history of the northern part of the project area should be clarified and, if ground surfaces still exist that were only superficially altered, then we feel

---

[14] Ellis, W. *Journal of William Ellis.* 1827 London ed. and 1917 Hawaii ed. Reprint, Honolulu: Advertiser Publishing, 1963:292.

some provision for dealing with potential burials. These should be included in the MOA for the proposed excavation of the light pipes, junction boxes and tunnels. In the historic preservation plan we are currently preparing, we will be asking that any excavation taking place on the summit cones be subject to testing and/or monitoring. This measure would address the persistent claim that burials were previously disturbed during construction of an observatory and the fact that known and suspected burials are present on other cinder cones in the summit region. Exceptions would be those areas that have been previously altered to such an extent that this degree of alteration would preclude the possibility of remaining burials.

To be in compliance with the 1992 amendments of the NHPA, the federal agency or its designee needs to consult with native Hawaiian organizations on undertakings that could have a potential effect on historic properties which are of religious and cultural significance to them. We suggest that you consider contacting those native Hawaiian groups and individuals who have been identified as having a particular interest in Mauna Kea during preparation of the new Mauna Kea Master Plan.

On another matter, concerns have been raised that this assessment and the pending permit applications may be approved and construction begin before the new Mauna Kea Master Plan has been completed and adopted. We agree it would be preferable to complete the application process after the new Master Plan has been adopted. While we feel there is sufficient information to assess the effects of this project on historic properties, it would be preferable to know that the final decisions were made within the context of the new, long-term development and management plan for the summit region.

Our detailed comments on the DEA can be found in Attachment 1. If you should have any questions about our review comments please contact either Patrick McCoy (692-8029) or Holly McEldowney (692-8028).

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

PM:amk

APPENDIX B

SECTION 106 NATIONAL HISTORIC PRESERVATION ACT MEMORANDUM OF AGREEMENT

This page intentionally left blank.

MEMORANDUM OF AGREEMENT
Among
The National Aeronautics And Space Administration,
The Advisory Council On Historic Preservation,
The Hawai‘i State Historic Preservation Officer,
The University of Hawai‘i,
The California Association for Research in Astronomy, and
The California Institute of Technology,
Regarding The Outrigger Telescopes Project,
Mauna Kea, Hawai‘i

WHEREAS, the National Aeronautics and Space Administration (NASA) has determined that the placement of the four, and potentially six, Outrigger Telescopes (hereinafter referred to as the "Undertaking") adjacent to the existing Keck Telescopes at the W.M. Keck Observatory (WMKO) on the summit of Mauna Kea, will meet the purpose and need of NASA's ground-based interferometry objectives; and

WHEREAS, by signing this Memorandum of Agreement (MOA), the Signatory or Concurring Party does not necessarily signify that the party approves of the Undertaking, but rather that the provisions of the MOA are an appropriate means to mitigate effects on cultural resources in the event that the Undertaking obtains all required approvals and is implemented; and

WHEREAS, NASA has been considering other alternatives, including the No Action alternative; and

WHEREAS, NASA acknowledges that the Native Hawaiian people place spiritual and religious significance on Mauna Kea; and

WHEREAS, NASA has determined that the Undertaking will have an adverse effect on Pu‘u Hau ‘Oki, one cinder cone within the cluster of cinder cones which merge and collectively form the summit of Mauna Kea. This single landscape feature (*i.e.*, cluster of cinder cones) probably bore the name Kūkahau‘ula and is now called Pu‘u Hau ‘Oki, Pu‘u Kea, and Pu‘u Wēkiu. NASA, in consultation with the State Historic Preservation Officer (Hawai‘i SHPO), has determined that this cluster of cones satisfies the criteria to be eligible for listing as an historic property in the National Register of Historic Places (hereinafter referred to as the "National Register"); and

WHEREAS, NASA has determined that the Undertaking will have an adverse effect on the summit region of Mauna Kea, an area that NASA and the Hawai‘i SHPO agree satisfies the criteria for listing as an historic district in the National Register; and

WHEREAS, NASA recognizes that human burials exist in the summit region of Mauna Kea; and

WHEREAS, NASA has made a commitment that a Wēkiu Bug Mitigation Plan will be prepared and implemented as a part of the Undertaking and has determined that some components of the mitigation plan, including certain activities associated with habitat restoration and monitoring, could have an effect on the historic property and historic district; and

WHEREAS, NASA is aware of a complex of historic properties located to the south and west of the staging area at Hale Pōhaku, and the concern of the Hawai‘i SHPO to avoid any potential effects on two historic properties (*i.e.*, shrines) located directly south of the staging area; and

WHEREAS, NASA has consulted with the Hawai‘i SHPO and the Advisory Council on Historic Preservation (hereinafter referred to as the "Council") on ways to avoid, reduce, or mitigate these adverse effects, pursuant to 36 CFR Part 800, regulations implementing Section 106 of the National Historic Preservation Act (NHPA) (16 U.S.C. 470f), and has invited the Hawai‘i SHPO and the Council to participate in the development of this MOA and sign as Signatories; and

WHEREAS, NASA has consulted with and invited those parties who will construct, install, operate, and manage the Outrigger Telescopes—including the California Association for Research in Astronomy (CARA), which will supervise on-site construction, installation, and operation of the Outrigger Telescopes; the University of Hawai‘i (UH), which has the responsibility for the overall monitoring and management of the Mauna Kea Science Reserve; and the California Institute of Technology (Caltech), which holds the sublease for the WMKO site—to participate in the development of the terms of this MOA and sign as Signatories; and

WHEREAS, NASA is aware of the historic/cultural significance of Mauna Kea and has conducted and participated in outreach and consultation efforts in Hawai‘i to inform local communities, organizations, and the general public of its plans for the proposed construction and operation of the Outrigger Telescopes and their effects on historic properties, and has invited and considered input on potential measures that could avoid, minimize, or mitigate the effects to the historic properties on Mauna Kea; and

WHEREAS, NASA has consulted with and invited the Office of Mauna Kea Management, Mauna Kea Management Board, and Kahu Ku Mauna (hereinafter collectively referred to as OMKM) to participate in the development of this MOA; and

WHEREAS, NASA has consulted with and invited the State Office of Hawaiian Affairs (OHA), and the following Native Hawaiian organizations, the Hawai‘i Island Burial Council (hereinafter referred to as the "Burial Council"), the Royal Order of Kamehameha I, Ahahui Ku Mauna, Mauna Kea Anaina Hou, and Hui Mālama I Nā Kūpuna o Hawai‘i Nei to participate in the development of the terms of this MOA and sign this MOA as Concurring Parties; and

WHEREAS, NASA's consultations with the parties invited to be Signatories and Concurring Parties and OMKM (hereinafter collectively referred to as "Consulting Parties") indicate that off-site mitigation should focus on preservation and protection of historic/cultural resources related to Mauna Kea and the educational needs of Native Hawaiians. As a component of the

Outrigger Telescopes Project in Hawai‘i, NASA is committed to implementing effective measures to preserve and protect historic/cultural resources, expanding the knowledge of Hawaiian culture and address educational needs in the Hawaiian community; and

WHEREAS, Signatory or Concurring Party status is achieved only through signing this MOA.

NOW, **THEREFORE**, NASA, the Council, the Hawai‘i SHPO, UH, CARA, and Caltech agree that, upon NASA's decision to proceed with the Undertaking, such an Undertaking shall be implemented in accordance with the following on-site and off-site stipulations in order to take into account its effects on historic properties; and NASA shall ensure that its funding of the Undertaking is conditioned upon compliance with such stipulations.

I. CULTURAL AND ARCHAEOLOGICAL MONITORING

A. General

1. The Construction Manager, hired by CARA, the contractor(s), supervisors, and all construction workers will be provided training to become aware of the historic/cultural significance of the project site and surrounding areas of the summit as set forth in this MOA.

2. A Cultural Monitor will be provided free access for monitoring activities during excavation, other on-site construction, and telescope installation (See I.C below for qualifications and duties of the Cultural Monitor).

3. A qualified Archaeologist will be present to monitor all excavation activities (See I.D below for qualifications and duties of the Archaeologist).

4. The CARA Construction Manager will oversee the on-site professional personnel and all on-site construction and equipment installation. The CARA Construction Manager will schedule mutually agreed upon meetings with the Archaeologist, Cultural Monitor, and OMKM, to ensure that work is being carried out according to applicable terms of this MOA. The CARA Construction Manager, at the request of the Archaeologist or the Cultural Monitor or on his/her own initiative, has the authority to stop construction if the stipulations in this MOA are not being complied with.

5. The CARA Construction Manager shall encourage the Cultural Monitor and Archaeologist to work closely with one another.

6. Review of any plan hereinafter referenced shall occur within a 45-day period. When a Consulting Party provides comments to one of these plans, the party submitting the plan shall, to the extent practicable during the 45-day review period, enter into a dialogue with a commentor. NASA, at its sole discretion, may grant time extensions.

B. Monitoring of Historic Properties Affected by the Undertaking

1. Cultural -- Prior to construction, a cultural monitoring plan will be developed by the Cultural Monitor (see I.C below) in consultation with CARA. CARA shall submit the plan for review by NASA and all Consulting Parties.

2. Inadvertent Discovery of Human Remains and Archaeological Properties

a. Prior to construction, an Inadvertent Discovery of Human Remains and Archaeological Properties monitoring plan will be developed by the Archaeologist (see I.D below) in consultation with the Cultural Monitor and CARA and will comply with draft State Historic Preservation Division Rules (Titles 13-275, 13-279, and 13-280). CARA shall submit this plan for review by NASA and all Consulting Parties. Thereafter, CARA shall submit the plan to the Hawai‘i SHPO for approval.

b. The above monitoring plan (see I.B.2.a) shall include burial and notification components that comply with Hawai‘i Revised Statutes (HRS) Title 6E-43.6 (Inadvertent Discovery of Burial Sites), and Hawai‘i Administrative Rules (HAR) Title 13-300-40 (Inadvertent Discovery of Human Remains) for the burial components; and with applicable draft State Historic Preservation Division Rules (*e.g.*, Sections 13-275-12, 13-279-1 *et seq.*, and 13-280-1 *et seq.*) for the archaeological components. The burial treatment component will reflect a preference, to the extent practicable, and if confirmed to be culturally appropriate, for any human remains found to be preserved in place.

3. As a minimum, if there were to be an inadvertent discovery of human remains, the Archaeologist has the authority to halt ground-disturbing activities in the immediate area of such remains until all parties identified in the plan have been notified, and the requirements of the appropriately approved plan have been carried out.

4. As a minimum, if previously unidentified historic/archaeological properties (*e.g.*, deposits, artifacts, and stone alignments) were to be discovered during construction, the Archaeologist has the authority to halt ground disturbing activities in the immediate area of such properties until all parties identified in the plan have been notified, and the requirements of the appropriately approved plan have been carried out.

C. CULTURAL MONITOR

1. Qualifications of the Cultural Monitor. In consultation with NASA and the other Consulting Parties, CARA shall develop criteria for and select an individual to be the project’s Cultural Monitor. Any Consulting Party may submit the names of persons who they believe would be appropriate to serve as a Cultural Monitor.

a. This individual will have knowledge or awareness of Mauna Kea’s cultural landscape, and traditions, practices, beliefs, and customs associated with Mauna Kea.

b. This individual will be able to communicate cultural values and protocols to others, both within and outside of the culture.

2. Cultural Monitor Responsibilities

a. The Cultural Monitor will become aware of the general scope and requirements of the on-site construction and installation of the Outrigger Telescopes including, but not limited to, becoming familiar with: project boundaries, identified areas of historic/cultural sensitivity, the "Construction Best Management Practices Plan" (BMP), the construction worker responsibilities, responsibilities of the Archaeologist, and the sequence of operations to ensure that mitigation actions are implemented. The Cultural Monitor shall develop the Cultural Monitoring plan referenced in I.B above.

b. The Cultural Monitor will provide cultural orientation to individuals who are associated with the on-site construction and installation of the Outrigger Telescopes and who will be on Mauna Kea. For safety purposes, all communication for the purpose of cultural orientation between project personnel and the Cultural Monitor will be scheduled and overseen by the CARA Construction Manager.

c. The CARA Construction Manager will provide to the Cultural Monitor a weekly schedule of all construction activities planned for the following week. Based on that schedule, the Cultural Monitor will determine his/her need to visit the site during construction and installation as deemed necessary by him/her. For safety purposes, prior to entering the site, the Cultural Monitor will meet and confer with the CARA Construction Manager.

d. The site and grading development drawings and the BMP for the Outrigger Telescopes project site, the staging areas, and nearby areas of the summit region will be provided to the Cultural Monitor. The Cultural Monitor shall keep a log and map notes of every visit — noting date of visit; identifying work locations; noting findings date; and reporting on potential problems, if any. All findings identified and deemed to be significant by the Cultural Monitor shall be reported to the CARA Construction Manager and OMKM; in turn, CARA shall promptly notify NASA, the Council, the Hawai‘i SHPO, UH, Caltech, and any other Consulting Party that has requested to be notified of the Cultural Monitor's findings. The Cultural Monitor will submit a final report to the CARA Construction Manager; CARA, in turn, will provide copies to NASA, the Council, the Hawai‘i SHPO, UH, OMKM, Caltech, and any other Consulting Party that has requested the report.

e. The Cultural Monitor shall consult with the CARA Construction Manager to determine under what circumstances the Cultural Monitor should have direct authority to halt construction activities in a given area.

D. ARCHAEOLOGIST

1. Qualifications of the Archaeologist. The Archaeologist will be hired by CARA in consultation with the Hawai‘i SHPO and OMKM. The archaeologist serving as principal investigator for the Undertaking shall have the following professional qualifications:

a. A graduate degree in archaeology, or anthropology with specialization in archaeology, or an equivalent field;

b. At least one year of cumulative archaeological experience in Hawai‘i or the Pacific;

c. At least four months of supervised archaeological field and analytic experience in Hawai‘i;

d. At least one year of archaeological research administration or management at a supervisory level with at least four months of field experience;

e. A demonstrated ability to carry research to completion, as shown by completed theses, publications, and manuscripts; and

f. A demonstrated knowledge of historic preservation laws, rules, and guidelines.

2. Archaeologist Responsibilities

a. The Archaeologist will follow State Historic Preservation Division draft Hawaiian Administrative Rules for archaeological monitoring studies and reports (draft HAR Chapter 279). The Archaeologist will develop the Inadvertent Discovery of Human Remains and Archaeological Properties monitoring plan referenced in I.B above.

b. The Archaeologist shall familiarize him/herself with the WMKO site before construction begins.

c. The Archaeologist will become aware of the general scope and requirements for the on-site construction of the Outrigger Telescopes Project. This would include, but not be limited to, becoming familiar with: project boundaries, identified areas of historic/cultural sensitivity, the BMP, construction worker responsibilities, responsibilities of the Cultural Monitor, and the sequence of operations to ensure that mitigation actions are implemented.

d. The Archaeologist will monitor all excavation activities for on-site construction. The CARA Construction Manager will provide to the Archaeologist a weekly schedule of all construction activities planned for the following week. The Archaeologist will have access to the site and be present during all excavation

activities. For safety purposes, prior to entering the site, the Archaeologist will meet and confer with the CARA Construction Manager.

e. The site and grading development drawings and the BMP for the Outrigger Telescopes project site, the staging areas, and nearby areas of the summit region will be provided to the Archaeologist. The Archaeologist shall keep a log and map notes of every visit — noting date of visit; identifying work locations; noting findings date; and reporting potential problems, if any. All findings identified and deemed by the Archaeologist to be significant shall be reported to the CARA Construction Manager, the Hawai‘i SHPO, and OMKM; in turn, CARA shall promptly notify the NASA, the Council, UH, Caltech, and the Cultural Monitor of the Archaeologist's findings. The Archaeologist will also notify the Cultural Monitor if human remains are found so that he or she can assist with notifying and consulting those individuals and organizations identified in the Inadvertent Discovery of Human Remains and Archaeological Properties monitoring plan. . The Archaeologist will submit a draft report to the CARA Construction Manager; CARA, in turn, will forward the draft report to the Hawai‘i SHPO for approval. The approved final report will be distributed by CARA, who will provide copies to NASA, the Council, UH, OMKM, Caltech, and any other Consulting Party that has requested a copy of the report.

II. ON-SITE PRE-CONSTRUCTION, CONSTRUCTION, AND INSTALLATION

A. Grading and Site Development Review

1. Proposed grading and site development drawings will be provided to all the Consulting Parties for a 45-calendar day review and comment period to ensure that every reasonable effort has been made to reduce the adverse effects on Pu‘u Hau ‘Oki and on the summit region of Mauna Kea by minimizing disturbance from the on-site construction and installation of the Outrigger Telescopes.

2. The goal of the grading and site development planning will be to minimize alteration of the cinder cone as it presently exists, maintain the general shape and form of the cinder cone as it presently exists, and to stabilize the cinder cone in the on-site construction and installation areas.

B. Construction Worker Training

1. As part of an orientation process to ensure work is carried out in as sensitive and respectful a manner as possible, the CARA Construction Manager, the contractor(s), supervisors, and all construction workers will be required to view a specially scripted training videotape reviewing the historic and sacred qualities of Mauna Kea.

2. This training videotape will be prepared by CARA in consultation with the Hawai‘i SHPO and OMKM. This training videotape will include a presentation on the history of Mauna Kea and its significance to Native Hawaiians, and an overview of what to do if human remains or archaeological properties are found. CARA shall provide the Consulting Parties an opportunity early in the videotape development process to provide ideas on subject matter that should be discussed and highlighted CARA shall afford the Consulting Parties an opportunity to review the draft script and preview the videotape before the videotape is produced in final form. Should disagreements arise, CARA will enter into consultation to resolve the disagreements. The time for such script review, videotape preview, and consultations shall cumulatively not exceed 45 days, unless CARA, at its sole discretion, agrees to a longer cumulative period.

3. The videotape or related orientation will also advise the workers of the potential that CARA will demand their removal from this Undertaking if they fail to comply with the conditions imposed by the Construction Best Management Practices Plan (see II.C below).

4. The CARA Construction Manager, contractor (s), supervisors, and construction workers will also be briefed by the Archaeologist and Cultural Monitor on Native Hawaiian objects, artifacts, and remains, and what to do if such materials are found during construction activities.

C. Construction Best Management Practices Plan

1. In order to implement a series of precautions and procedures to be undertaken to avoid or minimize adverse effects and prevent or reduce adverse impacts to the cinder cone and inner crater slope during on-site construction and installation, the CARA Construction Manager and the on-site construction and installation contractor(s) will prepare a “Construction Best Management Practices Plan” (BMP) in consultation and coordination with OMKM and UH. The BMP will be finalized prior to the start of construction. This BMP will reference this MOA and include it as an appendix.

2. Prior to the start of construction, CARA will submit the draft BMP to the other Consulting Parties for review. Copies of all comments received will be provided to NASA. CARA will take those comments into account before its final approval of the BMP and prior to mobilization. CARA will take no more than 15 calendar days to conclude consultation on any issues stemming from the comments.

3. On-site construction and installation activities related to the Outrigger Telescopes — from delivery of materials and equipment to the WMKO site or one of the two construction staging areas, excavation and removal of excess cinder to the summit stockpile area through assembly of the domes and telescopes to clean up of the staging, stockpile and WMKO site — will be managed in accordance with the BMP. The CARA Construction Manager will be responsible for following the BMP.

4. To address the effects on historic properties, the BMP will include, but not necessarily be limited to, the following items:

a. The process to be followed if there were to be an inadvertent discovery of human remains or archaeological properties (see I.B above).

b. Site characterization, including the locations of all construction and laydown/stockpile areas on the site, and temporary on-site fill material stockpiles.

c. The sequence of construction activities will be designed to minimize potential adverse effects on historic properties and to allow efficient scheduling of appropriate monitoring times.

d. The specific methods needed to protect the attributes of the historic properties within the project site, staging areas, and within the immediate vicinity of the project area will include, but are not limited to:

(1) Installing a temporary silt fence along the crater rim to facilitate on-site containment of all material, including cinder, so that no such material will spill over the slope. A silt fence will be used whenever excavation occurs within six feet of the slope.

(2) Transferring all excavated material, to the extent not necessary for backfill or Wēkiu bug habitat restoration, to other locations accessible from the established roads on the summit of Mauna Kea. These locations will be identified after consultation with the Hawai‘i SHPO and OMKM prior to the start of construction.

(3) Following all applicable County of Hawai‘i and State Department of Health (DOH) regulations concerning dust control which include, but are not limited to, suspending all dust-generating activities, securing equipment and materials during high winds and storms, minimizing dust by spraying with water or other environmentally-acceptable soil stabilizers whenever necessary, and, if needed, covering excavated material with a tarp which is anchored down.

(4) Ensuring adherence to effective drainage and erosion control as provided for in the BMP.

(5) Ensuring that precautions are adopted to prevent potential adverse effects on the historic properties arising from use of the staging areas near the summit of Mauna Kea and at Hale Pōhaku.

(6) Providing the process and identifying the project personnel responsible for reporting the inadvertent discovery of human remains or archaeological properties pursuant to the monitoring plans referenced in I.B.

(7) Providing an organization chart that identifies project personnel with the responsibility for maintaining the integrity of the historic properties and the historic district with respect to the following:

(a) controlling all trash and construction material stored on-site so that it does not blow or fall onto surrounding areas of the summit;

(b) recovering trash and construction material which, despite best efforts, blows or falls onto surrounding areas of the summit;

(c) ensuring that all outdoor trash containers will be secured to the ground and have secured lids and plastic liners;

(d) removing all trash, construction debris, and waste material on a regular basis (weekly during construction);

(e) removing all construction equipment and excess materials in a timely manner after construction is completed;

(f) ensuring that a magnetic device is driven over roadways to remove nails and other metallic debris; and

(g) ensuring daily proper disposal of all perishable waste products.

e. To reduce the visual impact on the cinder cone and the historic district, all structures or portions thereof will be of colors designed to blend in with the surrounding terrain; provided, however, that such colors would not adversely affect the operation and scientific capability of the Outrigger Telescopes. CARA will afford the Consulting Parties an opportunity to review and comment on the colors to be used.

f. Characteristics of any discharge of a pollutant into the environment associated with the construction activity (including solid waste, sanitary waste, oily waste, or toxic/hazardous waste, if any) will be identified as soon as it is practicable. Proposed control measures and/or treatment methods for any unplanned or accidental discharge of pollutants associated with construction activity will be developed by the contractor(s) and managed in accordance with the BMP.

g. Noise associated with construction will be minimized through the use of equipment with proper noise muffling devices. Idling of equipment when not in use will be kept to a minimum. The contractor(s) must comply with Hawai‘i DOH rules (HAR, Chapter 46, Community Noise Control).

D. Wēkiu Bug Mitigation

Because Wēkiu bug habitat restoration and monitoring may affect the historic/cultural resources of the project site and surrounding areas, and only for this reason, they are mentioned in this MOA. Any activities related to the Wēkiu bug itself will be covered in the separate Wēkiu Bug Mitigation Plan. Prior to implementation of the Undertaking and finalization of the Wēkiu Bug Mitigation Plan, CARA will consult with the Hawai‘i SHPO to ensure that the plan contains appropriate provisions that will avoid or minimize, to the extent practicable, any potential adverse effects on the historic property and historic district. These shall include, but not necessarily be limited to, installing permanent signs identifying Wēkiu bug habitat, preventing the dispersal of debris, screening and washing cinder for habitat restoration, placement of the restoration material, and erosion control.

E. Cultural Interpretation

During the construction and installation of the Outrigger Telescopes, OMKM, in consultation with the Hawai‘i SHPO, will develop and provide interpretive materials concerning the cultural significance of Mauna Kea. The Consulting Parties will be afforded an opportunity to review and comment on the interpretive materials during their development.

F. On-Site Compliance with Conditions

1. CARA shall ensure that the plans and mitigation measures reflected in this MOA for adverse effects on historic properties, including, visual impacts, erosion control, permit requirements and conditions, and monitoring commitments are incorporated into the contract(s) with its contractors and subcontractors; and that such contract(s) include a provision that CARA’s Construction Manager has the authority to enforce such requirements or conditions and, if infractions occur, to order work to stop until the contractor/subcontractor is in compliance.

2. CARA shall make provisions for the Consulting Parties to monitor and review the work during on-site construction and installation activities. However, for safety purposes, all construction site visits must be coordinated through the CARA Construction Manager’s office. If it appears that the terms of this MOA are not being followed, Consulting Parties are encouraged to notify NASA, CARA, and the Hawai‘i SHPO.

3. Before excavation begins, CARA and NASA will provide points of contact to the Consulting Parties, along with a copy of the final executed Memorandum of Agreement.

III. OFF-SITE MITIGATION MEASURES

Preservation and Protection of Historic/Cultural Resources and Educational Mitigation Measures

1. NASA, in consultation with OMKM, will fund, out of funds for the Outrigger Telescopes Project, an initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians as a mitigation component of the Outrigger Telescopes Project. Funding such an initiative, however, is conditioned on the approval of the Outrigger Telescope's being placed at the WMKO site on the summit of Mauna Kea, Hawai'i. This initiative will be sensitive to Native Hawaiian culture, history, and institutions.

2. The necessary first step is the formation of a local citizens' working group. NASA and OMKM, in consultation with the other Consulting Parties, will ensure the formation of this working group. The working group members will serve on a volunteer basis. OMKM will coordinate and manage the activities of this working group and provide administrative services.

3. Once this working group is formed, its task will be to inform NASA as to what types of opportunities or goals will best benefit Hawaiians, including Native Hawaiians. The working group will be asked to prioritize their proposals. The working group will have one year after it is formed to develop its recommendations, but is encouraged to submit the proposals sooner, if possible.

4. Funding will be subject to the availability of appropriated funds in accordance with Federal law (*e.g.*, the Anti-Deficiency Act). Such funds will be allocated to the proposals as prioritized by the working group until available funds are exhausted.

IV. OPERATIONS

CARA will ensure that all persons involved with the operations of the Outrigger Telescopes shall be required, within a thirty day period of commencing their job, to view as part of worker orientation the training videotape which addresses the cultural significance of Mauna Kea to Native Hawaiians. CARA will report to OMKM quarterly on the status of worker compliance with the viewing of the training videotape.

V. ADMINISTRATIVE STIPULATIONS

A. Dispute Resolution

1. Should any Signatory or Concurring Party object at any time to the manner in which the terms of this MOA are implemented, NASA shall consult with the objecting party(ies) to resolve the objection. NASA shall have no more than 45 days to resolve the objection. If resolution is reached, the terms of this MOA shall be carried out in accordance with such resolution. If resolution is not reached through such consultation, NASA shall forward all documentation relevant to the objection to the Council, including its proposed response to the objection, and request the Council's comments in accordance with 36 CFR 800.2(b)(2). Any comments provided by the Council, and all comments from the Signatory or Concurring Party regarding the objection, shall be taken into account by NASA in reaching its final decision regarding the objection. NASA will promptly provide all Signatory and Concurring Parties with a copy of its final decision regarding resolution of the dispute. After reviewing NASA's decision, the Council or the Hawai‘i SHPO, if in disagreement with the decision, may proceed under the provisions of V.B.2 below.

2. NASA's responsibility to carry out all actions under this MOA that are not the subject of the dispute will remain unchanged. Actions subject to dispute under paragraph 1 above shall be carried out in accordance with NASA's final decision.

B. Amendment and Termination

1. If any Signatory believes that the MOA should be amended, that Signatory may propose amendments to the other Signatories and Concurring Parties, whereupon all Signatories and Concurring Parties will consult to consider amendments pursuant to 36 CFR 800.6(c)(7) and 800.6(c)(8).

2. If NASA determines that it cannot implement the terms of this MOA, or if the Council or Hawai‘i SHPO determines that the MOA is not being properly implemented, any of these three Signatories may propose that the MOA be terminated. The Signatory proposing termination shall so notify all of the other Signatories and Concurring Parties to the MOA, explaining the reasons for termination and affording these other Signatories and Concurring Parties at least 15 working days to consult and seek alternatives to termination. The parties shall then consult.

3. Should such consultation fail, either NASA, the Council, or the Hawai‘i SHPO may terminate this MOA by so notifying the other Signatories and Concurring Parties.

4. Should this MOA be terminated, NASA shall either consult in accordance with 36 CFR 800.6 to develop and execute a new MOA or request the comments of the Council pursuant to 36 CFR 800.7.

C. Duration of this MOA

1. Unless terminated pursuant to Stipulations V.B.3/4 above, this MOA will be in effect until NASA, in consultation with the other Signatories and Concurring Parties, determines all of its terms have satisfactorily been fulfilled, or June 30, 2009, whichever is earlier.

2. Subsequent to the completion of the installation of Outrigger Telescopes 1 to 4, this MOA will be held in abeyance for on-site activities, pending determination by NASA as to whether Outrigger Telescopes 5 and 6 will be installed at the WMKO site. If NASA were to install Outrigger Telescopes 5 and 6, this MOA will remain in full force and effect for on-site activities during the period of installation. This MOA shall not apply to Outrigger Telescopes 5 and 6, if installation of those telescopes were to begin later than December 31, 2007. Should NASA decide to begin on-site installation of Outrigger Telescopes 5 and 6 after December 31, 2007, their installation will be considered a new Undertaking, and NASA will reinitiate the Section 106 process with the Hawai‘i SHPO and the Council.

3. Upon determination by NASA that all of this MOA’s terms have been satisfactorily fulfilled, the MOA will terminate and have no further force or effect. NASA will promptly notify the other Signatories and Concurring Parties with written notice of its determination and of termination of this MOA.

D. Applicability of this MOA

1. This MOA applies only to the Undertaking as defined herein.

2. If, following execution of this MOA, NASA is unable or decides not to construct or install the Outrigger Telescopes, this MOA will automatically become null and void.

SIGNATORIES TO THIS MEMORANDUM OF AGREEMENT

FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION:

By: _____ Date: 2-22-02

Printed Name: EDWARD J. WEILER

Title: ASSOCIATE ADMINISTRATOR FOR SPACE SCIENCE

FOR THE ADVISORY COUNCIL ON HISTORIC PRESERVATION:

By: _____ Date: 3/5/02

Printed Name: JOHN M. FOWLER

Title: EXEC. DIR.

FOR THE HAWAI'I STATE HISTORIC PRESERVATION OFFICER:

By: _____ Date: 2/28/02

Printed Name: Don Hibbard

Title: Deputy SHPO

FOR THE UNIVERSITY OF HAWAI'I:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE CALIFORNIA ASSOCIATION FOR RESEARCH IN ASTRONOMY:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE CALIFORNIA INSTITUTE OF TECHNOLOGY

By: _____ Date: _____

Printed Name: _____

Title: _____

SIGNATORIES TO THIS MEMORANDUM OF AGREEMENT

FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE ADVISORY COUNCIL ON HISTORIC PRESERVATION:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE HAWAI'I STATE HISTORIC PRESERVATION OFFICER:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE UNIVERSITY OF HAWAI'I:

By: _____ Date: 3/5/02

for President Evan S. Dobelle

Printed Name: Walter S. Kirimitsu

Title: Senior Vice President for Legal Affairs, University General Counsel and Chief of Staff

FOR THE CALIFORNIA ASSOCIATION FOR RESEARCH IN ASTRONOMY:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE CALIFORNIA INSTITUTE OF TECHNOLOGY

By: _____ Date: _____

Printed Name: _____

Title: _____

SIGNATORIES TO THIS MEMORANDUM OF AGREEMENT

FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE ADVISORY COUNCIL ON HISTORIC PRESERVATION:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE HAWAI'I STATE HISTORIC PRESERVATION OFFICER:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE UNIVERSITY OF HAWAI'I:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE CALIFORNIA ASSOCIATION FOR RESEARCH IN ASTRONOMY:

By: Frederic H. Chaffee Date: 03/01/02

Printed Name: Frederic H. Chaffee

Title: Director, W.M. Keck Observatory

FOR THE CALIFORNIA INSTITUTE OF TECHNOLOGY

By: _____ Date: _____

Printed Name: _____

Title: _____

SIGNATORIES TO THIS MEMORANDUM OF AGREEMENT

FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE ADVISORY COUNCIL ON HISTORIC PRESERVATION:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE HAWAI'I STATE HISTORIC PRESERVATION OFFICER:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE UNIVERSITY OF HAWAI'I:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE CALIFORNIA ASSOCIATION FOR RESEARCH IN ASTRONOMY:

By: _____ Date: _____

Printed Name: _____

Title: _____

FOR THE CALIFORNIA INSTITUTE OF TECHNOLOGY

By: William A. Jenkins Date: 3/4/02

Printed Name: William A. Jenkins

Title: Executive Vice President

PARTY CONCURRING ON THIS AGREEMENT

FOR THE AHAHUI KU MAUNA:

By: Edward Stevens Date: March 21, 2002

Printed Name: EDWARD STEVENS

Title: SPOKESPERSON

NOTE: WE SIGN THIS MOA WITH THE UNDERSTANDING THAT IT IS NOT AN ENDORSEMENT OF THE PROPOSED KECK OUTRIGGER PROJECT. IN PRINCIPLE, WE OBJECT TO ANY PARALLELING ACTIVITY IN PROGRESS SUCH AS THE STATE OF HAWAII CONSERVATION DISTRICT USE APPLICATION, AND THIS MOA AS PREMATURE IN THE PROCESS OF FIRST OBTAINING PROJECT APPROVAL FOR THIS UNDERTAKING.

Edward Stevens

PARTY CONCURRING ON THIS AGREEMENT

FOR THE HAWAI‘I ISLAND BURIAL COUNCIL:

By: _____ Date: _____

Printed Name: _____

Title: _____

PARTY CONCURRING ON THIS AGREEMENT

FOR HUI MĀLAMA I NĀ KŪPUNA O HAWAIʻI NEI:

By: _____ ***Date:*** _____

Printed Name: _____

Title: _____

PARTY CONCURRING ON THIS AGREEMENT

FOR THE MAUNA KEA ANAINA HOU:

By: _____ ***Date:*** _____

Printed Name: _____

Title: _____

PARTY CONCURRING ON THIS AGREEMENT

FOR THE OFFICE OF HAWAIIAN AFFAIRS:

By: _____ ***Date:*** _____

Printed Name: _____

Title: _____

PARTY CONCURRING ON THIS AGREEMENT

FOR THE OFFICE OF MAUNA KEA MANAGEMENT:

By: L.T. [illegible] Date: 3/8/02

Printed Name: LYLLIAM T. GORMON

Title: DIRECTOR

PARTY CONCURRING ON THIS AGREEMENT

FOR THE ROYAL ORDER OF KAMEHAMEHA I:

By: _____ ***Date:*** _____

Printed Name: _____

Title: _____

This page intentionally left blank.

APPENDIX C

BURIAL TREATMENT PLAN

This page intentionally left blank.

Burial Treatment Plan,

As Amended,

For the Outrigger Telescopes Project

Mauna Kea, Hāmākua District, Hawai‘i

TMK: Zone 4, Sec. 4, Plat 15

Prepared for:

National Aeronautics and Space Administration

July 21, 2004

I. INTRODUCTION

At the request of the National Aeronautics and Space Administration (NASA), International Archaeological Research Institute, Inc. (IARII) has prepared a Burial Treatment Plan for the proposed Outrigger Telescopes Project at the W. M. Keck Observatory (WMKO) site. The project area lies within the Astronomy Precinct of the Mauna Kea Science Reserve on the summit of Mauna Kea on the island of Hawai‘i (Figure 1). The proposed Outrigger Telescopes Project consists of the on-site construction, installation, and operation of four, and potentially up to six, 1.8 m diameter telescopes placed around the existing Keck Telescopes on the area of the cinder cone, Pu‘u Hau‘oki, also known as Pu‘u o Kukahauula for the summit cluster of cones, that was previously disturbed for construction of the two Keck Telescopes. The area of potential effect is within State Inventory of Historic Places Site 50-10-23-21438, the cluster of summit cones, and within a proposed Historic District.

Five burial or possible burial sites have been identified on the Mauna Kea summit within the Mauna Kea Science Reserve. The Reserve covers 11,288 acres leased by the University of Hawai‘i from the State of Hawai‘i. The Science Reserve is a circular area (2.5 miles in radius) centered on the Mauna Kea summit, and includes approximately those lands above the 12,000 foot elevation, except for those areas that are part of the Mauna Kea Ice Age Natural Area Reserve. The Mauna Kea summit is located in TMK: Zone 4, Sec. 4, Plat 15. Archaeological survey has located five sites identified as Sites 50-10-15-16195, 16248, 21413, 21414, and 21416 that are thought to be burial sites.

The proposed Outrigger Telescopes Project funded by NASA would be limited almost exclusively to the existing and previously disturbed footprint of the WMKO site within the Astronomy Precinct. This Burial Treatment Plan has been prepared for NASA at the request of the Office of Hawaiian Affairs in order to address long-term management goals associated with cumulative impacts conforming to the Environmental Impact Statement (EIS) process for this specific project. The proposed Outrigger Telescopes Project at WMKO will impact no recorded burial sites, and no inadvertent discovery is expected because of previous impact to the area. This Burial Treatment Plan is responsive to the provisions of the National Environmental Policy Act. However, since the region of influence for this proposed project includes all of the Mauna Kea Science Reserve, this Burial Treatment Plan has been prepared to consider any foreseeable impacts from the construction of the Outrigger Telescopes Project, indirect as well as direct.

The purpose of the Burial Treatment Plan is to ensure that known burials in the proposed project area are identified and protected, and that any burials inadvertently discovered during construction or maintenance activities are preserved in place or reburied on the project site in specially prepared reburial areas, depending on the situation and in consultation with lineal and cultural descendants. This Burial Treatment Plan facilitates the proper treatment of human burial remains in accordance with applicable sections of Chapter 6E-43 – Historic Preservation Law (Haw. Rev. St.; as amended), and the current administrative rules for the treatment of burial sites and human remains that were formally approved and adopted by the State of Hawai‘i in September 1996 (DLNR 1996). The Burial Treatment Plan provides the Hawai‘i Island Burial Council (HIBC) with the relevant information called for in Section 13-300-33, “Request for council determination to preserve or relocate Native Hawaiian burial sites.”

This Burial Treatment Plan provides a background on the archaeological and cultural history of Mauna Kea and its significance; a discussion of the known burial sites; a discussion of the search for lineal and cultural descendants; a proposed treatment plan for known as well as inadvertent burials; and guidelines for implementation of the proposed Burial Treatment Plan.

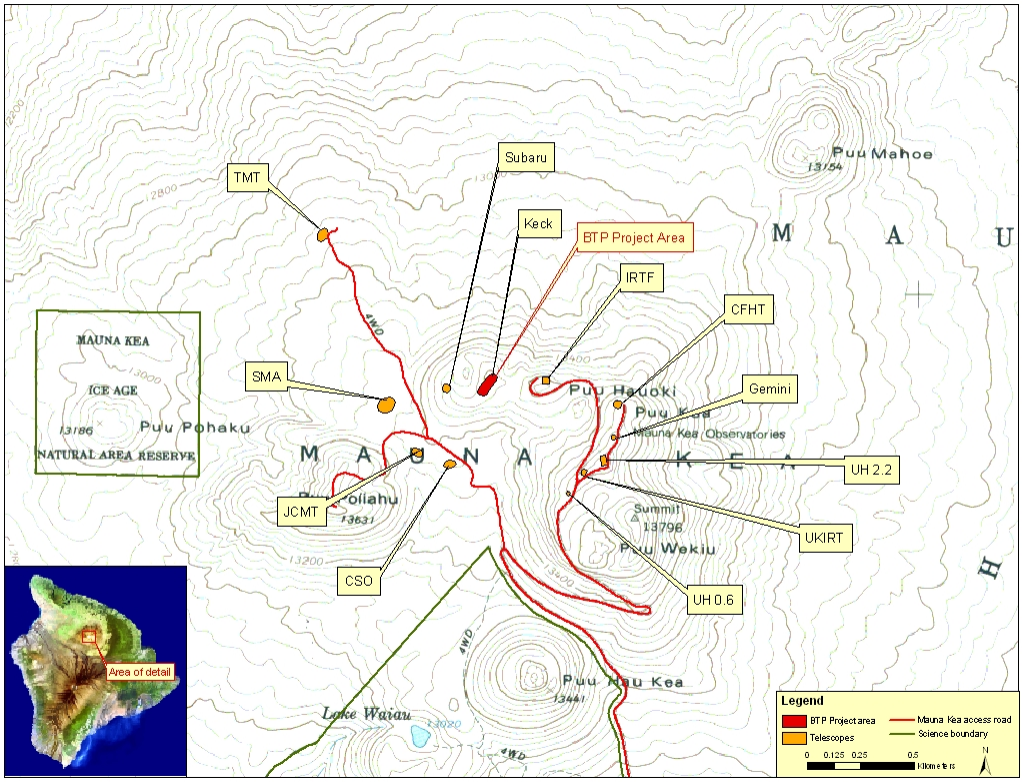


FIGURE 1. LOCATION OF PROPOSED OUTRIGGER TELESCOPES PROJECT, MAUNA KEA, ISLAND OF HAWAI'I

II. BACKGROUND

This background summarizes what is known of the prehistory and history of Mauna Kea from the time of initial Hawaiian settlement of the island of Hawai‘i to the recent development of observatories on the summit. It updates and adds to the documentary information provided by Kepa Maly’s (1998) archival study of Ka‘ohe and Humu‘ula *ahupua‘a*, in Hamakua and Hilo Districts (see definitions in the section on Hawaiian Traditions below), on Hawai‘i Island. These two land units include most of the lands on Mauna Kea. Mauna Kea Science Reserve and Hale Pohaku are both located in Ka‘ohe *ahupua‘a*, following the *ahupua‘a* boundaries formalized by the Boundary Commission (e.g., Baldwin 1891); U.S. Geological Survey (1982) plots both in Hamakua District.

The documentary historical study relies mainly on secondary sources – sources where original information has already been compiled. The main sources used include Maly (1998), McEldowney (1982), and Tomonari-Tuggle (1996). Other sources are cited where used. The archival collections searched by Maly and McEldowney for their studies include those at the following repositories: the State Survey Department, the Archives of the State of Hawai‘i, the Bishop Museum Archives, libraries including those at Bishop Museum and the University of Hawai‘i, and Mo‘okini Library. One primary source added here is a collection of papers now available at the Bishop Museum Archives in Honolulu: 45 boxes of papers left by Leicester Winthrop Bryan, who served as Territorial Forestry Office for the Island of Hawai‘i from 1922 to 1949, and as Territorial Forester until 1961 (Bryan 1921-1984). Materials from Boxes 2, 7, and 14, and portions of Boxes 16, 32, and 37 have been examined.

The primary sources for the archaeological information are a number of studies by Patrick McCoy, both original research (McCoy 1977a and b, 1978, 1981, 1982a and b, 1984, 1985, 1986, 1990, 1991) and compilations of work completed in both the quarry and the summit region (especially, McCoy 1999).

GENERAL

Mauna Kea, the white mountain, or the Mountain of Wakea, is one of the most prominent features of the Hawaiian Islands, rising 4,205 meters above sea level (m asl; 13,796 feet asl). From its base on the floor of the Pacific Ocean, it is one of the highest mountains on earth. During the winter months the summit of Mauna Kea is often blanketed in snow, hence the popular translation “white mountain.” In native Hawaiian traditions, however, “Kea” is also the abbreviated form of Wakea, the great sky god who, together with Papa, the earth mother, and other gods and forces, created the Hawaiian Islands. The summit is the meeting point of Wakea and Papa. In this cultural context, the summit of Mauna Kea is the domain of the gods.

These beliefs about Mauna Kea make it a highly significant and sacred place to the Hawaiian people. Mauna Kea figures centrally in Hawaiian cosmology, or and *mo‘olele* (traditions, legends or stories), *mele* (song), or *`oli* (chants). According to Hawaiian beliefs, Mauna Kea is the home of a number of ancient chiefs and chiefesses who are regarded as deities. Prominent among these are Kakahau‘ula, the pink-tinted snow god, Poli‘ahu, goddess of the snows of Mauna Kea, and Lilinoe, her sister, the goddess of mists.

The mountain is divided into zones or levels based on altitude, physical features, and vegetation. The highest level, that of the cones of the summit, is a very sacred area reserved for the realm of

deities and high chiefs and priests, while the second level, still above the tree line, is also a very special zone, reserved for use by the *ali'i* and *kahuna* (priests and masters of arts and crafts). Lower zones on the mountain, where *mamane* and other trees grew, were for use by others, such as forest spirits and commoners (Maly 1998:7; Kanahele and Kanahele 1997:14).

This background study looks at the history of the mountain as it is known from Native Hawaiian oral tradition, from the archaeological record, and from historical accounts, documents, and maps. The first part focuses on traditional Hawaiian beliefs and oral history about Mauna Kea as recorded by native and foreign writers soon after Contact (usually defined as1778, when Captain James Cook's ships reached the Hawaiian Islands). The second part summarizes what is known about pre-Contact Hawaiian use of the mountain from archaeological studies. The third part is a review of the nineteenth and early twentieth century history of the mountain, of the consequences of Contact, as known from both documentary and archaeological sources. The fourth part briefly summarizes recent developments on the mountain.

DOCUMENTARY EVIDENCE: HAWAIIAN TRADITIONS OF MAUNA KEA

Early historical accounts record information concerning traditional Native Hawaiian beliefs and oral history about Mauna Kea and traditional practices and land uses on the mountain. These records, although actually transcribed after Contact, focus on earlier times and traditions. The information comes from both Hawaiian and foreign sources; some of the most detailed includes family traditions remembered by 19th-century Hawaiian Boundary Commission interviewees (Maly 1998). Archaeological information, which has been provided by several studies conducted on the mountain during the 20th century, is considered in the next section.

Traditional Land Units

The Hawaiian term used by Kanahele and Kanahele (1997) for "district" (as, Hamakua, where the Science Reserve is located), is "*'apana,*" which is a traditional vertical land section (also, *moku o loko*, *'ōkana*; Maly 1998; (Pukui and Elbert 1986). It is also a political division, because it is one of the land units that organized the Hawaiian chiefdom/state. As mentioned, the Mauna Kea Science Reserve and Hale Pohaku are both located in Ka'ohe *ahupua'a* -- a very large, inland, vertical land division within Hamakua District. Ka'ohe includes the summit lands, most lands on the upper slopes, and saddle lands between Mauna Kea and Mauna Loa. Humu'ula, the other *ahupua'a* researched by Maly (1998), is south of Ka'ohe, covering lands on the lower slopes and the Hilo side of Mauna Kea, continuing beside Ka'ohe to the summit of Mauna Loa.

In addition to the vertical land division of the landscape, Hawai'i's lands were traditionally defined horizontally, as environmental and cultural zones, *wao*, defined largely by vegetation. *Ke kuahiwi* and *ke kualono* are, respectively, the very sacred summit and the near-summit lands where few trees grow; both are very special zones on Mauna Kea. In all, 23 land zones are listed for the islands by Maly (1998:7-8). Kanahele and Kanahele ((1997:13-15), considering Mauna Kea specifically, list six zones. Downslope, below the summit zones of *ke kuahiwi* and *ke kualono* (spellings here follow Maly), are four less sacred zones: *ka wao ma'u kele* (below *ke kualono*; a wet area of large *koa*, *'ohi'a*, lobelia, and *mamane* [botanical names and English translations provided below, in section concerning pre-Contact land uses]); *ka waoakua* (an area of more varied forest); *ka waokanaka* (the lowest forested area, the one most used as a cultural resource); and *ke kula* (the upland grassy plains). A seventh horizontal land unit, the ocean edge, is listed by Maly as *ka po'ina nalu* and by Kanahele and Kanahele as *ke kahakai*. Although the

shoreline is beyond the physical boundaries of Mauna Kea as it is usually conceived, residents of isolated upland *ahupuaʻa* like Kaʻohe typically had wide access across the shoreline to the sea beyond the inshore fisheries (Lyons 1903; McCoy 1990:111-112, citing and discussing Lyons).

Of the six horizontal land divisions on Mauna Kea, only *ka waokanaka* and *ke kula* were used for everyday purposes by Hawaiians. The upper forests and higher lands were considered special and were visited rarely, usually by specialists; they were carefully conserved. The Mauna Kea Science Reserve is located above the 3,660-m (12,000-foot) elevation, in the summit area, in *ke kuahiwi* and possibly also *ke kualono*. Hale Pōhaku (in English, stone house; (Pukui and Elbert 1986), is located farther downslope, on the east side of the Mauna Kea Observatory Access Road, at the 2,810-m (9,220-foot) elevation, in an area that still contains remnant *māmane* trees (McCoy 1985). The upper elevation and the presence of native forest suggest that Hale Pōhaku is located within one of the special and conserved forest zones, either *ka waoakua* or *ka wao maʻū kele*.

Place Names from Early Hawaiian History and Legends

While Mauna Kea's highest summit is that at Puʻu Kūkahauʻula (4,205 m asl; 13,796 feet asl), the mountain has many other peaks, an upland lake, and a broad upland plateau. The peaks are *puʻu*, old volcanic cones; their traditional names reflect the great importance of Mauna Kea, the highest mountain in the islands, in Hawaiian history and legend.

Kūkahauʻula is the traditional name for the highest peak at the summit. The name, as applied in the early maps by Baldwin (1891) and Lyons (1891), may describe only the highest peak (the "summit cone" of Mauna Kea, in Lyons 1891), the one now often called Puʻu Wekiu or Mauna Kea peak. Alternatively, it may include all the peaks in the summit cluster, encompassing all three of the highest volcanic cones, Puʻu Wekiu, Puʻu Kea, and Puʻu Hau Oki (Hibbard 1999; Maly 1998:11). Baldwin's (1891) "*puʻu*" may be either singular or plural. Kakahauʻula was named for the Waimea, South Kohala, chief who became the husband of Lilinoe. Līlīnoe was an *aliʻi*, a chiefess (Pukui and Elbert 1986:413), who became the woman of the mountains, the goddess of mists. They were ancestors of Pae, who was a *kupuna* (elder) and high chief in the time of ʻUmi (ca. the 16th century) and known as an exceptional fisherman. When Līlīnoe died, she is said to have been buried on Mauna Kea; in 1828, Kaʻahumanu visited the mountain to try to recover the bones. Puʻu Līlīnoe is the high peak southeast of Kūkahauʻula (Alexander 1892a; (Kamakau 1992:215, 285); Lyons 1891; Maly 1998:11, 25).

Kūkahauʻula, the pink-tinted snow god, was also the lover of Līlīnoe's sister Poliʻahu. Poliʻahu, after whom the high peak west of Puʻu Kūkahauʻula was named (Alexander 1892), became the goddess of the snows of Mauna Kea. She was not only the sister of Līlīnoe but the rival of Pele, the fire goddess, who lives on Mauna Loa (Beckwith 1970:179); (McEldowney 1982:1.2-1.3).

Two other names for places on Mauna Kea with particular importance in Hawaiian history and legend are Waiau and Kaluakakoi. Lake Waiau and Puʻu Waiau are named for one of the god companions of Poliʻahu; Maly (1998:13), translating original Hawaiian records, found that the earliest available reference to the lake by the name Waiau is that made by Haleʻole in 1862-1863. Waiau is labeled that way by Alexander (1892) and Lyons (1891). Other sources, including Baldwin (1891), Wiltse (1862)), and earlier mappers, considered the lake an unnamed pond or Poliʻahu's pond.

Kaluakākoi (cave or pit for making adzes), also called Keanakakoʻi (Alexander 1892a; Lyons 1891; U.S. Geological Survey 1982), is one of the main special-purpose areas near the summit. The Mauna Kea Adze Quarry, where rock, especially fine-grained basalt, was collected for the manufacture of adzes and other tools, was first mapped (for a Western survey) by its traditional name, spelled Kaluahakai, by Wiltse (1862; also, Maly 1998:11); Wiltse mapped it on the Kaʻohe/Humuʻula *ahupuaʻa* boundary (the incorrect spelling was a transcription error; K. Maly, personal communication 2004). Alexander (1892a) and Lyons (1891) also plotted approximate locations for the quarry complex, which includes quarries, mounds, temporary habitation areas, and shrines.

Hawaiian Place Names that are not Traditional

Several places have now been assigned non-traditional Hawaiian names that do not appear in early records. As an example, Puʻu Wekiu, a name frequently used today for the highest peak (Kūkahauʻula), was reportedly named that (*wekiu* translating into English as "summit") in the 1920s by L. W. Bryan. The name Puʻu Hau Oki, which translates into English as "frosty peak", for the westernmost summit cone was also first recorded by Byran in the 1920s (Hibbard 1999, citing 1973 Bryan letter). Hale Pohaku was named by Bryan for two stone cabins he and the Civilian Conservation Corps built in 1936 and 1939 for use by visitors to the mountain (Bryan 1921-1984:Box 2.6-2.7; e.g., June 21, 1939, log entry). Hale Pohaku is now used as the University of Hawaiʻi Institute for Astronomy's Mid-Level Facility and visitors' center, as well as a staging area and construction camp.

Archival References to Pre-Contact Land Uses

As mentioned earlier, the written information relating to traditional land use on Mauna Kea actually comes from documents, especially transcribed Hawaiian oral testimonies, that were compiled in the 19th century, after Contact. The following information is summarized from McEldowney ((1982), and from information translated and annotated by Maly (1998). Among the most informative original sources used by these and other historians are the native testimonies in the five-volume Boundary Commission Book for Hawaiʻi, prepared in the 1870s to formalize land boundaries according to the Western system; and historical maps including those cited earlier (Alexander 1892)a, Baldwin 1891; Lyons 1891; Wiltse 1862). Other sources include records left by early foreign visitors, although it is not always known whether the original source for much of this information was Hawaiian or another foreigner (1982:1.7).

Maly (1998:45-46), introducing the land-use information that is provided by the Boundary Commission testimonies, organizes the traditional land uses by zone: lower forest to upper forest, and upper forest to summit. The following summary is organized by site and land use type, with comments regarding the zones that were important for each.

Main trails and footpaths served the lower slopes and also provided access to lower and upper forest zones on the mountain, providing bird catchers and others access to resources including the forests and the adze quarry. Kamakau (1992:16) mentions the trail of Poliʻahu, which had been used by ʻUmi in the 16th century: "It was shorter to go by way of the mountain to the trail of Poliʻahu and Poliʻahu's spring [Waiau; K. Maly, review comment 2004] at the top of Mauna Kea, and then down toward Hilo. It was an ancient trail used by those of Hāmākua, Kohala, and Waimea to go to Hilo." ʻUmi's party of warriors descended via the trail to Kaūmana (above Hilo), camping on the way just above Waiʻanuenue Stream (Kamakau 1992:16-17).

Among the main trails is one that figured in a Humuʻula/Kaʻohe border dispute, probably the one mentioned in Waiki's testimony to the Boundary Commission; it passed from Lahohina (Puʻu Lahohinu, northeast of the summit), to or through Laumaia (Gulch, east of the summit), above the forest. The best-documented trails provided access to lower forest zones (e.g., *ka waokanaka*) and certain upper forested lands, from the lowlands or the Saddle (Maly 1998:52; McEldowney 1982:1.7-1.8).

Forest birds including *oʻo* (native honeycreepers, *Noho* species; Hawaii Audubon Society 1993:103) were hunted for their colorful feathers in the lower forests on the mountain. *He mau wai kōloa*, native duck ponds, were also mentioned in testimonies made to the Boundary Commission. Seabirds including especially *ʻuaʻu*, the dark-rumped petrel, and *nene* (*Pterodroma phaeopygia sandwichensis* and *Nesochen sandvicensis*; Hawaii Audubon Society 1993:10, 49) were hunted in the Saddle area, on the lower slopes (again, in *ka waokanaka*), and possibly at much higher elevations (Maly 1998:45-47; McEldowney 19821.7-1.8). Lyons (1903:25) indicates that the "owners" of Kaʻohe possessed the sole right to capture *ʻuaʻu.*

Hardwoods harvested in the forests included *koa* (*Acacia koa*) for canoe-building. The very durable wood of *māmane* (*Sophora chrysophylla*) was valued for *ʻōʻō* (spades, digging sticks) and the runners on sleds (Neal 1975:443; Pukui and Elbert 1986:236). Lyons (1903:25) indicates that the upper limit of the *māmane* forest coincided with that of Humuʻula (Hilo District). *Pili* grass (possibly mountain *pili*, either *Panicum tenuifolium* or *Trisetum glomeratum*; Wagner et al. 1990:110, 1573, 1602) was collected on lower slopes, along with bananas and *hāpuʻu* (*Cibotium*, tree fern). And ʻō*hiʻa* (*Metrosideros polymorpha*) formed extensive forests in areas below the *māmane* forest, in the saddle (as reported by Hawaiians to William Ellis in 1823) and in the Hakalau Forest on the Hilo slope (Maly 1998:38; Tomonari-Tuggle 1996:11-16). As mentioned, *ʻōhiʻa* was an important component of *ka wao maʻu kele*, the wet, uppermost forested *wao.*

Near the summit, in the highest zones, Kaluakākoʻi, the Mauna Kea Adze Quarry, was used by lithic specialists, specialists in the manufacture of stone tools, for the collection of rock, especially fine-grained basalt (hawaiite), which was worked into adzes for canoe-making and other purposes. The historical records that are most informative about use of the quarry prior to Contact (most of the available information is archaeological and covered below) include Waiki's testimony before the Boundary Commission (Maly 1998:46, 49-52,"Haiki" in McEldowney (1982:1.7)). To support his claim that the Kaʻohe/Humuʻula *ahupuaʻa* boundary had actually passed across the summit (west of the current boundary, the location finalized by the Commission), Waiki cited Kaluakākoʻi and a cave on Poliʻahu as landmarks along the boundary. Waiki was born ca. 1819; his father and grandfather were bird catchers and canoe-makers and had traditionally collected stone for adze-making at the quarry. His father-in-law pointed out traditional boundaries to Waiki, who assisted Wiltse ((1862) in surveying Humuʻula. The testimony of Kahue, another informant, agreed that resources and lands in Humuʻula included Kaluakākoi, Poliʻahu, and also Waiau (Maly 1998:46, 49-52).

Other site types on the mountain mentioned in testimonies and other historical documents include, importantly, burial sites; other ceremonial sites, which include bird-snarers', adze-making, and other shrines, primarily uprights and *ahu* (cairns and altars); special places such as those where *mele* were sung; and *kauhale* (house compounds, each composed of a group of

buildings such as eating houses, sleeping house, and cookhouse) (Maly 1998:11, 46; Pukui and Elbert 1986:135).

The burial sites listed for the Boundary Commission by Hawaiian informants are located several kilometers northeast of the summit, at slightly lower elevations. They include a site at Puʻukukaʻiau, likely the point mapped by Lyons (1891) as "Kukaʻiau," approximately 17 km northeast of the summit (in Kukaʻiau *ahupuaʻa*); a site or sites at Keahuonaiwi, on the slope of Puʻukihe, 11.5 km northeast of the summit (on the boundary between Kukaʻiau and Koholalele *ahupuaʻa*, as mapped by Lyons, but reportedly belonging to Kaʻohe); a site at ʻIolehaehae (also 11.5 km northeast of the summit); and in unspecified areas. Several 19th- and 20th-century visitors commented on the former use of the summit and the upper slopes and plateau, both in the uppermost two horizontal environmental zones, for burial (Maly 1998:46, 53, 57; (McEldowney 1982:1.8-1.9). Lyons (1891) reported a burial site at Keonenui, around the 2,896-m (9,500-foot) elevation, a short distance southeast of ʻIolehaehae. In 1892, Alexander's party observed burials and a possible *heiau* on Puʻu Līlīnoe, on the east side of the Humuʻula Ranch Trail (also called the Humuʻula-Mauna Kea Trail) to Waimea.

Alexander noted:

> …the surveyors occupied the summit of Lilinoe, a high rocky crater, a mile southeast of the central hills and a little over 13,000 feet in elevation. Here, as at other places on the plateau, ancient graves are to be found. In the olden time, it was a common practice of the natives in the surrounding region to carry up the bones of their deceased relatives to the summit plateau for burial [Alexander 1892b].

Shrines recorded in traditional Hawaiian history and legend near the summit, in the highest land zone, include, in addition to the possible *heiau* at Puʻu Līlīnoe, Pōhaku a Kāne, a sacred platform or *ahu* perched above the sacred water of Kāne; and an *ahu* or mound at Waiau, near the Humuʻula-Mauna Kea Trail (Maly 1999:15). Puʻu Kole was a *kūahu* (altar) *manu*, an altar for bird catchers, with a *kauhale*, located around 2,400 m asl, midslope, in Laupahoehoe (below Puʻuʻulaʻula, northeast of the summit). A large *ahu* was located at Mākanaka, a *kūahu* in Ahuapoʻopuaʻa (in Humuʻula), and an *ahu* (called Keahu o Kuakini by the 1870s) in Pōhakuloa (Maly 1998:28, 30, 45-46, 48). Both of these were located in upper forest or higher lands. *Mele* (chants) were sung in gulches including Kahawai Koikapue, whose waters were shared by Kaʻohe and Humuʻula (Maly 1998:48). *Kauhale*, in addition to the one just mentioned, included upland houses in Humuʻula and other areas, as mentioned by Boundary Commission informants (Maly 1998:46-47, 49, 50, 52). Most were located in the lower or upper forest zones.

Sacred and special-purpose sites were present in several traditional zones, from the base to the summit of Mauna Kea, and in various *ahupuaʻa* around the mountain. The other land uses, such as the use of trails, quarrying, and bird-snaring, either occupied small portions of their zones or had only transitory effects on the environment (for instance, wearing a path or harming a single tree), conserving the forests and other lands where they occurred.

ARCHAEOLOGICAL EVIDENCE FOR PRE-CONTACT LAND USES OF THE MOUNTAIN

Archaeological surveys of the summit region, the Mauna Kea Adze Quarry, and Hale Pōhaku have documented many archaeological sites that indicate Hawaiian visits to Mauna Kea before

Contact in 1778. Excavations of workshops and shelters within the quarry have yielded especially rich information about native Hawaiian practices on the mountain.

Polynesian Settlement of the Island of Hawai‘i

Polynesians sailing from islands to the south, in east central Polynesia, may have arrived in the Hawaiian Islands as early as 1,600 years ago and had certainly reached the islands by 1,200 years ago. The evidence for early settlement on the island of Hawai‘i itself remains rather unclear. The earliest well-dated site is Wai‘ahukini rockshelter, a site near South Point, used mainly as a fishing camp based on the large numbers of fishhooks and other fishing gear recovered. Both charcoal and shell samples from the lower cultural layer suggest occupation began between A.D. 650 and 850 (Emory and Sinoto 1969; Spriggs and Anderson 1993). On O‘ahu the picture is somewhat clearer; there is evidence from many locations on the island that show a major change in the lowland environments occurred about A.D. 850-950. These changes are clearly associated with the arrival of human colonizers of the islands and, perhaps more significantly in terms of the impact on vegetation, of the Pacific rat that came with the Polynesian voyagers (Athens et al. 2002). The early settlements were located along the coasts of the islands in locations that provided easy access to land well-suited for growing taro (*Colocasia esculenta*, an aroid with edible leaves and underground stem [corm]; the main Hawaiian staple food) and other crops. There is no archaeological evidence for use of the high inland areas during the first few centuries of settlement.

It was probably in these early years of settlement that the Hawaiian traditions and beliefs discussed above, about the highest place on the island, the summit of Mauna Kea, took form. Mauna Kea came to be regarded as sacred, the abode of the gods, a sacred place between earth and the sky, home of Wākea. However neither archaeology nor the much later documents of the post-Contact period provide evidence about the initial development of these traditions.

Early Journeys to the Mountain

Archaeological evidence suggests that Hawaiian entry into the region of the high volcanic mountains, Mauna Kea and Mauna Loa, and the Saddle between them, began in the 12th or early 13th century. The Hawaiians began using the lava tube caves and blisters along the lower slope of Mauna Loa in the Pōhakuloa portion of the Saddle for shelter about this time, based on a large series of radiocarbon dates from firepits in several of these shelters (Athens and Kaschko 1989; Reinman and Schilz 1994). Associated with these firepits are stone flakes, bird bones, and, rarely, marine shells, the remains of the materials left behind by the early expeditions. Hawaiians stayed overnight in these shelters probably while hunting the birds that inhabit the *māmane* and *naio* forests of the Saddle, and perhaps collecting stone for manufacturing tools from small dikes of basalt and volcanic glass that are found in the Pōhakuloa area (Bayman et al. 1999; Williams 2002).

During this same period and perhaps even earlier (McCoy 1999), Hawaiians began making their way up the slopes of Mauna Kea, camping in rockshelters near the summit. The goal of the earliest pilgrimages is uncertain; most likely they were made for spiritual reasons to honor the gods associated with the mountains, perhaps to make astronomical observations, perhaps in connection with navigation. Whatever the reasons, near the summit, on the south side of the mountain, they discovered large deposits of a very hard, fine-grained volcanic rock, now called hawaiite by geologists, a stone of much higher quality for stone tool-making than the dike and

extruded basalts found elsewhere. Radiocarbon dates from the earliest of the campsites used by Hawaiians procuring stone at the quarry demonstrate that by A.D. 1100 to 1300, at the latest, Hawaiians were journeying to areas near the summit of the mountain.

Procurement of Stone: the Mauna Kea Adze Quarry

For the next 500 years, until the beginning of sustained Western contact (after Captain Cook's arrival), groups of Hawaiians would journey to the summit to collect stone from the treeless alpine desert on the south side of the mountain. Most quarry sites are clustered in a 4-sq-km area between 3,350 and 3,780 m (11,000 and 12,400 ft) in elevation, although some extend down to about 2,600 m (8,600 ft).

The attractiveness of the stone for the tool-makers was the result of the unusual conditions in which it formed. During several intervals during the Pleistocene, the volcano summit region was capped by glacial ice. Geological interpretation suggests that the very dense, fine-grained hawaiite found on the upper slopes of Mauna Kea was formed as a result of a lava flow eruption beneath the ice cap, causing the magma to cool exceptionally quickly (S. C. Porter's 1987 research, cited, McCoy 1990:93). This quick-cooled lava yielded an especially fine-grained stone that could be turned into high-quality adzes, tools used traditionally to cut trees for woodworking and then to shape the wood for canoes and many other objects. One such eruption formed an escarpment of dense rock on the south side of the mountain below Lake Waiau, and this escarpment became the focus of stone procurement and working.

The scale of the enterprise was greater than any other of this type in Hawai'i. The quarry, including less intensively worked areas below the escarpment, was defined as covering 12 sq km, larger than all other known stone quarries combined. Archaeologists working at the quarry have identified over 264 workshop areas. These include areas where the stone was obtained and initially processed into blocks that could be taken elsewhere. Others are places where these blocks were further refined by percussion chipping. Some of these workshops include huge piles of waste debitage over 5 m high where the raw material was processed into "preforms" that could serve as blanks for making adzes (the most important Hawaiian tool for working wood).

When staying on the cold summit while working at the quarry, the Hawaiians protected themselves in the small rockshelters that are found on the mountain slopes. In these shelters there is evidence of the foods that the Hawaiians carried to the summit, hearths for cooking the food and for warmth, and stone flaking debitage. The entrances of many shelters were enclosed by rock walls. '*Opihi* shells may have been used as peelers for removing the corm or underground stem of the taro, which seems to have been one of the most important foods for those working at the quarry. Bird bone awls and volcanic glass flakes, used respectively to pierce and scrape wood and other soft materials, were other common tools. In one shelter an awl and flakes were found with pandanus leaves, possibly suggesting repair of mats or baskets, but it is perhaps more likely that the pandanus leaves were for use in offerings. Other perishable materials recovered in one of the shelters were a possible ti-leaf rain cape, sandal fragments, twisted cordage, and braided sennit (Allen 1981). In another shelter a silversword was found, wrapped with pieces of tapa cloth, pandanus leaf, and a wooden bottle gourd stopper with sennit cord attached. Food remains include shells of sea urchins, a barnacle, and marine mollusks including *'opihi*; and bones of fish (at least eight families represented), bird, most of which is probably dark-rumped petrel, but which also includes small numbers of native birds that are now

rare or extinct (the Hawaiian rail, coot, goose, duck, and crow, and honeycreepers); and mammal (pig, dog, and Pacific rat). Cultivated plants found at these sites most commonly are taro, ti, sugar cane, and gourd; seeds and fruits of wild plants are also common. The wild plants may have been available on the slopes of the mountain; others, such as the taro, ti, sugar cane, and gourd, were grown at lower elevations and carried up to the quarry.

From the hearths used for cooking and warmth come the fragments of charcoal that are used to date by radiocarbon analysis the use of the summit. Charcoal samples from the basal layers in three rockshelters have been dated to between A.D. 1100 and 1300, indicating that use of the quarry began within this period. The largest number of dates fall within the A.D. 1300-1650 year range, suggesting that this was a period of major use of the quarry.

An important aspect of the quarrying was the construction of shrines. As many as 45 shrines, identified as such on the basis of the presence of one or more upright stones, are found within the quarry. Most of these are directly associated with stone workshops or are above rockshelters, and their construction is therefore interpreted as relating to quarry activities. According to McCoy (1990), the surfaces of many shrines mimic workshops, with adze-manufacturing by-products scattered beneath the uprights, suggesting their use as ritual offerings. The shrines clearly reflect the close integration of spiritual beliefs and material practices in traditional Hawaiian culture.

Ritual Sites on the Mountain

In addition to the many shrines associated with the adze quarry, shrines are found in locations on the mountain where no evidence has been recovered to suggest any material resource procurement. For example, above the quarry, archaeological survey to date has revealed the presence of 93 sites within the Science Reserve; an additional 10 sites have been recorded high in the Natural Area Reserve, around Lake Waiau. Seventy-six of these are shrines, each comprised of a single upright stone or of multiple upright stones set together in a row or rows or grouped within a paved court area. Eight additional shrines are part of four adze-manufacturing workshops separate from the quarry.

The distribution of the shrines is of importance in interpreting their use and the traditional Hawaiian activities at the summit. Although *ahu* or *heiau* recorded historically (in documents) include one at the summit, the shrines recorded archaeologically in the Science Reserve are all located on the summit plateau, with none on the central summit cones or in their immediate vicinity. Most are located between 3,901 and 4,023 m (12,800 and 13,200 feet) in elevation and are concentrated most heavily on the north and northeast side of the mountain. The absence of shrines on the summit and their presence on the plateau may reflect environmental differences between the *pu'u* and the plateau, may result from differential preservation, or may suggest that the core summit region from about 4,023 m in elevation to the highest cone was largely avoided because of its high degree of sacredness.

The concentration of sites on the north and northeast sides also could be the result of survey bias or differential preservation, as the south side of the mountain has been more intensely modified in the past century. However, the distribution might also suggest that the usual approach to the mountain was not from the Saddle but rather from north side of the mountain, Although historical accounts such as that concerning the Poli'ahu Trail, used by 'Umi in the 16th century, document the use of trails from other directions, as well. It seems in any case that most access to

the summit was intended for high-ranking *ali‘i* from the population centers of Ka‘ohe and Hāmākua, the *ahupua‘a* and district within which the summit falls (according to the current boundaries).

In the absence of any organic remains associated with the summit shrines, it has not been possible to date directly the time of their use. Their similarity in style to the shrines in the adze quarry complex suggests that their time of construction and use may correspond with those dated shrines. However, the use of uprights as the central focus of the shrines is similar to early *marae* (temples) common in the islands of central and eastern Polynesia, the area from which the Polynesian voyagers came to Hawai‘i. This could be an indication that the first construction of these shrines may have begun quite early after Polynesian colonization, perhaps even earlier than the use of the quarry. Later, the use of uprights as the central focus of religious structures was replaced with a new type of temple structure as the Hawaiian *heiau* developed. McCoy (1982a, 1990) suggests that the summit region shrine complex reflects a historically undocumented pattern of pilgrimage to worship the snow goddess, Poli‘ahu, and the other mountain gods and goddesses.

Based on present knowledge, it seems that there are eight cairn sites on the summit plateau, of which one has been confirmed as containing burials and four others of which are considered likely to contain burials, based on similarities in form and placement to the known burial sites. All possible burial sites are located on the rims of cinder cones, although not on any of the highest cones at the summit itself. The known burials are on Pu‘u Mākanaka, northeast of the summit, three possible burials are located on cones northwest of the summit, and one is located on Pu‘u Līlīnoe, southeast of the summit. The distribution of burial sites, like that of shrines and other sites, may reflect differential preservation or may, as suggested by the burial places remembered by historical interviewees (e.g., Maly 1998:46, 1999:18-19), reflect a traditional preference to inter burials near the summit, but not in the most sacred region at the summit itself.

POST-CONTACT LAND USES AND ENVIRONMENTAL CHANGE

Contact with the Western world, beginning with the arrival of Captain Cook in the islands in 1778, altered in significant ways the relationship of the native Hawaiians with Mauna Kea. These changes completely alter the patterns of use, as reflected in the archaeological record of the post-Contact period, compared with that for the period before Contact.

Factors Causing Change after Contact

A number of factors were responsible for these post-Contact changes. The effect that appears to have been felt first and very rapidly after Contact was the reduction of the demand for stone tools with the introduction of iron and the very rapid and widespread adoption of iron tools by the Hawaiians. While the use of stone tools did not disappear (iron and stone tools are found together at some early post-Contact sites), iron replaced stone for most uses, and the need for new lithic raw material disappeared. As a result quarrying activities on the Mauna Kea summit appear to have ceased very soon after Contact. As noted above there are already indications in the archaeological record of decreased use during the last century before Contact. No materials introduced after Contact are found in the sites at the Mauna Kea Adze Quarry complex, nor are there the discarded remains of any animals and plants that were introduced after Contact.

The presence of only one reference in the early historical literature to actual quarrying on Mauna Kea (by the father and grandfather of Waiki, the man mentioned earlier who was born ca.1819) also suggests that these activities ended soon after Contact. Early European visitors to Mauna Kea observed the piles of flakes and adze preforms and the shelters, but are quiet in terms of any discussion of Hawaiian stone procurement or tool manufacture (e.g., McCoy 1977a and 1978:1, citing Joseph Goodrich, who accompanied Ellis to the summit in the 1820s and was the first to document the existence of the Mauna Kea Adze Quarry). This is interpreted as suggesting the rapid demise of stone adze manufacture and thus a reduced need for the raw stone material after the introduction of iron.

Several other factors were to reduce significantly the presence of Hawaiians on the mountain after Contact. The changes in Hawaiian social organization with the introduction of foreign ideas and goods and the unification of the islands under Kamehameha I produced changes that affected the use of this area. Regalia based on Western models began to supplant the traditional ways of expressing rank, such as the wearing of feathered cloaks by the *ali'i*, reducing the demand for hunting the colorful feathered birds in the upland forests. The introduction of foreign diseases to which the Hawaiians had no developed immunity severely reduced the population. The abolition of the *kapu* system in 1819 by Kamehameha II and others (Queen Keopuolani and Queen Ka'ahumanu), and the coming of Christian missionaries beginning in the following year ended certain traditional ritual practices and meant that those who continued to practice some of the traditions did so less conspicuously. Even though old shrines may have continued in use, new shrines were probably no longer ritually erected on the mountain. Thus the near-absence of clearly traditional sites on the summit is not surprising. While the traditional practices associated with the mountain were certainly not completely abandoned, as might be thought from reading the 19th-century documents of those non-natives who traveled around or up the mountain (discussed below), they were not as prevalent as in pre-Contact times.

Introduction of Cattle and Sheep and Environmental Degradation

Widespread environmental change began on the slopes of Mauna Kea soon after the introduction of cattle in 1792-1793 by Vancouver, who brought them from California. Vancouver gave cattle to Kamehameha I, who placed a *kapu* (restriction) on them for 10 years after Contact. Cattle were allowed to roam free and their numbers multiplied; soon they were grazing over wide areas that included the slopes of the mountain (Kamakau 1992:164); Kuykendall and Day 1962:33-34). By the 1820s the hunting of wild cattle was commercialized, supplying whaling and other ships with meat. By the 1830s, tallow and hides were also exported, and cattle ranching developed in Waimea. Wild cattle soon destroyed much of the vegetation cover on slopes where they grazed, turning native forests, shrub lands, and grasslands into pasturelands covered by introduced grasses. Cattle were observed by Ellis's party on the slopes above the forested zones by 1823 and, by 1840, were plentiful near the summit, as observed by Charles Wilkes, who commented that they must have been there either to drink snow or to escape hunters, as there was no vegetation to graze. Wilkes also commented on the fleas the cattle brought; insects thrive in cattle herds.

Between 1855 and 1868, Charles de Varigny commented that *nēnē* were being hunted to extinction in the saddle area, and were being replaced for purposes of hunting by cattle, boars, and wild dogs. Wild pigs, whose arrival on Mauna Kea is not well-documented, spread invasive introduced plants, harming the forest understory and the native forest birds who had formerly fed

in it. Feral pigs were still present in 1985-1986 in areas where *māmane* grew, near Hale Pōhaku (Bonk 1986). Pigs would also have fed on tree ferns, as they do elsewhere, encouraging water to pool in the stumps and inviting mosquitoes to breed. The Humuʻula Sheep Station was established, informally in 1856 to take advantage of feral sheep already present in the saddle (Maly 1998; Staples and Cowie 2001; (Tomonari-Tuggle 1996:17-18, 38-40)).

Firewood and other lumber were harvested commercially soon after Contact, decimating *koa* forests on Mauna Kea and elsewhere. *Pulu*, a silky fiber collected from *hāpuʻu,* the tree fern, was collected for export as pillow and mattress stuffing. Sugar cane was planted extensively on lower lands, below the forests, by the mid-19th century. Sugar mills needed large amounts of firewood, further depleting the mountain forests above, and their flumes both diverted mountain water and transported forest lumber downslope (Kuykendall and Day 1962:122; (Tomonari-Tuggle 1996:18-19, citing earlier sources).

In 1892, Alexander and his party, noting the spread of grass on the slopes, commented that, if not for the scant rainfall, they would be superb grazing land. He also reported that the *māmane* forests had all but disappeared on the western side of the mountain, and that even *ʻahinahina* (silversword, *Argyroxiphium sandwicense*; Wagner et al. 1990:261), high on the slopes, had nearly vanished (Maly 1998:38-41, 57-58). Many visitors, Hawaiian and foreign, had commented on the sandy nature of the upper-slope soils and sediments on Mauna Kea; Wilkes noted that the *puʻu* were composed of knee-deep loose sand. The stripping of tree and shrub cover would have led to increasing erosion on all slopes in the uppermost zones and those in deforested areas below, although that is not specifically noted in available 19th-century reports.

Nineteenth-Century Visits to the Mountain

Early European and American visitors reported difficulty obtaining guides to the highest areas on Mauna Kea. Although the reason was almost certainly the sacredness and special status of the mountain, especially the uppermost zones, in Hawaiian culture, some visitors concluded that the interior area was a virtually unknown wilderness (Maly 1998:38, quoting William Ellis in 1823). Foreign visitors apparently began to climb the mountain soon after Contact, as Joseph Goodrich, accompanying Ellis in 1823, found a rock cairn at the summit that he believed had been left by an even earlier visitor. Goodrich also mentioned foot paths through the large sandy region downslope.

Visits to the mountain increased in both frequency and in the numbers of people involved throughout the 19th century. In 1830, Kauikeaouli, Kamehameha III, visited the mountain on horseback, along with Hiram Bingham. In 1840, the Wilkes party (the U.S. Exploring Expedition party) documented Lake Waiau. In 1862, Wiltse and others began surveying boundaries on the mountain for the Boundary Commission. Isabella Bird, who traveled through many tropical lands, visited Mauna Kea in 1873. In 1882, J. S. Emerson, surveying other areas on the island, sketched Mauna Kea. In 1883, Queen Emma traveled over the mountain to Waimea; a pillar or cairn built to commemorate her visit was observed in 1892 by Alexander (1892b). In 1889 and 1891, E. D. Baldwin mapped the summit and near-summit areas, preparing his 1891 map (Baldwin 1891; Maly 1998).

Other changes during the 19th century included the building of cairns to commemorate visits. Two have been mentioned: the one built for Queen Emma's visit, and the one at the summit

observed much earlier, in 1823, by Goodrich, with Ellis's party. The Wilkes party erected a cairn in 1840. In 1891, Baldwin's party erected a cairn on the summit (Maly 1998); and, the following year, Alexander (1892b) built "a solid pier of masonry," with a flat rock for a pendulum apparatus. Three cairns are the only archaeological sites on the summit plateau that have been recorded during recent surveys (McCoy 1999).

Most of these groups traveled on horses, who, along with the cattle, no doubt obliterated many small earlier trails. Larger, wider roads built in the mid-19th century included the Judd Road, started in 1849 (south of Kailua, Kona) but completed only to a point just short of the 16th milepost; construction ceased in 1859. Built by prisoners, it was to cross the saddle all the way to Hilo. The mileposts were of *'ōhi'a* wood. The road, at its 14-mile point, passed very near Ahu o 'Umi, a *heiau* said to have built by 'Umi in the 16th century to celebrate a victory (Bryan 1921-1984:Box 7.10 [article and photographs originally published in the *Hilo Tribune Herald*, April 17, 1960]).

Late Nineteenth-Century Ranching

The Saddle and the lower slopes of the mountain witnessed the development of two large ranches in the late 1800s. These competed for the rights to raise cattle and sheep and hunt feral animals in the region. John Parker II held a lease to lands in Ka'ohe from sometime before 1876. The Waimea Grazing and Agricultural Company leased Humu'ula to the east from Kamehameha III around 1860 and raised sheep and also killed wild cattle for their hides. Their one sheep station along the current Mauna Kea Observatory Access Road, just above today's Saddle Road, was a remote and rather lonely place. A wagon road was built from Humu'ula to Waimea to transport wool to the harbor at Kawaihae. By 1885 the Humu'ula lease was held by the Humu'ula Sheep Station Company, which in that year obtained the lease for the east side of Ka'ohe, while Parker Ranch continued to lease the west side. The company hired immigrant Japanese stonemasons to build stone walls around their grazing lands in the 1890s; portions of these are still standing. After 1900 Parker Ranch expanded and took over control of the Humu'ula Sheep Station Company, and most of the lands in the Saddle became a part of Parker Ranch (Langlas et al. 1997; Peterson 2003).

In the late 19th century, the main trails on Mauna Kea increasingly merged with those serving the Humu'ula Sheep Station and Umikoa Ranch wagon trails, and additional roads began to appear. Among the better-known today are the Humu'ula-Mauna Kea Trail, on the Hilo side of the mountain, and the network of trails that join to become the Kahinahina Jeep Trail, which serves the upper slopes and circles the mountain (e.g., Bier 1988; (McEldowney 1982:1.12-1.13). All these roads provided increasingly easy access to all the traditional *wao* (environmental zones), and to the summit.

Early Twentieth Century

The 20th century brought additional, and rapid, change, especially with the planting by foresters of imported trees and other plants; and with road construction and the establishment of the observatories on Mauna Kea. Sheep were still numerous on the slopes in the 1930s -- some 40,000 around the mountain. One of L. W. Bryan's tasks as head of the Civilian Conservation Corps (CCC) was to build a sheep-proof fence around the summit of the mountain, to protect the remaining *māmane* forest and also the silversword, which he commented in a 1974 letter had

been devastated by wild sheep. *Māmane* continued to be endangered in the 1970s, the cause debated but possibly involving all of the cited causes: sheep, cattle, goats, fires, lumbering, and the growth of grasses that compete for the soil moisture needed for *māmane* seed germination (Bryan 1921-1984:Boxes 2.5 [inspection on 12/27/1935], 7.1 [1974 letter], 7.3 [newspaper articles]; (Tomonari-Tuggle 1996:18).

The CCC improved one of the main early roads, the Keanakolu Road, on the east side of the mountain, so that automobiles could now circumnavigate it. Bryan, as Forestry Officer and later Territorial Forester, eventually assumed the direction of the reforestation of denuded lands that had been initiated by Harold L. Lyon and the Hawaiian Sugar Planters Association in 1918, planting large numbers of trees – most of them introduced species – to control erosion (Bryan 1921-1984:Box 7.5 [brief history of Hawaiian forestry]; (Tomonari-Tuggle 1996:42-44)). The reforestation undoubtedly prevented much soil erosion, but also resulted in the additional isolation of the remaining patches of native forest.

Bryan and the CCC built the two stone cabins at Hale Pōhaku in 1936 and 1939, for use by visitors (Bryan 1921-1984:Box 2.6-2.7 [e.g., June 21, 1939, log entry regarding laying out second cabin]; (Pukui and Elbert 1986:38-39). Both have been preserved and remain in use today.

RECENT DEVELOPMENTS: OBSERVATORIES ON THE MOUNTAIN

The road improvements undertaken by the CCC were the first steps toward making the mountain more accessible and opening up new opportunities. With the coming of World War II, the U.S. Army took control of a large area in the western portion of the Saddle to use for training. This area was to remain in military hands after the war, developing into the Pōhakuloa Training Area, closing a large portion of the Saddle to public or private commercial use. However, the use of the area for training and the concern with providing an access route in case of Japanese invasion led to the construction of a graded, all-weather road through the Saddle by the CCC and U.S. Army Corps of Engineers in 1943. After the war, the Saddle Road, linking Hilo with Waimea, was paved, further easing access to Mauna Kea [Langlas et al. 1997:26].

In the early 1960s, interest grew in establishing an observatory on the summit. A paved road already existed from the Saddle Road at the base of the mountain to Hale Pōhaku. In 1964, a road was graded and graveled from Hale Pōhaku to the summit (Pickles 2003). The construction of this road, which became the Mauna Kea Observatory Access Road, opened up access to the summit and initiated intensive modification of the summit region.

Bishop (2003:27) provides a list of the main telescopes built at the observatories from 1968 through the present, with the years of their installation, beginning with the Air Force 0.6-m optical telescope south of the summit ridge in 1968. Its installation was quickly followed by a several other telescopes in the following five years, and then, in 1979, three telescopes. Following the completion in 1983 of a development plan, construction of new telescopes in the newly recognized Science Reserve resumed. Between 1986 and 1999 the submillimeter array, the Keck telescopes, the Very Long Baseline radio antenna (VLBA), the Subaru, and Gemini telescope were completed (Pickles 2003:46). Farther downslope, several observatory-related projects have also involved additions or modification of facilities at Hale Pōhaku, including

building of a dormitory for Subaru personnel. The stone cabins built by the CCC in the 1930s remain in place.

Increased access to the mountain and the need to evaluate the consequences of the development of the observatories has led to a number of cultural resource and environmental studies during the past 30 years. This research has included an intensive archaeological study of the Mauna Kea Adze Quarry by Bishop Museum under the direction of Patrick McCoy beginning in 1975 and 1976, archaeological surveys of the summit and extensive areas on the south side of the mountain, and the biological discovery and study of the rare *wēkiu* bug.

In 2002 the Keck Observatory and NASA proposed the construction of six 2-m-class telescopes to enhance the resolution of the Keck telescopes. The proposed project would join a complex of highly sophisticated astronomical observatories and contribute to the world-class significance of the astronomical information produced by investigations at the summit of Mauna Kea.

III. IDENTIFICATION OF BURIAL SITES

MAUNA KEA SCIENCE RESERVE BURIALS

Previous archaeological surveys of the Mauna Kea Science Reserve have documented numerous cultural resource sites, some of which have been identified as human burials. Oral history investigations document that there have been many other burials, including subsurface interment or burial as well as aerial dispersal of cremated human remains. This section of the Burial Treatment Plan identifies the areas where known burials have been reported (McCoy 1999). Five burial locations have been recorded as State of Hawai‘i archaeological sites (Table 1 and as shown on Fig. 2).

Figure 2: Burial locations on map of Mauna Kea Science Reserve (this figure has been withheld from publication in conformance with provisions of State of Hawai`i and Federal law)

TABLE 1. BURIALS AND POSSIBLE BURIALS INCLUDED IN SITE LIST FROM MCCOY (1999:TABLE1).

State Site No.	Elevation (ft. asl)	Description	Function
16195		2 cairns	possible burial
16248		series of cairns	burial
21413		cairn	possible burial
21414		cairn	possible burial
21416		cairn	possible burial

McCoy has conducted archaeological reconnaissance surveys in the Mauna Kea Science Reserve since 1979. Recently he updated much of this work for the Mauna Kea Science Reserve Master Plan (McCoy 1999). In that document, he defined a number of site types, as discussed in the background section of this Burial Treatment Plan. Among those definitions he included a type for known burials, as “a deliberate or intentional interment of human remains” and added, “all of the known and suspected burials in the Science Reserve are located in cairns situated on the tops of cinder cones” (McCoy 1999:3). He further discussed “Burials and Possible Burials - There are numerous references to human burials on the northern and eastern slopes of Mauna Kea, some at elevations that would fall within the boundaries of the Science Reserve (see discussion in McEldowey 1982)”(1999:25). Of these however, he asserted that “to date the only positively identified human remains found in the Science Reserve are located at Site 16248 on the

summit of Pu‘u Makanaka (Fig. 1). Jerome Kilmartin, a surveyor with the United States Geological Survey, noted the presence of human remains on this prominent cinder cone in 1925”(1999:26).

McCoy differentiated stone markers, which may have commemorated visits to summit localities, from burials, which appeared to McCoy to have been associated with the top of cinder cones. Site 16195 was recorded on the eastern rim of Pu‘u Lilinoe. McCoy proposed that this burial may have been among those reported by Alexander in 1892:

> The same afternoon (July 25, 1892) the surveyors occupied the summit of Lilinoe, a high rocky crater, a mile southeast of the central hills (the “summit”) and a little over 13,000 feet in elevation. Here, as at other places on the plateau, ancient graves are to be found. In olden times, it was a common practice of the natives in the surrounding region to carry up the bones of their deceased relatives to the summit plateau for burial.

Sites 21413, 21414, and 41416 consisted of single cairns, and are located on the southeastern rim of a cinder cone on the northwestern edge of the Science Reserve. These appeared to McCoy to be similar in form and location to the burial reported at Site 16195. In his report, McCoy discusses in detail the potential for additional burials in the Science Reserve:

> There is good reason to expect that more burials are to be found in the Science Reserve on the tops of cinder cones, either in cairns or in a small rockshelter or overhang. The basis for this prediction is that all of the known and suspected burial sites on the summit plateau are located on the tops of cinder cones and, more particularly, on the southern and eastern sides. No burials have been found on the sides or at the base of a cone, or on a ridgetop amongst any of the shrines. There in fact appears to be a clear separation between burial locations and shrine locations.
>
> The apparent restriction of the higher elevation burials to the apex of cinder cones is in sharp contrast to many of the burials found at Kanakaleonui, a well-known burial center located not too far outside of the Science Reserve, just below Pu‘u Makanaka and the summit plateau, which is the lower boundary of the proposed Mauna Kea Summit Historic District. Reconnaissance of this area indicates that there are indeed a great number of structural remains at this locality. There are platforms on the top of the cone and a great number of smaller cairns at the base. On current evidence there are more burials in the general environs of Kanakaleonui than probably exist higher on the mountain, possibly on all of the summit plateau. The disproportionate number of burials in the environs of Kanakaleonui suggests that the edge of the plateau might have been a major social boundary, with the area below reserved for commoners and the plateau for persons of higher social status (chiefs and priests). If the very top of the cones were

> reserved for higher status individuals and the ground below for commoners, then Kanakaleonui must have both"(McCoy 1999:28).

Following this reasoning, then each of the cinder cones throughout the District could have burials not only at their summit, as earlier proposed by McCoy, but also on the lower slopes as found on Kanakaleonui, apposite McCoy's conclusion. Nonetheless, in his judgment, the only "known" burials were found at Sites 16195, 16248, 21413, 21414, and 21416 as reported in the Table 1 and Figure 2, above.

OUTRIGGER TELESCOPES SITE

No burials have been found or reported specifically in the area impacted by construction of WMKO, the area within which the Outrigger Telescopes will be built. The area has been graded level and a significant volume of cinders at the top of the *pu'u* was removed for the Keck Telescopes. The areas proposed for on-site construction, installation, and operation of up to six Outrigger telescopes as part of the Outrigger Telescope Project have already been severely degraded.

In reviewing the results of previous construction at the site, the SHPD has concurred with NASA's conclusion that the removal of as much as 34 feet of earth from the top of this site during the construction of Keck I effectively precludes the presence of burials. However, the nature of the leveling that went on during construction of Keck II is less clear and leaves it uncertain whether burials might still be present at moderate depths in this portion of the WMKO site. SHPD concludes that, if ground surfaces still exist that were only superficially altered, then there remains a possibility that burials might be present and that provisions for treatment of such burials should be developed (Hibbard 1999).

Based on the extensive disturbance, archaeological inventory or testing of terrain, as recommended by the Historic Preservation Plan for Mauna Kea (McEldowney 1999:9-10) would not be appropriate. However, given the possibility that human remains might be present despite the disturbance, cultural and archaeological monitoring, as recommended in the Historic Preservation Plan and the EA and MOA for the project, should be conducted, and a Burial Treatment Plan (this document) should be submitted to the Hawai'i Island Burial Council and SHPD for their review and concurrence in advance of any construction activities.

IV. RECOGNITION OF LINEAL AND CULTURAL DESCENDANTS

DOCUMENTARY RESEARCH AND ORAL HISTORY INTERVIEWS

The Mauna Kea Science Reserve has been the focus of several comprehensive studies of documentary and oral history investigations. Maly (1998, 1999, as well as recently updated versions of these reports 2004, in preparation) has conducted the most recent effort. He interviewed numerous individuals with long-term relationships and special knowledge of the Mauna Kea summit and native Hawaiian cultural practice. Some of this information is incorporated in the background information presented in this plan. As an outcome of his exhaustive work, Maly identified one certain burial site, as documented by W.D. Alexander (1892b). This site is the same recorded as Site 16195 by McCoy (1999).

PUBLICATION OF LEGAL NOTICES

The following notice was published on May 2, 3, and 5, 2004 in the Hawaii Tribune-Herald and the Honolulu Star Bulletin, requesting information from any persons with knowledge about burials at the WMKO site. The text of legal notice is as follows:

Burial Notice

Notice is hereby given that possible burial sites on 11,288 acres of land owned by State of Hawaiʻi are located on parcel TMK 4-4-015:009 at W.M. Keck Observatory within Mauna Kea Science Reserve, Kaʻohe Ahupuaʻa, Hāmākua District, Hawaiʻi Island. A telescope installation project is proposed for the area. Archaeological survey has located four possible burial sites consisting of cairns (Sites 50-10-15-16195, 21413, 21414, and 21416). Site 16248 is a series of cairns containing human remains.

Although no known burials are located within the project area, a Burial Treatment Plan being prepared by Int'l Archaeological Research Inst., Inc. in accordance with Chapter 6E, HRS, regarding unmarked burial sites. Final decisions regarding treatment of burials located on the property shall be made by Hawaiʻi Island Burial Council. Individuals who are known to have cultural association with the general area have been contacted directly.

Hawaiʻi Island Burial Council requests that descendants of those who may have been buried in the aforementioned property and who may have knowledge regarding these remains or others in the area to immediately contact Kanaʻi Kapeliela (808) 692-8037 of State Historic Preservation Division, Burial Sites Program, 601 Kamokila Blvd., Room 555, Kapolei, HI 96707 on Oʻahu within 30 days of this notice to present information regarding appropriate treatment of the human remains. Responding individuals must be able to adequately demonstrate lineal descent from the Native Hawaiian remains, or cultural descent from ancestors associated with the burials on the summit of Mauna Kea where the graves are located.

CONSULTATIONS

Notification of consultations is pending publication of notice and response period.

V. PROPOSED TREATMENT

PRESERVATION PLAN

In keeping with the Historic Preservation Plan prepared for the Mauna Kea Science Reserve (McEldowny 1999), each individual historic property may have significance, but also each property contributes to the Historic District as a whole. Therefore, the significance of individual properties located within the district requires evaluation and treatment "collectively and within the context of the summit's natural landscape"(1999:3). For burials, which are both historically as well as culturally significant, preservation in place is the preferred treatment.

The Historic Preservation Plan requires that inventory, testing, and mitigative treatment be conducted before any project development in the Mauna Kea Science Reserve (McEldowney 1999:7-10). In areas that are already disturbed and where the terrain is no longer intact, the Plan recommends archaeological and cultural monitoring. Procedures for monitoring and compliance with the requirements for inadvertent discovery of burials are provided in Chapter 6E-43.6 (HRS) and administrative rule 13-300-40, and also in the "Mitigation and Monitoring Measures for the Outrigger Telescopes Project (Appendix G, Environmental Assessment for the Outrigger Telescopes Project, Mauna Kea Science Reserve, Island of Hawai'i).

In-place preservation would be the preferred treatment, where practicable, and this would be achieved through the establishment of defined preservation buffers.

PRESERVATION SITE BUFFERS

A buffer zone of 6.1 m (20 ft) will be established around the perimeters of burial sites except where this is incompatible with the Outrigger Telescopes Project design. Where a 6.1-m buffer zone would be incompatible with the Project design, either a smaller buffer zone will be established or the burial will be relocated. No land disturbing activity will occur within the buffer zones.

INADVERTENT BURIAL DISCOVERIES

This section of the Burial Treatment Plan provides guidelines and procedures for dealing with the inadvertent discovery of human remains during any activity at the Mauna Kea Science Reserve. The guidelines and procedures follow HRS 6E-43.6 (entitled "Inadvertent Discovery of Burial Sites") and the DLNR Administrative Rules Section 13-300-40.

Construction Monitoring

In order to insure recognition and proper treatment of any burial remains that may be inadvertently discovered during construction, construction activities will be monitored by an archaeologist and a cultural monitor, in accordance with the stipulations of the Memorandum of Agreement (MOA) prepared in connection with the Environmental Assessment for the Outrigger Telescopes project. NASA will be responsible for insuring that monitoring is undertaken as stipulated in the MOA.

During Construction

The following action will be taken during all ground alteration activities.

— An archaeological monitor will be present during all ground alteration activities, such as grading, grubbing, and excavation during any construction activities in the project area.

Following Construction

Following ground alteration activities, the professional archaeologist will prepare a report that meets all requirements of SHPD Administrative Rules 13-279-7, as well as documents (1) the measures taken to implement short-term preservation measures for burials and (2) any new burials that may hay have been uncovered. This report will be submitted to the SHPD.

Procedure for Inadvertent Burial Discoveries

SHPD Administrative Rules 13-300-40 lay out the procedure for inadvertent discoveries of human remains. In the event that previously unknown human remains are exposed during any action related to the development of the Mauna Kea Science Reserve, all work in the vicinity of the burial site shall cease (although work may continue in other areas of the development) and the remains shall be left in place and protected from further damage. Human remains may also be inadvertently exposed by natural events, such as storm erosion.

The SHPD Hawai‘i Island archaeologist, the Hawai‘i County Police Department, and the Hawai‘i County medical examiner coroner shall be notified. The SHPD will inform the representative of the Hawai‘i Island Burial Council of the discovery and the time that a site visit will be made. The Police Department has jurisdiction if the remains appear to be less than 50 years old; the SHPD has jurisdiction if they appear to be more than 50 years old.

If the remains are more than 50 years old, SHPD has three days to determine if they should be preserved in place or relocated. Remains shall be relocated if preservation in place is incompatible with the Project design. The SHPD determination will be made in consultation with landowners, any known lineal or cultural descendants, and appropriate ethnic organizations. When practicable, remains shall be preserved in place. If relocation is required, then provisions of this Burial Treatment Plan will be followed.

Once appropriate measures have been taken for protection or removal of the remains, development work in the area can resume.

Long-Term Preservation Treatment

Long-term preservation requirements address potential impacts from on-going use and occupation of the Mauna Kea Science Reserve.

1. All inadvertently discovered burial sites, whether in place or removed, will be set aside as preserves and will include a buffer zone that recognizes the surrounding landscape context of the site, although it will be a minimum of 6.1 m (20 ft) unless a buffer zone of such size is incompatible with the Project design. The site boundaries will be defined by an in-field evaluation of the relationship among described features and any surrounding undocumented features. Terrain features such as steep slopes that could act as a natural buffer will be considered in the final definition of buffer widths.

2. The burial site will be defined by berms, walls, or a combination of these elements, so long as there is no adverse effect on the historic property and historic district. The

purpose of this physical delineation is to clearly define the site and buffer boundaries and to protect the site from potential harm from unauthorized access. The physical barriers will be of such design that blends with the surrounding area.

3. Perpetual access to burial sites shall be granted to known lineal or cultural descendants.

MAINTENANCE AND SECURITY

Responsibility for maintenance and security of the burial site would lie with the University of Hawai‘i. Actual implementation could be placed in the hands of the Office of Mauna Kea Management or a successor organization, if any, that assumes its responsibilities. Long-term/permanent in-place preservation would be achieved by a means of a Memorandum of Agreement between the Hawai‘i Burial Council and the California Association for Research in Astronomy, project manager, which would include the appropriate requirements and restrictions relating to physical improvements, maintenance, security, and access by recognized lineal and/or cultural descendants.

ACCESS FOR LINEAL AND/OR CULTURAL DESCENDANTS

Access to the burial site for appropriate cultural activities would be permitted to any lineal and/or cultural descendant formally recognized by the HIBC or DNLR-SHPD in accordance with the administration procedures contained within Section 13-300-35: “Recognition of lineal and cultural descendants (DLNR 1006). Specific arrangements for access would be made by direct, mutual agreement between the University of Hawai‘i and recognized lineal and/or cultural descendants.

VI. IMPLEMENTATION OF THE BURIAL TREATMENT PLAN

Preservation measures contained in the Burial Treatment Plan would be implemented by the California Association for Research in Astronomy, project manager, following receipt by the applicant of DLNR written confirmation of mutual agreement to these measures.

VII. REFERENCES

Allen, M. S.

1981 *An Analysis of the Mauna Kea Adze Quarry Archaeobotanical Assemblage.* Unpublished M.A. thesis, University of Hawaii, Honolulu.

Alexander, W. D.

1892a *Summit Peaks of Mauna Kea.* Map. Original scale, 1:24,000. Registered Map 1860, Hawaii State Survey Office, Honolulu.

1892b The Ascent of Mauna Kea, Hawaii. *Hawaiian Gazette* 27(38):7. September 20, 1892. Honolulu. Copy on file, International Archaeological Research Institute, Inc., Honolulu.

Athens, J. Stephen, and Michael W. Kaschko

1989 Prehistoric Upland Bird Hunters: Archaeological Inventory Survey and Testing for the MPRC Project Area and the Bobcat Trail Road, Pohakuloa Training Area, Island of Hawaii. International Archaeological Research Institute, Inc., Honolulu. Prepared for U.S. Army Engineer District, Pacific Ocean Division, Fort Shafter, Hawai‘i. On file, U.S. Army Engineer District, Fort Shafter.

Baldwin, E. D.

1891 *Central Hawaii.* Map. Original scale, 1:24,000. Registered Map 1718, Hawaii State Survey Division, Honolulu.

Bayman, James M., Jadelyn J. Moniz-Nakamura, Timothy M. Reith, and Christine K. Paraso

2001 *The University of Hawai'i Archaeology Field School Pōhakuloa, Island of Hawaii: The 1998 & 1997 Seasons*. Department of Anthropology, University of Hawai'i at Mānoa, Honolulu.

Beckwith, Martha W.

1982 *Hawaiian Mythology*, originally published 1940 by Yale University Press. 3rd paperback printing. University of Hawaii Press, Honolulu.

Bier, James A.

1988 *Hawaii – The Big Island.* Map, 4th ed. (Bar scale). University of Hawaii Press, Honolulu.

Bishop, Hunter

2003 Balancing Act: Culture, Science Continue to Clash over Future Mauna Kea Development. *Stars over Mauna Kea.* Special ed., *Hawaii Tribune-Herald*:24-29. June 22, 2003.

Bryan, Leicester Winthrop

1921-1984 Notes, articles, correspondence. Ms. Group 243, Boxes 1-45. Bishop Museum Archives, Honolulu.

Emory, Kenneth P., and Yoshihiko Sinoto

1969 *Age of Sites in the South Point Area, Ka'u, Hawaii*. Pacific Anthropological Records 8. Department of Anthropology, B.P. Bishop Museum, Honolulu.

Hammatt, Hallett H., and Douglas Borthwick

1988 *Archaeological Reconnaissance of Two Proposed Antenna Sites for the National Radio Astronomy Observatory, Maunakea, Hawai'i.* Cultural Surveys Hawaii, Kailua, O'ahu. Prepared for MCM Planning, Honolulu. (Included as Appendix C in *Amendment to the Mauna Kea Science Reserve Complex Development Plan: Final Supplemental Environmental Impact Statement, VLBA Antenna Facility, Mauna Kea, Hāmākua, Hawai'i*, by MCM Planning; prepared for the University of Hawai'i Institute for Astronomy [1988]).

Hawaii Audubon Society

1993 *Hawaii's Birds*. 4th ed. Hawaii Audubon Society, Honolulu.

Hibbard, Don

1999 Letter dated May 3, 1999 from the State Historic Preservation Division Concerning the Cultural Importance of Mauna Kea. Appendix B, Environmental Assessment for the Outrigger Telescopes Project.

Kam, Wendell, and Jason Ota

1983 *Archaeological Reconnaissance Survey of Mauna Kea Observatory Powerline: Upper Portions, Mauna Kea, Hamakua, Hawaii.* State Historic Preservation Office, Honolulu. Prepared for University of Hawaii, Honolulu. On file, State Historic Preservation Division, Kapolei.

Kamakau, Samuel M.

1992 *Ruling Chiefs of Hawaii*. Rev. ed. Originally published, 1961. Kamehameha Schools Press, Honolulu.

Kanahele, Pualani Kanaka'ole, and Edward L. H. Kanahele

1997 *Hawaiian Cultural Impact Assessment of the Proposed Saddle Road Alignments.* Copy on file, International Archaeological Research Institute, Inc., Honolulu.

Kuykendall, Ralph S., and A. Grove Day

1962 *Hawaii: A History.* 2nd printing. Prentice-Hall, Englewood Cliffs, New Jersey.

Langlas, Charles, Thomas R. Wolforth, James Head, and Peter Jensen

1997 *Archaeological Inventory Survey and Historic and Traditional Cultural Assessment for the Hawai'i Defense Access Road A-AD-6(1) and Saddle Road (SR 200) Project, Districts of South Kohala, Hāmâkua, North Hilo, and South Hilo, Island of Hawai'i.* Paul H. Rosendahl, Ph.D., Inc., Hilo. Prepared for RUST Environmental and Infrastructure Inc., Phoenix, Arizona. On file, State Historic Preservation Division, Kapolei.

Lyons, Curtis J.

1891 *Kaohe and Humuula, Hawaii.* Map. Original scale, 1:60,000. Registered Map 1641, Hawaii State Survey Office, Honolulu.

1903 *A History of the Hawaiian Government Survey with Notes on Land Matters in Hawaii*. Appendices 3 and 4 in *Surveyor's Report for 1902*. Hawaiian Gazette, Honolulu.

Maly, Kepā

1998 "*Mauna Kea – Kuahiwi Ku Ha'o Mālie." A Report on Archival and Historical Documentary Research, Ahupua'a of Humu'ula and Ka'ohe, Districts of Hilo and Hāmākua, Island of Hawai'i.* Kumu Pono Associates, Hilo. (Note: the 1997 date on the title page is apparently incorrect). On file, State Historic Preservation Division, Kapolei, and International Archaeological Research Institute, Inc., Honolulu.

1999 *Mauna Kea Science Reserve and Hale Pōhaku Complex Development Plan Update: Oral History and Consultation Study, and Archival Literature Research. Ahupua'a of Ka'ohe (Hāmākua District) and Humu'ula (Hilo District), Island of Hawai'i.* Kumu Pono Associates, Hilo. Prepared for Group 70 International, Honolulu. On file, State Historic Preservation Division, Kapolei, and International Archaeological Research Institute, Inc., Honolulu.

McCoy, Patrick C.

1977a *The Mauna Kea Adz Quarry Project: A Summary of the 1975 Field Investigations.* Bishop Museum, Honolulu. On file, State Historic Preservation Division, Kapolei.

1977b The Mauna Kea Adze Quarry Project: A Summary of the 1975 Field Investigations. *Journal of the Polynesian Society* 86(2):223-244.

1978 *The B. P. Bishop Museum Mauna Kea Adz Quarry Project.* Bishop Museum Anthropology Department, Honolulu. Prepared for State Department of Land and Natural Resources, Historic Preservation Office, Honolulu. On file, State Historic Preservation Division, Kapolei.

1981 *Archaeological Survey: Kitt Peak National Observatory, Mauna Kea, Hawaii.* Bishop Museum Anthropology Department, Honolulu. Prepared for Hawaii Institute for Astronomy, Honolulu. On file, State Historic Preservation Division, Kapolei.

1982a Archaeological Reconnaissance Survey. Report 2 in *Cultural Resources Reconnaissance of the Mauna Kea Summit Region*, by Holly McEldowney and P. C. McCoy, pp. 2.1-2.38. Bishop Museum Anthropology Department, Honolulu. Prepared for Group 70, Honolulu. On file, State Historic Preservation Division, Kapolei.

1982b *Archaeological Survey of the Proposed Site of the Caltech 10-Meter Telescope on Mauna Kea, Hawai'i. Bishop Museum Anthropology Department, Honolulu. Prepared for Group 70, Honolulu.*

1984 *Archaeological Reconnaissance of Hopukani, Waihu, and Liloe Springs, Mauna Kea, Hawai'i.* Bishop Museum Anthropology Department, Honolulu. Prepared for U.S. Army Corps of Engineers, Pacific Ocean Division, Fort Shafter. On file, State Historic Preservation Division, Kapolei.

1985 *Preliminary Archaeological Survey of the Pu'u Kalepeamoa Site, Mauna Kea, Hawai'i.* Bishop Museum Anthropology Department, Honolulu. Prepared for MCM Planning (location not indicated). On file, State Historic Preservation Division, Kapolei.

1986 *Archaeological Investigations in the Hopukani and Liloe Springs Area of the Mauna Kea Adze Quarry, Hawai'i.* Bishop Museum Anthropology Department, Honolulu. Prepared for U.S. Army Engineer Division, Pacific Ocean, Fort Shafter. On file, State Historic Preservation Division, Kapolei.

1990 Subsistence in a 'Non-Subsistence' Environment: Factors of Production in a Hawaiian Alpine Desert Adze Quarry. In *Pacific Production Systems: Approaches to Economic Prehistory*, edited by D. E. Yen and J. M. J. Mummery, pp. 85-119. Australian National University Department of Prehistory, Research School of Pacific Studies, Canberra.

1991 *Survey and Test Excavations of the Pu'u Kalepeamoa Site, Mauna Kea, Hawai'i.* Mountain Archaeology Research Corp., Aiea, and Bishop Museum Applied Research Group, Public Archaeology Section, Honolulu. Prepared for the University of Hawaii at Manoa Facilities Planning and Management Office, Honolulu. On file, State Historic Preservation Division, Kapolei.

1999 Mauna Kea Science Reserve Archaeological Site Inventory: Formal, Functional, and Spatial Attributes. Appendix K, *Mauna Kea Science Reserve Master Plan Final Environmental Impact Statement*. Group 70 International, Inc., Honolulu.

McEldowney, Holly

1982 Ethnographic Background of the Mauna Kea Summit Region. Report 1 in *Cultural Resources Reconnaissance of the Mauna Kea Summit Region*, by H. McEldowney and Patrick C. McCoy, pp. 1.1-1.24. Bishop Museum Anthropology Department, Honolulu. Prepared for Group 70, Honolulu. On file, State Historic Preservation Division, Kapolei.

1999 Management Components of the Historic Preservation Plan for Mauna Kea – Outline and Review Draft. Appendix I, *Mauna Kea Science Reserve Master Plan Final Environmental Impact Statement*. Group 70 International, Inc., Honolulu.

Pickles, Andrew

2003 A Timeline of Astronomy in Hawaii Since the 1940s. *Stars over Mauna Kea.* Special ed., *Hawaii Tribune-Herald*:5, 46-47. June 22, 2003.

Pukui, Mary Kawena, and Samuel H. Elbert

1986 *Hawaiian Dictionary: Hawaiian-English, English-Hawaiian*. University of Hawaii Press, Honolulu.

Reinman, Fred, and Allan J. Schilz

1994 *Archaeological Data Recovery at the Multi-Purpose Range Complex, Pohakuloa Training Area, Island of Hawai'i.* Ogden Environmental and Energy Services, Honolulu. Prepared for U.S. Army Corps of Engineers, Fort Shafter, Hawai'i. On file, U.S. Army Corps of Engineers, Fort Shafter.

Robins, Jennifer J., and Hallett H. Hammatt

1990 *Archaeological Reconnaissance for Summit and Mid-Level Facilities for the Proposed Japan National Large Telescope, Maunakea, Hawai'i.* Cultural Surveys Hawaii, Kailua, O'ahu. Prepared for MCM Planning, Honolulu. (Included as Appendix B in *Project Description, Japan National Large Telescope (JNLT), Mauna Kea, Hāmākua, Hawaii*, by MCM Planning; prepared for the University of Hawai'i Institute for Astronomy [1991]).

Sinoto, Aki

1987 *Post-Field Report on the Archaeological Surface Survey of the Halepohaku Substation Site and the Overland Transmission Line-Mauka Approach Areas, Halepohaku, Mauna Kea, Hawai'i Island.* Mountain Archaeology Research, Aiea, and Bishop Museum Anthropology Department, Honolulu. Letter report submitted to Clyde Akita, Facilities Planning and Management Office, University of Hawai'i, Honolulu. On file, State Historic Preservation Division, Kapolei.

Spriggs, Matthew, and Atholl Anderson

1993 Late Colonization of East Polynesia. *Antiquity* 67:200-217.

Staples, George W., and Robert H. Cowie (editors)

2001 *Hawai'i's Invasive Species.* Mutual Publishing and Bishop Museum Press, Honolulu.

Tomonari-Tuggle, M. J.

1996 *Bird Catchers and Bullock Hunters in the Upland Mauna Kea Forest*: A Cultural Resource Overview of the Hakalau Forest National Wildlife Refuge, Island of Hawai'i. Prepared for U.S. Fish and Wildlife Service, Hilo, Hawaii. International Archaeological Research Institute, Inc., Honolulu.

U.S. Geological Survey

1982 *Mauna Kea.* Topographic sheet. Scale, 1:24,000. U.S. Geological Survey (location not indicated).

Wagner, Warren L., Derral R. Herbst, and S. H. Sohmer

1990 *Manual of the Flowering Plants of Hawai'i.* 2 vols. University of Hawaii and Bishop Museum Presses, Honolulu.

Williams, Scott

2002 *Ecosystem Management Program. Cultural Resources Inventory Survey of Previously Unsurveyed Areas, Redleg Trail Vicinity, U.S. Army Pohakuloa Training Area, Island of Hawai'i, Hawai'i.* Ogden Environmental and Energy Services, Honolulu. Prepared for U.S. Army Engineer District, Honolulu. On file, U.S. Army Engineer District, Honolulu.

Wiltse, S. C.

1862 *Humuula, Hilo, Hawaii*. Map. Bar scale. Tracing by L. Cabot. Registered Map 668, Hawaii State Survey Division, Honolulu.

This page intentionally left blank.

APPENDIX D

WĒKIU BUG MITIGATION PLAN

This page intentionally left blank.

APPENDIX D

WĒKIU BUG MITIGATION PLAN

Errata Sheet

July 28, 2004

This page intentionally left blank.

APPENDIX D WĒKIU BUG MITIGATION PLAN
ERRATA

Item 1: Wekiu bug habitat will be restored … (page 2). The 2nd paragraph under Item 1 is changed to read:

NASA and CARA have proposed Wēkiu bug habitat restoration in three areas within Puʻu Hau ʻOki that were previously damaged by observatory construction (Figure 1). The proposed restoration effort would encompass an area greater than 0.028 ha (0.069 ac), resulting in a habitat restoration of at least 3:1 relative to the amount of habitat that would be displaced by on-site construction and installation of Outrigger Telescopes 2 and 3. Restoration of the areas adjacent to JB5 and Outrigger Telescope 1 will be given equal priority to restoration of the area on the floor of Puʻu Hau ʻOki crater. Since the size of the restoration area will be limited by the amount of available cinder excavated during construction of the Outrigger Telescopes, the size of the restoration area on the floor of Puʻu Hau ʻOki crater may be reduced in order for areas adjacent to JB5 and Outrigger Telescope 1 to be restored. Restoration will continue until the supply of suitably-sized cinder is exhausted , or the restoration of all three areas is complete.

Item 12 (b): Contractors will be required to inspect … (page 7). The paragraph under Item 12 (b) is changed to read:

Prior to entry into the Mauna Kea Science Reserve, all large trucks, tractor-trailer rigs, earthmoving machinery, and other heavy equipment shall be inspected by a trained biologist, who shall certify that all large trucks, tractor-trailer rigs, earthmoving machinery, and other heavy equipment were inspected for flora and fauna that may potentially have an impact on the Mauna Kea summit ecosystem. This inspection will be recorded in the contractor's logbook.

Item 13 (b): Contractors will be required to inspect … (page 8). The first sentence in the 2nd paragraph under Item 13 (b) is changed to read:

Prior to entry into the Mauna Kea science reserve, all construction materials, equipment, crates, and containers carrying materials and equipment, shall be inspected by a trained biologist, who shall certify that all materials, equipment, and containers were inspected for flora and fauna that may potentially have an impact on the Mauna Kea summit ecosystem.

Item 16: Construction contracts will ensure … (page 9). The following is added to the paragraph:

To further ensure contractor compliance to mitigation procedures, CARA will implement the Wēkiu Bug Monitoring Plan.

This page intentionally left blank.

Wēkiu Bug Mitigation Plan

December 14, 2001

Wēkiu Bug Mitigation Plan

The following plan is based on recommendations provided by natural resource consultants at Pacific Analytics in the Wēkiu Bug Mitigation Report (Pacific Analytics 2000) (revised November 4, 2000) to restore habitat, and to prevent and mitigate impacts to the cinder slopes below the W.M. Keck Observatory (WMKO) complex during on-site construction, installation, and operation, as appropriate, of the proposed Outrigger Telescopes (Pacific Analytics 2000). (Numbers in parentheses after each commitment refer to the corresponding Pacific Analytics recommendation number.) It is the intention and hope that the Wēkiu bug population will actually **increase**, due to protection and restoration of potentially favorable habitat.

1. Wēkiu bug habitat will be restored in areas damaged by on-site Outrigger Telescope construction, and on the crater floor of Pu‘u Hau ‘Oki. Restored areas will total at least three times the total area damaged by new construction. (IV-1)

Areas damaged by new construction will be restored to the extent possible. This will not be possible in areas where new construction covers existing Wēkiu bug habitat with concrete foundations of junction boxes, air pipes, light tunnels, and retaining walls. Restoration of habitat of an area at least three times the area newly damaged will aid in enhancing the Wēkiu bug population in the crater. Material obtained from project excavations not used for backfill will be trucked to the temporary stockpile area where it will be screened and washed and all suitable material returned to Pu‘u Hau ‘Oki to be used for Wēkiu bug habitat restoration. All excavation material not directly used as fill or for Wēkiu bug habitat restoration will be placed on the mountain at locations to be determined after consultation with the State Historic Preservation Division (SHPD) and the Office of Mauna Kea Management (OMKM).

NASA and CARA have proposed Wēkiu bug habitat restoration within a portion of the crater bottom that was previously damaged by observatory construction on Pu‘u Hau ‘Oki. The proposed crater bottom restoration area is almost large enough to accomplish the proposed 3:1 restoration goal. Restoration of this area would be followed by restoration of the sloped crater wall habitat that would be disturbed by on-site construction of JB-5 at Outrigger Telescope 2. A third potential habitat restoration area has been identified at Outrigger Telescope 1. This third potential restoration area could be used in future restoration efforts or if the crater bottom restoration effort does not yield sufficient area to attain the 3:1 goal.

Restoration habitat will be composed of screened cinder larger than 1.3 centimeters (cm) (1/2 inch), washed with water to remove ash. Cinder will be spread 30 cm to 46 cm (12 to 18 inches) deep in the restoration areas, and will form a complete interface with cinder in

adjacent Wēkiu bug habitat. It may be necessary that cinder be spread more than 46 cm (18 inches) deep in some places, in order to assure the necessary contact with existing habitat.

Screened and washed cinder may be emplaced on the crater floor by partial tilting of the dump bed while the truck is slowly moving. No further working of the screened cinder is required; uneven deposition will make better habitat than an evenly spread or compacted surface. No preparation of the crater floor prior to deposition is required.

The non-permanent barrier blocking vehicle access to the crater floor will be removed to allow transport of the screened cinder into the crater floor. The barrier will be replaced after installation of the restored habitat.

Attractive, non-intrusive, educational signs will be installed near the crater access point along the adjacent service road, (see commitment 3). The signs will have information about Wēkiu bugs and their habitat. (Signs will help prevent unintentional disturbance of habitat by visitors to the summit.). Design of the signs will be consistent with the guidelines presented in the Mauna Kea Science Reserve Master Plan. Prior to installation, sign design and specifications will be submitted to both the Department of Land and Natural Resources (DLNR) and to OMKM for approval.

2. Under no circumstances during construction, installation, and operation will cinder or other materials be side-cast into Wēkiu bug habitat. Temporary barriers will be built along the slope breaks above the inner slopes of Pu‘u Hau ‘Oki crater. (IV-2)

Prior to any construction activities, temporary 3-foot high silt fences will be installed along the rim of the Pu‘u Hau ‘Oki crater, where excavation or trenching is planned to take place within six feet of the slope to contain cinder on the site. The temporary silt fences will be maintained by the contractor on a daily basis to repair any damage to the fence.

3. Educational signs will be placed along the slope break above Wēkiu bug habitat, and at the service road adjacent to the crater floor. (IV-3)

Many places along the WMKO leveled site provide special scenic vistas. There are foreground views into the Pu‘u Hau ‘Oki crater, midground views of the summit area, and background views of the entire Island and beyond. These vistas are unique and among the reasons people visit the summit.

Attractive, non-intrusive, educational signs will be installed to inform people about Wēkiu bugs and their habitat. Signs will help prevent unintentional disturbance of habitat by workers and visitors. Design of the signs will be consistent with the guidelines

presented in the Mauna Kea Science Reserve Master Plan. Prior to installation, sign design and specifications will be submitted to both the Department of Land and Natural Resources (DLNR) and to OMKM for approval.

4. Water will be applied to excavation sites and cinder stockpiles. (V-1)

Proposed excavation and construction activities will disturb less than one-half acre of the WMKO leveled site during the construction period. Water will be applied to excavation sites and cinder stockpiles during all earthmoving activities.

Construction contractors typically spray water as needed to minimize airborne particulate matter. Potable water is currently transported to the WMKO from Hilo in tankers capable of carrying up to 19 kiloliters (5,000 gallons) per trip. Potable water for dust suppression will also be transported to the site and applied as needed during trenching, bulldozing, or other soil disturbance activities.

The applied water is not expected to cause any negative impact to the Wēkiu bug, and may actually be beneficial. It is possible that the application of water to excavation sites could increase the amount of moisture available for Wēkiu bugs.

5. Dust-generating activities will be suspended during high winds. (V-2)

Storms and accompanying high winds can arise quickly at the summit. These winds are capable of raising dust from recently exposed cinder and ash. Dust-generating activities will be suspended during periods of high winds, and water will be applied to recently exposed cinder and ash.

6. Soil-binding stabilizers will be used sparingly, and will never be applied to Wēkiu bug habitat. (V-3)

Vehicle traffic to WMKO is expected to increase during and after construction of the Outrigger Telescopes. Environmentally-safe soil stabilizers may be applied to road and parking areas to reduce dust during and after on-site construction. Soil stabilizers may be needed to reduce dust during the excavation of Outrigger Telescope foundations and light tunnels. Environmentally-safe soil stabilizers will only be used where the application of potable water is inadequate for dust control. In no case will soil stabilizers be applied directly to Wēkiu bug habitat slopes, nor will they be applied to excavated cinder that is to be used in mitigation habitat. Application of soil stabilizers will be performed under light wind conditions to prevent drift into Wēkiu bug habitat.

Soil stabilizers are often applied to roads to improve stability and suppress dust. Generally, the stabilizers bind soil particles together to form a hard, protected surface. There are many commercially available dust control additives, each with characteristics

specific for soil types, climate conditions, and road uses. They also differ in soil penetration potential, suppression duration, and costs. All of these factors will be considered before a soil stabilizer treatment is applied.

Several dust-suppressing soil stabilizers are considered "environmentally friendly" and appear to be free of residuals that can harm native arthropod populations. Most have been tested for toxicity on micro-invertebrates, fish, and wildlife. Professional review before application of soil stabilizer products will reduce the chances of inadvertent impacts to Wēkiu bug habitat. An entomologist familiar with Wēkiu bug autecology will review the potential impacts of products being considered for use, and make recommendations. In no case will soil stabilizers be used indiscriminately, nor will they ever be applied beyond the slope break of the observatory site.

Soil stabilizers are not always appropriate for dust control. An alternative to soil stabilizers is the application of potable water to roads and construction site surfaces. Dust control watering could potentially increase water availability to Wēkiu bugs, enhancing survival and population growth.

7. The WMKO staff will continue to follow Federal guidelines specifying the use and disposal of substances used in the washing and recoating of observatory mirrors. (VI-1)

The WMKO 10-meter mirrors are made up of 36 segments, each approximately 1.8 meters (6 feet) in diameter. The proposed Outrigger Telescopes will use mirrors 1.8 meters (6 feet) in diameter. Under standard operating procedures, up to four mirror segments can be recoated in each month. Outrigger Telescope mirrors will be recoated on a similar schedule. The proposed additional four to six Outrigger Telescope mirrors will thus increase the total mirror surface area to be processed by 6 to 8 percent. Mirror recoating effluents at WMKO will be collected, and removed and transported off-site by a licensed waste handler.

8. Contractors will be required to minimize the amount of on-site paints, thinners, and solvents. Painting and construction equipment will not be cleaned on-site. Contractors will be required to keep a log of hazardous materials brought on-site and report spills immediately to a designated WMKO representative. (VI-2)

Many components of the proposed Outrigger Telescopes will arrive at the site ready for installation. Some components may require painting. Paints, thinners, and solvents are toxic to Wēkiu bugs. The amounts of such substances transported to the summit will be those required to support the current activity. The amount required for the entire project will not be stockpiled on the summit.

Cleaning paintbrushes, rollers, and paint-spraying equipment requires the use of solvents and thinners. Having these substances on-site increases the risk of spills. Painting equipment will be cleaned off-site to reduce the risk of spills that could impact Wēkiu bug populations.

Contractors will be required to keep a weekly log of hazardous materials they bring to the site. The log will consist of a list of the substances that are being used, and the number and size of the containers that arrive and leave the site. The log will be available for inspection by CARA representatives.

In the unlikely event of an accidental spill of hazardous materials, it will be reported immediately, and appropriate actions will be taken to limit the impact to Wēkiu bugs. Spills will be contained to limit the impact area, and if the spill results in soil contamination, the soil will be removed in a safe and effective manner. Logs and manifests can provide useful information regarding the hazardous materials on site, in case of an accidental spill.

9. Construction trash containers will be tightly covered to prevent construction wastes from being dispersed by wind. (VII-1)

Covering containers will decrease the amount of construction debris that could be blown onto Wēkiu bug habitat. "Roll off" containers will be equipped with secure tops and lids to ensure no debris escapes during high winds. Containers will be collected on a regular basis before they are completely full or overflowing. This could entail collection several times a week, particularly during periods of heavy use.

10. Construction materials stored at the site will be covered with tarps, or anchored in place, and not be susceptible to movement by wind. (VII-2)

Construction materials and supplies will be prevented from being blown into Wēkiu bug habitat by covering them with heavy canvas tarps. Steel cables, attached to anchors that are driven into the ground, can hold materials down.

Construction materials at the site will be tied down or otherwise secured during high winds and at close of work each day. Securing materials will reduce the chances of debris being blown off the site into Wēkiu bug habitat. Preventing debris from blowing onto the habitat slopes will reduce costs and potential habitat disturbance necessary to retrieve the items.

11. If construction materials and trash are blown into Wēkiu bug habitat, they will be collected to the extent practicable, with a minimum of disturbance to the habitat. (VII-4)

Despite efforts to prevent wind-blown construction materials and trash, some debris could end up in Wēkiu bug habitat. Retrieving this debris from sensitive areas will be done carefully and with minimum disturbance. Small pieces of debris will be allowed to blow out of Wēkiu bug habitat to spots where they can be collected safely. Larger debris will be removed with minimum disturbance to slope stability and structure. Methods for removal may vary depending on the material and its location. Contractors will be educated about appropriate debris retrieval methods.

12. Earthmoving equipment will be free of large deposits of soil, dirt, and vegetation debris that could harbor alien arthropods. (VIII-1)

(a) Contractors will be required to pressure-wash earthmoving equipment to remove alien arthropods.

Alien arthropods can arrive at the summit by two general pathways. First, alien species already on the Island can spread to new localities. Second, alien species can arrive with shipping crates and containers. In order to block the first pathway, heavy equipment, trucks, and trailers will be pressure-washed before being moved to the construction site at Pu‘u Hau ‘Oki.

Earthmoving equipment and large vehicles and trailers often sit at storage sites for several days or weeks between jobs. Most of these storage sites are located in industrial areas and usually support colonies of ants and other alien arthropods. These species often use stored equipment as refuges from rain, heat, and cold. Ants will colonize mud and dirt stuck to earthmoving equipment and could then be transported to uninfested areas. Spiders occupy stored equipment, looking for food or escaping predation by hiding in protected niches. Once transported to the summit, these species could migrate to Wēkiu bug habitat.

Pressure-washing of equipment before transportation to the construction site at Pu‘u Hau ‘Oki will remove dirt and mud and wash away ants, spiders and other alien arthropods, thereby reducing the chances of transporting these species to the summit area.

(b) Contractors will be required to inspect large trucks, tractors, and other heavy equipment before proceeding up the observatory access road.

Tractor-trailer rigs, earthmoving machinery, and other heavy equipment will be inspected for arthropods before proceeding up the observatory access road. This inspection will be recorded in the contractor’s logbook.

13. All construction materials, crates, shipping containers, packaging material, and observatory equipment will be free of alien arthropods when delivered to the summit. (VIII-2)

(a) Contractors will be required to inspect shipping crates, containers, and packing materials before shipment to Hawai‘i.

Alien arthropods can be transported to Hawai‘i via crates and packaging. Contractors will be requested to use only high quality, virgin packaging materials when shipping supplies and equipment. Pallet wood will be free of bark and other habitat that can facilitate the transport of alien species. WMKO managers will communicate to shippers, and suppliers the environmental concerns regarding alien arthropods, and inform them about appropriate inspection measures to ensure that supplies and equipment shipped to Hawai‘i are free of alien arthropods at the points of departure and arrival.

Shipping containers will be inspected and any visible arthropods removed. Construction of crates immediately prior to use will prevent alien arthropods from establishing nests or webs. Cleaning containers just prior to being loaded for shipping will also eliminate alien arthropod infestations.

Many arthropods may escape detection during shipping inspections. After arrival in Hawai‘i, crates or boxes to be transported to the summit will be re-inspected for spider webs, egg masses, and other signs of alien arthropods. Re-inspection prior to transport to the summit will reduce the potential for undetected alien arthropods reaching the summit.

(b) Contractors will be required to inspect construction materials before transport to the summit area.

Alien arthropods already resident in Hawai‘i are capable of hitchhiking on construction material such as bricks and blocks, plywood, dimensional lumber, pipes, and other supplies. Precautions will be taken to ensure that alien arthropods are not introduced to the Mauna Kea summit area.

Construction materials will be inspected before transport to the construction site. If any alien arthropods are discovered, the infestation will be removed prior to transport. Infestations of ants can be removed using pressure-washing. Infestations of spiders can be removed using brooms, vacuum cleaners, or other similar methods. Pesticide use on materials to be transported to the summit will be avoided.

14. Outdoor trash receptacles will be secured to the ground, have attached lids and plastic liners, and be collected frequently to reduce food availability for alien predators. (VII-3 & VIII-3)

Workers and visitors to the WMKO inevitably often bring some trash with them. Lunch bags, film canisters, wrappers, etc. can be easily blown into Wēkiu bug habitat. Receptacles will be provided to eliminate the dispersal of this kind of trash. The receptacles will be heavy and have attached lids so that they do not become flying objects in the high winds at the summit.

Readily available food supplies can facilitate the establishment of alien arthropods at the summit. Sanitary control of food and garbage will prevent access to food resources that could be used by invading ants and yellowjackets.

Refuse containers will be heavy and secured to the ground. Refuse will be collected on a regular basis before containers are completely full or overflowing. This could entail collection several times a week, particularly in eating areas and during periods of heavy use of the area.

Containers will be regularly washed using steam and/or soap to reduce odors that attract ants and yellowjackets. Plastic bag liners will be used in all garbage containers receiving food to control leaking fluids.

15. New alien arthropod introductions detected during monitoring will be eradicated. (VIII-4)

(a) Ant eradication

Sticky traps designed to capture ants will be deployed immediately after any ants are detected. Persistence of ant detections is indicative of larger infestations, and will prompt a search for and eradication of colonies. Bait and chemical control will be employed only when absolutely necessary and only by a certified pest control professional. In no case will pesticides be applied on or near restored habitat or crater slopes.

(b) Yellowjacket eradication

Traps will be deployed when yellowjackets are detected. Trapping yellowjackets is a useful method of control that does not require pesticides. Lures or baits will improve the effectiveness of traps. Localized yellowjacket populations can be reduced to non-threatening levels if trapping is employed immediately after detection. Traps will be maintained until yellowjackets are no longer detected.

(c) Alien spider eradication

Alien spider webs will be removed when detected. Native lycosid wolf spiders do not make webs. Native sheet-web spiders make tiny webs under the cinder surface. Only alien spiders make large spider webs at the WMKO site. Sweeping such webs away with a broom disrupts alien spider food capture success and destroys egg masses.

16. Construction contracts will ensure that compliance violations are corrected.

The commitments in this Mitigation Plan will become, as applicable, rules and guidance for contractors and operators during on-site construction, installation, and operation of the proposed Outrigger Telescopes, light tunnels, and retaining walls. This will be accomplished through appropriate contract provisions and CARA oversight of contractor activities. A well-designed monitoring plan will detect violation of the rules and guidance. Such a plan has been developed and will be implemented when construction begins. Violations or other errors will be corrected as soon as possible in a manner that protects and enhances Wēkiu bug population and habitat.

This page intentionally left blank.

APPENDIX E

WĒKIU BUG MONITORING PLAN

This page intentionally left blank.

APPENDIX E WĒKIU BUG MONITORING PLAN

Errata Sheet
July 28, 2004

This page intentionally left blank.

APPENDIX E WĒKIU BUG MONITORING PLAN
ERRATA

12. Section 3.1 – Introduction (page Effectiveness Monitoring - 1). The following is added after the last paragraph in this section:

NASA and CARA will implement the Wēkiu Bug Monitoring Plan, and restored habitats will be monitored quarterly by a qualified entomologist for 18 months following completion of the proposed habitat restoration to determine if the Wēkiu bug reestablishes in those areas. Monitoring of Wēkiu Bug populations shall continue biannually for no less than five (5) years following completion of the construction of the Outrigger Telescopes, and on an annual basis thereafter for the term of the CDUP. Additionally, efforts will be made to reduce the field study mortality of Wēkiu bugs to less than forty percent (40%). Progress reports on the efforts to reduce the field study mortality rate and monitoring results shall be submitted biannually to the Department of Land and Natural Resources, the Office of Mauna Kea Management, and the Bishop Museum for no less than five (5) years following completion of construction of the Outrigger Telescopes, and on an annual basis thereafter for the term of the CDUP.

13. Section 3.3 – Population Change Module; Question of Interest 3.3.1, Sampling Systems (page Effectiveness Monitoring – 3 - 4),

a. Sampling Intensities, 3.3.1A1 and 3.3.1B1) is changed to read:

3 pitfall traps in each location of restored habitat.

b. Sampling Frequencies, 3.3.1A all and 3.3.1B all) the text within the parentheses is deleted:

14. Section 3.3 – Population Change Module; Reporting: 3.3.1A all and 3.3.1B all) (page Effectiveness Monitoring - 4). The first part of the sentence is changed to read:

Include in all Quarterly, Biannual, and Annual reports,

15. Section 3.3 – Population Change Module; Question of Interest 3.3.2, Reporting System: 3.3.2A all and 3.3.2B all) (page Effectiveness Monitoring - 7). The first part of the sentence is changed to read:

Include in all Quarterly, Biannual, and Annual reports,

This page intentionally left blank.

WĒKIU BUG MONITORING PLAN - TABLE OF CONTENTS

1 OVERVIEW

1.1 Executive Summary
1.2 Introduction
1.3 Objectives
1.4 Systematic Monitoring

2 COMPLIANCE MONITORING

2.1 Introduction
2.2 Listing of the Questions of Interest
2.3 Habitat Restoration Module
2.4 Slope Stability Module
2.5 Dust Module
2.6 Hazardous Materials Module
2.7 Trash Module
2.8 Alien Arthropod Module

3 EFFECTIVENESS MONITORING

3.1 Introduction
3.2 Listing of the Questions of Interest
3.3 Population Change Module
3.4 Habitat Structure Module

4 RESULTS

4.1 Data Management
4.2 Data Analysis
4.3 Reporting

5 SCHEDULE & BUDGET

5.1 Schedule
5.2 Budget

6 PROTOCOLS

6.1 Population
6.2 Habitat
6.3 Contractor's Log Books
6.4 Meteorological Station
6.5 Alien Arthropod Inspection
6.6 Compliance Visual Inspection

This page intentionally left blank.

WĒKIU BUG MONITORING PLAN

Prepared for the Outrigger Telescopes Project

Jet Propulsion Laboratory

California Institute of Technology

Pasadena, California 91109

Pacific Analytics L.L.C.

P.O. Box 219

Albany, Oregon 97321

www.statpros.com

Revised October 24, 2001

OVERVIEW

1.1 - EXECUTIVE SUMMARY

The Mauna Kea Science Reserve is located on the summit of the tallest mountain in Hawai'i, (13,796 feet). Within the reserve are the world's two largest optical telescopes, constituting the W. M. Keck Observatory (WMKO). Directly adjacent to and below the WMKO is a unique natural environment that supports the Wēkiu bug, a rare insect found only in the extreme habitat of the Mauna Kea summit.

Current plans call for expanding the Keck Observatory by adding four Outrigger telescopes. These new telescopes will enhance the capabilities of telescopes by using a technique known as interferometry.

The National Aeronautics and Space Administration (NASA), through the Jet Propulsion Laboratory (JPL), together with the California Association for Research in Astronomy (CARA) and the University of Hawai'i Institute for Astronomy (IfA), have made a commitment to protect and enhance Wēkiu bug populations and habitat concurrently with construction of the new Outrigger Telescopes. To that end these collaborators have sponsored a Wēkiu Bug Mitigation Report from which they developed the Wēkiu Bug Mitigation Plan. They are also the sponsors of this Wēkiu Bug Monitoring Plan. Monitoring will help to assure all stakeholders that mitigation activities associated with the new construction will be beneficial to this rare insect.

Environmental monitoring is the scientific investigation of the changes in environmental phenomena that happen over time. This Wēkiu Bug Monitoring Plan describes the procedures necessary to implement an investigation of changes in Wēkiu Bug population and habitat adjacent to the WMKO during and after Outrigger Telescope construction.

This Monitoring Plan includes an Overview of Monitoring, (Section 1). Comprehensive discussions of the monitoring Questions of Interest are divided into Compliance and Effectiveness, (Sections 2 and 3). Data management, analysis, and reporting of monitoring findings are discussed in Section 4. A schedule may be found in Section 5. Protocols for data gathering are in Section 6.

1.2 - INTRODUCTION

The summit of Mauna Kea, on the Big Island of Hawai'i, is home to the largest observatory complex in the world. The summit is also home to unique plants and animals, including the Wēkiu bug. One of the principle habitats of this rare insect is directly adjacent to and below the Pu'u Hau Oki crater rim site of the W. M. Keck Observatory (WMKO).

This Monitoring Plan was developed to aid in protection and enhancement of the Wēkiu bug population. This Plan is consistent with the goal of good stewardship of the natural environment on the summit of Mauna Kea. The National Aeronautics and Space Administration, through the Jet Propulsion Laboratory, is the sponsor of this Monitoring Plan. The University of Hawai'i, the Institute for Astronomy, and the California Association for Research in Astronomy have provided significant assistance and collaboration.

Outrigger telescopes have been proposed as an addition to the WMKO. As part of that expansion project, three conservation programs have been recommended: mitigation, monitoring, and autecological studies.

Environmental mitigation is the protection and enhancement of natural resources. The Wēkiu Bug Mitigation Report, published under separate cover, recommends a mitigation program that will protect the Wēkiu bug population within Pu'u Hau Oki crater, and restore some of the habitat lost there in the past.

Environmental monitoring is the scientific investigation of the changes in environmental phenomena, attributes and characteristics that happen over time. Ecosystems are dynamic. Habitat conditions change daily, seasonally, and over longer periods of time. Animal and plant populations rise or fall in response to a host of environmental fluctuations. The general purpose of monitoring is to detect, understand, and predict the environmental changes.

JPL, NASA, CARA, and the IfA have made a commitment to do no harm to the Wēkiu bug population during the proposed construction and operation of the Outrigger Telescopes. In order to accomplish this, observatory planners and managers need scientific and reliable information about the Wēkiu bug, about the impacts of management actions to the habitat, and about changes in the population over time. Environmental monitoring is the best way to obtain that information.

This Monitoring Plan proposes methods for investigation of results of actions undertaken in the Mitigation Program, and the subsequent changes in the Wēkiu bug population and habitat. Two types of monitoring are necessary: compliance and effectiveness monitoring. This Plan specifies tasks, budgets, schedules, and methods for both types of monitoring. Compliance monitoring investigates the extent to which contractors, operators, managers, and visitors comply with Wēkiu bug protection guidelines and rules. Effectiveness monitoring investigates the changes in Wēkiu bug habitat and population that happen concurrently and subsequently to construction of the Outrigger telescopes. This includes monitoring of habitat restoration efforts.

The Monitoring Program will provide much of the data needed to protect and enhance natural resources, to modify management actions, to aid in compliance with environmental statutes, and to enhance public education and appreciation of the natural resources at the summit of Mauna Kea.

Monitoring alone, however, will not provide all the desired information about the Wēkiu bug. Additional autecological studies are also recommended. Autecology is the study of the patterns of distribution and abundance of individual species, together with the ecosystem structure and functions that influence distribution and abundance.

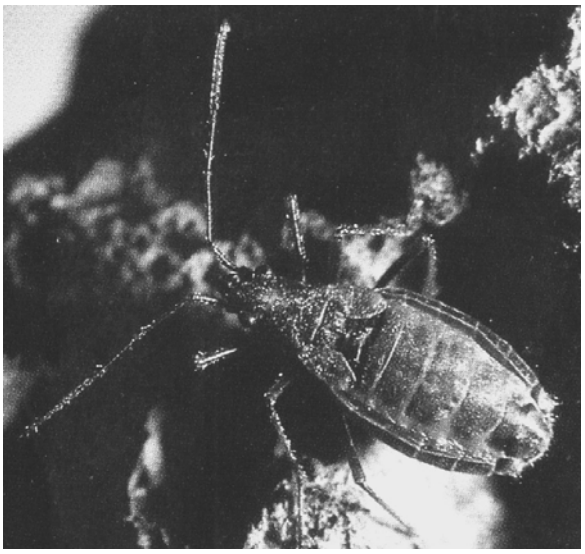


Figure 1 - 1. The Wēkiu bug, *Nysius wekiuicola*, native to the summit area of Mauna Kea. *Photo courtesy W.P. Mull.*

The three conservation programs, mitigation, monitoring, and autecological studies, together will provide the framework for protecting and enhancing the Wēkiu bug habitat and population on Mauna Kea. Lessons learned during the Outrigger Telescopes project will aid conservation efforts elsewhere on the summit, within the greater Mauna Kea Science Reserve, and on other mountaintops in Hawai'i.

1.3 - OBJECTIVES

The general objective of this report is to describe a Monitoring Program that aids in the protection and enhancement of the Wēkiu bug population and habitat adjacent to the W. M. Keck Observatory. The Monitoring Program will investigate the human activities and associated changes that occur to Wēkiu bug population and habitat during construction and operation of the proposed Outrigger Telescopes.

The Monitoring Plan is presented in sections and subsections. In the next subsection, 1.4 - Systematic Monitoring, we discuss the steps necessary to plan and implement monitoring. These steps apply to all the Questions of Interest (QOI's).

In the following two main sections, Section 2 – Compliance Monitoring, and Section 3 – Effectiveness Monitoring, we describe each recommended QOI in detail. The Compliance and Monitoring Sections are organized into modules:

Section 2 - Compliance Monitoring
- 2.1 Introduction
- 2.1 Listing of QOI's
- 2.3 Habitat Restoration Module
- 2.4 Slope Stability Module
- 2.5 Dust Module
- 2.6 Hazardous Materials Module
- 2.7 Trash Module
- 2.8 Alien Arthropods Module

Section 3 - Effectiveness Monitoring
- 3.1 Introduction
- 3.2 Listing of QOI's
- 3.3 Population Change Module
- 3.4 Habitat Module

This organizational structure allows for addition or deletion of component QOI's. As new knowledge is acquired about the Wēkiu bug, some QOI's may be satisfactorily answered and removed from the Program. New knowledge may also lead to new QOI's that can be added. In this way, the Monitoring Program is adaptable to new findings, needs, and conditions.

Discussions of data management, analysis, and reporting may be found in Section 4 - Results. A schedule for the Monitoring Program is given in Section 5 - Schedule and Budget. Protocols for data gathering are in Section 6 – Protocols.

1.4 - SYSTEMATIC MONITORING

Environmental monitoring is the investigation of the changes in environmental phenomena, attributes and characteristics that happen over time.

An investigation concerned only with measuring environmental phenomena, attributes, and characteristics at a single point in time is called an inventory. Monitoring is a series of inventories taken over time, repeated measurements taken in such a way as to be comparable with each other. Systematic monitoring is a monitoring program that follows a specified progression of tasks or steps to maximize the efficiency and utility of the investigation.

The Purposes of Monitoring

The most general purpose of environmental monitoring is to learn about the changes occurring in our natural world. This purpose may be subdivided into three more specific goals: to detect, predict, and understand those changes. Not all monitoring programs have all three of these goals, but all have at least one of them.

Every monitoring program has its own set of unique purposes, as well. These are usually one or more of the following, ranked in general order of increasing complexity and sophistication:

- To detect threshold events, or critical levels, of environmental phenomena, attributes, and characteristics.

- To detect specific changes in the environment.

- To detect hazards and risks to valued ecosystem attributes and functions and/or to the human communities that depend on them.

- To provide historical records of change in environmental phenomena, attributes, and characteristics.

- To detect trends, periodicities, cycles, and/or other patterns in those changes.

- To associate auxiliary phenomena, attributes, and characteristics with trends and patterns of change in key phenomena, attributes, and characteristics.

- To predict future changes in environmental phenomena, attributes, and characteristics.

- To link environmental changes to their causes.

Different monitoring programs may have different sets or combinations of these purposes. Clarity of purpose is important in planning monitoring programs. The more complex and sophisticated goals of establishing associations and cause-and-effect relationships typically require significantly more effort and expense than simple detection of change.

All these purposes of environmental monitoring involve increasing our knowledge and understanding. A closely related purpose of monitoring is to modify management actions. The new knowledge gained through monitoring should be useful in evaluating past environmental treatments and in directing new treatments, management actions, and other human influences. The ultimate goal of environmental management is good stewardship. Monitoring should inform stewardship efforts and help us to protect and enhance the natural world.

The Systematic Approach

We have identified the following seven-step process for planning of environmental monitoring:

1. Prepare clear statements of the important Questions of Interest (QOI's).

2. Design the sampling systems.

3. Develop sampling protocols for data collection.

4. Prepare the data management systems.

5. Plan the analysis and interpretation systems.

6. Develop a reporting system.

7. Develop a monitoring sustainability plan.

Each of these seven steps must be undertaken and completed to develop a successful monitoring program. The steps must be undertaken in a comprehensive manner. Planning decisions made in any one stage affect decisions at all the other stages.

Each QOI, (described in the Compliance Monitoring and Effectiveness Monitoring sections of this Plan), has been quantified, prioritized, and evaluated in accord with the seven planning steps.

1. Prepare clear statements of the QOI's.

The first step in developing this Monitoring Plan required clearly defining the QOI's. Key questions are those with answers that can be efficiently estimated and that yield the information necessary for management decision-making. The Monitoring Program depends upon identification of the important issues and concerns, and reducing general problems to questions of specific, measurable factors. Much future effort will be spent investigating the QOI's. Among those will be compliance checks to ensure that mitigation guidelines are followed. The QOI's also include measurement of Wēkiu bug population changes and changes in habitat characteristics, to be examined for relationships to natural phenomena (weather/climate) and human activities at the summit.

2. Design the sampling systems.

The second step in developing this Monitoring Plan was designing the sampling systems. Proposed questions of interest were prioritized, based on the projected costs of collecting the data and the projected value of the knowledge to be gained. Expertise in statistics, biometrics, and cost / benefit analysis was required for sampling system design. Some of the design techniques that were applied are power analysis, cost allocation analysis, sampling structure determinations, sample size determinations, scale evaluations, randomization, replication, blocking, and covariate determinations. Schedules of sampling efforts were also developed. Monitoring is the investigation of change over time, so planning the frequency and timing of sampling was an essential element in the sampling system design.

3. Develop sampling protocols for data collection.

The third step in developing this Monitoring Plan was creating the data collection systems. Sampling protocols are necessary to standardize data collection. Data gathered in the future must be comparable to data gathered today to statistically detect significant environmental changes. The protocols include specific methods to be used for each QOI, descriptions of the tools necessary for data collection, and randomization schemes for determining trap placement or measurement device location. Some of these protocols have been field-tested to assure feasibility and efficiency. Nondestructive sampling techniques have been recommended.

4. Prepare the data management systems.

The fourth step in developing this Monitoring Plan was the preparation of a data management plan. The data collected in each sampling exercise will be checked for errors and corrected. Data sets will be entered into a database for easy access and retrieval. Monitoring requires comparisons of attributes over lengthy periods of time. The database must be properly archived to be retrievable many years in the future.

It is important to recognize that data sets are expensive to obtain, and hence have significant monetary value. Not only will the archived data contribute information for future management decisions in the vicinity of Pu'u Hau Oki, they will also provide information potentially useful for natural resource management elsewhere on the Mauna Kea summit and on other mountaintops in Hawai'i.

5. Plan the analysis and interpretation systems.

The fifth step in developing this Monitoring Plan was the development of an analysis and interpretation plan. Statistical analysis and scientific interpretation are necessary to produce logical inferences and new knowledge from monitoring data. Techniques of exploratory data analysis (EDA), graphics, statistical distribution tests, data transformations, and modeling are described in this Plan.

Much of the information gained through monitoring will be evaluated by means of mathematical models. Such models include time trend analysis, survival analysis, growth and mortality models, and population change models. The appropriate model forms are specified for each QOI. These include the environmental parameters to be estimated, inferential strength measures appropriate to each QOI, and methods of biological interpretation.

6. Develop a reporting system.

The sixth step in developing this Monitoring Plan was the development of a plan for reporting the results. The new knowledge acquired through monitoring will be communicated to responsible parties and agencies, including JPL, NASA, CARA, the IfA, and other groups. Charts, tables, and maps may be the immediate products of analysis, but they will not stand alone. Associated reports will be clearly written, with consideration of the intended audience and the appropriate application of the findings. The reports will clearly explain the results of data analysis and the implications to natural resource management. Monitoring

reports will be produced according to the schedules specified for each QOI.

7. Develop a monitoring sustainability plan.

The seventh step in developing this Monitoring Plan is consideration of monitoring sustainability. Institutional commitment from stakeholders must be developed to secure annual budgetary planning for future monitoring efforts. Monitoring happens in the context of time. Environmental changes, and trends in those changes, are often detected only after several years of data collection. The individuals, groups and agencies concerned with management of the Mauna Kea summit must consider the Monitoring Program to be a permanent fixture in future budgets. Involving other stakeholders, such as the Hawai'i Department of Land and Natural Resources, the US Fish and Wildlife Service, native Hawaiian groups, environmental groups, and concerned citizens will help to build community commitment to the program.

Figure 1 - 2. Mauna Kea summit in winter. *Photo by D.A. Swanson, courtesy US Geological Survey.*

COMPLIANCE MONITORING

2.1 - INTRODUCTION

Compliance monitoring studies the extent to which contractors, operators, managers, and visitors comply with Wēkiu bug protection guidelines and rules. This Compliance Monitoring section is based on the twenty Recommendations made in the Wēkiu Bug Mitigation Report (under separate cover). CARA developed the Wēkiu Bug Mitigation Report based on this report and the Recommendations contained therein. Monitoring for compliance with guidelines will give the operators, oversight agencies, and the public the information necessary to ensure that natural resources are protected during the Outrigger Telescopes project.

This Compliance Monitoring Section is organized into eight modules:

2.1 Introduction
2.1 Listing of QOI's
2.3 Habitat Restoration Module
2.4 Slope Stability Module
2.5 Dust Module
2.6 Hazardous Materials Module
2.7 Trash Module
2.8 Alien Arthropods Module

More Questions of Interest (QOI's) may be added, or some deleted, if and when desired. The Monitoring Program is thus adaptable to new conditions and findings.

Each Module contains a comprehensive discussion of each of the associated QOI's, including justification, monitoring goals, sampling systems, sampling protocols, analysis and interpretation, and reporting.

Subsections on data analysis, data management and reports may be found in Section 4 – Results. Reports called for in this Monitoring Plan include Quarterly Reports during construction, a synthesis report upon Construction Completion, and a Post-Construction Report one year following completion. Special reports for some QOI's are also planned. The more complex sampling protocols may be found in Section 6 - Protocols.

Many of the QOI's include the general question of "when". It should be noted that, for the purposes of this Monitoring Program, initial conditions are those that will be found when the first inventories are performed, not the conditions estimated or hypothesized to have existed prior to this project.

2.2 - LISTING OF THE COMPLIANCE MONITORING QUESTIONS OF INTEREST

2.3 - Habitat Restoration Module

2.3.1 What type of habitat restoration has occurred, (final designs, installation procedures followed), where has habitat been restored, (location, dimension), and when, (dates, progress)?

2.4 - Slope Stability Module

2.4.1 What kind of temporary and permanent barriers have been installed to prevent disturbance to Wēkiu bug habitat in Pu‘u Hau Oki crater, (final designs, installation procedures followed), where have they been installed (location, dimension), and when were they installed (dates, progress)?

2.4.2 Where, when, and in what quantities has cinder been accidentally side-cast into Wēkiu bug habitat in Pu‘u Hau Oki crater?

2.4.3. Where, when, and in what quantities has snow or ice (accumulated by plowing) been side-cast into Wēkiu bug habitat in Pu‘u Hau Oki crater?

2.4.4 Where, when, what kind, and how many educational signs, (placed to discourage pedestrian traffic in Wēkiu bug habitat in Pu‘u Hau Oki crater), have been installed?

2.5 - Dust Module

2.5.1 Where, when, and in what quantities has water been applied to excavation sites and cinder stockpiles created by earthmoving activities?

2.5.2 Where and when have dust-generating activities been suspended, (to prevent dust from being blown into Wēkiu bug habitat in Pu‘u Hau Oki crater)?

2.5.3 Where and when have excavated materials and cinder stockpiles been covered, (to prevent dust from being blown into Wēkiu bug habitat in Pu‘u Hau Oki crater)?

2.5.4 Where, when, and in what quantities have soil-binding compounds been used?

2.6 - Hazardous Materials Module

2.6.1 Where, when, and in what quantities have chemicals been used for washing observatory mirrors? Have all regulatory guidelines been followed, including the proper disposal of associated compounds, tools, and containers?

2.6.2 Where, when, and in what quantities have contractors used paints, thinners, and solvents on-site? Have all regulatory guidelines been followed, including the proper disposal of associated compounds, tools, and containers?

2.6.3 Where, when, and in what quantities have spills of hazardous materials occurred? In the case of spills, have all regulatory guidelines for spill cleanup been followed?

2.7 - Trash Module

2.7.1 Where and when have roll-off trash containers been tightly covered, (or uncovered)?

2.7.2 Where and when have construction materials stored at the site been covered with tarps, or anchored in place to prevent movement by wind (or left uncovered and/or unsecured)?

2.7.3 What kind of outdoor trash receptacles have been installed to prevent trash from being blown into Wēkiu bug habitat in Pu‘u Hau Oki crater, where have they been installed, and when were they installed?

2.7.4 Where, when, what kind, and in what quantities have construction materials and other trash been blown into Wēkiu bug habitat in Pu‘u Hau Oki crater? Where, when, and what methods have been used to collect construction materials and other trash blown into Wēkiu bug habitat in Pu‘u Hau Oki crater?

2.8 - Alien Arthropod Module

2.8.1 Where and when have ants been detected at storage yards and staging areas, and what eradication actions have been taken?

2.8.2 Where and when have alien arthropods, or soil, dirt, or vegetation capable of harboring alien arthropods, been found on earth-moving equipment? When has earth-moving equipment been pressured-washed (to remove alien arthropods) before being moved to the construction site?

2.8.3 Where and when have large trucks, tractors, other vehicles, and construction materials been inspected before being transported to the summit? Have any alien arthropods been found in those inspections? Where, when, and what actions have been taken to eradicate any alien arthropods found in those inspections?

2.8.4 Where and when have shipping crates and boxes been inspected for spider webs, egg masses, and other signs of alien arthropods before being transported to the summit? Have any alien arthropods been found in those inspections? Where, when, and what actions have been taken to eradicate any alien arthropods found in those inspections?

2.8.5 Where, when, and in what quantities have alien arthropods been found at the WKMO observatory site? Where, when, and what actions have been taken to eradicate any alien arthropods found in those inspections?

2.3 - Habitat Restoration Module

Question of Interest 2.3.1

What type of habitat restoration has occurred, (final designs, installation procedures followed), where has habitat been restored, (location, dimension), and when, (dates, progress)?

Justification:

Habitat restoration areas will provide new habitat for Wēkiu bugs in areas damaged or disturbed by new or prior observatory construction activities, (see Recommendations IV-1 and IV-2 in the Wēkiu Bug Mitigation Report).

Monitoring goals:

To provide an historical record of Wēkiu Bug habitat restoration activities. See also Effectiveness Monitoring, Habitat, and Population.

Sampling System:

Sampling Measurements

2.3.1A) Professional review of plans prior to installation of the restored habitat. Engineers and entomologists will review proposed locations, designs, and construction procedures to insure that the restoration will have a high likelihood of recreating and restoring favorable Wēkiu bug habitat.

2.3.1B) Measurements during construction of restored areas.

1) Size distribution of screened and washed cinder used.

2) Locations, including spatial extent of site preparation and installation activities, as well as final size of restored areas.

2.3.1C) Measurements following construction of the restored areas.

1) Depths of installed screened and washed cinder.

2) Porosity of installed screened and washed cinder. Note: porosity is the percentage, by volume, of voids divided by the total volume of materials installed.

Sampling Intensities

2.3.1A) 100% review

2.3.1B1) Prior to installation count the number of rocks or rock fragments by diameter class (screen size) from a random sample of the screened and washed cinder to be used for habitat restoration. One twentieth of one percent (0.05%) of the material will be measured, (1 cubic foot measured per 2,000 cubic feet of screened and washed cinder). If screening and washing procedures are altered during construction, additional measurements should be made. Sampling target: 10 samples, 0.5 cu. ft. each.

2.3.1B2) After installation locate perimeter points every 20 feet around the restored areas. Locations should be accurate to ± 2 feet relative to fixed reference points, such as existing building corners or survey monuments. Sampling target: 15-20 located perimeter points, suitable for mapping the areas.

2.3.1C1) Measure depth of installed cinder ± 1 inch on a randomly located 20'x20' grid, (one measurement per 400 square feet of installed habitat mitigation structures or restored areas). Sampling target: 10 cinder depth measurements.

2.3.1C2) Measure porosity of installed screened and washed cinder. One twentieth of one percent (0.05%) of the installed material will be measured, (1 cubic foot measured per 2,000 cubic feet of screened and washed cinder). Sampling target: 10 samples, 1 cu. ft. each.

Sampling Frequencies

2.3.1A) Once, prior to restored habitat installation.

2.3.1B all) Once, during restored habitat installation. If procedures or locations are altered during installation, or repeated in new locations, measurements B1, B2, and B3 may need to be repeated.

2.3.1C all) Once, immediately after installation. If procedures or locations are altered during installation, or repeated in new locations, measurements C1, and C2 may need to be repeated.

Sampling Protocol: See Protocols, Habitat

Data Management: See Results, Data Management

Analysis and Interpretation:

2.3.1B1) Histogram

2.3.1B2) Map (GIS)

2.3.1C1) Mean, range, variation. Map point measurements (GIS)

2.3.1C2) Mean, range, variation. Map point measurements (GIS)

Reporting:

2.3.1A) Written review of habitat restoration plans, delivery prior to initiating installation.

2.3.1B all) Written report, within two months after installation.

2.3.1C all) Written report, within two months after installation. Include in Post Construction Report.

2.4 - SLOPE STABILITY MODULE

Question of Interest 2.4.1

What kind of temporary and permanent barriers have been installed to prevent disturbance to Wēkiu bug habitat in Pu'u Hau Oki crater, (final designs, installation procedures followed), where have they been installed (location, dimension), and when were they installed (dates, progress)?

Justification:

Temporary and permanent barriers constructed along the slope break prior to construction will prevent excavated cinder, construction materials, and trash from falling or blowing into Pu'u Hau Oki crater, (see Recommendation IV-3 in the Wēkiu Bug Mitigation Report).

Monitoring goals:

To provide an historical record of Wēkiu bug habitat protection activities. See also Effectiveness Monitoring, Habitat Structure Module.

Sampling System:

Sampling Measurements

2.4.1A) Measurements during construction and use of temporary barriers.
- **1)** Sizes, shapes, colors, and face textures of any barriers used.
- **2)** Locations of any barriers used.

2.4.1B) Measurements after installation of permanent barriers.
- **1)** Sizes, shapes, colors, and face textures of any barriers used.
- **2)** Locations of any barriers used.

Sampling Intensities

2.4.1A1 & 2.4.1B1) Describe each type of barrier used.

2.4.1A2 & 2.4.1B2) Locate points every 20 feet along the barriers. Locations should be accurate to ± 1 foot relative to fixed reference points, such as existing building corners or survey monuments. Sampling target: 20 located barrier points, suitable for mapping the barriers.

Sampling Frequencies

2.4.1 all) Once for each type of barrier. In addition, compliance visual inspections at random intervals, averaging once per month.

Sampling Protocol:

2.4.1A2 & 2.4.1B2) **Tools:** 100′ tape measure, compass, clinometer
Procedures: measure distance, azimuth, and slope from fixed reference points to points every 20′ along the temporary and permanent barriers.

Data Management: See Results, Data Management

Analysis and Interpretation:

2.4.1A1 & 2.4.1B1) Description

2.4.1A2 & 2.4.1B2) Map (GIS)

Reporting:

2.4.1A1& 2.4.1A2) For temporary barriers, include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

2.4.1B1 & 2.4.1B2) For permanent barriers, a written report, within two months after installation. Include in Post Construction Report.

Question of Interest 2.4.2

Where, when, and in what quantities has cinder been accidentally side-cast into Wēkiu bug habitat in Pu'u Hau Oki crater?

Justification:

Excavated cinder, side cast into Wēkiu bug habitat, could alter slope stability and habitat structure. (see Recommendation IV-3 in the Wēkiu Bug Mitigation Report).

Monitoring goals:

To detect hazards and risks to valued ecosystem attributes and functions, and to provide an historical record of Wēkiu bug habitat protection activities. See also Effectiveness Monitoring, Habitat Structure Module.

Sampling System:

Sampling Measurements

2.4.2A) Measure, during construction, the change in cinder surface position down slope of the construction areas adjacent to Pu'u Hau Oki crater.

Sampling Intensities

2.4.2A) Measurement points every 20 feet horizontally (on the contour) 10 feet (slope distance) down slope of construction areas for Outrigger Telescopes 1 and 2 (on the Pu'u Hau Oki crater side). Sampling target: 15-20 located measurement points.

Sampling Frequencies

2.4.2A) Once per month during construction, and again one year following completion of construction activities. Sampling target: 18-21 dates.

Sampling Protocol:

2.4.2A) Tools: Prepare measuring rods, using 6-foot-long rebar or metal fence posts, by painting white with red or black marks at one inch increments from top.

Procedures: Locate and mark with survey stakes the boundaries of construction areas. Drive measuring rods securely into the slope every 20 feet on the contour, 10 feet slope distance below edge of construction areas for Outrigger Telescopes 1 & 2 (on the Pu'u Hau Oki crater side). Repair and restore (by raking) the slope surface around each measuring rod. Record the vertical distance (length in inches) from the surface to the top of each measuring rod. Subsequent measurements should be made using binoculars to view the rods from upslope positions (to minimize any further habitat disturbance). Repeat these measurements once per month. If significant amounts of side cast cinder are detected, estimate the slope distance (in feet, down slope of each measuring rod, that side cast cinder is visually evident.

Data Management: See Results, Data Management

Analysis and Interpretation Systems:

2.4.2A) If the measuring rods are driven securely, they should not move up or down. If significant amounts of cinder are side cast from construction activities, changes in the vertical distances from the surface to the top of each rod will be detected. Trigonometric calculations, using the estimated down slope coverage of side cast cinder, will yield volume estimates of the amount of cinder side cast into Wēkiu bug habitat in Pu'u Hau Oki crater. Repeating the measurements every two weeks will provide an ongoing assessment of side cast cinder.

Reporting System:

2.4.2A) If side cast cinder is detected, it should be reported immediately. Otherwise, include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.4.3

Where, when, and in what quantities has snow or ice (accumulated by plowing) been side-cast into Wēkiu bug habitat in Pu'u Hau Oki crater?

Justification:

Large quantities of accumulated snow (ice boulders), side cast into Wēkiu bug habitat, could alter slope stability and habitat structure, (see Recommendation IV-3 in the Wēkiu Bug Mitigation Report).

Monitoring goals:

To detect hazards and risks to valued ecosystem attributes and functions, and to provide an historical record of Wēkiu bug habitat protection activities. See also Effectiveness Monitoring, Habitat Structure Module.

Sampling System:

Sampling Measurements

2.4.3A) Measure snow accumulations, should they occur, along the upper edge of Pu'u Hau Oki crater.

Sampling Intensities

2.4.3A) Measurement points every 40 feet horizontally along the upper edge of Pu'u Hau Oki crater. Sampling target: 10 located measurement points.

Sampling Frequencies

2.4.3A) Once per month, during periods when snow accumulates (from plowing or other snow removal methods). It is possible that deep snow may not occur during the Outrigger Telescope project.

Sampling Protocol:

2.4.3A) Tools: 100′ tape measure, shovel

Procedures: Measure width, breadth, and length of snow accumulations at points every 40′ along the upper edge of Puʻu Hau Oki crater.

Data Management: See Results. Data Management

Analysis and Interpretation Systems:

2.4.3A) Time series, volume of accumulated snow at dates.

Reporting System:

2.4.3A) If conditions are found that constitute a hazard to Wēkiu bug habitat in Puʻu Hau Oki crater, it should be reported immediately. Otherwise, include in Quarterly Reports, Construction Completion Report within two months after the completion of construction activities, and in the Post-Construction Report.

Question of Interest 2.4.4

Where, when, what kind, and how many educational signs, (placed to discourage pedestrian traffic in Wēkiu bug habitat in Pu'u Hau Oki crater), have been installed?

Justification:

Educational signs will help prevent unintentional disturbance of Wēkiu bug habitat by workers and visitors, (see Recommendation IV-4 in the Wēkiu Bug Mitigation Report).

Monitoring goals:

To provide an historical record of Wēkiu bug habitat protection activities. See also Effectiveness Monitoring, Habitat Structure Module.

Sampling System:

Sampling Measurements

2.4.4A) Measurements following installation
- **1)** Sizes, shapes, colors, and content of any educational signs used
- **2)** Locations of any educational signs used

Sampling Intensities

2.4.4A all) Describe each type of educational signs used and their locations. Locations should be accurate to ± 1 foot relative to fixed reference points, such as existing building corners or survey monuments.

Sampling Frequencies

2.4.4A all) Once, following sign installation.

Sampling Protocol:

2.4.4A all) **Tools:** 100′ tape measure, camera

Procedures: Measure distance, azimuth, and slope from fixed reference points to each educational sign. Photograph sign for record of content.

Data Management: See Data Management, Results Section

Analysis and Interpretation Systems:

2.4.4A all) Descriptions with photographs

Reporting System:

2.4.4A all) A written report within two months of completion of installation of educational signs, and include in the Construction Completion and Post-Construction Reports.

2.5 - DUST MODULE

Question of Interest 2.5.1

When and in what quantity has water been applied to excavation sites and cinder stockpiles created by earthmoving activities?

Justification:

Excessive deposition of ash and dust from excavation activity may alter the structure of Wēkiu bug habitat in Pu'u Hau Oki crater, (see Recommendation V-1 in the Wēkiu Bug Mitigation Report).

Monitoring Goals:

To provide an historical record of Wēkiu bug habitat protection activities. See also Effectiveness Monitoring, Habitat Structure Module.

Sampling System:

Sampling Measurements

2.5.1A) Measurements during construction
- **1)** The number of excavations
- **2)** The dates when water was applied to excavation sites and cinder stockpiles
- **3)** The quantity and dates of water trucked to the construction site

Sampling Intensities

2.5.1A all) 100% review of Contractors' Log Book

Sampling Frequencies

2.5.1A all) Once per month, during construction.

Sampling Protocol: See Protocols, Contractors' Log Book

Data Management: See Results, Data Management

Analysis and Interpretation:

2.5.1A1) Time series, dates of excavation activity.

2.5.1A2) Time series, dates water was applied to excavation sites and cinder stockpiles.

2.5.1A3) Time series, quantity of water delivered at dates.

Reporting:

2.5.1A all) If water is not being used to suppress dust, it should be reported immediately. Otherwise, include in Quarterly Reports, and in the Construction Completion Report within two months after completion of construction activities.

Question of Interest 2.5.2

When have dust-generating activities been suspended, (to prevent dust from being blown into Wēkiu bug habitat in Pu'u Hau Oki crater)?

Justification:

High winds at the summit are capable of blowing dust from recently exposed cinder and ash onto habitat slopes. Excessive deposition of ash and dust from excavation activity may alter the structure of Wēkiu bug habitat in Pu'u Hau Oki crater, (see Recommendation V-2 in the Wēkiu Bug Mitigation Report).

Monitoring Goals:

To provide an historical record of Wēkiu bug habitat protection activities, (see also Effectiveness Monitoring, Habitat Structure Module), and to associate auxiliary phenomena, attributes, and characteristics with trends and patterns of change in key phenomena, attributes, and characteristics.

Sampling System:

Sampling Measurements

2.5.2A) Measurements during construction
- **1)** Dates of suspension of dust-generating activities.
- **2)** Wind speed in miles per hour.

Sampling Intensities

2.5.2A1) 100% review of Contractors' Log Book.

2.5.2A2) Records from available meteorological information.

Sampling Frequencies

2.5.2A1) Once per month during the construction phase of the project.

2.5.2A2) As recorded by existing weather monitoring equipment.

Sampling Protocol: See Protocols, Contractors' Log Book and Meteorological Station

Data Management: See Results, Data Management

Analysis and Interpretation:

2.5.2A1) Time series, dates of suspension of dust-generating activities.

2.5.2A2) Time series daily high and lows. Comparison with suspension dates.

Reporting:

2.5.2A all) If dust-generating activities are not being suspended during periods of high winds, it should be reported immediately. Otherwise, include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.5.3

Where and when have excavated materials and cinder stockpiles been covered, (to prevent dust from being blown into Wēkiu bug habitat in Pu'u Hau Oki crater)?

Justification:

High winds at the summit are capable of blowing dust from recently exposed cinder and ash onto habitat slopes. Excessive deposition of ash and dust from excavation activity may alter the structure of Wēkiu bug habitat in Pu'u Hau Oki crater, (see Recommendation V-2 in the Wēkiu Bug Mitigation Report).

Monitoring Goals:

To provide an historical record of Wēkiu bug habitat protection activities, (see also Effectiveness Monitoring, Habitat Structure Module).

Sampling System:

Sampling Measurements

2.5.3A) Measurements during construction
- **1)** Dates excavated materials have been covered
- **2)** Wind speed in miles per hour.

Sampling Intensities

2.5.3A1) 100% review of Contractors' Log Book.

2.5.3A2) Records from available meteorological information.

Sampling Frequencies

2.5.3A1) Once per month during the construction phase of the project.

2.5.3A2) As recorded by existing weather monitoring equipment.

Sampling Protocol: See Protocols, Contractors' Log Book and Meteorological Station

Data Management: See Results, Data Management

Analysis and Interpretation:

2.5.3A1) Time series, dates excavated materials have been covered.

2.5.3A2) Time series daily high and lows. Comparison with covering dates.

Reporting:

2.5.3A all) If excavated materials and stockpiles are not being covered during periods of high winds, it should be reported immediately. Otherwise, include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.5.4

Where, when, and in what quantities have soil-binding compounds been used?

Justification:

Application of soil-binding compounds may reduce dust created during excavation or generated from vehicle traffic. Soil-binding compounds should not be applied to Wēkiu Bug habitat, (see Recommendation V-3 in the Wēkiu Bug Mitigation Report).

Monitoring Goals:

To provide an historical record of Wēkiu bug habitat protection activities. See also Effectiveness Monitoring, Habitat Structure Module.

Sampling System:

Sampling Measurements

2.5.4A) Professional review of soil-binding compounds prior to use at the construction site.

2.5.4B) Locations, dates, and quantities of soil-binding compounds applied.

Sampling Intensities

2.5.4A) Review of soil-binding compounds plans.

2.5.4B) 100% review of Contractors' Log Book.

Sampling Frequencies:

2.5.4A) Once, prior to application of soil-binding compounds.

2.5.4B) Once per month during the construction phase of the project.

Sampling Protocol: See Protocols, Contractors' Log Book

Data Management: See Results, Data Management

Analysis and Interpretation:

2.5.4B) Spatial time series: locations, dates, and quantities of soil-binding compounds.

Reporting:

2.5.4A) Written review of soil-binding compounds proposed for application, delivery prior to application.

2.5.4B) Include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

2.6 - HAZARDOUS MATERIALS MODULE

Question of Interest 2.6.1

Where, when, and in what quantities have chemicals been used for recoating observatory mirrors? Have all regulatory guidelines been followed, including the proper disposal of associated compounds, tools, and containers?

Justification:

When managed properly according to Federal guidelines, hazardous materials used during the mirror-washing procedures at WKMO pose little danger to the surrounding environment. Monitoring mirror-washing procedures provides assurance of safety, (see Recommendation VI-1 in the Wēkiu Bug Mitigation Report)

Monitoring Goals:

To detect threshold events, or critical levels, of environmental phenomena, attributes, and characteristics, and to provide an historical record of Wēkiu bug habitat protection activities.

Sampling System:

Sampling Measurements

2.6.1A) Measurements made during mirror washing activities
- **1)** Dates, locations, and quantities of chemicals used in mirror washing.
- **2)** Chemical and container disposal procedures followed.

Sampling Intensities

2.6.1A1 & 2.6.1A2) 100% review of procedural reports. CARA personnel currently report on procedures used in mirror washing, in accordance with Federal guidelines. CARA personnel will keep an Activity Log Book that will be available for review during monthly site inspections.

Sampling Frequencies

2.6.1A1 & 2.6.1A2) On dates when mirror washing occurs.

Sampling Protocol:

2.6.1A1) Monthly review of Activity Log Book

Data Management: See Results, Data Management

Analysis and Interpretation:

2.6.1A1) Time series, Dates, locations, and quantities of chemicals used in mirror washing activities.

2.6.1A2) Descriptive statistics of chemical and container disposal procedures.

Reporting:

2.6.1A1 & 2.6.1A2) Include in Quarterly Reports, and in the Post-Construction Report.

Question of Interest 2.6.2

Where, when, and in what quantities have contractors used paints, thinners, and solvents on-site? Have all regulatory guidelines been followed, including the proper disposal of associated compounds, tools, and containers?

Justification:

Paints, thinners and other solvents are toxic to Wēkiu bugs, and spills could impact Wēkiu bug populations. Monitoring the use of paints, thinners, and solvents on-site provides assurance of safety, (see Recommendation VI-2 in the Wēkiu Bug Mitigation Report)

Monitoring Goals:

To detect hazards and risks to valued ecosystem attributes and functions, and to provide an historical record of Wēkiu bug habitat protection activities.

Sampling System:

Sampling Measurements

2.6.2A) Review of Contractors' hazardous materials plans prior to use of paints, thinners, and solvents on-site.

2.6.2B) Locations, dates, and quantities of paints, thinners, and solvents used on-site, including equipment washing activities and disposal of chemicals and containers.

Sampling Intensities

2.6.2A) 100% review of Contractors' hazardous materials plans

2.6.2B) 100% review of Contractors' Log Book

Sampling Frequencies

2.6.2A) Once, prior to prior to use of paints, thinners, and solvents on-site.

2.6.2B) Once per month during the construction phase of the project.

Sampling Protocol: See Protocols, Contractors' Log Book

Data Management: See Results, Data Management

Analysis and Interpretation:

2.6.2B) Spatial time series: locations, dates, and quantities of paints, thinners, and solvents used on-site including equipment washing activities and disposal of chemicals and containers

Reporting:

2.6.2 all) If a spill occurs, or improper procedures are being used, it should be reported immediately. Otherwise, include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.6.3

Where, when, and in what quantities have spills of hazardous materials occurred? In the case of spills, have all regulatory guidelines for spill cleanup been followed?

Justification:

If spilled onto Wēkiu bug habitat, paints, thinners, solvents, or other hazardous materials can impact Wēkiu bug populations. Should spills occur, monitoring of their impact and associated clean-up efforts is necessary, (see Recommendation VI-2 in the Wēkiu Bug Mitigation Report)

Monitoring Goals:

To detect hazards and risks to valued ecosystem attributes and functions, and to provide an historical record of Wēkiu bug habitat protection activities.

Sampling System:

Sampling Measurements

2.6.3A) Review of spill response sections of the Contractors' hazardous materials plans, prior to use of paints, thinners, and solvents on-site.

2.6.3B) Measurements during construction

1) Locations, dates, and quantities of spills, should they occur.
2) Locations, dates, and procedures followed in clean-up of spills, should they occur.

Sampling Intensities

2.6.3A) 100% review of Contractors' hazardous materials plans

2.6.3B1 & 2.6.3B2) 100% review of Contractors' Log Book

Sampling Frequencies

2.6.3A) Once, prior to prior to use of paints, thinners, and solvents on-site

2.6.3B1 & 2.6.3B2) Once per month during the construction phase of the project.

Sampling Protocol: See Protocols, Contractors' Log Book

Data Management: See Results, Data Management

Analysis and Interpretation:

2.6.3B1 & 2.6.3B2) Spatial time series: locations, dates, and quantities of spills and clean-up efforts.

Reporting:

2.6.3 all) In case of a spill, report immediately, with monthly follow-up reports on the spill extent and clean-up actions. If no spills occur, include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

2.7 - TRASH MODULE

Question of Interest 2.7.1

Where and when have roll-off trash containers been tightly covered, (or uncovered)?

Justification:

High winds at the summit can extract construction debris from containers and disperse the material. Covering containers will decrease the amount of construction debris that could be blown onto Wēkiu bug habitat, (see Recommendation VII-1 in the Wēkiu Bug Mitigation Report).

Monitoring Goals:

To detect hazards and risks to valued ecosystem attributes and functions, and to provide an historical record of Wēkiu bug habitat protection activities.

Sampling System:

Sampling Measurements

2.7.1A) Measurements during construction
- **1)** Locations and dates roll-off trash containers at construction site.
- **2)** Wind speed in miles per hour.

Sampling Intensities

2.7.1A1) 100% review of Contractors' Log Book

2.7.1A2) Records from available meteorological information.

Sampling Frequencies

2.7.1A1) Once per month during the construction phase of the project.

2.7.1A2) As recorded by existing weather monitoring equipment.

Sampling Protocol: See Protocols, Contractors' Log Book and Meteorological Station

Data Management: See Results, Data Management

Analysis and Interpretation:

2.7.1A1) Time series, Dates roll-off trash containers have been covered.

2.7.1A2) Time series daily high and lows. Comparison with covering dates.

Reporting:

2.7.1 all) If roll-off trash containers are not being covered during periods of high winds, it should be reported immediately. Otherwise, include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.7.2

Where and when have construction materials stored at the site been covered with tarps, or anchored in place to prevent movement by wind (or left uncovered and/or unsecured)?

Justification:

High winds at the summit can potentially blow construction materials onto habitat slopes. Covering construction materials stored at the site will decrease the amount of construction debris that could be blown into Wēkiu bug habitat, (see Recommendation VII-2 in the Wēkiu Bug Mitigation Report).

Monitoring Goals:

To detect hazards and risks to valued ecosystem attributes and functions, and to provide an historical record of Wēkiu bug habitat protection activities.

Sampling System:

Sampling Measurements

2.7.2A) Measurements during construction
- **1)** Locations and dates construction materials at construction site.
- **2)** Wind speed in miles per hour.

Sampling Intensities

2.7.2A1) 100% review of Contractors' Log Book

2.7.2A2) Records from available meteorological information.

Sampling Frequencies

2.7.2A1) Once per month during the construction phase of the project. I

2.7.2A2) As recorded by existing weather monitoring equipment.

Sampling Protocol: See Protocols, Contractors' Log Book and Meteorological Station

Data Management: See Results, Data Management

Analysis and Interpretation:

2.7.2A1) Time series, Dates construction materials have been covered.

2.7.2A2) Time series daily high and lows. Comparison with covering dates.

Reporting:

2.7.2 all) If construction materials are not being covered during periods of high winds, it should be reported immediately. Otherwise, include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.7.3

What kind of outdoor trash receptacles have been installed to prevent trash from being blown into Wēkiu bug habitat in Pu'u Hau Oki crater, where have they been installed, and when were they installed?

Justification:

Workers and visitors to the WKMO often bring trash, (lunch bags, film canisters, wrappers, etc.). Trash receptacles provide workers and visitors with a place to dispose of their trash and prevent it from being blown into Wēkiu bug habitat, (see Recommendation VII-3 in the Wēkiu Bug Mitigation Report).

Monitoring Goals:

To detect hazards and risks, to valued ecosystem attributes and functions, and to provide an historical record of Wēkiu bug habitat protection activities.

Sampling System:

Sampling Measurements

2.7.3A) Measurements during construction
- **1)** Review of plans prior to construction and installation of trash receptacles.
- **2)** Locations and dates of installation of trash receptacles.

Sampling Intensities

2.7.3A1) 100% review of trash receptacle plans

2.7.3A2) 100% review of Contractors' Log Book

Sampling Frequencies

2.7.3A1) Once, prior to installation

2.7.3A2) Once, after installation.

Sampling Protocol: See Protocols, Contractors' Log Book

Data Management: See Results, Data Management

Analysis and Interpretation:

2.7.3A2) Descriptions of trash receptacles with dates of installation

Reporting:

2.7.3 all) Include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.7.4

Where, when, what kind, and in what quantities have construction materials and other trash been blown into Wēkiu bug habitat in Puʻu Hau Oki crater? Where, when, and what methods have been used to collect construction materials and other trash blown into Wēkiu bug habitat in Puʻu Hau Oki crater?

Justification:

Despite efforts to prevent wind-blown construction materials and trash, some debris could end up in Wēkiu bug habitat. Retrieving this debris from sensitive areas should be done without disturbing the habitat, (see Recommendation VII-4 in the Wēkiu Bug Mitigation Report).

Monitoring Goals:

To detect hazards and risks, to valued ecosystem attributes and functions, and to provide an historical record of Wēkiu bug habitat protection activities.

Sampling System:

Sampling Measurements

2.7.4A) Measurements during construction
- **1)** Review of plans prior to collection of debris from Wēkiu bug habitat in Puʻu Hau Oki crater.
- **2)** Locations and dates of trash collection.

Sampling Intensities

2.7.4A1) 100% review of trash collection plans

2.7.4A2) 100% review of Contractors' Log Book

Sampling Frequencies

2.7.4A1) Once

2.7.4A2) Once per month during the construction phase of the project.

Sampling Protocol: See Protocols, Contractors' Log Book

Analysis and Interpretation:

2.7.4A2) Descriptions of trash collection activities, with dates and locations

Reporting:

2.7.4 all) Include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

2.8 - ALIEN ARTHROPODS MODULE

Question of Interest 2.8.1

Where and when have ants been detected at storage yards and staging areas, and what eradication actions have been taken?

Justification:

Ants in storage yards and staging areas may be accidentally transported to the construction site. Several species of ants have established populations on the Island that could pose a threat to Wēkiu bugs. Efforts must be made to ensure that ants are not transported to the summit, (see Recommendation VIII-1 in the Wēkiu Bug Mitigation Report).

Monitoring goals:

To detect hazards and risks to Wēkiu bugs, and to provide an historical record of Wēkiu Bug habitat protection activities.

Sampling System:

Sampling Measurements

2.8.1A) Measurements at storage yards and staging areas within the MKSR
- **1)** Presence/absence of ants on the ground
- **2)** Presence/absence of ants on vehicles
- **3)** Review of ant eradication plans
- **4)** Actions taken to eradicate ants

Sampling Intensities:

2.8.1A1) Place baited ant traps on a randomly located 40′x40′ grid, (one measurement per 1600 square feet). Sampling target 25 traps per storage yard or staging area.

2.8.1A2) All vehicles at storage yard or staging area at time of inspection.

2.8.1A3) 100% review of ant eradication plans

2.8.1A4) 100% review of Contractors' Log Book

Sampling Frequencies:

2.8.1A1, 2.8.1A2, & 2.8.1A4) Once per month during the construction phase of the project.

2.8.1A3) Once, prior to initiation of ant eradication activities

Sampling Protocol:

2.8.1A1) Locate random sampling points (See Protocols, Habitat) and set freshly baited traps. Return after 3 hours and record presence/absence of ants.

2.8.1A2) See Protocols, Alien Arthropod Inspection

2.8.1A4) Review Contractors' Log Book

Data Management: See Results, Data Management

Analysis and Interpretation:

2.8.1A1 & 2.8.1A2) Time series, presence/absence of ants on dates.

2.8.1A4) Description

Reporting:

2.8.1A all) If ants are found at storage yards or staging areas within the MKSR, it should be reported immediately. Otherwise include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.8.2

Where and when have alien arthropods, or soil, dirt, or vegetation capable of harboring alien arthropods, been found on earth-moving equipment? When has earth-moving equipment been pressured-washed (to remove alien arthropods) before being moved to the construction site?

Justification:

Mud and dirt attached to earth-moving equipment should be removed before transport to the summit, where alien arthropods may pose a threat to Wēkiu bugs, (see Recommendation VIII-1 in the Wēkiu Bug Mitigation Report).

Monitoring goals:

To detect hazards and risks to Wēkiu bugs, and to provide an historical record of Wēkiu Bug habitat protection activities.

Sampling System:

Sampling Measurements

2.8.2A) Measurements taken during construction
- **1)** Presence/absence of alien arthropods on earth-moving equipment.
- **2)** Presence/absence of soil, dirt, and vegetation on earth-moving equipment.

2.8.2B) Information from contractors and subcontractors
- **1)** Date and description of most recent pressure washing of vehicles and earth-moving equipment used at the construction site.

Sampling Intensities:

2.8.2A1 & 2.8.2A2) All earth-moving equipment at construction site, or MKSR storage yards or staging areas, at time of inspection

2.8.2B1) 100% review of Contractors' Log Book

Sampling Frequencies:

2.8.2A1 & 2.8.2A2) Once per month during the construction phase of the project.

2.8.2B1) Once for each earth-moving equipment contractor and subcontractor

Sampling Protocol:

2.8.2A1 & 2.8.2A2) See Protocols, Alien Arthropod Inspection

2.8.2B1) Review Contractors' Log Book

Data Management: See Results, Data Management

Analysis and Interpretation:

2.8.2A1 & 2.8.2A2) Time series, number of vehicles with alien arthropods, soil, dirt, or vegetation at dates.

2.8.2B1) Description

Reporting:

2.8.2A1 & 2.8.2A2) If alien arthropods are found on earth-moving equipment, or if soil, dirt, or vegetation is found on earth-moving equipment at the construction site, it should be reported immediately. Otherwise include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

2.8.2B1) Include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.8.3

Where and when have large trucks, tractors, other vehicles, and construction materials been inspected before being transported to the summit? Have any alien arthropods been found in those inspections? What actions have been taken to eradicate any alien arthropods found in those inspections?

Justification:

Large trucks, tractors, other vehicles, and construction materials should be inspected before transport to the summit, where alien arthropods may pose a threat to Wēkiu bugs, (see Recommendation VIII-2 in the Wēkiu Bug Mitigation Report).

Monitoring goals:

To detect hazards and risks to Wēkiu bugs, and to provide an historical record of Wēkiu Bug habitat protection activities.

Sampling System:

Sampling Measurements

2.8.3A) Information obtained from operators of large trucks, tractors, other vehicles, and construction materials (see Protocols, Contractors' Log Book).

1) Inspections conducted for alien arthropods.
2) Actions taken to remove alien arthropods.

Sampling Intensities:

2.8.3A1 & 2.8.3A2) 100% review of Contractors' Log Book

Sampling Frequencies:

2.8.3A1 & 2.8.3A2) Once per month during the construction phase of the project, consisting of visual inspections of large trucks, tractors, other vehicles, and construction materials at the site during the inspection visit.

Sampling Protocol:

2.8.3A1 & 2.8.3A2) See Protocols, Contractors' Log Book and Alien Arthropod Inspection

Data Management: See Results, Data Management

Analysis and Interpretation:

2.8.3A1) Time series, number of large trucks, tractors, other vehicles, and construction materials found with alien arthropods at dates.

2.8.3A2) Description

Reporting:

2.8.3A1 & 2.8.3A2) If alien arthropods are found on large trucks, tractors, other vehicles, and construction materials at the construction site, it should be reported immediately. Otherwise include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.8.4

When have shipping crates and boxes been inspected for spider webs, egg masses, and other signs of alien arthropods before being transported to the summit? Have any alien arthropods been found in those inspections? What actions have been taken to eradicate any alien arthropods found in those inspections?

Justification:

Inspection and removal of alien arthropods will reduce the chance that these species will establish populations in Wēkiu bug habitat in Pu'u Hau Oki crater, (Wēkiu Bug Mitigation Report recommendation VIII-2).

Monitoring goals:

To detect hazards and risks to Wēkiu bugs, and to provide an historical record of Wēkiu Bug habitat protection activities.

Sampling System:

Sampling Measurements

2.8.4A) Information obtained from Contractors' Log Book (see Protocols, Contractors' Log Book and Alien Arthropod Inspection).

1) Inspections conducted for alien arthropods.
2) Actions taken to remove alien arthropods.

Sampling Intensities:

2.8.4A1 & 2.8.4A2) 100 % review of Contractors' Log Book

Sampling Frequencies:

2.8.4A1 & 2.8.4A2) Once per month during the construction phase of the project.

Sampling Protocol:

2.8.4A1 & 2.8.4A2) See Protocols, Contractors' Log Book and Alien Arthropod Inspection.

Data Management: See Results, Data Management

Analysis and Interpretation:

2.8.4A1) Time series, number of shipping crates and boxes found with alien arthropods at dates.

2.8.4A2) Description

Reporting:

2.8.4A1 & 2.8.4A2) If alien arthropods found on shipping crates and boxes, it should be reported immediately. Otherwise include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

Question of Interest 2.8.5

Where, when, and in what quantities have alien arthropods been found at the WKMO observatory site? Where, when, and what actions have been taken to eradicate any alien arthropods found in those inspections?

Justification:

Monitoring for of visible signs of alien arthropods, and eradicating alien arthropods if detected, will reduce the chance of these species from establishing populations will establish populations in Wēkiu bug habitat in Pu'u Hau Oki crater, (Wēkiu Bug Mitigation Report recommendation VIII-4).

Monitoring goals:

To detect hazards and risks to Wēkiu bugs, and to provide an historical record of Wēkiu Bug habitat protection activities.

Sampling System:

Sampling Measurements

2.8.5A) Measurements of alien arthropods

1) Presence/absence of ants.
2) Presence/absence spider webs on buildings, trailers, other observatory structures, and/or construction materials stored at the construction site.
3) Presence/absence of yellowjackets.

2.8.5B) Quantitative description of actions taken to eradicate any alien arthropods found during inspections.

Sampling Intensities:

2.8.5A1) Place baited ant traps on the ground next to temporary and permanent buildings at 40-foot intervals, at 20-foot intervals around construction materials stored at the construction site.

2.8.5A2) Visual inspection of temporary and permanent buildings, trailers other observatory structures, and construction materials stored at the construction site. See Protocols, Alien Arthropod Inspection.

2.8.5A3) Place 10 yellowjacket traps around the construction site, including locations near trash containers and portable toilets.

2.8.5B) Descriptions of actions taken, if and when they are taken.

Sampling Frequencies:

2.8.5A all) Once per month during the construction phase of the project.

2.8.5B) Descriptions of actions taken, if and when they are taken.

Sampling Protocol:

2.8.5A1) Locate sampling points and set freshly baited traps. Return after 3 hours and record number of ants at the trap.

2.8.5A2) See Protocols, Alien Arthropod Inspection

2.8.5A3) Locate sampling points and set freshly baited traps. Return after 3 hours and record number of yellowjackets in the traps.

2.8.5B) Quantitative descriptions of actions taken, if and when they are taken, including dates, locations, control methods applied, control method applicators, etc.

Data Management: See Results, Data Management

Analysis and Interpretation:

2.8.5A1) Spatial time series, number of traps that captured ants at dates and locations.

2.8.5A2) Spatial time series, number of spider webs at dates and locations.

2.8.5A3) Spatial time series, number of traps that captured yellowjackets at dates and locations.

2.8.5B) Quantitative description. Compare pre- and post-control-action trap counts.

Reporting:

2.8.5A all) If alien arthropods are found at the observatory site, it should be reported immediately. Otherwise include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

2.8.5A4) Actions taken to eradicate alien arthropods found at the observatory site should be reported monthly. Otherwise include in Quarterly Reports, and in the Construction Completion Report within two months after the completion of construction activities.

EFFECTIVENESS MONITORING

3.1 - INTRODUCTION

Effectiveness monitoring will investigate the changes in the Wēkiu bug population and habitat that happen concurrently with construction and operation of the Outrigger Telescopes. In essence, effectiveness monitoring asks whether the environmental controls adopted and mitigation treatments undertaken were successful in conserving the Wēkiu bug. Monitoring for changes in the population and habitat will give the operators, oversight agencies, and the public the information necessary to ensure that natural resources are protected during the Outrigger Telescope project.

This Effectiveness Monitoring Section is organized in four modules:

3.1 Introduction
3.2 Listing of the Questions of Interest
3.3 Population Change Module
3.4 Habitat Structure Module

More Questions of Interest (QOI's) may be added, or some deleted, if and when necessary. The Monitoring Program is thus adaptable to new conditions and findings.

Each Module contains a comprehensive discussion of each of the associated QOI's, including justification, monitoring goals, sampling systems, sampling protocols, analysis and interpretation, and reporting.

Subsections on data management, analysis, and reporting may be found in Section 4 – Results. Reports called for in this Monitoring Plan include Quarterly Reports during construction, a synthesis report upon Construction Completion, and a Post-Construction Report one year following completion. Special reports for some QOI's are also planned.

3.2 - LISTING OF THE EFFECTIVENESS MONITORING QUESTIONS OF INTEREST

3.3 - Population Change Module

3.3.1 How, where and when are the Wēkiu bug and other resident arthropod populations changing? Locations of interest include newly restored Wēkiu bug habitat, current habitat in Pu'u Hau Oki crater, and undisturbed Wēkiu bug habitat in other Mauna Kea summit areas (for comparison).

3.3.2 Are weather phenomena, human activities, and/or other factors associated with Wēkiu bug and/or other resident arthropod population change?

3.4 - Habitat Structure Module

3.4.1 How, where and when has existing Wēkiu bug habitat been damaged by new construction?

3.3 - POPULATION CHANGE MODULE

Question of Interest 3.3.1

How, where and when are the Wēkiu bug and other resident arthropod populations changing? Locations of interest include newly restored Wēkiu bug habitat, current habitat in Pu'u Hau Oki crater, and undisturbed Wēkiu bug habitat in other Mauna Kea summit areas (for comparison).

Justification:

Monitoring both the Wēkiu bug population and resident arthropod populations will yield reliable scientific information about population change, and whether mitigation and habitat restoration efforts have been successful at protecting and enhancing Wēkiu bugs and their habitat.

Monitoring goals:

1) To provide historical records of change in environmental phenomena, attributes, and characteristics,

2) To detect trends, periodicities, cycles, and/or other patterns in those changes, and

3) To associate auxiliary phenomena, attributes, and characteristics with trends and patterns of change in key phenomena, attributes, and characteristics

Sampling System:

Sampling Measurements

3.3.1A) Wēkiu bug population measurements
- **1)** in restored habitat
- **2)** in Pu'u Hau Oki crater
- **3)** in undisturbed Wēkiu bug habitat in other Mauna Kea summit areas

3.3.1B) Resident arthropod population measurements

1) in restored habitat
2) in Puʻu Hau ʻOki crater
3) in undisturbed Wēkiu bug habitat in Puʻu Wēkiu

Sampling Intensities

3.3.1A1 and 3.3.1B1) 3 pitfall traps in restored habitat

3.3.1A2 and 3.3.1B2) 5 pitfall traps in current habitat in Puʻu Hau ʻOki crater

3.3.1A3 and 3.3.1B3) 5 pitfall traps in undisturbed Wēkiu bug habitat in Puʻu Wēkiu.

Sampling Frequencies

3.3.1A all and 3.3.1B all) 21 day trapping sessions, four times per year (late winter, spring, summer, late fall).

Sampling Protocol: See Protocols, Population

Data Management: See Results, Data Management

Analysis and Interpretation:

3.3.1A all and 3.3.1B all) Spatial time series, capture rates at dates and locations, comparison with undisturbed sites. Include auxiliary weather data (QOI 3.3.2, this Module) in analyses.

Reporting:

3.3.1A all and 3.3.1B all) Include in Quarterly Reports, Construction Completion Report within two months after the completion of construction activities, and in the Post-Construction Report.

Question of Interest 3.3.2

Are weather phenomena, human activities, and/or other factors associated with Wēkiu bug and/or other resident arthropod population change?

Justification:

Snow, rain, day/night temperatures, and other weather phenomena may be associated with Wēkiu Bug population change. Human activities such as dust generation, side cast of debris on to habitat slopes, or other activities, and the presence/absence of alien arthropods may also be associated with population change. Monitoring these indirect factors will aid in analysis of mitigation success.

Monitoring goals:

1) To provide historical records of change in environmental phenomena, attributes, and characteristics,

2) To detect trends, periodicities, cycles, and/or other patterns in those changes, and

3) To associate auxiliary phenomena, attributes, and characteristics with trends and patterns of change in key phenomena, attributes, and characteristics

Sampling System:

Sampling Measurements

3.3.2A) Desirable meteorological measurements

1) Temperature
2) Wind speed
3) Barometric pressure
4) Relative humidity
5) Precipitation
6) Snow pack depth and extent

3.3.2B) Human activity measurements

1) Slope stability control activities
2) Dust control activities
3) Hazardous materials control activities
4) Trash control activities
5) Alien arthropod control activities

Sampling Intensities

3.3.2A all) As recorded by existing weather monitoring equipment.

3.3.2A6) Measure snow accumulations in Pu'u Hau Oki crater, should they occur. Measurement points every 120 feet horizontally along the upper edge of Pu'u Hau Oki crater and along the slope base at the bottom of Pu'u Hau Oki crater. Sampling target: 8 located measurement points. Map snow pack extent beyond Pu'u Hau Oki crater from aerial photographs, if available.

3.3.2B all) See Compliance Monitoring

Sampling Frequencies

3.3.2A all) As recorded by existing weather monitoring equipment.

3.3.2A6) Once per month, during periods when snow accumulates.

3.3.2B all) See Compliance Monitoring

Sampling Protocol:

3.3.2A all) See Protocols, Meteorological Station

3.3.2A6) **Tools:** Prepare measuring rods, using 12-foot-long fiberglass or metal fence posts, by painting white with red or black marks at one inch increments from top.
Procedures: Drive measuring rods securely into the slope every 120 feet on the contour, 10 feet slope distance below edge of construction areas for Outrigger Telescopes 1 & 2 (on the Pu'u Hau Oki crater side) and every 120 feet along the

slope base at the crater bottom (below the W.M. Keck site). Repair and restore (by raking) the slope surface around each measuring rod. Record the vertical distance (length in inches) from the surface to the top of each measuring rod. Subsequent measurements should be made using binoculars to view the rods from upslope and down slope positions (to minimize any further habitat disturbance). Repeat these measurements every month when snow pack is present.

3.3.2B all) See Compliance Monitoring

Data Management System: See Results, Data Management

Analysis and Interpretation Systems:

3.3.2A all) Time series analysis.

3.3.2A6) Spatial time series, dates and locations (depth and extent) of snow pack. Maps at dates (GIS).

3.3.2B all) Time series analysis.

Reporting System:

3.3.2A all) Include in Quarterly Reports, Construction Completion Report within two months after the completion of construction activities, and in the Post-Construction Report one year after completion of construction activities.

3.3.2B all) Include in Quarterly Reports, Construction Completion Report within two months after the completion of construction activities, and in the Post-Construction Report.

3.4 - HABITAT STRUCTURE MODULE

Question of Interest 3.4.1

3.4.1 How, where and when has existing Wēkiu bug habitat been damaged by new construction?

Justification:

Measurement of habitat damaged as a result of Outrigger Telescope construction is necessary to determine the appropriate amount of restoration needed for mitigation.

Monitoring goals:

1) To provide historical records of change in environmental phenomena, attributes, and characteristics.

Sampling Measurements

3.4.1A) Size and location of newly damaged Wēkiu bug habitat.

Sampling Intensities

3.4.1A) Locate perimeter points every 20 feet around the newly damaged areas. Locations should be accurate to ± 2 feet relative to fixed reference points, such as existing building corners or survey monuments. Sampling target: 15-20 located perimeter points, suitable for mapping the areas.

Sampling Frequencies

3.4.1A) Once after construction is complete.

Sampling Protocol: See Protocols, Wēkiu Bug Habitat

Data Management: See Results, Data Management

Analysis and Interpretation Systems:

3.4.1A all) Spatial time series, dates and locations, porosity profiles (cinder size distribution at depths below surface).

Reporting System:

3.4.1A all) Include in Construction Completion Report within two months after the completion of construction activities, and in the Post-Construction Report.

RESULTS

4.1 - DATA MANAGEMENT

The primary purpose of monitoring, as with any investigation, is to increase knowledge. Therefore the results, findings, and other forms of new information gained must be transmitted to decision-makers and stakeholders. The compilation, analysis, and presentation of results are key steps in the monitoring process.

Compilation of the findings is called data management. Much effort will be expended in the collection of raw data from field. That data must be checked for errors and archived for retrieval, as needed many years into the future.

Error checking is the first and most immediate task in data management. Field forms and types of raw data collected in this Monitoring Program will be examined for improper recording, blanks, or other errors. Error checking will be done daily during field collection sessions, at the end of the field day or that evening. If errors are found, they will be corrected immediately, or recollected the following day.

When appropriate, computerized error checking algorithms will be employed. Algorithms are useful for checking numerical data that conforms to known or expected distributions. For instance, weather data may be expected to fall into known ranges of temperature, wind speed, or precipitation. The error algorithm program will flag data values outside expected ranges. Investigators will be alerted, and the unusual data values can be verified or corrected through re-measurement or reentry into the database files. Utilization of error checking algorithms requires immediate entry into the computer, preferably on a daily basis.

Some types of data cannot be checked with algorithms. Records of dust suppression activities, snow plowing, barrier construction, and similar events must be "hand checked".

Data values will be entered into a set of database files. These will consist of prepared spreadsheets linked together for electronic queries. Data entry will be immediate, done daily during field collection sessions, at the end of the field day or that evening. Numerical data values may be recorded on hand-held or "palm" computers. Error checking algorithms may be included in the hand-held computer programs, thereby allowing error checking at the moment

of data entry in the field. Hand-held computer data will be downloaded into database files daily.

The database files will be backed up by storage in multiple computer data storage media and by hard copies.

The database files will contain all the field data. The files will be proprietary to the sponsors of the Monitoring Program. Data files will be released (shared) only with written permission of the sponsors. Released data files will always be accompanied by descriptions of the data collection methodology. Released data files may also be accompanied by analyses.

Some data will be spatial values indicating locations of events, activities, or phenomena. Spatial data will be stored in geographic information systems (GIS). GIS files may be shared with existing systems owned by IfA, UH, or other entities chosen by the sponsors.

4.2 - DATA ANALYSIS

Statistical analysis and scientific interpretation are necessary to produce logical inferences and new knowledge from monitoring data.

All data files will be initially evaluated using exploratory data analysis (EDA). EDA is a set of techniques for graphically examining data. Histograms, time series charts, multiple point plots, and other graphs aid in the visual examination of data. Visualization of data is a way of "decoding" quantitative and categorical information. Visual perception links numbers to understanding. Proper EDA includes display of mathematical (statistical) functions fit to the raw data. Simply graphing the data, without fitting and displaying the associated statistical models, may visually omit important traits of the data. Techniques employed will follow EDA guidelines elucidated by William S. Cleveland in his book "Visualizing Data", (Hobart Press, 1993).

Most of the data collected in monitoring is in the form of time series, a collection of observations made sequentially in time. The special characteristic of time series is that successive observations are not independent. Hence analyses of time series data must take into account the order of the observations. Non-independence means that future values are at least partially determined by past values. Because time series are deterministic, future values may often be predicted from past values, to some degree of accuracy. As a result, predictive models may be created for phenomena such as wildlife population changes.

There are many statistical methods for analyzing time series. The principal approach is the use of autocorrelation functions that quantify the deterministic links in processes through time. Frequency analysis, also called spectral analysis, is useful for analyzing the frequency of events. Survival analysis evaluates the time duration until an event occurs.

Time series often contain multiple patterns. The simplest pattern is trend, the increase or decrease of values over relatively long periods of time. Cycles may be detectable within trends, periodic fluctuations of values appearing over relatively shorter periods of time. Wildlife population changes often exhibit both long-term trends and short-term cycles.

Trends and cycles may best be evaluated using residual analysis. In residual analysis a trend model is fit to the data. The differences between the

actual values and the model values are known as the "residuals". Evaluating the model fit involves examination of the residuals for patterns. Once a good fit is established for the trend model, a cycle model may then be fit to the residuals. Again, the differences between the residuals and the cycle model are evaluated. These "second order" residuals are then examined for patterns. If the trend and cycle models are well fitted, the second order residuals should have no patterns; they should be small and random. This process often involves repeated (iterative) model fitting until the smallest and most random residuals result.

Wildlife population changes may be correlated with other phenomena, such as weather patterns, habitat changes, etc. The correlated phenomena are often also in the form of time series. Multivariate cross-correlation analyses are statistical methods for combining two or more time series. These methods are similar to the univariate methods described above, with the addition of cross-covariance terms in the models.

The ultimate purpose of time series analysis in monitoring is to develop models for predicting (and sometimes understanding) the changes. Prediction is simpler than understanding. Many phenomena that occur on a regular basis are highly predictable, even if we do not understand why they occur. For instance, the Monitoring Program may find that Wēkiu bug populations fluctuate with snowfall events or the lack thereof. Such fluctuations may be predictable, even if we do not understand the biological mechanisms at work.

Other statistical methods may also be employed. Mark-and-recapture techniques may be useful in making population estimates. In mark-and-recapture of insects, non-toxic phosphorescent dyes are carefully placed on captured bugs, which are then released. The percentage of marked individuals subsequently recaptured yields potentially more accurate inferences about the size of the population than simple trap counts.

Spatial analyses, using statistical methods for evaluating location data, may also be useful. It is unlikely, however, that the projected sampling intensities will reveal detectable patterns in the locations of Wēkiu bug population changes. To detect such changes many times more traps would be necessary. In this Monitoring Plan we have chosen to minimize habitat damage by data collectors and focus on population changes detectable with the fewest traps, and hence the least habitat disturbance.

4.3 - REPORTING

The new knowledge acquired through monitoring will be communicated to sponsors and stakeholders through reports. Five types of reports are anticipated:

1. Reviews. This Monitoring Plan calls for reviews of habitat restoration plans; soil-binding compounds to be applied, and hazardous material spill response plans, among others. These reviews will be done on a timely basis, so that construction activities are not delayed.

2. Quarterly Reports. Results from monitoring will be reported every three months during construction of the Outrigger Telescope. Progress on compliance, including restoration of habitat, installation of barriers, dust suppression activities, trash control activities, etc., will be conveyed in the Quarterly Reports.

3. Construction Completion Report. Within two months after completion of construction activities a comprehensive report will be issued. This report will address all the Questions of Interest, and provide a historical record of compliance with guidelines and the effectiveness of mitigation activities.

4. Post-Construction Report. Eighteen months after completion of habitat restoration activities a second comprehensive report will be issued. This report will address primarily the Effectiveness Monitoring QOI's; including any Wēkiu bug population changes detected.

5. Immediate Reports. If any special problems or events happen during or after construction, those situations will be reported immediately. Such occurrences as hazardous material spills, excessive side cast of cinder or trash into Wēkiu bug habitat, or establishment of colonies of alien arthropods at the Keck site, will be reported upon detection to the proper authorities, (selected by the Monitoring Program sponsors).

All the reports will be clearly written for use by the intended audience: JPL, NASA, CARA, IfA, UH, DLNR, and other stakeholder groups and individuals. The reports will include charts, tables, maps, photographs and other visual displays of the information acquired through monitoring.

As the Monitoring Program progresses, feedback from stakeholders will be used to improve the reports to enhance understanding of the results. Future decision-making may then be based on clear, reliable, new information about the Wēkiu bug and the effects of mitigation activities.

SCHEDULE

The schedule for monitoring is dependent upon start of the Outrigger Telescopes Project and is still to be determined. The schedule in this section is generic and representative of the actual time. The dates are undetermined and are dependent upon permitting for the Outriggers Telescope Project.

Updates to this schedule can be found on the World Wide Web at:

http://www.statpros.com/Wekiu_Bug.html

MONITORING SCHEDULE		CONSTRUCTION MONITORING MONTHS																				
		CM1	CM2	CM3	CM4	CM5	CM6	CM7	CM8	CM9	CM10	CM11	CM12	CM13	CM14	CM15	CM16	CM17	CM18	CM19	CM20	CM21
Phases		2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	2a
		2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	2b
Compliance Monitoring																						
Module	**QOI**																					
2.3 Habitat Restoration	1	A,B																B,C				
2.4 Slope Stability	1	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B
	2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3								A	A	A	A	A								A	A
	4																	A				
2.5 Dust	1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4	A,B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
2.6 Hazardous Materials	1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	2	A,B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	3	A,B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
2.7 Trash	1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	3	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
2.8 Alien Arthropods	1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	2	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B
	3	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	4	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	5	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B
Effectiveness Monitoring																						
Module																						
3.3 Population	1	A,B			A,B			A,B			A,B			A,B			A,B			A,B		
	2	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B
3.4 Habitat	1																	A				

				POST CONSTRUCTION MONITORING MONTHS																		
CM22	CM23	CM24	CM25	PCM1	PCM2	PCM3	PCM4	PCM5	PCM6	PCM7	PCM8	PCM9	PCM10	PCM11	PCM12	PCM13	PCM14	PCM15	PCM16	PCM17	PCM18	
2a	2a	2a	2a	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
2b	2b	2b	2b																			
																						QOI
			C																		C	1
A,B	A,B	A,B	A,B																			1
A	A	A																			A	2
A	A	A								A	A	A	A	A								3
			A																			4
A	A	A																				1
A	A	A																				2
A	A	A																				3
B	B	B																				4
A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	1
B	B	B																				2
B	B	B																				3
A	A	A																				1
A	A	A																				2
A	A	A																				3
A	A	A																				4
A	A	A																				1
A,B	A,B	A,B																				2
A	A	A																				3
A	A	A																				4
A,B	A,B	A,B																				5
A,B			A,B			A,B			A,B			A,B			A,B			A,B			A,B	1
A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	A,B	2
			A																			1

PROTOCOLS

Protocols for the sampling systems are included in the Compliance and Effectiveness Monitoring sections above. Some protocols are too complicated to be included in those sections and are given in this section. Protocols included in this section include, Wēkiu Bug Population Sampling, Wēkiu Bug Habitat Sampling, Contractor's Log Books, Meteorological Data Gathering, Alien Arthropod Inspections, and Compliance Visual Inspections.

6.1 - WEKIU BUG POPULATION PROTOCOL

Population estimates are classified into three types, relative estimates, absolute estimates, and population indices. Relative estimation is based on the catch per unit effort and is the most appropriate method for monitoring Wēkiu bug population change. Absolute estimates are collected by sampling known fractions of the habitat. This technique would be destructive of habitat, and is therefore inappropriate for Wēkiu bug population monitoring. Population indices are derived from measurements of animal products (e.g. frass, webs, nests) or effects (plant damage) and are not applicable to Wēkiu bugs.

Nondestructive sampling is the best approach to monitoring rare and sensitive invertebrate species. Data on relative abundance can be collected with specially designed live traps that cause minimal disturbance to Wēkiu bugs or their habitats.

Monitoring during Outrigger construction and operation will involve capturing Wēkiu bugs in improved live-traps similar to those used in the 1997-98 MKSR arthropod assessment. These traps provide Wēkiu bugs with food, moisture, and protection from predators and can sustain captured individuals for several days. Traps will be checked for Wēkiu bugs every three days during the sampling session. Captured bugs will be counted, marked with non-toxic, luminous powder, and released. The number of recaptured marked bugs will provide additional information about population change.

Materials

10 oz clear plastic drinking cups
12 oz clear plastic drinking cups
¼" mesh hardware cloth (12.5" square)
coffee filters
dried shrimp
luminous powder (various colors)
gum Arabic
mortar and pestle
trowel

30 foot ladder
½″ rebar (18″ lengths)
¼″ nylon rope
small sledge hammer
dark-cup illuminator
dusting bulb insufflator

Luminous Dust

Fluorescent substances, whose presence can be detected by placing the marked animals under an UV light, have been used extensively by entomologists in capture-recapture studies. The markers are considered safe for most insects, although some species are sensitive, and experience decreased longevity when exposed to some fluorescent substances.

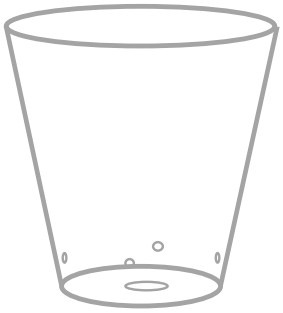
Specially formulated luminous powders are available from entomology equipment suppliers, and are considered the safest insect marking substance. They may be applied directly, but better adhesion is obtained when the dusts are combined with gum arabic. Mix one part luminous dust with six parts gum arabic until a paste is formed. Allow the paste to dry for at least 3 days. Pulverize the dry mixture to dust in a mortar. Store the dust mixture in sealed vials until needed. Apply dust with a dust bulb insufflator.

Traps

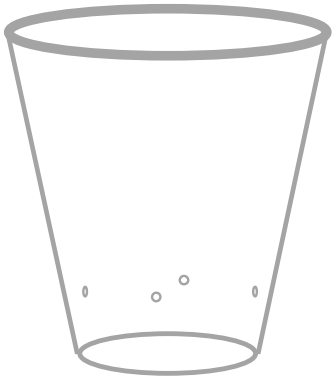
Construction

1. Remove the rim of the 10 oz cup and cut a hole 1.5 cm diameter hole in the bottom.
2. Punch four 2 mm holes around the side of the 10 oz cup about 1 cm from the bottom. Punch four 2 mm holes around the side of the 12 oz cup about 4 cm from the bottom.
3. Connect opposite edges of the hardware cloth making a wire tube the 12 oz cup will fit into.

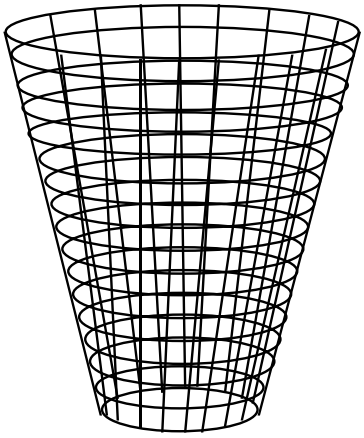
4. Fold a coffee filter 5 times and insert into the hole at the bottom of the 10 oz cup, leaving about 3 cm sticking up into the cup.



10 oz cup
Trap Cup



12 oz cup
Reservoir Cup



wire tube

Location

Traps in Wēkiu bug habitat will be installed at permanent monitoring stations and capped when not in use. Thirteen permanent stations will be established, five in Pu'u Hau Oki, five in Pu'u Wēkiu, and three in newly restored habitat.

Installation

Extend the ladder to its full open position on the crater floor. The bottom of the ladder should just touch the cinder slope below the sampling station. Drive an 18" length of rebar into the substrate on each side of the bottom of the ladder. Attach the bottom of the ladder to the rebar using nylon rope. Tie a 50 foot length of rope to the top rung of the ladder. Stand the ladder upright. Holding onto the rope attached to the top, gently lower the ladder onto the slope. Drive an 18" length of rebar into the substrate on

each side of the top of the ladder. Attach the top of the ladder to the rebar using nylon rope. Repeat for each sampling station.

Install a trap at each sampling station (at the top of the ladders) by carefully digging into the cinder, disturbing only the amount of cinder necessary to set up the trap. Place the hardware cloth tube into the hole so that the top of the tube is slightly below the existing surface. Refill the hole around the tube with the cinder that was removed from the hole.

Place the reservoir cup into the tube. The top of the cup should be slightly below the cinder surface. Pour 15 ml of purified water into the reservoir cup. Fold a coffee filter 5 times and insert into the hole in the bottom of the trap cup, leaving about 3 cm of filter in the cup. Attach a label to the outside of this cup identifying the trap number. Add 3 pieces of pre-moistened shrimp bait and 5-6 pieces of local substrate (i.e., 2-3 cm cinder) to the trap cup. Place the trap cup into the reservoir cup such that the coffee-filter wick makes contact with the water reservoir.

Distribute chum, consisting of pureed pre-moistened shrimp, around the trap and place the trap cover such that the entire trap is shaded from sunlight. Attach a flag to the trap cover. Record on data sheet the trap number, date set, time set, and distance to nearest snow patch.

Collection

Remove the cap rock and remove the trap-cup from the trap. Carefully inspect the cinder in the cup, and record the number of Wēkiu bugs and presence of other arthropods in the trap.

Gently place captured Wēkiu bugs into the dark-cup illuminator and inspect each Wēkiu bug for luminous powder. Record the number of individuals with luminous dust and the colors of the dust if any is found. Dust all captured bugs with luminous powder using the dust bulb insufflator. Record the number of bugs marked and the dust color on the data sheet.

Release all live specimens at least one meter away from the sampling station. Wēkiu bugs should not be handled or exposed to direct sunlight for more than 30-45 seconds. Observe released bugs for one minute, making sure they find cover.

At the end of the sampling session remove the reservoir cup and replace the cap rock and flag. Remove the ladders from the crater.

6.2 - WEKIU BUG HABITAT PROTOCOL

Monitoring during Outrigger construction and operation will include sampling Wēkiu bug habitat to measure the locations and extents of restored habitat and habitat mitigation structures. In addition, the cinder structure in restored and mitigated habitat will be measured and monitored for changes.

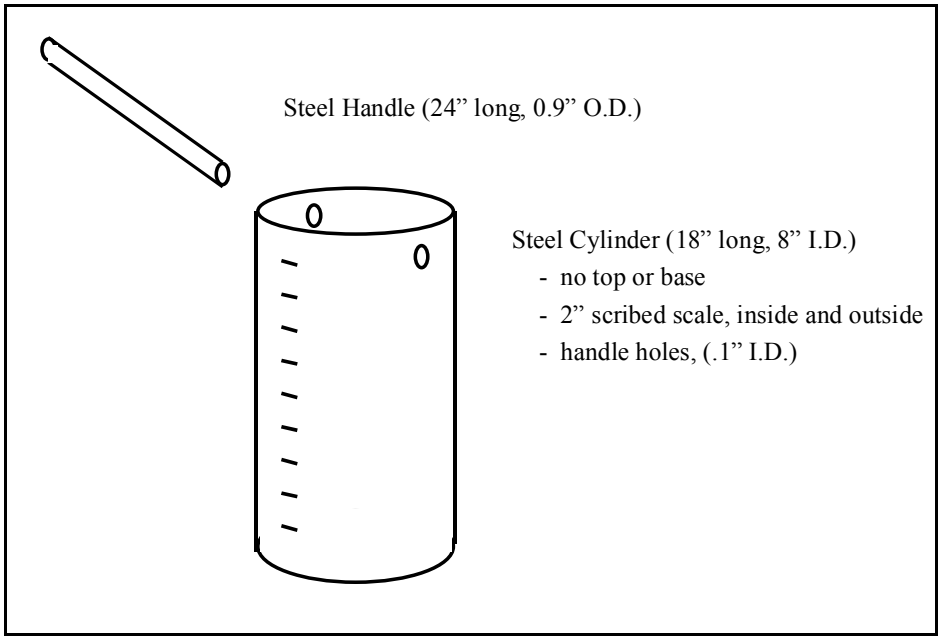
Researchers have determined that Wēkiu bugs live in the interstitial spaces, or voids, between the rocks in the surface layer. In the alpine environment of Mauna Kea's summit ice, frost heaving, and snowmelt wash and stratify the surface layer of cinder in the summit cones. Progressively larger rocks are lifted to the surface and washed clean of ash, which in turn accumulates in a layer 12 to 18 inches below the surface. This process is thought to create the interstitial spaces in which Wēkiu bugs live. The surface layer in restored habitat areas will be monitored for changes in interstitial porosity.

Materials

1 cylindrical shovel (see next section)
1 small trowel
~ 100 lidded containers (1/2 gallon)
100′ tape
3 screens (1″, 1/2″, 1/8″ meshes) ~ 12″x12″
scale
graduated cylinder or beaker (1 liter)

Cylindrical Shovel

The cylindrical shovel is a steel tube 8 inches in diameter and 18 inches long. The shovel has a drive handle and scribing that allows the operator to determine the depth the shovel is driven.



Locating Sampling Points

Thirteen sampling points in Wēkiu bug habitat will be installed at temporary monitoring stations: five in Puʻu Hau Oki, five in Puʻu Wēkiu, and three in newly restored habitat or habitat mitigation structures. These points will be established at trapping locations (see Population Protocol). This protocol will be implemented at those points prior to trap installation.

Additional sampling points in Wēkiu bug habitat will be necessary to monitor habitat structure changes over time, (any and all sampling point locations may be used only once). Additional points will be located using a grid established with a random starting point and random azimuth.

1) Place a grid map over a map of the site.
2) Randomly select one point on the grip as a starting point, (use a random number generator to select *x* and *y* coordinates).
3) Randomly select an azimuth, (use a random number generator to select a number between 0 and 360).
4) Re-orient the grid map, pivoting on the randomly chosen starting point, aligning the grid lines with the randomly chosen azimuth.
5) Sampling points may then be located at the re-oriented grid line intersections.

Field Collection

Drive the cylindrical shovel, perpendicular to the surface, as deep as possible. Carefully extract the cinder from within the cylinder in two-inch depth increments. Place each two-inch layer in a separate container for lab analysis. Mark each container with the sampling point number and the depth increment, (such as, Point 4 Hau Oki, 6-8 inches below surface). If necessary, drive the shovel deeper after extracting the top layers, so that 18" of cinder is eventually cored and removed. Following extraction of 9 two-inch layers, remove the shovel and fill the hole with loose cinder from the immediate vicinity.

Lab Analysis

For each two-inch layer sample, separate cinder particles by size using the three screens. Four fractions will be thus created. Submerge each fraction in a graduated beaker containing a known volume of water, and record the volume displacement, (i.e. the volume of the fraction). A wetting agent may be used in the water to eliminate small air bubbles that may cling to the cinder particles.

Calculate the particle size distribution of each two-inch layer (volume by particle-size-class). Calculate the porosity of each two-inch layer, (1 minus the ratio of the combined volume of the fractions to the total field volume of the layer). Note that each layer had a total field volume of $2\pi 4^2 = 100.5$ cubic inches.

6.3 - CONTRACTORS' LOG BOOK PROTOCOL

INSTRUCTIONS FOR FORM 1 - TRUCKS, EQUIPMENT, MATERIALS

The function of Form 1, Contractors' Log Book, is to provide a record of all trucks, heavy equipment, and construction materials that are transported to the Mauna Kea summit during construction of the Outrigger telescopes.

The purpose is to monitor for possible introductions of alien arthropods into Wēkiu bug habitat. Efforts to prevent alien arthropods from reaching the summit will help insure that the Wēkiu bug population is protected.

Information about each truck that arrives at the summit should be recorded in one column of Form 1, (one column per truck). The following numbered instructions correspond to the numbered rows on Form 1.

1: Arrival Time & Date

The **Arrival Time** is the hour, plus AM or PM, when each truck arrives at the construction site. The **Date** is the month, day, and year of arrival. Write down the hour of day and the date, (mm/dd/yy), when a truck arrives at the site.

2: Departure Time & Date

The **Departure Time** is the hour, plus AM or PM, when the truck leaves the construction site. The **Date** is the month, day, and year of departure. Write down the hour of day and the date, (mm/dd/yy), when the truck leaves the site. **One column per truck** means that the truck departing must be the same truck whose arrival is noted in the blank space above in the same column.

TRUCKS

3: Truck ID

The best **Identification Number** of a truck is its license plate number. Write down the license plate number of each truck that visits the construction site.

4: Number of Axles

Write down the number of axles, including those on any trailers attached to the truck.

5: Contents

Write down the contents of the load carried by the truck when it arrives at the construction site. **Contents** may be such things as: water, heavy equipment, construction materials, etc.

6: Loading location

Write down the address where the contents were loaded onto the truck. Include the **Name**, **Street Address,** and **City.**

7: Truck Owner

Write down the name of the person or company who owns the truck.

8: Truck Storage Yard

Write down the address where the truck (and trailer if applicable) is(are) stored when not in use. Include the **Street Address** and **City.**

9: Excess Mud on Truck?

Walk completely around the truck (and trailer if applicable) and note the presence of mud, dirt, or vegetation. In particular, inspect the undercarriage, axles, and wheel wells. Write down **YES** if the truck has clumps of mud or dirt larger than your fist, or if vegetation is clinging to the undercarriage. Write down **NO** if excess mud, dirt, or vegetation are not present on the truck (and trailer if applicable).

HEAVY EQUIPMENT

10: Heavy Equipment ID

Write down the **License Plate or Vehicle Identification Number** of each piece of heavy equipment arriving at the construction site**.** It is expected that heavy equipment will arrive on trucks Therefore, the information on each piece of heavy equipment should go in the same column as the information on the truck that transported it.

11: Type

Write down the **Type** of heavy equipment this piece is**.** Types of heavy equipment may be such things as loader, grader/scraper, back hoe, bulldozer, ditcher/excavator, fork lift, crane, snow plow, etc.

12: HE Owner

Write down the name of the person or company who owns this piece of heavy equipment**.**

13: HE Storage Yard Location

Write down the address where this piece of heavy equipment is stored when not in use. Include the **Street Address** and **City.**

14: Excess Mud on HE

Walk completely around this piece of heavy equipment and note the presence of mud, dirt, or vegetation. In particular, inspect the undercarriage, axles, wheel wells, tracks, and attachments. Write down **YES** if the heavy equipment has clumps of mud or dirt larger than your fist, or if vegetation is clinging to the undercarriage. Write down **NO** if mud, dirt, or vegetation are not present on the heavy equipment.

MATERIALS

15: Type of Materials

If the contents of the truck are construction materials, then write down the **Type** of materials arriving at the construction site. Types of materials may be such things as lumber and plywood, reinforcement bar (re-bar), concrete, steel beams and girders, building blocks, paints and/or solvents, etc.

16: Quantity

Write down the quantity of the construction materials on the truck. Also, be sure to specify the units, (gallons, pallets, cubic yards, etc.).

17: Evidence of Arthropods?

Examine the materials for signs of arthropods. Write down **YES** if there are signs of arthropods on the arriving materials. Write down **NO** if signs of arthropods are not present. Signs of arthropods include:

a. Ants, spiders, or other insects crawling on the materials
b. Spider webs on or among the materials
c. Small piles of sand-grain sized particles (frass) on wood objects
d. Clumps of mud or dirt
e. Clumps of vegetation

WEKIU BUG MONITORING PLAN - CONTRACTORS' LOG BOOK

FORM 1 - TRUCKS, EQUIPMENT, MATERIALS

Instruction Note No.		**Example**		
1	Arrival Time & Date	10 AM, 6/21/01		
2	Departure Time & Date	4 PM, 6/22/01		
	TRUCKS			
3	Truck ID	Lic: ABC123		
4	Number of axles	3		
5	Contents	Water		
6	Loading location	Co. Water Dept., XXXX Kaumana Dr., Hilo		
7	Truck Owner	A-1 Trucking		
8	Truck storage yard	XXXX Hinano St., Hilo		
9	Excess mud on Truck?	No		
	HEAVY EQUIPMENT			
10	Heavy Equipment ID			
11	Heavy Equipment Type			
12	Heavy Equipment Owner			
13	HE storage yard location			
14	Excess mud on HE?			
	MATERIALS			
15	Type	Water		
16	Quantity	1,000 gals		
17	Evidence of arthropods?	No		

WEKIU BUG MONITORING PLAN - CONTRACTORS' LOG BOOK

FORM 1 - TRUCKS, EQUIPMENT, MATERIALS

Instruction Note No.				
1	Arrival Time & Date			
2	Departure Time & Date			
	TRUCKS			
3	Truck ID			
4	Number of axles			
5	Contents			
6	Loading location			
7	Truck Owner			
8	Truck storage yard			
9	Excess mud on Truck?			
	HEAVY EQUIPMENT			
10	Heavy Equipment ID			
11	Heavy Equipment Type			
12	Heavy Equipment Owner			
13	HE storage yard location			
14	Excess mud on HE?			
	MATERIALS			
15	Type			
16	Quantity			
17	Evidence of arthropods?			

INSTRUCTIONS FOR FORM 2 - DUST, TRASH, HAZARDOUS MATERIALS

The function of Form 2, Contractors' Log Book, is to provide a record of all efforts to control dust, trash, and hazardous materials during construction of the Outrigger telescopes.

The purpose is to monitor for possible impacts to Wēkiu bug habitat. Recording control efforts will help insure that Wēkiu bug habitat is protected.

Information about daily control efforts should be recorded in one column of Form 2, (one column per day). The following numbered instructions correspond to the numbered rows on Form 2.

1: Date

Write down the **Date** of the log entry, month/day/year. Use one column per day, unless you require more room to record numerous control activities taking place on the same day . In that case, use a second or third column as needed, but be sure to clearly mark the **Date** in each column, (mm/dd/yy).

DUST CONTROL

2: Substrate type

The **Substrate Type** means the surface or substance to which dust control measures are be applied. Write down the substrate type where the dust-generating activity occurred. Common substrate types are: excavation (hole), cinder stock pile, road, parking lot, staging area, screened cinder, etc.

3: Location

Write down the location of the dust-generating activity. When excavations are for foundations and footings, specify the number of the nearest Outrigger (1 – 4). When excavations are for light tunnels, specify the origin and destination of the light tunnel. Write down the number of the nearest Outrigger (1 – 4) or staging area designation for cinder piles and construction pads.

4: Water applied? Quantity?

Write down **YES** if water was applied to the substrate to control dust. Write down **NO** if no water was used during the dust generating activity. Also write down the approximate quantity of water (in gallons) applied to the substrate.

5: Soil binders used? Type? Quantity?

Soil binders are chemicals that hold soil and dust particles together and prevent dust from being dispersed into the air. Soil binders may be mixed with water and applied to the substrate to control dust. Write down **YES** if soil binders were applied to the substrate, or **NO** if soil binders were not applied to the substrate. Write down the **Type or Brand Name** of the soil binder. Types of soil binders may be manufactured substances, soybean oilsoapstock, or lignins. Brands of manufactured substances include Soil-Sement, Pennzsuppress, and others. Record the Brand from the container. Report the **Quantity** of soil binder used, before mixing with water, and the units. **Reminder**: no soil binding compounds should be applied to cinder that will be used for habitat restoration.

6: Suspended for high winds?

Write down **YES** if any construction activity was suspended because of wind. Write down **NO** if no construction activities were suspended due to winds.

7: Covered? Type?

Some substrate, such as excavations or cinder stock piles, may be covered to prevent wind-generated dust. Write down **YES** if a substrate was covered, or **NO**, if the substrate was not covered. Also write down the **Type** of cover used. Cover types include tarps, plywood, etc.

TRASH

8: Roll-off containers covered?

Roll-off containers are large containers that are left at the site to receive waste materials. Write down **YES** if roll-off containers are securely covered to prevent wind-blown trash Write down **NO** if roll-off containers are not covered. Write down **NONE** if there are no roll-off containers on site on this day.

9: Construction materials covered?

Construction materials may be covered or tied down to prevent them from being blown off the site by high winds. Write down **YES** if construction materials were covered or anchored on this day. Write down **NO** if construction materials were not covered or anchored on this day.

10: Wind-blown debris?

Wind-blown debris may be trash, construction materials, or other items blown beyond the construction site boundaries. Write down **YES** if any debris was blown or fell beyond the construction site boundaries on this day. Write down **NO** if no debris was blown or fell beyond the construction site boundaries on this day.

11: If yes to 10, types, quantities.

If you wrote YES to No. 10, describe the types of debris and the quantities blown beyond the construction site boundaries on this day. **Types** of wind-blown debris include such things as plywood, plastic sheeting, packing material, paper, sheet metal, or other material. Estimate the size and number of the items.

HAZARDOUS MATERIALS

12: Chemicals used on site?

Chemicals are manufactured substances that are used during construction and maintenance of the Outriggers and the Observatory. These include paints, thinners, solvents, fuels, cleaners, acids, and mirror-coating materials. Write down **YES** if chemicals were used at the site on this day. Write down **NO** if chemicals were not used at the site on this day.

13: Types, quantities.

Write down the **Types** of chemicals (noted in No. 12) that were used at the site on this day. Write down the quantities of the chemicals used. Quantities may be a count of the number of containers (specify capacity), or the volume or weight of the chemicals used on this day. Be sure to specify the units.

14: Spills?

Spills are defined as any quantity of a chemical coming in contact with a surface or substrate to which it was not intended to be applied. Write down **YES** if a spill occurred on this day. Write down **NO** if no spill occurred on this day.

15: If yes to 14, to whom reported?

Spills should be reported to:

_____ , ph _____or to

_____ , ph_____.

Write down the name of the person to whom the spill was reported, and their phone number.

WEKIU BUG MONITORING PLAN - CONTRACTORS' LOG BOOK

FORM 2 - DUST, TRASH, HAZARDOUS MATERIALS

Instruction Note No.		**Example**		
1	Date	6/21/01		
	DUST CONTROL			
2	Substrate type	Excavation		
3	Location	O1 to JB4		
4	Water applied?, Quantity?	Yes, 250 gal		
5	Soil binders used? Type?, Qty?	Yes, SoilSement, 1qt.		
6	Suspended for high winds?	No		
7	Covered?, Type?	Yes, tarp		
	TRASH			
8	Roll-off containers covered?	Yes		
9	Construction materials covered?	Yes		
10	Wind-blown debris?	No		
11	If yes to 10, types, quantities	None		
	HAZARDOUS MATERIALS			
12	Chemicals used on site?	Yes		
13	Types, quantities	water-base paint, 5 gal		
14	Spills?	No		
15	If yes to 14, to whom reported	None		

WEKIU BUG MONITORING PLAN - CONTRACTORS' LOG BOOK

FORM 2 - DUST, TRASH, HAZARDOUS MATERIALS

Instruction Note No.				
1	Date			
	DUST CONTROL			
2	Substrate type			
3	Location			
4	Water applied?, Quantity?			
5	Soil binders used? Type?, Qty?			
6	Suspended for high winds?			
7	Covered?, Type?			
	TRASH			
8	Roll-off containers covered?			
9	Construction materials covered?			
10	Wind-blown debris?			
11	If yes to 10, types, quantities			
	HAZARDOUS MATERIALS			
12	Chemicals used on site?			
13	Types, quantities			
14	Spills?			
15	If yes to 14, to whom reported			

6.4 - METEOROLOGICAL STATION PROTOCOL

Monitoring weather during Outrigger construction and operation will include frequent sampling of temperature, humidity, windspeed, and precipitation. Wēkiu bugs are found only in the extreme alpine environment of Mauna Kea's summit. Extreme weather phenomena are thought to be associated with Wēkiu bug population change. Monitoring weather will provide measured variables to include in population change analyses. In addition, wind speed monitoring will provide data for determination of daily mitigation actions, such as dust control.

Several of the observatories have weather stations, and the information is readily available over the internet. Using existing weather stations will save costs and disturbance to habitat from installation of new equipment.

Tools

Computer with internet access.

Procedures

Access weather data at Mauna Kea Weather Center web site at http://hokukea.soest.hawaii.edu/index.html . Download weather information from UKIRT data logger. .

Download digital data monthly.

6.5 - ALIEN ARTHROPOD INSPECTION PROTOCOL

Arthropods that do not occur naturally at the summit area have the potential to disturb Wēkiu bug populations. Predators like ants and spiders are especially threatening. Regular inspections called for in the monitoring plan are intended to detect alien species so that they may be eradicated before being transported to the construction site.

This protocol is designed to be implemented by non-technical personnel and should detect most viable alien arthropod colonies present. Solitary arthropods are unlikely to establish populations at the summit and represent only a small threat to Wēkiu bugs.

Tools magnifying glass, knife, trowel. Notebook.

Targets soil, mud, vegetation, ants, spiders and spider webs, egg masses, frass, and yellowjacket nests.

Procedures

1. **Construction materials** Walk slowly around construction materials, trash containers, and shipping crates and examine all sides for ants, spiders, spider webs, egg masses, frass, and yellowjacket nests.

2. **Vehicles** Examine all of the wheel wells, wheels, tires, treads, and undercarriages of earth-moving equipment, large trucks, tractors, and other heavy equipment. Examine for ants, spiders, spider webs, egg masses, and yellowjacket nests. Also examine for soil, mud, dirt, vegetation, and other debris attached.

3. **Buildings** Examine sides of each building or structure, from base to 10 feet above the ground. Examine for ants, spiders, spider webs, egg masses, and yellowjacket nests.

Reporting

Type Describe what was inspected (e.g. construction material, vehicle, equipment, building)

Location Describe the general location of the subject inspected relative to fixed reference points.

Findings Describe the types and numbers of arthropods detected (e.g. ants, spiders, etc.), the types of arthropod artifacts detected (e.g. spider webs, yellowjacket nests, frass, etc.), and/or the type of arthropod habitats detected (e.g. soil, mud, vegetation, etc.).

6.6 - COMPLIANCE VISUAL INSPECTION PROTOCOL

Compliance monitoring investigates whether programs and personnel are following the guidelines established for protection of the Wēkiu bug. Random site inspections averaging one per month will be conducted during Outrigger construction to ensure compliance with the guidelines. The results of the random site inspections will be included in the quarterly reports

Tools

100′ tape measure, compass, notebook

Procedures

1. Note the locations of temporary barriers and verify their installation near excavations and other earth-moving activities (see QOI 2.4.1). Inspect and record the condition of the barriers (e.g. holding side-cast cinder, failing, etc.). Verify compliance with Wēkiu Bug Mitigation Plan Recommendation IV-3. Temporary, and if possible, permanent barriers should be built along the slope breaks above the inner slopes of Pu‘u Hau Oki crater. Report non-compliance or barrier failures to the construction-site manager.

2. Visually inspect for side-cast material (see QOI 2.4.2). Verify compliance with Wēkiu Bug Mitigation Plan Recommendation IV-3. Under no circumstances should cinder or other materials be side-cast into Wēkiu bug habitat. Report side-cast cinder to the construction-site manager.

3. Visually inspect active earth-moving operations, excavated materials and cinder stock piles (see QOI 2.5.1, QOI 2.5.2, & QOI 2.5.3). Verify compliance with Wēkiu Bug Mitigation Plan Recommendation V-1. Water should be applied to excavation sites and cinder stockpiles. Verify Contractors′ Log Book entries regarding Dust Control (CLB Form 2, Lines 2-7). Verify compliance with Wēkiu Bug Mitigation Plan Recommendation V-2. Dust-generating activities should be suspended and construction materials secured during high winds, and water should be applied to

recently exposed cinder and ash. Report non-compliance to the construction-site manager.

4. Visually inspect applications of soil-binding compounds (see QOI 2.5.4). Verify compliance with Wēkiu Bug Mitigation Plan Recommendation V-3. Soil-binding amendments should be used sparingly, and should never be applied to Wēkiu bug habitat. Verify Contractors' Log Book entries regarding Dust Control (CLB Form 2, Line 5). Report non-compliance to the construction-site manager.

5. Locate and observe the use of paints, thinners, and solvents and cleanup procedures. Describe cleanup and disposal activities (see QOI 2.6.2 and QOI 2.6.3). Describe spills, if any. Verify compliance with Wēkiu Bug Mitigation Plan Recommendation VI-2. Contractors should minimize the on-site use of paints, thinners, and solvents. Painting and construction equipment should not be cleaned on-site. Contractors should keep a log of hazardous materials brought on-site and report spills to a designated WMKO representative. Verify Contractors' Log Book entries regarding Hazardous Materials (CLB Form 2, Lines 12-15).Report non-compliance to the construction-site manager.

6. Visually inspect construction trash containers (see QOI 2.7.1). Describe trash containers, covers, and anchoring devices. Verify compliance with Wēkiu Bug Mitigation Plan Recommendation VII-1. Construction trash containers should be tightly covered to prevent construction wastes from being dispersed by wind. Verify Contractors' Log Book entries regarding Trash (CLB Form 2, Lines 8-11). Report non-compliance to the construction-site manager.

7. Visually inspect construction materials stored at the site (see QOI 2.7.2 and QOI 2.8.3). Describe material, covers, and anchoring devices. Verify compliance with Wēkiu Bug Mitigation Plan Recommendation VII-2. Construction materials stored at the site should be covered with tarps, or anchored in place, and not be susceptible to movement by wind. Verify Contractors' Log Book entries regarding Dust Control (CLB Form 2, Line 9). Walk slowly around the materials and examine for ants, spiders, spider webs, and yellowjacket nests. Report uncovered or unanchored material, or alien arthropods to the construction-site manager.

8. Locate and describe outdoor trash receptacles, and their lids and anchors (see QOI 2.7.3). Verify compliance with Wēkiu Bug Mitigation Plan Recommendation VII-3. Outdoor trash receptacles should be secured to the ground and have attached lids. Report non-compliance to the construction-site manager.

9. Locate and describe construction materials, trash, and wind-blown debris in Wēkiu bug habitat (see QOI 2.7.4). Describe the debris, general location, and retrieval activities if any. Verify compliance with Wēkiu Bug Mitigation Plan Recommendation VII-4. If construction materials and trash are blown into Wēkiu bug habitat, they should be collected without disturbing the habitat. Verify Contractors' Log Book entries regarding Trash (CLB Form 2, Lines 10-11). Report non-compliance to the construction-site manager.

10. Locate all large trucks, tractors, and other heavy equipment (see QOI 2.8.2 and QOI 2.8.3). Record vehicle identification numbers. Verify Contractors' Log Book entries regarding Trucks (CLB Form 1, Lines 1-14).Verify compliance with Wēkiu Bug Mitigation Plan Recommendation VIII-1. Earthmoving equipment should be free of large deposits of soil, dirt and vegetation debris that could harbor alien arthropods. Walk slowly around each vehicle and examine all of the wheel wells, wheels, tires, treads, and undercarriages. Examine and record the presence of spiders, spider webs, egg masses, ants, and other arthropods. Also examine and record the presence of soil, mud, dirt, vegetation, and other debris attached. Describe the presence of arthropods or arthropod harboring debris if any are found. Report alien arthropod presence to the construction-site manager.

11. Locate shipping crates and boxes. Examine and record the presence of spiders, spider webs, egg masses, ants, and other arthropods(see QOI 2.8.4). Also examine and record the presence of soil, mud, dirt, vegetation, and other debris attached. Describe the presence of arthropods or arthropod harboring debris if any are found. Verify Contractors' Log Book entries regarding Materials (CLB Form 1, Lines 15-17). Report alien arthropod presence to the construction-site manager.

12. Locate portable buildings and toilet facilities. Walk slowly around these structures and examine for ants, spiders, spider webs, or yellowjacket nests (see QOI 2.8.5). Record the presence of alien arthropods and describe their general location and the

degree of infestation. Report alien arthropod presence to the construction-site manager.

13. Walk slowly around the observatory building and outriggers, and examine for ants, spiders, spider webs, or yellowjacket nests (see QOI 2.8.5). Record the presence of alien arthropods, and describe their general location and the degree of infestation. Report alien arthropod presence to the construction-site manager.

This page intentionally left blank.

APPENDIX F

CONSTRUCTION BEST MANAGEMENT PRACTICES PLAN (BMP)

This page intentionally left blank.

W. M. KECK OBSERVATORY

CALIFORNIA ASSOCIATION FOR RESEARCH IN ASTRONOMY

Keck Interferometer Outrigger Telescopes

CONSTRUCTION BEST MANAGEMENT PRACTICES PLAN (BMP)

Draft Revision A

January 23, 2002

Keck Interferometer Plan

Title:	**Construction Best Management Plan (BMP)**
Author:	James Bell (CARA)
Version:	A – Draft pending site works contract
Date:	1/23/2002
Approvals:	Jim Beletic
Cc:	Peter Wizinowich (CARA), Jim Kelley (JPL)

Upon obtaining project approval for the new Keck Outrigger Telescopes, this Best Management Practices Plan (BMP) will be used to guide all activities associated with construction of the outrigger telescopes. The plan will serve as a working document that may be expanded and revised prior to project start. It will become part of the agreements/contracts with site work contractors. The purpose of this document is to facilitate project management by developing an organizational structure that will guide construction management, designate who has the authority to make decisions, and provide a checklist to ensure compliance with all mitigating measures and conditions on the project. It is a primary management tool for the CARA Construction Manager and Contractor's Project Manager. This Best Management Practices Plan becomes null and void if for some reason the project fails to move forward.

I. OVERVIEW 4
A. PURPOSE 4
B. SCOPE OF THE CONSTRUCTION BMP 4
II. ENVIRONMENTAL AND CULTURAL CONCERNS 5
A. WĒKIU BUG 5
B. CULTURAL CONCERNS 5
III. PRE-CONSTRUCTION ACTIONS 5
A. COORDINATION 5
B. ARCHAEOLOGICAL CONSULTATION 7
C. CULTURAL MONITORING 8
D. FINALIZE PLANS AND PROCEDURES 8
E. PREPARE MONITORING AND REPORTING SCHEDULES 8
F. FIELD MANUAL OF PROCEDURES AND PRACTICES 8
G. EDUCATION 8
IV. CONTROLS 9
A. CONSTRUCTION SAFETY ZONES 9
B HEALTH AND SAFETY 9
C. WASTE CONTROLS 10
D. ACCIDENTIAL CHEMICAL RELEASES 11
E. SPECIAL CONCERNS 11
V. ENFORCEMENT 13

I. OVERVIEW

A. PURPOSE

The purpose of the Construction Best Management Practices Plan (BMP) is to specify the methods and controls which will be implemented to prevent or minimize negative impacts to the surrounding environment, and to the natural and cultural resources on and adjacent to the W. M. Keck Observatory (WMKO) site during the construction of the Outrigger Telescopes project. Included in these controls is a proposed organizational structure which clearly sets forth the lines of authority and responsibility that will ensure proper supervision and oversight throughout the construction process.

The BMP will be overseen by the CARA Construction Manager and implemented by the Contractor's Project Manager. A Construction Management Organization Chart, identifying the proposed hierarchy and working relationships among the various interested parties, is attached (Figure 1). The BMP and accompanying organization chart will be finalized by CARA in coordination with the selected Contractor. It will also be attached to the construction contracts. The CARA Construction Manager will have the primary responsibility for all construction activities.

B. SCOPE OF THE CONSTRUCTION BMP

All construction activities related to the Outrigger Telescopes Project—from delivery of materials and equipment (to either the WMKO site or one of the two construction staging areas, Figure 2), through final clean up of the staging areas, stockpile area (Figure 3) and WMKO site—will be controlled by the BMP. These activities include, but are not limited to:

- Unloading containers at the staging area and delivering the contents to the site.
- Installing sheet piling, as required by the Hawaii Electric Light Company (HELCO), to protect power cables from inadvertent disturbance by construction equipment. Removal of piles upon completion of construction will also adhere to this plan.
- Excavating and trenching for junction boxes, light pipes and air pipes, enclosure and telescope footings, underground coudé rooms and tunnels.
- Removing excess excavated material, not used for backfill, to the approved summit stockpile area (Figure 3) to be screened, washed and used for Wēkiu habitat restoration on and adjacent to WMKO site.
- Grading and shoring for Outrigger Telescope enclosures and junction boxes, including placement of fill and construction of retaining walls.
- Pouring concrete (ready-mixed in Hilo or Waimea) for a tunnel, ring wall, retaining walls and telescope foundations.
- Installing up to five prefabricated junction boxes and up to six prefabricated coudé rooms (or pouring concrete if prefabricated structures are unavailable).
- Installing light pipes (together with electrical conduits) and air pipes.
- Assembling prefabricated enclosures, consisting of ring walls and rotating domes, on site; setting the ring walls on concrete footings and installing the domes on their tops.
- Installing a telescope, dual star module and other hardware within each enclosure.
- Complying with the Wēkiu Bug Mitigation Plan, including the restoration of Wekiu bug habitat.

- Maintaining the summit construction staging and stockpile areas (Figure 3), on-site stockpile areas and the construction staging area at Hale Pohaku (Figure 2) in clean, safe condition.
- Care and maintenance of equipment and vehicles.
- Cleanup of all construction areas.
- Complying with the Memorandum of Agreement on cultural resources.

II. ENVIRONMENTAL AND CULTURAL CONCERNS

A. WĒKIU BUG

Although the actual construction site has been altered by past development activities, nearby Wēkiu bug habitat could be affected by construction of the proposed project (Figure 4). The major negative effects that could occur during Outrigger Telescope construction are: trash, dust, side-cast cinder, introduction of non-native species, and spills of hazardous materials. The control and mitigation of these concerns will follow the Wēkiu Bug Mitigation Plan. Foot traffic in Wēkiu Bug habitat can be harmful to the habitat. The Construction Manager will ensure that the only foot traffic in the habitat will be with the concurrence of the project entomologist.

B. CULTURAL CONCERNS

Historic District. The State Historic Preservation Division (SHPD) believes that the summit region of Mauna Kea is eligible for listing in the National Register of Historic Places as an Historic District. The cluster of cones forming the summit, including Pu‘u Hau‘oki, would be a contributing historic property to this district and itself meets the criteria for listing in the National Register of Historic Places. Measures that would prevent or minimize activities that would further impact the structural and visual integrity (i.e., shape and contour) of the Pu‘u Hau‘oki cinder cone and its crater are a primary focus of the BMP.

Potential Burial Sites. Most of the land to be used for the Outrigger Telescopes has been previously altered to such an extent that there is a low probability of discovering burials on the site. An exception to this applies to areas near the outer edges of the Pu‘u Hau‘oki plateau, where it had not been previously disturbed other than being subjected to side-casting of cinder from the original grading of the plateau. Because the existence of burials cannot be conclusively verified, the project archeologist will monitor all excavation.

View Planes. All above ground parts of junction boxes and retaining walls will be colored to match the cinder.

III. PRE-CONSTRUCTION ACTIONS

A. COORDINATION

Prior to construction mobilization, meetings will be held to finalize all aspects of the construction process. The following information will be exchanged between CARA (including the Archeological, Cultural and Wēkiu Bug Monitors) and the Contractor at least two weeks before these meetings take place.

1.0 Information to be provided by CARA

a) A location map identifying all construction, staging and stockpile areas.

b) A description of the type, composition and quantity of material expected to be excavated during the project and its disposition.

c) A description of the type, composition and quantity of fill material to be used, including locations of temporary on-site stockpiles.

d) A chart showing preferred construction sequence (a schedule of construction activities) that will: (a) minimize potential adverse cultural and environmental effects, and (b) allow efficient scheduling of appropriate monitoring times.

e) A Construction Management Organization Chart, such as shown in Figure 1, that will clearly delineate lines of authority and responsibility; phone numbers of key personnel will also be included.

f) Provide a detailed description of specific mitigating measures to protect and preserve the natural and historic/cultural attributes of the project area.

g) Based on the Organization Chart, designation of areas of responsibility, names and phone numbers of responsible individuals, names and phone numbers of special advisors, and steps that will be taken to accomplish the following:
   - control of all trash and construction material stored on site;
   - removal of all trash on a regular basis;
   - monitoring of construction activity to ensure that no cinder or other materials are side-cast into the Pu‘u Hau‘oki crater or the outer slopes of the cone;
   - ensuring compliance with all provisions of the Section 106 memorandum of agreement (MOA) to be entered into by NASA, the Advisory Council on Historic Preservation, State Historic Preservation Officer, and others;
   - monitoring the on-site use of paints, thinners, and solvents and other hazardous materials and reporting spills to designated individuals;
   - ensuring that earth-moving equipment is free of large deposits of soil, dirt and vegetation debris that may harbor non-native species; and
   - ensuring that new non native species introductions detected during monitoring as described in Wēkiu Bug Monitoring Plan are eradicated;
   - ensuring compliance with all provisions of the Wēkiu Bug Mitigation Plan.

h) A list of telephone numbers of the responsible persons and alternates to be contacted (day or night) when violations are suspected. (After inspecting a particular incident, these individuals report their findings to the CARA Construction Manager; they do not interact with the workers or try to fix it themselves except for the archaeologist has the immediate authority to stop construction work in the area of an identified or potential find. The resource or burial could easily be destroyed by the time the Construction Manager is found, the issue discussed, and directive given. The archaeologist may also be responsible for discussing any findings with the SHPO and the cultural monitor under the Section 106 MOA.

i) A set of criteria to be used when determining whether or not to stop construction.

j) An emergency response plan for unplanned events to be based on the CARA Safety Manual.

2.0 Information to be provided by the Contractor

a) A list identifying the characteristics of raw materials to be brought to the site or lay down area, including:
   - the type of materials to be used, by construction phase;

- the frequency of delivery of these materials to the site;
- the quantities to be stored and length of storage;
- the location of proposed on-site storage and stockpile areas; and
- a description of how the Contractor would clean and care for these areas and materials.

b) A written summary of the characteristics and source of any discharge and potential pollutants associated with each construction activity together with proposed control measures or treatment methods, including but not limited to the following discharges:
- solid waste,
- oily waste,
- hazardous waste, and
- equipment cleaning and washing of cement truck mixers.

c) A written summary describing the type and characteristics of vehicles and equipment to be used, including:
- the duration of use by construction phase by vehicle and equipment type;
- emission characteristics by vehicle and equipment type;
- noise characteristics by vehicle and equipment type;
- type of fuel used by vehicle and equipment type; and
- on-site use and/or storage area(s) for each type of equipment.

d) An implementation plan for suspending all dust-generating activities and securing equipment and materials during high winds and storms.

e) A plan to control wind and water erosion during the construction period.

f) An implementation plan for cleaning vehicles and equipment to rid them of non-native species of plants and animals prior to transportation to the construction site.

B. ARCHAEOLOGICAL CONSULTATION

CARA and the Contractor will meet at least 2 weeks before construction starts with a qualified archaeologist as defined in the MOA (known as the project archeologist) to determine the scope and schedule of archaeological monitoring activities during the construction period. The archaeologist will first identify potentially sensitive construction areas on the WMKO site. The archaeologist, in coordination with the CARA Construction Manager and the Contractor, will develop standards and criteria for monitoring excavation activities and determining when remedial actions are required and work must be stopped. The archaeologist will then be present on site to monitor all excavation. The archaeologist will follow SHPD standards for archaeological monitoring studies and reports (HAR Chapter 279). The archaeologist has the immediate authority to stop construction work in the area of an identified or potential find. The archaeologist may also be responsible for discussing any findings with the SHPO and the cultural monitor under the Section 106 MOA. The archeologist is encouraged to work with the cultural monitor in developing monitoring plans and actual monitoring. The archeologist has the discretion to make random visits to the project site, but for safety reasons must check in with the Construction Manger before entering the site.

C. CULTURAL MONITORING

The CARA Construction Manager and the Contractor will meet with the project cultural monitor to determine the scope and schedule of cultural monitoring activities during the construction period at least 2 weeks before construction starts. The cultural monitor, in coordination with the CARA Construction Manager and the Contractor, will develop standards and criteria for monitoring construction activity and determining when remedial actions are required. Details of the monitoring and required qualifications of the monitor are defined in the cultural resources MOA. The project cultural monitor is encouraged to work with the project archeological monitor in developing monitoring plans and actual monitoring. The project cultural monitor has the discretion to make random visits to the project site, but for safety reasons must check in with the Construction Manger before entering the site.

D. FINALIZE PLANS AND PROCEDURES

The CARA Construction Manager and the Contractor Project Manager will meet, discuss and revise all information and produce a final Organization Chart, a set of criteria for ensuring compliance with all mitigating measures, and criteria and procedures for stopping construction if necessary.

E. PREPARE MONITORING AND REPORTING SCHEDULES

The CARA Construction Manager, in consultation with various specialists and the Contractor, will prepare schedules for monitoring on-going activities for compliance with the BMP. Procedures for reporting violations and the status of corrective measures to bring the project into compliance will also be determined. The name and phone number of each monitor will be identified.

F. FIELD MANUAL OF PROCEDURES AND PRACTICES

The CARA Construction Manager, in cooperation with CARA, the Contractor, OMKM and special advisors, will prepare a manual which will incorporate the finalized BMP; specific emergency response plans for injuries, medical emergencies, and fire; other standard practices (CARA's safety manual); and protocols for Wēkiu bug and cultural mitigation. Both CARA and the General Contractor will approve this manual.

The CARA Construction Manager will schedule mutually agreed upon meetings with the Archaeologist, Cultural Monitor, and OMKM, to ensure that work is being carried out according to applicable terms of the MOA.

G. EDUCATION

Prior to starting work on the project site, all project personnel and all contractor(s) employees will be briefed on and shown a videotape concerning the cultural significance of the project area. OMKM will be consulted on the production of the video and advised on the briefings. A natural resource specialist will brief them on the importance of protecting the Wēkiu habitat. Mitigating measures for both cultural and natural resources will be explained in detail. They will also be advised of procedures that must be taken in the event of an infraction of the conditions imposed on the project. Suggestions as to the most effective ways of informing their workers about the importance of adhering to all of the stipulations set forth in the agreement will also be discussed. The archaeological monitor and the cultural monitor will also give presentations to project personnel and contractor employees as specified in the MOA.

IV. CONTROLS

A. CONSTRUCTION SAFETY ZONES

1.0 Pu'u Hau Oki Crater Rim and Outer Slopes

Temporary 3-foot-high silt fences will be installed along the rim of the Puʻu Hauʻoki crater and outer slopes, where excavation or trenching is planned to take place where any significant potential that material may be overcast down slope. At a minimum the fences will be located down slope of any area to be excavated within 6 feet of the slope. The temporary silt fences will be maintained by the contractor on a daily basis to repair any damage.

2.0 Other Construction Areas

a) Construction safety fencing and temporary signage to deter unauthorized visitors and Observatory personnel from inadvertently entering into construction zones will delineate each area under construction. To the extent possible, the color of the fencing will blend in with the surrounding cinder terrain.

b) As the construction in each area is completed, the fencing and signage will be removed as soon as practicable.

c) The fencing and signage will remain at any area where archaeological artifacts are found until the State Historic Preservation Division approves removal, if any, of the fencing and temporary signage.

B. HEALTH AND SAFETY

1.0 Noise

a) The Contractor will minimize high noise levels from construction equipment by outfitting all equipment with proper noise muffling devices.

b) The Contractor will comply with State Department of Health (DOH) rules (HAR, Chapter 46, Community Noise Control).

2.0 Air Quality

The Contractor will comply with Hawaii DOH rules (HAR Chapter 11, Section 60.1, Air Pollution Control) and the County of Hawaii grading permit as well as this BMP.

a) Dust Control

- fugitive dust will be minimized by spraying with potable water or other environmentally acceptable suppressant as necessary. The Wekiu Bug Monitor will define what is environmentally safe; and
- all dust-generating activities will be suspended during high winds. The critical velocity of these winds will be determined later but is assumed to be about 40 to 50 miles per hour (64 to 80 kilometers per hour).
- Cinder stored in the summit stockpile area at the project site will be covered with heavy tarps as needed to minimize dust.

b) Emissions

- all engine emissions will be mitigated by the use of properly functioning emission control devices as required by law;
- all construction equipment will be properly maintained;
- equipment idling will be kept to a minimum when equipment is not in use.

3.0 Worker Safety

All personnel working on the project site including monitors must attend Pre-Start Safety Induction training that will cover at a minimum:

- CARA and Contractor Safety Policy
- Contractor MSDS Management and Control
- Discussion of harards associated with working at high alititude
- Review of lockout proceedure on dome and telescope.
- Reporting accidents
- Emergency medical treatment for workers in the event of an accident
- Dealing safely with hazardous materials
- Highlight the critical proceedures that are most likely to affect workers or the project.

The Contractor will comply with all OSHA standards and regulations.

C. WASTE CONTROLS

The Contractor will comply with all Hawaii DOH rules.

Every member of the construction crew, managers, observatory personnel, and other people associated with the proposed Outrigger Telescopes Project will undergo an orientation about the impacts of the Outrigger Telescope construction and installation, and how they may prevent and minimize disturbance caused by trash.

1.0 Solid Waste (Construction and Domestic)

a) Construction materials and supplies will be prevented from being blown into Wēkiu bug habitat and historic properties by covering them with heavy canvas tarps, using steel cables attached to anchors.

b) Construction trash containers will be tightly covered to prevent construction wastes from being dispersed by wind.

c) Outdoor trash receptacles will be secured to the ground and have secured lids and plastic liners.

d) "Roll off" containers will be equipped with heavy canvas tarps held securely with cables. Containers will be collected on a regular basis before they are completely full or overflowing.

e) All trash will be removed to an authorized disposal site in either Hilo or Waikoloa. This will be done on at least a weekly basis throughout the construction period.

f) As necessary, a magnetic device will be driven over roadways to remove metallic debris.

2.0 Toxic/Hazardous Waste

a) Contractors will minimize the on-site use of paints, thinners, and solvents.
b) Painting and construction equipment will not be cleaned on-site.
c) Contractors will keep a log of toxic/hazardous materials, if any, brought on-site and their disposition.
d) Spills will be immediately reported to the CARA Construction Manager who will activate the appropriate emergency response procedures.
e) Any toxic/hazardous waste generated by the construction project will be properly disposed of as recommended by CARA's Hazardous Disposal consultant.

D. ACCIDENTIAL CHEMICAL RELEASES

1.0 Precautions

a) Fuel tanks of equipment and construction vehicles will not be filled to the top.
b) Equipment will be properly secured during non-working hours, away from previously identified (during pre-construction activities) sensitive areas.
c) Fuel spill clean-up kits will be readily accessible at the work area at all times.

2.0 Spill Response Plan

a) Procedures for spill response are included in CARA's Safety Manual. Additional requirements will be added if necessary.
b) The Contractor will comply with all Federal and State DOH rules and regulations.

E. SPECIAL CONCERNS

1.0 Cultural Resources

a) Any human remains discovered during the construction process will immediately be reported to the CARA Construction Manager. As set forth in HAR 13-300-40, "Inadvertent discovery of human remains," the Archeologist will immediately order all work stopped in the area of the discovery and report the findings to the following:
   - the State Historic Preservation Division, unless the discovery occurs on Saturday, Sunday or holiday, at which time the report shall be made to the Division of Conservation and Resources Enforcement;
   - the University of Hawaii Office of Mauna Kea Management;
   - the Hawaii County medical examiner or coroner; and
   - the Hawaii County Police Department.

   Work in the discovery area can resume only upon approval of SHPD.
b) Because use of the construction staging and/or stockpile areas within the summit area of the Science Reserve may affect the landscape of a proposed historic property (the summit area of Mauna Kea), the following precautions must be observed:
   - construction materials stored at the site must be anchored in place and not be susceptible to movement by wind;
   - trash must not be scattered over the site; and

- trash containers must be secured to the ground and tightly covered to prevent construction wastes from being dispersed by wind.

c) The construction staging and stockpile areas on the summit (and in some instances at Hale Pohaku) must be inspected for compliance with the BMP every evening (after the work day is completed), and during high winds and storms. The construction staging and stockpile areas must also be inspected upon completion of all construction and habitat restoration activities to ensure that the areas have been restored.

d) All stipulations in the cultural resource MOA related to construction activities, as well as conditions attached to the Conservation District Use Permit, will be incorporated into this BMP and the construction contract.

2.0 Wēkiu Bug

a) Non-native species
- monitoring will be undertaken to identify any no-native species infestations at the Outrigger Telescopes construction site and staging areas;
- large deposits of soil, dirt and vegetation debris that may harbor non-native species will be removed from all earth-moving equipment by pressure washing or other means at the Contractor's base yard before ascending Mauna Kea;
- large trucks, tractors, and other heavy equipment will be inspected for non-native species at the Contractor's base yard or marine terminal and at the intersection of the Saddle Road and the Summit Road; the inspection near the intersection of the Saddle and Summit Roads will be conducted by a qualified biologist. If non-native species are found at the intersection of the Saddle and Summit Roads, the qualified biologist can either remove the non-native species or send the vehicle back to the base yard for required cleaning;
- the Contractor will ensure that all construction materials, crates, shipping containers, packaging material, and observatory equipment are free of non-native species when delivered to the summit; and
- new non-native species introductions detected during monitoring of the Outrigger Telescopes construction site and staging areas including, but not limited to, ants, yellow jackets and alien spiders, shall be eradicated.

b) Wēkiu Bug Habitat Protection
- soil-binding amendments will be used sparingly
- if construction materials and trash are blown into Wēkiu bug habitat (Figure 4), it will be collected by staff trained by the project entomologist taking care to minimize habitat disturbance.

c) Wēkiu Bug Habitat Restoration. Excess excavated material, not used for backfill or site grading, will be removed to the approved stockpile area, screened and washed. The cinder will be sieved for ½" and larger size and washed with an estimated 1 gal/ft^3. The sieving and washing process should be done simultaneously to minimize a dust plume. All material of suitable size will be used to restore Wēkiu bug habitat on or adjacent to Puʻu Hauʻoki. Any remaining material will be placed in the summit area after consultation with the SHPD and Office of Mauna Kea Management.

- The project entomologist will be on site during the habitat restoration and will have the necessary authority to ensure that the work is done properly;
- new cinder will be placed only on previously-disturbed surfaces;
- to the extent possible, the new cinder will match the existing cinder;
- washing of the cinder will be done in such a way that there is no erosion or other marking of the landscape by runoff;
- screening and washing of cinder will occur in an up-slope section of the staging area that is farthest removed from unaltered ground surfaces down slope.

3.0 Construction Staging Areas

a) The Hale Pohaku and summit construction staging areas will be inspected each evening to ensure that all materials are secured and that all trash is placed in appropriate approved containers.

b) When in use, the staging areas will be checked daily for oil spills from vehicles. These spills will be cleaned up immediately and the offending vehicle(s) will be removed from the mountain for maintenance.

c) The staging areas will be checked regularly for the presence of non-native species; any infestations will be immediately eradicated.

4.0 Potential Interference with Observatories

a) Use of exterior lighting is not permitted between sunset and sunrise.

b) Use of any radio transmitter that may interfere with observatory operations is not permitted.

5.0 Photographic Record

a) The contractor shall keep a photographic record of all construction activities on the site starting with pictures before any activities, during and after. This record shall be available for viewing in the site project office. At the end of the job the contractor will deliver 2 copies of the photos, one for CARA and another for OMKM.

V. ENFORCEMENT

It is the responsibility of the CARA Construction Manager to enforce the provisions of the BMP. All monitors will report their findings to him or her.

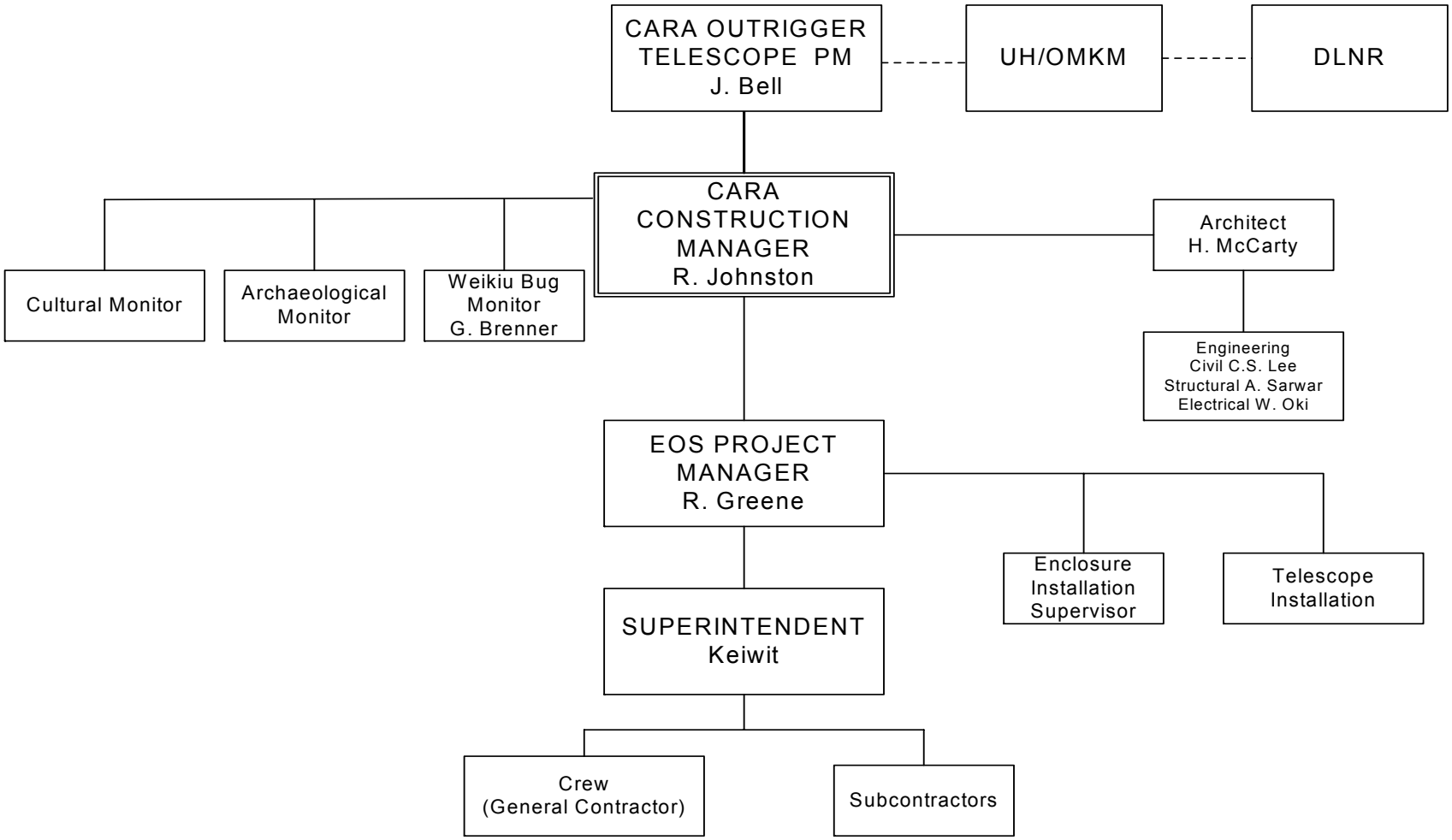


Figure 1
CONSTRUCTION MANAGEMENT ORGANIZATION CHART

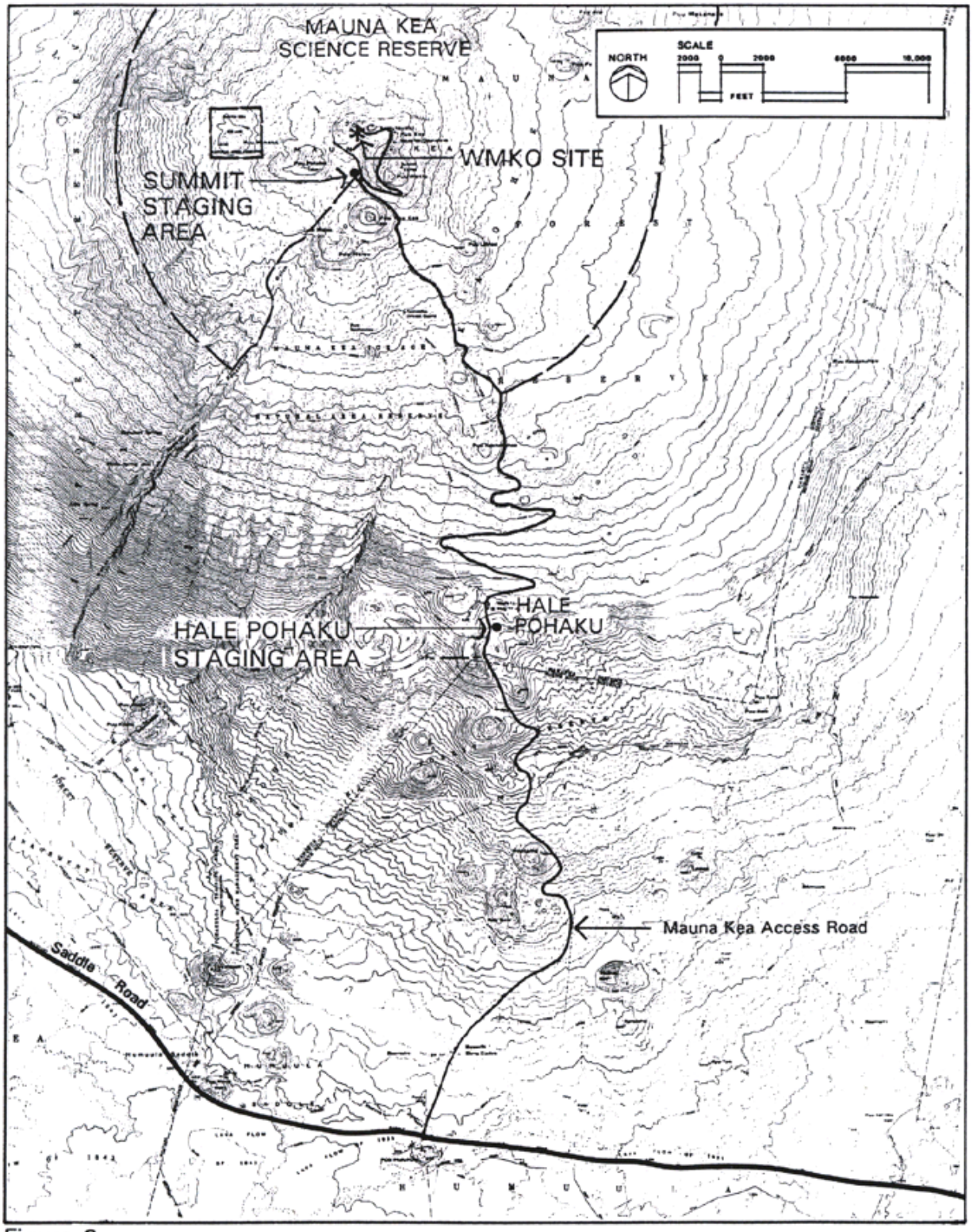


Figure 2
CONSTRUCTION STAGING AREAS

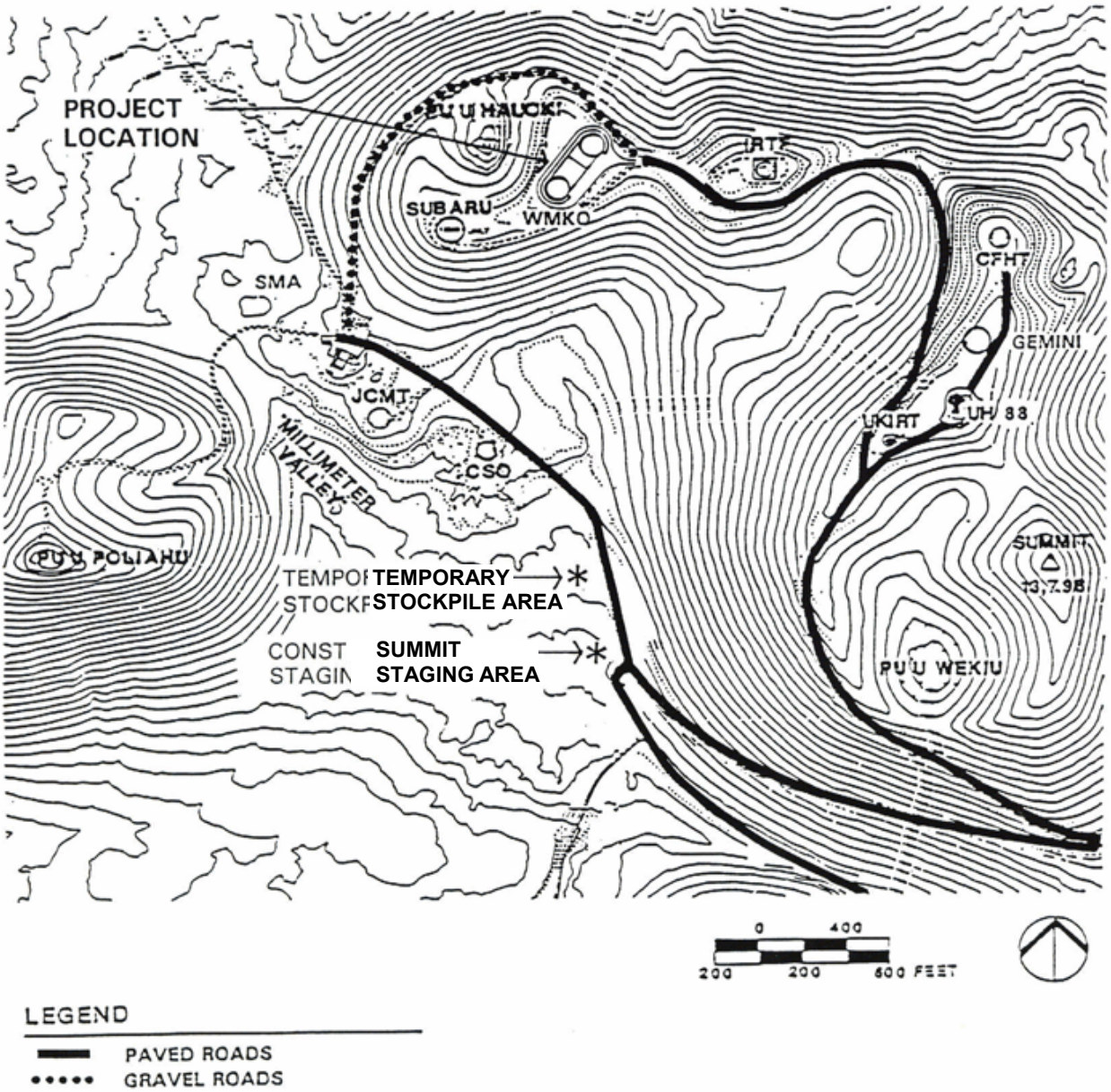
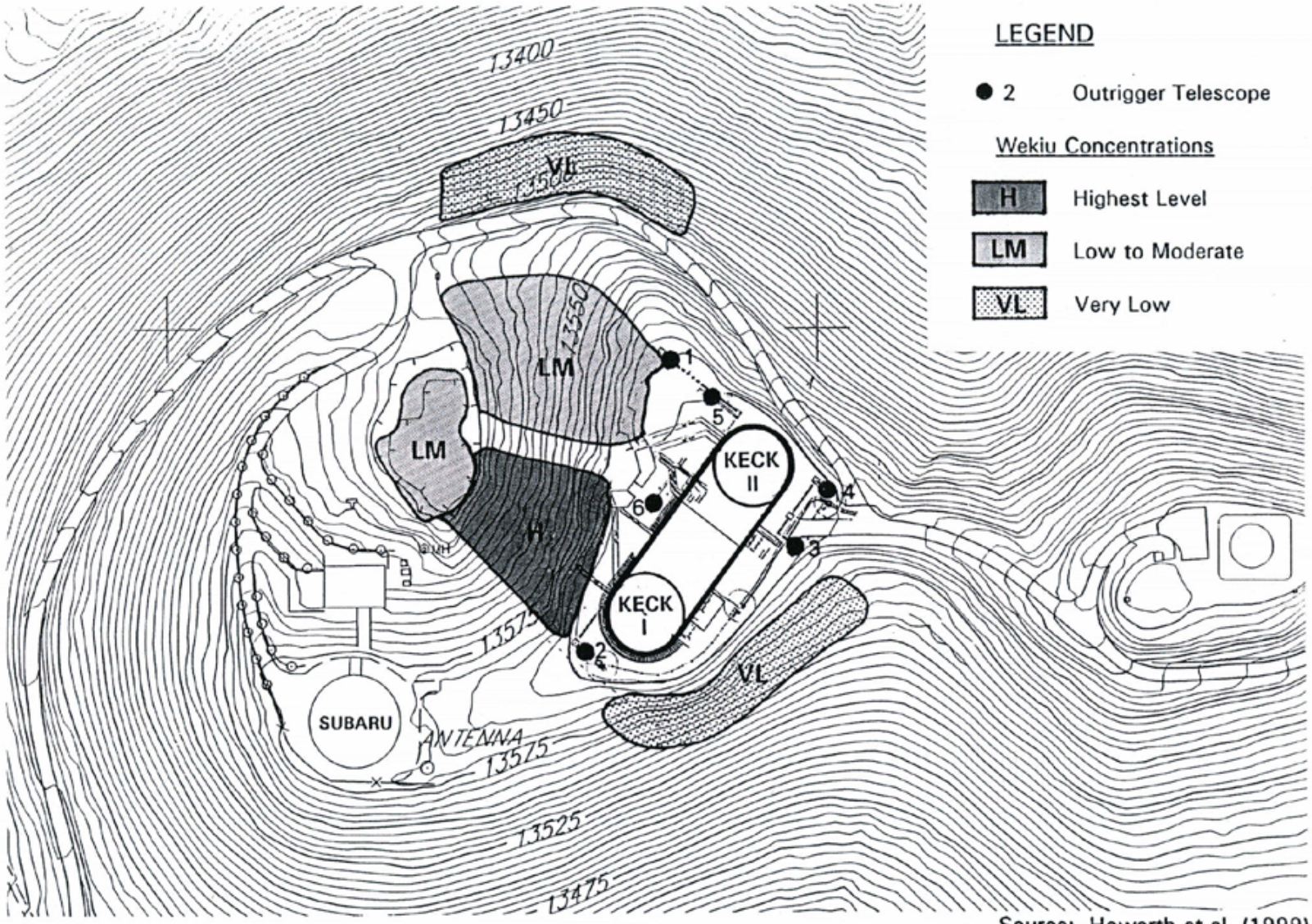


Figure 3
LOCATION OF THE PROJECT WITHIN THE SUMMIT AREA



Source: Howarth et al. (1999)

Figure 4

PU'U HAU OKI: AREAS OF WEKIU BUG CONCENTRATION (1997-1998)

APPENDIX G

COMMENTS ON THE DRAFT EIS

This page intentionally left blank.

APPENDIX G
RESPONSE TO COMMENTS

Appendix G describes the public comment process for the Draft Environmental Impact Statement for the Outrigger Telescopes Project and the procedure used in responding to those comments. Section G.1 describes the means through which comments were acquired and summarized. Section G.2 describes the public meeting format that was used to solicit comments from the public. Section G.3 describes how the comment responses are organized. Section G.4 provides the oral comments received with comment responses immediately following. Section G.5 provides the written comments received with comment responses immediately following. The Appendix concludes with a discussion of the changes from the Draft Environmental Impact Statement for the Outrigger Telescopes Project brought about by the public comment process.

G.1 Introduction

In July 2004, the National Aeronautics and Space Administration (NASA) published the Draft Environmental Impact Statement (DEIS) for the Outrigger Telescopes Project evaluating the funding decision for the on-site construction, installation, and operation of the Outrigger Telescopes on Mauna Kea and alternative sites. The public comment period began August 6, 2004, and ended September 30, 2004.

During the comment period, public meetings were held on:

- August 23, 2004, King Kamehameha Beach Hotel; 75-5660 Palani Road, Kailua-Kona, HI 96740;
- August 25, 2004, Naniloa Hotel; 93 Banyan Drive, Hilo, HI 96720;
- August 26, 2004, Waikoloa Beach Marriott; 69-275 Waikoloa Beach Drive, Waikoloa, HI 96738-5711;
- August 30, 2004, Maui Arts & Cultural Center; One Cameron Way, Kahului, HI 96732;
- September 1, 2004, Wai‘anae District Park; 85-601 Farrington Highway, Wai‘anae, HI 96792; and
- September 2, 2004, Japanese Cultural Center; 2554 South Beretania Street, Honolulu, HI 96826.

In addition, the public was encouraged to provide comments via mail, facsimile, electronic mail, and telephone (toll free).

Attendance and the number of speakers at each public meeting are presented in Table G-1. Attendance is based on the number of participants who completed registration. Total attendance was higher because not all attendees chose to register. In addition to oral and written comments received at the public meetings, additional written comments were received through September 30, 2004, the conclusion of the public comment period. Table G-2 provides an

Table G-1 Public Meeting Attendance and Speakers

Meeting Location	Participants Registered	Number of Speakers
Kona	18	9
Hilo	56	21
Waikoloa	17	10
Maui	16	9
Wai‘anae	28	10
Honolulu	49	18
Total	**184**	**77**

Table G-2 Comment Submission Method

Method	Comments Received
Hand-in at public meetings	13
Mail in	31
Form letters/e-mails	285
Total	**329**

overview of the number of comments submitted orally at the public meetings, and in writing throughout the public review and comment period.

G.2 Public Meeting Format

NASA used a two-part approach for the meetings. The first half-hour of the meeting was an open house format. Participants were able to enjoy light food while they browsed limited display materials. Key authors of the DEIS were available to answer questions from the participants. As each participant registered they were given a comment response form that could be completed and handed in as a comment to the facilitator or sign-in desk.

After the open house, opening remarks were made by a facilitator who then introduced key personnel on the DEIS team. A videographer taped the entire meeting and a Hawaiian translator was available for anyone who required it. After opening remarks by the DEIS team members, the general public was offered a chance to speak. After all participants had spoken, the DEIS team made closing remarks and the meeting was adjourned. Participants were reminded of the closing date of the public comment period and the methods by which the public could provide comments. The participants were reminded that oral remarks would be summarized along with NASA’s responses in an appendix to the Final EIS and written comments would be reproduced exactly as delivered, also with NASA’s responses.

G.3 Comment Response Organization

The comments are organized in two ways. Section G.4 provides the oral comment summaries along with NASA’s responses immediately following. The oral comments are organized by

meeting location. Section G.5 provides the written comments received with NASA's responses immediately following.

G.4 Oral Comment Summaries

G.4.1 Kona Public Meeting Comments

Comment O1: The DEIS does not give enough emphasis to spirituality.

Response: NASA attempted to reflect in the EIS what it has been told about the spiritual significance of Mauna Kea to Native Hawaiians.

Comment O2: NASA needs to talk to kahuna (the spiritual leaders) and reflect their feelings in the DEIS.

Response: In recognition of the sanctity of Mauna Kea in Native Hawaiian culture, NASA has made a particular effort to consult with Native Hawaiian religious practitioners. Their perspectives have had great influence on the content of this EIS. See Section 3.1.2.5 and Table 3-2 for more details.

Comment O3: The DEIS does not answer the question about whether the State rightfully owns the land.

Response: The concerns expressed by the Commenter are within the jurisdiction of the State and University of Hawai‘i, not NASA, and therefore are outside the scope of this EIS.

Comment O4: The DEIS does not answer the question whether there is a connection between NASA and the military.

Response: NASA is the nation's civil space agency, established by the National Air and Space Act of 1958 (Pub. L. No. 85-568, As Amended). NASA space missions and related research programs are conducted for peaceful, scientific purposes. NASA and the Department of Defense (DoD) may at times have a common interest in the development of a particular technology. For example, DoD developed a technology called *adaptive optics* that is used for scientific studies at ground-based astronomical observatories (such as the W.M. Keck Observatory) to correct telescopic images for distortions caused by Earth's atmosphere. Additionally, DoD and NASA occasionally work together to develop a technology of interest to both agencies.

Comment O5: The Commenter questioned whether the mitigation measures in this DEIS will be used for other construction on Mauna Kea.

Response: It is not within NASA's jurisdiction to propose mitigation activities for areas of the Mauna Kea Science Reserve other than the Outrigger Telescopes Project site. NASA hopes that the mitigation measures proposed for the Outrigger Telescopes Project will serve as a model for future projects. NASA will forward this question to the University of Hawai‘i for consideration.

Comment O6: NASA should consider the alternative of operating telescopes in space.

Response: Space missions and ground-based programs each make unique contributions to NASA’s Origins program, particularly to the search for worlds around other stars. Detecting planets in orbits like those of Uranus and Neptune (periods of 84 and 165 years, respectively) requires observations over many decades (a significant fraction of one orbital period). Space missions generally have lifetimes of a decade or less. It is therefore not practical to detect planets with periods of several decades to more than a century from space.

Connecting the Outrigger Telescopes to one or more 8- to 10-meter telescopes (a requirement of the Outrigger Telescopes Project) is also not possible in space, in part because the technology for such a large space telescope does not yet exist. For these reasons, the goals of the Outrigger Telescopes Project cannot be achieved in space.

Comment O7: Fifty feet of the *pu‘u* was cut off to construct the Keck Telescopes.

Response: Based on engineering drawings in NASA’s possession, 34 to 36 feet of the *pu‘u* were removed during construction of the Keck Telescopes.

Comment O8: “Previously disturbed” is not an acceptable term when discussing cultural impact and is highly misleading.

Response: NASA recognizes this concern, but was unable to find an acceptable alternative term. The use of the term “previously disturbed” has been minimized in the Final EIS.

Comment O9: There are no records of inadvertent findings of remains/burials during the construction of the W.M. Keck Observatory. Witnesses say there were, but that is in the past. We view all *pu‘u* as possible burial sites. There was great care in the past to bury highborn bones. When bones were placed on Mauna Kea, there were hidden away on the slopes by tunneling into the slopes. The edges of the *pu‘u* are significant and have the potential to contain bones.

Response: NASA is committed to being a responsible steward in the implementation of the Proposed Action. To this end, NASA proactively completed a Draft Burial Treatment Plan specifying procedures to deal with an inadvertent discovery of human remains. Following an initial informational presentation of the Draft Burial Treatment Plan to the Hawai‘i Island Burial Council (Council) in April 2004, public burial notices were placed in local newspapers

in early May and an amended Draft Plan was submitted to the Council. The plan was discussed at the Council meeting on August 19, 2004. The members of the Council expressed their general agreement with the procedures recommended in the Burial Treatment Plan for monitoring during the Outrigger Telescopes construction and for treating any human remains uncovered during construction. Because no actual burials are known to be present, the Council took no action actually approving the plan or its procedures, concluding that this would be beyond its purview at this time. In addition, a qualified Archaeologist would be present during all excavation activities.

Comment O10: The Commenter is concerned about the number of telescopes on Mauna Kea, the Master Plan and the $1/year rental fee. The Commenter suggests negotiating for a fair and reasonable contract with the University of Hawai‘i and the Department of Land and Natural Resources (DLNR), and then set up a fund to monitor burial sites on Mauna Kea.

Response: The concerns expressed by the Commenter are within the jurisdiction of the State and University of Hawai‘i, not NASA, and are out of scope for this EIS.

G.4.2 Hilo Public Meeting Comments

Comment O11: There is no evidence that between 1994 and 2002 that any water testing was done. There needs to be a new water plan for Mauna Kea.

Response: It is not within NASA’s purview to create a water plan for Mauna Kea. The concerns expressed by the Commenter are within the jurisdiction of the State and the University of Hawai‘i. These concerns have been forwarded to the University of Hawai‘i.

Comment O12: Wastewater systems have not been tested except for Subaru.

Response: The frequency of wastewater system inspection and biosolids removal for W.M. Keck and the other observatories is provided by the EIS, Sections 3.1.4.5 and 4.2.5.2, respectively. Statements about wastewater system servicing were provided by each observatory.

Comment O13: The Commenter suggested that more species should be evaluated in the DEIS besides the Wēkiu bug.

Response: Detailed quantitative information about the ten other native arthropods that are thought to be residents of the summit of Mauna Kea is unavailable. These arthropods are new to science and have not been described as species. However, the Wēkiu Bug Mitigation Plan addresses all of the potential stresses to the natural ecosystem on the summit of Mauna Kea from the proposed Outrigger Telescopes Project and would reduce potential impacts on

the other native Hawaiian arthropods present as well. In addition, of the ten other native arthropods found within the summit area, six have also been found in the *Area Below the Summit Area Cinder Cones* (Howarth and others 1999). Any impact to these arthropods would be similar and likely proportionate to any impact to the Wēkiu bug. The remaining four arthropods, which include two species of mites and two species of sheetweb spiders, have been found only on the *Summit Area Cinder Cones* (Howarth and Stone 1982; Howarth and others 1999). However, it is unlikely that the Outrigger Telescopes Project would have any reasonably foreseeable significant adverse effect on these species. See Sections 3.1.3.1, 3.1.3.2, and 4.1.2.2 for more details.

Comment O14: DEIS did not take into consideration that 18-ton vehicles from the Stryker Force would be in and around Hale Pōhaku.

Response: Based on the *U.S. Army Corps of Engineers (USACE) Environmental Impact Statement for the Transformation of the 2nd Brigade Combat Team in Hawai'i*, the Stryker vehicles will be operating at the Pōhakaloa Training Area (PTA) and the Military Vehicle Trail between PTA and Kawaihae Harbor. They will not be traveling in the Hilo direction or on the road to or past Hale Pōhaku (USACE 2004).

Comment O15: The DEIS failed to say that NASA would have to comply with all Hawai'i State laws.

Response: The California Association for Research in Astronomy (CARA), which would manage on-site construction, installation, and operation of the Outrigger Telescopes on Mauna Kea, will comply with applicable State laws and State and local permits.

Comment O16: Any tampering with Wēkiu bug habitat would be against the State law.

Response: The Wēkiu bug is a candidate species for listing under the Endangered Species Act. NASA has met with the U.S. Fish and Wildlife Service (USFWS), and they have reviewed the Environmental Assessment and DEIS for the Outrigger Telescopes Project. A letter is presented from the USFWS representing their comments on the current Wēkiu Bug Mitigation and Monitoring Plans in Appendix A of this EIS. NASA has tried to use all practicable means to protect the Wēkiu bug and its habitat.

Comment O17: The hazardous materials section of the DEIS is insufficient. There needs to be a plan to look at hazardous materials treatment, monitoring, handling, and enforcement on Mauna Kea.

Response: Section 3.1.5.2 of the EIS presents substantial information about hazardous materials at the W.M. Keck Observatory, including use, handling, storage, and

disposal, emergency response procedures, and reporting requirements. Section 4.2.6.2 describes past and present hazardous materials use by the other observatories, including types of hazardous materials, and management, disposal, and recycling. This comment has been referred to the Office of Mauna Kea Management for further consideration.

Comment O18: There are no protocols for hazardous material events.

Response: Section 3.1.5.2 of the EIS presents information about hazardous material emergency response procedures, reporting requirements, and employee training at the W.M. Keck Observatory. Section 4.2.6.2 states that each observatory has procedures for handling hazardous materials, provides training for workers involved with hazardous materials, and has emergency procedures for responding to hazardous material spills.

Comment O19: NASA needs to check on whether they are inhibiting the right to practice religion.

Response: The Outrigger Telescopes Project would not substantially burden the right to religious practice.

Comment O20: Hydrology testing is insufficient because it was not done over all four seasons of the year.

Response: The hydrologic impacts analyses are based on the physics of subsurface flow, not on the quality of water in various surface water bodies. By testing, it appears that the comment refers to the water quality data that are provided in the Massey report. The sampling was one time only, but the data on Lake Waiau reproduced from the Massey report do cover numerous samples over five consecutive months in 1977. These data are presented for informational purposes only. They are not used in the analysis of impacts, for example to prove by the water quality data that discharges at the W.M. Keck Observatory or elsewhere at the summit are or are not reaching various water bodies.

Comment O21: The DEIS did not discuss the fact that this project is not covered under Hawai‘i State Law or under the Board of Land and Natural Resources (BLNR) Master Plan.

Response: NASA recognizes the Mauna Kea Science Reserve (MKSR) Master Plan which was approved by the University of Hawai‘i Board of Regents on June 16, 2000 (UH 2000b). On February 2, 2000, Governor Benjamin J. Cayetano accepted the MKSR Master Plan Final Environmental Impact Statement (MKSR FEIS) as satisfactorily fulfilling the requirements of Chapter 343, Hawai‘i Revised Statutes (State of Hawai‘i 2000). The MKSR FEIS contains a November 2, 1999 comment letter from the Department of Land and Natural Resources (DLNR) signed by Timothy Johns, Chairperson, in which he states

DLNR's position regarding the Master Plan. "The Department of Land and Natural Resources would continue to review each situation in the context of a Conservation District Use Application. DLNR's acceptance and consideration of applications for new uses, such as telescopes, will be contingent upon implementation of the local design review process and more generally, the performance of the local management authority in fulfilling its stated responsibilities. . . It will be the University's and the telescope operators' responsibility to ensure that procedures outlined in the Master Plan are followed for day-to-day management and development guidelines. Failure to do so could jeopardize Conservation District Use Application approvals and any future telescope development on Mauna Kea." Under the heading "New Management Responsibilities," Mr. Johns further states that "A Hilo-based review process, with the Board of Land and Natural Resources continuing to consider individual Conservation District Use Applications and sublease agreements, would guide new telescope and facilities development. DLNR enforcement would be limited primarily to compliance with Conservation District Use Permit conditions and response to enforcement issues related to violations of Conservation District laws. . ."

Comment O22: The DEIS did not address the well-documented fact that Mauna Kea is spiritually significant.

Response: NASA has attempted to reflect its understanding of the spiritual significance Mauna Kea has for Native Hawaiians in the Preface as well as numerous other sections of the EIS. NASA is committed to being a responsible steward in the implementation of the Proposed Action.

Comment O23: NASA needs to consider the full cumulative region of influence.

Response: NASA determined where the impact of the past, present, and reasonably foreseeable activities occurs for each of the resources areas in the cumulative impact analysis. This defined the geographic boundary or region of influence for that resource area.

Comment O24: The Cultural Monitor is portrayed in the EIS as not having the authority to talk to construction workers.

Response: The Cultural Monitor has the authority to talk to construction workers.

Comment O25: It is positive that the EIS addresses cumulative impacts, however it is negative that the impacts are significant, adverse, and substantial.

Response: This comment is respectfully noted.

Comment O26: Mercury calculations and hazardous materials are suspect.

Response: The Outrigger Telescopes will not use mercury. The W.M. Keck Observatory has a written mercury spill response plan for use with the existing Keck Telescopes. The W.M. Keck Observatory has a mercury handling checklist that is reviewed prior to any mercury handling procedure. The W.M. Keck Observatory has procedures in place to handle any hazardous material spills.

Table 4-20 in the Outrigger Telescopes Project EIS summarizes known spills that have occurred either at the summit, along the Mauna Kea Access Road, or at Hale Pōhaku. The table describes the type of substance involved, the size and location of the spill, and the response. The observatories on Mauna Kea and Hale Pōhaku have written procedures to handle hazardous material spills.

Comment O27: The Burial Treatment Plan is legal fiction.

Response: NASA is committed to being a responsible steward in the implementation of the Proposed Action. To this end, NASA proactively completed a Draft Burial Treatment Plan specifying procedures to deal with an inadvertent discovery of human remains. Following an initial informational presentation of the Draft Burial Treatment Plan to the Hawai‘i Island Burial Council (Council) in April 2004, public burial notices were placed in local newspapers in early May and an amended Draft Plan was submitted to the Council. The plan was discussed at the Council meeting on August 19, 2004. The members of the Council expressed their general agreement with the procedures recommended in the Burial Treatment Plan for monitoring during the Outrigger Telescopes construction and for treating any human remains uncovered during construction. Because no actual burials are known to be present, the Council took no action actually approving the plan or its procedures, concluding that this would be beyond its purview at this time.

Comment O28: The DEIS summary needs to conclude that there is significant and adverse cumulative impact.

Response: Both the Draft EIS and Final EIS conclude that there are significant and adverse cumulative impacts.

Comment O29: The EIS needs to insure that the Memorandum of Agreement and mitigation measures will be done.

Response: When signed, the Memorandum of Agreement became a legally binding document. NASA would ensure the mitigation measures are followed, if NASA selects the W.M. Keck Observatory site.

Comment O30: The EIS needs to discuss photovoltaics.

Response: The EIS discusses photovoltaics or solar cells in Section 4.1.8.2.

Comment O31: The EIS should contain a full cumulative analysis (covering the ocean floor to the top of Mauna Kea).

Response: NASA determined where the impact of the past, present, and reasonably foreseeable activities occurs for each of the resources areas in the cumulative impact analysis. This defined the geographic boundary or region of influence for that resource area.

Comment O32: The EIS needs to define adverse effects.

Response: The EIS is consistent with the Council on Environmental Quality guidance and generally accepted usage.

G.4.3 Waikoloa Public Meeting Comments

Comment O33: The Commenter suggested an environmental resolution (*i.e.*, put the telescopes on the Canary Islands). There is less adverse environmental impact.

Response: NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA's decision on the proposed Outrigger Telescopes process will be documented in the Record of Decision (ROD), issued no earlier than 30 days after issuance of this EIS. The ROD will state the course of action that NASA has selected. It also will specify the environmentally preferable alternative. The selected and environmentally preferable alternatives may or may not be the same. NASA will make the ROD publicly available.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Comment O34: It would be unfortunate if the Outrigger Telescopes Project went elsewhere [other than Mauna Kea] because this commenter wants the cutting edge of astronomy to stay in Hawai‘i.

Response: This comment is respectfully noted.

Comment O35: The Commenter believes that the Outrigger dome enclosures are already being built.

Response: The Outrigger Telescopes and their enclosures were designed and ordered shortly after funding became available in 1998. This was necessary because it was recognized that it would take 4 to 5 years for the Telescopes and their enclosures to be completed. NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No decision will be made until the National Environmental Policy Act process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Comment O36: The Commenter questioned why the need for six more telescopes when the search for planets can be done with smaller telescopes.

Response: There are several different ways of detecting planets around other stars. They differ in the types of planets that can be detected and what can be learned. Telescopes as small as a few inches in diameter can be used to survey large numbers of bright stars to search for transits of Jupiter-size planets. That is, these small telescopes can detect the ~1 percent decrease in the light observed from a star when an orbiting Jupiter-size planet passes in front of the star as viewed from Earth. In general, the Jupiter-size planets detectable this way are those that orbit close to their parent star, *i.e.*, much closer than Earth's distance from the sun.

In contrast, the Outrigger Telescopes would detect smaller planets much further from their parent stars. The Outrigger Telescopes would be used to measure the positional "wobble" of a star caused by an orbiting planet. It

would be sensitive to Uranus/Neptune-mass planets (about 1/20 the mass of Jupiter or 15 times the mass of Earth) at distances from their parent stars 20 to 30 times Earth's distance from the sun (*i.e.*, the distance of Uranus or Neptune from the sun). The two techniques thus provide complementary information about planetary systems around other stars.

Comment O37: The commenter wants NASA to consider connecting together all the existing telescopes on Mauna Kea instead of adding six more telescopes.

Response: The proposed Optical Hawaiian Array for Nano-Radian Astronomy (OHANA) Project would connect the existing observatories on Mauna Kea (See Section 4.2.2 of the EIS).

The OHANA and the Outrigger Telescopes Projects would achieve different science. With the very long baselines, OHANA would have a different (much higher) angular resolution, not as well suited to the planet-formation-related science as the Outrigger Telescopes. Also, while OHANA would achieve high sensitivity by combining large telescopes, it would always be limited in the number of telescopes available given the tremendous scheduling issues involved. Also, due to limitations of fiber optic communication technology, OHANA would be more limited than the Outrigger Telescopes. Finally, the astrometry program requires almost continuous nightly observations – that would never be possible with OHANA.

Comment O38: The Commenter is concerned about the statement in the DEIS that "no archaeological sites have been found." The commenter questioned "What about ashes that have been spread and umbilical cords that were bulldozed?"

Response: NASA is unaware of any archaeological or burial sites that were impacted by development at the W.M. Keck Observatory site.

Comment O39: NASA should be talking about a Final Burial Treatment Plan, not a Draft Plan.

Response: NASA is committed to being a responsible steward in the implementation of the Proposed Action. To this end, NASA proactively completed a Draft Burial Treatment Plan specifying procedures to deal with an inadvertent discovery of human remains. Following an initial informational presentation of the Draft Burial Treatment Plan to the Hawai'i Island Burial Council (Council) in April 2004, public burial notices were placed in local newspapers in early May and an amended Draft Plan was submitted to the Council. The plan was discussed at the Council meeting on August 19, 2004. The members of the Council expressed their general agreement with the procedures recommended in the Burial Treatment Plan for monitoring during the Outrigger Telescopes construction and for treating any human remains uncovered during construction. Because no actual burials are known to be

present, the Council took no action actually approving the plan or its procedures, concluding that this would be beyond its purview at this time.

Comment O40: Has there been an exhaustive search on other bugs that may even be more rare than the Wēkiu bug? There needs to be comprehensive study of all gastropods on the mountain.

Response: Detailed quantitative information about the ten other native arthropods that are thought to be residents of the summit of Mauna Kea is unavailable. These arthropods are new to science and have not been described as species. However, the Wēkiu Bug Mitigation Plan addresses all of the potential stresses to the natural ecosystem on the summit of Mauna Kea from the proposed Outrigger Telescopes Project and would reduce potential impacts on the other native Hawaiian arthropods present as well. In addition, of the ten other native arthropods found within the summit area, six have also been found in the *Area Below the Summit Area Cinder Cones* (Howarth and others 1999). Any impact to these arthropods would be similar and likely proportionate to any impact to the Wēkiu bug. The remaining four arthropods, which include two species of mites and two species of sheetweb spiders, have been found only on the *Summit Area Cinder Cones* (Howarth and Stone 1982; Howarth and others 1999). However, it is unlikely that the Outrigger Telescopes Project would have any reasonably foreseeable significant adverse effect on these species. See Sections 3.1.3.1, 3.1.3.2, and 4.1.2.2 for more details.

Comment O41: The DEIS contains no discussion of environmental impact at end of lease.

Response: The cumulative impacts at end of lease are discussed in Section 4.2.15.

Comment O42: The EIS does not address where the wastewater goes.

Response: The hydrologic analyses address where the wastewater goes. Section 4.1.3 shows why no wastewater from the observatories can enter Lake Waiau. The rest of the analyses describe the subsurface flow paths and water quality changes enroute. Wastewater disposed of at Hale Pōhaku, after nearly vertical travel through the vadose zone, moves with groundwater toward Hilo. Wastewater disposed of at the summit, also after travel downward in the vadose zone, moves with groundwater toward the west.

Comment O43: The project should choose a Cultural Monitor and Archaeologist from the community.

Response: The Archaeologist has been selected by the California Association for Research in Astronomy (CARA) in consultation with the Office of Mauna Kea Management and the State Historic Preservation Division. The Consulting Parties to the National Historic Preservation Act Section 106

Memorandum of Agreement (MOA), whether they signed the MOA or not, have an opportunity to participate in the selection of the Cultural Monitor. NASA desires that the Cultural Monitor be acceptable to the Native Hawaiian community. Native Hawaiians are encouraged to recommend candidates to CARA.

Comment O44: The Commenter asked whether tourism should be allowed on Mauna Kea.

Response: This question should be posed to the University of Hawai‘i and Office of Mauna Kea Management.

Comment O45: The EIS should address the social impacts on cultural practitioners and recreational users.

Response: The EIS addresses the socioeconomic impacts on all users (see Section 4.1.9 of the EIS).

Comment O46: The Commenter questioned the mitigation measures and whether they can be implemented.

Response: NASA, through reasonable means, will ensure the mitigation measures are followed. See Section 2.1.3.10 and the MOA in Appendix B of this EIS. In addition, CARA will ensure that any of the MOA provisions relating to on-site construction and installation of the Outrigger Telescopes will be included as provisions in any contracts for on-site construction and installation.

Should any Signatory or Concurring Party object to the manner in which the terms of the MOA are implemented at any time, NASA shall consult with the objecting party(ies) to resolve the objection. Section V of the MOA contains more detailed information about dispute resolution.

Comment O47: There is confusion about the number of telescopes, observatories, etc. The 2000 Master Plan was not approved. Who is the ruling authority?

Response: All inquiries about the number of telescopes and observatories should be directed to the University of Hawai‘i. See also Response to Comment O21.

Comment O48: The Commenter questioned whether NASA would guarantee that the site would be returned to its pristine condition. This would include returning cinder that was removed when Keck was built.

Response: NASA cannot guarantee that the site would be returned to its pristine condition. The terms of the lease are between the State Board of Land and Natural Resources and the University of Hawai‘i. Any decisions regarding the end of the lease arrangements would be determined by these two parties.

G.4.4 Maui Public Meeting Comments

Comment O49: A Commenter asked who would answer questions on cultural and spiritual issues in the EIS.

Response: NASA is the responsible entity and has consulted with a number of Hawaiians with knowledge of cultural and spiritual issues.

Comment O50: The DEIS should consider psychological and spiritual effects.

Response: The National Environmental Policy Act (NEPA) does not contemplate an analysis of psychological effects. See Section 4.1.1 regarding cultural resources for impacts on spiritual values.

Comment O51: Hawaiians are the lawful heirs to Mauna Kea. The University of Hawai‘i has no lawful jurisdiction over Mauna Kea. This should be considered in the EIS.

Response: This issue is outside the scope of the EIS.

Comment O52: A logical alternative would put the telescopes in orbit.

Response: Space missions and ground-based programs each make unique contributions to NASA's Origins program, particularly to the search for worlds around other stars. Detecting planets in orbits like those of Uranus and Neptune (periods of 84 and 165 years, respectively) requires observations over many decades (a significant fraction of one orbital period). Space missions generally have lifetimes of a decade or less. It is therefore not practical to detect planets with periods of several decades to more than a century from space.

Connecting the Outrigger Telescopes to one or more 8- to 10-meter telescopes (a requirement of the Outrigger Telescopes Project) is also not possible in space, in part because the technology for such a large space telescope does not yet exist. For these reasons, the goals of the Outrigger Telescopes Project cannot be achieved in space.

Comment O53: The Commenter is concerned about who will be in the group that will determine where the $2 million is spent? The Commenter thinks that it is a payoff.

Response: If NASA selects the W.M. Keck Observatory site, NASA will commit $2 million to an initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians as a mitigation component of the Outrigger Telescopes Project.

NASA and OMKM, in consultation with the other Consulting Parties, will ensure the formation of a local citizens' working group that represents a broad spectrum of Hawaiians. The local citizens' working group will decide upon

the prioritized use of the $2 million NASA has committed. The working group members will serve on a volunteer basis. OMKM will coordinate and manage the activities of this working group and provide administrative services.

Comment O54: Put the telescopes up in space.

Response: See Response to Comment O52.

G.4.5 Wai‘anae Public Meeting Comments

Comment O55: The commenter rejected NASA's idea of summarizing the oral comments for the EIS. The Commenter demanded that the oral comments be made a part of the record in their entirety; otherwise it disenfranchises Native Hawaiians.

Response: Summaries of the oral comments received are in this Appendix. Comments were summarized to facilitate responses and to protect the privacy of individuals.

Comment O56: Royal Order of Kamehameha I (ROOK I) will not recognize this DEIS because specific issues need to be resolved before NASA can move forward.

Response: This comment is respectfully noted.

Comment O57: The Commenter favors the project.

Response: This comment is respectfully noted.

Comment O58: The Commenter wants to submit the Puhipau video as part of her testimony, but is awaiting permission from videographer. The telescopes have contaminated the island.

Response: These comments are respectfully noted.

Comment O59: The DEIS needs to take into account the cultural and environmental issues as expressed by the Hawaiian community.

Response: NASA has attempted to reflect the views on cultural and environmental issues expressed by the Hawaiian community in the EIS.

Comment O60: NASA needs to consult with cultural and religious practitioners.

Response: In recognition of the sanctity of Mauna Kea in Native Hawaiian culture, NASA has made a particular effort to consult with Native Hawaiian religious practitioners. Their perspectives have had great influence on the content of this EIS. See Section 3.1.2.5 and Table 3-2 for more details.

Comment O61: The Commenter opposes the project because of the continuing desecration of iwi of kupuna.

Response: NASA is committed to being a responsible steward in the implementation of the Proposed Action. To this end, NASA proactively completed a Draft Burial Treatment Plan specifying procedures to deal with an inadvertent discovery of human remains. Following an initial informational presentation of the Draft Burial Treatment Plan to the Hawai‘i Island Burial Council (Council) in April 2004, public burial notices were placed in local newspapers in early May and an amended Draft Plan was submitted to the Council. The plan was discussed at the Council meeting on August 19, 2004. The members of the Council expressed their general agreement with the procedures recommended in the Burial Treatment Plan for monitoring during the Outrigger Telescopes construction and for treating any human remains uncovered during construction. Because no actual burials are known to be present, the Council took no action actually approving the plan or its procedures, concluding that this would be beyond its purview at this time.

Comment O62: The DEIS has not captured how Native Hawaiians feel about the land and Mauna Kea.

Response: NASA has attempted to reflect the views on cultural and environmental issues expressed by the Hawaiian community in this EIS.

Comment O63: The DEIS is inadequate because it hasn’t addressed the alternatives or the impacts.

Response: The Alternatives are addressed in detail in Chapter 2 and the impacts are addressed in detail in Chapter 4 of the EIS.

Comment O64: The EIS should incorporate the testimony and the video from this meeting.

Response: NASA has chosen to not make the oral comments in their entirety a part of the EIS. The comments have been summarized and are responded to in this Appendix. See also Response to Comment O55.

Comment O65: The EIS should discuss psychological and personal impacts on Hawaiian people.

Response: NEPA does not contemplate an analysis of psychological effects. See Section 4.1.1 regarding cultural resources for impacts on spiritual values.

G.4.6 Honolulu Public Meeting Comments

Comment O66: Kepā Maly [of Kumu Pono Associates] did not interview any kupuna on the Big Island.

Response: Kepā Maly did interview kupuna on the Big Island when gathering ethnohistories from participants in his survey.

Comment O67: NASA must ensure that water put back in the ground is tested and proven to be clean.

Response: The California Association for Research in Astronomy (CARA) has the responsibility as the implementer of the Outrigger Telescopes Project to ensure that they are compliant with applicable State regulations and State and local permits.

Comment O68: Other native species need to be studied. We are concerned about other animals besides the Wēkiu bug.

Response: Detailed quantitative information about the ten other native arthropods that are thought to be residents of the summit of Mauna Kea is unavailable. These arthropods are new to science and have not been described as species. However, the Wēkiu Bug Mitigation Plan addresses all of the potential stresses to the natural ecosystem on the summit of Mauna Kea from the proposed Outrigger Telescopes Project and would reduce potential impacts on the other native Hawaiian arthropods present as well. In addition, of the ten other native arthropods found within the summit area, six have also been found in the *Area Below the Summit Area Cinder Cones* (Howarth and others 1999). Any impact to these arthropods would be similar and likely proportionate to any impact to the Wēkiu bug. The remaining four arthropods, which include two species of mites and two species of sheetweb spiders, have been found only on the *Summit Area Cinder Cones* (Howarth and Stone 1982; Howarth and others 1999). However, it is unlikely that the Outrigger Telescopes Project would have any reasonably foreseeable significant adverse effect on these species. See Sections 3.1.3.1, 3.1.3.2, and 4.1.2.2 for more details.

Comment O69: The Wēkiu bug studies are seriously flawed.

Response: The Wēkiu bug studies have been conducted by a qualified entomologist. The mitigation measures were reviewed and approved by the U.S. Fish and Wildlife Service (USFWS) and follow all the recommendations given in previous Mauna Kea Science Reserve arthropod assessments (Howarth and Stone 1982; Howarth and others 1999).

In a letter regarding the Wēkiu Bug Mitigation Plan for the W.M. Keck Observatory, Outrigger Telescopes Project at Mauna Kea, the USFWS states "The Service [USFWS] supports the recommendations in the WBMP [Wēkiu Bug Mitigation Plan] to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor use. . . We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to the wekiu bug habitat." See Volume II, Appendix A, for the letter from USFWS/Henson (USFWS 2000).

The U.S. Department of Interior (USDOI) submitted a comment letter on the DEIS stating "It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wēkiu Bug Mitigation Plan and the Wēkiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities." See the USDOI comment letter from Patricia Sanderson Port located in this Appendix.

In addition, the USDOI letter states "These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology."

Comment O70: The more people that travel to Mauna Kea, it will be more likely the area will be contaminated.

Response: This comment is respectfully noted.

Comment O71: The Commenter is concerned about water pollution and mercury spills.

Response: See Sections 3.1.4, 4.1.3, and 4.2.5 of the EIS for discussions on water resources and Sections 4.1.4, and 4.2.6 for discussions of hazardous materials management.

Comment O72: NASA should work with University of Hawai‘i Archaeology and Anthropology professors.

Response: This comment is respectfully noted.

Comment O73: The commenter believes that the impact determinations are not adequately backed up throughout the document.

Response: NASA believes the analyses provided, which are based on the best available information, adequately support the conclusions drawn.

Comment O74: The Outrigger Telescopes standing at 30 feet tall are visually significant.

Response: The visual impact of the Outrigger Telescopes Project is discussed in Section 4.1.12 of the EIS.

Comment O75: The Commenter questioned how the beneficial socioeconomic impacts translate to the general public.

Response: See Section 4.1.9 of the EIS for the socioeconomic impacts associated with the Outrigger Telescopes Project.

Comment O76: The Commenter questioned whether NASA mitigates for the cumulative impact to cultural resources.

Response: The mitigation measures specified in the EIS and the National Historic Preservation Act Section 106 Memorandum of Agreement are primarily focused on mitigating the incremental adverse impact arising from the Outrigger Telescopes Project (See Chapter 5 and Appendix B of the EIS).

Comment O77: The Environmental Justice section of the EIS ignores the desecration of land.

Response: The EIS is consistent with the Council on Environmental Quality guidance. This issue is addressed under the cultural resources section of the EIS (See Section 4.1.1).

Comment O78: NASA should do a cultural summary of the Canary Islands.

Response: The cultural resource impacts analysis for the Canary Islands site is addressed in Section 4.3.1 in the EIS.

Comment O79: Evaluate the $1/year rental fee the observatories pay and rent by the hour.

Response: NASA has no jurisdiction over this matter. This is a matter for the State of Hawai‘i.

Comment O80: A 4-in telescope just found a planet. The Commenter questioned why we need more and larger telescopes.

Response: There are several different ways of detecting planets around other stars. They differ in the types of planets that can be detected and what can be learned.

Telescopes as small as a few inches in diameter can be used to survey large numbers of bright stars to search for transits of Jupiter-size planets. That is, these small telescopes can detect the ~1 percent decrease in the light observed from a star when an orbiting Jupiter-size planet passes in front of the star as viewed from Earth. In general, the Jupiter-size planets detectable this way are those that orbit close to their parent star, *i.e.*, much closer than Earth's distance from the sun.

In contrast, the Outrigger Telescopes would detect smaller planets much further from their parent stars. The Outrigger Telescopes would be used to measure the positional "wobble" of a star caused by an orbiting planet. It would be sensitive to Uranus/Neptune-mass planets (about 1/20 the mass of Jupiter or 15 times the mass of Earth) at distances from their parent stars 20 to 30 times Earth's distance from the sun (*i.e.*, the distance of Uranus or Neptune from the sun). The two techniques thus provide complementary information about planetary systems around other stars.

Comment O81: The DEIS should consider cultural uses; access; historic sites; handling of wastewater; aquifer of Mauna Kea; transportation; effects of hazardous materials; full evaluation of Mauna Kea, not just summit; habitat of Wēkiu bug; maintain place of sanctity and reverence.

Response: See the appropriately titled sections of the EIS where these impacts and uses are discussed. For the "full evaluation of Mauna Kea, not just the summit" see the subsections on Regions of Influence in Chapter 4.

Comment O82: The DEIS should address the full disclosure of the military connection, funding sources, and all users using technologies on the mountain, including patents on mountain and how applied. Need to know more information about technology that NASA has passed to military.

Response: NASA is the nation's civil space agency, established by the National Air and Space Act of 1958 (Pub. L. No. 85-568, As Amended). NASA space missions and related research programs are conducted for peaceful, scientific purposes. NASA and the Department of Defense (DoD) may at times have a common interest in the development of a particular technology. For example, DoD developed a technology called *adaptive optics* that is used for scientific studies at ground-based astronomical observatories (such as the W.M. Keck Observatory) to correct telescopic images for distortions caused by Earth's atmosphere. Additionally, DoD and NASA occasionally work together to develop a technology of interest to both agencies. The other matters raised in this comment are beyond the scope of the EIS.

Comment O83: Oral comments made at the public meeting should be reproduced verbatim in the EIS.

Response: Oral comments have been summarized and are responded to in this Appendix.

Comment O84: The commenter feels that NASA should track JPL and their contracts and that these should be noted in the EIS.

Response: This matter is beyond the scope of the EIS.

Comment O85: The Commenter wants cultural concerns to be addressed in the DEIS.

Response: Cultural concerns are addressed in the EIS. Please see Section 4.1.1 for the Proposed Action, Section 4.2.3 for cumulative impact to cultural resources, and Section 4.3.1 for cultural resource impacts for the Canary Island site.

Comment O86: Royal Order of Kamehameha I (ROOK I) will not recognize this DEIS because it failed to acknowledge the need for face-to-face meetings.

Response: This comment is respectfully noted.

G.5 WRITTEN COMMENTS RECEIVED ON THE DRAFT EIS

Table G-3 provides a list of the individuals with their affiliation who commented in writing on the Draft EIS.

TABLE G-3. COMMENTERS ON DRAFT EIS

Individual Presenting Comment	Organization
Abelson, Maris	Self
Adams, Clayton	Island Community Lending
Aila, Melva	Self
ʻAkahi, Kūlani and 52 others (See Response for names)	Self
Alucier, Rosemary	Self
Anonymous	No Affiliation
Anthony, J.M., Ph.D.	Hawaiʻi--Laʻieikawai Association
Antonov, Vladimir, Ph.D. and Nikolenko, Mikhail, Ph.D.	Scientific-Spiritual Ecological Center SWAMI
Avallone, Charlene and 223 others (See Response for names)	Self
Beeman, Albert	Self
Blair, Patricia	Self
Blankenship, Anne	Self
Boykie, Royelen	Self
Brady, Kat	Life of the Land
Campbell, Paul	Self
Carr, Raymond, Ph.D.	County of Hawaiʻi, Department of Research and Development
Ching, Clarence	Self
Connolly, Joseph W.	NASA Glenn Research Center, Native American Advisory Council
Conry, Paul J.	State of Hawaiʻi, DLNR, Division of Forestry & Wildlife
Cooper, Joshua	Self
Cotton, Kaleialoha	Self
Dittmar, Jim & Sherry	Self
Ebel, Lawrence G. (Bud)	Self
Fergerstrom, Hanalei	Self
Fernandez, Charles A.	Self
Fernandez, Jessina A.K.	Self
Hanakahi , Haumea	Self
Hanf, Lisa B.	EPA
Harden, Cory	Sierra Club

TABLE G-3. COMMENTERS ON DRAFT EIS (CONTINUED)

Individual Presenting Comment	Organization
Harrison, John T., Ph.D.	University of Hawai‘i at Manoa Environmental Center
Kahanamoku. III (aka Bunny), Samuel Alapai Taula,	Kahanamoku Estate Foundation
Kajihiro, Kyle	American Friends Service Committee
Kamakawiwo‘ole, Reynolds	Self
Kamauu, Mahealani	Self
Keli`ikoa, Andrew K.T.	Royal Order of Kamehameha I (ROOK I)
Kim, A.	Self
Koehler, Paul E.	Self
Kubat, Kristine	Self
Lovell, David	Royal Order of Kamehameha I (ROOK I)
Loy, Genesis Lee	ROOK I
McNeely, Terry	Self
McNett, Mark	Self
Mefford, Alan	Self
Morimoto, MD, Daniel	Self
Spencer, Maureen O’Dea	Self
Ota, Ruth	Self
Pacheco, Kason Hoku	Self
Peek, Tom	Self
Pisciotta, Kealoha	Mauna Kea Anaina Hou
Pisciotta, Kealoha Smith, Cha Takamine, Vicky Holt Kajiro, Kyle	Mauna Kea Anaina Hou KAHEA ‘Ilio‘ulaokalani Coalition American Friends Service Committee
Pollard, Vincent K., Ph.D.	Self
Port, Patricia Sanderson	U.S. Department of the Interior
Powell, Cheryl J.	Department of Transportation Los Angeles County
Roberts, Terry	State of California, Governor's Office of Planning and Research, State Clearinghouse and Planning Unit
Sinkin, Lanny	Self
Snyder, Ann Ku`uleinani	Self
Stevens, Edward G.	Ahahui Ku Mauna
Stone, Fred D., Ph.D.	Self
Stormont, William T.	Office of Mauna Kea Management
Sullivan, Paul M.	Self
Tanimoto, Jojo	Self
Teague, Mine	Self

TABLE G-3. COMMENTERS ON DRAFT EIS (CONTINUED)

Individual Presenting Comment	Organization
Trembath, Kale and Charles	Self
Vredenburg, Theone	Self
Ward, Deborah J.	Self
Whitney, Tom	Self
Winchester, Hayden	Self
Wong, Christina	Self
Yamada, Kats	Self
Yamamoto, Eric R.	Self
Yuen, Christopher	County of Hawai‘i, Planning Department
Ziegler, Marjorie	Conservation Council for Hawai‘i
University of Hawai‘i at Manoa Concerned Individuals (29 individuals)	University of Hawai‘i at Manoa

The written comments follow with responses.

This page intentionally left blank.

Comment on NASA's Draft Environmental Impact Statement (DEIS)

Submitted by: Maris Abelson

September 1, 2004

The science of looking at the stars is one that reveals the awesome beauty of the heavens and strives to discover life on other planets. How would alien beings feel however, if they knew that our stargazing took precedence over the delicate balance of life in our own home? Would they believe this to be a valuable sacrifice? The mountains and volcanoes provide the only fresh water that contains the Earth's beneficial nutrients, for both humans and the flora and fauna that grace its slopes. Now that most of the Earth's rivers and streams are polluted with industrial and farm-related pollutants, are we to add more to the Island of Hawaii's water source? Will aged septic tanks, cesspools and antiquated leech fields not leak into the environment, destroying for perhaps, forever, our most critical resource? Are there not already documented mercury spills on the Mauna Kea site occupied by NASA? The University's Master Plan has not been approved by the Board of Land and Natural Resources (BLNR). The BLNR rules expressly require an approved management plan for any facilities, and further require that any amendments to the 1983 plan be approved by the BLNR. This has not occurred. A B C

Also of concern are the impacts from continued expansion on cultural, traditional and religious uses and access, including protection of burials, historic sites, ceremonial view-planes and traditional cultural properties of Mauna Kea.

We must protect our natural resources above all else. Otherwise we will not have life on this planet to investigate others. D

Aloha and may the Aina be protected for our lifetime and for the next Generation,

Maris Abelson

Maris Abelson

Maris Abelson
September 1, 2004

Response to Comment A:

No measurable groundwater contamination can result from the disposal of wastewater at the summit, as shown by the hydrologic analysis done as part of the cumulative impacts analysis in the EIS (see Section 4.1.3). The same analysis shows that wastewater from the observatories cannot reach Lake Waiau. All disposal of wastewater is done through State-approved septic systems. No hazardous materials are disposed of through the septic systems, but rather are trucked down by licensed and State-approved contractors.

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available scientific information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system are negligible.

Response to Comment B:

There have been mercury spills in the past (See Sections 3.1.5.2 and 4.2.6.2 for more details). However, the Outrigger Telescopes would not use mercury. The W.M. Keck Observatory has a written mercury spill response plan for use with the existing Keck Telescopes. The Observatory has a mercury handling checklist that is reviewed prior to any mercury handling procedure. The W.M. Keck Observatory has procedures in place to handle any hazardous material spills. Table 4-20 summarizes the known mercury spills on Mauna Kea related to astronomy operations. Best available information indicates the mercury spills were cleaned up and none of the spills reached the outside environment.

Response to Comment C:

NASA recognizes the Mauna Kea Science Reserve (MKSR) Master Plan which was approved by the University of Hawaii Board of Regents on June 16, 2000 (UH 2000b). On February 2, 2000, Governor Benjamin J. Cayetano accepted the MKSR Master Plan Final Environmental Impact Statement (MKSR FEIS) as satisfactorily fulfilling the requirements of Chapter 343, Hawaii Revised Statutes (State of Hawai‘i 2000). The MKSR FEIS contains a November 2, 1999 comment letter from the Department of Land and Natural Resources (DLNR) signed by Timothy Johns, Chairperson, in which he states DLNR’s position regarding the Master Plan. “The Department of Land and Natural Resources would continue to review each situation in the context of a Conservation District Use Application. . . DLNR’s acceptance and consideration of applications for new uses, such as telescopes, will be contingent upon implementation of the local design review process and more generally, the performance of the local management authority in fulfilling its stated responsibilities. . . It will be the University’s and the telescope operators’ responsibility to ensure that procedures outlined in the Master Plan are followed for day-to-day management and development guidelines. Failure to do so could jeopardize Conservation District Use Application approvals and any future telescope development on Mauna Kea.” Under the heading “New Management Responsibilities,” Mr. Johns further states that “A Hilo-based review process, with the Board of Land and Natural Resources continuing to consider individual CDUAs and sublease agreements, would guide new telescope and facilities development. DLNR enforcement would be limited primarily to compliance with Conservation District Use Permit conditions and response to enforcement issues related to violations of Conservation District laws. . .”

Maris Abelson
September 1, 2004

Response to Comment D:

NASA is committed to being a responsible steward in the implementation of the Proposed Action. NASA made a considerable effort to consult with interested and concerned parties about the Outrigger Telescopes Project. As a result, NASA has made numerous commitments to on-site and off-site measures that would mitigate adverse impacts, and to the extent practicable protect and enhance the cultural and environmental resources of Mauna Kea. In addition, NASA will commit $2 million to an initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians as a mitigation component of the Outrigger Telescopes Project, if NASA selects the W.M. Keck Observatory site.

From: Clayton Adams

To: <otpeis@nasa.gov>

Subject: Mauna Kea

Date: Thu, 26 Aug 2004

Carl,

Thank you for your in-depth environmental impact study. You have my full support to build the outrigger telescopes on the upper slope of Mauna Kea. The positive research potential far outweighs any negative environmental or cultural effects. Mahalo!

CLAYTON S ADAMS

ISLAND COMMUNITY LENDING

65-1158 MAMALAHOA HWY #16

KAMUELA, HI 96743

Clayton Adams
August 26, 2004

NASA appreciates your support of the Outrigger Telescopes Project.

OUTRIGGER TELESCOPES PROJECT
COMMENTS FORM

NASA welcomes and encourages written public comments on environmental impacts and concerns (including historical, archeological, and traditional cultural issues) and proposed mitigation associated with the proposed Outrigger Telescopes.

Your comments will be reproduced in the Final EIS for the Outrigger Telescopes Project. If you prefer that your name not be published with your comments, please express that desire in the comments section below. NASA will not publish your address in the Final EIS.

Your comments may be written on this form and left at the registration desk. Or, you may send your comments to Carl B. Pilcher, Program Executive, Science Mission Directorate, Universe Division, NASA Headquarters, 300 E Street SW, Washington, D.C. 20546-0001. Comments must be provided in writing and received by NASA on or before 4:30 PM Eastern Daylight Time September 30, 2004; fax (202-358-3096) or e-mail (otpeis@nasa.gov)

Commenter's name: Melva Aila

Commenter's full address (street, city, state, and zip code):

Date: 9/1/04

Place an X in this box if you wish to receive copies of future environmental planning documents on the proposed Outrigger Telescopes Project (including the Record of Decision) that NASA distributes to the public. [X]

Comments: No New expansion. Move existing facilities to another location off the Hawaiian islands. Priority should be given to the residents who live in the area to give their input. In which their input should be considered and implemented ASAP.

• MOVE Mauna Kea telescopes to Canary Islands. BUT PLEASE ASK that community first. What they think about it coming to their islands. Then don't forget to CLEAN UP YOUR OPAZA Before leaving.

Melva Aila
September 1, 2004

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No final decision will be made until the National Environmental Policy Act process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Deadline for written comments is September 30, 2004

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
NASA Headquarters
300 "E" Street SW
Washington, DC 20546-0001

Aloha Dr. Pilcher:
Mauna Kea is a profoundly holy and sacred temple. The summit area has been developed, paved, bulldozed and occupied by the telescope industry for 30 years. The existing footprint expands over twenty facilities. The Goddess Poliahu, who resides on the summit, has been paved, graded and changed forever. The native Wēkiu bug has been nearly wiped out, the view plane of the summit, on which an important religious practice is dependent, has been destroyed. Cultural sites have been routinely destroyed. A, B C

According to NASA's own Draft Environmental Impact Statement past and present telescope activities on Mauna Kea have, "substantially and adversely impacted cultural resources." NASA further admits, "future activities on the summit would continue the substantial and adverse impacts on cultural resources."

Any additional development on the mountain is unacceptable to the people of Hawai'i.

- There is no Mauna Kea management plan, which is necessary to guide proposals and management needs of the summit region. D
- The DEIS was hastily done, ignores important data, includes shoddy science and does not adequately address the combined effects of existing and proposed expansion. E
- Lake Waiau and Hawai'i Island's principal aquifer are threatened by existing and proposed activities. F
- NASA has identified the Canary Islands as a viable alternative for this project.
- NASA's expansion plans would open the door to even more development, including a thirty meter telescope, being proposed for the untouched northern slope. G

There has been unencumbered development on the summit for thirty years. Enough is enough.
NO More Development.

I support the position that there should be no further development on the sacred summit of Mauna Kea.

Signed, Kūlani 'Akahi

Address:

Deadline for written comments September 30, 2004
e-mail to: otpeis@nasa.gov
fax: (202) 358-3096

Response to Comment A:

Although there have been no definitive population ecology studies of the Wēkiu bug, a number of trapping studies have been conducted on Mauna Kea since 1982. Trapping studies are ongoing today as part of the Wēkiu bug Baseline Monitoring initiated by the California Association for Research in Astronomy (CARA) in 2001.

The first two sampling studies were conducted in 1982 and in 1997/98. A comparison of the results of these the two studies indicated that in 1997/98 trapping rates were about 1 percent of the 1982 rates. This has been taken as an indirect indication that the populations of the Wēkiu bug on the summit area of Mauna Kea may have declined by 99 percent between 1982 and 1997/98. Recent trapping data from the ongoing Wēkiu bug Baseline Monitoring effort being conducted by CARA indicates that trapping rates have returned to about the same level as in 1982 on Puʻu Hauʻoki.

The causes of the apparent Wēkiu bug decline between 1982 and 1997-98 are not known. Hypotheses include climate change, a possible long-term downward trend in winter snow pack depth and persistence, scientific sampling, introduction of predatory alien arthropods, mechanical habitat disturbance from observatory construction, recreational impacts, vehicle impacts, long-term population cycles, and the possible presence of environmental contaminants from human activities. The most likely cause would probably be a combination of some or all of the above factors.

Appendix C contains the Wēkiu bug mitigation measures proposed for the Outrigger Telescopes Project. If implemented, NASA will fund a Wēkiu bug autecology to gather more information about habitat requirements, life cycle, nutritional requirements and breeding behavior of the unique bug.

Response to Comment B:

NASA acknowledges that visual impacts of past and present astronomy-related activities in the Mauna Kea Science Reserve (MKSR) have been substantial (See Section 4.2.14.2).

Response to Comment C:

NASA is unaware of any evidence that supports this claim.

Response to Comment D:

NASA recognizes the MKSR Master Plan which was approved by the University of Hawaii Board of Regents on June 16, 2000 (UH 2000b). On February 2, 2000, Governor Benjamin J. Cayetano accepted the MKSR Master Plan Final Environmental Impact Statement (MKSR FEIS) as satisfactorily fulfilling the requirements of Chapter 343, Hawaii Revised Statutes (State of Hawaiʻi 2000). The MKSR FEIS contains a November 2, 1999 comment letter from the Department of Land and Natural Resources (DLNR) signed by Timothy Johns, Chairperson, in which he states DLNR's position regarding the Master Plan. "The Department of Land and Natural Resources would continue to review each situation in the context of a Conservation District Use Application. . . DLNR's acceptance and consideration of applications for new uses, such as telescopes, will be contingent upon implementation of the local design review process and more generally, the performance of the local management authority in fulfilling its stated

responsibilities. . . It will be the University's and the telescope operators' responsibility to ensure that procedures outlined in the Master Plan are followed for day-to-day management and development guidelines. Failure to do so could jeopardize Conservation District Use Application approvals and any future telescope development on Mauna Kea." Under the heading "New Management Responsibilities," Mr. Johns further states that "A Hilo-based review process, with the Board of Land and Natural Resources continuing to consider individual CDUAs and sublease agreements, would guide new telescope and facilities development. DLNR enforcement would be limited primarily to compliance with Conservation District Use Permit conditions and response to enforcement issues related to violations of Conservation District laws. . . "

Response to Comment E:

NASA believes the analyses presented, which are based on the best available information, adequately support the conclusions drawn.

Response to Comment F:

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system are negligible. No wastewater travels to Lake Waiau.

Response to Comment G:

The Outrigger Telescopes Project is separate and independent from any reasonably foreseeable development on Mauna Kea. All future proposed projects on Mauna Kea would be subject to the terms and conditions of the June 2000 Mauna Kea Science Reserve Master Plan and State compliance requirements including the Conservation District Use Permitting process.

Other individuals who sent substantially identical comments:

Lydia Amona
Scott Amona
William Koʻomealani Amona
William J. Bauer
Tamara Bestman
C.K. Boy
Julie Busch
Sarah Avena
Daniel J. Barshis
Carlyn Battilla
Tracie Buser
L.P. Bush
S.D. (sp?)
Shayne Norlani Dahil
Lely Davidoff (sp?)
Amy Day
Shaunna Dilwith
Elise Diueu (sp?)
Barbara Essman
Garid Faria
Phyllis Frus
Tom Hunter
Emily Johns
Michelle Kapuniai
C. Cado (sp?)
Ciss Kauab Ci
Haunaui Kaula
Malia L. Kipapa
Crystal Koga (sp?)
Dawn Kovach
Kahea Maxwell
Brandy McDougall
Sarah McKuaolter (sp?)
Gigi Miranda
Zachary Montizor
Jessica Motoi
Christopher Nakahashi
Maliu Neilson
Michelle Norman
K. Picon
Doreen Redford
Joseph Rodrigues
Bonnie K. Ross
J.S. (sp?)
Paul A. Schroeder
Dina Shele
Andrea Song
Aileen Suzara
A. Thelzsreth (sp?)
Coruli Texeira

Kūlani ʻAkahi
September 30, 2004

J.J. Wilson Eric R. Yamamoto

Deadline for written comments is September 30, 2004

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
NASA Headquarters
300 "E" Street SW
Washington, DC 20546-0001

Aloha Dr. Pilcher:
Mauna Kea is a profoundly holy and sacred temple. The summit area has been developed, paved, bulldozed and occupied by the telescope industry for 30 years. The existing footprint expands over twenty facilities. The Goddess Poliahu, who resides on the summit, has been paved, graded and changed forever. The native Wēkiu bug has been nearly wiped out. the view plane of the summit, on which an important religious practice is dependent, has been destroyed. Cultural sites have been routinely destroyed. A, B C

According to NASA's own Draft Environmental Impact Statement past and present telescope activities on Mauna Kea have, "substantially and adversely impacted cultural resources." NASA further admits, "future activities on the summit would continue the substantial and adverse impacts on cultural resources."

Any additional development on the mountain is unacceptable to the people of Hawai'i.

- There is no Mauna Kea management plan, which is necessary to guide proposals and management needs of the summit region. D
- The DEIS was hastily done, ignores important data, includes shoddy science and does not adequately address the combined effects of existing and proposed expansion. E
- Lake Waiau and Hawai'i Island's principal aquifer are threatened by existing and proposed activities. F
- NASA has identified the Canary Islands as a viable alternative for this project.
- NASA's expansion plans would open the door to even more development, including a thirty meter telescope, being proposed for the untouched northern slope. G

There has been unencumbered development on the summit for thirty years. Enough is enough. **NO More Development.**

I support the position that there should be no further development on the sacred summit of Mauna Kea.

Signed: Rosemary Lucia

Address:

Deadline for written comments September 30, 2004
e-mail to: otpeis@nasa.gov
fax: (202) 358-3096

H

Why can't they put the scopes into outer space & work them via satellite? You wouldn't desecrate a church to build a telescope. Why ruin the sacred lands of Hawaii. The mountains are living spirits preserved in stone. Please stop further development. Thank you.

Rosemary Lucia

Rosemary Alucier
September 23, 2004

Response to Comment A:

Although there have been no definitive population ecology studies of the Wēkiu bug, a number of trapping studies have been conducted on Mauna Kea since 1982. Trapping studies are ongoing today as part of the Wēkiu bug Baseline Monitoring initiated by the California Association for Research in Astronomy (CARA) in 2001.

The first two sampling studies were conducted in 1982 and in 1997/98. A comparison of the results of these the two studies indicated that in 1997/98 trapping rates were about 1 percent of the 1982 rates. This has been taken as an indirect indication that the populations of the Wēkiu bug on the summit area of Mauna Kea may have declined by 99 percent between 1982 and 1997/98. Recent trapping data from the ongoing Wēkiu bug Baseline Monitoring effort being conducted by CARA indicates that trapping rates have returned to about the same level as in 1982 on Pu'u Hau'oki.

The causes of the apparent Wēkiu bug decline between 1982 and 1997-98 are not known. Hypotheses include climate change, a possible long-term downward trend in winter snow pack depth and persistence, scientific sampling, introduction of predatory alien arthropods, mechanical habitat disturbance from observatory construction, recreational impacts, vehicle impacts, long-term population cycles, and the possible presence of environmental contaminants from human activities. The most likely cause would probably be a combination of some or all of the above factors.

Appendix C contains the Wēkiu bug mitigation measures proposed for the Outrigger Telescopes Project. If implemented, NASA will fund a Wēkiu bug autecology to gather more information about habitat requirements, life cycle, nutritional requirements and breeding behavior of the unique bug.

Response to Comment B:

NASA acknowledges that visual impacts of past and present astronomy-related activities in the Mauna Kea Science Reserve have been substantial (See Section 4.2.14.2).

Response to Comment C:

NASA is unaware of any evidence that supports this claim.

Response to Comment D:

NASA recognizes the Mauna Kea Science Reserve (MKSR) Master Plan which was approved by the University of Hawaii Board of Regents on June 16, 2000 (UH 2000b). On February 2, 2000, Governor Benjamin J. Cayetano accepted the MKSR Master Plan Final Environmental Impact Statement (MKSR FEIS) as satisfactorily fulfilling the requirements of Chapter 343, Hawaii Revised Statutes (State of Hawai'i 2000). The MKSR FEIS contains a November 2, 1999 comment letter from the Department of Land and Natural Resources (DLNR) signed by Timothy Johns, Chairperson, in which he states DLNR's position regarding the Master Plan. "The Department of Land and Natural Resources would continue to review each situation in the context of a Conservation District Use Application. . . DLNR's acceptance and consideration of applications for new uses, such as telescopes, will be contingent upon implementation of the local design review process and more generally, the performance of the local management

authority in fulfilling its stated responsibilities. . . It will be the University's and the telescope operators' responsibility to ensure that procedures outlined in the Master Plan are followed for day-to-day management and development guidelines. Failure to do so could jeopardize Conservation District Use Application approvals and any future telescope development on Mauna Kea." Under the heading "New Management Responsibilities," Mr. Johns further states that "A Hilo-based review process, with the Board of Land and Natural Resources continuing to consider individual CDUAs and sublease agreements, would guide new telescope and facilities development. DLNR enforcement would be limited primarily to compliance with Conservation District Use Permit conditions and response to enforcement issues related to violations of Conservation District laws…"

Response to Comment E:

NASA believes the analyses presented, which are based on the best available information, adequately support the conclusions drawn.

Response to Comment F:

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system are negligible. No wastewater travels to Lake Waiau.

Response to Comment G:

The Outrigger Telescopes Project is separate and independent from any reasonably foreseeable development on Mauna Kea. All future proposed projects on Mauna Kea would be subject to the terms and conditions of the June 2000 Mauna Kea Science Reserve Master Plan and State compliance requirements including the Conservation District Use Permitting process.

Response to Comment H:

Space missions and ground-based programs each make unique contributions to NASA's Origins program, particularly to the search for worlds around other stars. Detecting planets in orbits like those of Uranus and Neptune (periods of 84 and 165 years, respectively) requires observations over many decades (a significant fraction of one orbital period). Space missions generally have lifetimes of a decade or less. It is therefore not practical to detect planets with periods of several decades to more than a century from space.

Connecting the Outrigger Telescopes to one or more 8- to 10-meter telescopes (a requirement of the Outrigger Telescopes Project) is also not possible in space, in part because the technology for such a large space telescope does not yet exist. For these reasons, the goals of the Outrigger Telescopes Project cannot be achieved in space.

From: J.M. Anthony
Date: Wed, 29 Sep 2004
Subject: Outrigger Telescopes Project: Maunakea Draft EIS

To: otpeis@nasa.gov

Attention Carl Pilcher:

The comments I made at the public hearing in Honolulu stand as part of the record.

We have been advised by counsel to keep these written comments narrow and short and we have decided to do just that.

So, in addition to what is already on the record, we make the following additional comments:

1. As it stands the Draft EIS fails in its primary purpose as an instrument of disclosure. For example: the Draft EIS does not take into account what the regulations (40 CFR Ch. V (7-1-97) edition, Section 1508.27 sets out with respect to what the Statute says about the term 'significantly.' **A**

2. The Draft EIS says in effect that just one more telescope, in addition to all the other ones already up on Maunakea, is not a significant development. The arguments in the Draft EIS are faulty. We argue, on the contrary, that one more telescope and its attendant infrastructure is the straw that breaks the camel's back. It is a remarkable indication of NASA's cultural insensitivity that it proposes to build yet another sewage disposal system in an area that NASA clearly recogn izes as being sacred to native Hawaiians. Here section 1508.27 of the regs. is clearly pertinent. NASA rejects the 'enough is enough' argument and, like the hedgehog in the fable of the camel and the hedgehog, says just one more paw in the tent is all that it is asking for. We reject that argument. **B** **C**

3. NASA has an adequate alternative site. That site should be selected. **D**

4. The Draft EIS does not adequately address the cumulative impact aspect of what it plans to do in the instant case in the overall context of what is already there and the impacts of what is already there in terms of 'context' and 'intensity'--language taken from Section 1508.27. **E**

5. The proposed MOU is a travesty. **F**

6. The whole Draft EIS, the cultural impact section in particular, is based on skewed epistemological premises. The Draft EIS deals with the problerm of cultural impact from the standpoint of a model. We argue from the standpoint of the metaphor of traditional Hawaiian culture. If you don't understand the difference between models and metaphors I suggest you read Chris Dening's work: Islands and Beaches. **G**

7. We intend to argue, as we do now, that a mountain has standing following the logic of the arguments in Should Trees Have Standing? The time may be ripe for the 9th Circuit to hear

arguments on this issue and we may well decide to test them there.

Parenthetically, just one more point, not legal perhaps but ethical: Where tons of money, with flow on effects for the University of Hawaii, contractors and high powered/highly paid NASA personnel, are pitted against a sacred mountain, the interests of the mountain are in fact being relegated to the periphery. Too many sacred sites in Hawaii have suffered the same fate and now, so it seems, it is NASA's turn at sticking the knife in and drawing more cultural blood. You wouldn't dare build a sewage disposal system on the grounds of Westminister Abbey but somehow, in the calculus of your 'unreasoning' its kosher to build one on a site sacred to 'natives'. I see racism here; you seem to be in denial.

One final caveat: Consider this written statement supplementary to all of the arguments I made in my oral presentation in Honolulu.

You will recall that I confronted you in Honolulu about having selected private meetings with parties which have an interest in this matter. I am renewing my request to meet with you about matters that are pertinent for you to take into account before your Agency makes its decision which may well invite litigation. As an indication of my good faith I am prepared to fly to Washingtopn, DC (if that is where you are) at our expense for the meeting I have in mind.

J.M. Anthony, Ph.D.
Executive Director
Hawai'i--La'ieikawai Association
P.O. Box 629
Ka'a'awa, Hawai'i 96730

J.M. Anthony
Hawai‘i--La‘ieikawai Association
September 29, 2004

Response to Comment A:

Both the Draft EIS and Final EIS are consistent with the Council of Environment Quality guidance.

Response to Comment B:

NASA has concluded that past, present, and reasonably foreseeable future activities have a significant impact on the quality of the human environment. NASA has also concluded that, in general, the Outrigger Telescopes Project would add a small incremental impact (See Section 4.2.16).

Response to Comment C:

The proposed Outrigger Telescopes Project would use the W.M. Keck Observatory’s existing sewage disposal system and off-site mirror decoating wastewater disposal practices, if NASA selects the Mauna Kea site. No additional sewage disposal systems would be built.

It would not be sensible to truck off the mountain only the sewage from the additional 2 to 3 people present on the summit at any one time in association with the Outrigger Telescopes, since this would require the construction of separate sanitation facilities for these individuals with consequent adverse environmental impacts. The other alternative, trucking all sewage produced at the W.M. Keck Observatory off the mountain, is beyond NASA’s purview or authority.

Response to Comment D:

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No final decision will be made until the National Environmental Policy Act process has been completed. NASA’s decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA’s final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment E:

As stated in the Response to Comment D, NASA has not made a final decision about a site for the Outrigger Telescopes Project. NASA has made a good faith effort to address cumulative impacts comprehensively in accordance with Council of Environmental Quality guidance.

J.M. Anthony
Hawai‘i--La‘ieikawai Association
September 29, 2004

Response to Comment F:

Your comment is respectfully noted.

Response to Comment G:

NASA has made a good faith effort to address impacts on cultural resources.

From: Maria Shtil

To: <otpeis@nasa.gov>

Subject: Spiritual ecology in Russia

Date: Mon, 13 Sep 2004

Peace to you, dear friends!

We are happy to find the information about your Movement!

We, the Scientific-Spiritual Ecological Center SWAMI in Russia, St.-Petersburg, do the same efforts during already more, than 30 years.

Our main scientific-spiritual direction is the Spiritual Ecology and Modern Advanced Hesychasm.

Our main motto is: To become able to love the Creator - we must learn first to love the Creation.

We are about 10 specialists, including two with the Ph.D. degree (in biology and physics), all others - the masters of sciences. We accomplish researches, issue new books, create films, develop methods of spiritual self-perfection.

Our activity is scientific research. On this subject we issued more, than three tens books (some of which are translated into a number of other languages, including English), created 4 video films with the total duration of 24 hours.

By us:

the most perfect system of psychical self-regulation (that uses chakras and basic meridians of organism) is developed and repeatedly published,

historical experience of peoples of different countries and cultures is investigated and generalized in the field of religious concepts and practices,

for the first time the structure of multidimensional space is practically investigated and described in our books - from the position of scientists; on the published scheme a logical place of both the Abode of the Creator (loka of the Primary Consciousness), the hell, and "the dark matter" (about which physicists speak now much) is found, also the evolutionary processes inside the Universal Consciousness are shown,

the new scientific direction - Methodology of Spiritual Perfection is created; including, "stairs" of methods of the spiritual development consisting of many steps is developed, allowing worthy people to achieve the direct personal cognition of God and "dissolve" by the advanced consciousness in the Creator's Abode (loka of the Primary Consciousness) in Mergence with Him; we have hundreds sacred places (places of power) - for every step of meditative growth of one's consciousness,

among our publications there were the following: the book Original Teaching of Jesus Christ (where His Teaching for the first time is systematized - with using apocryphal Gospels - on

thematic sections), the apocryphal Gospel of Phillip in a literary form and with comments, a selection of the basic citations from Sathya Sai Baba's books, the analysis of the Juan Matus' Teaching (under Carlos Castaneda's publications), Bhagavad Gita in new competent wording of a translation and with comments; books with the following names speaking for themselves were issued also:

Meaning of Our Lives. What Kind of Russia Is Needed by God?

How God Can Be Cognized. Autobiography of a Scientist, Who Studied God

Spiritual Practices. Training Aid

God Speaks, The Textbook on Religion

Spiritual Work with Children

Ecology of Human Being in Multidimensional Space

Spiritual Heart: The Path to the Creator (Poems-Meditations and Revelations)

Spiritual Heart. The Religion of Unity

General Theology - the Science about God

The New Upanishad. Structure and Cognition of the Absolute

Sun of God. How to Become the Ocean of Pure Love.

The book Spiritual Practices. Training Aid is published in USA polygraphically and may be ordered from http: //www.iuniverse.com/bookstore/book_detail.asp?isbn=059527699

Educational-methodological video films are created:

"Immersion into Harmony of Nature. The Way to Paradise" - a slideshow with audio commentary, 1,5 hours, on CD and DVD;

"Sattva of Spring" - 1,5 hours, on videocassettes and DVD;

"Sattva" - 1 hour, on videocassettes and DVD,

"The Places of Power. Three Steps of Centering" - 20 hours on videocassettes and DVD.

We are ready to send them to you by post: please make contacts for this with Mikhail -.

(The films have distribution licenses).

The word "Sattva" means "Harmony, Purity". The films are dedicated to the harmony of relationships with nature, emotional self-attunement with its subtlest manifestations. They teach to treat the nature carefully, with love. In these films - the beauty of blossoming plants, purity of wood lakes and rivers, spring singing and courtship displays of birds, including, snipes, woodcocks, black grouses, also beavers with the dam constructed by them, traces of animals on snow and many other things. These materials have an orientation not only ecological, aesthetic and ethical, but also philosophical-religious, representing a methodological direction which can be defined as the modern developed hesychasm. It includes such methods of self-perfection, as regulation of the

emotions (easy removal of negative emotions and stresses, finding the steady internal joyful calm), and - what is the main thing - development of the spiritual heart.

The word "hesychasm" (from Greek word "hesychia") means inner calm. Hesychasts find it by means of particular methods, and also work on opening and growing the spiritual heart - the "organ" of spiritual love.

"God is Love!" - God teaches us. Therefore, to come closer to Him, we must develop ourselves as Love, simultaneously destroying in ourselves an ability to such emotional states of consciousness, as anger, annoyance, egocentric desires for ourselves, also complacency, arrogance, etc.

To become able to love the Creator - we must learn firstly to love the Creation.

One unique peculiarity of our spiritual work consists in finding by us the best, optimal places on the surface of the Earth ("places of power") for every principle kind of meditations. This permits to take the stages of the spiritual Path the most conveniently, effectively, rapidly. We have hundreds of such places.

A "byproduct effect" of mastering the practical methods of this system is a complete recovering from, in fact, all diseases. And the result of full mastering of many steps and stages of all this "stairs", created by us under a direct guidance of God, is personal cognition of God and the opportunity of easy discussion with Him - about all vital problems and private questions.

Our films can be used as manuals in education of natural sciences: biology, ecology, philosophy, and of religious studies. They also will help to any person (both to an adult, and a child) - when watching even every day - for rest after work or study, for replacement of negative emotions to positive. But the main thing - these films are the manuals for spiritual self-perfection.

Most brightly it is illustrated with the poem of one of the greatest Russian poets N.A.Nekrasov, which is published in the book "Spiritual Heart: The Path to the Creator":

Light of dawn has reflected in birch freshing leaves

So they shine and become trilled with this magical sunlightŠ

I am falling in love with the Earth with tears!

All I hold on my palms full of bliss, pet in full might!

I am cherishing trees, kissing flowers and blossoms,

Growing warm to give Loving sensation!

So, do love dear nature with full heart to its bottom

Wholly knowing: all of it is God's Creation!

The ecology is a science about mutual relationships of an organism with its environment. It includes studying in such directions, as ethics of mutual relationships of people among themselves, people - with other beings, also problems of nurturing, some medical aspects of a life, and also mutual relationships of a person with God.

And all ecological contacts of each advanced person can become spiritualized.

In particular, bringing up the rising generation we shall bring by these knowledge and principles the most significant contribution for revival of society as a whole - if to look in prospect. Let children grow, being guided by the true knowledge of God, Evolution, the meaning of our lives, the structure of our organisms, and about our human opportunities - instead of being confused between ideologies of atheism and variations of belief.

In our books and films:

We explain to all people in simple and accessible language the true meaning of our lives in a philosophical foreshortening and the ways of it realization. And in fact, the understanding of it is the radical way of struggle against drug addiction, alcoholism, against suicides, aggressiveness and criminality, mental frustration and diseases, many conflicts between people -of interpersonal and international scales,

We introduce ideas of careful, harmonious relationships with nature,

The important place in our program of self-perfection is taken by meditative training on natural energetically significant for a man sites on the surface of the Earth ("places of power"); the main accent is done on "opening" and development of "spiritual heart" - the bioenergetic "organ" responsible for production of the emotions of love (certainly, not in sexual sense of this word); we consider this work, as it was already specified, as the development and scientific appearance of the ancient Christian tradition known under the term hesychasm; self-perfection on these methods results, in particular, in radical improvement of a state of health.

The main line of our work, I repeat, is the methodology of spiritual perfection. We for the first time in history have stated, in quite simple and clear language, the essence of the nature of God, of meaning of our lives and lives of all other beings - as the participants of Great Evolutionary Universal Process. Also the structure of the Absolute and all "stairs" of techniques of spiritual development, which conduct to direct cognizing the Creator, was described. Thus our wide experience of the spiritual help to people and supervision over efforts and mistakes of other people in this direction - allow to describe a set of nuances of spiritual promotion and features of teaching, and also enable to differentiate precisely true spiritual Schools and directions - and false sects.

All this is made for the first time. It was possible to do all this due to, first of all, to the direct guidance of really cognized by us God. The manuals created by us (books and films) suit to people of very different levels of development: everyone may take from them what he or she is capable to contain now. We have helped to find the Way to ethical purity, to spiritual perfection, to God - very many Russians. Some our books are translated from Russian - into a number of other languages, they are issued polygraphically and in the Internet - and serve people of many other countries. We conduct the active help to people of all planet through the Internet, informing about results of our researches, helping by consulting the spiritual seekers and teachers. We have a lot of thanks for materials of our web site - from experts of some countries, first of all, USA and Canada.

Our input into the activity of your Movement might be the following:

- the theoretical and practical knowledge presented on our site and in films; consider please the possibility to republish our books polygraphically and duplication our films (the slideshow in pressed form may be downloaded from our site for the preview),

- the preparation the specialists on modern hesychasm who could assist then to other people in "opening" their spiritual hearts and spiritual growth on the principles and with help of the methods of spiritual ecology,

- the detacting the sacred places (the places of power) in the USA and in any other country - for the different steps of spiritual work and health improvement.

Please, get acquainted with our materials on the web site www.swami-center.org - books, articles, photogallery, slideshow, videofilms.

We have made the links to all your sites - on our site. You may do the same.

We would like to consider us as the members of your Movement. We are waiting your opinions about our taking part in our common activity.

Please inform the members of your organizations about the possibilities of our Russian Center.

With the best regards and love,

Vladimir Antonov, Ph.D. (in Biology),

Mikhail Nikolenko, Ph.D. (in Physics),

and collaborators,

Russia

Your comments are respectfully noted.

Date: 25 Sep 2004
From: Charlene Avallone
To: otpeis@nasa.gov
Subject: No Further Development on Mauna Kea

Dr. Carl Pilcher
Office of Space Science NASA Headquarters 300 E Street SW
Washington DC,

Dear Dr. Pilcher,

I am writing to express my strong opposition to NASA's proposed development on the summit of Mauna Kea on Hawaii Island. The summit region-- which already supports 24 telescope installations--is profoundly sacred to the Native Hawaiian people. The sanctity of the seriously compromised summit region should not be further violated. **A**

There are many more than approved number of telescopes on the summit now. This project will open the door to even more proposed development on Mauna Kea, including the destruction of an adjacent pristine area near the summit region. This systematic desecration must stop now. I do not support any further development on the summit of Mauna Kea. **B**

In the Draft EIS, NASA admits that the impacts of this and proposed projects to this fragile summit would be, "adverse and significant." It is unacceptable for NASA and the University of Hawai'i to pursue continued degradation of this sacred area. **C**

The potential impacts from further development to the Island's principal aquifer, which lies below the summit region, are unacceptable. In addition the most sacred, Lake Waiau, is at risk of continued desecration. **D**

The rare and imperiled Wekiu bug (a candidate for endangered species designation), is at great risk from being decimated by any further development in the summit region, which is its primary habitat. **E**

The religious significance of the summit region has been seriously damaged by thirty years of unencumbered development. Further desecration of Mauna Kea cannot be tolerated. **F**

NASA's Draft EIS has identified the Canary Islands as a suitable site for the six new telescopes for the Keck Observatory. Please spare the already seriously compromised summit of Mauna Kea and select the acceptable alternative on which to build. **G**

I am opposed to any additional facilities being built on the sacred summit of Mauna Kea. **H**

Sincerely,

Charlene avallone

Charlene Avallone
September 25, 2004

Response to Comment A:

NASA acknowledges in the EIS that Mauna Kea has always been considered a sacred place by Native Hawaiians.

Response to Comment B:

The Outrigger Telescopes Project is separate and independent from any reasonably foreseeable development on Mauna Kea. All future proposed projects on Mauna Kea would be subject to the terms and conditions of the June 2000 Mauna Kea Science Reserve Master Plan and State compliance requirements including the Conservation District Use Permitting process.

Response to Comment C:

NASA has concluded that past, present, and reasonably foreseeable future activities have a significant impact on the quality of the human environment. NASA has also concluded that, in general, the Outrigger Telescopes Project would add a small incremental impact (see Section 4.2.16).

Response to Comment D:

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system are negligible. No wastewater travels to Lake Waiau.

Response to Comment E:

The studies have been conducted by a qualified entomologist. The mitigation measures were reviewed and approved by the U.S. Fish and Wildlife Service (USFWS) and follow all the recommendations given in previous Mauna Kea Science Reserve arthropod assessments (Howarth and Stone 1982; Howarth and others 1999).

In a letter regarding the Wēkiu Bug Mitigation Plan for the W.M. Keck Observatory, Outrigger Telescopes Project at Mauna Kea, the USFWS states "The Service [USFWS] supports the recommendations in the WBMP [Wēkiu Bug Mitigation Plan] to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor use. . . We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to the wekiu bug habitat." See Volume II, Appendix A, for the letter from USFWS/Henson (USFWS 2000).

The U.S. Department of Interior (USDOI) submitted a comment letter on the DEIS stating "It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wēkiu Bug Mitigation Plan and the Wēkiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities." See the USDOI comment letter from Patricia Sanderson Port located in this Appendix.

In addition, the USDOI letter states "These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology."

Response to Comment F:

Your comment is respectfully noted.

Response to Comment G:

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No final decision will be made until the National Environmental Policy Act process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment H:

Your comment is respectfully noted.

Charlene Avallone
September 25, 2004

Other individuals who sent virtually identical comments:

Pi‘ilani Akina
Kathy-Lynn Allen
Charles Alvarez
Harolynn Arakaki
Colleen Ariola
Kainoa Ariola
Kris Aton
Byron Bader
Jacquelyn Baetz
Daniel Barnett
Sara Bartlett
Joseph Bateman
Carol Bender
Bruce Berard
Leilani Birely
David Bishaw
Beryl Blaich
Patricia Blair
Dumont Blankenship
Nathan Boddie
Taylor Boger
Connie Boitano
Eric Bowman
Katherine Brede
Alohalani Brown
Raylene Brown
Lori Buchanan
Debbie Burack
Paulo Campbell
Donna Camvel
Victoria Caridas
Karen Carroll
Christopher Carvalho
Joy Chambers
Dr. Healani Chang
Miguel Checa
Duane Choy
Raymond Chuan, Ph.D.
Brendan Cooper
Sara Cosson
Amanda Coursey
Robin Craig
Charmaine Crockett
Nancy Crom
Amy Cutler
Dena Cutler
Russell Cutler
J. Scott Daniels
James Danoff-Burg
T. Davey
Jesse Dawn
Pete Doktor
Erin Donnelly
Stephen Donnelly
Dinda Evans
Suki Ewers
Anela O Maunakea Fernandez
Jeff Fishman
Armance Flores
Katy Fogg
Karen Gallagher
William Golove
Jack Goodburn
Libbie Hambleton
Bill Hanrahan
Dennis Hart
Alison Hartle
Sara Hayes
Selina Heaton
Lea Heimerman
Mike Hendrickson
Dave Herring
Ellen Hightower
Andrew Hina
Adrienne Hohenberg
Tina Horowitz
Amy Horwitz
Forrest Hurst
Tom Jackson
Raiha Johns
Timothy Johnston
Anthony Jones
Mahealani Jones
Lois Joudrie
Charles Kainoa
Monica Kaiwi
Kamuela Kala‘i
Paulette Kaleikini
A. Ke‘ala Kapololu
Jamie Moana Kawauchi
Terrilee Keko‘olani-Raymond
Genai Keliikuli
Colleen Kelly
Marion Kelly
Lei Kihoi
Wendy King
Jill Komoto
Stephanie Kowalski
Denise Lambeth
Rose Laolagi
Charles Lawson
Aaron Lehmer
Renee Leiter
Katheryn Letkey
Micah Levitt
Pualani Lincoln
Rosanne Lindley
Chris Lipman
Sam Long
Daniel Lovejoy
Paul Lugo
Alapaki Luke
Jessica Ma
Ben Manuel
Amy Marsh
Vincent Martinez
Barbara G. Mathews
Katherin Matolcsy
B. McClintock
David Meanwell
Michael Mihok
Dick Miller
Samuel Mitchell
Michele Mitchum
Ann F. Moffat
Maya Moiseyev
Kealoha Moku

Charlene Avallone
September 25, 2004

Zachary Montizor
Donald Moore
Harold Moraes
Kaimikila Moraes
Kamuela Moraes
Mahealani Moraes
Sharon Moraes
Sandra Morey
Gian Andrea Morresi
Nanea Morris
Fredy Morse
Claire Mortimer
Paul Moss
Pamela Nakagawa
Kristie Nakasato
Damianna Ah Nee
Charlotte Needham
Elizabeth Nelson
Vivian Newman
Nancy O'Harrow
Scott O'Bara
Catherine Okimoto
Kathleen O'Nan
Wendy Oser
Brenda Osterlye
Kaleo Paik-Matsuura
Lori Painter
Janice Palma-Glennie
Benton Pang
Ann Parker
Joseph Pearson
Kapena Perez
Kekailoa Perry
William Peterson
Stephanie Place
Mikhail Ponce
Pat Porter
Richard Powers
Marilyn Prater
David Quintana
Shyla Raghav
Mary Rahilly
Mylene Reiners
Carrie Rex
Anna Reycraft
J.G. Richardson
Joseph Rodrigues
James Rogers
Puanani Rogers
Emily Rosenberger
Cheryl Rosenfeld
Klaus Rudolph
Margaret Rydant
Rhonda Saenz
Joan Scanlan
Ed Schlegel
Achahn Schulze
Gregg Schulze
Sarah Sharp
Matan Shelomi
Forest Shomer
Philip Simon
Amanda Sims
Shaun Smakal
Greg Smith
Harry Snodgress
Aggelige Spanos
Maureen O'Dea Spencer
Kahea Stocksdale
Jill Strawder-Bubala
Leona Tafuna
Susan Tagliente
Gabriela Taylor
Addie Texeira
Stefan Thiesen
Stephen & Deborah Thompson
Sarah Thornton
Maxine Veale
Phoenix Vie
Kanoe C. Vierra
Sheila Ward
Will Ware
William Ware, Jr.
Sinclair Weinstock
Erin Weston
Jeanne Wheeler
Momi Wheeler
Maxine Wilcox
Paul Williams
Marty Wilson
Malia Wong
Noe Noe Wong-Wilson
Ricky Wright
Richard Naiwieha Wurdeman
Toni Auld Yardley
Rose Zellers

Date: Sun, 22 Aug 2004

From: Al Beeman

Subject: Message in support of the Outrigger Telescopes Project

To: otpeis@nasa.gov

Cc: Laura Kraft

Bill Stormont

Dear Dr. Carl Pilcher,

I have read the entire draft EIS and all of the attachments for the Outrigger Telescopes Project. I find it covers all aspects I could possibly think of related to Environmental Impact and I find all of the analysis complete and very satisfactory.

My only comment is that design and placement of the Outriggers should not be constained by Wekiu habitat when remediation of their habitat can accommodate the best design that science can come up with. If we are going to spend our money on science we should get the best possible design and do the most science that can be done considering how difficult and expensive it is to make changes in future.

Let me be clear in my whole-hearted support of the Outrigger Telescope Project now that I have read the EIS. Everyone who has contributed to this massive effort is to be congratulated on a job well done. I would particularly like to commend the efforts to take into account the needs and beliefs of the Hawaiian community. I see no reason whatsoever why Mauna Kea cannot continue to spiritually inspire us all while also teaching mankind more and more about our universe. Astronomical advances are just another of Pele's many gifts.

I wish as much care was taken by everyone else on the Island, especially the County Planning Commision, and as the people working on Astronomy projects on Mauna Kea. I am much more worried about what is going on below 9,000 feet!!!

Respectfully,

Albert E. Beeman

Hilo, Hawaii
Friendly place in the middle of the Pacific Ocean

Albert Beeman
August 22, 2004

Thank you for your support of the Outrigger Telescopes Project. The placement of the telescopes would not compromise the science.

Date: Sat, 21 Aug 2004

From: patricia blair

Subject: Mauna Kea

To: otpeis@nasa.gov

Dr. Carl B. Pilcher, Office of Space and Science, NASA Headquarters.
Dr. Pilcher, I am emailing my strong objections to any further expansion on Mauna Kea which is a spiritual place for the Hawaiian People. It is time for NASA and the American Government to honor and respect the cultures/beliefs of the Hawaiians. No furthur building should be done on this scared mountain. Mahalo and Aloha, Pat Blair.

Patricia Blair
August 21, 2004

Your comments are respectfully noted.

Date: 26 Sep 2004
From: Anne Blankenship
To: otpeis@nasa.gov
Subject: No Further Development on Mauna Kea

Dr. Carl Pilcher
Office of Space Science NASA Headquarters 300 E Street SW
Washington DC,

Dear Dr. Pilcher,

I'm sure you have heard from many people by now and I wish to add my objection, mainly to protect the fragile environment which has already been over-exposed to outside influences. I have a science background and believe there are other sites in the world that would better accomplish and even exceed NASA's objectives. **A**

I am opposed to any additional facilities being built on the sacred summit of Mauna Kea. **B**

Sincerely,

Anne Blankenship

Anne Blankenship
September 26, 2004

Response to Comment A:

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No final decision will be made until the National Environmental Policy Act process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment B:

Your comment is respectfully noted.

Date: 25 Sep 2004
From: Royelen Boykie
To: otpeis@nasa.gov
Subject: No Further Development on Mauna Kea

Dr. Carl Pilcher
Office of Space Science NASA Headquarters 300 E Street SW
Washington DC,

Dear Dr. Pilcher,

Mauna Kea is sacred land and your are among her caretakers. Please protect Mauna Kea from further development and from telescopes which are not essential to life anywhere on this planet. Further intrusion on Mauna Kea is detrimental to our Native people. Have we not forced them to give up enough?

Sincerely,

Royelen Boykie

Royelen Boykie
September 25, 2004

Your comments are respectfully noted.

LIFE OF THE LAND

76 North King Street * Suite 203 * Honolulu, Hawai`i 96817
Phone * E-Mail: (808) 533-3454 * katbrady@hotmail.com

Dr. Carl Pilcher
Office of Space Science
National Aeronautics and Space Administration
Mail Code SZ
Washington, DC 20546-0001
E-Mail: otpeis@nasa.gov

Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawai`i 96813
E-Mail: oeqc@pixi.com

MAUNA KEA, KUAHIWI KŪ HA`O I KA MAILE
Mauna Kea, astonishing mountain that stands in the calm

Dear Mr. Pilcher!

My name is Kat Brady and I am the Assistant Executive Director of Life of the Land, Hawai`i's own environmental and community action group advocating for the people and `aina since 1970. Our mission is to preserve and protect the life of the land through sustainable land use and energy policy and to promote open government through research, education, advocacy, and litigation. Life of the Land has been involved in protecting cultural properties, ensuring access to sacred sites, and preserving and enhancing the Constitutionally protected cultural rights of the first people of our archipelago.

Life of the Land hereby officially requests a copy of the DVD of all of the public hearings conducted in relation to this Draft Environmental Impact Statement (DEIS). A

Life of the Land has been reviewing documents relating to Mauna Kea for many years and we have read the Draft Environmental Impact Statement for the Outrigger Telescopes Project on Hawai`i's sacred temple, Mauna Kea.

We appreciate NASA's acknowledgement of the sacredness of Mauna Kea and the deep connection that Kanaka Maoli have to this hallowed place. Over the years we have spoken to many kupuna, some who have since left this world but continue to guide us, and the overwhelming comment we hear from them is that the astronomy community needs to share their resources, not continue to expand development on Mauna Kea. Auntie Eleanor Ahuna explained what Mauna Kea represents to the native people to us many years ago. When the Polynesians first came to Hawai`i, Mauna Kea was the first land they saw from their canoes. The sight was so overwhelming to them that they have identified Mauna Kea as the *piko* (umbilical cord) ever since. That deep connection is indelible to the Kanaka Maoli and one that continues to be a guiding force for the first people of this land.

Life of the Land agrees with our wise kupuna....YOU MUST SHARE. Why does more development have to occur in this sacred temple? Can you recycle or upgrade existing telescopes to meet your perceived need? B

Would NASA consider putting this development on the altar of a church, synagogue, or other place considered blessed by its congregation? How would the people of NASA feel if the gravesites of their `ohana were continually desecrated in the quest for the origins of life? NASA's, as well as the other telescope's search for the origins of life are in direct conflict with the way that search is actually conducted. Your scientific curiosity is at the expense of an entire culture. It is hard for our community to perceive your deep respect for life as you trample the very being of the Hawaiian people. What type of mitigation could possibly make such continue violation acceptable?

At hearing after hearing in the last decade the astronomy community has heard and witnessed the pain that your irreverence and disregard for Mauna Kea, that hallowed ground that guides the lives of the Hawaiian people, has caused the current generations. Mauna Kea is in the chants and genealogy of the Kanaka Maoli. People have cried, they have pleaded with the scientists to stop the desecration and each time you apologize and promise to do better. Only to go back to your polluting and disrespectful ways. Trust is something that takes years of positive action to earn, and the scientific community has a long way to go before there can be any trust with the community. How do you plan to show the community that you hear us? What actions will you take to demonstrate that you hear us when we tell you the pain you have caused? What will you do to begin to develop a trusting relationship with us? Have you experienced this heartfelt pain in other locations? How have you handled it? What have you done to gain the trust of communities? Please include any contracts or agreements you have reached with communities and/or indigenous people in other telescope locations. C

The cumulative impacts of the over-development on Mauna Kea are significant. The Council on Environmental Quality (NEPA) defines cumulative impacts as *"the incremental environmental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over time."*

NASA has determined that, in general, the time frame for the cumulative impact evaluation would extend from about 1964, before the first telescope was installed on Mauna Kea until the year 2033 when the lease agreement between the State of Hawaii and UH ends." (ES.2.2.13)

Certainly, you must acknowledge that the cumulative impacts on Mauna Kea are irreversible. Every aspect of life on that sacred ground has been, and continues to be, severely impacted. Life of the Land finds it unconscionable that yet another project is being proposed in the face of your admission of the significant impacts the over-development has caused. How do you justify further expansion while acknowledging that the cumulative impacts are substantial and adverse with the existing development of this holy place? D

The summary of the Cumulative Impacts in the DEIS states, *"Mauna Kea has a rich traditional history and many archeological sites, including some that have yet to be discovered. Before 1982, only limited cultural and archaeological surveys were conducted in preparation for developments on the mountain. Thus, it is not known whether development of the Astronomy Precinct beginning in 1964 has damaged subsurface cultural resources. However, such development has clearly altered the appearance of the Kukahau`ula traditional cultural property, interfered with views to and from the summit, and affected traditional cultural uses and practices. Grading and removal of earth for new structures, redeveloped structures, roads, and other astronomy projects could further affect these resources adversely. Following appropriate mitigation measures, such as those described in the NHPA Section 106 MOA, and developing project-specific mitigation measures for future activities would reduce adverse effects.*

...From a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on cultural resources on Mauna Kea is substantial and adverse. The addition of the Outrigger Telescopes would have a small incremental impact".

How can forty years of substantial and adverse impacts possibly be mitigated? NASA says that this proposed project will have a small incremental impact? How can you possibly say that in the face of the forty years of destruction and disrespect displayed toward the first people of these fragile islands? **E**

The Environmental Justice section ignores the impact of this desecration on the Kanaka Maoli. Several years ago, there were two 'hate crimes' committed on O`ahu - a desecration of two cemeteries - one in Nu`uanu and the other at Punchbowl - where graves were disturbed and defiled. What is the difference between those crimes and the destruction and desecration of sacred burials and cultural properties at Mauna Kea? How can this *hewa* be mitigated? Does NASA plan to compensate the Kanaka Maoli for these abuses? How will this be handled? Please explain in detail, the plans for this mitigation. **F**

The community continually hears about the positive economic impacts that this over-development brings to Hawai`i, please explain, in understandable language, the money that the state of Hawai`i receives for the use of Mauna Kea? How do the citizens of Hawai`i benefit from the astronomical activities there? We understand that the University of Hawai`i is 'paid' in time, i.e. use of the telescopes, but what is the economic benefit to the general public? What is the economic benefit to the Native Hawaiians who, under statute, are entitled to twenty percent of the revenue generated from the use of ceded/STOLEN lands? Please include a full accounting of the benefits for the use of this sacred property to both the native Hawaiians and the general public. **G**

The Hawai`i State Constitution protects traditional and customary rights of Native Hawaiians including access for gathering, worship, or ceremonies. How does the astronomy community comply with these rights? Do cultural practitioners have unfettered access to their temple now? If so, please describe how this is accomplished. If not, please explain why? Do you have telescopes in other locations where indigenous people practice their traditional and customary rights? How is access handled in those locations? Do you have contracts with those groups? If so, please include them in your response to us. **H**

The UH Master Plan for Mauna Kea has never been approved by the Board of Land and Natural Resources. How can any development occur if that plan has never legally been adopted? Your document's No Action section appears to make a mockery of this process since you announced at the September 2, 2004 public hearing that you are concurrently seeking a Conservation District Use Permit to proceed with this development. There is a saying that those who ignore history are doomed to repeat it. How does this concurrent action assure the community that you are taking our concerns seriously? It appears to us that this DEIS is merely an exercise so you can say that you examined the impacts, while at the same time are proceeding with the project. I J

How does NASA interact with the UH Institute for Astronomy? Is there an advisory committee of all the different entities operating on Mauna Kea to discuss important issues such as cultural rights, environmental protection, recreational compatibility, educational opportunities, and reporting violations in these areas? Does the UH IFA have staff specifically dedicated to these areas needing protection? Do the different entities jointly pay for this? If not, would NASA be willing to spearhead a plan that would institute this - i.e. an advisory committee, a staff dedicated specifically to protect these various areas? We are aware of the Mauna Kea Advisory Committee, and that is not what we are talking about. Saying it another way, would NASA be willing to spearhead the formation and funding of a committee and staff dedicated to cultural protection and access rights, environmental protection, recreational compatibility, educational opportunities and reporting of violations to UH IFA, with copies to DLNR? Life of the Land requests that the process of picking representatives for the advisory committee be open to the public, and further requests that the notes of meetings of the advisory committee and the reports of violations be done on a monthly basis with the records open and available for public scrutiny. K

The habitat for the wekiu bug is all be decimated because of the over-development of Mauna Kea. What responsibility is borne by the astronomy community for this irreplaceable destruction? The DEIS talks about mitigating the damage, but the astronomy community has destroyed 99.7% of this species already. How can this be mitigated? How much money is NASA putting into protecting the critical habitat for this threatened, and in our view, endangered species? What part does NASA play in the restoration plan? Please understand that the Hawaiian Islands are a rich ecological and cultural treasure. There are plants and animals here that are found no where else on the planet, as well as species yet to be discovered. How can you possibly mitigate the loss of these precious resources, and those yet to be discovered? L

At the public meeting earlier this month, NASA was described as a 'civilian' agency. Life of the Land has found this not to be true. The fact that NASA is using the telescopes for military purposes is tremendously distressing for the community. Hawai`i is already one of the most militarized places and to think that our sacred mountain, sacred temple, is used for military purposes is more than troubling. What is NASA's history with the military? Please include all projects that were funded by or in partnership with the Department of Defense in Hawai`i or in other telescope locations in the world. Please include dates, projects, locations, and a description of the military applications. M

An article by Seth Hettena of AP, entitled "Military Uses NASA Images in Combat" posted at "http://www.space.com/news/navy_nasa_020412.html" states:

"The Navy has been using NASA satellite data to help guide ships and planes in the war in Afghanistan, marking the first time the military has employed the space agency's up-to-date information in combat, Navy officials said Thursday. Some in Congress have expressed concerns that NASA risks overstepping its 44-year-old civilian charter, though military planners say the images they have been using are unclassified. That information is available to "anyone and everyone," including a host of federal agencies and foreign governments, said NASA spokesman David Steitz. He said NASA has no qualms about the military's use of the images, which was first reported this week in Aviation Week & Space Technology magazine."

How can there be any trust with the community if you don't tell the truth? How could you describe NASA as a civilian agency, when it is obviously not true? How does that help the community believe that you respect the most sacred place in all of Polynesia? **M**

What military applications are conducted by NASA on Mauna Kea? Please describe these activities in detail. What are the activities that NASA conducts on Mauna Kea on a regular basis? Do you work in concert with other agencies? Which agencies, both federal and state, and for what purposes? Do you work with other governments? Which governments and for what purposes? Please describe all the activities, in detail and in plain language, conducted by NASA on Mauna Kea. **N**

On September 10, 2004, the Department of Land and Natural Resources (DLNR) fined the UH IFA $20,000 for land use violations they considered 'serious.' The staff recommendation states that they are 'particularly concerned about this case in that the violations occurred at the summit of Mauna Kea which is considered culturally significant. Staff notes departmental records do not indicate any approvals were received for the alleged violations.' Their report unequivocally states that 'it is the responsibility of the UH to be knowledgeable of and enforce the various telescopes and/or observatories CDUP's terms and conditions as approved by the Board.' What is NASA's relationship with DLNR? What is NASA's relationship with UH? We understand that NASA is a lessee, but please explain in detail how you interface with UH and DLNR. Who do you consult with before an action is taken to make sure that it complies with the lease? Does UH or DLNR monitor your activities on Mauna Kea? What activities does NASA undertake to comply with your lease? Please include a copy of your lease with the UH IFA. Does the UH IFA provide oversight to your work? Do you have regular meetings with the lessor, the state of Hawai`i, and the other lessees on Mauna Kea? What is the process for notification of these meetings? What are NASA's general interactions with the lessor, the state of Hawai`i and the other lessees? Do all the lessees interact and advise each other on pending proposals? How does that this happen, if at all? **O** **P**

How did you reach the conclusion that this project would have no impact on the hydrology and water quality, especially since it is above the main aquifer of Moku Keawe? We are aware that NASA has said that the aquifer is far enough below the surface not to be impacted, but our mountains are different that mountains in other places. Since our islands were formed by volcanic eruptions, there are many fissures for contamination impaction. To **Q**

your knowledge, has any contamination reached the aquifer in the forty years of development on Mauna Kea? What safeguards will NASA undertake to insure the integrity of the aquifer? Q

The DEIS mentions that no mercury would be used for this project, but the rinse water from the mirror recoating would be collected and transported off the mountain. How will the rinse water be transported? Where will it be taken? How will it be disposed of? Will it be tested for contamination? Will a private company be hired accomplish this? Is this water considered hazardous? Will the company or people charged with this task be specially certified to accomplish collection and disposal? What kind of certification is needed for collection and disposal? R

How many hours per year will the proposed telescopes be used? Who will use them? How much time will each user be allocated? How is this decided? Who manages, oversees or supervises who gets to use the telescope at any given time? Are telescope hours tradable? That is, can one entity which has the right to use the telescope for a given time slot either trade their hour with another entity or sell their time period to a third party? How is this decided? Are there limits or restrictions on whom they can sell their time to? Is there a bulletin board, web site or listing of those who want to sell, buy, acquire, give up time slots? If so, who oversees the process? Please include the logs for the last year showing the time allocation schedule for the Keck telescopes. Can time periods ever be sold for a financial amount? Who benefits from this? Does the Hawai`i general public benefit financially? How does OHA get compensated for the use of this resource? Can those with time slots trade them for time slots on other telescopes at Mauna Kea? Are there explicit or implicit buy out agreements for time periods on the telescope? If the telescope goes off-line for unscheduled maintenance, or a time slot becomes unavailable for another reason, then how are time slots re-allocated? Who must be notified of reallocation of time slots? Is there an entity that oversees this time allocation process? If so, who is that entity? Do the overseers have the right to reject the re-allocation? Is there a liquid trading hub or market place for viewing time slots? Do the time slots have equal value? What is the financial equivalent of the time allocated to UH in lieu of rent? S

How does NASA interface with the educational system (elementary, intermediate/middle, and high schools, and universities in Hawai`i? If classes are held on Mauna Kea, please include the educational schedule with the names of schools, classes, etc. in the FEIS. T

How can NASA consider building telescopes 3 and 4 close to the steep edges of Pu`u Hau`oki, when your DEIS acknowledges that, *"Kukahau`ula summit cones (site 21438). These cones (including Pu`u Hau`oki) are considered eligible for the National Register of Historic Places (NRHP) because of their association in Native Hawaiian mythology with Wakea, the sky god and ancestor of the Hawaiian people, and with Kukahau`ula, a male deity, who has been identified as a form of the god Ku and the lover of Poli`ahu. Kukahau`ula is also identified in Hawaiian traditional histories and genealogies as a chief, an `aumakua (family deity) of fishermen, and the husband of Lilinoe. The summit is thus associated with the activities of Hawaiian deities, and appear as the focal point in numerous legends and oral histories. These cones are also critical landscape elements in maintaining the integrity of Mauna Kea."* U

Doesn't this proposal conflict with the statement, "*Grading and removal of earth for new structures, redeveloped structures, roads, and other astronomy projects could further affect*

these resources adversely."?

The DEIS acknowledges that there would be a 'minor increase in electrical demand during construction and installation.' What is the current electrical demand for NASA? How much would it be increased? Over how long a period is that increase expected? How does NASA currently pay for their electrical use? V

The DEIS states that the project would *'have a small positive socioeconomic impact on the County and State of Hawai`i.'* What is the current socioeconomic impact of NASA's use of Mauna Kea? What is the expected positive increase? Does NASA have telescopes in other parts of the world? Does NASA pay rent for the use of those sites? If so, how much rent does NASA pay for its sites? Please be specific and provide a full accounting site by site. Does NASA has 'time allocation' agreements for its telescopes in other places? Please describe these agreements in detail along with a full accounting of the agreements and the arrangements for these time allocations as well as any contracts you have entered into. W

The DEIS states that up to six permanent signs would be located on the site, primarily along the Pu`u Hau`oki crater rim (which Life of the Land finds insulting) to inform visitors of the historic and cultural significance of the crater and the need to protect the wekiu bug. Who will create these signs? What is the cultural and environmental, entomological experience of this person and/or entity? Will the signs be in both the official languages of Hawai`i - Hawaiian and English? X

Have the telescopes already been built? If so, where were they built? If not completely built, are there any components already built? If so, where were they built and where are they being stored now? Who built them? Please give the name and address of the company. How are they to be installed? What measures are taken to minimize damage to cultural properties and the environment? What guidelines are provided to the company to minimize damage? Who wrote or will write the guidelines and train the company's employees? How long will each installation take? Who will install them? Please give the name of and address of the company. How will the telescopes and/or their components be carried up to the summit? How much does each component weigh? Will all the components be stored on the mountain or brought up piece by piece? Where will they be stored? Will there be increased security until they are all installed? Y

Has the contractor already been hired? Who is it? How many workers will be needed to build/install the telescopes? What are the 'best management practices' referred to in the DEIS? Who will educate and train the construction workers to make them aware of the sensitive environment, historic and cultural significance of Mauna Kea? What is that person's/entity's experience? Z

How many new jobs will be generated from this project? What types of jobs will be created? Will local people be given the right of first refusal for these jobs? How many local residents are currently employed by NASA? How will those new jobs be advertised for workers? Is NASA willing to train local people to perform those jobs? AA

What is required to maintain the telescopes? How often is maintenance performed? Does maintenance require the hiring of people not usually at the site? The DEIS states that the bearings require periodic lubrication. How often do they need to be lubricated? What is the lubricant used? How is it applied? Does it ever spill onto the ground? How is that cleaned up? What is done with soil that has been in contact with the lubricant? Where is the lubricant stored? Is it the same lubricant used by other telescopes? Do the telescopes share the lubricants and chemicals needed to keep their equipment in working order? **BB**

What is the 'common cleansing solution' referred to in the DEIS? How is it used? If water is used with it, what happens with the rinse water? Chemicals and water are used to remove the aluminum surface. What chemicals? Are they toxic? How are they described by the EPA? What happens with the rinse water? How is it disposed of? Is disposal on Mauna Kea or is it transported off the mountain? If it is transported, where is it taken? How is it disposed of? Are there any special permits needed for the use of these chemicals? If it is stored on Mauna Kea, where is it stored? Are the cleaning solutions shared by all the telescopes operating on Mauna Kea? Are any of these chemicals considered hazardous by either the State Department of Health or the U.S. Environmental Protection Agency? How are the containers disposed of? Who pays for disposal? Do the telescopes share these costs? **CC**

What other chemicals are used on Mauna Kea? Please describe them and their effect on human health and the environment in detail. What is the Maximum Contamination Level (mcl) of each chemical according to the State Department of Health and the U.S. Environmental Protection Agency? How are these chemicals stored? How much is stored on Mauna Kea? Have there been spills or other contamination caused by these chemicals? If so, please describe the date, the incident and the action taken to clean it up. **DD**

With the technological advances being made in astronomy, does finding the origin of life have to be done on Mauna Kea, or can it be accomplished by satellites monitored by computers from below? Could two satellites triangulate with the star or celestial body being studied instead? What are the strengths and limitations of space-based systems? Please describe the latest technologies available to accomplish this and where it is or might be used. **EE**

The DEIS admits that, '*future activities on the summit of Mauna Kea would continue the substantial adverse impact on cultural resources. No area at or near the summit is assumed to be devoid of archaeological properties, including the slopes surrounding the pu`u, which can be indirectly affected by the development of the pu`u.*' It is commonly held that there are many sites yet to be discovered on Mauna Kea. How then, with that admission, can NASA propose this project? Life of the Land is at a loss to understand the conflicting statements made by NASA. How can you mitigate the loss of cultural treasures known and yet to be known? **FF**

The DEIS mentions that there will be cultural monitoring during on-site construction and installation. Who will the cultural monitors be? How will they be chosen? Will Kanaka Maoli with ancestral ties be given unfettered access during construction? Will cultural monitors be paid? If so, who will pay them? Will they only be observants, or will they have the ability to stop construction in the event that an important discovery is made? Who will they interface with? What agency and or entity will they consult with? Has NASA contracted **GG**

with cultural monitors in other locations? If so, please include a copy of a typical contract for a cultural monitor. GG

Will NASA favorably consider contracting with an entity of Native Hawaiians to contract with other entities to sell viewing time on the telescopes, so that Constitutional obligations between the State and Native Hawaiians can be met? If so, please describe how NASA plans to accomplish this. If not, please explain why not. HH

Life of the Land is concerned about water management and hazardous waste disposal. How much solid waste is generated each day on Mauna Kea? How much will it increase if this project is approved? How is waste currently disposed of? What hazardous materials are generated on Mauna Kea by all the activity there? Please describe these in detail as well as the disposal method used. If it is transported off the mountain, where is it taken? Please describe in detail the hazard waste type and the optimum disposal method, II

What types of vehicles will be used during the proposed construction? How many are anticipated to be used? Where will they start? What route are they expected to take? How will this affect traffic? What time of day would they be traveling on public roads? How will this affect the current traffic patterns? What mitigation measures are anticipated to be undertaken to minimize the impact on the existing community? JJ

At the September 2, 2004 public hearing, it was mentioned that NASA is concurrently seeking a Conservation District Use Permit while this DEIS is out for public comment. Please include a copy of the application for the CDUP that has been filed for this project. KK

Sadly, the community has learned that when the astronomy community is caught and fined, they are appropriately contrite and some are possibly remorseful, but they quickly revert back to their old destructive and disrespectful ways. What will NASA do to earn the trust of the community? Please describe your plan to gain community trust in detail. LL

Please understand that Mauna Kea is not yours. Auntie Pua has explained that it is not hers, either. Mauna Kea is Akua's. It is a holy place to be cared for and nurtured. It is the guiding star to help the Kanaka Maoli know their place in the universe. Please educate yourself about this sacred place.

We will never forget the deep sadness we felt when we had the privilege to visit Mauna Kea. We thank Akua for making that visit possible and for helping us understand and feel what Mauna Kea is and why it is so vital, not only to Hawaiian culture, but to the world. MM

Mauna Kea, the sacred temple, looks more like an industrial park than a temple. We could immediately feel its mana and know why it evokes such visceral emotions. We feel them as well, even though we are guests in the magnificent place. We feel called upon to do all we can to protect Mauna Kea for future generations...for the whole world. We all have much to learn from her. And if you stop for a moment, you can learn too.

To quote the great poet Arundhati Roy: *"I think my eyes were knocked open and they don't close. I sometimes wish I could close them and look away... But once you've seen certain things, you can't un-see them, and seeing nothing is as political an act as seeing something."*

This powerful quote sums up our feelings about Mauna Kea. We wish we could unsee the damage done to her, but we know that is not possible. So we are doing what we can to make you scientists understand that this is not the place to continue development. You must learn to share what is there and not expand development. NO MORE. MM

Use your technology to figure our some other way to study the origin of life, because while you scientists are searching for the origins of life, you are destroying the very sacred ground on which you are standing, where the answers to many of the questions you are seeking reside for us.

Mahalo for this opportunity to offer comments on the DEIS.

Ua Mau Ke Ea O Ka 'Āina I Ka Pono

The Life of the Land is Perpetuated in Righteousness

Sincerely,

Kat Brady
Assistant Executive Director

Kat Brady
Life of the Land
September 29, 2004

Response to Comment A:

Copies of the DVD's for all of the public meetings were provided to Life of the Land.

Response to Comment B:

The Outrigger Telescopes would be an upgrade to the W.M. Keck Observatory. The Outrigger Telescopes would make a unique contribution to NASA's program to discover and study planets around other stars. This contribution cannot be duplicated with any other existing telescopes.

Response to Comment C:

NASA is committed to being a responsible steward in the implementation of the Proposed Action. NASA made a considerable effort to consult with interested and concerned parties about the Outrigger Telescopes Project. As a result, NASA has made numerous commitments to on-site and off-site measures that would mitigate adverse impacts, and to the extent practicable protect and enhance the cultural and environmental resources of Mauna Kea. In addition, NASA will commit $2 million to an initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians as a mitigation component of the Outrigger Telescopes Project, if NASA selects the W.M. Keck Observatory site.

Response to Comment D:

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No final decision will be made until the National Environmental Policy Act process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment E:

The Outrigger Telescopes Project mitigation is not intended to address 40 years of past action. The purpose of the mitigation is to limit the incremental impact of the Outrigger Telescopes Project. Although most of NASA's mitigation measures are directly related to the Outrigger Telescopes Project, some measures extend beyond the scope of the project. For example, as part of the Outrigger Telescopes Project implementation and mitigation, NASA will fund a Wēkiu Bug autecology study to gather more information about habitat requirements, life cycle, nutritional requirements, and breeding behavior of this unique bug.

Kat Brady
Life of the Land
September 29, 2004

Response to Comment F:

The Proposed Action addressed by the EIS is the on-site construction, installation, and operation of the Outrigger Telescopes, and, as stated in the Environmental Justice section of the EIS, the impact of the health and environmental effects of the Proposed Action on minority and low income communities ranges from very small to negligible. As further stated in that section, NASA recognizes the significance of Mauna Kea to the Native Hawaiian community, and addresses the effects of the Proposed Action on cultural resources elsewhere in the EIS.

There is no evidence that the proposed project would impact burials, shrines, or archaeological properties. However, NASA proactively completed a Draft Burial Treatment Plan specifying procedures to deal with an inadvertent discovery of human remains. Following an initial informational presentation of the Draft Burial Treatment Plan to the Hawai‘i Island Burial Council in April 2004, public burial notices were placed in local newspapers in early May and an amended Draft Plan was submitted to the Council. The plan was discussed at the Council meeting on August 19, 2004. The members of the Council expressed their general agreement with the procedures recommended in the Burial Treatment Plan for monitoring during the Outrigger Telescopes construction and for treating any human remains uncovered during construction. Because no actual burials are known to be present, the Council took no action actually approving the plan or its procedures, concluding that this would be beyond its purview at this time. In addition, a qualified Archaeologist would be present during all excavation activities.

Response to Comment G:

The discussion on socioeconomics can be found in Sections 3.2.10, 4.1.9, and 4.2.11. The question of revenue from ceded lands is a matter for the State of Hawai‘i to resolve. The community also benefits from a highly educated astronomy work force that can be used as an educational resource.

Response to Comment H:

Access to the summit of Mauna Kea has improved as a result of the development of the summit. In particular, the construction and improvement of the Mauna Kea Access Road in the Region of Influence has made it possible for the public, including many Native Hawaiians, to travel to the summit. The road is occasionally closed to vehicular traffic when road conditions such as snow and ice render travel unsafe. Other than such temporary road closings, there are no access restrictions (except into the observatories themselves) to any part of the summit region.

Response to Comment I:

NASA recognizes the Mauna Kea Science Reserve (MKSR) Master Plan which was approved by the University of Hawaii Board of Regents on June 16, 2000 (UH 2000b). On February 2, 2000, Governor Benjamin J. Cayetano accepted the MKSR Master Plan

Final Environmental Impact Statement (MKSR FEIS) as satisfactorily fulfilling the requirements of Chapter 343, Hawaii Revised Statutes (State of Hawai‘i 2000). The MKSR FEIS contains a November 2, 1999 comment letter from the Department of Land and Natural Resources (DLNR) signed by Timothy Johns, Chairperson, in which he states DLNR’s position regarding the Master Plan. “The Department of Land and Natural Resources would continue to review each situation in the context of a Conservation District Use Application. . . DLNR’s acceptance and consideration of applications for new uses, such as telescopes, will be contingent upon implementation of the local design review process and more generally, the performance of the local management authority in fulfilling its stated responsibilities. . . It will be the University’s and the telescope operators’ responsibility to ensure that procedures outlined in the Master Plan are followed for day-to-day management and development guidelines. Failure to do so could jeopardize Conservation District Use Application approvals and any future telescope development on Mauna Kea.” Under the heading “New Management Responsibilities,” Mr. Johns further states that “A Hilo-based review process, with the Board of Land and Natural Resources continuing to consider individual CDUAs and sublease agreements, would guide new telescope and facilities development. DLNR enforcement would be limited primarily to compliance with Conservation District Use Permit conditions and response to enforcement issues related to violations of Conservation District laws. . .”

Response to Comment J:

The University of Hawai‘i's responsibility to acquire a Conservation District Use Permit (CDUP) and the Federal Government's responsibility to complete the National Environmental Policy Act process are separate and independent processes.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. If a decision is made to proceed with the Proposed Action at Mauna Kea, the Outrigger Telescopes Project would be bound by all terms of the NASA ROD, the National Historic Preservation Act Section 106 Memorandum of Agreement, and the CDUP. Each of these terms is enforceable either through a regulatory authority or contract.

Response to Comment K:

NASA acts as a funding agency to the University of Hawai‘i Institute for Astronomy (UH IfA) in support of research and development initiatives. Most specifically, UH IfA receives funds under a cooperative agreement with NASA to operate the Infrared Telescope Facility (IRTF). State agencies, particularly the Office of Mauna Kea Management (OMKM), have general responsibility for managing the resources of Mauna Kea. NASA has no authority over State lands.

Response to Comment L:

The causes of the apparent Wēkiu bug decline between 1982 and 1997-98 are not known. Hypotheses include climate change, a possible long-term downward trend in winter snow pack depth and persistence, scientific sampling, introduction of predatory alien

arthropods, mechanical habitat disturbance from observatory construction, recreational impacts, vehicle impacts, long-term population cycles, and the possible presence of environmental contaminants from human activities. The most likely cause would probably be a combination of some or all of the above factors. Recent trapping data from the ongoing Wēkiu bug Baseline Monitoring effort being conducted by California Association for Research in Astronomy (CARA) indicates that trapping rates have returned to about the same level as in 1982 on Pu‘u Hau‘oki.

The Wēkiu Bug Mitigation Plan calls for Wēkiu bug habitat restoration as mitigation, to replace the habitat that would be displaced by on-site construction and installation of Outrigger Telescopes 3 and JB-5. At least 0.024 ha (0.057 ac) of habitat would be restored in areas disturbed by previous construction activities. The overall habitat displacement of the Outrigger Telescopes Project would be very small (an increase of about 0.06 percent), and there is potential to increase the amount of available habitat through restoration. See Response to Comment F. Also, please refer to Section 4.1.2.2 and Appendices D and E for Wēkiu Bug mitigation information.

Response to Comment M:

NASA is the nation's civil space agency, established by the National Air and Space Act of 1958 (Pub. L. No. 85-568, As Amended). NASA space missions and related research programs are conducted for peaceful, scientific purposes. NASA and the Department of Defense (DoD) may at times have a common interest in the development of a particular technology. For example, DoD developed a technology called *adaptive optics* that is used for scientific studies at ground-based astronomical observatories (such as the W.M. Keck Observatory) to correct telescopic images for distortions caused by Earth's atmosphere. Additionally, DoD and NASA occasionally work together to develop a technology of interest to both agencies. A list of all such projects is beyond the scope of this EIS.

Response to Comment N:

See Response to Comment M. Many of the questions posed in this comment are outside the scope of the EIS.

Response to Comment O:

The University of Hawai‘i paid the fine associated with the violations and by receipt of a letter on October 21, 2004 addressed to Robert McLaren, Associate Director of the UH IfA, from Samuel Lemmo, Administrator of the Office of Conservation and Environmental Affairs, it was determined that all violations have been adequately resolved (UH IfA 2004h).

Response to Comment P:

NASA has no relationship with DLNR. NASA interacts with the University of Hawai‘i as a funding agency. See Response to Comment K.

Kat Brady
Life of the Land
September 29, 2004

Response to Comment Q:

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system are negligible.

Response to Comment R:

Section 3.1.5.2 of the EIS, provides information about mirror decoating wastewater. Analysis by Aqua/Waste Engineers in 2001 showed this wastewater to be non-hazardous, and it has been accepted for disposal by the public wastewater treatment plant in Waimea. A CARA-authorized driver transports the wastewater in sealed drums by flat-bed truck to W.M. Keck Observatory Headquarters in Waimea. The wastewater is pumped out (currently) by Bob's Pumping Service and transported to the treatment plant.

Response to Comment S:

In general, observing time on research telescopes is awarded on the basis of competitive proposals submitted to Telescope Allocation Committees (TACs). The TACs review proposals on the basis of scientific merit and technical feasibility. They present the results of their review to a selecting official who makes the final award determinations.

If the Outrigger Telescopes are installed at the W.M. Keck Observatory, observing time would be awarded through four TACs. These are the TACs operated by NASA, Caltech, the University of California, and the University of Hawai‘i to review proposals for observations at the W.M. Keck Observatory. Observers awarded telescope time occasionally trade that time with another observer who has also been awarded time. Rarely, telescope time trades are made between observatories. However, observers must use their assigned time for the scientific program described in their proposal. If for any reason they determine in advance that they cannot conduct the proposed observations, the time will generally be reassigned on the basis of the TAC reviews to another proposer. Observers do not "own" their assigned observing time; they must use it for the investigation proposed, and cannot transfer or "sell" their time to any other party for another purpose. Because telescope time is assigned in advance (in 6-month blocks at the W.M. Keck Observatory), there is limited ability to accommodate observers who cannot make their observations because of unexpected telescope or instrument down-time. As is the case for observers who encounter bad weather, the main recourse is to repropose for additional observing at a later time. The W.M. Keck Observatory Director has final authority over telescope time assignments.

Response to Comment T:

NASA awards grants for educational activities competitively, essentially in the same manner it awards scientific research grants. Proposals to NASA for educational programs are peer reviewed. A selecting official then makes the final award determinations on the basis of the reviews. Most NASA supported programs in the

public schools are the result of a successful proposal to NASA by someone associated with that educational system. NASA also makes speakers (*e.g.*, astronauts, scientists, engineers) available in response to specific requests.

Response to Comment U:

NASA recognizes there would be an impact associated with placing Outrigger Telescopes 3 and 4 in close proximity to the edge of Pu‘u Hau‘oki. There have been several design changes and mitigation measures adopted to minimize the disturbance to the surrounding area. Appendix C contains the mitigation measures that NASA proposed for the Outrigger Telescopes Project.

Response to Comment V:

The current electrical demand for each observatory on Mauna Kea is listed in Table 4-22 of the EIS. The addition of the Outrigger Telescopes would increase electrical demand at the W.M. Keck Observatory by about 34 percent to 705 kW. See Section 4.1.8 and 4.2.10 of the EIS for additional information.

Response to Comment W:

The commenter is referred to the socioeconomic sections of the EIS, see Section 3.2.10, 4.1.9, and 4.2.11. The remaining questions are outside the scope of an EIS.

Response to Comment X:

Design of the signs would be consistent with the guidelines presented in the Mauna Kea Science Reserve Master Plan and conform to criteria specified in HAR 13-5-22. Before installation, the sign design and specifications would be submitted to both DLNR and OMKM for approval. See Section 2.1.3.6 of the EIS for additional information.

Response to Comment Y:

The Outrigger Telescopes were built by EOS Technologies in Tucson, Arizona. Please refer to Section 2.1.3 of the EIS for information that pertains to the on-site construction and installation of the Outrigger Telescopes.

Response to Comment Z:

A construction contractor has not been hired at this time. See Section 2.1.3.9 of the EIS for information on the number of workers that would needed to install the Outrigger Telescopes. The Construction Best Management Plan (BMP) is a working document designed to facilitate project management by developing an organizational structure that will guide construction management, designate who has the authority to make decisions, and provide a checklist to ensure compliance with all mitigating measures and conditions on the project. See Appendix F of the EIS to review the BMP.

The Cultural Monitor will provide cultural orientation to individuals who are associated with the on-site construction and installation of the Outrigger Telescopes and who will be on Mauna Kea. In consultation with NASA and the other Consulting Parties, CARA

shall develop criteria for and select an individual to be the project's Cultural Monitor. See the Memorandum of Agreement in Appendix B for additional information.

Response to Comment AA:

The Outrigger Telescopes Project would result in the creation of approximately 35 temporary jobs (construction crews, Archaeologist, Cultural Monitor, etc.) on Mauna Kea. It is estimated that a total of eight full-time personnel would be added to the W.M. Keck Observatory staff. In addition, there could be several new technicians who would work on the summit. CARA would have the responsibility of hiring new personnel. NASA is the funding agency and does not employ any people on Mauna Kea or for Mauna Kea- related activities.

Response to Comment BB:

Section 3.1.5.2 of the EIS describes the types of materials and work activities involved in maintaining the W.M. Keck Observatory telescopes. Routine maintenance at the observatory is performed daily by the CARA facilities group in coordination with Keck staff. Lubrication of ball bearings throughout the observatory is also described in this section. The lubricant is standard industrial grease, and it is applied with a grease gun. The operation is performed indoors, so the grease, if spilled, does not touch soil and is wiped up promptly. Lubricants such as grease are also used by other telescopes, but there is no program to share lubricants or other chemicals routinely between observatories.

Response to Comment CC:

The common cleaning solution is Liqui-nox® made by Alconox, Inc. Its use and disposal are described in Section 3.1.4.5 of the EIS. Section 3.1.5.2 provides substantial information about mirror decoating, including a list of the chemicals applied during the process, their hazard classification, and the nature and disposal of the resultant wastewater. There is no program to share these chemicals routinely between observatories. Analysis by Aqua/Waste Engineers in 2001 showed the Keck mirror decoating wastewater to be non-hazardous, and it has been accepted for disposal by the public wastewater treatment plant in Waimea. A CARA-authorized driver transports the wastewater to W.M. Keck Observatory Headquarters in Waimea whereupon Bob's Pumping Service transports it to the treatment plant. The W.M. Keck Observatory reuses the containers it uses to transport the wastewater. The W.M. Keck Observatory bears the cost of disposal.

Response to Comment DD:

Sections 3.1.5.2 and 4.2.6.2 of the EIS provide a substantial summary of the chemicals used and stored at the W.M. Keck Observatory and other observatories, respectively. The evaluation presented in Section 4.6.2 concludes that the impacts by hazardous materials have not been significant. Maximum Contaminant Levels are relevant to represent the maximum permissible level of a contaminant in water that is delivered to any user of a public water system. W.M. Keck Observatory and the other observatories

do not deliver water to public water-system users. Section 4.2.6.2 summarizes the type and amount of chemicals stored at the observatories and Hale Pōhaku. The chemicals are stored in a manner appropriate for that material, such as in flammable products cabinets, corrosives storage lockers, and drums placed within spill containment pallets. Section 4.2.6.2 also summarizes hazardous material spills and spill responses, including dates, associated with astronomy operations on Mauna Kea.

Response to Comment EE:

Space missions and ground-based programs each make unique contributions to NASA's Origins program, particularly to the search for worlds around other stars. Detecting planets in orbits like those of Uranus and Neptune (periods of 84 and 165 years, respectively) requires observations over many decades (a significant fraction of one orbital period). Space missions generally have lifetimes of a decade or less. It is therefore not practical to detect planets with periods of several decades to more than a century from space.

Connecting the Outrigger Telescopes to one or more 8- to 10-meter telescopes (a requirement of the Outrigger Telescopes Project) is also not possible in space, in part because the technology for such a large space telescope does not yet exist. For these reasons, the goals of the Outrigger Telescopes Project cannot be achieved in space.

Response to Comment FF:

No individual archaeological sites have been identified within the proposed Outrigger Telescopes Project area. Mitigation measures for cultural impacts associated with the Outrigger Telescopes Project are set forth in the Memorandum of Agreement (MOA), including cultural and archaeological monitoring of the construction area, education of workers on site, mandatory adherence to the construction Best Management Practices Plan, adhering to the Burial Treatment Plan developed for this project, and general historic property protection measures (see Appendices B, C, and F of the EIS). Please refer to the MOA for additional information that pertains to the selection and role of Cultural Monitor.

Response to Comment GG:

Based on best available information, NASA is not aware of any contractual relations with any cultural monitors in other locations.

Response to Comment HH:

NASA takes no position on the Constitutional obligations between the State of Hawai‘i and Native Hawaiians.

Response to Comment II:

Table 4-19 in the EIS summarizes solid waste (*i.e.*, trash) generated by each of the observatories and Hale Pōhaku on a weekly basis. Section 4.1.4.2 estimates the increase in solid waste generation due to operation of the Outrigger Telescopes. Sections 3.1.5.1

and 4.2.6.2 describe the disposal of solid waste. It is disposed of in the landfills in Hilo and Waikoloa. Sections 3.1.5.2 and 4.2.6.2 provide a substantial summary of the hazardous materials used at the W.M. Keck and other observatories, respectively. In addition to Unitek Solvent Services, Inc., listed in the EIS, Philips Services Corporation, Haztech Environmental Services, and Hawai‘i Petroleum, Inc., were identified by the observatories as firms handling the disposal of their hazardous and industrial-type (*e.g.*, used oil) waste. These wastes are transported off Mauna Kea for disposal. The waste is either recycled in Hawai‘i or shipped to the mainland for disposal.

Response to Comment JJ:

Please refer to Section 4.1.7 entitled Transportation.

Response to Comment KK:

See Response to Comment J. Members of the general public may ask DLNR for a copy of the CDUA or CDUP.

Response to Comment LL:

Please refer to Response to Comment C.

Response to Comment MM:

Your comments are respectfully noted.

OUTRIGGER TELESCOPES PROJECT
COMMENTS FORM

NASA welcomes and encourages written public comments on environmental impacts and concerns (including historical, archeological, and traditional cultural issues) and proposed mitigation associated with the proposed Outrigger Telescopes.

Your comments will be reproduced in the Final EIS for the Outrigger Telescopes Project. If you prefer that your name not be published with your comments, please express that desire in the comments section below. NASA will not publish your address in the Final EIS.

Your comments may be written on this form and left at the registration desk. Or, you may send your comments to Carl B. Pilcher, Program Executive, Science Mission Directorate, Universe Division, NASA Headquarters, 300 E Street SW, Washington, D.C. 20546-0001. Comments must be provided in writing and received by NASA on or before 4:30 PM Eastern Daylight Time September 30, 2004; fax (202-358-3096) or e-mail (otpeis@nasa.gov)

Commenter's name: Paul Campbell

Commenter's full address (street, city, state, and zip code):

Date: 8/29/04

Place an X in this box if you wish to receive copies of future environmental planning documents on the proposed Outrigger Telescopes Project (including the Record of Decision) that NASA distributes to the public. [X]

Comments: The new EIS on Outrigger acknowledges at last, the cultural significance of Mauna Kea. In my opinion, enough is enough. Let's rather re-focus on Hubble! Keep it going. No more scopes on our beloved mountain, please.

Paul H Campbell

Paul Campbell
August 29, 2004

Your comments are respectfully noted.

Harry Kim
Mayor

Jane H
Dire

County of Hawaii

DEPARTMENT OF RESEARCH AND DEVELOPMENT
25 Aupuni Street, Room 219 • Hilo, Hawaii 96720-4252
(808) 961-8366 • Fax (808) 935-1205
E-mail: chresdev@interpac.net

September 30, 2004

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
300 E St., SW
NASA Headquarters
Washington, DC 20546-0001

Dear Dr. Pilcher:

Re: Draft Environmental Impact Statement for the Outrigger Telescopes Project – Mauna Kea Science Reserve, Island of Hawai`i.

We would like to take this opportunity to comment on the referenced Draft EIS, specifically Section 4.1.8.2, Impacts of the Outrigger Telescopes Project on Utilities and Services.

In discussing the operational impacts of the outriggers, it is indicated that estimated demand for each outrigger telescope is 30 kW and that total demand for the W.M. Keck Observatory site would increase by 34% to about 705 kW, an amount that would have no impact on the electrical supply system at the Keck site. While this may be the case, there will, of course, be an increase in the electrical demand from HELCO's grid and, correspondingly, the power generating units across the island most of which are fossil fueled. The combined power demands of the Keck observatories together with the other telescopes located on Mauna Kea currently amounts to 2,230 kW, making the Mauna Kea Science Reserve one of the largest consumers of electricity on the Big Island.

The Mauna Kea Science Reserve is also one of the best locations in the nation for average daily insolation, making it an ideal site for the generation of electricity using photovoltaic (PV) systems. We therefore recommend that NASA consider installing a PV system at Hale Pohaku. At the minimum this could be a small system designed to offset the daytime usage of the visitor center. This would demonstrate NASA's awareness of the benefits of renewable energy derived directly from the sun, our nearest star, and also serve to educate the public about photovoltaic power generation, a technology owing much of its initial development to NASA's early space program. A

A more ambitious project would be to install a much larger system to generate a significant fraction of the total usage at the Mauna Kea Science Reserve. If all the observatories contributed to this installation, each could benefit proportionately, assuming HELCO is amenable to offsetting the observatories' nighttime demand with the daytime power production of the photovoltaic system. **A**

We hope that NASA is able to make a commitment to meeting a significant portion of its electricity needs by using solar power. This would reduce expensive oil imports to the Big Island, delay the need to build another power plant to meet increasing demands on the grid, and effectively demonstrate NASA's commitment to minimizing the environmental impacts of the telescopes. **B**

We thank you for the opportunity to comment on the Draft EIS.

Yours truly,

Raymond Carr Ph.D.
Energy Coordinator.

c.c. Jane Testa, Director
Harry Kim, Mayor

Raymond Carr
County of Hawai‘i
Department of Research and Development
September 30, 2004

Response to Comment A:

The W.M. Keck Observatory studied the viability of a photovoltaic system to support electrical demand. To produce a significant amount of power, the system would have to cover most of the observatory and carport roof with solar panels, about 200 in total. According to an insolation survey, the system would produce about 154,000 kW-hours of power per year. This is about 5 percent of the Observatory's total consumption of 2,857,000 kW-hours last year.

The Outrigger Telescopes are expected to increase power demand at the W.M. Keck Observatory by about 34 percent. This corresponds to additional power usage of about 900,000 kW-hours per year. A photovoltaic solar power system would produce about 154,000 kW-hours of power per year which is only a small fraction (17 percent) of the additional power required for the Outrigger Telescopes.

The W.M. Keck Observatory chose not to pursue this project for two reasons.

- It was not clear that the proposed panels could withstand a 100-year storm.
- Cost savings were minimal.

Since adequate power is available through the existing Hawaiian Electric Light Company (HELCO) service, and because there are serious issues associated with ensuring that a solar power system can survive and function under the severe conditions at the summit of Mauna Kea, this option was not considered further.

However, your recommendations have been forwarded to the University of Hawai‘i for further consideration.

Response to Comment B:

Your comments are respectfully noted.

TO: Dr. Carl Pilcher
Outrigger Telescopes Project
Astronomy and Physics Division
Office of Space Science

FROM: Clarence Ching

DATE: October 30, 2002

SUBJECT: Comments on Draft Environmental Impact Statement for The Outrigger Telescopes Project

Dr. Pilcher,

The following comments are timely filed on behalf of my individual self for the Subject purposes. My comments will be made somewhat as you have listed in Executive Summary, pp. xiii to xxv.

I. THE PROJECT

As it is stated, the Draft Environmental Impact Statement (hereinafter referred to as "EIS") is being made "to support decision-making on whether to fund the on-site construction, installation, and operation of the Outrigger Telescopes Project." And that "No final action will be taken by NASA regarding funding for the on-site construction, installation, and operation of the Outrigger Telescopes until the decision-making process under the National Environmental Policy Act has been completed."

However, THE Outrigger Telescopes Project is one that includes, as an essential operating component, light gathering devices known as a lenses, or telescopes. Said optical components are essential parts of the system as the project is described – The **Outrigger Telescopes Project.** Without optics, there is NO Outrigger Telescope Project.

A

Therefore, it is imperative that the optical parts of the proposed system be an essential component of this EIS. Without telescope systems, there is **NO** Outrigger Telescopes Project.

However, probably by intent, the optical component(s) have been bifurcated out of this EIS. This is the product of a fatal decision made by administrators of this Project. Such a position, taken arbitrarily, is a deception, misrepresentation, or fraud in the undertaking of this project.

It is fairly common knowledge that the construction of the telescopes for the project have already been completed. In light of the restriction for funding until **after** a final decision has been made as a conclusion of this EIS process, because funds have already been spent on the telescopes, an essential and integral part of this project, a major violation of this EIS process, challengeable in court, has already taken place.

That the telescopes have been bifurcated out of the EIS also shows a lack of good faith in the scope and depth that NASA assumably should have in carrying out this EIS process.

II. INTERFEROMETER COMPONENTS ALREADY IN PLACE

In meeting the requirements and objectives for its being, NASA needs to utilize telescopes of high resolution. Interferometry, the combination of two or more telescopes optically and electronically connected to act as one "big" telescope, is critical technology for obtaining such resolution. The Outrigger Telescopes are designed, by increasing the baseline, the distance between the lenses, and thus converting the Keck Telescopes into one "super-large" interferometry instrument.

B

However, the components of an even larger, and by implication one with finer resolution, interferometer (than using the Outriggers) is already present on Mauna Kea. Connecting the other existing observatories would solve the problem. But this possibility, which should be included here, has been left out of this EIS. B

While the necessary softwear to integrate this "super" interferometer is not yet in existence, the technology to make the interferometer involving the implementation of the "Outriggers" is unproven at this point too. An additional consideration is that, and this might even be conjecture, that the twin Keck's working in tandem has not been 100% perfected either.

III. THE USE OF THE TERM "PREVIOUSLY DISTURBED" IS DISINGENUOUS.

While it may be argued that the ground that the proposed Outrigger Telescope Project has already been "previously disturbed" is disingenuous. Such attempted use begs the question. For example, in preparing the site for the two Keck Telescopes, the surrounding land had to be cleared, if only for parking. However, that "clearing" is now being used as justification for minimizing any "new" damage because it has already been damaged.

If every approved project includes some circumstantial clearing, then that clearing will pave the way for the next expansion. Such an argument can be used *ad infinitem* until the entire area is covered by telescopes.

Such a specious argument denotes a defect in western-style thinking.

From my point of view, and this point of view is operational for me and my religious beliefs, the removal of 30 plus feet of the top of Pu'uHauoki was a desecration. Further disturbance of this so-called "previously disturbed" area, in my book, IS further desecration.

Western views are restricted to a two-dimensional outlook and involving tangible qualities. In my kanaka maoli (Hawaiian) point of view, sacredness of the 'aina (land) is three-dimensional and includes intangible qualities. C

Therefore, the tremendous volume of removed pu'u, that has been somewhat replaced by the two Keck Telescopes, continues to be sacred. In other words, removal of the pu'u did not remove the sacredness of the space that was created. And, the "new" excavation necessary for the foundations for the Outriggers will be further desecration in such a three-dimensional orientation. Therefore, the foundation excavations, according to my cosmology, is indeed further substantial desecration of the pu'u.

However, "cumulative impact" is defined by the National Environmental Policy Act (hereinafter referred to as "NEPA") as "impacts on the environment that results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions."

In this case, the former incremental impact of the "leveling" of Pu'uHauoki was an enormously horrendous desecration. When the definition of "cumulative impact" is taken into effect, the addition of a relatively small area for the four to six Outrigger Telescopes, albeit three-dimensional, of incremental impact, when added to substantial "past" desecration, results in a gargantuan "cumulative" impact that is unarguably unacceptable.

It is NOT the small incremental impact of the Outriggers that is important, it is the "addition" of that "small" incremental impact to the former gigantic impact, that is operational. Such a compilation amounts to a significantly unacceptable impact.

IV. THE CUMULATIVE IMPACTS ON CULTURAL RESOURCES

The fact that cultural resources were impacted to a great degree with the construction of the two Keck Telescopes is beyond argument. If permits to build the Keck's telescopes were to be attained at this time, there is no question that the significant impacts accompanying such construction would scuttle the project.

Some of the negative cultural qualities that the Kecks would have affected include, but are not limited by 1) access for viewing the alignments of certain heavenly bodies and their associated movements, 2) the loss of opportunities for daily ritual involving Kukahau'ula, and 3) the ability to view the physical form of the goddess Poli'ahu without interference.

The claimed small incremental adverse impact of the Outriggers, when added to the large past impact results, in applying the NEPA "cumulative impact" definition, is an outrageously large adverse impact. D

V. SIGNIFICANT IMPACTS OF WEKIU BUG HABITAT

The obliteration of superb Wekiu Bug habitat by the initial destruction of the top of Pu'uHauoki was significantly large and adverse.

While it is argued that construction of the Outrigger Telescopes would result in an "no" significant impacts on biological resources, by implementing the NEPA "cumulative impact" definition, the actual result is an outrageously large adverse impact. E

While NASA argues that any adverse impacts involving construction of the Outrigger Telescopes would be mitigated by habitat restoration, there is NO assurance that such habitat restoration will be successful. While NASA relies on the plan being developed in conjunction with U.S. Fish and Wildlife Service and "other scientists familiar with Wekiu bug ecology," there are other scientists who disagree. Frank Howarth and Fred Stone, two prominent entomologists who have worked on the bug, are in opposition to the proposed restoration plan. It is misrepresentation, deceit, and/or fraud to have completely ignored these scientists in promoting the supposed likelihood that the restoration plan is assumably completely workable and would result in actual habitat restoration. F

On the other hand, the EIS is noticeably vacant in any assessments of bugs other than the Wekiu. It is a fairly common expectation that there are other bugs and insects on the mountain and in the vicinity of the Kecks that do exist. No comprehensive study of them has taken place and the EIS surely overlooks them. A comprehensive survey of insecta in the project and surrounding area results in a significantly deficient EIS. G

VI. THE EIS IS DEFICIENT IN DISCUSSING WASTE MANAGEMENT

It was of great interest that Mr. Nance, who was deemed a qualified hydrology expert in the Conservation District Use Permit (hereinafter referred to a "CDUP") contested case, stated that he searched for but could not find any evidence at Waiki'i, a community located on the lower slopes of Mauna Kea, of detrimental substances that presumably came from astronomy installations. While such a discovery would be astronomically improbable, like finding the proverbial needle in a haystack, there has been no attempt made to carry out such assessments at the "source" of possible contamination.

On the other hand, the substances allowed to be injected into the mountain have to go some place. While transmission through subterranean channels may be relatively very slow, sooner or later, these substances will show up. That contamination of this island's water supply, no matter how infinitesimal, is still contamination.

As far as can be ascertained, there have been no assessments at the point where such substances would/could initially get into the ground. This is an important issue that needs to be reconsidered. How can NASA claim that there are no detrimental substances going into the ground when there have been no studies carried out at the point of possible introduction H

In fact the EIS is probably deficient in that raw sewage, until a year or so ago, was still permitted to enter the principal acquifer that the Keck Telescopes are situated over. Now that septic tanks and/or cesspools have been installed, the assumption is made that there is no detrimental substances going into the water table. If this is so, then I challenge NASA officials to partake of an effluent cocktail from that that is now being disposed of into the mountain. H

On the other hand, because human excrement is so distasteful in the realm of kanaka maoli culture, allowing even treated sewage to enter the mountain is a severe desecration, and something to be avoided at all cost. Such practice is a big insult to the Hawaiian culture – the proverbial slap in the face. However, if water used in telescope facilities must be trucked up the mountain, it wouldn't be such a difficult thing to truck human and other wastes thereby generated to be taken down the mountain. The EIS is deficient in any discussion of this matter. I

So, I am proposing that **ALL** waste water be trucked down the mountain. Will NASA take full responsibility to adopt rules and procedures that will guarantee that no further desecration encompassing any form of human waste take place on Mauna Kea? J

VII. THE SUGGESTION THAT THE 2000 MKSR MASTER PLAN IS CONTROLLING IS ERRONEOUS.

The statement is made (on page xviii): "The Outrigger Telescopes Project would be consistent with uses permitted in the Astronomy Precinct of the Mauna Kea Science Reserve and with the 2000 MKSR Master Plan."

Officially speaking, for purposes of applicable administrative rules (of the Hawaii State Board of Land and Natural Resources), there is NOT an Astronomy Precinct and NOT a viable 2000 MKSR Master Plan.

While the University of Hawaii, through its Institute for Astronomy, administers all astronomic activities on Mauna Kea, the Astronomy Precinct, from BLNR's standpoint, does not exist. K

Additionally, any reference to the 2000 MKSR Master Plan that creates an illusion that it controls what happens on the mountain is purely fiction. This is another attempt to use misrepresentation, deceit, and/or fraud to justify the use of THIS EIS for valid decision making.

The attempted confusion of a number of master plans and management plans have created a smokescreen that inhibits an honest and valid EIS process. To be validly considered (for instance in the maximum allowable numbers of telescopes on the mountain), by statutory requirement, THE "Master Plan" must be one that has been approved by BLNR. The 2000 MKSR Master Plan has not been approved by BLNR. Therefore its mention in the EIS merely provides a smokescreen in attempting to inject some kind of validity into this EIS process. This is ethically shameful and a violation of the principal of good faith.

VIII. NASA HAS NO VALID STANDING IN THE HAWAII STATE CDUP PROCESS.

While the University of Hawaii's Institute for Astronomy is the "Applicant," assumably with its joint venturers that includes NASA, for a Conservation District Use Permit (hereinafter referred to as "CDUP"), the truth is that NASA is not a legal member of the so-called joint venture.

The precedent has been set in the Keck I and Keck II construction procedures. BEFORE each of the separate Keck projects took place, there was an "Operational Agreement" entered into by ALL parties.

However, in the case of the Outrigger Telescopes, the subject of this EIS, there is NO such Operational Agreement in existence. Therefore, NASA is NOT a legal party to the CDUA that is before the BLNR. This fact, because it is of utmost importance to contractural and other requirements of the Outrigger Telescopes Project is a major impediment. And its absence in this EIS discussion is a material deficiency. L

IX. ANOTHER CUMULATIVE IMPACT DEFICIENCY

That the present Keck Observatories sub-lease extends to the year 2033, the date of termination of the general lease, all reasonably foreseeable cumulative impacts from past, present and future actions must be noted (see NEPA definition on "cumulative impacts").

Monitoring Wekiu bug habitat only during actual construction of the Outrigger Telescopes Project is short-sighted. Monitoring and reporting of Wekiu survival should continue for the entire life of the proposed project. Therefore, such "monitor" studies should be projected until 2033. M

On the other hand, there is a possibility that the facilities being proposed here will have to be torn down at the termination of the sublease in 2033. However, there is no such mention or plans for implementation of such deconstruction in the Draft EIS. These plans MUST be included in the EIS. Failure to do so would result in the EIS being materially deficient. N

X. FULL CONSIDERATION OF THE CANARY ISLAND ALTERNATIVE MUST BE CONSIDERED.

The existence of a valid and non-controversial alternative to locating the Outrigger Telescopes Project to the Gran Telescopio de Canarias, in Spain's Canary Islands, should be given full consideration and priority.

Because there are no significant adverse cultural and/or biological impacts, serious consideration to locate the Project to the Canary Islands seems to be the path of least resistance. O

While losing the Outrigger Telescopes Project to the Canary Islands may mean some negative impacts to the economic situation on Hawai'i Island, economic impact is not one of the eight criteria to be considered in granting or denying BLNR's CDUA process.

XI. CONCLUSION

The Draft EIS has numerous shortcomings as noted in these comments. Said comments should be noted and addressed in the forthcoming Final EIS. The ball is now in your court.

However, with the myriad substantial cumulative impacts expected by due consideration of the comments herein on the Draft EIS, the Outrigger Telescopes Project SHOULD definitely be re-located to the Canary Islands.

/s/ Clarence Ching
Clarence Ching

Clarence Ching
October 30, 2002

Response to Comment A:

The Outrigger Telescopes and their enclosures were designed and ordered shortly after funding became available in 1998. This was necessary because it was recognized that it would take 4-5 years for the Telescopes and their enclosures to be completed. NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No decision will be made until the National Environmental Policy Act process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment B:

The proposed Optical Hawaiian Array for Nano-Radian Astronomy (OHANA) Project would connect the existing observatories on Mauna Kea (see Section 4.2.2 of the EIS).

The OHANA and the Outrigger Telescopes Projects would achieve different science. With the very long baselines, OHANA would have a different (much higher) angular resolution, not as well suited to the planet-formation-related science as the Outrigger Telescopes. Also, while OHANA would achieve high sensitivity by combining large telescopes, it would always be limited in the number of telescopes available given the tremendous scheduling issues involved. Also, due to limitations of fiber optic communication technology, OHANA would be more limited than the Outrigger Telescopes. Finally, the astrometry program requires almost continuous nightly observations - that would never be possible with OHANA.

Response to Comment C:

The format for the cumulative impacts analysis was derived from and is consistent with the definition of cumulative impacts found in Council of Environmental Quality (CEQ) guidance. CEQ defines cumulative impacts as the incremental environmental impacts of the action when added to other "past, present, and reasonably foreseeable future actions. . ." (See 40 CFR 1508.7). The EIS acknowledges that from a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on cultural and biological resources is substantial, adverse, and significant.

Response to Comment D:

See Response to Comment C.

Response to Comment E:

The EIS acknowledges that from a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on biological resources on Mauna Kea is substantial and adverse.

Response to Comment F:

The Wēkiu bug studies have been conducted by a qualified entomologist. The mitigation measures were reviewed and approved by the U.S. Fish and Wildlife Service (USFWS) and follow all the recommendations given in previous Mauna Kea Science Reserve arthropod assessments (Howarth and Stone 1982; Howarth and others 1999).

In a letter regarding the Wēkiu Bug Mitigation Plan for the W.M. Keck Observatory, Outrigger Telescopes Project at Mauna Kea, the USFWS states "The Service [USFWS] supports the recommendations in the WBMP [Wēkiu Bug Mitigation Plan] to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor use. . . We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to the wekiu bug habitat." See Volume II, Appendix A, for the letter from USFWS/Henson (USFWS 2000).

The U.S. Department of Interior (USDOI) submitted a comment letter on the DEIS stating "It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wēkiu Bug Mitigation Plan and the Wēkiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities." See the USDOI comment letter from Patricia Sanderson Port located in this Appendix.

In addition, the USDOI letter states "These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology."

Response to Comment G:

Detailed quantitative information about the ten other native arthropods that are thought to be residents of the summit of Mauna Kea is unavailable. These arthropods are new to science and have not been described as species. However, the Wēkiu Bug Mitigation Plan addresses all of the potential stresses to the natural ecosystem on the summit of Mauna Kea from the proposed Outrigger Telescopes Project and would reduce potential impacts on the other native Hawaiian arthropods present as well. In addition, of the ten other native arthropods found within the summit area, six have also been found in the *Area Below the Summit Area Cinder Cones* (Howarth and others 1999). Any impact to these arthropods would be similar and likely proportionate to any impact to the Wēkiu bug. The remaining four arthropods, which include two species of mites and two species of sheetweb spiders, have been found only on the *Summit*

Area Cinder Cones (Howarth and Stone 1982; Howarth and others 1999). However, it is unlikely that the Outrigger Telescopes Project would have any reasonably foreseeable significant adverse effect on these species. See Sections 3.1.3.1, 3.1.3.2, and 4.1.2.2 for more details.

Response to Comment H:

No measurable groundwater contamination can result from the disposal of wastewater at the summit, as shown by the hydrologic analysis done as part of the cumulative impacts analysis in the EIS (see Section 4.1.3). The same analysis shows that wastewater from the observatories cannot reach Lake Waiau. All disposal of wastewater is done through State-approved septic systems. No hazardous materials are disposed of through the septic systems, but rather are trucked down by licensed and State-approved contractors.

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available scientific information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system are negligible.

Response to Comment I:

The text of the EIS was modified to reflect the disposal of sewage through septic systems contributing to an adverse impact on cultural resources. See Section 4.1.1.2 for more details.

Response to Comment J:

The proposed Outrigger Telescopes Project would use the W.M. Keck Observatory's existing sewage disposal system and offsite mirror decoating wastewater disposal practices, if NASA selects the Mauna Kea site. The W.M. Keck Observatory currently retains a licensed septic waste hauler to pump out the digested bio-solid sludge from the septic system every six months for disposal off site at an approved treatment facility. It is not within NASA's jurisdiction to require that all wastewater be trucked down the mountain. However, NASA has forwarded your request to the University of Hawai‘i for consideration.

Response to Comment K:

NASA recognizes the Mauna Kea Science Reserve (MKSR) Master Plan which was approved by the University of Hawaii Board of Regents on June 16, 2000 (UH 2000b). On February 2, 2000, Governor Benjamin J. Cayetano accepted the MKSR Master Plan Final Environmental Impact Statement (MKSR FEIS) as satisfactorily fulfilling the requirements of Chapter 343, Hawaii Revised Statutes (State of Hawai‘i 2000). The MKSR FEIS contains a November 2, 1999 comment letter from the Department of Land and Natural Resources (DLNR) signed by Timothy Johns, Chairperson, in which he states DLNR's position regarding the Master Plan. "The Department of Land and Natural Resources would continue to review each situation in the context of a Conservation District Use Application. . . DLNR's acceptance and consideration of applications for new uses, such as telescopes, will be contingent upon implementation of the local design review process and more generally, the performance of the local management authority in fulfilling its stated responsibilities. . . It will be the University's and the telescope operators' responsibility to ensure that procedures outlined in the Master Plan are followed for day-to-day management and development guidelines. Failure to do so could jeopardize

Conservation District Use Application approvals and any future telescope development on Mauna Kea." Under the heading "New Management Responsibilities," Mr. Johns further states that "A Hilo-based review process, with the Board of Land and Natural Resources continuing to consider individual CDUAs and sublease agreements, would guide new telescope and facilities development. DLNR enforcement would be limited primarily to compliance with Conservation District Use Permit conditions and response to enforcement issues related to violations of Conservation District laws…"

Response to Comment L:

NASA agrees that they are not a party to the Conservation District Use Permit (CDUP). The University of Hawai‘i's responsibility to acquire a CDUP and the Federal Government's responsibility to complete the National Environmental Policy Act process are separate and independent processes.

Response to Comment M:

The Wēkiu Bug Mitigation and Monitoring Plans include clearly stated objectives and a discussion of systematic monitoring (Appendix D and E reference the Plans). California Association for Research in Astronomy (CARA) would implement the Wēkiu Bug Mitigation and Monitoring Plans and habitat restoration. The restored habitat would be monitored quarterly by a qualified entomologist for 18 months following completion of the proposed habitat restoration to determine if the Wēkiu Bug reestablishes itself in those areas. Monitoring of Wēkiu Bug populations would continue semiannually for no less than five years following completion of the construction of the Outrigger Telescopes, and on an annual basis thereafter for the term of the CDUP. Progress reports on the monitoring results will be submitted semiannually to the DLNR, Office of Mauna Kea Management (OMKM), USFWS, and the Bishop Museum for no less than five years following completion of construction of the Outrigger Telescopes, and on an annual basis thereafter for the term of the CDUP.

Long-term monitoring of the entire Mauna Kea Science Reserve is recommended in the Mauna Kea Science Reserve Master Plan Final Environmental Impact Statement, and is the responsibility of the University of Hawai‘i. Your comment will be referred to the University of Hawai‘i.

Response to Comment N:

The End of Lease event in 2033 could result in a variety of outcomes. The State of Hawai‘i, through its Board of Land and Natural Resources and the University of Hawai‘i, will decide upon a course of action at the expiration of this lease. The potential impacts associated with the decommissioning and demolition of the observatories on Mauna Kea are addressed in Section 4.2.15.2 of the EIS.

Response to Comment O:

See Response to Comment A.

From: Clarence Ching

Date: Mon, 20 Sep 2004

Subject: Another Viable Alternative to the Outrigger Telescopes

To: Carl.B.Pilcher@nasa.gov

Dr. Pilcher,

Please add this article, or its practical contents, to the Final EIS that you are preparing. The alternative provided by this "new" location seems to be extremely viable. Additionally, the telescopes, of the correct dimension, already built for this project can easily be substituted to this new location and proposed project.

Along with the other reasonably viable alternative in the Canary Islands, and, on the other hand, the cumulative impacts, taken together, of the total numbers of "small cumulative," "small and not significant," "small incremental," "substantial," "substantial and positive," "adverse and significant," and "substantial" impacts of past, present, and reasonably foreseeable future activities, is prohibitive. No amount of mitigation can adequately and/or feasibly justify this project.

Clarence Ching

Clarence Ching (2)
September 20, 2004

Mr. Ching's attached article entitled "Antartica deemed perfect for stargazing" published in *Nature* magazine was not reproduced in the EIS because of copyright issues.

****

Your comments are respectfully noted.

X-Info: ODIN / NASA Glenn Research Center
X-Sender: caconno@popserve.grc.nasa.gov
Date: Thu, 30 Sep 2004 15:30:28 -0400
To: otpeis@nasa.gov
From: Joseph Connolly <Joseph.W.Connolly@grc.nasa.gov>
Subject: Comments on the draft EIS
Cc: James.B.Jackson@nasa.gov, Avis.V.Hudson@nasa.gov, aw@grc.nasa.gov,
George.R.Harpster@nasa.gov, Calvin.T.Ramos@nasa.gov, Kelly.L.Hall@nasa.gov,
Emye.L.Benavage@nasa.gov, Mark.W.Manthey@grc.nasa.gov,
Jeremy.W.John@nasa.gov, Joseph.W.Connolly@nasa.gov,
Aloysius.F.Hepp@nasa.gov, Michael.W.Capelety@nasa.gov
X-Virus-Scanned: by NASA Headquarters Spam Firewall at mail.hq.nasa.gov

Dear Carl B. Pilcher,

In response to the environmental impacts survey for the Outrigger Telescopes Project the Native American Advisory Council of NASA Glenn Research Center has responded to your invitation for comments. In the attached word document our comments on the project are express and signed by the members of our advisory council. Our group would like to receive copies of future environmental planning documents on the proposed Outrigger Telescopes Project. Thank you for allowing us the oppurtunity to freely express our opinion. If you have any question please do not hesitate to ask.

Take care,

Joseph W. Connolly

Aerospace Engineer
NASA Glenn Research Center
21000 Brookpark Road, MS 54-5
Cleveland, OH 44135
(216) 433-8728

NAAC EIS Comment.doc

September 28, 2004

Att: Carl B. Pilcher
Program Executive
Science Mission Directorate
Universe Division
NASA Headquarters
300 E Street SW
Washington, D.C. 20546-0001
Fax: 202-358-3096
e-mail: otpeis@nasa.gov

Dear Carl B. Pilcher,

The Native American Advisory Council of the NASA Glenn Research Center has recently been made aware of Indigenous peoples land issues pertaining to the Outrigger Telescopes Project. As Native Americans working for NASA our group has prided ourselves in the great accomplishments NASA has made in advancing education in our area communities and reservation communities. We are now trying to get involved in reaching out to tribal colleges through teleconferencing and web casting, possibilities that we feel can greatly advance Native American youth. Needless to say, when we heard that the Jet Propulsion Laboratory was sponsoring a project that would further develop and infringe upon sacred lands of the Native Hawaiians we had some concerns.

The further development of four, and possibly six Outrigger Telescopes at the W.M Keck Observatory site located within the Astronomy Precinct of the Mauna Kea Science Reserve on the island of Hawai'i could have very adverse effects on Native Hawaiian cultural practices and the surrounding environment. This project will not only have its own harmful effects, but also encourage further development of Mauna Kea, as members of the Office of Hawaiian Affairs has expressed. In an article by the Honolulu Advertiser, "Rival emerges for Mauna Kea telescope project," members of the Hawai'i Island Economic Development Board expressed that the decision of NASA to further develop at Mauna Kea could have an impact on the future development of the National Science Foundation Working Group's proposed Thirty Meter Telescope. A B

One of our advisory council's concerns is that there could be a lack of adequate investigation into the ramification of further developing Mauna Kea. It has already been demonstrated that NASA has pushed ahead rapidly in this project without doing an adequate assessment. The U.S. District Judge Susan Oki Mollway ruled that NASA's claim of no significant environmental impact resulting from the Outrigger project is flawed. We concur with Judge Mollway's quote in the article "Judge reject's NASA's telescope impact survey" in the Honolulu Advertiser stating that "the court specifically holds that the present EA does not adequately consider the impact of development of the outrigger telescope site when added to other past, present and reasonably foreseeable actions." It is our impression that NASA has not currently looked into its precedent setting action of further developing this sacred site. C

Despite NASA's insistence on no significant environmental impact many Native Hawaiians like Mikahala Roy have stated "I am repeating what I and other Hawaiians have said before: no further development on Mauna Kea. Construction has done irreparable damage to our sacred mountain." (USA Today, "Hawaiians speak out against Mauna Kea telescope project") Stated in your Draft Environmental Impact Statement for the Outrigger Telescope Project NASA has a central Mission with three components:

1. To understand and protect our home planet
2. To explore the universe and search for life
3. To inspire the next generation of explorers

While the development of the outrigger on Mauna Kea will accomplish the second component of the NASA mission, it comes at the expense of the other two components. This project is hurting our home planet, mother earth, by further desecrating sacred land. Mauna Kea is the place where sky and earth come together and is the place of creation for many Native Hawaiian cultures. By showing this disrespect for our home planet we are disenfranchising the next generation of future explorers.

It is our recommendation that the alternate location of the Outrigger Telescope Project at the Canary Islands would be able to meet all of the components of NASA's central mission. While NASA engineers might have to prove their ingenuity and excellence in scientific study once again to get equal performance out of the telescope if placed at the Canary Islands, we are sure that NASA will uphold the motto of, "For the betterment of all." We are confident that NASA will do what is best for all and not simply the majority, as developing upon the sacred land of the Native Hawaiian people is certainly not "For the betterment of all". **D**

Sincerely,

The Native American Advisory Council of NASA Glenn

Members:

Avis V Hudson
James B Jackson
Emye L Benavage
Kelly L Hall
Allen Wilkinson
Mark W Manthey
Jeremy John
Joseph W Connolly

NASA Glenn Research Center
21000 Brookpark Road
Cleveland, OH 44135
(216) 433-4000

Joseph Connolly
NASA Glenn Research Center
September 30, 2004

Response to Comment A:

See Section 4.1 regarding potential impacts on Native Hawaiian cultural practices and the surrounding environment.

Response to Comment B:

The Outrigger Telescopes Project is separate and independent from any reasonably foreseeable development on Mauna Kea. All future proposed projects on Mauna Kea would be subject to the terms and conditions of the June 2000 Mauna Kea Science Reserve Master Plan and State compliance requirements including the Conservation District Use Permitting process.

Response to Comment C:

The Outrigger Telescopes Project EIS acknowledges that the overall cumulative impact of all past, present, and reasonably foreseeable activities is substantial, adverse and significant, and that the Outrigger Telescopes Project would add a small incremental impact (See Section 4.2.16). However, the Outrigger Telescopes Project is taking a number of mitigation measures to ensure that the incremental impact is as small as possible.

Response to Comment D:

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.,* the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No final decision will be made until the National Environmental Policy Act process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

LINDA LINGLE
GOVERNOR OF HAWII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DAN DAVIDSON
DEPUTY DIRECTOR FOR LAND

YVONNE Y. IZU
DEPUTY DIRECTOR FOR
THE COMMISSION ON
WATER RESOURCE MANAGEMENT

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND MANAGEMENT
STATE PARKS

September 29, 2004

Mr. Carl Pilcher
Science Mission Directorate
National Aeronautics & Space Administration Headquarters
300 E Street, South West
Washington, D.C. 20546-001

Dear Mr. Pilcher:

Subject: Request for Comments: Draft Federal Environmental Impact Statement for the Outrigger Telescopes Project, Mauna Kea Science Reserve, Island of Hawai`i (Volumes I & II).

The Division of Forestry & Wildlife (DOFAW) has reviewed the subject document regarding impacts the project may have on adjacent DOFAW-management lands and programs. We are providing corrections, comments, and recommendations for your consideration.

The summit of Mauna is the only known home of the Wekiu bug (*Nysius wekiuicola*), and is recognized by the US Fish & Wildlife Service as a Candidate Species. The proposed telescope construction could further alter a portion of the Wekiu bug's habitat. Although there are plans to do some habitat restoration, there are still many unknowns concerning the Wekiu bug's biology, range, and habitat requirements, not to mention the status and distribution of remaining populations. This data is necessary to determine whether there is sufficient information to propose the Wekiu bug for listing as an Endangered Species, or to take steps to manage the entire summit so as not to cause further decline to Wekiu bug numbers. In so doing, there would be protection of the other rare native plants and animals (including arthropods and lichens) as well as the State Historic Preservation Division's mandates for protection of Hawaiian cultural sites.

Mauna Kea is considered to be one of the most sacred and important places and cultural landscapes in Hawaiian culture. The summit cinder cone complex was historically known as

Kukahau`ula, with no known reference to individual cones. Today, individual cones have their own names for specific reference points: Pu`u Wekiu (actual summit cone), Pu`u Kea, and Pu`u Hau `Oki. Within the document, there are inconsistencies in the naming particularly of Hau `Oki, with some as "Hau`oki" appearing as one word. There needs to be consistency. **A**

There appear to be numerous typographical errors in Volume I, such as section 3-3, right column, 12th line down, "Visitor" should be plural, and there should be some recommended time interval for visitors to remain at Hale Pohaku for acclimatization. Section 3-5, right column, it is Mauna Kea Ice Age Natural (not "National") Area Reserve (NAR). Also, section 8-3, it is Betsy Gagne not "Gagney", under individuals consulted. **B**

The NAR is adjacent to the Science Reserve and one small separate portion, Pu`u Pohaku, is immediately adjacent to the Astronomy Precinct, the area designated for Astronomy, with the remaining Science Reserve considered to be a buffer zone. DOFAW has concerns that all activities involved with construction and operations be conducted in such a manner that no harm is done to the NAR (Chapter 195, HRS) and surrounding lands, including Mauna Kea Forest Reserve, also adjacent to the Science Reserve. **C**

Section 3-19 addresses native arthropods, but there should be mention of introduced arthropods such as a predatory Linyphiid spider. Entomologists are concerned that improperly inspected gear (including personal gear of astronomers and staff) as well as construction materials are potential avenues for further unwelcome introductions that might harm Wekiu bug populations in particular. **D**

In section 3-27, the Kamehameha butterfly has been proposed as Sate Insect, but has not been officially recognized as yet by the State Legislature. **E**

Volume II has a number of different fonts and headings in the Burial Treatment Plan both in upper and lower case and variations, making it difficult to follow organization of this very important section. On page 18, "MAUna Kea" as a heading is an example of this concern. On page 19 there is a large space between lines at the bottom of the first paragraph, and again on page 21 there are more upper and lower case, font and style differences that do not serve to clarify headings. **F**

On page 23, there should be more details under the "during construction" section if you are going to indicate there are actions; but then list only 1. with no 2., 3., and so on. **G**

The Final Federal Environmental Impact Statement should include any new information on Wekiu bug status, additional sampling techniques, and results from data loggers. DOFAW would appreciate direct contact with project ands site managers and any monitors, throughout any of the activities in relation to construction. There needs to be a constant awareness on the part of all personnel that they are operating adjacent to a Natural Area Reserve, the Mauna Kea Forest Reserve, that all lands lie within a significant cultural landscape, and that no further harm be done to the resources that we are charged with protecting above all else. **H**

We appreciate the opportunity to comment on this Draft Federal Environmental Impact Statement by NASA. Please contact Betsy Gagne, NARS Commission Executive Secretary, if you have any questions regarding our comments or recommendations. Her phone is (808) 587-0063, fax (808) 587-0064, and e-mail betsy.h.gagne@hawaii.gov.

Sincerely yours,

Paul J. Conry
Administrator

C: Peter Young, DLNR Chairperson
Betsy Gagne, NARS Commission, DLNR/DOFAW
Roger Imoto, DLNR Forestry and Wildlife, Hawaii Branch
Lisa Hadway, DLNR Forestry and Wildlife, Hawaii Branch

Paul Conry
State of Hawaii, Department of Land and Natural Resources, Division of Forestry & Wildlife
September 29, 2004

Response to Comment A:

The spelling inconsistencies have been corrected.

Response to Comment B:

NASA corrected the spelling and grammatical errors. Recommended acclimatization time is a State issue.

Response to Comment C:

On-site construction, installation, and operation of the Outrigger Telescopes would be conducted in such a manner that no harm will be done to the Natural Area Reserve (NAR).

Response to Comment D:

The impacts of introduced alien arthropods, including a predatory Linyphiid spider are discussed in Sections 4.1.2.1 and 4.2.4.2 of the EIS. NASA is also concerned about the introduction of new alien predatory arthropod species to the summit ecosystem. Specific measures have been proposed to reduce the likelihood of such introductions (See EIS Volume II, Appendix D, Wēkiu Bug Mitigation Plan Items 12 – 15).

Response to Comment E:

The text has been corrected.

Response to Comment F:

The Burial Treatment Plan has been reformatted correctly.

Response to Comment G:

The text has been corrected. There is one item under this section. The word "actions" has been replaced by "action."

Response to Comment H:

Thank you for your suggestions. The Final EIS contains updated information on the status of the Wēkiu bug. NASA is aware that a petition to list the Wēkiu bug as an endangered species has been received by the U.S. Fish and Wildlife Service (USFWS). The results of Wēkiu Bug Baseline Monitoring are reported quarterly with copies sent to Department of Land and Natural Resources (DLNR), Office of Mauna Kea Management (OMKM), and USFWS. The quarterly reports are available for anyone to download on the World Wide Web at: http://www.statpros.com/Wekiu_Bug.html. NASA has communicated your interest to CARA and asked them to contact your office.

Date: Thu, 30 Sep 2004

From: Joshua Cooper

Subject: Aloha Comments on Moana Kea

To: otpeis@nasa.gov

Comment on Outrigger Telescopes

Joshua Cooper
Hawaii Institute for Human Rights

While one segment of society is looking to the stars for age-old-questions, the indigenous culture of the islands is asking the scientific community to look into the human heart for answers.

The issue focuses on the human rights of indigenous peoples and the struggle in society between traditional knowledge and technology. The soul of a culture and star worshipping both take place on the mountaintop of Moana Kea. The mountain is a symbol of the Hawaiian struggle for physical, cultural and political survival and for the scientific community the telescopes on the mountain provide the answers to the future and our past are in the cosmos.

Should the summit should be preserved as a cultural temple or used for astronomical observatories is the cultures colliding question our community should answer.
Currently and historically, the telescope construction is at the expense of the host culture. It actually insults the integrity of the majestic mountain and holy place of Moana Kea.

The people speaking at NASA hearings on Maui and Oahu were very respectful but also resolute that before we focus on space we must first malama the sacred place of Moana Kea. The potential scientific gains to give insight into the meaning of life can't continuously destroy the very essence of another culture.

Every culture honors peaks. Moana Kea is the highest holy mountain in Polynesian civilization. Currently, 11 countries continue to build telescopes in the temple of Na Kanaka Maoli. The citizens of Hawaii maintain the conviction to not turn our backs on the ancestors and stand up against the astronomers plans for the peaks of the Pacific.

The spirituality of the sacred mountain is sandwiched between live military testing and star seeking scientists. The spiritual serenity of Moana Kea is the soul of the people and a true pilgrimage for peace.

On a recent family event, mom thought it would be great to see some of the most stunning landscapes at the fantastic mountains exhibit from Shanghai museum. While walking in the museum to see the 500 years of history, a lesson leaps out of the paintings. Mountains in China are considered sacred, spiritual retreats capable of connecting us to the cosmos.

Would we build these new telescopes in China?

Is it that people of Hawaii don't have the political power to resist such development due to a century of colonization?

People providing testimony at the NASA hearings asked some important questions, "Why do we have to justify you not building on our lands?" Another observed the disadvantage facing indigenous peoples challenging the scientific developers, "You control the question. You determine the answer."

Citizens maintained in the name of science, progress and development, Kanaka Maoli have endured policies of racial supremacy, spiritual poisoning and cultural desecration.

According to cultural practicioners, "Moana Kea is the piko of Hawaii. Every particle on the mountain is sacred. When will people not from Hawaii realize that our culture was here. We are the survivors to this land. The development is tearing out the hearts of Hawaiians"

In the first study ever done by NASA reviewing the three decades of astronomy action of searching the sky, the completed report recognized the cumulative impact of development was significant and adverse.

The legacy of the extinction and endangered species capitol of the world lingers with astronomy. Indigenous flaura, fauna and insects crumble under the construction and occasional industrial accident such as the mercury spill in 1995.

While looking to the stars, there were spills in the sacred sands of Moana Kea. Could spills contaminate the essential aquafers providing water for the people of Hawaii? **A**

The Outrigger Telescopes Project is a key element in NASA's Origins program seeking to answer two basic questions: "Where do we come from?" and "Are we alone." NASA said it has an alternative in Spain's Canary Islands. The indigenous peoples of the Canary Islands are also against the development of their sacred peaks. Indigenous peoples there have been resisting since Columbus first stopped on his way to the Carribean in 1492. The respect of traditional knowledge and cultural survival are at the heart of the struggle for indigenous peoples around the world.

In the culture of law emerging there is the evolving concept and legal principle for free, prior and informed consent. Indigenous peoples should be able to say no if the people believe it is not in the best interest of the community and contradictory to the cultural values.

Indigenous peoples have faced a record of human wrongs fitting a pattern of gross violations of human rights, especially fundamental freedoms of civil and political rights relating to religious practice.

Kanaka Maoli people made it overwhelmingly clear that the potential Outrigger will tear out the

hearts of the people. The lands are part of Kanaka Maoli and the most sacred land mass in the Pacific.

Joshua Cooper
September 30, 2004

Your comments as a whole are respectfully noted.

Response to Comment A:

Sections 3.1.5.2 and 4.2.6.2 of the EIS describe the actions the Mauna Kea facilities have taken to handle hazardous materials carefully and respond appropriately in the unlikely event of a spill.

From: Kalei Cotton

To: otpeis@nasa.gov

Subject: Mauna Kea Development

Date: Mon, 20 Sep 2004

To whom it may conscern,

I request that all development on Mauna kea be stopped emmediately.

Aloha,

Kaleialoha Cotton Septembe, 20 2004

Kaleialoha Cotton
September 20, 2004

Your comment is respectfully noted.

From: JAMES G DITTMAR

To: "Carl Pilcher" <cpilcher@hq.nasa.gov>

Subject: Draft EIS

Date: Sun, 19 Sep 2004

Attached in Word and Wordperfect are my comments on the Draft EIS. The Draft looks good and answers and presents the right information.

Aloha Jim

Jim & Sherry Dittmar

September 19, 2004

Dr. Carl B. Pilcher

Office of Space Science, Code SZ

300 East Street, SW

NASA Headquarters

Washington, D.C. 29546-0001

Dear Carl

Subject: Comments on the Draft Environmental Impact Statement for the

Outrigger Telescopes Project

I have reviewed the Draft EIS for the Outrigger Telescopes Project and in my opinion I find it meets the requirements of the National Environmental Policy Act of 1969. The Project Description is adequate. The Alterative Section clearly shows the Project Alternatives. The Impact Section is adequate and provides safe guards for future mitigation of the project's impact. Most importantly the EIS provides that if additional technical information becomes available in the future, NASA will undertake necessary measures to minimize negative impacts. The proper cultural assurances are provided, and given my experience, with federal agencies on EIS's, and these assurances will be implemented.

There is sufficient information for the federal decision makers to make an informed decision on the future of the project.

However, it is unfortunate that this EIS is coming so late in the development of Mauna Kea Telescopes Facility. During the 1970's it was common to have EIS's cover projects which the major decisions had been made. On Mauna Kea, as far as I can tell this EIS is the first one which covers the project concerns of long term development of the Mauna Kea. This lack of past comprehensive planning and long term environmental studies, by the present users, have placed an undue burden on NASA. It is the typical deep pocket's approach to let the federal agencies last in the door to provide for the future planning and mitigation.

This EIS does provide answers for many of those concerns and provide assurances that future concerns of the project will be addresses as they arise.

If you have any question please do not hesitate to call me.

Jim Dittmar

Jim and Sherry Dittmar
September 19, 2004

Thank you for your supportive comments.

Sept. 1, 2004

NASA
Washington DC

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
300 E St. , SW
NASA Headquarters
Washington DC 20546-0001
Astronomy and Physics Division

Electronic comments to: otpeis@nasa.gov

Sir:

My wholehearted support for the Keck Outrigger project is extended to you and a very warn welcome to all who participate in the noble endeavor of basic research. The days of Galileo are long gone and only through the massive team efforts and huge expenditures and alliances of government, universities and foundations will bring advancements to your work. I realize "backyard" telescopes are being built by amateur astronomers and their work is inspiring and successful especially in the field of discovering, tracking and naming comets, stars and other observations. But nothing even close to the scope of the outrigger telescope, being proposed, could be considered without the cooperation of intellectual, government, philanthropic and the scientific communities. The enlightenment by the scientific community , from quarks to extra solar planets and galaxies, is a marvel of mans capabilities. You have my undying respect and admiration. It is also my opinion that the Mauna Kea observatory complex here in the USA offers the best possible site. Please bring this project to Mauna Kea. The air is clearest here in the middle of the ocean and may the thinking of our decision makers be as clear.

I also wish to express my dismay that an environmental impact statement was found to be a requirement. What a waste of 2 million dollars. IS THIS EXTORTION ???

We are living in a most exciting time and your community is among the forefront. Please keep up the good work. I believe the survival of mankind will only prevail through your success.

Respectfully submitted Lawrence G. Ebel

Lawrence G. (Bud) Ebel

Lawrence G. (Bud) Ebel
September 1, 2004

Thank you for your supportive comments.

August 25, 2004

Aloha Kakou,

My name is Hanalei Fergerstrom. I am appearing before you to comment on the Draft EIS prepared by NASA with regards to the building of six outrigger telescopes to be apart of the two existing Keck Telescopes on the summit of Mauna Kea.

First, I would like to state for the record, that I am a Religious Practitioner of the ancient traditional Hawaiian religion. PA HALAU O TE ATUA is the foundation.. I have received my direct training from Kahuna Nui Pali Tu Samuel Hoopi'i O Kalani LONO. PA HALAU O TE ATUA is the foundation of the four gods KU, KANALOA, LONO, KANE. A

Regarding the outriggers and the Draft EIS. There are several areas of concern. All of which have to do with the location. B

1) This area is a WAHI KAPU and is integral to our religious beliefs.
2) That Nasa has not taken the time to consult with the Native Hawaiian Religious Practioners as required P.L. 95-341 section 2. Native American Religious Freedom Act.
3) Further that such an action would be a violation of the 1st. amendment, the freedom of religion.

In the reviewing of the Draft EIS continually it is written of **the** adverse affects it will have on the Hawaiian Community. You speak of your knowledge that the Mountain is sacred to the Hawaiian People. YET you continue to push ahead as if our religious beliefs don't count and that our temples are at your liberty to move or deface. That you can overrule my religious rights(not different from your own), and destroy the sanctity of our sacred sites, no different than yours.
What is seen is that this project really doen't effect anyone but the Hawaiian but would that is also fall into a description of ***discrimination***.

We comment that the EIS could not be complete without a complete Cummulative Impact Statement on the entire Mauna Kea. That it is not a true cumulative Impact Statement unless you do it all. C

This document may serve as legal judicial notice and prima facie in evidence.

Shoud you require more information.. Hanalei Fergerstrom

13-1339 Leilani Ave.
Pahoa. Hawaii
808 965-6184

Comments: Dated September 22, 2004 NASA's Draft EIS for the Outrigger Telescopes projects, Mauna Kea, Hawaii

By: Hanalei Fergerstrom

Spokesperson for Na Kupuna Moku O Keawe
13-1339 Leilani Ave.
Pahoa, Hawaii 96778
808 965-6184
warhawaii@hotmail.com

Aloha NASA,

I am Hanalei Fergerstrom, a traditional religious (non- Christian) practitioner of the temple of LONO. I am also the chosen spokesperson for Na Kupuna Moku O Keawe, a gathering of traditional Hawaiian elders representing the six major districts of Hawaii Island. I am also a contestant in the contested case hearings currently before the Board of Land and Natural Resources regarding the permitting process (CDUA) for the extention of the KECK I and II by adding on of up to six outrigger telescopes.

There are several areas of great concern:

1) The summit region of Mauna Kea is of extrodinary religious significance. It is a natural temple of the Gods. The entire summit region is literally in the " Realm of PO ". The realm of PO is and has always been recognized by the Kanaka Maoli people as a sacred realm of the Gods, the place where the Gods take on bodily forms (Kinolau). It is also the home of several other gods such as Poliahu (Snow Goddess) and Lilinoe (Goddess of the sacred mist).
2) The summit region of Mauna Kea is currently under the so-called jurisdiction of the State of Hawaii. **There is not nor has there ever been a transfer of these lands to the State of Hawaii by any authority and therefore remain in the land inventory of the Hawaiian Kingdom.** See ***United State Public Law 103-150*** D
3) NASA's attempt to do a complete EIS for outrigger projects fails dramatically as a complete EIS must be done for the ***entire mountain*** to gain the understanding of the cumulative impacts. E

Several years ago the Office of Hawaiian Affairs sued NASA in Federal Court over the Environmental Assessment it had produced for this outrigger project. The courts found that the EA was inadequate and ordered another one. NASA claimed that would go a step further and do a complete Enviormental Impact Statement. We believe that it is in the greater interest of the Hawaiians, the community at large and NASA to do just that but, to accomplish this one would have to do a complete cumulative impact of the entire mountain.

What we find missing from the Draft EIS is any mention of the continuing Contested Case for the ***conservation use permit process*** that has been going on for the past year and a half. F

We do not find the cummulative impacts of the other 10 telescopes on the summit in the Mauna Kea Science Reserve. We do not find reports on the cumulative impacts that would be required for the future developments .We do not find procedures for the containment and removal of toxic chemicals nor even suggestions of the use of less than toxic chemicals to replace those toxic chemicals that are currently in use in the summit region. Chemicals, such as, Ethylene Glycol used as a coolant, and Elemental Mercury used as a cleaner for the telescope glass, to mention a few. We do not find any reports from the State of Hawaii Health Department on the use of such hazardous chemicals especially relating to the fact that G

Mauna Kea is the primary source of freshwater on the island of Hawaii. We have yet to understand the possible contamination of Hawaii islands freshwater supply and the sever impact it would have on all the people of Hawaii island should a mercury spill (or other hazardous materials) enter the aquifer.

H

We do not find reports on the effects or impacts on places like the sacred lake "Waiau". Nothing that can explain how it is that the lake has been becoming "GREEN"... and although it does not fall into the science reserve itself, it is believed that the Greening of lake Waiau to be caused by the effluents from drainage derived from the summit region.

NASA must come to understand that Hawaii is an island and that we must look at the entire island when we evaluate cumulative impacts. Mauna Kea is the "PE'A" of our island and therefore everything from the summit on down to shore and down to the ocean floor must be considered to validate a complete cumulative impact statement. I

There is no mention of the National endangered Palila Bird who's sole food source is the Mamane tree seed. There is no mention of the realignment of the existing saddle road to go above the existing Pohakuloa Military Training Area which will destroy the mamane forest on the west side of the mountain knowing that the National Endangered Palila Bird will not migrate to the east side of the mountain. J

Nor do we find any mention of the impacts on the lower regions of Mauna Kea. Those of course would include the existing Pohakuloa Military Training area who is presently attempting to expand up to 23,000 acres. In this Pohakuloa area (also a religious sphere known as the PA'E or KUAHUIWI)will be the deployment of the Military Stryker Brigade. This area exist between our two great mountains and is looked to as the "womb, where new life will began". K

NASA works in concert with the Keck Telescopes, whom subleased lands from the University of Hawaii, Department of Astronomy. The University of Hawaii, leases the lands known as the Science Reserve from the Department of Land and Natural Resourses The language of this least is specific as to the area. It claims that the lease is in the area known as Ka'ohe, District of Hamakua, Island of Hawaii. The area known as Pu'u Kaohi on the side of Hamakua is not on the summit area. In fact the term Ka'ohe refers to the 5 existing Pu'u Kaohe that circle the mountain. The one in the district of Hamakua is closer to Laupahoehoe. There is another one on the slopes of Mauna Kea at the base of the mountain near saddle road on the Hilo side near the old Parker Ranch site known as Humuula. Nevertheless ther is no L

Pu'u Ka'ohe on the summit area. As matter of fact, those 5 separate Pu'u Ka'ohe's are the geographic borders demarking the realm of PA'E. Therefore even the so- called least to the University of Hawaii is questional. And actually indicates that the science reserve is actually further down the slope near the Pu'u Kaohi in Hamakua. L

In the draft EIS created by NASA has numerous statements of the significant, substancial and adverse. But most of these significant, substantial and adverse impact generally impacting mostly Hawaiian People and their Religious beliefs and sacred enviorments. **NASA has not consulted with the Religious Practitioners as prescribed in Public Law 95-341 (Native American Religious Freedom act). In specific sec.2 of P.L. 95-341 , where it required that the office of the president shall direct various Federal agencies to counsult with RELIGIOUS PRACTITIONERS**, not simply with cultural practitioners or cultural specialist. I make the claim that no such consultation with Religious Practitioners has ever taken place. Under the intent of P.L. 95-341 was to help keep the Federal Government from mistakenly creating adversity on the native cultures resultant from the lack of information of the nature of the native Religious practices. M

NASA makes claims that consultation regarding NAGPRA, and NEPA was made through Hawaiian organizations such as Kahu Kumauna and Ahahui Ku Mauna. Both of these organizations are directly connected to the University of Hawaii and therefore their independence of thought are questionable and appear to be directly influenced by the University of Hawaii as self promotional. Further that in the list of consulted parties indicated in section 8 of volume 1, speaks of the many persons whom may have participated in some community meeting but fails to illustrate just what there comments or points of counsultation was nor is there any further description of the depth of the consultations or the resultant outcomes. So it appears that NASA has utilized these names as consultants (both organizational and individual) as persons favorable to the outrigger project while the truth is that **most of those parties testified to the objection of the project as well as any further development of the summit of Mauna Kea.** N

A little more regarding Na Kupuna Moku O Keawe. Na Kupuna Moku O Keawe is a gathering of traditional Kupuna from the six major district of the Island of Hawaii. They are in fact representative of those districts. On May 31st, 2003 Na Kupuna made a position paper(1) opposing the further development of the summit of Mauna Kea in direct response to the proposed outriggers on to Keck. Attached is a copy of said document. Similarly on July 2, 2003 another position paper paper was filed opposing the further development of Mauna Kea.. A copy of this is also attached(2)for your records. O

Also find attached(3) is an article that appeared in the Hilo Tribune Herald that site violations for projects in the Summit Astronomy precinct. It appeared a week after the NASA hearing It further illustrates that the draft EIS is a far cry from being complete, especially with regards to cumulative impacts. P

In closing I would lke to reiterate our position. There shall be no further development on the summit of Mauna Kea. Q

Mauna Kea is so sacred to the Hawaiian Religion that it would be cause for a 1st amendment challenge in U.S. District Court and such a case would be supported with P.L. 95-341.

That the Traditional Hawaiian religion is founded on the Pa Halau O Te Atua, the four gods, TU, TANALOA, LONO,TANE.

That the author, Hanalei Fergerstrom is a traditional Religious Practitioner (non-Christian) having received full training from Tahuna Nui Pali Tu, Sam Lono

Please feel free to contact me at the address provided.

Signed this day: Sept 30th, 2004

Hanalei Fergerstrom

ATTACHED DNE(1)

RECEIVED
03 JUL -2 P2:59
DEPT OF LAND & NATURAL RESOURCES
STATE OF HAWAII

Na Kupuna Moku O Keawe

Ke Akua is the Spiritual Foundation of the Hawaiian Kingdom

We gather this day May 31st, 2003 in the district of Puna, to address the following : *Continued Development of the Summit of Mauna Kea.*

Where as the summit area of Mauna Kea is the recognized as the Realm of the Po, that Heavenly realm of Ke Akua,

Where as the summit area of Mauna Kea is the home of Na Aumakua, Poliahu, and Lilinoe.

Where as the summit area of Mauna Kea is also the sacred burial grounds of our highest Alii.

Where as, the summit area of Mauna Kea is spiritual center of the Hawaiian People.

Where as the summit area of Mauna Kea is also the location of the sacred life giving waters of Kane at lake Waiau.

Where as the summit area of Mauna Kea is also the location of our sacred adze.

We recognize the summit area to be the sacred realm of the Po. The area where our ancestors enter the heavenly realm, the area where or gods take on earthly shapes (kinolau), and is recognized as the most sacred and religious site, and forbidden to enter but to seek Ke Akua, conduct sacred and religious ceremony as well as the top of our islands aquifer.

Therefore all are hereby noticed that, We , Na Kupuna Moku O Keawe are adamantly oppose Any further development on the summit of Mauna Kea.

Signed this day May 31, 2003

Kupuna Po'o O Hilo — Eleanor Aduna

Kupuna Po'o O Puna — Robert Kelihoomalu

Kupuna Po'o O Ka'u — Margaret Grace

Kupuna Po'o O Kona — Arthur Mahi / KANAK NAPEAHI

Kupuna Po'o O Kohala — Sonny Paaloa

Mele Alimau K. Hilo Dist.

Abbie Rupraln — Hilo

Jim McLean — Kona

NA KUPUNA MOKU O KEAWE PUBLIC DOCUMENT

Kupuna Po'o O Hamakua Nettie C. Vieira

The following signatures are from other Kupuna of the various districts that so confer as well as witness to this document of opposition continued development of the summit area of Mauna Kea.

Tahi Kelii — Puna
Le'lani Chow - Puna - Kupuna
Athena Peanut - Puna - Kupuna
[illegible] - Puna -
Richard K. [illegible]
John H. Rossano
Richard K. Jowell - Hilo
Greenwell Kuhi - Puna
Jim McRae Kona
Keppela Kaaiakamai - Puna
Justin Cox Zabin PUNA
Kionipaa Choy PUNA DIST
Henry K Kekai Kupuna Kona
[illegible] (K) - Waimea
Abel Simeona Jr Kupuna Kaua

ATTACHED 2

Na Kupuna, Moku O Kaewa
1001 Railroad Avenue
Hilo, Hawaii 96720
Telephone: (808) 959.1460

July 2, 2003

NA KUPUNA PUBLIC DOCUMENT MOKU O KEAWE

United States Senator Daniel Akaka
101 Aupuni street
Hilo, Hawaii 96720
(808) 935.1114

Re: Telescopes and NASA\DoD Projects on Mauna Kea Mountain, and the Pew Charitable organization.

Honorable Senator Akaka:
We are not in favor of any new Telescopes and NASA\DoD Projects on Mauna Kea Mountain for the following reasons. The projects are located on native Hawaiian cultural and heritage sites which are historically and currently of significant religious areas, and our community does not have any meaningful employment opportunities within these projects.

What we want and have not had is the opportunity to speak directly with representative decision-makers from the Telescopes and NASA\DoD Projects. We want to know of what significant importance these projects have to our community. We want to have discussions with the following: NASA/DoD, Pew Charitable organization, as well as the Telescope consortiums. The information we want addressed is the significant importance of the projects. That is to say the hypothetical, theory, and actual project activities these projects will develop.

What we don't want is to be left simple-minded and dumb-founded in this most important matter. We want to be of benefit to our nation and the Pacific basin and its resources. Will you, or your office please coordinate the fact finding meeting we are asking for with the "Telescopes and NASA\DoD Projects on Mauna Kea Mountain."

Respectably Submitted,

Elizabeth "Maile" K. Akimseu
Kupuna, Representative
Hilo District

RECEIVED
S
HILO OFFICE
RECEIVED JUL 0 8 2003
7/8/03

RECEIVED
JUL 8 2003
Office of

ATTACH. 3

UH may be fined by state

University failed to get permits for work done on Mauna Kea

By HUNTER BISHOP
Tribune-Herald staff writer

State Land Board members are expected to hear today of serious permit violations at three observatories on the summit of Mauna Kea.

A Department of Land and Natural Resources report also recommends the board fine the University of Hawaii $20,000 for nine violations. The university leases state land on the summit of Mauna Kea to international groups to study the universe from what is widely considered the best location in the world for astronomy.

The university's Institute for Astronomy, which manages the leases, has already removed several unpermitted storage areas following citations by the DLNR staff after a two-day inspection of the summit in May. But the university is requesting after-the-fact permits for a couple of weather towers, two parabolic antennas and a seepage pit collar that already exist. One of the weather towers was built 21 years ago.

Inspectors said the violations were serious enough to classify them as Level I, sending them directly to the Land Board for review rather than to administrative hearings. The board meets today in Honolulu.

"Staff is particularly concerned about this case in that the violations occurred at the summit of Mauna Kea which is considered culturally significant," said the report signed by staff

MAUNA KEA

From front page

Young, chairman of the seven-member Land Board.

The report recommended $2,000 fines for each of nine violations and a $2,000 fine for administrative costs. Additional fines of $2,000 a day could be assessed for any additional work on the summit that does not have prior Land Board approval.

Sam Lemmo, chief of the Office of Conservation and Coastal Lands in the DLNR, said Thursday that DLNR inspectors periodically spot-check the observatories for compliance "like the sort of inspection conducted in May was "not one we routinely do."

"We spent a couple of days up there and systematically looked at everything," he said.

Violations include failing to get approvals for two antennas, a weather tower, trash and crates at the James Clerk Maxwell observatory, a low damaged steel wall to keep cinders out of a seepage pit built by Subaru Japan National Large telescope at Pu'u Hanaula, and construction materials, a storage container and concrete pads at the Smithsonian Astrophysical Observatory Submillimeter Array.

Kealoha Pisciotta, who represented Mauna Kea Anuina Hou, a Hawaiian cultural group that was one of six organizations and individuals who successfully contested the university's application for the $60 million Keck outrigger telescope project last year, pinned blame for the violations on the university.

"I don't think (the observatories) were consciously trying to violate the permits," said Pisciotta, a former James Clerk Maxwell Telescope employee. "You can't expect foreign governments to know all the rules. The university is not doing its job."

Pisciotta said, however, that it's encouraging the violations have been cited. The Land Board has given the university too much leeway in its administration of the summit for years, she said. "But the astronomy community may find itself in a catch-22. They want further development, so they are following procedures. But if they follow procedures, they might not get their further development."

Lemmo said his office is just trying to hold the university to the same standards that apply to everyone else. "We don't cut people any slack anymore," he said, while acknowledging that previous inspections somehow missed that weather tower for 21 years.

The university is responsible for making sure things are done in an environmentally and culturally sensitive way, he said. "When they err, we have to remind them of their role."

Institute for Astronomy Director Rolf-Peter Kudritzki did not return telephone calls for comment Thursday.

Hunter Bishop can be reached at hunter@hawaiitribune-herald.com.

Hanalei Fergerstrom
August 25, 2004

Response to Comment A:

NASA appreciates your experience and consultation as a religious practitioner.

Response to Comment B:

In recognition of the sanctity of Mauna Kea in Native Hawaiian culture, NASA has made a particular effort to consult with Native Hawaiian religious practitioners. Their perspectives have had great influence on the content of this EIS. See Section 3.1.2.5 and Table 3-2 for more details.

Response to Comment C:

NASA determined where the impact of the past, present, and reasonably foreseeable activities occurs for each of the resources areas in the cumulative impact analysis. This defined the geographic boundary or region of influence for that resource area.

Response to Comment D:

These State issues are out of scope for the National Environmental Policy Act (NEPA) process.

Response to Comment E:

See Response to Comment C.

Response to Comment F:

The University of Hawai‘i's responsibility to acquire a Conservation District Use Permit and the Federal Government's responsibility to complete the NEPA process are separate and independent processes.

Response to Comment G

Section 3.1.5.2 of the EIS describes the current use of hazardous materials at the W.M. Keck Observatory and precautions that are taken to minimize the possibility of any release to the environment or other adverse effect. Section 4.2.6.2 describes the cumulative impact of hazardous materials usage by the Mauna Kea observatories and at Hale Pōhaku. Table 4-19 describes efforts by these facilities to find “green product” substitutions for hazardous materials. Elemental mercury is not used as a telescopes glass cleaner on Mauna Kea.

The analysis presented in Section 4.2.6.2 includes that impacts from past and present use of hazardous materials have been small and not significant.

Response to Comment H:

No measurable groundwater contamination can result from the disposal of wastewater at the summit, as shown by the hydrologic analysis done as part of the cumulative impacts analysis in the EIS (See Sections 4.1.3 and 4.2.5). The same analysis shows that wastewater from the observatories cannot reach Lake Waiau. All disposal of wastewater is done through State-approved septic systems. No hazardous materials are disposed of through the septic systems, but rather are trucked down by licensed and State-approved contractors.

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available scientific information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system are negligible.

Response to Comment I:

See Response to Comment C.

Response to Comment J:

Both the *mamane* and *palila* bird are discussed in Chapters 3 and 4 of the EIS (See Sections 3.1.3.4, 4.1.2.2, and 4.2.4.2 for more detail).

Response to Comment K:

The Pōhakuloa Training Area is discussed in Section 4.2.2 of the EIS.

Response to Comment L:

These State issues are outside the scope of the NEPA process.

Response to Comment M:

Please see Response to Comment B.

Response to Comment N:

NASA has consulted with many Native Hawaiian organizations. These organizations have provided NASA with a wide variety of views. People and organizations were not listed as being supportive or in opposition to the Outrigger Telescopes Project. NASA has made no representation in listing the names of persons and organizations consulted in Chapter 8 of the EIS.

Response to Comment O:

Your comments and those of the other kupuna are respectfully noted.

Response to Comment P:

The University of Hawai‘i paid the fine associated with the violations and by receipt of a letter on October 21, 2004 addressed to Robert McLaren, Associate Director of the University of Hawai‘i Institute for Astronomy (UH IfA), from Samuel Lemmo, Administrator of the Office of Conservation and Environmental Affairs, it was determined that all violations have been adequately resolved (UH IfA 2004h).

Response to Comment Q:

Your comments are respectfully noted.

>Date: Sun, 26 Sep 2004

>From: Charles A. Fernandez

>Subject: Maunakea

>To: otpeis@nasa.gov

>

>Aloha, My name is Charles Fernandez. I am a full time student at
>Leeward Community College. I am born and raised on Maui but I
>currently reside in Makaha Valley on the island of Oahu with my wife
>and daughter. I am the oldest of 8 sibling and I am writing to you in
>opposition to the construction of the Outrigger Telescope Project on
>the island of Hawaii on Maunakea.

>

>I understand the significance of building the telescope with the
>finding of the interferometer of the twin Keck observatory where they
>can null the light from the dust and detect the origin a light is
>generating and therefore see other galaxies and planets in orbit, but
>that doesnt mean they have to build it on Maunakea. They can build it
>on Montana or Tahiti or even New Zealand.

>

>I am against the building of the telescope because 1) with four
>possibly six more on one sites its going to be damn ugly. It will
>disminish the beauty of Maunakea and give it injustice to cover it up
>with a bunch of buildings. **A**

>

>2) I feel like everyone has taken and taken and taken everything from
>us and no one ever gives us back anything. I am against the fact that
>the telescope will only benefit scientist but it will not benefit the
>Hawaiian people and it will not benefit the children to come. **B**

>

>3)It is so unnessecary to build and I think the devastation to our

>aina and our people needs to stop. Charles Fernandez

Charles A. Fernandez
September 26, 2004

Your comments are respectfully noted.

Response to Comment A:

Your comments are respectfully noted.

Response to Comment B:

The State of Hawai‘i has benefited from astronomy development on Mauna Kea. In addition to the numbers of jobs astronomy provides, there are jobs created indirectly as well. Historically, NASA has provided funds to the University of Hawai‘i at Hilo to develop astronomy education programs with an emphasis on Native Hawaiian involvement. New elementary, middle school, and high school curricula have been developed to bring modern space science together with concepts of Hawaiian celestial navigation and traditions of the land.

In addition, as a mitigation component of the Outrigger Telescopes Project, NASA will commit $2 million to an initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians.

>Date: Sun, 26 Sep 2004

>From: Jessina A.K Fernandez

>Subject: Maunakea

>To: otpeis@nasa.gov

>

>Aloha, My name is Jessina Anela Kuuipo Kealani O Maunakea Fernandez. I

>am one of six to have graduated from the Hawaiian Immersion School Ke

>Kula Kaiapuni o Anuenue located on the island of Oahu in Palolo Valley.

> Hawaiian is my first language and I am the oldest to twelve. I was

>born and raised in Nanakuli but now I reside in Makaha Valley.

>

>I have written a letter to the editor with the Honolulu Advertiser as

>well as letter of Commentary IN OPPOSITION TO THE CONSTRUCTION OF THE

>OUTRIGGER TELESCOPE PROJECT. I am also writing to you before the Sept

>30th, 04 due date for the DEIS of the building of the Outrigger

>Telescope project on Maunakea on the island of Hawaii in the State Of

>Hawaii which I am AGAINST.

>

>Nasa is proposing building four or possibly up to six 1.5 m diameter

>telescope at the WMKO site. The Maunakea science reserve I believe

>consist of 11,288 acres leased out by the University of Hawaii by the

>State of Hawaii. NASA wants to build these telescopes around the

>existing twin Keck telescopes and others sites.

>

>NASA claims that there are no burial sites in the area, but fact

>remains that up to five burial sites were found during the construction **A**

>of the Keck observatory. NASA claims the the environment wont be

>impacted, but the fact remains in the DEIS Volume 1 on page 4-86 that

>Hazardous has indeed been spilled such as paints, solvents, lubricants, **B**

>vehicle and generator fuel, hydraulic fluid, glycol coolanats, acid(

>used in mirror decoating) and mercury. Nasa believes that there will
>be no cultural impact, but thats where there wrong.

B

>
>Maunakea or Mountain of Wakea, Sky Father and Papa, Earth mother and
>other gods and forces have created the Hawaiian islands. Maunakea is
>the summit in which Papa and Wakea can meet and be together hence the
>domain of the Gods(DEIS JULY 04)
>
>Maunakea as you noticed from my name above is my families name. Our
>Kupuna once told me that we were born to Poliahu goddess of Maunakea.
>To her descendant they are born with a few white hair as I was when my
>mother gave birth to me. I think the building the Outrigger Telescope
>is a direct violation to my rights as a Native Hawaiian, a direct
>insult to my tradition and heritage and an ugly sight for sore eyes.
>
>First of all, the telescopes cants feed me and it cant feed my people.
>And when I say feed I am not talking about the food in which we digest,
>I mean it cant feed my spirit, my soul, my lanuguage or the future
>generation coming. The fact remains that the Outrigger telescopes can
>be built anywhere, it does not necessarily mean it has to be built on
>Maunakea it can be built in Australia or the Canary islands for
>example. Where am I to go if I want to hooponopono, to better my self.
> I want to camp on Maunakea and dance hula, I want to oli, I want to
>see the stars with my own eyes and to reconnect with my akua, or gods
>as I see fit, not when the road closes, or a sign that says I am
>trespassing, not where cameras are located to tell me to get out, I
>want to be free to feel, see and hear my akua and dream the vision of
>the gods.

C

>

>Secondly, am I allowed to practice my tradition, my right as a Native
>Hawaiian. As stated in the DEIS the building of the Outrigger
>Telescope will be up to a 100 vehicle in a day, in and out. Thats
>means signs will be up, construction, road closed, warning signs,
>traffic. It also means that with all the equipment NASA will have up
>there it means that more security will be there, more cameras maybe and
>more rubbish. It is stated in the DEIS the many trash has been found
>all around the WMKO area. Why arent you malama or caring for our aina?
> It is also stated in the DEIS that if burial sites are found then
>NASA has $2million dollars for the Burial plans, where is that money
>going, bones of our people sure cant spend that money they are past.
>
>Third, it is a ugly sight for sore eyes. Nasa wil have probably 8 to
>ten telescopes and they think its alright as long as they paint it
>white. Thats not going to help, its still going to disminish the
>prestine beauty of Maunakea. NASA is like a pimp selling prostituting
>anf whoring our sacred wahi pana. Maunakea is like a puuhonua a refuge
>for our people.
>
>Finally, Nasa doesnt believe that there will be any significanct
>cultural impact to the Native Hawaiian. They are wrong. They prevent
>us from practicing our traditon, it prohibits us to freely roam
>Maunakea without being kicked out, the telescope isnt even open to us,
>it doesnt benefit the Hawaiian people in any way it only benefit NASA.
>Maunakea to me is like my mother, my father my family. It is home to
>me, he iwi o kuu iwi, the bones of my bones lay on Maunakea, he koko o
>kuu koko, the blood of my blood of my people and my nation, na iwi a
>lehu, our generation our heritage too many to count, na oiwi ponoi o
>nei paeaina, the tru children to the land, oia kuu kulaiwi, Maunakea is
>our legacy, our right and our ohana, family fou the present and the

D

E

F

G

H

>future generation coming. Jessina ANELA KUUIPO O MAUNAKEA FERNANDEZ

Jessina A.K. Fernandez
September 26, 2004

Response to Comment A:

NASA is not aware of any documented evidence showing that burial sites were discovered during the construction of the W.M. Keck Observatory. NASA is committed to being a responsible steward in the implementation of the Proposed Action. To this end, NASA proactively completed a Draft Burial Treatment Plan specifying procedures to deal with an inadvertent discovery of human remains. Following an initial informational presentation of the Draft Burial Treatment Plan to the Hawai‘i Island Burial Council (Council) in April 2004, public burial notices were placed in local newspapers in early May and an amended Draft Plan was submitted to the Council. The plan was discussed at the Council meeting on August 19, 2004. The members of the Council expressed their general agreement with the procedures recommended in the Burial Treatment Plan for monitoring during the Outrigger Telescopes construction and for treating any human remains uncovered during construction. Because no actual burials are known to be present, the Council took no action actually approving the plan or its procedures, concluding that this would be beyond its purview at this time. In addition, a qualified Archaeologist would be present during all excavation activities.

Response to Comment B:

NASA refers the commenter to Table 2-3 of the EIS for a summary of the potential environmental and cultural impacts associated with the Outrigger Telescopes Project. The corresponding sections of Chapter 4 provide greater detail. NASA concluded that “From a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on cultural resources on Mauna Kea is substantial and adverse.” See Section 4.2.3.4 for more detail.

Response to Comment C:

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No final decision will be made until the National Environmental Policy Act process has been completed. NASA’s decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA’s final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment D:

The EIS correctly states that depending on the construction phase, daily construction worker traffic would add about 15 to 17 trips during the morning and afternoon peak periods. The increase in traffic in the summit area during construction would be minimal, except for the assembly enclosure phase, because most heavy equipment would be stored on site. Construction activities would generate other traffic originating off the mountain, including service vehicles, water tankers, and fuel trucks. In addition, it is assumed that a Cultural Monitor and an Archaeologist would travel daily from off-mountain to the summit during the construction and installation phase of the Outrigger Telescopes Project.

Road closures will only occur during inclement weather and during periods when heavy equipment and material is transported to the summit. Road closures related to construction would be temporary and limited to off-peak traffic periods.

Response to Comment E:

Section 5.2 of the EIS lists mitigation measures aimed to prevent the movement of waste created by Outrigger Telescopes Project. For example, construction trash containers will be tightly covered to prevent construction waste from being dispersed by wind. Construction material stored at the site will also be covered with tarps, or anchored in place, and not be susceptible to movement by wind. Outdoor trash receptacles will be secured to the ground, have attached lids and plastic liners, and collected frequently. In addition, every member of the construction crew, managers, observatory personnel, and other people associated with the proposed Outrigger Telescopes Project will undergo an orientation about the impacts of the Outrigger Telescopes construction and installation, and how they may prevent and minimize disturbance caused by trash.

As described in Section 4.2.4.3, researchers performing a botanical survey in 1982 reported a considerable amount of trash around the mountaintop. The University of Hawai‘i responded to this concern in the 1999 Mauna Kea Science Reserve (MKSR) Master Plan EIS by accepting responsibility for waste removal within the MKSR (UH 1999). Since then, trash has been collected by Mauna Kea Support Services, including trash left by visitors to the summit, and is now rarely seen within MKSR.

Response to Comment F:

NASA, in consultation with the Office of Mauna Kea Management (OMKM), will fund, out of funds for the Outrigger Telescopes Project, a $2 million initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians as a mitigation component of the Outrigger Telescopes Project. A local working group of Hawaiian citizens will establish the priorities for this initiative. Funding such an initiative, however, is conditioned on the approval of the Outrigger Telescopes being placed at the W.M. Keck Observatory site on the summit of Mauna Kea, Hawai‘i. This initiative will be sensitive to Native Hawaiian culture, history, and institutions.

Response to Comment G:

For an observatory to take advantage of the excellent atmospheric "seeing" at a site such as Mauna Kea, the air temperature within its building enclosure must be carefully controlled. The standard method of control is making the enclosure reflective, either by painting it white or covering it with an aluminized reflective coating. Although other approaches to thermal control have been studied, these alternative technologies are still experimental and not as mature as reflective approaches.

Because the Outrigger Telescope domes are relatively small (approximately 10.7-m (33-ft) high), they would in any case be barely discernable from locations below Mauna Kea with site lines to the W.M. Keck Observatory (*e.g.*, Waimea). Outrigger Telescopes that are seen projected against the existing white Keck Telescopes domes would be less visually intrusive colored white (*i.e.*, blending with their background) than with an alternative exterior treatment.

Response to Comment H:

The Outrigger Telescopes Project would not substantially burden the right to religious practice. Access to Mauna Kea has improved as a result of the development of the summit. In particular, the construction and improvement of the Mauna Kea Access Road in the Region of Influence has made it possible for the public, including many Native Hawaiians, to travel to the summit. The road is occasionally closed to vehicular traffic when road conditions such as snow and ice render travel unsafe. See also the response to Comment B.

From: "Haumea"
To: <otpeis@nasa.gov>
Subject: Comment on Outrigger Telescope Project, Hawaii Date: Thu, 30 Sep 2004 15:18:02 -1000
X-Priority: 3
X-Virus-Scanned: by amavisd-new at ilhawaii.net X-Virus-Scanned: by NASA Headquarters Spam Firewall at mail.hq.nasa.gov

This is my written comment for the record re: Outrigger Telescopes Project, Mauna Kea, Hawaii

Is Wisdom the knowledge that we collect, or the collection of data?
Is it the search for meaning,
or the meaning of the Search?
Is Wisdom the excitement of new imagery, or the detection of off-planet intelligence? Is Wisdom creating a new history,
or is it the telling grin behind the story? Is Wisdom the display of arrogance,
or the stupidity of wearing blinders?
Is it exterminating on race of the stars for a race to the stars?
Wisdom, my friend, is found in the most profound space of all - within your soul -
that is connected to mine.

In my humblest prayer, I see the strength of your mind. I pray that your Ancestors may speak to you of your True Origins so that LIFE may flourish on Earth and your descendants may celebrate.

Mauna Kea should never have been built upon in the first place. But we of the Islands and the Knowing were complacent and busy with our lives.

Do not bring your interferemetry project to Hawaii.

In Peace,

Haumea Hanakahi

Haumea Hanakahi
September 30, 2004

Your comments are respectfully noted.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

September 15, 2004

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
300 E Street, SW
NASA Headquarters
Washington, DC 20546-0001

Subject: Draft Environmental Impact Statement (DEIS) for the Outrigger Telescopes Project [CEQ # 040358]

Dear Dr. Pilcher:

The U.S. Environmental Protection Agency (EPA) has reviewed the above-referenced document pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1509) and Section 309 of the Clean Air Act.

We have rated this Draft EIS as Environmental Concerns, Insufficient Information (EC-2) (see enclosed "Summary of Rating Definitions"). EPA recognizes the scientific importance of the W.M. Keck Observatory on Mauna Kea and supports the recent decision to complete an EIS for this project. We also recognize the efforts to receive input from Native Hawaiian organizations regarding the proposed improvements and to include mitigation measures. However, EPA is concerned that the negative impacts associated with locating additional structures on this sacred site would primarily impact Native Hawaiians.

EPA recommends that the Final EIS address scoping comments and suggestions from Native Hawaiians that were received as a result of this process and the ways in which the agency will respond to these concerns. A
In addition, the Final EIS should discuss the timeline and methods for adoption of an appropriate cultural monitor as directed by the National Historic Preservation Act, Section 106 Memorandum of Agreement (MOA). B
NASA should continue to consult with Native Hawaiian organizations throughout development of the project to address concerns. C
A Mauna Kea Environmental Center for research and education as proposed during the January 8 public scoping meeting in Waimea, could also be considered as a mitigation measure for known adverse impacts to cultural resources. D

Printed on Recycled Paper

The Draft EIS concludes that the Gran Telescopio de Canarias site in La Palma, Canary Islands, would have fewer impacts to transportation, cultural resources, air quality, noise levels, and visual resources, while meeting the purpose and need. It would also avoid impacts to the Wekiu bug, a candidate for listing under the Endangered Species Act. If the proposed action is adopted, the basis for this selection in light of the additional impacts to Native Hawaiian cultural resources should be addressed in the Final EIS. We also recommend that the Final EIS specifically document consistency with Executive Order 13007 regarding the avoidance of impacts to sacred sites. E F

The Draft EIS also concludes that the project would not have a disproportionately high or adverse human health or environmental effects on minority populations (page 4-41). However, it acknowledges that the cumulative effects of past projects and planned projects such as the Thirty Meter Telescope project, the redevelopment of telescope facilities on Mauna Kea, and the visitor information station expansion, in combination with the proposed action, will continue to have a substantial and adverse impact on the cultural, biological, visual, and geological resources of Mauna Kea (page 4-71). These impacts will be primarily on the Native Hawaiians that hold these areas as sacred. For example, cultural practices at locations such as Pu'u Lilinoe and Waiau would be affected by the visual impacts from the project. The Final EIS should include a more detailed description of the NASA-funded preservation initiative and the associated working group that will be created in accordance with the MOA. We support formation of the proposed local citizen's working group and recommend the Final EIS provide details regarding the timeline and NASA commitments, ensuring mitigation measures receive a high priority. G

Best Management Practices (BMPs) should incorporate an integrated resource management planning approach, as suggested by Native Hawaiian organizations to ensure that all impacts to cultural resources, visual resources, and biological resources are avoided or mitigated. Protection of cultural values relies on the implementation of BMPs. The Final EIS should identify specific BMPs that will be used to minimize adverse effects on historic properties, guarantee effective drainage and erosion control methods, and reduce the visual impact of the project. In particular, they should include specific emission plans for construction. H I

We recognize NASA's commitment in the MOA to implement mitigation measures for dust control. In addition to mitigation for dust, EPA recommends evaluating the use of particle traps and other appropriate controls to reduce emissions of diesel particulate matter and other air pollutants that will result from the use of construction equipment. Traps can control approximately 80 percent of diesel particulate matter and specialized catalytic converters can control up to 50 percent of hydrocarbon emissions. NASA should ensure that construction-related trips of workers and equipment, including trucks and heavy equipment, are reduced as much as possible, that equipment does not idle unnecessarily, and equipment is tuned to the manufacturer's specifications. To the extent that NASA adopts additional mitigation to reduce project-related emissions from construction of the proposed facility, these mitigation measures should be reflected in the FEIS and NEPA Record of Decision. J K L

We appreciate the opportunity to review this DEIS. Please send two copies of the Final EIS to this office when it is officially filed with our Washington, D.C. office. In the meantime, if you have any questions, please call Summer Allen, the lead reviewer for this project, at (415) 972-3847.

Sincerely,

Lisa B. Hanf, Manager
Federal Activities Office

MI# 003596
Enclosure:
Summary of Rating Definitions

cc: Dr. Wendy Wiltse, US EPA, Pacific Islands Contact Office, Honolulu
Genevieve Salmonson, Director, Office of Environmental Quality Control, Honlulu

SUMMARY OF EPA RATING DEFINITIONS

This rating system was developed as a means to summarize EPA's level of concern with a proposed action. The ratings are a combination of alphabetical categories for evaluation of the environmental impacts of the proposal and numerical categories for evaluation of the adequacy of the EIS.

ENVIRONMENTAL IMPACT OF THE ACTION

"LO" (Lack of Objections)

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

"EC" (Environmental Concerns)

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

"EO" (Environmental Objections)

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

"EU" (Environmentally Unsatisfactory)

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

ADEQUACY OF THE IMPACT STATEMENT

Category 1" (Adequate)

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

"Category 2" (Insufficient Information)

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analysed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

"Category 3" (Inadequate)

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analysed in the draft EIS, which should be analysed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

Lisa Hanf
U.S. Environmental Protection Agency
September 15, 2004

Response to Comment A:

Summaries of the oral scoping comments made at the public scoping meetings are provided in Acrobat® format at http://www2.keck.hawaii.edu/. Comments were summarized and not attributed to facilitate responding and protect individual privacy. The EIS was developed taking into account scoping comments. Analysis focused on the issues of most concern to commenters. Some scoping comments raised issues that are outside the scope of the National Environmental Policy Act.

Response to Comment B:

If NASA in the Record of Decision (ROD) selects the W.M. Keck Observatory site alternative for the Outrigger Telescopes Project, the Cultural Monitor will be hired once the permits are obtained. In consultation with NASA and the other Consulting Parties, the California Association for Research and Astronomy (CARA) shall develop criteria for and select an individual to be the project's Cultural Monitor. The term "Consulting Parties" includes the parties that formally participated in the Section 106 process, whether or not they signed the Section 106 Memorandum of Agreement (MOA). While CARA will make the final selection, CARA invites input from the Native Hawaiian community. The Cultural Monitor will be selected and on duty before on-site construction of the Outrigger Telescopes begins. The Cultural Monitor will be on-site for the life of the on-site construction and installation. See the MOA in Appendix B of the EIS.

Response to Comment C:

As part of the MOA completed under the National Historic Preservation Act, there is continuing consultation throughout the period of the on-site construction and installation activities. NASA will keep the door open for continuing meaningful dialogue. As the Outrigger Telescopes Project progresses, Native Hawaiian organizations would be encouraged to contact NASA with any concerns.

Response to Comment D:

Such an initiative would be beyond NASA's purview and more properly would be associated with overall astronomy activity.

Response to Comment E:

NASA's decision on the proposed Outrigger Telescopes process will be documented in the ROD, issued no earlier than 30 days after issuance of this EIS. The ROD will state the course of action that NASA has selected. It also will specify the environmentally preferable alternative. The selected and environmentally preferable alternatives may or may not be the same. NASA will make the ROD publicly available.

NASA's decision on a site for the Outrigger Telescopes Project, or even to go forward with the Proposed Action, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these

factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment F:

Executive Order 13007, entitled Indian Sacred Sites, applies only to Federal lands. No Federal lands are associated with the Outrigger Telescopes Project. The land is leased to the University of Hawai‘i from the State of Hawai‘i. Although Executive Order 13007 does not apply to the Outrigger Telescopes Project, a Cultural Monitor and an Archaeologist would be present during on-site construction and installation of the Outrigger Telescopes.

Response to Comment G:

NASA and Office of Mauna Kea Management (OMKM), in consultation with the other Consulting Parties, will ensure the formation of the citizen’s working group. The working group is to represent a broad spectrum of Hawaiians and will decide upon the prioritized use of the $2 million NASA has committed. OMKM will coordinate and manage the activities of this working group and provide administrative services.

A detailed discussion of the citizen’s working group is not provided in the EIS because the details are not known. The EIS has been revised to include language regarding NASA’s $2 million commitment. If the project goes forward, NASA will include the $2 million initiative in the ROD.

Response to Comment H:

The Best Management Practices Plan (Appendix F) considered cultural resources (pages F-6, F-8, F-9, F-12), visual resources (pages F-6, F-10), and biological resources (pages F-6, F-13). Even though some best management practices may not be contained in Appendix F, additional practices are contained within Volume I of the EIS.

Development of an integrated resource management plan is most appropriately within the purview of the entity with overall management responsibility for Mauna Kea.

Response to Comment I:

The Best Management Practices Plan (Appendix F) discussed specific practices for historic properties (pages F-6, F-8, F-9), drainage and erosion control methods (pages F-5 and F-8), and visual impacts (pages F-6, F-10). Best management practices for emission controls are addressed on pages F10-11.

Response to Comment J:

Particle traps and catalytic converters are not practical due to the current unavailability of ultra-low sulfur diesel on the Big Island of Hawai‘i.

Lisa Hanf
U.S. Environmental Protection Agency
September 15, 2004

Response to Comment K:

NASA will make reasonable efforts to ensure that CARA follows your recommendations.

Response to Comment L:

Any additional mitigation adopted by NASA to reduce project-related emissions from construction of the Outrigger Telescopes will be reflected in the EIS and the ROD.

COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE OUTRIGGER TELESCOPES PROJECT Aug. 25, 2004
Cory Harden for Sierra Club Moku Loa group

NASA (National Aeronautics and Space Administration) is to be commended on several fronts. One, NASA went beyond the EA (Environmental Assessment) ordered by the court to do a full EIS (Environmental Impact Statement.) Two, NASA went beyond its own project to give us the first assessment of the cumulative impact of all telescopes. Three, NASA concluded, rightly, that in many areas the cumulative impact is severe.

This brings us to many points of concern.

First, we need a new master plan to protect the mountain. The severe cumulative impact was caused by piecemeal and misguided management of activities on Mauna Kea. No new astronomy facilities must be built until a new plan is in place. Sierra Club urges NASA to support such a plan.

The plan now being used, UH Master Plan 2000, has not been approved by BLNR (Board of Land and Natural Resources.)

We need a new plan which sets up a management board, chosen by the community, with power to make decisions. It must represent native Hawaiians, community people, biologists, archaeologists, and groups using the mountain.

The planning process must be public. A

The plan must name responsible parties, require regular reports, and include penalties for non-compliance.

The plan must name a mechanism to secure reliable funding to protect the mountain.

The plan must state clear goals and objectives. It must stress mitigating the impact of astronomy activities. It must include a system to monitor resident species, habitat, hydrology, and water resources. It must spell out monitoring and data analysis procedures, and corrective and mitigation actions.

The plan must clarify the decision-making process, now divided among the Mauna Kea Management Board, the UH Hilo Chancellor, the UH Institute for Astronomy, the UH Manoa Chancellor, the UH President, the UH Board of Regents, DLNR, and BLNR

The second concern is water testing. Astronomy facilities generate over 50,000 gallons of waste water per month. But three facilities do not inspect or pump out their systems periodically. And for eight years (1994 to 2002) there is no evidence B

that any waste water systems were inspected, maintained, or pumped, except for Subaru. Wastewater will increase 25% if the telescopes now planned are built.

Wastewater may contain hazardous materials. IfA denied that mercury and other hazardous materials were used at Keck, but in fact they were used. Wastewater from mirror de-coating went directly into wastewater systems at Keck and Canada-France-Hawaii up till two years ago. There have been about 20 hazardous material and sewage spills in 25 years--almost one per year. B

This is all occurring on a mountain which is the principal aquifer for Hawaii Island.

So water quality is of concern. To test surface water, generally ten samples are taken a month apart, five in dry season and five in wet season, according to Department of Health Environmental Planning Office. But the EIS, like many environmental studies, reports only one recent water sample from three sites. And although the EIS reports levels of many substances, it does not say what is normal for comparison.

Third, there are land use issues. The EIS says the outriggers are allowed under the UH 2000 Master Plan, but does not say this plan was never approved by BLNR. The outriggers are not allowed under the last plan approved by BLNR, the 1995 plan.

The IfA (Institute for Astronomy) has applied for a CDUP (Conservation District Use Permit) for the outriggers. C

But IfA has no operating agreement or legal document authorizing them to act on behalf of NASA or CARA (California Association for Research in Astronomy.)

And without a final EIS, BLNR lacks knowledge to guide its decision on the permit.

The fourth concern is biological resources. The Wekiu bug population dropped almost 100% from 1982 to 1997. So NASA is to be commended for committing to a study of the Wekiu bug which includes life cycle, habitat requirements, and breeding behavior. The study should also include reproduction rates and ability to tolerate dust and compaction. Changes must be made in the Wekiu Bug Mitigation Plan if the study shows a need. D

Debbie Ward has concerns about EIS information on wekiu habitat and will be commenting when she returns.

14 other animal species are thought to live in the summit cinder cone area, many unique to Hawaii. These species also must be studied.

The fifth concern is socioeconomics. The EIS states correctly that the telescopes benefit Hawaii by bringing jobs and spending.

But it must also speak to the long-standing issue of groups paying reasonable rent to fund protection for natural and cultural resources on the mountain. UH says one dollar a year rent is reasonable, because astronomy is education and therefore an appropriate use of ceded lands. But UH has contracts with industries which do military work, and some observatories are private. E

The EIS must also factor in the cost of funding the IfA and Office of Mauna Kea Management, management activities, and maintenance of infrastructure, and the cost of lost opportunities such as preserving Mauna Kea as a natural and cultural park.

The sixth concern is about proper EIS process. NASA has already built the outriggers ready to install. That means Federal money was spent before the EIS process was complete. F

IfA already applied for a CDUP. This should not occur till after the Record of Decision on the EIS, to avoid even the appearance of a "done deal."

The last concern is an alternate site. The EIS names an alternate site for the outriggers in the Canary Islands. It expects no impact on cultural practices or archaeological resources, and minor impact on the environment. If the people of the Canary Islands want the outriggers--and they must be asked--that site looks like a far better choice. G

In closing, Mauna Kea now has biggest collection of telescopes, and the densest concentration of telescopes, in the world. But the UH Master Plan (though unapproved) calls for up to 21 new telescopes, 5 upgrades of existing facilities, 24 large radio antennas, and up to 48 telescope pads. Compare this with the carrying capacity once set for Mauna Kea telescopes--13.

Astronomy can occur in many places. But many Hawaiian traditions carried out on Mauna Kea cannot be carried out anywhere else in the world. The summit is a place so sacred to native Hawaiian religion that not even shrines were built there. It has now endured three decades of industrial development so severe that the mountain can never be fully restored.

Mauna Kea deserves protection, and protection is long overdue.

Cory Harden
Sierra Club
August 25, 2004

Response to Comment A:

NASA recognizes the Mauna Kea Science Reserve (MKSR) Master Plan which was approved by the University of Hawai‘i Board of Regents on June 16, 2000 (UH 2000b). On February 2, 2000, Governor Benjamin J. Cayetano accepted the MKSR Master Plan Final Environmental Impact Statement (MKSR FEIS) as satisfactorily fulfilling the requirements of Chapter 343, Hawai‘i Revised Statutes (State of Hawai‘i 2000). The MKSR FEIS contains a November 2, 1999 comment letter from the Department of Land and Natural Resources (DLNR) signed by Timothy Johns, Chairperson, in which he states DLNR's position regarding the Master Plan. "The Department of Land and Natural Resources would continue to review each situation in the context of a Conservation District Use Application. . . DLNR's acceptance and consideration of applications for new uses, such as telescopes, will be contingent upon implementation of the local design review process and more generally, the performance of the local management authority in fulfilling its stated responsibilities. . . It will be the University's and the telescope operators' responsibility to ensure that procedures outlined in the Master Plan are followed for day-to-day management and development guidelines. Failure to do so could jeopardize Conservation District Use Application approvals and any future telescope development on Mauna Kea." Under the heading "New Management Responsibilities," Mr. Johns further states that "A Hilo-based review process, with the Board of Land and Natural Resources continuing to consider individual CDUAs and sublease agreements, would guide new telescope and facilities development. DLNR enforcement would be limited primarily to compliance with Conservation District Use Permit conditions and response to enforcement issues related to violations of Conservation District laws. . ."

Response to Comment B:

No measurable groundwater contamination can result from the disposal of wastewater at the summit, as shown by the hydrologic analysis done as part of the cumulative impacts analysis in the EIS (See Section 4.1.3 and 4.2.5). The same analysis shows that wastewater from the observatories cannot reach Lake Waiau. All disposal of wastewater is done through State-approved septic systems. No hazardous materials are disposed of through the septic systems, but rather are trucked down by licensed and State-approved contractors.

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available scientific information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system is negligible.

Response to Comment C:

See Response to Comment A. The University of Hawai‘i's responsibility to acquire a Conservation District Use Permit (CDUP) and the Federal Government's responsibility to complete the National Environmental Policy Act (NEPA) process are separate and independent processes.

Cory Harden
Sierra Club
August 25, 2004

Response to Comment D:

Over the past three years substantial new information on Wēkiu bug life cycle, behavior, and distribution has been collected through studies funded by Office of Mauna Kea Management (OMKM) and through Wēkiu Bug Baseline Monitoring funded by California Association for Research in Astronomy (CARA). For example, information collected during Wēkiu Bug Baseline Monitoring has been shown that Wēkiu bug trap capture rates (a measure of movement and behavior) change with temperature. In addition, new information about Wēkiu bug distribution has been collected by Englund and others (2002), establishing a new lower boundary for this insect's habitat. Other information that has come from Wēkiu Bug Baseline Monitoring includes more details about the life cycle and the seasonal activity of juvenile bugs. Much of this information has been presented in the form of reports. Articles for professional journals are also being prepared that will present the information to the scientific community through a peer review process.

The analyses provided in the EIS are based on the best available scientific information. If the Outrigger Telescopes Project goes forward on Mauna Kea, NASA will fund a Wēkiu Bug autecology study to gather more information about habitat requirements, life cycle, nutritional requirements, and breeding behavior of this unique bug.

Detailed quantitative information about the ten other native arthropods that are thought to be resident of the summit of Mauna Kea is unavailable. These arthropods are new to science and have not been described as species. However, the Wēkiu Bug Mitigation Plan addresses all of the potential stresses to the natural ecosystem on the summit of Mauna Kea from the proposed Outrigger Telescopes Project and would reduce potential impacts on the other native Hawaiian arthropods present as well. In addition, of the ten other native arthropods found within the summit area, six have also been found in the *Area Below the Summit Area Cinder Cones* (Howarth and others 1999). Any impact to these arthropods would be similar and likely proportionate to any impact to the Wēkiu bug. The remaining four arthropods, which include two species of mites and two species of sheetweb spiders, have been found only on the *Summit Area Cinder Cones* (Howarth and Stone 1982; Howarth and others 1999). However, it is unlikely that the Outrigger Telescopes Project would have any reasonably foreseeable significant adverse effect on these species. See Sections 3.1.3.1, 3.1.3.2, and 4.1.2.2 for more details.

Response to Comment E:

These issues are outside the scope of the EIS.

Response to Comment F:

The Outrigger Telescopes and their enclosures were designed and ordered shortly after funding became available in 1998. This was necessary because it was recognized that it would take 4 to 5 years for the Telescopes and their enclosures to be completed. NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the

Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No decision will be made until the NEPA process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

The University of Hawai‘i’s responsibility to acquire a CDUP and the Federal Government's responsibility to complete the NEPA process are separate and independent processes.

<u>Response to Comment G:</u>

See Response to Comment F.

From: Cory (Martha) Harden
To: "NASA otpeis" <otpeis@nasa.gov>
Subject: comments on Keck EIS
Date: Thu, 30 Sep 2004
September 30, 2004

Dear Dr. Pilcher,

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Outrigger Telescopes Project. Although my comments are not official Sierra Club comments, I have been following the issue for some time as a member of Sierra Club, and spoke for Sierra Club at the Hilo hearing on the draft EIS.

NASA is to be commended for going beyond the EA (Environmental Assessment) ordered by the court to do a full EIS, and for going beyond its own project to give us the first assessment of the cumulative impact of all telescopes.

However, it is disappointing that the Draft EIS appears to gloss over facts at times, downplaying the severe impacts of the telescopes on the irreplaceable natural resources of Hawai‘i Island and the cultural and spiritual life of native Hawaiians.

Please see specific comments below.

Sincerely,

Cory Harden

BIOLOGICAL RESOURCES

Draft EIS p 4-12 to 13 if any alien species are found "appropriate measures would be taken."

My comment on draft EIS *The EIS must specify these measures.* **A**

p 4-13 My comment on draft EIS *Off-site activities that could impact flora and fauna should include "people walking"* **B**

Draft EIS p 4-13 "when vehicles follow the recommended speed limit of 8 km (5 mi) per hour, only a small amount of dust would be generated"

My comment on Draft EIS *The EIS must analyze wind data for Mauna Kea (which, like many mountain summits, has high winds) and the effect on dust dispersal.* **C**

Draft EIS p 4-16 "CARA will implement the [Wekiu Bug] monitoring plan, and enforce compliance with the mitigation plan."

My comment on Draft EIS *The EIS should discuss whether a government agency would be a better choice to enforce compliance, and which agency would be best.* **D**

Draft EIS p 4-19 "all participants in the Outrigger Telescopes Project will comply with the Wekiu Bug Mitigation Plan, the Wekiu bug Monitoring Plan, the NHPA Section 106 MOA, the Construction Best Management Practices Plan and all other existing plans and agreements designed to protect the natural resources of Mauna Kea."

My comment on Draft EIS *Many such agreements have been violated in the past (see news clip.) The EIS must explain why this lack of compliance would change.* **E**

State Land Board fines Institute for Astronomy for permit violations

By Associated Press September 12th, 2004
HILO, Hawaii (AP) _ The state Board of Land and Natural Resources has fined the University of Hawaii's Institute for Astronomy 20-thousand dollars for various permit violations. Nine violations, including failure to update some permits, were discovered in May. The Land Board fined the Institute two-thousand dollars for each violation and two thousand dollars for administrative costs. Officials with the Institute called the violations embarrassing, but accepted the fines levied Friday by the Land Board. Officials say five of the violations have already been taken care of and steps are being taken to address the other four issues.

Draft EIS p 3-24 "The only fauna currently found in the Area Below the Summit Area Cinder Cones are arthropods. **It is not known** whether other indigenous arthropods [other than the few briefly described in the EIS] are resident in [this area]"

Draft EIS p 3-25 [in the silversword/alpine shrub zone] The fauna of [this zone] **has not been well studied**. There may be resident arthorpod species in this zone, but **no systematic survey has been conducted**." [emphasis added]

Draft EIS p 3-27 to 3-28 "There are more than 6,000 native arthropod species in Hawai'i. Many elements of this fauna are restricted to narrow geographic or ecological limits·[in the] mamane forest on Mauna Kea. More than 200 arthropod species have been collected there, and more are found with every new study. Competition from alien species has pushed many native arthropod species to the brink of extinction.."

Draft EIS p 4-75 "Trap capture rates of the other summit resident native arthropod species **have not been measured or analyzed** there has been a substantial adverse impact on Wekiu bugs **there is not enough information** to determine the contribution of human activities to that impact." [emphasis added]

Draft EIS p 4-13 "The mitigation measures in the Wekiu Bug Mitigation Plan would also protect the habitat of the other resident species."

My comment on Draft EIS *Species other than the Wekiu bug are at risk of extinction. The EIS must explain how the Wekiu Bug Mitigation Plan will protect their habitat, when many are unstudied and even undetected. Studies of the other species should be done and put out for public comment, then included in the final EIS. These studies should include life cycles, ability to feed, ability to tolerate dust or compaction, reproduction rates, breeding behavior, number of offspring, details of habitat needed for survival, and conditions impacting the species. Habitat restoration procedures and principles must be formulated by creating and testing hypotheses.* **F**

Draft EIS p 3-21 "scientists concluded that Wekiu bug activity apparently experienced a 99.7 percent decline" from 1982 and 1997/98

My comment on Draft EIS *"apparently" downplays the dramatic decline.* **G**

Draft EIS p 3-24 "The Mauna Kea silversword is a Federally listed endangered species."

Draft EIS p 3-25 "The alpine plant community is almost entirely comprised of native species·systematic surveys have not been conducted·.

My comment on draft EIS *Surveys should be done and put out for public comment, then included in the final EIS.* **H**

Draft EIS p 4-19 "New information [from the Wekiu bug autecology's study] could be used to modify the habitat restoration protocol·"

Draft EIS p 4-42 "knowledge of Wekiu bug ecology and population dynamics is incomplete"

My comment on draft EIS *NASA should have completed research before developing the Wekiu Bug Mitigation Plan. And mitigation must be strictly enforced: Wekiu bug habitat was damaged because UH did not take measures outlined in the 1982 EIS to minimize disturbance to the habitat during telescope construction.* **I**

Draft EIS p 4-76 "NASA has requested an updated opiion regarding activities at Hale Pohaku and their potential impact on palila."

My comment on draft EIS *This should have been included in the draft EIS so the public could comment*.

My comment on draft EIS *The EIS must analyze why there is plenty of funding for up-to-date telescopes, but little funding for up-to-date environmental studies.*

CULTURAL/ HISTORIC

Draft EIS p3-11 the Mauna Kea "landscape itself is considered sacred"

Draft EIS p 3-16 "At one level the entire mountain is a traditional cultural property"

My comment on draft EIS *The EIS must explain how native Hawaiian cultural and spiritual practices bound to the landscape of Mauna Kea can be fully carried out with 20 telescopes present, and how it is reasonable to expect native Hawaiians to publicly speak out on issues that are historically private and personal.* **J**

Draft EIS p 4-95 "The development of the NASA IRTF, the W.M. Keck Observatory, and the

Subaru Telescope were accompanied by great modification of the physiography of Puʻu Hauʻoki and the unnamed cinder cones to the west, as connecting roads were built·and as the tops of these cones were flattened·"

Draft EIS p 4-112 "There is not enough surplus cinder·to restore the pre-observatory topography·"

My comment on draft EIS *The EIS downplays the facts. NASA's infrared telescope leveled a pristine area of the summit, changing the mountain's profile and destroying wekiu habitat. Even if all telescopes are removed, this area, and other cinder cones which were cut off, can never be fully restored. The EIS must explore in detail the impact of this irrevocable damage on native Hawaiian religion, which is bound to the landscape, and on the natural beauty of the mountain.* **K**

CUMULATIVE IMPACT

Draft EIS p 3-23 "Twenty-six species of lichens have been found·in the Area Below the Summit Area Cinder Cones. Apparently all are indigenous·but about half are not unique to Hawai'i. The proposed Outrigger Telescope site is not located within or adjacent to any of these sensitive areas."

My comment on draft EIS *The EIS must explain how the cumulative impact of all the telescopes will affect them.* **L**

Draft EIS p 4-63 Army Transformation Project

My comment on draft EIS *The EIS fails to even mention the highest-impact part of the Army project: devoting 23,000 more acres of island to military training, creating severe impacts from dust, 24-hour noise, major erosion, hazardous substances, harm to endangered species, and destruction of native Hawaiian cultural sites. This could be coupled with future astronomical construction visible from most parts of the island, and far in excess of the carrying capacity of Mauna Kea. The Army and telescope projects will combine to fundamentally change the character of the island, intruding on its vast tracts of natural open space with military and industrial construction and activity.* **M**

My comment on draft EIS *The EIS repeatedly says the impact of the outriggers will be small.*

But if the outriggers are built in spite of mounting objections from native Hawaiians and environmentalists, pressure to build even more telescopes will follow. So the EIS must address the impact of these future telescopes in relation to the carrying capacity of the mountain, determined to be 13 telescopes in the plan approved about 1985 by BLNR. **N**

EIS PROCESS ISSUES

Draft EIS p 2-41 "the start of operations [is] increasingly urgent if data are to be available in time to support NASA's future Origins missions."

My comment on draft EIS *The Origins deadline, the prospect of time-consuming dealings with a foreign government at the Canary Island site, and fears in the astronomy community that a slowdown or stoppage of the outriggers will hold up all future telescopes·all create pressure to put the outriggers on Mauna Kea, and quickly. The EIS must explain how NASA is avoiding bias for Mauna Kea despite this pressure.* **O**

My comment on draft EIS

The EIS should explain how the community can reasonably track 13 separate EIS processes for 13 separate observatories.

The EIS must explain the rationale for choosing NASA as the applicant, when the University of California and the California Institute of Technology also own Keck.

The EIS must explain how it is legal that the IfA (Institute for Astronomy) applied for a CDUP (Conservation District Use Permit) for the outriggers. IfA has no operating agreement or legal document authorizing them to act on behalf of NASA or CARA (California Association for Research in Astronomy.) **P**

NASA already built the outriggers with no EIS. The EIS must explain how this is legal, and how there could be no bias to go forward with the outriggers. **Q**

The EIS must explain how baselines can be adequate, when there is no baseline data from the time before any telescopes were built. **R**

The Land Board may decide on the CDUA before the final EIS comes out. The EIS must explain--

**how it is legal for the Land Board to consider or approve the CDUA before the final EIS is completed*

how the Land Board can make an informed decision based on an EA that was found to be inadequate, without information from the final EIS* **S

**what will happen to the outrigger project if the CDUA is found to be invalid*

how EIS mitigation measures can be enforced if the CDUA permit is already approved.* **T

The EIS must take into account all information from the Contested Case Hearing held on the Conservation District Use Application, the Sierra Club Legislative Briefing on UH Compliance with the Auditor's Report, and the Summary of the 1999 State Auditor's Report on the UH Institute for Astronomy. **U**

FIRE

3.1.9.3 Emergency Services and Fire Suppression p 3-52

My comment on draft EIS *This section downplays the dangers of fire on the summit.*

The EIS must include information on the fire during construction of Subaru telescope that killed three people, and measures needed to prevent future fires.

"The telescope, eight years in construction, cost some $350 million-and took the lives of three workers, who died in a fire in the dome in 1996." "Japan Fields a Big League Light Gatherer" by Gary Stix, Technology and Business, April 1999 **V**

"A 1996 fire 'killed three workers building the Subaru telescope on the mountain' "Science, Culture Clash Over

Sacred Mountain" by Usha Lee McFarling, Times Science Writer, Sunday Report, Los Angeles Times, March 18, 2001

The EIS must also include the fact that tests (done at Keck itself) show materials catch fire more easily at high altitudes, and identify procedures to address this.

"Tests at Keck after the disastrous Subaru fire revealed that all flammable materials tested caught fire much more easily on Mauna Kea than at sea level. (This is because, while there is still plenty of oxygen for combustion of most materials, there is only half as much air to cool the igniting object, making the process easier.)" The United Kingdom Infrared Telescope Annual Report 1997 **V**

Draft EIS p 4-14 "Fire prevention and suppression measures that are part of the Best Management Practices would make this potential for fire damage small."

My comment on draft EIS *The EIS must spell out exactly what practices will be followed, and name the responsible parties.*

HAZARDS

Draft EIS p 4-12 "environmentally friendly soil-binding stabilizers" will be used to control dust

My comment on draft EIS *The EIS must specify which substances that may be used, so public can evaluate their safety. One "environmentally friendly" stabilizer in Army Transformation EIS contained hazardous substances.* **W**

Draft EIS p 4-94 to 4-95 "It is assumed that reasonably foreseeable future activities would use and generate waste from hazardous materials similar to those generated by past and present activities 'that new or redeveloped facilities would each have written standard operating and emergency procedures for handling hazardous materials and would provide training for workers accordingly' that contractors would provide only the necessary amounts of paints and solvents on the summit, eliminating temporary storage needs there, and that transportation of hazardous materials and waste would be coordinated with other construction traffic to minimize the chance for an accident·Given these assumptions and other procedures available to manage hazardous materials, no significant impacts within the ROI [region of influence] are expected from reasonably foreseeable future activities."

My comment on draft EIS

The assumptions appear to be extremely optimistic. The EIS must spell out the facts used as a basis for the assumptions.

The EIS should include these facts:

**in 1999 two staff from IfA denied the use of mercury at Keck, when in fact it was used and there were three mercury spills in 1995*

**in 2003 staff from IfA stated several hazardous chemicals were not used at Keck, when in fact they were used*

Since the public has been seriously misled in the past, the EIS must spell out protocols for

transportation, storage, and disposal of hazardous substances, including required procedures for monitoring, reporting, and enforcement of safety measures.

Also, there have been six documented elemental mercury spills. NASA must provide documentation that they were adequately cleaned up. **X**

LAND USE

Draft EIS p 3-2 "Astronomy facilities in the resource subzone require a board permit and an approved management plan" HAR 13-5-24

My comment on draft EIS *The EIS must explain how it is legal to build the outriggers when the current management plan, UH Master Plan 2000, has not been approved by BLNR.* **Y**

Draft EIS p 1-4 "Some comments [during the scoping period] raised issues, such as overall management of the summit of Mauna Kea and ceded lands, that are beyond the scope of the Outrigger Telescopes Project and this document."

My comment on draft EIS *The community has raised both issues repeatedly. They must be addressed in the EIS.* **Z**

Draft EIS p 4-32 "A Coastal Zone Management Act compatibility determination does not apply to NASA's proposal to fund the Outrigger Telescopes on Mauna Kea·" and Appendix A has a letter from DBEDT [Department of Business, Economic Development and Tourism] on the subject

My comment on draft EIS *The EIS should explain in detail why a CZM (Coastal Zone Management) federal consistency review is not required.* **AA**

My comment on draft EIS

The EIS must explain how Keck will abide by three plans at once: the proposed UH Master Plan 2000, EIS mitigation and monitoring measures, and Keck's mitigation measures.

The EIS must also explain how mitigation measures will be enforced when historically the mountain has been badly managed and promises have been broken. **BB**

**The Legislative Auditor's report of 1998 says the summit was managed "primarily for the development of astronomy facilities" and "University of Hawaii's management·is inadequate to ensure protection of natural resources·management plans ·were often late and weakly implemented·The university's control over public access was weak and its efforts to protect natural resources were piecemeal. The university neglected historic preservation, and the cultural value of Mauna Kea was largely unrecognized. Efforts to gather information on the Wekiu bug came after damage had already been done." The report says that with interferometers that spread over large areas, the university must "reassess its methodology for managing future telescope construction." It also says DLNR "needs to improve its protection of Mauna Kea's natural resources·permit conditions, requirements, and regulation were not always enforced·administrative requirements were frequently overlooked or not completed in a timely manner."*

**For 20 years UH failed to submit timely applications for approval of telescopes constructed and subleases issued, thus requiring after-the-fact review.*

**UH failed to remove remnants of abandoned facilities.*

PREFACE

My comment on draft EIS

The preface downplays the controversy surrounding Mauna Kea. It must present a more balanced view of recent events including, but not limited to, the controversial 1997 proposal to limit public access to the summit, the highly critical Legislative Auditor's report, the lawsuit which led to the current EIS, and the Contested Case Hearing for the CDUA.

No new telescopes, even the outriggers, should be built until a comprehensive management plan is developed. The UH 2000 Master Plan contains data that is 15 years old, fails to study the cumulative impact of all the telescopes, and was never approved by BLNR.

The comprehensive management plan should:

**be developed by a board chosen by the community, with power to make decisions, including native Hawaiians, a biologist, an archaeologist, and representatives of groups using the mountain*

**be developed by involving the public, agencies responsible for compliance, UH, and its agencies.*

**describe goals and objectives for the Science Reserve with emphasis on mitigating the impacts of astronomy activities*

**set lines of authority and name responsible parties*

CC

**provide protection considering both current and future activities*

**spell out corrective actions and mitigation actions, and procedures for monitoring and data analysis*

**require regular reports*

**spell out compliance requirements and penalties for non-compliance*

**identify mechanisms for obtaining reliable funding needed to protect resources, such as a detailed budget including funding sources, legally binding agreements obligating funding for the lifetime of each project, and a security deposits before new construction*

**include a system to effectively monitor resident species and habitat, and hydrology and water resources.*

SOCIOECONOMICS

My comments on draft EIS *The EIS must factor in:*

**lost revenue from--*

charging only $1 a year rent instead of fair market value

lack of impact fees

**costs of--*

management

maintenance of public facilities and infrastructure

DD

liability for contamination and degradation

UH Institute for Astronomy and Office of Mauna Kea Management

development of the (unapproved) UH 2000 Master Plan

**economic benefits that would accrue from alternate uses, such as dedicating the mountain as*

a natural and cultural park which would increase the appeal of the island to tourists and residents **DD**

VIEW PLANES

My comments on draft EIS *The EIS minimizes visual impacts. It must include a detailed discussion of the views looking up, down, and around at the summit. These views, of the sky, the rest of the mountain, Hawai'i Island, and Maui, are all obstructed by the telescopes.* **EE**

WASTE

My comment on draft EIS *Waste in a sacred site is an offense to native Hawaiian religion.*

Waste should be removed from the mountain, not injected into it. **FF**

Draft EIS p 4-84 Before 2002, Canada France Hawaii Telescope and Keck "directed process wastewater from mirror decoating into their respective IWSs." [individual wastewater systems]

Keck's mirror washing and mirror aluminizing rooms had open drains that fed directly into the ground. The EIS must evaluate the effect of chemicals from this practice entering the wastewater systems.

Draft EIS p 4-84 "The IWSs are inspected by observatory maintenance crews periodically. The exceptions are VLBA, UKIRT, and JCMT which **do not inspect or pump out their systems periodically**." [emphasis added]

My comment on draft EIS *Wastewater treatment is crucial because the telescopes produce 40 to 80 gallons of effluent from cesspools and septic systems, plus 60 to 120 gallons from heating and cooling, per day, per telescope, and Mauna Kea is the principal aquifer for Hawai'i Island.* **GG**

The EIS must include the fact that as of about 2003, no evidence was given that any inspection, maintenance, or pumping of waste systems was done since 1994 except at Subaru. Keck had a Septic Tank Inspection Record, but it contained no data. The EIS must state what problems have resulted, and can result, from ongoing failure to perform inspection and maintenance. **HH**

The EIS must spell out specific measures to actively assess, identify, and prevent contamination of the groundwater and Lake Waiau. **II**

It must also evaluate the alternative of transporting all waste off the mountain. **JJ**

WATER

My comment on draft EIS *Hydrology information brought by plaintiffs to the Contested Case Hearing must be included in this section. For areas where the plaintiff's conclusions differ from NASA's, the EIS must explain why NASA's were chosen.* **KK**

Draft EIS p 3-30 "The limited and strongly seasonal supply of water to the lake [Waiau] lead s to substantial changes in its depth (it has been measured between 0.5 to 2.5 m (1.6 to 8.2 ft.) in the middle of the lake), its surface area (from 0.4 to 0.7 ha (1.0 to 1.7 ac)), and its volume (from 1,900 to 11,400 cubic meters (2,485 to 14,911 cubic yards)).

My comment on draft EIS *Since Mauna Kea is the principal aquifer for Hawaii Island and the volume of water in Lake Waiau has extreme variations, the usual procedure for testing surface water should be followed: ten samples are taken a month apart, five in dry season and five in wet season.* **LL**

For comparison, the EIS should also report normal levels of substances.

Draft EIS p 3-32 figures from water samples of Lake Waiau mg/l

Calcium 3.0 Aug 1976

5.03 May 1977

5.76 June 1977

6.25 July 1977

5.86 Aug 1977

5.72 Sept 1977

9.7 Jan 2003 east side

9.5 Jan 2003 west side

Mercury none detected Aug 1976

.0012 Jan 2003 east side

.0012 Jan 2003 west side

Phosphate 0.003 Aug 1976

0.021 May 1977

0.014 June 1977

0.004 July 1977

0.012 Aug 1977

0.009 Sept 1977

0.158 Jan 2003 east side

0.161 Jan 2003 west side

Potassium 2.3 Aug 1976

3.30 May 1977

3.85 June 1977

3.78 July 1977

3.75 Aug 1977

4.20 Sept 1977

7.70 Jan 2003 east side

3.40 Jan 2003 west side

Silicon 10.70 Aug 1976

1.39 May 1977

1.00 June 1977

0.74 July 197

1.35 Aug 1977

2.37 Sept 1977

43.10 Jan 2003 east side

41.20 Jan 2003 west side

Sodium 4.1 Aug 1976

5.98 May 1977

6.30 June 1977

6.39 July 1977

6.48 Aug 1977

6.20 Sept 1977

24.00 Jan 2003 east side

11.00 Jan 2003 west side

Zinc 0.095 Aug 1976

0.043 May 1977

0.075 June 1977

0.061 July 1977

0.024 Aug 1977

0.040 Sept 1977

0.380 Jan 2003 east side

0.088 Jan 2003 west side

My comment on draft EIS *Levels of some substances [in bold type] changed substantially The EIS should explore possible reasons for these changes, using these samples and future water samples.* **MM**

Cory Harden
September 30, 2004

Response to Comment A:

The Wēkiu Bug Mitigation Plan (Appendix D) addresses procedures for eradicating alien arthropods detected during monitoring.

Response to Comment B:

The EIS addresses foot traffic as an impact (See Section 4.2.3.3). NASA does not anticipate foot traffic in Wēkiu bug habitat by construction personnel, except under very rare circumstances, such as retrieving loose materials or trash (as directed by the consulting entomologist, see Wēkiu Bug Mitigation Plan page D-6, item 11), and in fact natural resource training has been proposed for the construction and operations crews to educate them about NOT walking into habitat. In addition, educational signs and barriers are proposed that would help prevent inadvertent walking into habitat.

Response to Comment C:

Dust control measures are addressed in Section 4.1.10.2 of the EIS.

Response to Comment D:

California Association for Research in Astronomy (CARA) would implement the Outrigger Telescopes Project and be subject to all applicable Federal and State statutes and regulations, permits issued by State and local agencies, and mitigation measures specified in the NASA Record of Decision (ROD). Enforcement of state laws and regulations is outside the scope of this EIS.

Response to Comment E:

The Outrigger Telescopes Project would be bound by all terms of the NASA ROD, the National Historic Preservation Act Section 106 Memorandum of Agreement, and the Conservation District Use Permit (CDUP). Each of these terms are enforceable through either a regulatory authority or a contract.

Response to Comment F:

The Wēkiu bug is the only species on the summit that is a candidate for listing under the Endangered Species Act. There is no information that "other arthropod species" are at risk of extinction.

Detailed quantitative information about the ten other native arthropods that are thought to be residents of the summit of Mauna Kea is unavailable. These arthropods are new to science and have not been described as species. However, the Wēkiu Bug Mitigation Plan addresses all of the potential stresses to the natural ecosystem on the summit of Mauna Kea from the proposed Outrigger Telescopes Project and would reduce potential impacts on the other native Hawaiian arthropods present as well. In addition, of the ten other native arthropods found within the summit area, six have also been found in the *Area Below the Summit Area Cinder Cones* (Howarth and others 1999). Any impact to these arthropods would be similar and likely proportionate to any impact to the Wēkiu bug. The remaining four arthropods, which include

two species of mites and two species of sheetweb spiders, have been found only on the *Summit Area Cinder Cones* (Howarth and Stone 1982; Howarth and others 1999). However, it is unlikely that the Outrigger Telescopes Project would have any reasonably foreseeable significant adverse effect on these species. See Sections 3.1.3.1, 3.1.3.2, and 4.1.2.2 for more details.

Response to Comment G:

Section 4.2.4 of the EIS addresses the decline in Wēkiu bug activity.

There have been no definitive population ecology studies of the Wēkiu bug. A number of trapping studies have been conducted on Mauna Kea since 1982. Trapping studies are ongoing today as part of the Wēkiu bug Baseline monitoring initiated by CARA in 2001.

The first two sampling studies were conducted in 1982 and in 1997/98. A comparison of the results of these the two studies indicated that in 1997/98 trapping rates were about 1 percent of the 1982 rates. This has been taken as an indirect indication that the populations of the Wēkiu bug on the summit area of Mauna Kea may have declined by 99 percent between 1982 and 1997/98. Recent trapping data from the ongoing Wēkiu bug Baseline Monitoring effort being conducted by CARA indicates that trapping rates have returned to about the same level as in 1982 on Puʻu Hauʻoki.

The causes of the apparent Wēkiu bug decline between 1982 and 1997-98 are not known. Hypotheses include climate change, a possible long-term downward trend in winter snow pack depth and persistence, scientific sampling, introduction of predatory alien arthropods, mechanical habitat disturbance from observatory construction, recreational impacts, vehicle impacts, long-term population cycles, and the possible presence of environmental contaminants from human activities. The most likely cause would probably be a combination of some or all of the above factors.

Response to Comment H:

The EIS contains survey information pertaining to the Silversword/Alpine Shrub Zone (See Section 4.2.4).

Response to Comment I:

The mitigation measures were reviewed and approved by the U.S. Fish and Wildlife Service (USFWS) and follow all the recommendations given in previous Mauna Kea Science Reserve arthropod assessments (Howarth and Stone 1982; Howarth and others 1999).

In a letter regarding the Wēkiu Bug Mitigation Plan for the W.M. Keck Observatory, Outrigger Telescopes Project at Mauna Kea, the USFWS states "The Service [USFWS] supports the recommendations in the WBMP [Wēkiu Bug Mitigation Plan] to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor use. . . We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to the wekiu bug habitat." See Volume II, Appendix A, for the letter from USFWS/Henson (USFWS 2000).

The U.S. Department of Interior (USDOI) submitted a comment letter on the DEIS stating "It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wēkiu Bug Mitigation Plan and the Wēkiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities." See the USDOI comment letter from Patricia Sanderson Port located in this Appendix.

In addition, the USDOI letter states "These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology."

An autecology study will be done as part of project implementation. NASA is committed to this study as stated in Section 4.1.2.2 of the EIS.

Response to Comment J:

In recognition of the sanctity of Mauna Kea in Native Hawaiian culture, NASA has made a particular effort to consult with Native Hawaiian religious practitioners. Their perspectives have had great influence on the content of this EIS. See Section 3.1.2.5 and Table 3-2 for more details.

Response to Comment K:

The EIS acknowledges that from a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on cultural resources on Mauna Kea is substantial and adverse.

Response to Comment L:

The EIS addresses cumulative impacts on lichens in Sections 4.2.4.2 and 4.2.4.3.

Response to Comment M:

A discussion of the Training at Pohakuloa Training Area (PTA) for Stryker Brigade Combat Team Army Transformation Project was included in Section 4.2.2 of the EIS. Impacts associated with PTA activities within the Region of Influence for a particular resource were included in the impacts analysis.

Response to Comment N:

NASA has addressed the cumulative impact of past, present, and reasonably foreseeable future activities on Mauna Kea in Section 4.2 of the EIS.

Response to Comment O:

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.,* the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a decision about a site for the Outrigger Telescopes Project. No decision will be made until the National Environmental Policy Act (NEPA) process has been completed. NASA's decision on the proposed Project will be presented in a ROD. Present plans anticipate that the ROD will be issued in early 2005.

NASA's decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment P:

The University of Hawai‘i has applied for the CDUP on behalf of CARA in the University's capacity as the leaseholder to the Mauna Kea Science Reserve.

Response to Comment Q:

The Outrigger Telescopes and their enclosures were designed and ordered shortly after funding became available in 1998. This was necessary because it was recognized that it would take 4 to 5 years for the Telescopes and their enclosures to be completed. See also Response to Comment O.

Response to Comment R:

The EIS is based on the best available information.

Response to Comment S:

The actions of the Land Board with respect to the Conservation District Use Application (CDUA) are a State matter and beyond the scope of the EIS.

Response to Comment T:

See Response to Comment S.

Response to Comment U:

The federal NEPA process is separate and independent from State processes. NASA has made a good faith effort to consider all pertinent information in the EIS process.

Response to Comment V:

There are plans [for all facilities] that contain fire prevention and safety procedures. See Section 4.2.10.2 of the EIS for additional information, including a discussion of the Subaru Telescope construction fire that took the lives of three workers.

Response Comment W:

Many dust-suppressing soil stabilizers are manufactured. Some may be environmentally safe and therefore appropriate for use at the Outrigger Telescopes Project construction site. For example, Harvard University research found that the soil stabilizer, NaturalPAVE® XL, is suitable for environmentally sensitive areas such as bird sanctuaries and riparian corridors. NaturalPAVE® XL has been used in several state and national parks including the Lorance Creek Natural Area in Arkansas, the Running Eagle Falls Nature Trail in Glacier National Park, Montana, and the Pinnacles National Monument in California. NaturalPAVE® XL has also been favorably reviewed in the Green Building and Design Recommendations at the University of Wisconsin – Madison.

Item 6 of the Wēkiu Bug Mitigation Plan (Appendix D) describes when and under what conditions soil stabilizers would be used. Soil stabilizers considered for use would be professionally reviewed, and only those found to be environmentally safe would be used.

Response to Comment X:

Section 3.1.5.2 of the EIS describes hazardous materials use, including mercury, at the W.M. Keck Observatory. This section also provides information about hazardous materials handling and storage; the CARA safety program related to hazardous materials; hazardous waste; and emergency response procedures and reporting requirements in the unlikely event of a spill.

Table 4-20 summarizes seven elemental mercury spills associated with astronomy operations on Mauna Kea. Best available information indicates that these spills were cleaned up adequately.

Response to Comment Y:

NASA recognizes the Mauna Kea Science Reserve (MKSR) Master Plan which was approved by the University of Hawai‘i Board of Regents on June 16, 2000 (UH 2000b). On February 2, 2000, Governor Benjamin J. Cayetano accepted the MKSR Master Plan Final Environmental Impact Statement (MKSR FEIS) as satisfactorily fulfilling the requirements of Chapter 343, Hawai‘i Revised Statutes (State of Hawai‘i 2000). The MKSR FEIS contains a November 2, 1999 comment letter from the Department of Land and Natural Resources (DLNR) signed by Timothy Johns, Chairperson, in which he states DLNR’s position regarding the Master Plan. “The Department of Land and Natural Resources would continue to review each situation in the context of a Conservation District Use Application. . . DLNR’s acceptance and consideration of applications for new uses, such as telescopes, will be contingent upon implementation of the local design review process and more generally, the performance of the local management authority in fulfilling its stated responsibilities. . . It will be the University’s and the telescope operators’ responsibility to ensure that procedures outlined in the Master Plan are followed for day-to-day management and development guidelines. Failure to do so could jeopardize

Conservation District Use Application approvals and any future telescope development on Mauna Kea." Under the heading "New Management Responsibilities," Mr. Johns further states that "A Hilo-based review process, with the Board of Land and Natural Resources continuing to consider individual CDUAs and sublease agreements, would guide new telescope and facilities development. DLNR enforcement would be limited primarily to compliance with Conservation District Use Permit conditions and response to enforcement issues related to violations of Conservation District laws. . ."

Response to Comment Z:

These State issues remain out of scope of the NEPA process.

Response to Comment AA:

The letter from the State of Hawai'i's Department of Business, Economic Development and Tourism explains in detail the reason a Federal Coastal Zone Management Act consistency review is not required (see Volume II, Appendix A).

Response to Comment BB:

NASA is not aware of any fundamental conflicts among the 2000 Mauna Kea Science Reserve Master Plan, mitigation and monitoring presented in the EIS, and other commitments. To the extent that requirements vary, the Outrigger Telescopes Project would comply with the most stringent conditions. See also Response to Comment E.

Response to Comment CC:

These issues are outside the scope of the EIS.

Response to Comment DD:

These issues are outside the scope of the EIS.

Response to Comment EE:

The EIS acknowledges that the cumulative visual impact from past, present, and reasonably foreseeable activities is substantial (4.2.14.4).

Response to Comment FF:

As described in Sections 3.1.5 and 4.2.6 of the EIS, all solid and hazardous waste is transported off Mauna Kea for disposal. All domestic wastewater from the observatories is disposed of through individual wastewater treatment systems approved by the State of Hawai'i Department of Health. The text of the EIS has been modified to address the impact of septic system discharge on cultural resources.

Response to Comment GG:

The text of the EIS has been modified to address the impact of past mirror decoating wastewater disposal practices. All domestic wastewater from the observatories is disposed of through individual wastewater treatment systems approved by the State of Hawai'i Department of Health.

Response to Comment HH:

Best available information indicates that there have been only several small sewage spills onto the cinder on the order of several liters (gallons). Those spills, identified in Table 4-20, were the results of accidents and not a failure to perform inspection and maintenance.

Response to Comment II:

No measurable groundwater contamination can result from the disposal of wastewater at the summit, as shown by the hydrologic analysis done as part of the cumulative impacts analysis in the EIS (See Sections 4.1.3 and 4.2.5). The same analysis shows that wastewater from the observatories cannot reach Lake Waiau. All disposal of wastewater is done through State-approved septic systems. No hazardous materials are disposed of through the septic systems, but rather are trucked down by licensed and State-approved contractors.

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available scientific information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system are negligible.

Response to Comment JJ:

The proposed Outrigger Telescopes Project would use the W.M. Keck Observatory's existing sewage disposal system and off-site mirror decoating wastewater disposal practices, if NASA selects the Mauna Kea site. The W.M. Keck Observatory currently retains a licensed septic waste hauler to pump out the digested bio-solid sludge from the septic system every six months for disposal off site at an approved treatment facility. It is not within NASA's jurisdiction to require that all wastewater be trucked down the mountain. However, NASA has forwarded your request to the University of Hawai‘i for consideration.

Response to Comment KK:

See Response to Comment U.

Response to Comment LL:

The hydrologic impacts analyses are based on the physics of subsurface flow, not on the quality of water in various surface water bodies. By testing, it appears that the comment refers to the water quality data that are provided in the Massey report. The sampling was one time only, but the data on Lake Waiau reproduced from the Massey report does cover numerous samples over five consecutive months in 1977. These data are presented for informational purposes only. They are not used in the analysis of impacts, for example to prove by the water quality data that discharges at the W.M. Keck Observatory or elsewhere at the summit are or are not reaching various water bodies.

Response to Comment MM:

Your comment is respectfully noted. The comment has been forward to the University of Hawai‘i and OMKM for further review.

Date: Thu, 30 Sep 2004 19:44:27 -1000
From: John Harrison
Subject: Comments on the Outrigger Telescopes Project draft EIS
To: otpeis@nasa.gov

Dear Dr. Pilcher:

Please find attached the University of Hawai'i Environmental Center review of the referenced draft EIS.

Thank you for the opportunity to comment.

John T. Harrison, PhD
Environmental Coordinator
University of Hawai'i Environmental Center

Content-type: application/octet-stream; x-mac-type=5738424E; x-unix-mode=0644;
 x-mac-creator=4D535744; name="NASA Outrigger DEIS"
Content-disposition: attachment; filename="NASA Outrigger DEIS"

NASA Outrigger DEIS

UNIVERSITY OF HAWAI_I AT MANOA
Environmental Center

October 1, 2004

RE: 0741

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
300 E St., SW
NASA Headquarters
Washington, DC 20546-0001

Dear Dr. Pilcher:

Draft Environmental Impact Statement
Outrigger Telescopes Project, W.M. Keck Observatory
Mauna Kea, Hawai'i

NASA proposes to fund construction, installation and operation of four to six Outrigger Telescopes adjacent to the existing twin Keck Telescopes at the summit of Mauna Kea. The Outrigger Telescopes each would have mirror elements 1.8 m in diameter, with circular base housings 8 m in diameter, a 9.1 m diameter dome, and rising to an elevation of 10.7 m above ground level. Connections with existing Keck Telescope facilities would be via underground light pipes to instrumentation located in the basement of the Keck II Telescope Building.

This review was conducted with the assistance of Davianna McGregor, Ethnic Studies; and Karen Umemoto, Urban and Regional Planning.

General Comments

From the perspective of process, we commend the preparers of this draft EIS on the level of detail and completeness of factual information presented. Our reviewers generally found that technical descriptions of both the settings and the proposed actions were conveyed in a highly comprehensive manner. A

However, we also remain somewhat at a loss to understand why NASA chose to distance this effort from State environmental disclosure processes as noted on page xiii of the Executive Summary. We note that environmental documentation pursuant to Hawai'i Statutory provisions has addressed many of the crucial issues surrounding this proposed action, and we further note that §343-5(f), Hawai'i Revised Statutes, states, in part:

2500 Dole Street, Krauss Annex 19, Honolulu, Hawai'i 96822-2313
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

An Equal Opportunity/Affirmative Action Institution

Whenever an action is subject to both the National Environmental Policy Act of 1969 (Public Law 91-190) and the requirements of this chapter, the office and agencies shall cooperate with federal agencies to the fullest extent possible to reduce duplication between federal and state requirement.

We suggest that this is more than a mere academic concern, in that particular concerns regarding cultural and traditional practices of Native Hawaiians engage an epistemological framework that argues for more regional approaches to reconciliation. Although previously published Hawai'i environmental documentation, which has extensively explored cultural concerns is referenced in the present draft EIS, our reviewers are left with a sense that rather than seeking enhanced strategies to bridge cultural perspectives, this document adopts the presumptive stance that the scientific arguments for the proposed action trump cultural sensitivities. As such, it's difficult to imagine an outcome that promotes compromise and coexistence of the inherently dichotomous Native Hawaiian and technical perspectives.

Cultural Impacts

Proposed additional expansion of astronomical research facilities on the summit of Mauna Kea evokes impassioned responses within the Native Hawaiian community. Our reviewers have duly noted these concerns, and identify two issues that are perceived to be irreconcilable.

1. The EIS acknowledges the cultural impact study conducted by Kepa Maly and Kumu Pono Associates, which states that all of the informants, except one, do not want to see any further development on the summit. The proposed outriggers constitute an expansion and further development of the summit. Thus, all of the informants, except one, would be opposed to the proposed development of the outriggers. To the cultural informants the proposed development constitutes significant negative impact. In their view, this concern should be recognized and honored. There should not be any expansion on the summit. Any technological innovations should be constructed on the footprint of outmoded telescopes. There should be no further impact upon the sacred summit.

2. The cultural impact study by Kumu Pono, according to the EIS, also notes that the informants did not consider the proposed mitigation of impacts, the appointment of a committee to consult on cultural impacts, as an adequate measure to address their concerns about additional development on the summit. The principal mitigation measure proposed by the EIS, i.e. the appointment of an advisory committee, was not considered to be adequate by the cultural informants. How then can the project accommodate the informants' concerns? Will the position of the cultural informants simply be ignored? **B**

The clear position of the Native Hawaiian community is that while the proposed development of the outriggers does not seem huge and intrusive on the surface, it comes after decades of unplanned development of a very fragile ecosystem and cultural center. These

outriggers will compound the cumulative impact of the science center upon Mauna Kea. Native Hawaiians have very few wahi pana that remain untouched by technology, industry or tourism. Mauna Kea, itself, is already more developed than it should be. This fragile cultural resource needs to be protected, in much the same way that the government of Japan protects its sacred mountain Fuji.

The draft EIS acknowledges the existing and projected future adverse impacts of astronomical research at the summit of Mauna Kea, particularly with regard to these cultural concerns. However, where prior assessments have devoted considerable effort towards establishing active, participatory management efforts, both in the process of developing the disclosure documentation and in the implementation of on-the-mountain activities, this document appears to place all mitigation in the realm of a Memorandum of Agreement that is admittedly unsigned by and unacceptable to a substantial fraction of the very entities to which it applies.

C

As noted earlier, two conflicting epistemologies are in evidence in this situation, that of a cultural perspective that views the mountain as a sacred temple and that of a Western scientific perspective that views the mountain as a scientific temple. The great irony is that both frameworks fundamentally pursue the same reverence for the mystery of cosmic, and by derivative logic, human origins. Our reviewers offer conflicting opinions on the capacity for resolution of these issues. However, as written, the draft EIS seems remiss in not further exploring possible areas of compromise, particularly those relating to strategies for improving management of the mountain in ways that acknowledge equal validity for each of the prevailing epistemological perspectives.

Thank you for the opportunity to comment on this Draft EIS.

Sincerely,

John T. Harrison, Ph.D.
Environmental Coordinator

cc: OEQC
D. McGregor
K. Umemoto
James Moncur

John T. Harrison, Ph.D.
University of Hawai‘i Environmental Center
October 1, 2004

Response to Comment A:

Thank you for your supportive comments.

Response to Comment B:

NASA is committed to being a responsible steward in the implementation of the Proposed Action. NASA made a considerable effort to consult with interested and concerned parties about the Outrigger Telescopes Project. As a result, NASA has made numerous commitments to on-site and off-site measures that would protect and enhance the cultural and environmental resources of Mauna Kea. In addition, NASA will commit $2 million to an initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians as a mitigation component of the Outrigger Telescopes Project.

Response to Comment C:

NASA has made a good faith effort to develop mitigation measures in active dialogues with individuals and organizations representing Native Hawaiian perspectives on Mauna Kea. The overall management of Mauna Kea is a state issue, beyond NASA’s authority and outside the scope of this EIS.

Kahanamoku Estate Foundation

501.c3

Po Box 2158

Kamuela Hawaii 96743

808-887-0200. Voice 808-887-0205 fax

We mean not to overthrow the constitution but to overthrow those that pervert the constitution,
Abraham Lincoln.
A former President of the United States of America.

ABSTRACT

Mauna Kea

The Mauna Kea situation if need be can be stopped by the first Amendment of the Constitution of The united States of America as stated;

LAW

Amendment 1,

Congress shall make no law respecting an establishment of Religion. **Or prohibiting the free exercise thereof;** or abridging the freedom of speech, or of the press; **or the right of the people peaceably to assemble,** and petition the Government for a redress of grievances.

Amendment XIV

(Quote)
First paragraph
Sentence four (4)
No state shall make or enforce any Law which shall abridge the privileges or immunities of citizens of the United States:

ISSUE

As a citizens rights under the constitution of the United States of America, The Keck organization a private company. et al, has infringed on the first amendment of the constitution as well as the State of Hawaii i.e.; the University of Hawaii under an illegal lease of agreement; (church/state) Without the consent of the indigenous peoples of said (Church lands) State of Hawaii.

HISTORY

The Hawaiians as well as its descendants a group of the Polynesian people. Who have declared that the whole of the mountain known as Mauna kea is a Church of a group of Hawaiian people? (rights under the constitution of America) Its declaration of church-hood began from its hereditary beginning B.C (Before Cook) to this date. (infinity) Circa 1200 b c +/- 1000 years. They have been denied the rights of offertories or at times denied approach to said church (Mauna Kea) to perform their rightful religious connotations at their discretion.

The State of Hawaii, The University of Hawaii, Keck Corp, NASA, the Federal Reserve Board and the Federal Reserve Banking System, both incorporated May 18 1914 at Minneapolis. The Congress of the United States of America. Et al

Has been proven that they have denied the Hawaiian, and its descendants. As well as desecrated their Church (Mauna Kea by erecting Building upon its sacred sites with fecal waste leakage into its sacred grounds.

And now is attempting to place a Striker Brigade making the Church a First Strike Military Target for the United States of America's future Enemies of Asian countries who will regard the church as their number one Target of an American Military Deployment.

The Native Hawaiian Parishioners have acclimated to the Western ways of life knowing under conquest; by commercialism, they are under involuntary servitude. (Slavery) check http://www.nativehawaiianrights.com

And further more **the Public access Shoreline Hawaii called the PASH decision (PASH vs. State of Hawaii. Et al) which won a landmark court case which forced courts and government agencies to acknowledge and protect Native Hawaiian subsistence, cultural and RELIGIOUS rights in making development decisions and consider any development's impact on cultural and religious resources. Includes the whole of the**

Native Hawaiian Culture and Religious rights in the State of Hawaii and it's Dominions.

Moreover, the order of life for the native Hawaiian is survival of the fittest, by Dictatorship par involuntary servitude under The Government of the United States of America and its separate State of Hawaii,
Quoting From the Preambles of the Constitution;
"Equality for All"

PROPOSALS

An opinion can never come to a conclusion: But a compromise yes! That is the bases of societies. It's as simple as a signal light, Red you wait, green you go. otherwise chaos.

These are some of the compromise;

1. Parishioners unlimited access to site.
2. Buildings; exteriors, conform its décor to the mountain. I.e. (pu'u conception)
3.Or remove said building from scared site and stop all commercialism from use of site (mountain) tours. Star gazing. Etc.
4.Striker Brigade if allowed must create a buffer zone between populations with flora;
So that the carbon dioxide may be engulfed by the flora, and exerting oxygen thus giving rise to the carbon monoxide to an altitude where the methane in combination will disburse both compositions in winds of 65 miles plus.
5. Restitution to the Native Hawaiian, Health care for the age! Infrastructure! Community Concerns!
6. Approach issues with Hawaiian people and the immediate Communities Rather than with any government agency of the State of Hawaii in any form.
7.Set date of conference of conclusion and finalized through camaraderie and understanding and an apology and restitution to the respect of said people of Hawaii and those that live within its immediate area Mauna kea Wai'kii, Wai'kaloa, Wai'mea, Ko'hala, Hilo, Hono'kaa, Ku'kai'au, Ha'makua and the whole of the 7th district of the island of Hawaii.

We ask not what can you give us, But we would ask, what can we give you! that you already have not taken. "an old Hawaiian saying!

" hu'i hele mai ai"

This deposition is by no way meant to defamed the question of astrology Or the purpose of man's quest to seek a positive position of genealogy from the beliefs that some where in the vastness of the universe he derived from rather than declare that he is a virus on a biological planet, with the same traits as all living life; to survive and reproduce.

It is his honor of the beliefs of superstition that this deposition had come to being.

What gives an entity the right through Dictatorship to possess without concern for the people to whom an inflection of harm shall befall them in the name of science. One that is the same as looking at a cemetery for what is seen in the universe is dead as light travels at 186 thousand mile per minute declared by astrology and physics, then declare that a star was discovered at thirty billion light years away. That would mean that at an astronomical unit of distance equal to the distance that light travels in one year in a vacuum or about 5.88 trillion miles depicting that its at a constant rate would place that discovery at a distance of thirty Billion times 5.88 trillion mile away from earth, what a discovery! (176.400 trillion mile) With that we can abide with science, But Dictatorship in a State of the Empire of America, isn't that rather questionable or is it true. As stated by General Leonard Wood wrote to Theodore Roosevelt: The Hawaiian islands one-third of the way across the Pacific, with pineapple and plantation owners, and had been described by American officials as "a ripe pear ready for plucking" was annexed by joint resolution of Congress in July of 1898.

Revenge! Hate! The Masse case! Slavery!

"Hu'I hele mai ai"

Perhaps this is a case for the Supreme Court of the Unite States of America on a constitutional base.

Church and state.

The Kahanamoku Estate Foundation

A 501c3 non-profit charitable corporation for the Native Hawaiian people and all the Peoples of Hawaii as stated in its by-laws;

(a) To perpetuate contemporary and traditional Hawaiian social, economic and culture values and lifestyles;

(b) To Perpetuate the heritage of the Native Hawaiians and promote, encourage, and foster the common good and general welfare of all the peoples of Hawaii.

(c) To promote, encourage and foster charitable activity, as defined in section 501 (c) 3 of the internal revenue code of 1954 (as amended) and the rules and regulations promulgated there under including the stimulation, promotion, sponsorship and or encouragement activities for and behalf of the Aged people and the Children of Hawaii.

(d) To promote, encourage, sponsor and foster charitable, education or scientific activities having purpose constant with those of the corporations; and

(e) To transact any and all lawful, activities for which nonprofit corporations may be incorporated under chapter 415b Hawaii revised Statutes.

Samuel Alapai Taula Kahanamoku. III. (aka) Bunny Kahanamoku.
Ceo/President. Kahanamoku Estate Foundation 501c3
Po. Box 1258 Kamuela Hawaii 96743
Info@kahanamoku.net
808-887-0200 voice 808-887-0205 fax
http://www.nativehawaiianrights.com (Involuntary Servitude)

Samuel Alapai Taula Kahanamoku, III
Kahanamoku Estate Foundation
Undated

Your comments are respectfully noted.

American Friends Service Committee

Hawai'i Area Program
2426 O'ahu Avenue • Honolulu, HI 96822 • Phone 808/988-6266 • Fax 808/988-4876
Website: www.afschawaii.org • Email: afschawaii@afsc.org

Date: September 29, 2004

To: NASA
Mail Code: SZ
Washington, D.C. 20546-0001

Attn: Dr. Carl Piltcher
Outrigger Telescopes Project
Astronomy and Physics Division
Office of Space Science

From: Kyle Kajihiro, Program Director, Hawai'i Area Program

Subject: Draft Environmental Impact Statement Comments Relating To The NASA/William M. Keck Observatory- Outrigger Telescopes Project, Mauna Kea, Hawai'i

Aloha Kakou

The American Friends Service Committee Hawai'i Area Program opposes the expansion of the Keck Outrigger Telescopes Project on the summit of Mauna Kea due to the significant, adverse and unavoidable cumulative impacts of the project. We concur with the comments and concerns submitted by Mauna Kea Anaina Hou and Kahea. Furthermore, we wish to submit the following additional comments.

The DEIS is inadequate and fails to comply with the National Environmental Policy Act (NEPA).

The DEIS fails to consider issues raised in the scoping process. In January 2004, I testified at the Wai'anae public scoping meeting for this project. However the DEIS contained no record of my comments, nor that of any of the hundreds of others who submitted scoping comments. All scoping comments were summarized into a few scant paragraphs in the DEIS which denied testifiers the ability to review the record for accuracy. A

The Final EIS should include written transcripts of all scoping meetings and public hearings on the DEIS as well as copies of written testimonies submitted. This would allow testifiers to check the accuracy of the information in the final EIS.

DEIS Fails to Provide Full Disclosure of Military Connections

Issues I raised in oral scoping comments that were not reflected in the DEIS included the question of military connections with NASA and the Keck Observatories. Presenters for NASA at the DEIS public hearing made the unsubstantiated and blanket declaration that NASA has no relationship to the military. This contradicts NASA's own version of its history: "NASA's birth was directly related to the pressures of national defense." (Garber, Stephen J., and Roger D. Launius. "A Brief History of the National Aeronautics and Space Administration." www.hq.nasa.gov/office/pao/history/factsheet.htm.) B

Given NASA's genealogical ties to Cold War military research, we demand full disclosure about all possible military connections to the program in question. The question of military connections is relevant to the DEIS because it actually determines the true purpose of the project.

- Disclose all past and foreseeable future users of the Keck Telescopes.
- Provide a list of all past and foreseeable future research projects using the Keck Telescopes. Are any classified research projects being conducted at Keck? If so, describe these to the fullest extent allowable.
- Provide a full accounting of all funding sources and their amounts for projects at Keck, including projects that pass through the Research Corporation of the University of Hawai'i. Provide a full list of all technologies invented and patented at Keck, the patent holders, licenses granted for the use of those patents and licensees. B
- What are the military applications, if any, of technologies developed at Keck? For example, can any of the optics invented for the Keck observatory be used for military satellites or tracking and guidance systems? Are they currently being used for that purpose?
- Describe the computing and communications infrastructure used by Keck and the UH Astornomy program. Are any of these assets related to the military in any way? For example, does the military have any ownership or authority over the fiber optics communications system or supercomputers utilized by the telescopes on Mauna Kea?

<u>Withdraw NASA's permit application before the Board of Land and Natural Resources (BLNR)</u>

As I commented at the scoping meeting, it is inappropriate for NASA and the BLNR to consider the permit application for the Outrigger expansion on Mauna Kea before the EIS and Record of Decision has even been finalized. I urge you to withdraw your permit application. C

I commend NASA for its honesty in admitting that there are in fact alternative sites for the Outriggers, and that the cumulative impacts for the proposed action on Mauna Kea would be significant and adverse. However, your DEIS goes on to excuse the incremental impacts of the project. For the Native Hawaiians who have paid the highest price for the adverse and significant cumulative impacts of 111 years of wrongful occupation of lands and for the endangered native ecosystem of Hawai'i, this kind of incrementalism leads to death by a thousands cuts. We say "enough." D

Thank you for your consideration of these comments.

Sincerely

Kyle Kajihiro

Kyle Kajihiro
American Friends Service Committee
September 29, 2004

Response to Comment A:

NASA has made every effort to address all scoping comments that are within scope of the EIS. Summaries of the oral scoping comments made at the public scoping meetings are provided in Acrobat® format at http://www2.keck.hawaii.edu/. Comments were summarized and not attributed to facilitate responding and protect individual privacy.

Response to Comment B:

NASA is the nation's civil space agency, established by the National Air and Space Act of 1958 (Pub. L. No. 85-568, As Amended). NASA space missions and related research programs are conducted for peaceful, scientific purposes. NASA and the Department of Defense (DoD) may at times have a common interest in the development of a particular technology. For example, DoD developed a technology called *adaptive optics* that is used for scientific studies at ground-based astronomical observatories (such as the W.M. Keck Observatory) to correct telescopic images for distortions caused by Earth's atmosphere. Additionally, DoD and NASA occasionally work together to develop a technology of interest to both agencies. The specific requests for detailed information are beyond the scope of this EIS.

Response to Comment C:

The University of Hawai‘i's responsibility to acquire a Conservation District Use Permit and the Federal Government's responsibility to complete the National Environmental Policy Act process are separate and independent processes.

Response to Comment D:

Your comments are respectfully noted.

From: Reynolds Kamakawiwoole

To: <otpeis@nasa.gov>

Subject: Written statement/Reynolds Kamakawiwoole

Date: Mon, 27 Sep 2004

Aloha Nasa,

I want these statements to be part of your draft EIS.

1. Has NASA ever received statements from Kahuna(s) allowing >further development on Mauna Kea? **A**

None of the reports in the drafts has an acceptance to build from any Kahuna.

2. I believe that NASA and the military continue to co-exist with one another, will this movement involve military Connection with NASA now or the future? **B**

3. Does the people know that Mauna Kea spirituality is also Christian?

4. Will this draft allow further development by others on the mountain? **C**

5. Will NASA pay the rightful amount to Native Hawaiians for the use of the mountain? **D**

Mahalo,

Reynolds Kamakawiwoole

Reynolds Kamakawiwo‘ole
September 27, 2004

Response to Comment A:

In recognition of the sanctity of Mauna Kea in Native Hawaiian culture, NASA has made a particular effort to consult with Native Hawaiian religious practitioners. Their perspectives have had great influence on the content of this EIS. See Section 3.1.2.5 and Table 3-2 for more details.

Response to Comment B:

NASA is the nation's civil space agency, established by the National Air and Space Act of 1958 (Pub. L. No. 85-568, As Amended). NASA space missions and related research programs are conducted for peaceful, scientific purposes. NASA and the Department of Defense (DoD) may at times have a common interest in the development of a particular technology. For example, DoD developed a technology called *adaptive optics* that is used for scientific studies at ground-based astronomical observatories (such as the W.M. Keck Observatory) to correct telescopic images for distortions caused by Earth's atmosphere. Additionally, DoD and NASA occasionally work together to develop a technology of interest to both agencies.

Response to Comment C:

The Outrigger Telescopes Project is separate and independent from any reasonably foreseeable development on Mauna Kea. All future proposed projects on Mauna Kea would be subject to the terms and conditions of the June 2000 Mauna Kea Science Reserve Master Plan and state compliance requirements including the Conservation District Use Permitting process.

Response to Comment D:

The issue of the rental arrangements for the subleased lands is an issue for the State of Hawai‘i. However, if Mauna Kea is selected as the site for the Outrigger Telescopes Project, NASA will commit $2 million to an initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians as a mitigation component of the Outrigger Telescopes Project.

From: Mahealani Kamauu

To: kahea-alliance@hawaii.rr.com

Cc: otpeis@nasa.gov

Subject: Draft EIS, Mauna Kea

Date: Wed, 29 Sep 2004

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
NASA Headquarters
300 "E" Street SW
Washington, D.C. 20546-0001

Dear Dr. Pilcher:

I oppose building more observatories on Mauna Kea.

1. Mauna Kea is a sacred temple. Building monolithic structures atop it is racist.
2. The observatories desecrate my family's place of worship.
3. My family's ability to worship has and will continue to be severely and adversely impacted.
4. More observatories will make the injury to my family more severe.
5. What was once a pristine environment is now polluted with dangerous biohazards, including mercury.
6. Native Hawaiian spiritual practices, beliefs and way of life are being destroyed and recklessly savaged:

a) So some rich nations can outdo other rich nations;

b) So scientists can enhance their professional credentials;

c) To garner international prestige for the University of Hawai`i;

d) Because close-up shots of stars are amazing;
e) To unlock secrets of the universe;
f) Because of Mauna Kea's strategic location in the middle of the Pacific;
g) Because of the potential for military applications;
h) Because U.H. can use native land for free and bargain for viewing time worth $$$millions.
i) Because money, power and international prestige are more important than Hawaiians.
j) Because according to astronomers, observatories are sacred temples too.
k) Because according to astronomers, they and and traditional Hawaiian navigators are spiritual kin.
l) Because NASA is powerful and can do whatever it wants.
m) Because there can never be enough telescopes and observatories atop Mauna Kea.

n) Because Mauna Kea offers the choicest viewing.
o) Because Hawaiians should have known from the beginning U.H. would build as many obervatories as it could get away with.

p) Because _____(fill in the blank)_____

All of which are either specious or racist, and would not be legally justified if native spiritual beliefs and practices were accorded the same respect and protections as western orthodox religions. That observatories can be built on Mauna Kea is racist. I protest America racism and its racist agent NASA. I denounce the University of Hawai`i's Astronomy Department for its rank betrayal and the genocidal practices it continues to inflict upon Hawaiians.

Mahealani Kamauu

Mahealani Kamauu
September 29, 2004

Your comments are respectfully received.

August 31, 2004

Aloha Dr. Pilcher, members of NASA and guests,

My name is Andrew K. T. Keli`ikoa of the Royal Order of Kamehameha I and I am here to present testimony tonight on behalf of the Kahu Po`o Nui of the Royal Order of Kamehameha I.

"The Royal Order of Kamehameha I cannot and will not support NASA's Draft EIS in its present form because NASA asked for the community's mana`o – which they shared – but NASA failed to acknowledge and subsequently ignored their concerns."

"We demand that NASA's representatives conduct face-to-face meetings with respondents from Moku o Keawe to resolve important issues before NASA completes the Final EIS."

"Imua e Na Kamehameha"

by order of the

`Aha Kahu Po`o

Heiau O Na Ali`i

Royal Order of Kamehameha

Andrew K.T. Keli‘ikoa
Royal Order of Kamehameha I
August 31, 2004

NASA appreciates the continuing involvement by the Royal Order of Kamehameha I (ROOK I) in the Federal environmental compliance process for the Outrigger Telescopes Project.

Date: Fri, 27 Aug 2004 13:33:39 -1000

From: Alakupaa

To: <otpeis@nasa.gov>

Subject: TESTIMONY: Stop the Mistreatment of Mauna Kea

To Whom It May Concern:

I will not be able to attend the meeting on 1 September in Wai` anae, O`ahu as I have previous engagements, however, I would like to submit my testimony about the building of the new "outrigger telescopes" by NASA on Mauna Kea.

The appearance of NASA's and others of disregard for the Hawaiian people, their culture, the respect of their holy and sacred places is alarming. The disregard for the environment that the present astronomical community that is presently utilising a mountain that Hawaiians consider sacred is disgusting.

NASA you acknowledge that the impacts produced by the astronomy industry are adverse and great. The NASA Draft EIS Cumulative Impact Summary states: "In conclusion, the overall cumulative impact of past, present and reasonably foreseeable future activities is substantial, adverse, and significant"

In my opinion, the following selected issues must be addressed by NASA:

a.. The impact on continued expansion on cultural, traditional and religious uses and access, including protection of burials, historic sites, ceremonial view-planes and traditional cultural properties of Mauna Kea;

b.. The impact of the increasing restrictions and Western disrespect of the Hawaiian people as it pertains to their lands, sacred sites and the ability to freely live their culture, especially on Mauna Kea and what effects this has in contributing to the ethnocide, which is a form of genocide, of the Hawaiian people most especially by the United States of America and its agencies such as NASA;

c.. The sanctity of Mauna Kea must be protected and revered; **A**

d.. The cumulative effects of hundreds of thousands of gallons of effluent being deposited into aged septic tanks, cesspools and antiquated leech fields; **B**

e.. Mauna Kea is the principle aquifer for the entire island, and is home to a delicate, complex hydrology and ecosystem. How will this vital aquifer be protected from contamination; **C**

f.. The impacts of transportation, storage, use, handling and disposal of hazardous, toxic substances, including documented mercury spills on site; **D**

g.. The systematic destruction of prime habitat for the rapidly disappearing Wekiu bug and other vulnerable species on the mountain; **E**

h.. There are numerous procedural problems with this process. A central problem is the University's Master Plan has not been approved by the Board of Land and Natural Resources (BLNR). The last Management Plan approved by BLNR was in 1983, and that plan set the limit on **F**

the number of astronomy facilities allowed on the summit at thirteen. The BLNR rules expressly require an approved management plan for any facilities, and further require that any amendments to the 1983 plan be approved by the BLNR. This has not occurred.

i.. Despite the fact that the EIS process by NASA has not been completed, the University of Hawai`i Institute for Astronomy (UHIFA), which administers astronomy activities on the mountain, applied to the BLNR for a Conservation District Use Permit to begin the construction of the six proposed Outrigger Telescopes. **G**

j.. How can NASA and UHIFA proposed a "No Action" alternative in the DEIS, while simultaneously pursuing a permit to build? How can BLNR make an informed decision if they rule on the Conservation District Use Permit before having an assessment of the data that is supposed to be provided by the EIS? **H**

Mauna Kea is a premiere site for astronomy. However, there are 93 observatory complexes around the world where world-class astronomy is also conducted. If no more telescopes are built on Mauna Kea, it will not be the end of astronomy.

Mauna Kea is a wahi pana and an invaluable foundation of the heritage and sacred traditions of the Hawaiian people. Many of the Hawaiian traditions and practices conducted on Mauna Kea can be practiced nowhere else in the world. It is the sacred temple, belonging to Akua, Na Akua, and Na `Au makua. The mountain is the burial ground of our most sacred and revered ancestors. Currently the summit is used routinely for ceremonies and other cultural practices, which pre-date modern science by millennia.

There has been a 30-year history of deep-seated public opposition to further development on the mountain. The industry has had unencumbered access to the summit of Mauna Kea, at the expense of our cultural and environmental resources. The Hawaiian people have compromised enough.

Unless the aforementioned items can be adequately addressed and the impact of these telescopes on the environment, the culture, the Hawaiian people and the safety to all the people of the Island of Hawai`i can be ascertained, I testify against expansion or building of any new telescopes on the summit of Mauna Kea or any Hawaiian Mountain.

Sincerely,

A. Kim

A. Kim
August 27, 2004

Response to Comment A:

See Section 4.1.1 of the EIS entitled Cultural Resources for a discussion of the impacts the Outrigger Telescopes Project would have on historic properties, cultural values, and traditional cultural practices. In addition, see Section 4.1.12 for a discussion of the visual impacts associated with the Outrigger Telescopes Project.

The Outrigger Telescopes Project would not substantially burden the right to religious practice. Access to Mauna Kea has improved as a result of the development of the summit. In particular, the construction and improvement of the Mauna Kea Access Road in the Region of Influence has made it possible for the public, including many Native Hawaiians, to travel to the summit. The road is occasionally closed to vehicular traffic when road conditions such as snow and ice render travel unsafe.

Response to Comment B:

See Section 4.2.5 of the EIS for a discussion of the cumulative effect of the subsurface disposal of domestic wastewater.

Response to Comment C:

No measurable groundwater contamination can result from the disposal of wastewater at the summit, as shown by the hydrologic analysis done as part of the cumulative impacts analysis in the EIS (See Sections 4.1.3 and 4.2.5). The same analysis shows that wastewater from the observatories cannot reach Lake Waiau. All disposal of wastewater is done through State-approved septic systems. No hazardous materials are disposed of through the septic systems, but rather are trucked down by licensed and State-approved contractors.

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available scientific information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system are negligible.

Response to Comment D:

See Section 4.2.6 of the EIS for a discussion of the cumulative impacts associated hazardous materials.

Response to Comment E:

Section 4.2.4 of the EIS addresses the decline in Wēkiu bug activity.

There have been no definitive population ecology studies of the Wēkiu bug. A number of trapping studies have been conducted on Mauna Kea since 1982. Trapping studies are ongoing today as part of the Wēkiu bug Baseline monitoring initiated by CARA in 2001.

The first two sampling studies were conducted in 1982 and in 1997/98. A comparison of the results of these the two studies indicated that in 1997/98 trapping rates were about 1 percent of the 1982 rates. This has been taken as an indirect indication that the populations of the Wēkiu bug on the summit area of Mauna Kea may have declined by 99 percent between 1982 and 1997/98. Recent trapping data from the ongoing Wēkiu bug Baseline Monitoring effort being conducted by

CARA indicates that trapping rates have returned to about the same level as in 1982 on Puʻu Hauʻoki.

The causes of the apparent Wēkiu bug decline between 1982 and 1997-98 are not known. Hypotheses include climate change, a possible long-term downward trend in winter snow pack depth and persistence, scientific sampling, introduction of predatory alien arthropods, mechanical habitat disturbance from observatory construction, recreational impacts, vehicle impacts, long-term population cycles, and the possible presence of environmental contaminants from human activities. The most likely cause would probably be a combination of some or all of the above factors.

Appendix C contains the Wēkiu bug mitigation measures proposed for the Outrigger Telescopes Project. If implemented, NASA will fund a Wēkiu bug autecology to gather more information about habitat requirements, life cycle, nutritional requirements and breeding behavior of the unique bug.

Response to Comment F:

NASA recognizes the Mauna Kea Science Reserve (MKSR) Master Plan which was approved by the University of Hawaiʻi Board of Regents on June 16, 2000 (UH 2000b). On February 2, 2000, Governor Benjamin J. Cayetano accepted the MKSR Master Plan Final Environmental Impact Statement (MKSR FEIS) as satisfactorily fulfilling the requirements of Chapter 343, Hawaiʻi Revised Statutes (State of Hawaiʻi 2000). The MKSR FEIS contains a November 2, 1999 comment letter from the Department of Land and Natural Resources (DLNR) signed by Timothy Johns, Chairperson, in which he states DLNR's position regarding the Master Plan. "The Department of Land and Natural Resources would continue to review each situation in the context of a Conservation District Use Application. . . DLNR's acceptance and consideration of applications for new uses, such as telescopes, will be contingent upon implementation of the local design review process and more generally, the performance of the local management authority in fulfilling its stated responsibilities. . . It will be the University's and the telescope operators' responsibility to ensure that procedures outlined in the Master Plan are followed for day-to-day management and development guidelines. Failure to do so could jeopardize Conservation District Use Application approvals and any future telescope development on Mauna Kea." Under the heading "New Management Responsibilities," Mr. Johns further states that "A Hilo-based review process, with the Board of Land and Natural Resources continuing to consider individual CDUAs and sublease agreements, would guide new telescope and facilities development. DLNR enforcement would be limited primarily to compliance with Conservation District Use Permit conditions and response to enforcement issues related to violations of Conservation District laws. . ."

Response to Comment G:

No on-site construction or installation of the Outrigger Telescopes would occur until all permits and approvals are obtained. The University of Hawaiʻi's responsibility to acquire a Conservation District Use Permit and the Federal Government's responsibility to complete the National Environmental Policy Act process are separate and independent processes.

A. Kim
August 27, 2004

Response to Comment H:

See Response to Comment G.

ALOHA KE AKUA!

BY THE ORDER OF HIS MAJESTY THE KING, RIGHTFUL HEIR OF THE KINGDOM OF HAWAI'I! ALL AMERICAN FLAGS COME DOWN! HAW'N FLAGS REMAIN FLYING, IF NO MORE ONE, PUT ONE UP! AMERICA WILL BE LEAVING OUR ISLANDS FOR GOOD!! THEIR SQUATTING DAYS ON OUR ISLANDS ARE ALL PAU! U.S. ILLEGAL PROLONG OCCUPIERS ONLY! WE ARE A NATION STATE, A FOREIGN COUNTRY. KINGDOM LAWS SHOULD BE ENFORCED NOT U.S. LAWS! PLEASE LEAVE OUR COUNTRY IN A PEACEFULLY MANNER!

BY THE AUTHORITY OF HIS MAJESTY
THE KING, RIGHTFUL HEIR OF THE
KINGDOM OF HAWAI'I. I WILL
ADDRESS MY PEOPLE NOV. 28,
2004 LĀ KŪ'OKO'A IOLANI PALACE.
KANAKA MAOLI WE ARE STILL
A LIVING NATION AND WE WERE
NEVER ANNEXED TO THE UNITED
STATES! THE UNITED STATES
WERE NEVER HONEST WITH THE
KANAKA MAOLI INDIGENOUS
PO'E! EVERYTHING IN HAWAI'I IS
ILLEGAL PROLONG! THEY'LL BE
MANY CHANGES AFTER REMOVAL
OF ALL MILITARY ARMED FORCES
ON ALL OF OUR ISLANDS!
HIS MAJESTY THE KING

Anonymous
September 23, 2004

Your comments are respectfully noted.

At 1:06 PM -1000 9/2/04, Ann & Paul Koehler wrote:

Aloha!

Thank you for making the 8/23/04 "King Kam Hotel" dialogue possible. I quickly scanned the E.I.S. report. I found it to be complete, concise and objective.

I found the objections from opponents of subject project interesting, but sad. Their remarks were based entirely on hearsay, conjecture and innuendo support by "feelings" and speculation. Please take note and include the bases of opposition in your summary of findings.

I know for a fact, that there is a sizable number of Hawaiians who support this project, just as they support many other community and infrastructure projects. But, when they speak out in support, their personal property is damaged, their businesses are vandalized and family members threatened with harm. Isn't it strange, that to my knowledge, no Hawaiian has come forward as a strong advocate of subject?

The completion of the Outrigger Project on Mauna Kea, will be a WIN - WIN - WIN. A win for the talented community our astronomers here. A win for the science of Astronomy that will be able to enhance a very productive, state of the art, facility. A win for all of Hawaii, who will benefit with more and better jobs, a reputation for having the best technology and by putting waist land to good use.

I wish you well,

Paul E. Koehler

Paul E. Koehler
September 8, 2004

Thank you for your continuing support and interest in the Outrigger Telescopes Project.

>Date: Wed, 29 Sep 2004

>Subject: DEIS for the Outrigger Project

>From: Kristine Kubat

>To: Carl.B.Pilcher@nasa.gov

>

>I am reluctant to submit these comments to you as you are the person
>who looked me in the eye and said this document would be a legitimate
>review when in fact it has been nothing of the sort. What is the use of
>complaining to the party that's cheating the process about the party
>that's cheating the process? I see this a formality and look forward to
>holding you accountable elsewhere.

>

>Kristine Kubat

>

>In Response to the Draft Environmental Impact Statement for the Keck
>Outrigger Telescopes Project.

>

>The review of the environmental impacts related to energy usage is
>meaningless and does not comply with statutory requirements. By
>focusing solely on how the project will impact the existing electrical
>supply the statement skirts the entire issue of the environmental
>impact of energy generation. In only one section, that dealing with the
>irretrievable commitment of resources, does NASA make the connection
>between the project, the generation of electricity and the consumption
>of fossil fuels. This is not acceptable. Hawai'i State law does not
>require developers to disclose how their projects will impact the
>Hawaii Electric Light Company, it requires disclosure of how a project
>will impact the environment. With four out of the top five and seven
>out of the top ten sources of pollution in Hawai'i related to the
>generation of electricity it is the State's heaviest industry and the

A

>greatest threat to our ecosystem. This aspect of the project deserves a
>meaningful, thorough, review.

A

>
>A proper review should include an analysis of the life cycle costs of
>the production, transport, storage and eventual burning of the fossil

B

>fuels. It should assess the potential for using solar energy to offset
>the use of fossil fuels and such assessment should use on-site data to
>determine the cost-effectiveness of this alternative. This is important
>because the geographic location of the proposed development is in that
>region with perhaps the greatest solar potential in the United States
>and existing, textbook comparisons will fail to include this advantage.
>Any comparison between the two sources of power should weigh
>quantifiable costs and socio-economic benefits, i.e. stimulating the
>local solar industry in support of the State's long-term energy goal of
>self-sufficiency. It should further consider the cumulative impacts of
>the State supporting such energy intensive industries versus more
>energy efficient ventures.

C

>
>That the existing document fails to provide any of the above mentioned
>analysis is proof that NASA prepared this document in bad faith.
>Further proof of bad faith is found in the complete lack of detail
>provided on how the energy will be used, making it impossible for the
>public to provide an independent analysis.
>
>Kristine Kubat
>

Kristine Kubat
September 29, 2004

Response to Comment A:

Evaluating the environmental impact of energy generation on the island of Hawai‘i is beyond the scope of the EIS.

Response to Comment B:

This matter is outside the scope of the EIS.

Response to Comment C:

The text of EIS has been modified to include a discussion of the potential for using solar energy to offset the use of fossil fuels at the W.M. Keck Observatory (see Section 4.1.8).

As the Kahu Poʻo I am empowered by the Aliʻi Nui to make the following statement of exception:

Development may be continued if it is done intelligently, with compassion and sensitivity to the Hawaiian people and their culture, and with extreme care for the fragile environment, and when:

- Substantial alterations are made to proposed cultural mitigations.
- Hawaiians are chosen by Hawaiians to negotiate the cultural mitigations.
- Hawaiians form majorities on cultural mitigation committees.
- Approaches to environmental pollution are transformed, including sewage treatment, Wekiu Bug mitigation and toxic materials handling.
- All mitigations are guaranteed over the life of the project and funded with normal escalators for inflation.
- All mitigation funds be awarded to the Royal Order of Kamehameha I, Office of the Kahu Poʻo, to be used for the benefit of the Hawaiian people, without conditions.

David Lovell
Royal Order of Kamehameha I

NASA appreciates the statement by the Royal Order of Kamehameha I that "Development may be continued if it is done intelligently, with compassion and sensitivity to the Hawaiian people and their culture, and with extreme care for the fragile environment. . ."

NASA is committed to being a responsible steward in the implementation of the Proposed Action. NASA made a considerable effort to consult with interested and concerned parties about the Outrigger Telescopes Project. As a result, NASA has made numerous commitments to on-site and off-site measures that would protect and enhance the cultural and environmental resources of Mauna Kea. In addition, NASA will commit $2 million to an initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians as a mitigation component of the Outrigger Telescopes Project.

25 August, 2004

Dr. Carl B. Pitcher
Office of Space Services, Code SZ
NASA Headquarters
300 E. Street SW
Washington, D.C. 20546-3096

Re: Proposed "outriggers" for the KECK telescope systems

Dear Dr. Pitcher and to whom it may concern,

I am a native Hawaiian, born and raised on the island of Hawaii. Some in America trace their heritage back to the days of the Mayflower. My wife and I each trace our lineage back to kane 'O Kumuhonua and wahine 'O Haloiho. Our great grandchildren also acknowledge their ancestors also came from America, England, Ireland, Japan, Portugal, Germany and China.

It is with this cultural background that I submit the following comments on the proposed construction of NASA's observatory atop Mauna Kea as stated in your DEIS. Initially, I note that the University of Hawaii has permitted the construction of additional facilities on Mauna Kea notwithstanding the promises made to us by Donald Hall for the construction of the initial facility. Subsequent protests were lodged (years ago) about the mercury and vapor lamp issues. Then, the astronomy community took issue with hunters driving up the mountain, creating dust, and then animals were eradicated to protect a bird. The net effect is to keep self sustaining type people off the mountain. The present stewards of the mountain, the UH, says nothing to you about your DEIS failure to address the Stryker mega force that will be drumming the dirt around Hale Pohaku, getting training and ready for assignment to mountainous, dusty regions our loved ones now find in service worldwide, protecting America. Nothing is mentioned in your DEIS about the 18 ton vehicles driving around in the dirt and unpaved pathways atop Mauna Kea. Thus it appears that construction of the "spider" A

facility will not end the construction period. It is my belief that construction will go on until every bit of the mountain has some sort of government facility on it. Thus my concerns about Mauna Kea go beyond my cultural and spiritual (religious) beliefs.

First, the lands on which the observatory and its outriggers are to be constructed are lands now held by the State of Hawaii, designated as conservation district and placed in the protective sub zone since it consists of lands occupied by an endangered species. The DEIS failed to take into consideration the fact that you will be required to comply with all the laws of the State of Hawaii, including applying for a Conservation District Use Authorization, in dealing with this issue. **B**

Second, Hawaii State laws provides for the protection of all endangered species and their associated ecosystems.

Third, the Hawaii State Legislature adopted a statement of necessity which requires that protection of endangered species and their associated ecosystems be given the highest priority. The project site is inhabited by the Wekiu bug. The project intends to mitigate the impact to its critical habitat by translocating the endangered species (wekiu bug) to adjacent sites. The Hawaii statutes prohibit the taking of the site currently occupied by the insects. Furthermore, there exists no definite scientific or practical evidence that such translocation can and will continue the life struggle for the endangered species. Also, the Hawaii statutes do not permit the translocation of the species and instead requires that the endangered species and its associated ecosystem be protected and preserved. **C**

Fourth, because the land belongs to the State of Hawaii, and is in the "protected" sub zone of the conservation district, the proposed land use requires the approval of the Board of Land and Natural Resources. The CDUA does not permit the Board to evaluate the mitigation of the endangered species, but by its own rules and regulations requires the Board to only evaluate the impact of the proposed land uses on the endangered species and its associated ecosystem. **D**

Fifth, the Hawaii Statutes and the Hawaii Supreme Court's decisions reiterate time and again that the laws, including rules and regulations legally adopted by the administrative agencies, be given full effect to the plain meaning of the rules when the rules themselves are not ambiguous.

Sixth, there are substantial citations of the Hawaii Supreme Court and Intermediate Court of Appeals holding to this decision. In short, the Board can only apply the "plain language" of its rules and regulations and cannot look at mitigation as a means of evaluating the impact to the endangered species.

Seven, the lands where the project is being considered now belongs to the State of Hawaii and thus the laws of the State of Hawaii govern its use. Yet your DEIS chooses to follow the requirements of NEPA in total disregard of the EIS requirements and the laws of the State of Hawaii. NEPA apparently permits the translocation of endangered species whereas Hawaii State law does not allow translocation. E

Eight, pertinent Hawaii State law includes HRS 195D-1 and 195D-5(d); these provisions speak of the Legislature's requirement of making specific "Findings and declaration of necessity" when it adopted Chapter 195D, HRS, and to the statutes' declared insurance to continue the perpetuation of indigenous life and native ecosystems, and the necessity of the State to take positive action to enhance their prospects for survival. Another statutory provision, HRS 344-4(3)(A)(3), addresses the environmental policy to protect [endangered] flora and fauna.

Nine, Article XI, Section 1, Hawaii State Constitution, Conservation and Development of Resources, Section 1, states: "...[The] State shall conserve and protect Hawaii's... natural resources.... [A]ll public natural resources are held in trust by the State for the benefit of the people...."
The Hawaii Supreme Court recently construed the constitutional provision as "the people of this state have elevated the public trust doctrine to the level of a constitutional mandate. In Re Water Use Permit Applications, 94 Haw. 97, 131 (2000). Further, Chapter 13-5, HAR, which deals with the issuance of the Conservation District Use Authorization, requires the Board of Land and Natural Resources to determine whether "the proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region." These rules, which have the force and effect of law, does not provide for the mitigation of those impacts in order to qualify the applicant for the permit. Therefore, any construction on the site of the wekiu bug will be in violation of State law.

Finally, even if you were to cut off parts of the hills atop Mauna Kea to expand the existing Keck twin scopes (there is no room on the existing hill), I wonder how you can envision continuing to have a world class observatory facility when a major Stryker Brigade moves in next door.

For all these reasons, I strongly suggest you rethink your efforts at further construction atop Mauna Kea. You've done enough.

Sincerely,

Genesis Lee Loy
GENESIS LEE LOY

Royal Order of Kamehameha
Helu Elua O
Manalahoa

Genesis Lee Loy
Royal Order of Kamehameha I
August 25, 2004

Response to Comment A:

See Section 4.1.7.2 of the EIS for information regarding traffic and transportation of large construction vehicles.

Based on the *U.S. Army Corps of Engineers (USACE) Environmental Impact Statement for the Transformation of the 2nd Brigade Combat Team in Hawai'i*, the Stryker vehicles will be operating at the Pōhakaloa Training Area (PTA) and the Military Vehicle Trail between PTA and Kawaihae Harbor. They will not be traveling in the Hilo direction or on the road to or past Hale Pōhaku (USACE 2004).

Response to Comment B:

The California Association for Research in Astronomy (CARA) would implement the Outrigger Telescopes Project and be subject to all applicable Federal and State statutes and regulations, permits issued by State and local agencies, and mitigation measures specified in the NASA Record of Decision (ROD).

No on-site construction or installation of the Outrigger Telescopes would occur until all permits and approvals are obtained. The University of Hawai'i's responsibility to acquire a Conservation District Use Permit (CDUP) and the Federal Government's responsibility to complete the National Environmental Policy Act process are separate and independent processes.

Response to Comment C:

The Wēkiu bug is a candidate for listing under the Endangered Species Act. The mitigation measures were reviewed and approved by the U.S. Fish and Wildlife Service (USFWS) and follow all the recommendations given in previous Mauna Kea Science Reserve arthropod assessments (Howarth and Stone 1982; Howarth and others 1999).

In a letter regarding the Wēkiu Bug Mitigation Plan for the W.M. Keck Observatory, Outrigger Telescopes Project at Mauna Kea, the USFWS states "The Service [USFWS] supports the recommendations in the WBMP [Wēkiu Bug Mitigation Plan] to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor use. . . We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to the wekiu bug habitat." See Volume II, Appendix A, for the letter from USFWS/Henson (USFWS 2000).

The U.S. Department of Interior (USDOI) submitted a comment letter on the DEIS stating "It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wēkiu Bug Mitigation Plan and the Wēkiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities." See the USDOI comment letter from Patricia Sanderson Port located in this Appendix.

In addition, the USDOI letter states "These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology."

Response to Comment D:

See Response to Comment B.

Response to Comment E:

A Federal EIS must be prepared in compliance with federal law. See also Response to Comment B.

OUTRIGGER TELESCOPES PROJECT
COMMENTS FORM

NASA welcomes and encourages written public comments on environmental impacts and concerns (including historical, archeological, and traditional cultural issues) and proposed mitigation associated with the proposed Outrigger Telescopes.

Your comments will be reproduced in the Final EIS for the Outrigger Telescopes Project. If you prefer that your name not be published with your comments, please express that desire in the comments section below. NASA will not publish your address in the Final EIS.

Your comments may be written on this form and left at the registration desk. Or, you may send your comments to Carl B. Pilcher, Program Executive, Science Mission Directorate, Universe Division, NASA Headquarters, 300 E Street SW, Washington, D.C. 20546-0001. Comments must be provided in writing and received by NASA on or before 4:30 PM Eastern Daylight Time September 30, 2004; fax (202-358-3096) or e-mail (otpeis@nasa.gov)

Commenter's name: GENESIS LEE LOY

Commenter's full address (street, city, state, and zip code): 510 AUWAE RD; HILO, HI; 96720

Date:

Place an X in this box if you wish to receive copies of future environmental planning documents on the proposed Outrigger Telescopes Project (including the Record of Decision) that NASA distributes to the public. [X]

Comments: I submitted my comments on Aug 25, 04 in Hilo at the Naniloa Hotel. I failed to list my address, as noted above.

Mahalo

per the Royal Order of Kamehameha

Genesis Lee Loy
Royal Order of Kamehameha I

Thank you for providing your mailing address.

OUTRIGGER TELESCOPES PROJECT
COMMENTS FORM

NASA welcomes and encourages written public comments on environmental impacts and concerns (including historical, archeological, and traditional cultural issues) and proposed mitigation associated with the proposed Outrigger Telescopes.

Your comments will be reproduced in the Final EIS for the Outrigger Telescopes Project. If you prefer that your name not be published with your comments, please express that desire in the comments section below. NASA will not publish your address in the Final EIS.

Your comments may be written on this form and left at the registration desk. Or, you may send your comments to Carl B. Pilcher, Program Executive, Science Mission Directorate, Universe Division, NASA Headquarters, 300 E Street SW, Washington, D.C. 20546-0001. Comments must be provided in writing and received by NASA on or before 4:30 PM Eastern Daylight Time September 30, 2004; fax (202-358-3096) or e-mail (otpeis@nasa.gov)

Commenter's name: PATRICK (TERRY) McNEELY

Commenter's full address (street, city, state, and zip code):

Date: Sept 24 2004

Place an X in this box if you wish to receive copies of future environmental planning documents on the proposed Outrigger Telescopes Project (including the Record of Decision) that NASA distributes to the public. [X]

Comments: my comments are attached.

Thank you

Patrick T McNeely

Terry McNeely

MAUNA KEA

I

We go to Kalapana, on the southeast coast of Hawai'i,
where the lava recently flowed to the sea, to speak
again with its old friend water, and speaking explodes
most rapturously creating the new black sands
where now people plant coconuts, their shells split
and part, and new fronds open and spread
and ride the winds

with joy, and one recalls pandanus-leaf sails,
lauhala the local word, that crowned large double
hulled canoes, and the people traversed
the great Polynesian distances, centuries, millennia
ago, long before we Westerners navigated
longitudes and latitudes, we still singing of Odysseus
and his adventures, while yet we sailed cautiously
round Homer's wine-dark sea.

Here, as the eye scans this endless 'broad-backed'
sea, here one can appreciate great great distance
and other times, and when one hears the local myths,
local legends, can more easily imagine the voices of
intrepid voyagers telling their stories, the tales
opening with genealogies, long lines of connection
to the past, even to the beginnings of time.

II

Mauna Kea
the White Mountain
girded with late afternoon cloud
was this what they first saw?

III

The asphalt streets of Hilo are still slick
dreaming a predawn rain, the whiteness
of plumeria shines in the early light,
and just off shore one lone canoe.
Paddlers practice and train, a darkness fills the sky,
a promise of rain from the east. The air is clear
and clean and six bodies bend forward in unison,
dip their paddles, pull, a deeper bend, lift
and the paddles drip, the wrists angle, the backs
retreat and they do it again, six dips
in unison, backs stretch, stretch forward, the shoulders
slightly turn, its pull and pull again
in unison, pull and pull again, in unison
pull, the canoe is close to shore
pull, the canoe is close to shore.

IV

Myself, i have traveled time and oceans and a continent
from my own ancestors, and now, older, only sit by the sea
and listen for echoes of my earlier self, and when
i sleep at night my dream is troubled by visions
of bones dissolving, a slow internal self-consuming.

These are troubling times, given to an arrogant audacity,
to knowledge without constraint, and insupportable consumption,
but our lives,
though they quicken with stimulation,
their flow as ephemeral as a wave
but waves without a sea.
Yet what does it matter, soon enough i will arrive
at death's great beach and disappear, as water
percolates
down through the sand
returns to the beginning.

V

But it is saturday night, late in the week, a time for
story, for food, for celebration. I go to Kalapana, and
where the lava once flowed, a home was spared,
and now, Uncle Robert opens his home,
his land for feasting, and kava flows, and song and story,
stars fill the night sky, and a shower comes and goes.

It reminds me of long ago, of my youth
"Na lā e lana ana ke koko, the days .
when the blood circulates freely."[1]

But now
what will it take to reopen the sluice gates,
to irrigate the parched fields. For even in
this deluge of plenty, people thirst
for a wilder fruit, still swing machetes
and open coconuts. "Here,
have a taste, eat some of this" They tend
to their work, grow their food, and feed the keiki,
and pray
lest they and the children, be homeless.

VI

For in the night shadows, deep in the alley
behind the dumpster, look closely, you can
see the hunched shoulders, the tied-off
arms, the bulging veins of the powerful,
lightin' the match of progress, heatin' the spoon
of development, the downward thrust of the
plunger, the needle of exploitation, the powerful
shootin' up in the alleys of America
the crack houses of America, the powerful

[1] Olelo No'eau-Hawaiian Proverbs & Poetical Sayings-Mary Kawena Pukui

reveling in the festering rains, among the ruins
shootin' up with the blood of those they disdain,
the long dark line of power, that sailed with the
Santa Maria into the frontiers of Space, our
culture a background radiation that can permeate
our every action, a 'manifest destiny' confusing
our best intentions. Our burden our perplexed
innocence as we reign over our mother,

and chant with a sureness our own genealogy:
On Isabel, On Columbus, On Elizabeth and Drake,
On Cook and King George, On Washington.
On Adams, On Jefferson, On Jackson, On
Clinton, and on Sheridan(the only good Indian
is a dead Indian), On Stanford and Crocker,
On Lincoln, On Grant, On McKinley and Roosevelt
and Manifest Destiny, On Bancroft, who said of our war
in the Philippines:

"It was worth to Spain all it cost in delivering her from unprofitable colonies; and it was worth it to the US many times its cost as an object lesson, teaching men how to kill their fellow men gracefully, humanely, and in all Christian charity. Never before was seen in war such zeal and patriotism unattended by enmity, and where there was such an absence of any desire to inflict wanton injury upon the enemy."[2] (and Rumsfield recently said much the same).

On Wilson and Hoover, Roosevelt and Churchill
On DeGaulle, On Ike, On Kennedy, On Nixon
On Reagan and Thatcher, On Bush and On Clinton,
On Bush, On and on and on.

Here, the poet has perhaps overweighed his song
with rant, his age such his body has begun to fail him
his emotions erupt like an angry volcano. Oh, our
triumphs and excesses so intertwined. 'Could this
be me?" He looks to the sea for solace.

[2] HH Bancroft in Imperial San Francisco by Gray Brechin, p 149

VII

The float of the canoe is of wiliwili wood
shaped in a gentle curve
to keep harmonious contact with the water.

VIII

It is late spring, and at Denali i watch a reckless fog
challenge the sun, and read Homer, of blind
fools devouring the cattle of the Sun. The
temerarious fog soon enough finds itself
spread too thin yet clings in shadowy overhangs
while scree breaks loose, skipping and hopping
with reckless abandon, eyes run here and there
searching for sheep, loose words swim
upstream in the brain's escalator, a panama
hat glides into another century, inadequate
machinery coughs and chokes
scene changes
too numerous
too rapid
to process
i stand in an airport at 2 am
in the faint light energy slides
to a standstill. where is my bag?
i flee west, the sun in a panting pursuit.

IX

From the window i see the mountain, and
up my spine crawls a memory
from the plane, the first time across
the ocean, the distant
the snow clad peak.

X

Mauna Kea

XI

It is first light. There is a glow, a red-orange glow
to the the mountain peak, the summit, piko, the connection
to the infinite, the beginning, the beginning of another
day. in these revolutions we find hope.
I pore through my notes, the sun streams in the
windows, warms me, cheers me. Some would take
the umbilical cord, also piko, of the new child
to a special place, maybe the summit lake, Waiau.
water and the passing of time,
water that swirls,
water with currents. The cord
that connected to the two hearts, reconnects
to the beginning of the earth, this smoldering,
upheaving earth, no, go further back,
to the very beginning, piko, the genitals, life
connecting to the beginning of time, to the first light.
Is it so hard to consider,
the timeless knowledge of another culture,
is it so hard to experience
the sacred, to feel, to sense in a particular
place that which brings flavor and meaning to life,
to know the fountain of relationship that weaves
and flows between oneself and all the beings
all the objects, all the living energy
of the earth, is it so hard for me to consider
as i am part of the universe
the entire universe suffers and dies and grows
with and within me, through me
we die and grow and die and grow and die again.

XII

In the stillness of the night
our bodies curve into the moon
white flowers float in the trees.

XIII

On the mountain, ceded homelands seeded
with foreign money, and today, thirteen telescopes
peer into the darkness collecting light and radio
signals, signals radiating from deep space,
thirteen telescopes sprout like a mushroom circle,
thirteen telescopes, a modern stonehenge
a rift zone, cones protruding, intruding
in chaos confirming
the complexity
of particle physics, what is the value
of astronomy if not philosophy
if not poetry
connecting our inner and outer worlds, besides
we need this mountain for the benefit of all
but though i am a foreigner here
even i can sense this mountain is more than just
a mountain... can sense
the majesty of its presence, can sense the truth
of a rumbling earth that can startle us at any moment
breaking a fragile shell with new birth. Some years ago
deaths and inner rumblings began a cracking of my own
long-held beliefs, my Western sense that nature
is ours to rule and conquor.

XIV

"Much of navigation is this internal journey," he said
and, "The canoe is really

a vessel of healing."[3]

XV

A full moon will soon rise behind me, but now
half-hidden behind the banyan,
the stars form arcs and patterns, but blurring
in and out of failing vision, voices raised
in anger drift across the river. I spend
the day, the night trying to make sense
of what i learn, seek to find
at least the questions that make sense. The
night air fills with the sweet scent of tropical
decay and lost coquis out shout the crickets
the moonglow begins to shield the stars
from my prying eyes.
What is the value of looking, of this search
to what end this bubbling curiosity that roils
my being, that slowly builds on the charred
and broken fragments of the past,
the disturbed bones
that slowly builds
only to erode, time and time again
as new questions seep
from the earth to disturb and haunt
my nights and days.
What value if not to recognize
not so much to understand but
to grasp
the sacred, the unknown
wrapped in its mysteries,
to recognize the very kaleidoscope
of nature, of life,
its very gift
that flows like sweet milk
through all this universe?

[3] Nainoa Thompson in Voices of Wisdom by MJ Harden, p219,223.

XVI

"Mauna Kea kuahiwi ku ha'o i ka mālie,"
Mauna Kea, standing alone in the calm."[4]

XVII

From the old histories(i am a foreigner and
have to read-- books, the land and sea and sky,
and people-- to learn, and learn, as we always
have, in an incomplete and groping manner,
and do not know the enchantment of
intimacy with the living world) we learn
of Wākea and Papa
the sky and the earth, father and mother
giving birth to these islands, and the following
ancestors, peopling the lines, the islands
its songs, its dances.
In the testimonies of today, before alien
commissions, the people speak of
their losses, of their anger
of heiau, of burial practices, of quarries
of sacred waters, of their ties
to the natural world, to the land.

And some do not speak; it is alien
to their culture.

XVIII

Flows of broken lava flank the mountain
flows of broken promises.

[4] #2146-Olelo No'eau-Hawaiian Provers & Poetical Sayings-Mary Kawena Pukui

XIX

When the west arrived, disease
rode in on the wind, and with the wind
trickery, self-interest, self-righteousness
and false assumptions. progress and development
and exploitation, a long-term lease at a dollar
a year.

"Ōkole kālā- a people whose buttocks
sit on money."[5]
what else could they say, overwhelmed,
this culture that so values generosity,

a generosity born of the earth's
own gifting providence, over the cyclic eons
eons of time, moon and tide and sun,
the journey of water
from sea to sky to earth to sea
seed to fruit to seed.,
a generosity that does not demand an
immediate reciprocity, but arises from
a deeper understanding of caring for the land, the 'aina,
and receiving the gifts of the Sun.

XX

And the stars would guide them,
and the waves, and the weather and the birds
and the interior life that filled their hearts.

XXI

Can astronomy heal the wounds of our dissolute ways,
or is it an unstable canoe that has lost its float?
Telescopes poke at the extreme

[5] Native Land and Foreign Desires-Lilikala Kame'eleihiwa

ends of the universe
search through the fragments of our thought
for the grand unification
of theory with life, ride the saxophone
chill thrill of our mind waves
to the still center of the universe
through the outlaw fringes of the universe
through the wildness of black holes
saxophone mind wave
straining straining
a blue train through interstellar space
into the turquoise stillness
interior bones collapse
into liquid fragments
particles are waves
the essence of one is the other
the hidden revealed
the taut note breaks open
the line of the stone's hidden adz
and the canoe becomes a possibility
if false, a fragment a screeching mistake.
The outrigger rides the thought waves
harmonizes
balances discontinuities, a blue-green train
rolls to shore.

XXII

At night, as a child, i longed
to jump into the stars
to visit that unknown world
and its hidden God

XXIII

Relativity and quantum mechanics

belated twentieth century rediscoveries
of the consubstantial nature of all things.
Our obsessional counting world too
connects with the beginning of time
seeking the measurement of
nature's web, we find the truest knowledge
inexpressible, puzzling the unity
of being and non-being and
leaves us with in awe of the sacred
astronomy can challenge the background radiation
the assumptions of our culture
but new knowledge, like the molten lava
that pushes forth from earth's
beating, pulsating, breathing heart takes time
to become fertile soil

XXIV

As i age my vision
fails and narrows
becomes shortened becomes
more local
well, this failure perhaps not a failure, and i
listen for those echoes of my earlier self.
But hard to hear, all those city walls.
I stand in the rain
and hope for a chance
at reconciliation
but it is not the grace of God that draws me
towards a reoriented life, but our own
hard-developed grace
over eons of time
that moves me towards the sacred
and then, perhaps God.

The sounds of a ukulele
i stop at ka huina

people jamming,
following the evening
breeze as it pushes up Mamo street
mauka, towards the mountain
the taste of liliqoi in a glass of water
e, that's all i need
or want of the infinite.
a calm joy fills me, the music
pulsing, the mountain
hidden in the clouds, at the lower edge
a cone visible, an old rift zone
knowing everywhere, it flows around me.

XXV

paddlers walk back and forth, an anticipatory
energy in the lightness of their
steps in the sands, paddles gripped in their
hands, or in cases slung off the shoulder, the
line running down a strong back
paddles hang from the eave lines of tents
like pelts gutted and cleaned, the
wood carefully selected, shaped and polished
or maybe a high-tech plastic
the old and the new, the picnic table i write on
still smelling of new pine, just cut
just sanded, still unpainted, in the bay
paddlers bend and stroke, pull.
along the shore, some eat, talk story
or rest, stretch out, nap.

XXVI

Each month the full moon's paler light
stretches across my floor, though in truth, some
months it be rain and cloud obscure, but either way

rain or moonlight
cyclic reminders of earth's deep providence, but
i, a product of steel, concrete and asphalt, and barely
i grasp the sense of this old knowing, a knowing
that lies again in uncharted waters, the old maps
lost and destroyed.
Do we dare to sail into these waters, waters
long forgotten, to give back Mauna Kea, to recede
the 'āina? Do it, i say, only the sacred awaits.
Do it! i say,the gift awaits.
Ride the turquoise train!
Aloha.

It reminds me of long ago, of my youth.
"Na lā e lana ana ke koko."
'The days when the blood circulates freely.'
"Na lā e lana ana ke koko."

XXVII

Mauna Kea
the white mountain
girded in cloud
was this what they first saw?

Terry McNeely
September 24, 2004

Your comments are respectfully noted.

OUTRIGGER TELESCOPES PROJECT
COMMENTS FORM

NASA welcomes and encourages written public comments on environmental impacts and concerns (including historical, archeological, and traditional cultural issues) and proposed mitigation associated with the proposed Outrigger Telescopes.

Your comments will be reproduced in the Final EIS for the Outrigger Telescopes Project. If you prefer that your name not be published with your comments, please express that desire in the comments section below. NASA will not publish your address in the Final EIS.

Your comments may be written on this form and left at the registration desk. Or, you may send your comments to Carl B. Pilcher, Program Executive, Science Mission Directorate, Universe Division, NASA Headquarters, 300 E Street SW, Washington, D.C. 20546-0001. Comments must be provided in writing and received by NASA on or before 4:30 PM Eastern Daylight Time September 30, 2004; fax (202-358-3096) or e-mail (otpeis@nasa.gov)

Commenter's name: Mark McNett

Commenter's full address (street, city, state, and zip code):

Date: August 25th, 2004

Place an X in this box if you wish to receive copies of future environmental planning documents on the proposed Outrigger Telescopes Project (including the Record of Decision) that NASA distributes to the public. [X]

Comments: I , as the sole member of the public ,present to testify concerning your Keck Outriggers when this came before Hawai'i County Council and another hearing in Council chambers. Also ,, in recent weeks ,, I was privileged to address President Bush's Top Space Advisor, a Mr., aldredge ,, to the best of recollection. Please grant this request to present a recorded copy of various prior statants on my part., on VHS or DVD or Written Transcript.

Mark McNett
August 25, 2004

Thank you for your comment.

>Date: Fri, 27 Aug 2004

>From: Alan Mefford

>Subject: Keck Outrigger Telescope Project

>To: otpeis@nasa.gov

>

>Attention Carl Pilcher,

>

>I support the Keck Outrigger Telescope Project for the following

>reasons:

>

>1. For the Mauna Kea Observatory complex to stay at

>the leading edge of astronomy there must be continued development and

>improvement.

>

>2. The proposed telescopes are to be placed on ground

>that has been previously run over and disturbed.

>There is nothing pristine about the site.

>

>3. The Mauna Kea Observatory complex provides an

>excellent industry with good paying jobs for the

>County of Hawaii. It is as clean and environmentally

>sound an industry as can ever be hoped for.

>

>4. The Mauna Kea Observatory complex provides the

>opportunity for the University of Hawaii and the Hilo

>Campus to become the world university leaders in the

>field of astronomy. For this to happen the research

>has to be supported by development projects such as

>this one.

>

>I believe that the support for this project far

>outweighs the non-support. Unfortunately, most of the supporters won't

>get around to sending a comment. Somewhere it needs to be publicly

>stated "Hawaii, if you want this project you had better send in your

>support comments".

>

>Alan Mefford

Alan Mefford
August 27, 2004

Thank you for your supportive comments.

DEAR DR. ALCHER:

THANK YOU FOR SENDING ME THE DEIS COPY.

BECAUSE THERE HAS BEEN SO MUCH IMPACT ALREADY, AS STATED IN YOUR REPORT, THEN IT WOULD SEEM, THAT THIS FURTHER INCREMENTAL PROJECT, CANNOT (BY DEFINITION) HAVE NO IMPACT OR NO SUBSTANTIAL IMPACT (ETC.)

A

AT THE VERY LEAST, YOUR DEIS DOES NOT PLAN TO RETURN ALL-WATER-USED, BACK TO THE SOIL/AQUIFER, IN THE <u>SAME</u> (PURE) CONDITION RECEIVED!

B

NOR ARE THERE PRESERVED PLANS FOR THE REMOVAL OF ALL STRUCTURES / PIPING ETC, WHEN THEIR PROJECT-LIFE IS COMPLETED.

C

THESE, AND OTHER CONCERNS, CONSTITUTE A MINIMUM OF WHAT IS NECESSARY, FOR PROPER RESPECT OF THIS HOLY SPIRITUAL PLACE; SADLY, NONE OF THIS IS IN YOUR DEIS.

OUTSIGHT ORGANIZATIONS SHOULD BE FUNDED BY NASA/KECK, TO ADDRESS THESE AND OTHER CONCERNS, FOR PROPER STEWARDSHIP.

D

THANK YOU Daniel Moreno MD 9/30/04

Daniel Morimoto
September 30, 2004

Response to Comment A:

NASA has concluded that past, present, and reasonably foreseeable future activities have a significant impact on the quality of the human environment. NASA has also concluded that, in general, the Outrigger Telescopes Project would add a small incremental impact (see Section 4.2.16).

Response to Comment B:

No measurable groundwater contamination can result from the disposal of wastewater at the summit, as shown by the hydrologic analysis done as part of the cumulative impacts analysis in the EIS (See Sections 4.1.3 and 4.2.5). The same analysis shows that wastewater from the observatories cannot reach Lake Waiau. All disposal of wastewater is done through State-approved septic systems. No hazardous materials are disposed of through the septic systems, but rather are trucked down by licensed and State-approved contractors.

The hydrology analyses in Sections 4.1.3 and 4.2.5 of the EIS are based on the best available scientific information. As discussed in Section 4.2.5, the impacts of all past, present, and reasonably foreseeable future astronomy-related projects, including the Outrigger Telescopes Project, on the hydrologic system are negligible.

Response to Comment C:

The End of Lease event in 2033 could result in a variety of outcomes. The State of Hawai‘i, through its Board of Land and Natural Resources and the University of Hawai‘i, will decide upon a course of action at the expiration of this lease. The potential impacts associated with the decommissioning and demolition of the observatories on Mauna Kea are addressed in Section 4.2.15.2 of the EIS.

Response to Comment D:

NASA is committed to being a responsible steward in the implementation of the Proposed Action. NASA made a considerable effort to consult with interested and concerned parties about the Outrigger Telescopes Project. As a result, NASA has made numerous commitments to on-site and off-site measures that would protect and enhance the cultural and environmental resources of Mauna Kea. In addition, NASA will commit $2 million to an initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians as a mitigation component of the Outrigger Telescopes Project.

OUTRIGGER TELESCOPES PROJECT
COMMENTS FORM

NASA welcomes and encourages written public comments on environmental impacts and concerns (including historical, archeological, and traditional cultural issues) and proposed mitigation associated with the proposed Outrigger Telescopes.

Your comments will be reproduced in the Final EIS for the Outrigger Telescopes Project. If you prefer that your name not be published with your comments, please express that desire in the comments section below. NASA will not publish your address in the Final EIS.

Your comments may be written on this form and left at the registration desk. Or, you may send your comments to Carl B. Pilcher, Program Executive, Science Mission Directorate, Universe Division, NASA Headquarters, 300 E Street SW, Washington, D.C. 20546-0001. Comments must be provided in writing and received by NASA on or before 4:30 PM Eastern Daylight Time September 30, 2004; fax (202-358-3096) or e-mail (otpeis@nasa.gov)

Commenter's name: Ruth Ota

Commenter's full address (street, city, state, and zip code):

Date: 8/25/04

Place an X in this box if you wish to receive copies of future environmental planning documents on the proposed Outrigger Telescopes Project (including the Record of Decision) that NASA distributes to the public. [X]

Comments: What has happened to mankind? What has happened to his heart? Is mankind really so very arrogant that he feels above God? Is mankind really so very arrogant, self-serving and devoid of emotion and feeling that he feels Spirituality is not important? Is mankind so ruthless and greedy that they feel the "right" to disregard feelings of deep sacredness of others spirituality? Nasa - America - what has happened to you!! Have you conveniently forgotton the words of John Glenn, when he saw Earth? How heinously selfish, self-serving and greedy you have become! Are you so numb you cannot feel the mana here?? Wake up!!!! Be human!! Would you like this done to your very sacred place or don't you know the meaning? Look in the mirror and discover you are not God!

Ruth Ota
August 25, 2004

Your comments are respectfully noted.

Kason Pacheco
September 8, 2004

Hi, My name is Kason I am from Hilo on the Big Island. I recently went to Mauna Kea to visit the different spiritual sites that are located on Mauna Kea. I noticed that the observatories and other structures are located directly in the path of some trails and other important Hawaiian areas. I feel that Mauna Kea has more than enough observatories on it. And I know about the good (observatories) it can do to the economy but I feel that to develop more on the mountain is not necessary to make another eye sore on the beautiful mountain. I believe that what you have is good enough already and the older structures should be removed if they are not being in use. Thank you
Kason Pacheco

Kason Pacheco
September 8, 2004

Your comments are respectfully noted.

Canary Island Alternative Provides "Win-Win" Solution to Mauna Kea Controversy

Comments by Tom Peek on the NASA Outrigger EIS
August 25, 2004 – Hilo, Hawai'i

"NASA has also identified a reasonable alternative to the Mauna Kea site in Spain's Canary Islands. NASA's initial determination is that all of the science objectives set out for the Outrigger Telescopes Project can also be attained at this alternative site."

Draft EIS for the Outrigger Telescopes Project, page xi

Aloha. My name is Tom Peek, from Volcano. Thank you for this opportunity to comment on the draft EIS.

I was an early tour guide for the Mauna Kea Observatories and conducted public stargazing, observatory tours and special programs between 1988 and 1996. I loved it. The job was inspiring for an amateur astronomer, I got to live on the beautiful mountain during my stints, and I had an opportunity to meet many islanders. Even so, I resigned my position when I found out that the Institute for Astronomy and the observatories they represent—had violated master plan and other provisions they had agreed to in the 1980s. At that time, they were also studying the possibility of building a 90 telescope submillimeter array just below the summit, despite calls for moderation from the islanders who had hosted them all those years.

During my time on the mountain, I came to appreciate the deep cultural traditions of Mauna Kea—and developed my own connection to the mountain (as anyone privileged to live there would do). I also became friends with Native Hawaiians and others connected to the mountain—either by ancestry or by spirit. It didn't take long for me to realize just how important this mountain was to the people of Hawai'i. A

This is why I am pleased that a *serious* cumulative analysis of the cultural and environmental impacts has finally been done—the first ever in the history of Mauna Kea. As others have pointed out, the EIS acknowledges that modern astronomy has had and will continue to have "substantial, adverse and significant" impacts on the mountain (pp.xxii, and xix-xxii), something which the Institute for Astronomy has consistently denied in their environmental assessments—but which islanders have been saying for decades.

NASA has also prepared the first detailed—and I think honest—analysis of alternative sites for a proposed Mauna Kea observatory project. I am pleased that NASA has concluded that their scientific goals can be fully met by building their Outrigger Project elsewhere, at the Gran Telescopio de Canarias on La Palma in the Canary Islands. That site, they conclude, would suffer

fewer negative cultural and environmental impacts and enjoy greater positive socioeconomic impacts, given the relative size of that archipelago's economy. According to the EIS, "there are no groups that consider (that site) to be sacred or of religious importance," so that construction and installation "will have no impact on traditional cultural practices." (p.xxii, and xxiii-xxiv))

This is good news for someone like me, who loves both astronomy and Mauna Kea and respects the island people. We now have a reasonable alternative that halts continued damage to Mauna Kea but also allows modern astronomy to progress.

Let's take it.

It's also an easy alternative to implement; NASA has the power to shift their project to the Canary Islands and create a "win-win" situation of the type that I didn't think would emerge out of this controversy. We can protect Mauna Kea and allow international astronomy to flourish into the future.

Now it does mean that the limited economic benefits of this project—35 temporary jobs and 8 longer term jobs—will go to the Canary Islands. (p. 4-36) But that seems a small price to pay for an otherwise "win-win" situation for the community and astronomy. A

Of course, the University of California and Caltech will lose the opportunity to improve their twin Kecks, but that's not *our* concern. And they will still operate the two best telescopes on Earth under Mauna Kea's fine skies.

The Institute for Astronomy may also feel disappointed if the Keck Telescopes aren't upgraded, but they have little real justification for that reaction. The small decrease in the Institute's overall observing capacity caused by not upgrading the Kecks is trivial compared to the abundant telescope time they already receive on all the other telescopes in lieu of observatory impact fees to the public. I would say to Drs. Kudritzski and McLaren (and their predecessors), after all that you've won over the years, please don't be greedy now that a viable alternative has been identified that may finally ease the tension between the island community and the great quest of modern astronomy.

Thank you.

Tom Peek

OUTRIGGER TELESCOPES PROJECT
COMMENTS FORM

NASA welcomes and encourages written public comments on environmental impacts and concerns (including historical, archeological, and traditional cultural issues) and proposed mitigation associated with the proposed Outrigger Telescopes.

Your comments will be reproduced in the Final EIS for the Outrigger Telescopes Project. If you prefer that your name not be published with your comments, please express that desire in the comments section below. NASA will not publish your address in the Final EIS.

Your comments may be written on this form and left at the registration desk. Or, you may send your comments to Carl B. Pilcher, Program Executive, Science Mission Directorate, Universe Division, NASA Headquarters, 300 E Street SW, Washington, D.C. 20546-0001. Comments must be provided in writing and received by NASA on or before 4:30 PM Eastern Daylight Time September 30, 2004; fax (202-358-3096) or e-mail (otpeis@nasa.gov)

Commenter's name: TOM PEEK

Commenter's full address (street, city, state, and zip code):

Date: 9-18-2004

Place an X in this box if you wish to receive copies of future environmental planning documents on the proposed Outrigger Telescopes Project (including the Record of Decision) that NASA distributes to the public. [X]

Comments: PLEASE SEE ENCLOSED. THANK YOU.

Tom Peek

September 18, 2004

Dr. Carl Pilcher, Program Executive
Science Mission Directorate, Universe Division
NASA Headquarters
300 E Street SW
Washington, D.C. 20546-0001

Dear Dr. Pilcher:

Thank you again for the opportunity to comment on NASA's Draft Environmental Impact Statement for the Keck Outrigger Project. Attached is a copy of the testimony I gave at the Hilo public meeting on August 25, 2004. I have two additional comments to add to the record.

NASA Breaks the Tradition of Shoddy Environmental Analysis for Mauna Kea

As I mentioned to you privately that evening, it is a relief to finally evaluate an environmental study of a proposed Mauna Kea project that is actually professional in tone and content—probably the first of that quality ever conducted since astronomy arrived a generation ago. While the NASA EIS contains some serious errors of omission or misinterpretation (outlined by various people at the hearings), I never had the sense while reviewing it that I was being intentionally deceived or manipulated by the analysis. From that perspective, your draft EIS stands in stark contrast to most of the state environmental assessments, master plan documents, economic analyses and public relations materials prepared for the University's Institute for Astronomy (IfA) by a local planning firm, Group 70 International. As your own analysts probably discovered in preparing NASA's EIS, those earlier IfA-contracted documents have generally been political, often overtly biased in their interpretations of data, and marred with factual mistakes and even outright distortions. I applaud you for breaking that dubious tradition, which has contributed to the public's distrust of the astronomical community on Mauna Kea. B

NASA's Economic Analysis is Incomplete and Probably Inaccurate

That said, there are some deficiencies in the NASA EIS, as you would expect in any draft. In my view, the major—and perhaps debilitating—deficiency comes from NASA's failure to do its own independent socioeconomic impact study for the cumulative impact analysis section. Instead it relies as its primary source on data from IfA's 1999 Master Plan EIS, which was prepared by Group 70 International in a highly political context (during debate on proposed observatory expansion) and which failed to adequately break down its employment and economic activity data into useful categories. Thus the current draft EIS leaves out crucial data and analysis vital to the decision-makers who must evaluate the Outrigger Project.

First, regarding the specific Group 70/IfA data cited, it is difficult for me to independently judge whether the base numbers for economic activity and job creation are even close to accurate, but given Group 70's track record, I think an independent evaluation of those data would be prudent. C

Beyond that, there is a major structural problem with the Group 70/IfA analysis cited as your primary source in your draft EIS. It does not break down either the job figures or the economic activity figures into meaningful categories that reveal an accurate picture of the economic impacts of the observatories cumulatively *on the existing island population.* Nor does your own analysis of the socioeconomic impact of the single proposed Outrigger project do that. These are a crucial deficiencies because people in

Hawai'i are deeply concerned about finding replacement jobs for islanders who lost their work after the demise of the sugar plantations, including many Native Hawaiians and others classified as "minorities." Importing labor to fill necessary observatory jobs does not help meet that need.

To be truly meaningful for your impact analysis, the gross job figures in the study need to broken down into several categories:

- Temporary (usually construction) jobs
- Long-term (or permanent) jobs
- Jobs requiring imported employees (including scientific, managerial and technical jobs)
- Jobs requiring particular skill levels and educational training
- Pay levels of jobs created by the observatory projects

I would expect the final EIS to disclose the specific numbers for these categories. These breakdowns will then allow the public and decision-makers (at NASA and in Hawai'i) to better judge the impact of the observatories and the Outrigger Project on the island economy.

For example, of the 820 statewide jobs (and a $50 million payroll) claimed by Group 70/IfA (and cited in your EIS) to have been created directly or indirectly by the observatories (p. 3-58), how many were actually filled by islanders? This number should be obtainable by looking at actual observatory employment records. What kinds of observatory-related jobs (and at what skill, educational and pay levels) have islanders actually been able to fill (as opposed to those jobs which ultimately went to imported workers)? How would those numbers compare to the jobs generated by, say, construction and operation of another Walmart or Home Depot or a new hotel or other tourist attraction in a less culturally and environmentally sensitive area? How would they compare to the jobs generated by beefing up the staff and programs of one of the state's heavily visited national parks or monuments? C

These job categories and data interpretation questions apply not only to the cumulative analysis, but to the Outrigger Project's specific socioeconomic impacts as well (pp. 2-35 to 2-36). These considerations may also affect the "Environmental Justice" impact analysis, as required by Executive Order 12898 (p. 4-41) as it relates to Native Hawaiians and the other three-quarters of the state's population classified as "minority residents" (p. 3-53).

Because this part of your draft EIS (e.g. IfA's earlier assertions) has been widely quoted in the media and is central to the land use debate currently underway in Hawai'i, including solid (truly defendable) data and analysis must be a component of the final NASA EIS.

Again, thank you for the opportunity to comment on the draft. I look forward to seeing the final report, and would anticipate that it will adequately address these current deficiencies.

Sincerely,

Tom Peek

c.c. Office of Hawaiian Affairs
Sierra Club Hawai'i Chapter
Mauna Kea Anaina Hou

Tom Peek
August 25, 2004

Response to Comment A:

Thank you very much for sharing your thoughts.

NASA has not made a decision about a site for the Outrigger Telescopes Project. No decision will be made until the National Environmental Policy Act process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment B:

Thank you for your favorable comment on the quality of the EIS.

Response to Comment C:

NASA made an effort to obtain employment breakdown data from the observatories, but was unable to obtain a clear picture. The best available information indicates that the majority of observatory employees are from the State of Hawai‘i. New hires at the observatories have included Big Island residents, residents from elsewhere in Hawai‘i, and out-of-state residents. The information available has been added to Section 3.1.10 of the EIS.

TO: **National Aeronautics and Space Administration**
Mail Code: SZ
Washington, DC 20546-0001
Ph: 877-283-1977
ATTN: Dr. Carl Pilcher
Outrigger Telescopes Project
Astronomy and Physics Division
Office of Space Science

FROM: Mauna Kea Anaina Hou
230 Lyman Avenue
Hilo, Hawai`i 96720
Ph. (808) 934-7668
Email: kealohap@aloha.net
ATTN: Ms. Kealoha Pisciotta, President

Date: 28 September, 2004

Subject: Draft Environmental Impact Statement Comments Relating To The NASA/William M. Keck Observatory- Outrigger Telescopes Project, Mauna Kea, Hawai`i

Aloha Dr. Pilcher,

The following comments are filed on behalf of Mauna Kea Anaina Hou, a Native Hawaiian Organization as defined by the National Historic Preservation Act (NHPA). Mauna Kea Anaina Hou (MKAH) is dedicated to the protection, preservation and restoration of the traditional and customary Native Hawaiian traditional, cultural and religious practices relating to Mauna Kea. MKAH provided extensive comments at the Draft EIS ("DEIS") meetings and also at the NASA EIS Scoping meetings (*Please see attached scoping comments*), we submit the following comments in addition to our previously recorded comments.

MKAH, previously participated in the NHPA, Section 106 Consultation (Consulting Party), the National Environmental Policy Act (NEPA) Environmental Assessment (EA) process and the recent NASA Environmental Impact Scoping Hearings held here in Hawai`i in January (Jan. 5-13, 2004), relating the NASA/William M. Keck Observatory, (WMKO) Outriggers Telescopes Project. Although MKAH participated in the Section 106 process as a

consulting party, MKAH did not sign the Memorandum of Agreement (MOA) offered by NASA.

Members of MKAH also participated as plaintiff witnesses in the federal court case (Civil No. 02-00227 SOM/BMK-Office of Hawaiian Affairs v. Sean O`Keefe), challenging the adequacy of the NASA's FEA for the Outriggers Telescopes Project. The Federal Court found NASA's EA inadequate, and not in compliance with NEPA, for failure to adequately consider the cumulative impacts of the Outrigger Telescopes Project. The court remanded NASA to redo the EA pursuant to NEPA. NASA has decided forego the EA, to complete a full federal EIS.

Lastly, MKAH, along with five (5) other Environmental and Hawaiian organizations and individuals (*Sierra Club, Ching, Fergerstrom, Royal Order of Kamehameha I*) is currently engaged in a state administrative hearing called a contested case hearing (CCH). MKAH and the other contesting parties are challenging the University of Hawai`i's Institute for Astronomy's (UHIFA) request (on behalf of CARA/NASA) for the Conservation District land use and permit to construct the four (4) to six (6) Outrigger Telescopes, for which this Draft EIS is the subject of.

I. PROCESS

A. No Scoping Comments Were Included In The Draft EIS :

No Scoping comments were attached to the Draft EIS. With no public comments attached it is impossible for decision makers and the public to determine the scope and adequacy of the Draft EIS. Members of the public, interested parties and pertinent governmental agencies took time to comment and currently have no way determining if the NASA EIS adequately considered the public and governmental concerns because there is no information with which to compare them with. A

B. Two Hundred and Fifty (250) Comments Received Where Lumped Together and Treated As One:

On page 8-5, NASA notes that "approximately 250 virtually identical emails where received from individuals entitled 'Prevent Further Degradation of Mauna Kea.' " in addition to the many other comments, but you did not identify the individuals commenting. We believe it is very important, that NASA identify the members of the public that comment, for the following reasons:

1) Although these comments might have been "virtually identical", virtually is not equal to "exactly", Public comment regardless of the volume,

should not just be treated as a single comment, there were -250 comments submitted by 250 individuals;

2) Lumping these comments together is equivalent to counting 250 "**no**" votes as one, because they are virtually identical or identical. Democracy is not handled this way-it is one (1) vote per person, even if the individual votes are exactly or "virtually identical" they must be counted.
3) Lastly, these comments demonstrate that these 250 people feel strongly about "Preventing Further Degradation of Mauna Kea."

A

II. Cumulative Impacts:

A. Cumulative Impact is defined by the National Environmental Policy Act ("NEPA") as:

The impacts on the environment which result from the incremental impact of the action when **added** to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from other individually minor but collectively significant actions taking place over a period of time.

The Executive Summary cumulative impact summary section on page xxii-states:

> *"In conclusion, the overall cumulative impact of past, present and reasonable foreseeable activities is* ***substantial, adverse and significant.*** *In general, the Outrigger Telescopes Project would add a small incremental impact." (Emphasis added)*

The above statement establishes that the cumulative impacts are adverse and great, but then separates the outrigger project from the previously established cumulative impacts. This is not reasonable. If cumulative impacts are defined as the sum of the impacts when **added** to other incremental impacts, it doesn't logically follow that "...the Outrigger Telescopes Project would **add** a small incremental impact."

B

B. No Cumulative Impact Mitigation Measures:

In order to determine mitigation measures for offsetting or reducing cumulative impacts, there must be at least three precedent conditions 1) data, 2) analysis and evaluation of the data and 3) measures proposed based on data to reduce those impacts. Generally, to reduce cumulative impacts to less than significant.

C

The Draft EIS, does not offer any cumulative impact mitigation measures. This appears to be the result of the Outrigger Telescopes being separated out from the cumulative impacts, and defined as having small incremental impacts. C

C. Data Used In Draft EIS Are Contested In Official Proceedings:

Much of the data used in the Draft EIS continue to be contested in the State BLNR Contested Case Hearing proceedings relating to the Conservation District Use Permit, filed by the UHIFA and WMKO on behalf of NASA for the Outrigger Telescopes Project. D

Sierra Club, who is one of the Petitioners in the State BLNR case, supplied you with copies of the Petitioners collective Findings of Fact, Conclusions of Law and Exceptions as filed. These documents were provided to NASA so that the data that are being challenged by other experts could be identified. It was our hope that NASA might collect **new** data; or incorporate the concerns of the Petitioners witnesses; yet we see no evidence of your inclusion of the Petitioners evidence. E

D. Wekiu Bug Data Disputed:

The Draft EIS relies almost entirely on Dr. Greg Brenner's data, and proposed mitigation measures. In our scoping comments we recommended that NASA put together a team of scientist to review Dr. Greg Brenner data and mitigation measures, and that this team could include but not be limited to Dr. Fred Stone, Dr. Frank Howarth and Dr. Greg Brenner. We made this specific request this because we have reasons to believe that Dr. Greg Brenners's data did not have peer review or support. Our reasons where based on the information from the contested case hearing, the testimony of expert witnesses, and the conclusions by the team of scientists who reviewed the Wekiu bug candidacy from December 2003 to March 2004. F

Furthermore, NASA has not included the U.S. Fish and Wildlife ("USFW") information as was requested by a number of the groups consulted, including Mauna Kea Anaina Hou and Sierra Club. The organization KAHEA-The Hawaiian Environmental Alliance, filed a formal petition for the listing the Wekiu Bug on the Endangered Species list. The data identified in that petition should be included in this assessment. The USFW with OMKM convened a team of scientists to review the candidacy status of the Wekiu bug. The findings of this committee, which recommend immediate listing as Endangered species have been omitted from the DEIS. This omission violates the terms of the mandate of full disclosure.

E. Visual Vistas And View Planes Important To Cultural, Traditional And Religious Practices:

Throughout the Draft EIS, the outriggers are cited as being 33′ (33 feet) in size. Although this number is true for the size of the mirrors at the Keck I and G

Keck II Telescopes, it is in not accurate when considering the domes sizes. Continally referencing the mirror size instead of the dome size is misleading. The domes on both the KECK's are 11 stories high each or about 111' (one hundred and eleven) feet high. The Outrigger Telescopes with their domes are each about 3 ½ stories high (35' feet). So the total impact visually would be the combined impact from the Two (2) Eleven (11) story buildings surrounded by four (4) to six (6) - 3 1/2 story buildings clustered with in a five (5) acre area. This will have a significant, substantial and adverse impact on the visual vistas or view planes.

The visual vistas or view planes used by the Native Hawaiian People, are important to the cultural, traditional and religious practices. The impacts on the view planes are both to the tangible and intangible cultural, traditional and religious resources. They are thousands of years old. The view plans and vistas are identified Traditional Cultural Properties. We have provided information regarding the importance of these view planes for ritual and ceremony, yet they where not addressed in the Draft EIS. G

The view planes are not only looking toward the summit from below (from the east in Hilo and other places on the island), but also from the various pu`u (cinder cones) looking toward the summit cluster of cinder cones (Kukahau`ula), and lastly, looking from the summit down toward the sea and other islands.

The divine manifestation of the Deities (Kinolau) are apart of the ritual landscape and view planes. The image of Poli`ahu lying facing the sky is seen from Hilo. The Observatories are sitting atop her body, the Outriggers will impact this image by changing her physical form. This is a tremendously unacceptable impact that cannot be mitigated.

The Project will also change the view planes and alignments used in ceremonies and navigational practices that mark the alignments of various constellations and the sun.

Other view planes include the image of the deity Kukahau`ula, as the god descends from the heavens (each day) to greet Poli`ahu-these images are impacted from various locations on the summit and from below.

Lastly, there is no reference to the cumulative impact and loss of the 360 degree view plane from the summit. Actually there is no longer a 360 degree view from the summit area, and the Outriggers will negatively impact what view plane is left.

F. No Soil Tests Done Near The Cesspools, Leech Field, Septic Tanks, Or the Diesel and Oil Containment Systems:

We could not find evidence in the DEIS to indicate that data or analysis of soil testing near major sources of contamination had been conducted. It seem most logical to test for hazardous and sewage leakages from the source, as well to test for transportation of contamination. This is a gross omission of assessing H

existing and future impacts. There is no baseline data and represents another example of not providing full disclosure. H

G. Hydrology Data Used In Draft EIS Already Contested In State and Federal Hearings

1. Precipitation From Clouds And Mist That Occurs Two Times A Day:

The Draft EIS data on precipitation relies mostly on snowmelt, it should however, include the mist and cloud cover that generally occurs in the morning and evening-this is significant over the entire summit area and much water is released on the surface of the summit area. I

2. Discharge Of Human Waste

The Draft EIS, claims that there are no cumulative impacts associated with the human waste deposits into septic tanks/cesspools and leech field systems. We would have to disagree!! In Hawai`i it is generally acknowledged that defecating in a burial area or on a heiau or in a temple of worship is defiling (haumia) and considered a high form of desecration. Mauna Kea is a burial ground for important ancestors and heiau or temple of worship, so human waste entering the ground is considered desecration. There is no cumulative analysis of the cumulative impacts of sewage treatment on the cultural, traditional and religious practices and use. J

Although the Draft EIS claims that all of the telescopes Individual Waste Water Systems ("IWS") are inspected and pumped, there was no evidence in the record of this, in fact the record reflects that WMKO had no pumping records. Where are the data to support this claim? K

3. No Base-Line Data On Hydrology

Data are already in the hearing record that demonstrate, Mr. Nance took only one data point at two separate sites. This means that there is no base-line data to substantiate any claims there are no cumulative impacts to the hydrology system of Mauna Kea. L

Further, Tom Nance's data and sources including his reliance on Ebel (2001) a undergraduate, non-published and non-peer-reviewed report have been challenged. The data supplied in the Ebel is based on only a 5 day sample, and further misstates Dr. Woodcock's reports (1980). I have attached the rebuttal testimony of our hydrology witness Dr. Brad Finney regarding these points.

The Draft EIS claims that many of the hazardous material spills (including mercury) have occurred "inside" the observatories, however, it omits the important discussion contained on our contested case hearings files regarding the "French drains" or **"open drain systems" used in the observatories that** M

enter directly into the ground and could allow any hazardous materials spilled inside the observatories to be introduced into in to the ground. M

The Draft EIS also provided some information but no analysis of the information provided regarding the sump pump system used to remove hazardous materials from the mirror aluminizing and washing processes; in that, the KECK engineers testified that the sump pump had ONLY been installed one year prior to the State hearings. There is no cumulative impact analysis relating to the years prior to the installation of the sump bump nor is there analysis relating to the other observatories mirror washing and aluminizing histories provided in the Draft EIS. N

We could not find any references or cumulative impact analysis regarding the past and/present use of Carbon Disulfide, for mirror washing and which is listed in WMKO MSDS. KECK employees testified at our hearing that it was permitted to enter the ground via the open drain systems up until the KECK installed the sump pump for the collection of hazardous material (about 1 year ago).

Only one licensed hazardous waste contractor is listed in the Draft EIS-the rest specify only that the waste is handled by licensed contractors to a hazardous material facility. None of the Hazardous waste facilities are identified. O

H. Cumulative Noise, And Traffic Impacts On The Cultural, Traditional And Religious Practices And Use:

There is no data on the cumulative impact of the noise generated from the telescopes on the cultural, traditional, religious practices or the fauna on Mauna Kea. There are just general statements, asserting that the noise from the Telescope is not significant. P

I. Access

The Draft EIS claims that the outriggers will not limit access for cultural, traditional and religious access. Although, the UHIFA has blocked physical access to the summit in the name of safety, there are other forms of access that are being abridged, these include but are not limited to 1) access to views of the the alignments of certain heavenly bodies and associated movement, 2) the loss of Kukahau`ula's daily ritual and practitioner's participation in those rituals, and 3) the practitioner's ability look upon the goddess Poli`ahu without obstruction. There is no cumulative analysis of these view planes in the Draft EIS. Q

4) Impacts of increased traffic due to future expansion desires of the industry are also not addressed. R

J. Burial Treatment

It is a well established fact that Mauna Kea is the burial ground of our most revered and sacred ancestor. However, the Historic Preservation division has not yet completed an inventory survey to determine the burials atop Mauna S

Kea. Most of the Practitioner's have stated that they do not wish to violate the cultural laws regarding protecting the burials. There is no cumulative impacts analysis of these concerns or the burial grounds protection. S

The Section 106:

One of the reasons that Mauna Kea 'Anaina Hou did not sign the MOA is because it did not adequately assess the cumulative impact upon the burial grounds nor were concerns about impacts on the hydrology adequately addressed. Neither of these issues is adequately addressed in the Draft EIS. T

In conclusion,

Many of the Cultural, Traditional and Religious practices conducted atop Mauna Kea the Temple are ancient and specific the mountain and can only be done on Mauna Kea. There is no where else in the world where it is possible to perform many traditional ceremonies and practices. On the other hand, there are about 93 observatories sites around the world where world class astronomy can and is being accomplished. U

We support Astronomy in general and have supported it on Mauna Kea for over 30 years. The Draft EIS identifies alternative locations where NASA's scientific goals and objectives can be achieved. Therefore, it is our positions that NASA consider either the no build alternative for Mauna Kea or the best alternative site for scientific discovery, provided that the people in the alternative areas support the Outrigger Telescopes project. V

The **Outrigger Telescopes have already been fabricated and constructed**. Therefore, all that is left is for the Outriggers to be installed at the project site. Only 8 eight permanent jobs would be jeopardized if the Outriggers where moved to an alternative location.

We do not support further development atop Mauna Kea, and believe that the observatories need to work to together to maximize the science currently conducted atop Mauna Kea, it is a world premier site and should be for many years to come if innovation and creativity are maximized.

NASA carried the unfair burden of completing cumulative impact studies, when the UHIFA should have been conducting cumulative effects studies and monitoring the resource for the past 30 years. UHIFA should have worked in a more transparent and honest manner with the public and especially with the Native Hawaiian community. W

life is it is out of balance in our house of worship, our cultural base and delicate eco-system is threatened, and the cumulative impacts to the cultural and natural resources are adverse, substantial and significant. The general future of Astronomy science is not threatened and can continue in a more appropriate location. As a result, our position must be that there can be no further development on the summit of Mauna Kea. . It is a call for balance and Aloha.

Mahalo a nui loa,

In Aloha I remain,

Kealoha Pisciotta, President, Mauna Kea Anaina Hou

N.B. Mauna Kea Anaina Hou's previously submitted EIS scoping comments are attached below as well as our Hydrology Witnesses Rebuttal, Testimony.

TO: **National Aeronautics and Space Administration**
Mail Code: SZ
Washington, DC 20546-0001
Ph: 877-283-1977
ATTN: Dr. Carl Pilcher
Outrigger Telescopes Project
Astronomy and Physics Division
Office of Space Science

FROM: **Mauna Kea Anaina Hou**
230 Lyman Avenue
Hilo, Hawai`i 96720
Ph. (808) 934-7668
Email: kealohap@aloha.net
ATTN: Ms. Kealoha Pisciotta, President

Date: February 14, 2004

Subject: Environmental Impact Statement Scoping Comments Relating To The NASA/William M. Keck Observatory- Outrigger Telescopes Project, Mauna Kea, Hawai`i

The following comments are filed on behalf of Mauna Kea Anaina Hou, a Native Hawaiian Organization as defined by the National Historic Preservation Act (NHPA). Mauna Kea Anaina Hou (MKAH) is dedicated to the protection, preservation and restoration of the traditional and customary Native Hawaiian traditional, cultural and religious practices relating to Mauna Kea. MKAH provided extensive comments at the EIS Public Scoping meetings, we submit the following comments in addition to our previously recorded comments. We would like to note that we have not had a chance to review the NASA record of the meetings and would like to reserve our right to review and comment, after the EIS web link has been fixed.

MKAH, previously participated in the NHPA, Section 106 Consultation (Consulting Party), the National Environmental Policy Act (NEPA) Environmental Assessment (EA) process and the recent NASA Environmental Impact Scoping Hearings held here in Hawai`i in January (Jan. 5-13, 2004), relating the NASA/William M. Keck Observatory, (WMKO) Outriggers

Telescopes Project. Although MKAH participated in the Section 106 process as a consulting party, MKAH did not sign the Memorandum of Agreement (MOA) offered by NASA.

Members of MKAH also participated as plaintiff witnesses in the federal court case (Civil No. 02-00227 SOM/BMK-Office of Hawaiian Affairs v. Sean O`Keefe), challenging the adequacy of the NASA's FEA for the Outriggers Telescopes Project. The Federal Court found NASA's EA inadequate, and not in compliance with NEPA, for failure to adequately consider the cumulative impacts of the Outrigger Telescopes Project. The court remanded NASA to redo the EA pursuant to NEPA. NASA has decided forego the EA, to complete a full federal EIS.

Lastly, MKAH, along with five (5) other Environmental and Hawaiian organizations and individuals (*Sierra Club, Ching, Fergerstrom, Royal Order of Kamehameha I*) is currently engaged in a state administrative hearing called a contested case hearing (CCH). MKAH and the other contesting parties are challenging the University of Hawai`i's Institute for Astronomy's (UHIFA) request (on behalf of CARA/NASA) for the Conservation District land use and permit to construct the four (4) to six (6) Outrigger Telescopes, for which this EIS is the subject of.

I. PROCESS

A. Deadline for comments set on holiday:

We would first like the record to reflect that the deadline set for this comment period falls on Presidents Day, a federal holiday. In Hawai`i the Federal Post Offices are closed. It is our hope, therefore, that NASA will accept any comments at least post-marked by February 17, 2004, since it is not possible to send comments out on the actual deadline date.

B. Process is rushed:

The Public Notices where sent during the winter holiday season. Public Scoping meetings began on January 5, 2004. We believe that the abovementioned made it difficult for people to fully participate.

Mauna Kea has cultural and religious significance for all Hawaiian people regardless of where they reside. We believe the scoping meetings where not broad enough, since they where only held on Hawai`i and O`ahu islands, the outer islands where not allowed to participate. Scoping meetings should be held on the other islands as well.

C. Process Lacks Good Faith.

Although MKAH is pleased that NASA decided to go the extra-step to complete a full EIS, especially since, prior to the NASA EA, no federal environmental review pursuant to NEPA, have been conducted on Mauna Kea in over thirty (30) years. We are seriously concerned, however, that NASA has not required the UHIFA, (the State Agency filing for the conservation district use and construction permit (CDUP) on behalf of NASA), to withdraw the CDUP application, at least until the EIS has been completed.

The information gathered for this project should be provided to the proper decision makers of the state prior to the decision to grant a land use and construction permit. Without, the

EIS information, there is **no rational** way for the responsible decision makers of Hawai`i to insure that the cultural and environmental resources will not be negatively impacted.

The argument offered by NASA, that what the UHIFA does it out of NASA's control, must fail. There is no question that the UHIFA, is acting on behalf of NASA and is to seeking the land and construction permit, for the NASA Project that is currently the subject of this EIS.

Not only is your agency continuing to seek the necessary land use and construction permits from the State of Hawai`i via the UHIFA, it is a well documented fact, that **the Outrigger Telescopes have already been fabricated and constructed**. All that is left is for the Outrigger to be installed at the project site.

This knowledge has generated much fear and frustration in the community and for those of us that have been participating in good faith. There is a general feeling that this whole process is in vain, that the project is a "done deal" and that therefore the agency's decision is a foregone conclusion.

We consider NASA's failure to act to insure that the UHIFA withdraws the land use and construction permits (CDUP) at least until the NASA EIS has been completed, as **an extreme lack of good faith.**

II. NO ACTION-NO BUILD ALTERNATIVE REQUIRED.

It is our understanding that the EIS is meant to provide the pertinent information to the decision makers in order to assist them to make an informed decision. An EIS therefore, is a decision making tool and not simply an informational document; which is also to say, that the "No Built" or "No Action Alternative" under NEPA must be taken seriously.

In some case, and Mauna Kea maybe one, the negative impacts resulting from the project may far out weigh the benefits gained by the project; in which case the "No Action" is a viable alternative for the Agency, NASA in this instant case.

Despite the general feelings that the EIS process was rushed and a forgone conclusion, people turned out in large numbers and spoke out about their concerns for the cultural and environmental impacts ensued by this project.

The vast **majority of people that testified, expressly asked that NASA not build this project at all**, and those testifying at the public hearing also represent the communities most negatively impacted by the project. Those testifying represented a broad spectrum of the community, for which the land and resources in question are held in trust for by the State of Hawai`i (i.e. the General Public, Environmental and Native Hawaiian individuals and organizations).

MKAH, is certain that this project will have serious and significant impacts to the cultural and traditional properties, and to the cultural and religious practices, including but not limited to, impacts to the view planes used in ceremony, the mauka-makai, and makai-mauka view planes that make up the ritual landscape, impact to the navigational rituals, impact to the medicinal waters, ice and snows by sewage and toxic material. These impacts are significant, and in some cases cannot be mitigated, to a less than significant level. We are certain of the impacts, because we are practitioners and because the incremental build up has slowly, but incrementally impacted the sacred landscape and our practices. Therefore, **MKAH would ask that NASA seriously consider the "No Action Alternative" for the outrigger telescopes project.**

MKAH, in public hearing provided proof that some in their membership began seeking NEPA and NHPA consultation as early on as 1996[1]. The community therefore, began showing a good faith interest in participating in the NEPA and NHPA process over nine years ago. Is hard to understand why the people have lost faith, and have begun to question NASA's good faith efforts under NEPA and NHPA?

III. CUMULATIVE IMPACTS REQUIRED

A. General

What NASA must be clear on is that there is a strong and clear legal basis for the people's position that no further development should occur atop Mauna Kea. Although this project is clearly a federal undertaking, there are still state and county rules and regulations that must also be met, and many challenges are occurring on these other specific levels.

For over thirty 30 years there has been an incremental build up of the astronomy industry on the mountain, with no federal environmental review. The federal court in ***OHA v. O`Keefe***, found that "...with no previous EIS or EA that encompassed the site of the outrigger telescope project, NASA's obligation to consider cumulative impacts of development at the Keck observatory is correspondingly greater."; the federal court, specifically held "...the present EA does not adequately consider the impact of development of the outrigger telescopes when added to other past, present and reasonably foreseeable actions regardless of what agency...or person undertakes such other actions."

The State of Hawai`i, and the UH after many years of debate and deliberations, determined that **carrying capacity of the mountain allowed for only thirteen (13) observatory facilities atop Mauna Kea**. This number was derived using the scientific data provided in the early 70's and 80's to determine carrying capacity. The thirteen (13) limit set on the number of observatory facilities allowed atop Mauna Kea has been exceeded already therefore, adding four (4) to six (6) more telescopes, will certainly exceed this number even further.

NASA cannot operate in a vacuum, and must take into consideration all of general and specific rules and regulation that relate to development of Mauna Kea and to the development of their proposed project. NASA cannot transfer their responsibilities for compliance under the specific rules over the UHIFA.

Although we would certainly argue on behalf of NASA, in that, because the UH never took care to ensure federal projects built atop Mauna Kea in the past complied with federal statues relating to both NEPA and NHPA, the state statutes should also be used to consider the "No Action Alternative". After all if in fact no further development is permitted in the Conservation District, under the previous agreements, and rules and regulation, then would it be appropriate or responsible for a Federal agency (using tax-payer funds) to continue a project that could violate these rules and that could eventually be challenged in the court?

MKAH, again would like to request that NASA seriously consider the "No Action Alternative" under NEPA for this project, and further to compel the UHIFA to withdraw their CDUP Application, at least until the EIS is complete.

---

[1] The Information presented by MKAH was from the Report titled "Mauna Kea the Temple: protecting the Sacred Resource" Please see www.KAHEA.org, under the section titled Mauna Kea, Mauna Kea the Temple Report, Appendix S-U. The information presented were copies of the formal correspondence between NASA, Ka Lahui Hawai`i, and U.S. Representative Ms. Patsy Mink.

B. Cumulative Impacts: Traditional Cultural Properties, and Cultural and Religious Use, Access and Practices:

First, MKAH would like the record to reflect that we fully support Kepa Maly's participation in the NASA EIS process. We would also like to recommend that NASA as hire Dr. T. King, co-author of the National Register Bulletin 38 guidelines for Identifying Traditional Cultural Properties for the National Register, to review the draft EIS.

In the EIS, NASA must use the National Register Bulletin 38 guidelines for Identifying Traditional Cultural Properties for the National Register in order to help identify the Cumulative Impacts to the Traditional Cultural Properties of Mauna Kea.

In the course of Kepa Maly's previous studies he identified a number of potential Traditional Cultural Properties within the Mauna Kea Science Reserve Master Plan project area. These are historic properties that are of importance to Native Hawaiians because they possess traditional cultural significance derived from associated cultural practices and beliefs. The Traditional and Cultural Properties of Mauna Kea that have been identified, include but are not limited to the following:

1. The summit region from approximately 6,000 feet elevation to the Kukahau`ula (summit);
2. Many of the Pu`u [cinder cones];
3. View plane;
4. Mountain landscape in navigational traditions;
5. Lake Waiau and adjacent cinder cone;
6. Numerous Trail systems.

The cluster of pu`u (cinder cones) forming the Summit of Mauna Kea have been identified by the State Historic Preservation Division ("SHPD") of the Department of Land and Natural Resources ("DLNR") as a **Historic Property and the summit region of including most of the Mauna Kea Science Reserve has been identified by SHPD as a Historic District.** Both Historic Properties are eligible for listing on the National Historic Register.

Generally a historic district is defined as a historic property that '...possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.

The Mauna Kea Summit as a "cultural landscape" has been determined eligible for the National and State Register of Historic Places under multiple criteria including cultural significance to the native Hawaiian People (cf. letter of D. Hibbard to R. Evans, September 12, 1991). As a result, archaeologists with DLNR-SHPD have referred the summit region of Mauna Kea as a "ritual landscape," with all of the individual parts contributing to the integrity of the

whole summit region. (pers. comm. P. McCoy and H. McEldowney; Group 70 meetings of September 10, 1998). *Id* Citing McCoy and McEldowney).

The historic district of Mauna Kea incorporates virtually the entire Science Research summit area, extending beyond limits of the entire reserve, and also portions of the Natural Area Reserve and the district includes 93 archaeological sites, three landscape features which qualify as traditional cultural properties, including but not limited to the Mauna Kea Adze Quarry Complex, incompassing over 76 shrines of varying complexity, four are adze manufacturing workshops, burials.

The largest of the three traditional and cultural properties, 'Kukahau`ula refers to the cluster of three pu`u that merge and collectively make up the summit of Mauna Kea...The second property, 'Waiau' refers to the small lake and adjacent pu`u situated southwest of the summit and within the Natural Area Reserve. The third property, 'Lilinoe' refers to a pu`u situated southeast of the summit and within the Science Reserve.

1. State Law requires Cultural Impact Statement and a Burial Treatment Plan.

No Cultural Impacts Statement (CIS) or Burial Treatment Plans have been completed for this project. In fact, no Burial Treatment plan has been completed for Mauna Kea in general. Mauna Kea has traditional and historically been used as a burial ground of the highest born and most sacred ancestors. The burial practices continue today. Again we maintain that the University the lease-holder, has not complied with the relevant state statutes regarding burial treatment and or Chapter 343, however, that does not mean that NASA should not. NASA must protect the known, possible and inadvertent burials of Mauna Kea.

2. Section 106 Consultation pursuant to NHPA under EIS required

Although, a Memorandum of Agreement (MOA) for the outrigger telescope project under NHPA has been created, this MOA, was created specifically for the NASA EA, and not for the more comprehensive EIS. We would like the record to reflect that **MKAH, did not sign the NASA EA/MOA**; because we did not support the mitigation measures relating to the Traditional Cultural Properties, the complex hydrology and because the mitigation measure did not address the significant impacts relating to the cultural and religious practices to a less than significant level. As a matter of fact, **no Native Hawaiian Organization as defined by NHPA, except Kahu Ku Mauna signed the MOA, and Kahu Ku Mauna signed with the caveat, that their signature did not indicate support for the project**. Because, the EIS will provided more complex analysis of the cumulative impacts, it is reasonable for NASA to created another more comprehensive MOA or in the alternative to provide for amendments to the existing MOA that would more accurately reflect the significant impacts that will be created by this project.

3. Social impacts must be considered

We would add here that NASA must take into account the social impacts, those impacts that specifically impact Native Hawaiian cultural and religious beliefs relating to the Sacred landscape and the Temple-Mauna Kea.

For the Native Hawaiian People Mauna Kea is home of Na Akua (the Divine Deities), Na 'Aumakua (the Divine Ancestors), and the meeting place of Papa (Earth Mother) and Wakea (Sky Father) who are considered the progenitors of the Hawaiian People. Mauna Kea, it is said, is where the Sky and Earth separated to form the Great-Expanse-of-Space and the Heavenly

Realms. Mauna Kea in every respect represents the zenith of the Native Hawaiian people's ancestral ties to Creation itself.

The upper regions of Mauna Kea reside in Wao Akua, the realm of the Akua-Creator. It is also considered the Temple of the Supreme Being.

There are over 93 Astronomical Observatories and Observatory complexes around the world in which to do world class astronomy. Mauna Kea is already considered a world premier site for astronomy work, and houses the largest and most advanced observatories in the world. However, **NASA must consider that Mauna Kea represents the only place on earth where the special and unique Native Hawaiian ritual and ceremonies are conducted**. NASA must consider the impacts to the Native Hawaiian Communities cultural and religious practices. NASA must also consider the socio-economic impacts this project will have on the Hawaiian Community. The U.S. Civil Rights Commission statistics reports that there are approximately 6000 pure blooded Hawaiian people left in the world today, and their projected survival is only through the year 2044. the Commission further reports that approximately 54% of native Hawaiian people (those with 50% or more blood), make less than 9000 dollars per year.

C. Cumulative Impacts: Hydrology, Hazardous Materials and Sewage Treatment

NASA must consider and evaluate the impacts from the use, storage and handling of hazardous materials, and sewage upon the Mauna Kea aquifer system. Mauna Kea is the principle aquifer for Hawai`i Island.

The waters, ice and snow collected from Mauna Kea are used for Native Hawaiian healing and other ritual and ceremony.

There is serious concern also for the protection of the waters of Lake Waiau, and the other Pu`u (cinder cones) that also pool water. The Lake is a Traditional Cultural Property, and is home to deities. Waters are harvested for ceremony from Lake Waiau, and other pooling waters.

NASA is obligated to ensure the Public Trust doctrine is protected.

MKAH would like to recommend that NASA consider putting a team of hydrologist together to review the complex hydrology of Mauna Kea. We would like to recommend that NASA hire Dr. Brad Finney and Bill Meyers to participate on the team, or a least to review and comment on the studies in the Draft EIS prior to releasing it for public comment.

At the EIS Public Scoping meetings MKAH offered to supply NASA with copies of the over 10,000 Material Safety Data Sheets (MSDS) we received by subpoena in the State CCH. We spoke with a SAIC representative, regarding various methods to get them copied and to NASA. We have not hear anything further from your representatives on that. The following represents a brief overview of the information collected from the MSDS.

According to the Material Safety Data Sheets ("MSDS") received, the following Observatory/Telescope Facilities were found to use "elemental" mercury. The University Of Hawai`i 88 inch or 2.2 meter Observatory ("UH88") (Exhibit F-64), The Canada-France-Hawaii Telescope ("CFHT") (Exhibit F-62), The William M. Keck Observatory I and II ("WMKO") (Exhibit F-61), The NASA Infrared Telescope Facility ("IRTF") (Exhibit F-60), and The United Kingdom Infrared Telescope ("UKIRT").

There have been 3 Mercury spills reported at the William M Keck Telescope. August 10, 1995, September 15, 1995, and November 6, 1995.

The Hazardous materials listed below were found to be stored and used at the Observatories/Telescope Facilities they include but are not limited to, the following:

Hydrochloric-Acid (Note: not listed in JCMT Exhibit F-66)
Potassium Hydroxide
Hydraulic, Motor, and Lubricating Oils
Pesticides
Insecticides
Calcium Carbonate
Sulfuric Acid
Diesel, Jet Fuel, and Unleaded Gasoline
Ethylene Glycol
Kerosene
Methyl Ethel Keytone
Toluene
Paints, Thinners and Solvents
Rush Treatments and Inhibitors
Carbon Disulfide
Elemental Mercury (Note: used or stored in amounts beyond that contained in a household thermometer.

Carbon disulfide is currently listed in WMKO MSDS.

Five Telescopes indicated that they stored and used elemental mercury in the amount beyond that stored in a thermometer.

1. **Mirror washing and aluminizing chemicals:**

The William M. Keck Observatory (WMKO) has open drain systems also known as "French Drains". These drains enter directly into the ground under the Keck. The WMKO has open-drains in floors of both the Mirror- Washing and Mirror Aluminizing Rooms.

The WMKO one year ago installed a sump pump to collect the mirror washing wastewater, prior to one year ago various chemicals used for the mirror washing, where allowed to enter the drains that go directly into the ground.

Many of the observatories atop Mauna Kea aluminize their mirrors, there has been no evaluation of their use, storage or handling of the mirror washing or aluminizing.

The WMKO has Glycol transportation (intake/outtake) pipes that continuously transport the ethylene glycol from the nasmyth platform on the Telescope backing structure down to the lower basement floors of the observatory. These pipes are mounted against the wall directly above the "French drain systems".

On November 3, 1995, sixty (60) to sixty-five (65) gallons of diesel fuel and engine/hydraulic fluid was spilled off of the summit road by an overturned construction truck.

On September 3, 1996, another ethylene glycol spilled occurred at the Subaru Telescope construction site. The release occurred when two (2) fifty-five (55) gallon drums split open after

falling from a pallet being craned failed, dropping barrels from approximately thirty feet onto the cinders below.

2. Sewage

Approximately forty eight thousand seven hundred fifty (48,750) gallons of human waste is generated per month by the observatories/telescope facilities on Mauna Kea. That is about five hundred thousand (585,000) gallons per year.

Il of the Observatories/Telescope Facilities use a combination of Septic Tank/Cesspool/Leach field Systems. The older Observatories use only Cesspools. No evidence was produced in the MSDS records provided by the UHIFA or any observatories/telescope facilities that demonstrated that any inspections, maintenance, or pumping of the waste water systems has occurred since 1994. Blank septic tank records were provided by UHIFA.

The university provided "Septic Tank Inspection Record" for the WMKO, but the data section is blank, indicating that no records were kept, and no records are on file for inspection.

D. Cumulative Impacts: Flora and Fauna, and eco-system of Mauna Kea

First we would like the record to reflect that we don't support the Wekiu bug mitigation measures, this is principally because the measures are proposed in parallel with the construction of the project. In other words, the measures have not been tested, and there is no data that can demonstrate that these proposed measures will even work. The mitigation measures are therefore, only a theory. The Wekiu bug and its essential habitat have been significantly impacted, and some numbers set the population down by as much 99.7%.

We maintain that the condition of the Wekiu bug requires immediate attention. We cannot support any measure that may lead to the possible extinction of any living thing, and the incremental taking of the Wekiu bugs and its essential habitat are now serious and dire.

"From a Hawaiian cosmological view, based in the Hawaiian Chants of Creation, when one thing ceases to exist the process of Creation begins to un-ravel"-Kealoha Pisciotta.

Secondly, we would not support NASA only re-hiring Dr. Greg Brenner and Pacific Analytics for the EIS process, because his data and proposed mitigation measure have not stood up under peer review. We strongly recommend that NASA consider forming a team of scientist that would include Dr.'s Fred Stone and Frank Howarth.

1. Other Species

There are some 17 other species found on the summit and summit slopes and very little is known about the ecology and habits of most of them. Many of these species are found no where else in the world. No studies have been done to ascertain the ability to feed, tolerate dust or compaction, life cycles, reproduction rates or details of the required habitat for survival.

2. Wekiu bug habitat destruction and "restoration plan":

In 1982 the first survey of the Wekiu bug was conducted as part of an arthropod inventory commissioned by UH. (Howarth & Stone, An Assessment of the Arthropod Fauna and Aeolian Ecosystem near the Summit of Mauna Kea, Hawaii-1982). The 1982 study identifies five major habitat types, with the sixth being snow patches.

Pu`u Wekiu and Pu`u Hau Oki were found to be the cinder cones with the best habitat and the greatest number of Wekiu bugs.

The Keck I, Keck II, and Subaru telescopes were constructed in the prime Puu Hau Oki Wekiu bug habitat.

No Environmental Assessments or Environmental Impact Studies were conducted for these telescopes. Critical Wekiu bug habitat on the crater and slope of Puu Hau Oki was severely impacted by construction of the Keck I and II telescopes which resulted in removal of approximately 35 feet of the summit ridge of Puu Hau Oki and side-casting the material on the crater slopes.

Additional Wekiu bug habitat was impacted by construction of the access road on the north and west slopes of Puu Hau Oki. The power line trench dug up the south slope of Puu Hau Oki further impacted Wekiu bug habitat

Construction of the Subaru telescope removed more of the crater rim and inner slope and the material was deposited as compacted fill on the inner crater floor and lower slopes, severely impacting additional Wekiu bug habitat.

The 1997-98 Wekiu bug survey on the summit of Mauna Kea showed a drastic decline from the levels found in 1982. (Howarth, Brenner & Preston, 1999). The February 2002 FEA (p 73) states that in **1997/8 a second arthropod assessment concluded that a 99.7% decline in Wekiu bug populations in comparable areas surveyed.**

In the 1982 study Wekiu bugs were found from the summit area cinder cones down to an elevation of about 12,800-foot elevation below the summit cinder cones. In the 1997/8 study, no Wekiu bugs were found below the 13,400-foot elevation of the summit area.

Neither the Federal EA for the Outrigger Telescopes Project (Feb. 2002) nor the State EA for the Keck Observatory Outrigger Telescopes Project (March 2002) included a cumulative study of the impacts of telescope construction on the Wekiu bug habitat in Pu`u Hau Oki crater. **Therefore, there is no baseline to which "habitat restoration" can be referred.**

Currently the Wekiu bug population has declined to the point that the bug is being considered for am emergency listing as an Endangered Species.

The document titled "Wekiu bug habitat restoration" actually describes artificial habitat rather than restoration to the pre-construction habitat, which is not described. Therefore, there is no "habitat restoration" included in the plan.

There is no life cycle information, behavioral information, or population size information known about the Wekiu bug on which to base an effective mitigation plan. These studies have not been included in the mitigation plan.

3. **Aeolian Drift cycles and impacts**

A thorough and complete study of Aeolian drift as it relates to deposition of food sources for the Wekiu bug, must be considered and evaluated.

4. Flora

A field survey of the flora of the summit was conducted as part of the EIS completed for the university in 1982. In 1997, only a literature search was conducted. No additional field surveys or on-going monitoring have been conducted, nor are they anticipated.

We thank you for this opportunity to comment further on the NASA EIS Scoping issues. If you have any further questions regarding the information contained herein, or regarding supportive documentation please feel free to contact me.

In Aloha I remain,

_____

Kealoha Pisciotta, President

Mauna Kea Anaina Hou

Kealoha Pisciotta
Mauna Kea Anaina Hou
September 28, 2004

Response to Comment A:

Summaries of the oral scoping comments made at the public scoping meetings are provided in Acrobat® format at http://www2.keck.hawaii.edu/. Comments were summarized and not attributed to facilitate responding and protect individual privacy. The EIS was developed taking into account scoping comments. Analysis focused on the issues of most concern to commenters. Some scoping comments raised issues that were outside the scope of the National Environmental Policy Act (NEPA). Although individual scoping comments were not published, oral comments on the Draft EIS are summarized in this Appendix and written comments are published and attributed to individuals.

Response to Comment B:

The format for the cumulative impacts analysis was derived from and is consistent with the definition of cumulative impacts found in Council of Environmental Quality (CEQ) guidance. CEQ defines cumulative impacts as the incremental environmental impacts of the action when added to other "past, present, and reasonably foreseeable future actions. . ." (See 40 CFR 1508.7). It is therefore appropriate to evaluate both the incremental impact of the Proposed Action (See Section 4.1) as well as the impact of past, present, and reasonably foreseeable future activities (See Section 4.2). Cumulative impacts are the combination of all these (See Section 4.2).

Response to Comment C:

The Outrigger Telescopes Project mitigation is not intended to address 40 years of action. The purpose of the mitigation is to limit the incremental impact of the Outrigger Telescopes Project. Although most of NASA's mitigation measures are directly related to the Outrigger Telescopes Project, some measures extend beyond the scope of the project. For example, as part of the Outrigger Telescopes Project implementation and mitigation, NASA will fund a Wēkiu Bug autecology study to gather more information about habitat requirements, life cycle, nutritional requirements, and breeding behavior of this unique bug.

Response to Comment D:

The University of Hawai‘i's responsibility to acquire a Conservation District Use Permit (CDUP) and the Federal Government's responsibility to complete the NEPA process are separate and independent processes.

Response to Comment E:

As noted in Response to Comment D, the State and Federal processes are separate and independent processes. Nonetheless, the substance of the comments received regarding the Wēkiu bug (the subject of the submitted testimony) has been considered and has been discussed throughout the biological resources text.

Kealoha Pisciotta
Mauna Kea Anaina Hou
September 28, 2004

Response to Comment F:

NASA has considered the independent Wēkiu bug study by the Office of Mauna Kea Management's "Wēkiu Bug Scientific Data Review Committee" and their recommendations for listing as an endangered species. See Section 4.1.2.2 (pages 4-17 to 4-18) for new text. NASA's entomologist is actively consulting with this committee as well as the United States Fish and Wildlife Service (USFWS) has reviewed the Wēkiu Bug Mitigation and Monitoring Plan.

In a letter regarding the Wēkiu Bug Mitigation Plan for the W.M. Keck Observatory, Outrigger Telescopes Project at Mauna Kea, the USFWS states "The Service [USFWS] supports the recommendations in the WBMP [Wēkiu Bug Mitigation Plan] to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor use. . . We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to the wekiu bug habitat." See Volume II, Appendix A, for the letter from USFWS/Henson (USFWS 2000).

The U.S. Department of Interior (USDOI) submitted a comment letter on the DEIS stating "It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wēkiu Bug Mitigation Plan and the Wēkiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities." See the USDOI comment letter from Patricia Sanderson Port located in this Appendix.

In addition, the USDOI letter states "These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology."

Response to Comment G:

The EIS has been modified so that dome size is referenced in all discussions of view planes. The EIS acknowledges that the cumulative visual impact from past, present, and reasonably foreseeable future activities is substantial (See Section 4.2.14). A new section on Religious Practices has also been added that addresses the visual impacts of the observatories (See Section 3.1.2.5).

Response to Comment H:

Based on information received from the observatories, contaminated soil at the sites of the limited number of hazardous materials spills (See Table 4-20) was removed for off-site disposal. The single exception is the suspected leak of a diesel generator discovered in 1982 (See Table 4-20 for details). As shown in Table 4-20, there has been only one sewage spill on soil related to observatory operations. Best available information indicates the minor sewage spill (7.6 liters (2 gallons)) was cleaned up completely.

Response to Comment I:

The precipitation data used in the EIS is the measured precipitation at the summit. These data account for all forms of precipitation throughout the day and night, not just the fraction that is snow or becomes snowmelt.

Response to Comment J:

The text of the EIS has been modified to reflect the impact of use of septic systems on cultural resources. NASA acknowledges that disposal of sewage does contribute to a substantial and adverse impact on cultural resources (See Section 4.2.3.2).

Response to Comment K:

Statements about wastewater system servicing in the EIS were provided by each observatory (See Section 4.2.5).

Response to Comment L:

The hydrology impacts addressed in this EIS are based on the best available information and scientific analysis.

Response to Comment M:

Several observatories do have open drains for draining water condensate. As reported in Table 4-20, no hazardous materials have been released through these drains. Section 4.2.6 states that the observatories have procedures and trained personnel to prevent hazardous material spills and respond appropriately in the unlikely event of a release.

Response to Comment N:

A discussion of cumulative impacts associated with mirror washing and aluminizing has been added to Section 4.2.5.2.

As stated in Section 3.1.5.2 of the EIS, the observatory does not store or use carbon disulfide in any application. At one time carbon disulfide had been purchased as an additive for the W.M. Keck Observatory septic system. However, it was never used, and it has been removed from the summit.

Response to Comment O:

In addition to Unitek Solvent Services, Inc. listed in the EIS, Philips Services Corporation and Hawaii Petroleum, Inc. were identified by the observatories as firms handling the disposal of their hazardous and industrial-type (*e.g.*, used oil) waste.

Response to Comment P:

The cumulative noise impact analysis is based on the best available information. In addition, see Section 3.1.2.5 on Religious Practices.

Response to Comment Q:

The EIS acknowledges that the cumulative impact of astronomy-related development has included alteration of the appearance of Kūkahau‘ula and interference with views to and from the summit (See Section 4.2.3.4). The EIS also acknowledges the visual impact of the observatories on religious practices (See Section 3.1.2.5).

Response to Comment R:

Impacts of increased traffic from future astronomy development are discussed in Section 4.2.9 of the EIS.

Response to Comment S:

Prior to construction, an Inadvertent Discovery of Human Remains and Archaeological Properties monitoring plan will be developed by the Archaeologist in consultation with the Cultural Monitor. The California Association for Research in Astronomy (CARA) will comply with draft State Historic Preservation Division Rules (Titles 13-275, 13-279, and 13-280). CARA shall submit this plan for review by NASA and all Consulting Parties. Thereafter, CARA shall submit the plan to the State Historic Preservation Officer (Hawai‘i SHPO) for approval.

NASA is committed to being a responsible steward in the implementation of the Proposed Action. To this end, NASA proactively completed a Draft Burial Treatment Plan specifying procedures to deal with an inadvertent discovery of human remains. Following an initial informational presentation of the Draft Burial Treatment Plan to the Hawai‘i Island Burial Council (Council) in April 2004, public burial notices were placed in local newspapers in early May and an amended Draft Plan was submitted to the Council. The plan was discussed at the Council meeting on August 19, 2004. The members of the Council expressed their general agreement with the procedures recommended in the Burial Treatment Plan for monitoring during the Outrigger Telescopes construction and for treating any human remains uncovered during construction. Because no actual burials are known to be present, the Council took no action actually approving the plan or its procedures, concluding that this would be beyond its purview at this time. In addition, a qualified Archaeologist would be present during all excavation activities.

Response to Comment T:

The EIS extensively addresses cumulative impacts under NEPA (See Section 4.2). Section 106 of the National Historic Preservation Act does not require an analysis of cumulative impacts.

Response to Comment U:

In recognition of the sanctity of Mauna Kea in Native Hawaiian culture, NASA has made a particular effort to consult with Native Hawaiian religious practitioners. Their perspectives have had great influence on the content of this EIS. See Section 3.1.2.5 and Table 3-2 for more details.

Kealoha Pisciotta
Mauna Kea Anaina Hou
September 28, 2004

Response to Comment V:

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No final decision will be made until the NEPA process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment W:

Your comments are respectfully noted.

TO: **National Aeronautics and Space Administration**
Mail Code: SZ
Washington, DC 20546-0001
Ph: 877-283-1977 Fax:

ATTN: Dr. Carl Pilcher
Outrigger Telescopes Project
Astronomy and Physics Division
Office of Space Science

FROM: Mauna Kea Anaina Hou
230 Lyman Avenue
Hilo, Hawai'i 96720
Ph. (808) 934-7668
Email: kealohap@aloha.net
ATTN: Ms. Kealoha Pisciotta, President

'Īlio'ulaokalani Coalition
P.O. Box 17309
Honolulu, Hawai'i 96817

American Friends Service Committee,
Hawaii Project
2426 O'ahu St.
Honolulu, Hawai'i 96822

KAHEA:
The Hawaiian-Environmental Alliance
P.O. Box 27112
Honolulu, Hawai'i 96827

Date: 28 September, 2004

Subject: Draft Environmental Impact Statement Comments Relating To The NASA/William M. Keck Observatory- Outrigger Telescopes Project, Mauna Kea, Hawai`i

Aloha Dr. Pilcher.

The telescope industry developments on the sacred summit of Mauna Kea has been by far one of the most publicly opposed use of public trust lands known to Hawaii. Consistent and strong public opposition has surrounded this industry from the beginning. The University of Hawaii has pressed their agenda forward with disrespect and contempt for the residents of this state. This long-term contentious processes was not characterized at all in the DEIS. NASA does not address the fact that there is a nearly total lack of agreement by the Native Hawaiian participants in the 106 Consultation (save one individual with caveat). None of the Native Hawaiian groups signed the Memorandum of Agreement. This indicates that the consultation did not meet the requirements put forth and should be considered to be invalid. Again, this is appears to be an exercise that NASA/UH can dismiss out of hand, without any accountability. This lack of disclosure is unacceptable. A

The Executive Summary does not reflect the controversy or reveal the long litany of issues, lack of accountability and questionable procedures that have been raised by elected officials, public agencies or the public. Accurate characterization of the broader issue is required by federal regulation, 40 CFR § 1502.12. B

The following comments are filed on behalf of Mauna Kea Anaina Hou, a Native Hawaiian Organization as defined by the National Historic Preservation Act (NHPA). Mauna Kea Anaina Hou (MKAH) is dedicated to the protection, preservation and restoration of the traditional and customary Native Hawaiian traditional, cultural and religious practices relating to Mauna Kea. MKAH provided extensive comments at the Draft EIS ("DEIS") meetings and also at the NASA EIS Scoping meetings (*Please see attached scoping comments*), we submit the following comments in addition to our previously recorded comments.

MKAH, previously participated in the NHPA, Section 106 Consultation (Consulting Party), the National Environmental Policy Act (NEPA) Environmental Assessment (EA) process and the recent NASA Environmental Impact Scoping Hearings held here in Hawai'i in January (Jan. 5-13, 2004), relating the NASA/William M. Keck Observatory, (WMKO) Outriggers Telescopes Project. Although MKAH participated in the Section 106 process as a consulting party, MKAH did not sign the Memorandum of Agreement (MOA) offered by NASA.

Members of MKAH also participated as plaintiff witnesses in the federal court case (Civil No. 02-00227 SOM/BMK-Office of Hawaiian Affairs v. Sean O'Keefe), challenging the adequacy of the NASA's FEA for the Outriggers Telescopes Project. The Federal Court found NASA's EA inadequate, and not in compliance with NEPA, for failure to adequately consider the cumulative impacts of the Outrigger Telescopes Project. The court remanded NASA to redo the EA pursuant to NEPA. NASA has decided forego the EA, to complete a full federal EIS.

Lastly, MKAH, along with five (5) other Environmental and Hawaiian organizations and individuals (*Sierra Club, Ching, Fergerstrom, Royal Order of Kamehameha I*) is currently engaged in a state administrative hearing called a contested case hearing (CCH). MKAH and the other contesting parties are challenging the University of Hawai'i's Institute for Astronomy's (UHIFA) request (on behalf of CARA/NASA) for the Conservation District land use and permit to construct the four (4) to six (6) Outrigger Telescopes, for which this Draft EIS is the subject of.

I. PROCESS

A. No Scoping Comments Were Included In The Draft EIS :

No Scoping comments were attached to the Draft EIS. With no public comments attached it is impossible for decision makers and the public to determine the scope and adequacy of the Draft EIS. Hundreds of members of the public, interested parties and pertinent governmental agencies took time to comment and currently have no way determining if the NASA EIS adequately considered the public and governmental concerns because there is no information with which to compare them with.

B. Two Hundred and Fifty (250) Comments Received Where Lumped Together and Treated As One:

On page 8-5, NASA notes that "approximately 250 virtually identical emails where received from individuals entitled 'Prevent Further Degradation of Mauna Kea.' " in addition to the many other comments, but you did not identify the individuals commenting. We believe it is very important, that NASA identify the members of the public that comment, for the following reasons: C

1) Although these comments might have been "virtually identical", virtually is not equal to "exactly", Public comment, regardless of the volume, should not just be treated as a single comment, There were are -250 comments submitted by 250 individuals;
2) Lumping these comments together is equivalent to counting 250 "no" votes as one, because they are virtually identical or identical. Democracy is not handled this way-it is one (1) vote per person, even if the individual votes are exactly or "virtually identical" they must be counted.
3) Lastly, these comments demonstrate that these 250 people feel strongly about "Preventing Further Degradation of Mauna Kea."

II. Cumulative Impacts:

A. Cumulative Impact is defined by the National Environmental Policy Act ("NEPA") as:

The impacts on the environment which result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from other individually minor but collectively significant actions taking place over a period of time.

The Executive Summary cumulative impact summary section on page xxii-states:

"In conclusion, the overall cumulative impact of past, present and reasonable foreseeable activities is ***substantial, adverse and significant.*** *In general, the Outrigger Telescopes Project would add a small incremental impact." (Emphasis added)*

The above statement establishes that the cumulative impacts are adverse and great, but then separates the outrigger project from the previously established cumulative impacts. This is not reasonable. If cumulative impacts are defined as the sum of the impacts when added to other incremental impacts, it doesn't logically follow that "...the Outrigger Telescopes Project would add a small incremental impact." D

B. No Cumulative Impact Mitigation Measures:

In order to determine mitigation measures for offsetting or reducing cumulativeimpacts, there must be at least three precedent conditions 1) data, 2) analysis and evaluation of the data and 3) measures proposed based on data to reduce those impacts. Generally, to reduce cumulative impacts to less than significant. E

The Draft EIS, does not offer any cumulative impact mitigation measures. This appears to be the result of the Outrigger Telescopes being separated out from the cumulative impacts, and defined as having small incremental impacts.

C. Data Used In Draft EIS Are Contested In Official Proceedings:

Much of the data used in the Draft EIS continue to be contested in the State BLNR Contested Case Hearing proceedings relating to the Conservation District Use Permit, filed by the UHIFA and WMKO on behalf of NASA for the Outrigger Telescopes Project. F

Sierra Club, who is one of the Petitioners in the State BLNR case, supplied you with copies of the Petitioners collective Findings of Fact, Conclusions of Law and Exceptions as filed. These documents were provided to NASA so that the data that are being challenged by other experts could be identified. It was our hope that NASA might collect new data; or incorporate the concerns of the Petitioners witnesses; yet we see no evidence of your inclusion of the Petitioners evidence. G

D. Wekiu Bug Data Disputed and Incomplete

The Draft EIS relies almost entirely on Dr. Greg Brenner's data, and proposed mitigation measures. In our scoping comments we recommended that NASA put together a team of scientist to review Dr. Greg Brenner data and mitigation measures, and that this team could include but not be limited to Dr. Fred Stone, Dr. Frank Howarth and Dr. Greg Brenner. We made this specific requested this because we have reasons to believe that Dr. Greg Brenners's data did not have peer review or support. Our reasons where based on the information from the contested case hearing the testimony of expert witnesses, and the conclusions by the team of scientists who reviewed the Wēkiu Bug candidacy from December 2003 to March 2004. H

Furthermore, NASA has not included the U.S. Fish and Wildlife ("USFW") information as was requested by a number of the groups consulted, including Mauna Kea Anaina Hou and Sierra Club. The organization KAHEA-The Hawaiian Environmental Alliance, filed a formal petition for the listing the Wēkiu Bug on the Endangered Species list. The data identified in that petition should be included in this assessment. The USFW with OMKM convened a team of scientists to review the candidacy status of the Wēkiu Bug. The findings of this committee, which recommend immediate listing as Endangered species have been omitted from the DEIS. This omission violates the terms of the mandate of full disclosure.

E. Impacts to Traditional And Religious Practices:

Throughout the Draft EIS, the outriggers are cited as being 33' (33 feet) in size. This number is true for the size of the mirrors at the Keck I and Keck II Telescopes, but this in not accurate when considering the domes sizes. Continually referencing the mirror size instead of the dome size is misleading. I

The domes on both the KECK's are about 11 stories high each or about 111' (one hundred and eleven feet) high. The Outrigger Telescopes with their domes are each about 3 ½ stories high (35' feet). So the total impact visually would be the combined impact from the Two (2) Eleven (11) story buildings surrounded by four (4) to six (6) - 3 1/2 story buildings clustered

with in a five (5) acre area. This will have a significant, substantial and adverse impact on the visual vistas or view planes.

The visual vistas or view planes used by the Native Hawaiian People, are important to the cultural, traditional and religious practices. The impacts on the view planes are both to the tangible and intangible. They are thousands of years old. The view plans and vistas are identified Traditional Cultural Properties. We have provided information regarding the importance of these view planes for ritual and ceremony, yet they where not addressed in the Draft EIS.

The view planes are not only looking to the summit from below (from the east in Hilo and other places on the island), but also from the various pu`u (cinder cones) looking toward the summit (Pu`u Wēkiu) but also from the summit looking down toward the sea and other islands.

"Some Native Hawaiians" have identified the summit region to be sacred. This language attempts to marginalize the religious and cultural importance and significance of this profoundly sacred area and typifies NASA and UH's approach to minimizing the input of Kupuna, Kumu Hula, cultural practitioners, cultural historians, and general public. NASA's own cultural historian (Kepa Maly) does not reduce the importance of the summit as an "opinion of some Native Hawaiians." This is blatantly racist statement must be deleted. The cultural and religious significance of Mauna Kea is not for NASA to determine or judge. I

Religious practices of the Native Hawaiian people are dependent on the integrity of the view plane. The divine manifestation of the Deities (kinolau) are apart of the landscape and view planes. The image of Poli`ahu lying facing the sky is seen from Hilo. The Observatories are sitting atop her body, the Outriggers will impact this image by changing her physical form. This is a tremendously unacceptable impact that cannot be mitigated.

The Project will also change the view planes and alignments used in ceremonies and navigational practices to mark the alignments of various constellations and the sun.

Other view planes include the image of the deity Kukahau`ula, as the god descends from the heavens (each day) to greet Poli`ahu-these images are impacted from various locations on the summit and from below.

Lastly, there is no reference to the cumulative impact and loss of the 360 degree view plane from the summit. Actually there is no longer a 360 degree view from the summit area, and the Outriggers will negatively impact what view is left.

F. No Soil Tests Done Near The Cesspools, Leech Field, Septic Tanks, Or the Diesel and Oil Containment Systems:

We could not find evidence in the DEIS to indicate that data or analysis of soil testing near major sources of contamination had been conducted. It seem most logical to test for hazardous and sewage leakages from the source, as well to test for transportation of contamination. This is a gross omission of assessing existing and future impacts. There is no baseline data and represents another example of not providing full disclosure. J

G. Hydrology Data Used In Draft EIS Already Contested In State and Federal Hearings

1. Precipitation From Clouds And Mist That Occurs Two Times A Day:

The Draft EIS data on precipitation should include the mist and cloud cover that generally occurs in the morning and evening-this is significant over the entire summit area and much water is released on the surface of the summit area. K

2. Discharge Of Human Waste

The Draft EIS, claims that there are no cumulative impacts associated with the human waste deposits into septic tanks/cesspools and leech field. We would have to disagree!! In Hawai'i it is generally acknowledged that defecating in a burial area or on a heiau or temple of worship is defiling (Haumia) and considered desecration. Mauna Kea is considered a burial ground for important ancestors and heiau or temple of worship, so human waste entering the ground is considered desecration. There is no cumulative analysis of the cumulative impacts of sewage treatment on the cultural, traditional and religious practices and use. L

Although the Draft EIS claims that all of the telescopes Individual Waste Water Systems ("IWS") are inspected and pumped, there was no record of this, in fact the record reflects that WMKO had no pumping records. Where are the data to support this claim? M

3. No Base-Line Data On Hydrology

Data are already in the hearing record that demonstrate, Mr. Nance took only one data point at two separate sites. This means that there is no base-line data to substantiate any claims there are no cumulative impacts to the hydrology system of Mauna Kea.

Tom Nance's data and sources including his reliance on Ebel (2001) an undergraduate, non-published and non-peer-reviewed report. The data supplied in the Ebel is based on only a 5 day sample, and further misstates Dr. Woodcock's reports (1980). I have attached the rebuttal testimony of our hydrology witness Dr. Brad Finney regarding these points. N

The Draft EIS claims that many of the hazardous material spills (including mercury) have occurred "inside" the observatories, however, it omits the important discussion contained on our contested case hearings files regarding the "French drains" or **"open drain systems" used in the observatories that enter directly into the ground and could allow any hazardous materials spilled inside the observatories to be introduced into in to the ground.** O

The Draft EIS also provided *some information but no analysis of the information* provided regarding the sump pump system used to remove hazardous materials from the mirror aluminizing and washing processes; in that, the KECK engineers testified that the sump pump *had ONLY been installed one year prior to the State hearings. There is no cumulative impact* analysis relating to the years prior to the installation of the sump bump nor is there analysis relating to the other observatories mirror washing and aluminizing histories provided in the Draft EIS. P

We could not find any references or cumulative impact analysis regarding the past and/present use of Carbon Disulfide, for mirror washing and which is listed in WMKO MSDS .KECK employees testified at our hearing that it was entering the ground up until KECK installed the sump pump to collect hazardous material (about 1year ago).

Only one licensed hazardous waste contractor is listed in the Draft EIS-the rest specify only that the waste is handled by licensed contractors to a hazardous material facility. None of the Hazardous waste facilities are identified. Q

H. Cumulative Noise, And Traffic Impacts On The Cultural, Traditional And Religious Practices And Use:

There is no data on the cumulative impact of the noise generated from the telescopes on the cultural, traditional, religious practices or the fauna on Mauna Kea. There are just general statements, asserting that the noise from the Telescope is not significant. R

I. Access

The Draft EIS claims that the outriggers will not limit access for cultural, traditional and religious access. Although, the UHIFA blocks physical access to the summit in the name of safety, there are other forms of access that are being abridged, these included but are not limited to 1) access to view the alignments of certain heavenly bodies and associated movement, 2) the loss of Kukahau`ula's daily ritual and practitioner's participation in those ceremonies, or 3) practitioner's ability look upon the goddess Poli`ahu without obstruction. There is no cumulative analysis of these view planes in the Draft EIS. S

4) Impacts of increased traffic due to future expansion desires of the industry are not addressed. T

J. Burial Treatment

Mauna Kea is well established to be a burial ground. However, the Historic Preservation division has not completed an inventory survey to determine the burials atop Mauna Kea. *Therefore, the draft Burial Treatment Plan is based only on those burials that have been found in* the process of development. Most of the Practitioner's have stated that they do not wish to violate the cultural laws regarding protecting the burials There is no cumulative impacts analysis of these concerns or the burial grounds protection. U

The Section 106:

One of the reasons that Mauna Kea Anaina Hou did not sign the MOA is because it did not adequately assess the cumulative impact upon the burial grounds nor were concerns about impacts on the hydrology adquatley addressed. Neither of these issues is adequately addressed in the Draft EIS. V

In conclusion,

Many of the Cultural, Traditional and Religious practices conducted atop Mauna Kea the Temple are ancient and specific to the mountain and can only be done on Mauna Kea There is no where else in the world where it is possible to perform many traditional ceremonies and practices. There are 93 observatories sites around the world where world class astronomy can and is being achieved. W

It is also important that NASA and the telescope industry respect the fact that Mauna Kea is of vital and profound religious significance to Native Hawaiian people throughout ka pae 'aina. (the archipelago). And it is not necessary to travel to the summit of the sacred mountain in *order to worship. The sacred temple is revered and sacred unto itself. The knowledge that the* summit is protected and sound and that ceremony is being observed on designated days is fulfilling.

The integrity of the current state of an already imperiled profoundly sacred summit region must be preserved without any further desecration for future generations.

The Draft EIS identifies alternative locations where NASA's scientific goals and objectives can be achieved, and it is our positions that provided the people in the alternative locations and surrounding areas are in support of the NASA project, we hope that you consider either the no build alternative for Mauna Kea or the best alternative site for scientific discovery. X

The **Outrigger Telescopes have already been fabricated and constructed**. Therefore, all that is left is for the Outriggers to be installed at the project site. Only 8 eight permanent jobs would be jeopardized if the Outriggers where moved to an alternative location.

We do not support further development atop Mauna Kea, and believe that the observatories need to work to together to maximize the science currently conducted atop Mauna Kea, it is a world premier site and should be for many years to come if innovation and creativity are maximized.

NASA carried the unfair burden of completing cumulative impact studies. when he UHIFA should have been conducting cumulative effects studies and monitoring the resource for the past 30 years. UHIFA should have worked in a more transparent and honest manner with the public and especially with the Native Hawaiian community. Y

Life is it is out of balance in our house of worship, our cultural base and delicate eco-system is threatened and the cumulative impacts to the cultural and natural resources are adverse, substantial and significant. The future of science is not threatened and can continue in a more appropriate location. As a result, our position must be that there can be no further development on the summit of Mauna Kea. . It is a call for balance and Aloha.

We strongly request that a revised Draft Environmental Impact Statement be prepared for public comment and review that includes peer-reviewed science, accurate accounts, full disclosure of pertinent information and includes the scoping comments submitted by hundreds of concerned citizens.

Mahalo a nui loa ame Aloha no,

Kealoha Pisciotta, President, Mauna Kea Anaina Hou

Cha Smith, Executive Director, KAHEA: The Hawaiian-Environmental Alliance

Vicky Holt Takamine, President, 'Ilio'ulaokalani Coalition

Kyle Kajihiro, Executive Director, Hawai'i Project American Friends Service Committee

ADDENDUM ATTACHED.

Kealoha Pisciotta/Mauna Kea Anaina Hou
Cha Smith/KAHEA: The Hawaiian-Environmental Alliance
Vicky Holt Takamine/ʻĪlioʻulaokalani Coalition
Kyle Kajihiro/American Friends Service Committee, Hawaiʻi Project
September 28, 2004

Scoping comments submitted by Mauna Kea Anaina Hou on the Draft EIS for the Outrigger Telescopes Project are provided in the previous letter and are not reproduced here.

****

Response to Comment A:

NASA completed the National Historic Preservation Act Section 106 consultation process when the Memorandum of Agreement was signed by NASA, the Advisory Council on Historic Preservation, the Hawaiʻi State Historic Preservation Officer, University of Hawaiʻi, the California Association for Astronomy (CARA), the California Institute for Technology (Caltech), and Ahahui Ku Mauna (with caveat). Consulting Parties who did not sign the Memorandum of Agreement (MOA) included the Hawaiʻi Island Burial Council, Hui Mālama I Nā Kūpuna o Hawaiʻi Nei, Mauna Kea Anaina Hou, the Office of Hawaiian Affairs, and the Royal Order of Kamehameha I. NASA is required to consult to determine what would be appropriate mitigation measures considering the magnitude of the project and its effects on historic properties. It is not necessary that all Consulting Parties agree on the proposed mitigation measures. Nonetheless, NASA held three Section 106 meetings and has consulted with Native Hawaiian consulting parties in good faith.

Response to Comment B:

NASA's Executive Summary in the Outrigger Telescopes Project EIS has been revised in response to your comment.

Response to Comment C:

See Response to Comment A in the previous letter.

Response to Comment D:

See Response to Comment B in the previous letter.

Response to Comment E:

See Response to Comment C in the previous letter.

Response to Comment F:

See Response to Comment D in the previous letter.

Response to Comment G:

See Response to Comment E in the previous letter.

Kealoha Pisciotta/Mauna Kea Anaina Hou
Cha Smith/KAHEA: The Hawaiian-Environmental Alliance
Vicky Holt Takamine/ʻĪlioʻulaokalani Coalition
Kyle Kajihiro/American Friends Service Committee, Hawaiʻi Project
September 28, 2004

Response to Comment H:

See Response to Comment F in the previous letter.

Response to Comment I:

See Response to Comment G in the previous letter.

Response to Comment J:

See Response to Comment H in the previous letter.

Response to Comment K:

See Response to Comment I in the previous letter..

Response to Comment L:

See Response to Comment J in the previous letter.

Response to Comment M:

See Response to Comment K in the previous letter.

Response to Comment N:

See Response to Comment L in the previous letter.

Response to Comment O:

See Response to Comment M in the previous letter.

Response to Comment P:

See Response to Comment N in the previous letter.

Response to Comment Q:

See Response to Comment O in the previous letter.

Response to Comment R:

See Response to Comment P in the previous letter.

Response to Comment S:

See Response to Comment Q in the previous letter.

Response to Comment T:

See Response to Comment R in the previous letter.

Response to Comment U:

See Response to Comment S in the previous letter.

Response to Comment V:

See Response to Comment T in the previous letter.

Response to Comment W:

See Response to Comment U in the previous letter.

Response to Comment X:

See Response to Comment V in the previous letter.

Response to Comment Y:

See Response to Comment W in the previous letter.

Vincent K. Pollard

9 September 2004

Carl B. Pilcher

Program Executive

Science Mission Directorate

Universe Division

NASA Headquarters

300 E. Street SW

Washington, D.C. 20546-0001

Re: Mauna Kea Science Reserve (draft EIS)

Dear Dr. Pilcher,

We share an interest in the exciting challenges of exploring the unknown. Ever since a high school science teacher assigned me to write a report on a history of Niclas Kopernik, a/k/a "Copernicus" (1473-1543), Tycho Brahe (1546-1601) and their contemporaries, astrophysics has fascinated me. Much later, I learned how long-distance Polynesian navigators guided small ocean craft for thousands of miles with the stars as their referents—and without telescopes.

However, the purpose of this letter is to offer testimony concerning defects in the draft Environmental Impact Statement for proposed further expansion of the Mauna Kea Science Reserve on Hawai‘i Island.

On 26 August 2004, I attended the sixth public meeting for comments on the draft EIS at the Japanese Cultural Center (Honolulu, Hawai‘i). There I was enlightened by three hours of testimony from individuals and organizations in Hawai‘i. Afterwards, I reviewed the draft EIS.

My background for understanding the draft EIS stem from my education and professional background as a political scientist and as a practitioner of what I teach to students in the University of Hawai‘i System. A continuing research interest is to refine democratic theory to help us understand how small, apparently weak civil society organizations sometimes achieve their objectives in the face of daunting obstacles and powerful institutions. If you wish, please feel free to access a short version of my curriculum vitae with the URL **www2.hawaii.edu/~pollard/cv.html** on my website.

Vincent Kelly Pollard, Ph.D., Testimony, 9 September 2004

In four parts, the rest of my testimony follows below.

1. The National Aeronautics and Space Administration (NASA) has borne the brunt of (justifiable) public criticism from community organizations for a three-way working alliance between and two "silent partners." These collaborators are the University of Hawai‘i and the State of Hawai‘i's Bureau of Land and Natural Resources. Indirectly, therefore, my criticisms reflect on the conduct of those two institutions, as well. All three bear responsibility for—are complicit in—encouraging or acquiescing in the behavior endorsed in the draft EIS.

2. You and your colleagues have heard and read testimony to the cultural, religious and historical importance of sacred mountains in Hawai‘i like Mauna Kea. A public trust has been violated here. If you doubt that claim, let me suggest analogies closer to home. In Washington, D.C., you are closer than I am to the site of the bloody Civil War Battle of Gettysburg. And your office is not far from the Lincoln Memorial. Would you flush raw sewage (human urine, excrement) through these areas and others dedicated to remembering combatants and leaders of the war that brought an end to a shameful era of plantation slavery? I doubt it. Historic places of worship and past burial grounds dot the environs of Mauna Kea. Please make a greater effort to understand that those who push ahead with further intrusions on Mauna Kea will be perceived with genuine sadness, disgust and anger.

3. Institutional history matters. How can one believe that NASA's Record of Decision (ROD) in this case will restore faith in the decision making progress? Present-day NASA administrators are saddled with the sins of the past. In light of thirty-plus years of incremental, cumulating intrusions—unfettered access, can you give us a single cogent argument for believing that the next six telescopes will be the last ones?

4. Meanwhile, local memory of unjust decisions by NASA and its "silent partners" is resilient. For NASA and its "silent partners," the financial, political and reputational cost of retreating in the future will be even higher, In other words, if the ROD goes ahead with the six telescopes, then the present proceedings will simply be another chapter in a series of vibrant, resilient community campaigns in which NASA's activity and morality will be publicly scrutinized for months and years to come.

5. In conclusion, do not install six more Outrigger Telescopes on Mauna Kea. Cut your losses now. Deny the bid for expansion!

Thank you, Dr. Pilcher, for considering my testimony

Sincerely,

Vincent Kelly Pollard, Ph.D.

Vincent K. Pollard, Ph.D.
September 9, 2004

Your comments are respectfully noted.

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1111 Jackson Street, Suite 520
Oakland, CA 94607

September 27, 2004

ER: 04/558

Dr. Carl Pilcher
Office of Space Science
National Aeronautics and Space Administration
Mail Code SZ
Washington, DC 20546-0001

Subject: Review of the Draft Environmental Impact Statement (EIS) for the Outrigger Telescope Project, Mauna Kea Science Reserve, Island of Hawaii

Dear Dr. Pilcher:

The U.S. Department of the Interior has received and reviewed the subject document and has the following comments to offer.

General Comments

The DEIS has compiled information on impacts to cultural resources, biological resources, hydrology and water quality, waste water and solid waste management, hazardous materials management, geology and soils, land use and existing activities, transportation and utilities, socioeconomics, air quality, noise, and visual and aesthetic features. This information is presented in two volumes, with Volume II comprised of six appendices. Our comments focus on the natural resources on Mauna Kea and in particular on the wekiu bug (*Nysius wekiuicola*), a candidate for listing under the Endangered Species Act.

The summit area of Mauna Kea is host to a set of unique plants and animals that are restricted to this high elevation site. While most of these organisms do not occur at the Outrigger Telescopes Project (OT) construction site, the continued transport of invasive weeds and arthropods by vehicular traffic from lower elevations may constitute a threat to the long-term survival of some or all of these species. **A**

Impacts from invasive species are a common and growing problem in Hawaii. On Mauna Kea, the invasive plant mullein (*Verbascum thapsus*) is an example of how vehicular traffic may contribute to the spread of nonnative plants. This plant occurs along road sides and is not found very far away from roads. It is present from lower elevations on Mauna Kea (about 5,000 feet) to upwards of 10,000 – 11,000 feet.

Weed control is an important management requirement for Mauna Kea, and development projects such as the OT should include weed control activities. **A**

Vehicular weed dispersal is an important issue given the level of vehicular traffic on the mountain. For example, 34,659 vehicles accessed the mountain in 2003, 59 percent of which were for observatory activities. Vehicular use on the mountain is expected to increase as new observatories are built, as older ones are upgraded, and as commercial and independent ecotourism increases.

All construction materials and personnel for the OTs will be moved up the mountain and will reside at Hale Pohaku for varying periods of time. This also applies to the materials and personnel involved in the day-to-day maintenance and operation of the OTs. The local area around Hale Pohaku has a long history of human impacts and is a potential source area for nonnative species that may encroach into the summit area.

Specific recommendations are included below that may help address impacts associated with traffic, materials, and personnel anticipated to move along the summit transportation corridor and/or reside at Hale Pohaku.

It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wekiu Bug Mitigation Plan and the Wekiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities.

These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology. **B**

Finally, with regard to oversight during construction, we suggest that representatives from the Office of Mauna Kea Management (OMKM), entomologists familiar with the wekiu bug and its habitat, and biologists from the Pacific Islands Fish and Wildlife Office be given an opportunity to observe the excavation process and participate in the habitat mitigation and restoration process. This would promote a greater understanding among biological experts of the nature and extent of impacts to wekiu bug habitat due to the excavation of cinders. **C**

Specific Comments

VOLUME I: Draft Environmental Impact Statement for the Outrigger Telescopes Project

Pg. xxxviii, Table of Contents: Page numbering is incorrect for 5.2, Wekiu Bug Mitigation and Monitoring Measures. D

Pg. 2-12, On-Site Construction and Installation: Section 2.1.3.1 discusses when construction would begin. While a specific time period is not identified, we recommend that construction of footings on the NW slope of the Keck footprint not be undertaken during early spring when wekiu bug activity is highest. This measure should further reduce any potential impacts to wekiu bugs that may be in the vicinity of construction sites, and it would only affect construction activities for OT footings one and two (see Figure 2-7). E

Pg. 2-14, Estimated Excavation: Section 2.1.3.2 discusses restoration of wekiu bug habitat using cinders excavated during construction. The text should make it clear that restoration of wekiu bug habitat is an uncertain undertaking due to lack of scientific knowledge about habitat requirements of the wekiu bug. Also, we recommend that prior to excavation, areas identified for excavation or disturbance, be sampled by biologists familiar with the wekiu bug and its habitat. We suggest a joint effort involving OMKM representatives, the U.S. Fish and Wildlife Service, and NASA representatives. This should include removal of cinders that might constitute wekiu habitat in a manner that will increase our knowledge of the fine details of this habitat. F G

Pg. 2-22, History of Engineering Design Changes to Minimize Disturbance: Section 2.1.3.4 provides a good overview of design changes incorporated into the project to minimize impacts to wekiu bug habitat. We suggest a final check of numeric values in this section and in Table 2-3 so they are in agreement. It is unclear if the amount of area that may be impacted is 0.007 hectares or 0.008 hectares. In either case, the area impacted is low (70-80 sq. m. [753-861 sq ft]) when compared to the amount of available wekiu bug habitat on Mauna Kea. H

Pg. 2-23, Installation of Telescopes and Dome Enclosures: Section 2.1.3.7 states that prior to entry into Mauna Kea Science Reserve (MKSR), all construction materials and equipment will be inspected by a trained biologist who would certify that all materials and equipment are free of any and all flora and fauna that could potentially have an impact on the Mauna Kea summit ecosystem. While the intention of these inspections is very good, we are concerned that the final certification may not actually accomplish its goal. It can be very difficult or even impossible to find any and all dispersal agents that may be detrimental to the Mauna Kea summit ecosystem. I

We suggest that OMKM and NASA consider establishing a vehicle washing system that would clean the undercarriage of all vehicles traveling up to the summit from Hale Pohaku or any site lower on the mountain. Similar washing systems are used by the military during the transport of their vehicles in aircraft.

We recommend discussing this issue with the Army at Pohakuloa Training Area on the Mauna Kea saddle. Please consider enhancing the project's design and include measures in the final EIS to more efficiently meet the needs of the Mauna Kea summit, particularly during winter conditions. OMKM should consider a requirement that all vehicles traveling above Hale Pohaku first pass through the vehicle washing system. **I**

We also suggest that, prior to construction, staging areas at Hale Pohaku and the summit be established to ensure that all invasive or non-native plants are identified and removed. Over the course of the construction project, we recommend that quarterly surveys of these staging areas be conducted to evaluate any new occurrences of non-native plants that may arrive on Mauna Kea. **J**

Finally we recommend that any nonnative species found or identified using these survey methods be removed and all reasonable efforts to encourage native vegetation be undertaken. **K**

Pg. 2-51, Table 2.3: In the section on Biological Resources, the Proposed Action Operation states that a very small adverse impact to wekiu bug habitat may be more than offset by habitat restoration, monitoring, and autecological studies. This section concludes that there will be no impact from the project.

We suggest that the Proposed Action Operation conclusion be changed to "Small Adverse Impact" or (preferably) state that the level of adverse impact is unknown but possibly small, and that the exact level will be determined through further study and monitoring. We base this recommendation on the general lack of knowledge about wekiu bug habitat and the currently tenuous potential for its restoration. **L**

We strongly believe that further autecological studies and monitoring will increase our understanding of the wekiu bug and its habitat and will also contribute to understanding complex issues associated with habitat restoration. However, we cannot say for certain that these scientific undertakings will counterbalance the potential adverse impacts associated with the construction of the OTs.

Pg. 3-21, Biological Resources of the Summit Area Cinder Cones: Section 3.1.3.1 states that wekiu bug trap capture rates on Puu Hauoki returned to levels comparable to the high capture rates there in 1982. If there are data for a similar comparison for Puu Wekiu, please include that information in this section. **M**

Also, please comment on the low trap returns reported by other entomologists or for the same or similar time period. In addition, the DEIS should point out that while the range of the wekiu bug was greatly expanded in 2002, these surveys also support the view that

prime habitat of the wekiu bug is the summit cones of Mauna Kea; lower elevation cones seem to be peripheral, lower quality habitat. **M**

This latter point is the major reason that all wekiu bug experts (perhaps 4 or 5 entomologists) agree that habitat protection in the summit area is an essential requirement for long-term survival of the wekiu bug.

Finally, OMKM recently sought an evaluation of the status of the wekiu bug by an independent group of scientists that does not work on the wekiu bug and have no research interests on Mauna Kea. This review was completed in 2004 and results support the status of the wekiu bug as a candidate for listing under the Endangered Species Act. **N**

Please obtain this report from OMKM, and discuss this report in the final EIS.

Thank you for our opportunity to review this project.

Sincerely,

Patricia Sanderson Port
Regional Environmental Officer

cc: Director, OEPC, HQ,
FWS, Portland, OR,
FWS, Sacramento, CA

Patricia Sanderson Port
United States Department of Interior
September 27, 2004

Response to Comment A:

Alien arthropod mitigation measures would also help manage invasive weed dispersal. The pressure-washing and inspection mitigation measures for vehicles traveling to Mauna Kea would likely limit weed dispersal during the Outrigger Telescopes Project (See Appendix D).

Response to Comment B:

Thank you for your supportive comment.

Response to Comment C:

NASA supports the recommendation and has forwarded it to California Association for Research in (CARA).

Response to Comment D:

The text has been corrected.

Response to Comment E:

NASA has forwarded this recommendation to CARA.

Response to Comment F:

The text of the EIS has been modified to acknowledge the uncertainty about the success of Wēkiu bug habitat restoration.

Response to Comment G:

NASA supports the recommendation and has forwarded it to CARA.

Response to Comment H:

The text has been corrected.

Response to Comment I:

NASA has forwarded your recommendation for a vehicle washing system to the University of Hawai‘i and the Office of Mauna Kea Management.

Response to Comment J:

NASA has forwarded this recommendation to CARA.

Response to Comment K:

NASA supports the recommendation and has forwarded it to CARA.

Response to Comment L:

The suggested change has been made both in Table 2-3 and in the corresponding text (See Section 4.1.2.2).

Response to Comment M:

The text was modified to include Pu‘u Wēkiu bug capture rates. The trap capture rates in the contemporaneous Polhemus 2001 study are discussed in Section 3.1.3.1, page 3-24. On that same page, the EIS states that “Wēkiu bug trap capture rates near the lower extent of the habitat range are low, and evidence suggests that Wēkiu bugs prefer habitat on the *Summit Area Cinder Cones*.”

Response to Comment N:

NASA reviewed the Wēkiu Bug Scientific Data Review Committee’s report and new text was added to Section 4.1.2 of the EIS.

DEPARTMENT OF TRANSPORTATION
DISTRICT 7, REGIONAL PLANNING
IGR/CEQA BRANCH
120 SO. SPRING ST.
LOS ANGELES, CA 90012
PHONE (213) 897-6536
FAX (213) 897-1337
E-Mail:NersesYerjanian@dot.ca.gov

Flex your power!
Be energy efficient!

Mr. Carl B. Pilcher
NASA, Headquarters
Office of Space Science, Code SZ 300 E. Street SW
Washington, DC 20546-0001

IGR/CEQA # 040832NY
DEIR/Outrigger Telescopes Project
LA/2/

August 30, 2004

Dear Mr. Pilcher:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the proposed Outrigger Telescopes Project in Los Angeles County.

We would like to remind you that any transportation of heavy construction equipment and/or materials which requires the use of oversized-transport vehicles on State highways will require a Caltrans transportation permit. We recommend that large size truck trips be limited to off-peak commute periods. A B

If you have any questions regarding this response, please call the Project Engineer/Coordinator Mr. Yerjanian at (213) 897-6536 and refer to IGR/CEQA # 040832NY.

Sincerely,

Cheryl J. Powell
IGR/CEQA Branch Chief
Regional Transportation Planning
Caltrans, District 7

Cheryl J. Powell
Department of Transportation, CA
August 30, 2004

Response to Comment A:

Thank you for the reminder.

Response to Comment B:

During the construction and installation phases of the Outrigger Telescopes Project, heavy truck trips would be scheduled during off-peak hours to avoid interfering with normal traffic flow.

STATE OF CALIFORNIA

Governor's Office of Planning and Research

State Clearinghouse and Planning Unit

Arnold Schwarzenegger
Governor

Jan Boel
Acting Director

September 24, 2004

Carl Pilcher
National Aeronautics and Space Administration
Office of Space Science
Code SZ 300 E Street SW
Washington, DC 20546-0001

Subject: Outrigger Telescopes Project
SCH#: 2004084002

Dear Carl Pilcher:

The State Clearinghouse submitted the above named Draft EIS to selected state agencies for review. The review period closed on September 23, 2004, and no state agencies submitted comments by that date. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act.

Please call the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process. If you have a question about the above-named project, please refer to the ten-digit State Clearinghouse number when contacting this office.

Sincerely,

Terry Roberts

Terry Roberts
Director, State Clearinghouse

1400 TENTH STREET P.O. BOX 3044 SACRAMENTO, CALIFORNIA 95812-3044
TEL (916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

SCH# 2004084002
Project Title Outrigger Telescopes Project
Lead Agency National Aeronautics and Space Administration

Type EIS Draft EIS

Description NASA has just released an approximately 600 page Draft Environmental Impact Statement (DEIS) for the Outrigger Telescopes Project, a proposal to fund the construction and installation of four to six 1.8-m telescopes at the W.M. Keck Observatory site on Mauna Kea, Hawaii. At nearly 600 pages, this DEIS represents the most comprehensive study ever done undertaken of the impacts of past projects and potential future development on Mauna Kea.

Lead Agency Contact

Name Carl Pilcher
Agency National Aeronautics and Space Administration
Phone 202 358-0291 **Fax**
email
Address Office of Space Science
Code SZ 300 E Street SW
City Washington **State** DC **Zip** 20546-0001

Project Location

County Los Angeles
City La Canada-Flintridge
Region
Cross Streets Red Box Road / Mount Wilson Road
Parcel No.
Township **Range** **Section** **Base**

Proximity to:

Highways State Highway 2
Airports Los Angeles International
Railways
Waterways Campo / Cottonwood Creek Aquifer
Schools La Canada Unified School District
Land Use

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Cumulative Effects; Drainage/Absorption; Forest Land/Fire Hazard; Geologic/Seismic; Landuse; Minerals; Noise; Public Services; Recreation/Parks; Septic System; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wildlife

---

Reviewing Agencies Resources Agency; Regional Water Quality Control Board, Region 4; Department of Parks and Recreation; Native American Heritage Commission; Office of Emergency Services; Office of Historic Preservation; Department of Forestry and Fire Protection; Department of Fish and Game, Region 5; Department of Water Resources; Caltrans, District 7; Caltrans, Division of Aeronautics

---

Date Received 08/10/2004 **Start of Review** 08/10/2004 **End of Review** 09/23/2004

Note: Blanks in data fields result from insufficient information provided by lead agency.

Terry Roberts
Director, State Clearinghouse
September 24, 2004

Thank you for your letter acknowledging that NASA has complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act.

Testimony of Lanny Sinkin
Public Hearing August 25, 2004
Naniloa Hotel, Hilo, Hawai`i
Outrigger Telescope Project
Draft EIS

Lanny Sinkin
Attorney at Law (Federal Practice)

The National Aeronautics and Space Administration proposes to build yet another telescope on the top of Mauna Kea.

My testimony focuses on the spiritual, psychological, and medical impacts of this proposal. At the same time, I incorporate by reference all other testimony raising additional issues, including, and not limited to, environmental, social, and cultural impacts.

I have appended to my testimony some citations to relevant statutes that you might be well served to consider before complete the EIS process and reaching a decision.

In preparing the draft EIS, NASA consulted with environmental and cultural groups to learn their concerns and supposedly to address those concerns. The American Indian Religious Freedom Act required NASA to also consult with Native Hawaiian spiritual practitioners. **A**

Had such consultation taken place, NASA would be aware that Mauna Kea is not simply a sacred site. Mauna Kea is considered the most significant temple within the Hawaiian spiritual tradition. The top of the mountain is considered the realm of Po, the realm that belongs to the Gods. The building of telescopes on top of Mauna Kea is a direct intrusion into the most sacred ground on this island. **B**

The mountain is also the burial site for the remains of the most revered ancestors of the Hawaiian people. **C**

While Mauna Kea may be an excellent site for the scientific and military research that NASA intends to conduct, there is no compelling interest that requires the United States government to use this site. **D**

The failure to consult and abide by the wishes of spiritual practitioners, the disrespect for Hawaiian spiritual beliefs demonstrated by these failures, and the proposal to invade a sacred space by building another telescope violate the United States Constitution's **E**

guarantee of freedom of religion and various statutes that protect Native Hawaiian spiritual practices from being burdened by federal actions that lack a compelling interest. E

There is also the question of cumulative impact. The Hawaiian people have paid a high price for showing aloha to foreigners.

The highest price came when the United States minister in Hawai`i used United States military forces to overthrow the legitimate government of the Kingdom of Hawai`i. The Apology Resolution passed by Congress and signed by President Clinton in 1993 provides a succinct and fairly accurate account of that illegal action.

The overthrow destroyed the governmental structure put in place by the Hawaiian people to regulate their national life and took away their self governance. While the Apology Resolution acknowledged that the Hawaiian people never relinquished their sovereignty, the resolution provided no mechanism for restoring the actual practice of that sovereignty.

Having begun to extinguish the national identity of the Hawaiian people with the illegal overthrow, the United States then proceeded to take away the land base that supported the Hawaiian civilization. The destruction of the ahupua`a system changed drastically the economic and cultural practices of the Hawaiians.

For a time, the occupying power even outlawed the speaking of the Hawaiian language, the dancing of the hula, and Hawaiian traditional spiritual practices dating back for thousands of years.

Today, the assault on the Hawaiian people continues.

A heiau is a stone platform constructed as a sacred site by the Hawaiians, similar to the function of a church. We have seen the County of Hawai`i bulldoze a heiau to build a parking lot.

The bones of those that have "changed address" as the Hawaiians refer to the passage from this life to another dimension are considered sacred, wrapped in a special cloth, and buried in secret places. We have seen these bones dug up, concrete poured over burial sites, and other desecration to facilitate the real estate marketing and development of this island into a mecca for rich refugees from the mess created in the United States.

The military massively developed their facility on the sacred mountain, working their way toward creating yet another military superfund site of pollution, exploding ordinance on the sacred temple of the Hawai`i people, and otherwise acting with complete disregard for Hawaiian wishes and values. Making Hawai`i the forward base for the planned confrontation with China is completely contrary to the non-aligned status of the Kingdom of Hawai`i, where aloha extended to all nations.

Every impact on Mauna Kea is an impact on the Hawaiian people. A true cumulative F

impacts assessment would look at the entire mountain from the ocean floor to the peak to assess the impacts to date and the likely contribution of new impacts from the proposed telescope. F

The scientific and military occupation of the most sacred site on this island is one more burden of suffering added to the impacts to date. The impact of all these accumulated attacks on the Hawaiians are seen today in the high incidence of disease and other medical problems found in the Hawaiian community, the high percentage of Hawaiians in the occupation prison system, and other manifestations of a people suffering from more than a hundred years of oppression. G

In discussing cumulative impacts, NASA has failed utterly to consider this historical build up of adverse impacts to which the latest telescope proposal will make a significant contribution. Breaking the barrier of the thirteen telescope limit will be the harbinger of more telescopes to come. The Hawaiians will have to continue their difficult struggle to protect the mountain, rather than know that a final resolution of no more than thirteen telescopes is in place. This prospect of continuing strife will add still further stress to the Hawaiian community. H

From an agency that thinks nothing of putting massive amounts of plutonium on an unreliable space shuttle and launching this deadly payload over the people of Florida, we do not necessarily expect very much. This testimony will at least highlight some of the issues that NASA may be forced to address in some other forum, if not adequately considered in the EIS.

I wish that you could experience a day in the Hawaiian state of mind. Watch the parade of nations at the Olympics and ask "Where is Hawai`i?" Watch the international canoe races celebrating the sport so prized by the Hawaiian people and ask "Where is the team from the Kingdom of Hawai`i?" Look at the contracts for telescope operation on Mauna Kea that are provided by an institution created by the occupying power and ask "Where is the contract with the Hawaiians?" After a few of those experiences, you might begin to understand that your proposed telescope is simply one more step in the effort to extinguish a once independent, highly educated, creative, and loving people. If you embraced that understanding, you would take no pride in taking such a step.

Aloha.

SELECTED STATUTES

42 USC § 1996 (2004)

§ 1996. Protection and preservation of traditional religions of Native Americans

Henceforth it shall be the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

Religious Freedom Restoration Act of 1993

§ 2000bb. Congressional findings and declaration of purposes

(a) Findings. The Congress finds that--
(1) the framers of the Constitution, recognizing free exercise of religion as an unalienable right, secured its protection in the First Amendment to the Constitution;
(2) laws "neutral" toward religion may burden religious exercise as surely as laws intended to interfere with religious exercise;
(3) governments should not substantially burden religious exercise without compelling justification;
(4) in Employment Division v. Smith, 494 U.S. 872; 110 S. Ct. 1595; 108 L. Ed. 2d 876 the Supreme Court virtually eliminated the requirement that the government justify burdens on religious exercise imposed by laws neutral toward religion; and
(5) the compelling interest test as set forth in prior Federal court rulings is a workable test for striking sensible balances between religious liberty and competing prior governmental interests.

(b) Purposes. The purposes of this Act are--

(1) to restore the compelling interest test as set forth in Sherbet v. Verner, 374 U.S. 398; 83 S. Ct. 1790; 10 L. Ed. 2d 965 and Wisconsin v. Yoder, 406 U.S. 205; 92 S. Ct. 1526; 32 L. Ed. 2d 15 and to guarantee its application in all cases where free exercise of religion is substantially burdened; and

(2) to provide a claim or defense to persons whose religious exercise is substantially burdened by government.

Appropriations Act

*103 P.L. 317, *; 108 Stat. 1724, **;*
1994 Enacted H.R. 4603; 103 Enacted H.R. 4603

Sec. 610.

(a) Findings. --The Congress finds that--

(1) the liberties protected by our Constitution include religious liberty protected by the first amendment;

(2) citizens of the United States profess the beliefs of almost every conceivable religion;

(3) Congress has historically protected religious expression even from governmental action not intended to be hostile to religion;

(4) the Supreme Court has written that "the free exercise of religion means, first and foremost, the right to believe and profess whatever religious doctrine one desires";

(5) the Supreme Court has firmly settled that under our Constitution the public expression of ideas may not be prohibited merely because the content of the ideas is offensive to some;

(6) Congress enacted the Religious Freedom Restoration Act of 1993 to restate and make clear again our intent and position that religious liberty is and should forever be granted [**1775] protection from unwarranted and unjustified government intrusions and burdens

Lanny Sinkin
August 25, 2004

Response to Comment A:

In recognition of the sanctity of Mauna Kea in Native Hawaiian culture, NASA has made a particular effort to consult with Native Hawaiian religious practitioners. Their perspectives have had great influence on the content of this EIS. See Section 3.1.2.5 and Table 3-2 for more details.

Response to Comment B:

The cultural and religious significance of Mauna Kea is extensively documented throughout the EIS, which proposes numerous measures to minimize and mitigate the impact of the Outrigger Telescopes Project.

Response to Comment C:

NASA is committed to being a responsible steward in the implementation of the Proposed Action. To this end, NASA proactively completed a Draft Burial Treatment Plan specifying procedures to deal with an inadvertent discovery of human remains. Following an initial informational presentation of the Draft Burial Treatment Plan to the Hawai‘i Island Burial Council (Council) in April 2004, public burial notices were placed in local newspapers in early May and an amended Draft Plan was submitted to the Council. The plan was discussed at the Council meeting on August 19, 2004. The members of the Council expressed their general agreement with the procedures recommended in the Burial Treatment Plan for monitoring during the Outrigger Telescopes construction and for treating any human remains uncovered during construction. Because no actual burials are as yet known to be present, the Council took no action actually approving the plan or its procedures, concluding that this would be beyond its purview at this time. In addition, a qualified Archaeologist would be present during all excavation activities.

Response to Comment D:

NASA is the nation's civil space agency, established by the National Air and Space Act of 1958 (Pub. L. No. 85-568, As Amended). NASA space missions and related research programs are conducted for peaceful, scientific purposes. NASA and the Department of Defense (DoD) may at times have a common interest in the development of a particular technology. However, the only objectives of the Outrigger Telescopes Project are to develop the technique of interferometry and use it to expand our knowledge of the cosmos.

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No decision will be made until the National Environmental Policy Act process has been completed. NASA’s decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment E:

NASA interviewed a number of contemporary religious practitioners (See Section 3.1.2.5). NASA believes that the Outrigger Telescopes Project would not substantially interfere with access, affect known shrines or other archaeological sites, or otherwise burden Native Hawaiian practices.

Response to Comment F:

NASA determined where the impact of the past, present, and reasonably foreseeable activities occurs for each of the resources areas in the cumulative impact analysis. This defined the geographic boundary or region of influence for that resource area.

Response to Comment G:

As discussed in the Environmental Justice section of the EIS, the impact of human health and environmental effects of the Proposed Action on minority and low income communities ranges from very small to negligible (see Section 4.1.13).

Response to Comment H:

The Outrigger Telescopes Project EIS acknowledges that the overall cumulative impact of all past, present and reasonably foreseeable activities is substantial, adverse and significant, and that the Outrigger Telescopes Project would add a small incremental impact. However, the Outrigger Telescopes Project is taking a number of mitigation measures to ensure that the incremental impact is as small as possible.

The Outrigger Telescopes Project is separate and independent from any reasonably foreseeable development on Mauna Kea. All future proposed projects on Mauna Kea would be subject to the terms and conditions of the June 2000 Mauna Kea Science Reserve Master Plan and state compliance requirements including the Conservation District Use Permitting process.

To:
Dr. Carl B. Pilcher; Office of Space Science
Code SZ;
NASA Headquarters
300 E Street SW
Washington, D.C. 2054(

Re:
My comments at the hearing about Mauna Kea on the Island of Hawai`i,
at the Japanese Chamber of Commerce Building
Honolulu, Hawai`i
September 2, 2004.

Aloha Kakou,

THEY HANG THE MAN AND FLOG THE WOMAN
THAT STEAL THE GOOSE FROM OFF THE COMMON
BUT LET THE GREATER VILLAIN LOOSE
THAT STEALS THE COMMON FROM THE GOOSE.

Folk poem, circa 1764

The "enclosure movement" happened in 18th-century England, from whence sprung this folk poem. Back then, with the blessing of parliament, the dukes and barons of the aristrocracy suddenly laid claim to the forests, meadows, wild game, and other resources that, up till then, ALL had shared. (And the peasantry had literally relied on the commons for sustenance.) The aristocracy actually enclosed these commons in order for them ro become the private property of the elites.

Mauna Kea is a sacred "common" from Ke Akua, Na akua and Na `aumakua for the people of the Hawaiian Nation.. As such, Mauna Kea should never have been "enclosed". in the first place. But "enclosed" it is, and worse yet, built upon and desecrated..

And who are these greater villains who steal the common?
For more than 30 years hasn't the University of Hawaii been one?
The DLNR (BLNR) is one.
The University of Hawai`i Institute for Astronomy is one.
The legislature of the state of Hawai`i is one.
The government of the overall United States nation is one.

And all those other governments of the world who pay a paltry $1.00 (one dollar) per year to utilize and desecrate our `aina are others. A

Should all these ones who have enclosed the common be allowed to continue to "steal the common from the goose."?

Any more building of any kind on Mauna Kea is unacceptable. It is not acceptable for many more reasons than this over-arching one - that sacred Mauna Kea is part of the commons..Those other important reasons have been or will be touched upon in more depth by others at this hearing I'm sure. So let me end my contribution to this evening with this thought: B

I strongly urge everyone here to read Lester R. Brown's book,

PLAN B
RESCUING A PLANET UNDER STRESS
AND A CIVILIZATION IN TROUBLE

<www.earth-policy.org>

It has immense relevance to all of us at this time of urgency and will perhaps help some of us to realize whether our priorities should really be in outer space.

For more about The Commons, a very good website is:

<http://www.bollier.org/reclaim.htm>

It is the website of David Bollier, author of

Silent Theft: The Private Plunder of Our Common Wealth

Respectfully submitted by:
Ann Ku`uleinani Snyder
1969 BA Anthropology U.H.Manoa Phi Beta Kappa, Phi Kappa Phi
1976 AS Aviation Maintenance Technology Honolulu Comm. College
1994 -97 studied toward degree in Hawaiian Studies U. H. Hilo

Ann Ku‘uleinani Snyder
September 2, 2004

Response to Comment A:

NASA has no jurisdiction over this matter. This is a matter for the State of Hawai‘i.

Response to Comment B:

Your comments are respectfully noted.

Date: 29 Sep 2004
From: Ku`uleinani Snyder
To: otpeis@nasa.gov
Subject: No Further Development on Mauna Kea

Dr. Carl Pilcher
Office of Space Science NASA Headquarters 300 E Street SW
Washington DC,

Dear Dr. Pilcher,

First, it is necessary to realize that Ke Akua, the Creator, provides the means for us to develop our thinking powers to include empathy for all things on our planet. Ke Akua need not be pursued by earthings with their telescopes just to find out how things developed/are developing in the universe. It is as if we are trying to "catch" Ke Akua in the act! This is not pono. Let's concentrate our powers of thought and research on the many problems here on earth. This is where I believe the Creator, Ke Akua, intends our mental powers to be applied

Therefore, I am writing to express my strong opposition to NASA's proposed development on the summit of Mauna Kea on Hawai‘i Island. The summit region-- which already supports 24 telescope installations--is profoundly sacred to the Native Hawaiian people. The sanctity of the seriously compromised summit region should not be further violated. **A**

NASA's Draft EIS has identified the Canary Islands as a suitable site for the six new telescopes for the Keck Observatory. If you feel you just MUST proceed, please spare the already seriously compromised summit of Mauna Kea and select the acceptable alternative on which to build. **B**

I am completely opposed to any additional facilities being built on the sacred summit of Mauna Kea. **C**

Sincerely,

Ku`uleinani Snyder

Ku‘uleinani Snyder
September 29, 2004

Response to Comment A:

NASA acknowledges in the EIS that Mauna Kea has always been considered a sacred place by Native Hawaiians.

Response to Comment B:

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No final decision will be made until the National Environmental Policy Act process has been completed. NASA’s decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA’s final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

Response to Comment C:

Your comment is respectfully noted.

From: Maureen O'Dea Spencer

To: otpeis@nasa.gov

Subject: Letter re Mauna Kea, restrict development

Date: Sat, 25 Sep 2004

to: Dr. Carl Pilcher

re: Mauna Kea

Dear Dr. Pilcher,

I have sent a copy of a form letter to you through KAHEA, to express my wishes that no further development be done on Mauna Kea. The letter best explains the reasons this mountain is sacred to our Hawaiian culture. We are not protesting the fact there are already observatories on the mountain. We are asking that no further expansions be performed, including the current push by NASA for further development.

Oia'i'o (Sincerely),

Maureen O'Dea Spencer

Maureen O'Dea Spencer
September 25, 2004

Your comments are respectfully noted. Please see the responses to Charlene Avallone's comment letter with regard to your form letter.

AHAHUI KU MAUNA

C/O Edward G. Stevens
76-6335 Leone Street
Kailua Kona, HI 96740

September 30, 2004

Dr. Carl B. Pilcher
Science Mission Directorate
NASA Headquarters
300 E. Street, SW
Washington, DC 20546-0001

SUBJECT: Draft Environmental Impact Statement for the Outrigger Telescopes Project, Mauna Kea Science Reserve, Island of Hawai'i

Dear Dr. Pilcher:

Thank you for inviting Ahahui Ku Mauna to comment on the Draft Environmental Impact Statement prepared by NASA. After public comments made at the earlier Draft "EA" meetings, and the most recent Draft "EIS" meetings, we feel all that needs to be said has already been said and put on record. There is one exception, however, where we emphasize our disagreement with all sections of the Draft EIS that make references to the cumulative impact of the Outrigger Project to the cultural resources on Mauna Kea as being "substantial and adverse," yet goes on to say the addition of the Outrigger Telescopes to the two Keck Observatories "would have a small incremental impact." This is contradictory, as we feel impacting one part, however small, would have a cumulative adverse impact on the entire mountain. A

In regards to all comments received and recorded by NASA during both the "EA" and "EIS" meetings, Ahahui Ku Mauna wishes to add our support in principle, to the "EA" document commentary as submitted by the Royal Order of Kamehameha, dated February 16, 2004. We feel this is still a valid document and should be included with comments gathered in the EIS process. B

Finally, in conclusion, we urge NASA to consider the "NO ACTION ALTERNATIVE" for Mauna Kea, and shift your efforts instead towards an Outrigger Telescope site in the next best site identified as the Canary Islands. Thank you, once again, for giving us this opportunity to offer our comments. C

Very truly yours,

Ed Stevens

Ed Stevens
For Ahahui Ku Mauna

Copy to: Office Of Mauna Kea Management

Edward Stevens
Ahahui Ku Mauna
September 30, 2004

Response to Comment A:

From a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on cultural resources is substantial, adverse, and significant. The format for the cumulative impacts analysis was derived from and is consistent with the definition of cumulative impacts found in Council of Environmental Quality (CEQ) guidance. CEQ defines cumulative impacts as the incremental environmental impacts of the action when added to other "past, present, and reasonably foreseeable future actions. . ." (See 40 CFR 1508.7). It is therefore appropriate to evaluate both the incremental impact of the Proposed Action (See Section 4.1) as well as the impact of past, present, and reasonably foreseeable future activities (See Section 4.2). Cumulative impacts are the combination of all these (See Section 4.2).

Response to Comment B:

Your comment is respectfully noted.

Response to Comment C:

NASA is giving full consideration to reasonable alternative sites that meet the Outrigger Telescopes Project's technical and programmatic requirements (*i.e.*, the Gran Telescopio Canarias site on the island of La Palma in the Canary Islands, Spain), as well as the Reduced Science Option and the No-Action Alternative. See Section 2.2 of the EIS for a description of the considered alternatives.

NASA has not made a final decision about a site for the Outrigger Telescopes Project. No final decision will be made until the National Environmental Policy Act process has been completed. NASA's decision on the proposed Project will be presented in a Record of Decision (ROD). Present plans anticipate that the ROD will be issued in early 2005.

NASA's final decision on a site for the Outrigger Telescopes Project, or even to go forward with the Project, will be based on many factors as described in Section 2.2 of the EIS. In addition to environmental impacts and effects on cultural resources, these factors include, but are not necessarily limited to, the observing quality of the site, the scientific capability of the telescope array including the large telescope(s), the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, and cost.

>Date: Thu, 16 Sep 2004
>From: Fred Stone
>Subject: Comments on Draft Keck Outrigger EIS
>To: otpeis@nasa.gov
>
>DATE: September 16, 2004
>
>
>To: Dr. Carl B. Pilcher at otpeis@nasa.gov
>
>From:
>
> Fred D. Stone, Ph.D.
>
>
>
>
>1. My written testimony submitted at the scoping hearings in Hilo and
>Waimea was not included in the draft EIS. A bulleted summary of
>testimony was included in the NASA web site without clear attribution.
>I feel this is a subversion of the process, and makes the EIS scoping
>process illegitimate. Testimony should be included in full in an
>Appendix to the final EIS.

A

>
>2. Figure 3-3, p. 3-22 is entitled "Wekiu Bug Habitat and Astronomy-
>Related Facilities", giving the false impression that it is showing
>KNOWN Wekiu Bug habitat. The key states: "Potential Cinder Cone
>Habitat. Wekiu bugs have been collected from . . ."
>
> This map is misleading to the point of presenting a FALSE view of
>the known Wekiu Bug distribution. The map is actually a portion of a
>geological map in which ALL cinder cones in the upper mountain slopes
>with an orange color are mis-represented as potential habitat. This
>potential distribution is NOT supported by the data.
>
> Only in the uppermost summit cones of Mauna Kea have Wekiu bugs
>been shown to have large numbers of reproducing individuals. These
>include Pu`u Wekiu, Pu`u Hau Oki and Pu`u Hau Kea. The Wekiu bug
>numbers in both Pu`u Wekiu and Pu`u Hau Oki have severely declined
>since the 1982 survey, leaving ONLY Pu`u Hau Kea with a relatively
>undisturbed habitat and high Wekiu bug numbers. NONE of the other
>cones surveyed in the Englund 2002 survey had high Wekiu bug numbers.
>
> In July, 2004 I met with Dr. Carl Pilcher and Kenneth Kumor and
>others and showed maps with the ACTUAL wekiu bug distributions based on

B

>all the past surveys. Dr. Pilcher stated that he would pursue having a
>professional GIS expert produce maps for the EIS. I was appalled to
>see that rather than this, there was only the misleading
>potential habitat map in the EIS.
>
>3. Cumulative impacts are required to include future impacts:
>
>Nowhere in the EIS is the future impact of global warming on the Wekiu
>Bug habitat addressed. Other recent studies have shown that global
>warming is causing the frost line to rise substantially in alpine
>areas. Over the period of the Keck Outrigger project, this will cause
>the potential Wekiu Bug habitat to be significantly diminished and
>focused on the upper cinder cones where the project is causing
>incremental damage. Additional impacts of summit telescope development
>added to the global warming effect substantially increase the potential
>impacts on the Wekiu habitat.
>
>For example, p. 3-24 states "Wekiu bugs have been found as low as
>3,572 m (11,715 ft) . . .".
>
>
>4. No analysis of returning the site to its pre-development state
>at the end of the lease.
>The General Lease (S-4191) issued to the university requires that items
>be removed before the lease termination, or be abandoned with prior
>approval from the BLNR. The Hawaii State Auditor noted that since the
>university has failed to remove remnants from abandoned facilities,
>"the Board (BLNR) may have to require security deposits for all
>existing telescope structures to assure that those structures and
>facilities will eventually be removed and summit restored to its
>pristine condition."
>
>The area of the summit ridge of Pu`u Hau Oki had extremely high Wekiu
>bug numbers in the 1982 survey. Over 30 feet of this ridge was removed
>during the Keck telescope construction, and deposited on the upper
>crater slopes, severely impacting both the upper ridge and the critical
>slope habitat of the Wekiu bug. Additional severe impact was done to
>Pu`u Hau Oki during construction of the Subaru Telescope, with
>excavated material dumped in the crater bottom and leveled and
>compacted. Part of this leveled and compacted area is included as
>Wekiu bug "habitat restoration".
>
>5. Chap. 3, pp 3-21
>
> "The 1997/98 trapping data indicated that Wekiu bugs occurred in
>greater numbers in previously disturbed areas where habitat appears to

B

C

D

E

>have recovered." The Wekiu numbers collected in the 1997/98 survey
>were extremely low-a total of only 47 individuals for the entire study.
>There is not sufficient evidence to support the above statement. On
>the contrary, in 2002, high populations of the Wekiu bug were found in
>the undisturbed neighboring cinder cone Pu`u Hau Kea, indicating the
>OPPOSITE, that disturbed areas continued to have depressed Wekiu
>populations.
>
>There is still no or very little data on Wekiu bug life cycles,
>reproduction rates, behavior, movement, and distribution. It is
>premature to make conclusions about Wekiu bug populations in the
>absence of this basic information about the bug. Drastic fluctuations
>in the numbers of Wekiu bug captured in traps from day to day and
>season to season point out the lack of understanding of Wekiu bug
>behavior and the difficulty of drawing conclusions about population
>sizes.

E

>
>6. Statements on Chap 3-44 incorrectly imply that studies have been
>conducted on the preferences of Wekiu bugs for certain sizes of
>tephra. On the contrary, NONE of the past studies has examined in any
>detail the issues of critical depth of cinder for Wekiu bug survival,
>the minimum and maximum size of cinder necessary, the relation of Wekiu
>bug reproductive needs to habitat characteristics, the foraging
>capability of the Wekiu bug to habitat or the critical habitat for
>Wekiu bug survival at night or during inclement weather when it is NOT
>foraging. Habitat characteristics were included in some studies, but
>in a purely descriptive manner rather than with statistically valid
>comparisons using controls.

F

>
>7. On page 4-13 it states "In summary, mitigation measures . . .
>would make potential impacts to Wekiu bugs and their habitat small."
>This is speculation, and is not supported by any experimental evidence.
>
>8. Page 4-16, it states "A key element of the Wekiu Bug Mitigation
>Plan is restoration of Wekiu bug habitat." None of the mitigation
>measures discussed actually restores any habitat to its original state.
>The measures proposed are for untested artificial habitat. The depth
>and size of cinders proposed for the "restoration habitat" are based on
>observations that have not been subjected to controlled testing.
>
> It is stated that "The habitat restoration portion of this plan
>has been developed in conjunction with the USFWS and other scientists
>familiar with Wekiu bug ecology . . .". This statement is not
>substantiated by reference to specific scientists and studies. On the
>contrary, testimony by scientists at the Outrigger CDUA Contested Case
>Hearing in 2003-4 directly contradicted this statement.

G

Fred D. Stone, Ph.D.
September 16, 2004

Response to Comment A:

Summaries of the oral scoping comments made at the public scoping meetings are provided in Acrobat® format at http://www2.keck.hawaii.edu/. Comments were summarized and not attributed to facilitate responding and protect individual privacy.

Response to Comment B:

Figure 3-3 of the EIS is intended to provide the reader with a general idea of the potential *cinder cone* habitats on Mauna Kea. The figure legend and caption have been modified to reflect this more precisely. Studies have reported that Wēkiu bugs apparently prefer habitats comprising accumulations of loose cinders and tephra rocks where interstitial spaces are large enough to allow the insects to migrate downward (Howarth and Stone 1982, Howarth and others 1999, Englund and others 2002). These substrate characteristics can be found on the cinder cones that appear as orange on the figure. A 1997/98 arthropod assessment described the cinder cones in Figure 3-3 as "Potential Wēkiu bug habitats" (Howarth and others 1999). Wēkiu bugs have also been collected in habitats with other characteristics not shown on Figure 3-3 (Howarth and Stone 1982). While the highest trap capture rates have been measured on the *Summit Area Cinder Cones*, Wēkiu bugs have been observed on several of the other cinder cones listed in the figure legend. Thus, these cinder cones represent habitat. Thorough sampling of many of the outlying cinder cones is not complete.

Response to Comment C:

The possible impacts of global warming (*i.e.*, climate change and changing weather patterns) are identified as a potential contributing factor resulting in the decline in Wēkiu bug trap capture rates measured between 1982 and 1999. Decreasing availability and persistence of snow could potentially have detrimental impacts on Wēkiu bug distribution and abundance. Whatever the effects of climate change on Wēkiu bug populations, the incremental impact of Outrigger Telescopes construction on Wēkiu bug habitat would be small. The amount of habitat that would be disturbed by the proposed Outrigger Telescopes construction is a small fraction of the amount of potential habitat available on the *Summit Area Cinder Cones*, and habitat restoration may actually increase the amount of habitat on Pu‘u Hau‘oki.

Response to Comment D:

The End of Lease event in 2033 could result in a variety of outcomes. The State of Hawai‘i, through its Board of Land and Natural Resources and the University of Hawai‘i, will decide upon a course of action at the expiration of this lease. The potential impacts associated with the decommissioning and demolition of the observatories on Mauna Kea are addressed in Section 4.2.15.2 of the EIS.

Response to Comment E:

The results about greater trap capture rates in disturbed habitats were reported in the 1997/98 arthropod assessment (Howarth and others 1999). That report stated "The odds of finding a Wēkiu bug in disturbed habitat was estimated to be 2.7 times greater than finding a Wēkiu bug in an undisturbed habitat." The report goes on to say "The highest trap capture rates occurred in Pu‘u Hau‘oki, where inner crater walls and the crater bottom have been modified by observatory

construction activity." The conclusion is supported by more recent data collected during Wēkiu Bug Baseline Monitoring. In the 2nd quarter 2003 monitoring session, capture rates in Pu'u Hau'oki reached about 90 Wēkiu bugs per trap per 3-days. This is approaching the rate measured in 1982 (105 WB per trap per 3 days) and is more than double the highest trap capture rate measured on Pu'u Hau Kea in 2001 (35 WB per trap per 3 days).

Over the past three years substantial new information on Wēkiu bug life cycle, behavior, and distribution has been collected through studies funded by Office of Mauna Kea Management (OMKM) and through Wēkiu Bug Baseline Monitoring funded by California Association for Research in Astronomy (CARA). For example, information collected during Wēkiu Bug Baseline Monitoring has been shown that Wēkiu bug trap capture rates (a measure of movement and behavior) change with temperature. In addition, new information about Wēkiu bug distribution has been collected by Englund and others (2002), establishing a new lower boundary for this insect's habitat. Much of this information has been presented in the form of reports. Articles for professional journals are also being prepared that will present the information to the scientific community through a peer review process.

The analyses provided in the EIS are based on the best available scientific information. If the Outrigger Telescopes Project goes forward on Mauna Kea, NASA will fund a Wēkiu Bug autecology study to gather more information about habitat requirements, life cycle, nutritional requirements, and breeding behavior of this unique bug.

Response to Comment F:

The text was removed. While no controlled studies have been conducted on the size and depth of cinder substrate preferred by Wēkiu bugs have been conducted, all studies of this insect indicate that the highest trap capture rates occur in loose accumulations of cinder where interstitial spaces are large enough to allow the insects to migrate downward to moisture and shelter (Howarth and Stone 1982; Howarth and others 1999; Englund and others 2002).

The restoration protocol was reviewed by a group of experts that comprise the Office of Mauna Kea Management Wēkiu Bug Scientific Advisory Committee (OMKM WBSAC). After several meetings, the last held on December 9, 2004, the OMKM WBSAC recommended that the cinder size used for habitat restoration be increased to one inch or larger. As a result of the recommendations from the committee, modifications may be made to the habitat restoration protocol.

Response to Comment G:

The mitigation measures were reviewed and approved by the U.S. Fish and Wildlife Service (USFWS) and follow all the recommendations given in previous Mauna Kea Science Reserve arthropod assessments (Howarth and Stone 1982; Howarth and others 1999).

In a letter regarding the Wēkiu Bug Mitigation Plan for the W.M. Keck Observatory, Outrigger Telescopes Project at Mauna Kea, the USFWS states "The Service [USFWS] supports the recommendations in the WBMP [Wēkiu Bug Mitigation Plan] to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor

use. . . We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to the wekiu bug habitat." See Volume II, Appendix A, for the letter from USFWS/Henson (USFWS 2000).

The U.S. Department of Interior (USDOI) submitted a comment letter on the DEIS stating "It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wēkiu Bug Mitigation Plan and the Wēkiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities." See the USDOI comment letter from Patricia Sanderson Port located in this Appendix.

In addition, the USDOI letter states "These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology."

OMKM
Office of Mauna Kea Management

University of Hawai'i at Hilo
640 N. A'ohoku Place, Room 203, Hilo, Hawai'i 96720
Telephone (808) 933-0734 Facsimile (808) 933-3208
Mailing Address: 200 W. Kawili Street, Hilo, Hawai'i 96720

September 30, 2004

Dr. Carl B. Pilcher
Science Mission Directorate
NASA Headquarters
300 E. Street, SW
Washington, D.C. 20546-0001

SUBJECT: Draft Environmental Impact Statement for the Outrigger Telescopes Project, Mauna Kea Science Reserve, Island of Hawai'i

Dear Dr. Pilcher:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement (DEIS) for the Outrigger Telescopes Project. The following comments reflect the views of the Mauna Kea Management Board, MKMB functional committees, and the *Office of Mauna Kea Management.*

Cumulative Impact

DEIS states:

"...From a cumulative perspective, the impact to cultural resources on Mauna Kea is substantial and adverse. The addition of the Outrigger Telescopes to the existing observatories on the mountain would have a small incremental *impact*"

From a western perspective the above conclusion may seem reasonable. However, from the Native Hawaiian perspective, this statement is believed to be contradictory in its conclusion. This cultural landscape has been determined to be eligible for the National and State Register of Historic Places, under multiple criteria including cultural significance to the Native Hawaiian people (cf. letter of D. Hibbard to R. Evans, September 12, 1991). As a result archeologists with the Department of Land and Natural Resources, Historic Preservation Division have referred to the summit region of Mauna Kea as a "ritual landscape," with all of the individual parts contributing to the integrity of the whole summit region (pers. com P. McCoy and H. McEldowney; Group 70 meeting of September 10, 1998). In conclusion, impact one part you impact all. A

Impacts to Cultural Resources

- **Mitigation Measures**
  There remains broad concern in the community that the developer will have too much control over the cultural monitor and archeologist. Adding reassurances that the Kahu Ku Mauna Council shall play a greater role in selecting the cultural monitor and archeologist will help allay community concerns and suspicions. Further, NASA also must clearly state its commitment to the distribution of mitigations funds to the Office of Mauna Kea Management. B

  Specifically:
  - The Kahu Ku Mauna Council should be given the opportunity to recommend individuals for the positions of the cultural monitor and archeologist. The individuals that CARA hires must be approved by OMKM, or CARA can provide funding to OMKM to hire the individuals. In both cases, the selection of the individuals should be made subject to approval by the Kahu Ku Mauna Council. C
  - OMKM should be given direct oversight of the cultural monitor and archeologist. Direct oversight by OMKM over these individuals will minimize the perception of a conflict-of-interest resulting from the cultural monitor and archeologist reporting to CARA's construction manager. D
  - Kahu Ku Mauna Council shall be given the opportunity to review and OMKM will have the authority to approve the Cultural Monitoring Plan. E
  - The cultural monitor should be given authority similar to the archeologist to halt construction activity in a given area if he/she sees there is potential or real impact to the cultural resource. Equal status with the archeologist makes the statement that culture is as important as archeology. F
  - NASA must clearly state and provide reassurances that mitigation funds shall be given to OMKM to distribute to a group established by Native Hawaiians for the purpose of developing initiatives that will preserve and protect the cultural and natural resources of Mauna Kea, as well as benefit Native Hawaiians. G

  The Kahu Ku Mauna Council agrees in principle that OMKM, who consults with the Council on cultural issues, should play a greater role in selecting and overseeing the cultural monitor and archeologist. It is OMKM's role and responsibility to ensure protection and preservation of the cultural and natural resources of Mauna Kea. It is H

also responsible for preventing past practices detrimental to the mountain from occurring again. H

- **Project Boundary**
  To protect the areas outside the construction site, CARA must provide a boundary around the construction area. Construction workers will not be allowed to conduct work related, or recreational activities outside the construction area. I

Impacts to Natural Resources

- **Wekiu Bug Mitigation Plan**
  OMKM does not support the Wekiu Bug Mitigation Plan in its present form. The Plan was developed in 2001 and does not incorporate discussions since that time with other scientists including a representative from the U.S. Fish and Wildlife Service. One of the primary concerns of the Plan is the lack of control measures that will provide data for assessing the actual success (or failure) of the mitigation effort. There is also disagreement about assumptions in the Plan, such as cinder size, depth, and slope.

  OMKM upon consultation with the U.S. Fish Wildlife Service shall approve a habitat mitigation/restoration study that has input by a scientific review committee. This committee will be organized by the OMKM and will include, but not limited to, the individual or consultant hired by CARA, representatives from U.S. Fish and Wildlife Service, Bishop Museum and University of Hawai'i. In June 2004, members from the aforementioned organizations, including the entomologist hired by CARA to conduct quarterly wekiu bug monitoring surveys, met to discuss designing a methodology that would yield better information on habitat restoration efforts. J

- **Wekiu Bug Studies including Monitoring Plan**
  OMKM is pleased to learn that NASA is still committed to fund a graduate student to study "wekiu bug autecology and gather more data about habitat requirements, life cycle, nutritional requirements and breeding behaviors."

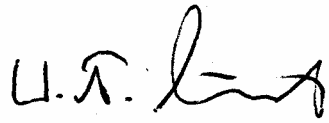
  However, for similar reasons cited above regarding community concern about oversight of the cultural monitor and archeologist by the developer, the individual hired by CARA to conduct wekiu bug studies and monitoring should report directly to OMKM. Further, this individual must consult with the scientific review committee organized by OMKM (described above under Wekiu Bug Mitigation Plan) regarding study and monitoring plans. Direct reporting to OMKM will not only allay community concerns about the developer having direct oversight over the K

CARA individual, but also because permits may be required to conduct studies within a conservation district. If permits are required, the University of Hawai'i (OMKM) will be held accountable for overseeing compliance with those permits. K

Recovery of Wekiu Bug Population
Page 3-21. There is debate among scientists regarding whether or not the bug's population has "apparently grown since 1998."

In closing, OMKM commends NASA for preparing an environmental impact statement. The OMKM thanks NASA again for the opportunity to comment on the DEIS.

Sincerely,



William T. Stormont
Director

William Stormont
Office of Mauna Kea Management
September 30, 2004

Response to Comment A:

The format for the cumulative impacts analysis was derived from and is consistent with the definition of cumulative impacts found in Council of Environmental Quality (CEQ) guidance. CEQ defines cumulative impacts as the incremental environmental impacts of the action when added to other "past, present, and reasonably foreseeable future actions. . ." (See 40 CFR 1508.7). It is therefore appropriate to evaluate both the incremental impact of the Proposed Action (See Section 4.1) as well as the impact of past, present, and reasonably foreseeable future activities (See Section 4.2). Cumulative impacts are the combination of all these (See Section 4.2).

Response to Comment B:

NASA acknowledges and supports Office of Mauna Kea Management's (OMKM) overall management of Mauna Kea. The $2 million in off-site mitigation funds shall be distributed administratively through the Office of Mauna Kea Management (OMKM).

If NASA decides to pursue the Proposed Action at the W.M. Keck Observatory site, NASA will ensure that Outrigger Telescopes Project complies with the conditions of the Conservation District Use Permit (CDUP). NASA recognizes that the State of Hawai'i Board of Land and Natural Resources has assigned the OMKM substantial management responsibilities as a condition of the CDUP.

Response to Comment C:

If NASA decides to pursue the Proposed Action at the W.M. Keck Observatory site, NASA will ensure that Outrigger Telescopes Project complies with the conditions of the CDUP. NASA recognizes that the State of Hawai'i Board of Land and Natural Resources has assigned the OMKM substantial management responsibilities as a condition of the CDUP.

Response to Comment D:

Please see Response to Comment C.

Response to Comment E:

Please see Response to Comment C.

Response to Comment F:

Please see Response to Comment C.

Response to Comment G:

Please see Response to Comment B.

Response to Comment H:

Please see Response to Comment C.

William Stormont
Office of Mauna Kea Management
September 30, 2004

Response to Comment I:

Construction workers will not engage in recreation during construction hours. CARA will use appropriate means to delineate the construction area and inform workers that work-related activities must be confined to that area.

Response to Comment J:

Modifications to mitigation planning are being considered. Further discussions are on-going regarding the control measures. Most areas of scientific disagreement have been resolved. Updated information is included from the Wēkiu Bug Scientific Data Review Committee (Wēkiu Bug Scientific Data Review Committee 2004).

Response to Comment K:

Please see Response to Comment C.

Paul M. Sullivan

October 2, 2004

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
NASA Headquarters
300 E Street SW
Washington, DC 20546-0001

Dear Dr. Pilcher:

On September 30, 2004 I sent you, by e-mail and by FAX, my comments on the Draft EIS for the Outrigger Telescopes Project. In those transmittals I said that I would send a hard copy by mail. I am enclosing that copy. I have taken the liberty of correcting some typographical and citation errors and editing a few places in the text that were redundant or unclear, so if your procedures permit it, I would ask that you replace the earlier version of my comments with this one.

Thank you for the opportunity to comment. The work being done on Mauna Kea is admirable and important. I wish you and all those involved in these projects the very best of success.

Aloha,

Paul M. Sullivan

Comments on NASA's Draft Environmental Impact Statement for the Outrigger Telescopes Project

by
Paul M. Sullivan

September 30, 2004

Disclaimer

The positions I take and the opinions I express in this document are my own. They do not necessarily reflect the positions or opinions of any of my employers or any organizations of which I am a member.

Introduction

My comments on the DEIS pertain to the sections on cultural resources and in particular, Sections 3.1.2, 4.1.1, 4.2.3 and 5.1.

My objections to the Draft EIS center on a number of terms which are central to the sections of the DEIS mentioned above. There is a Hawaiian proverb, *i ka olelo no ke ola, i ka olelo no ka make,* "in the word is life, in the word is death." Since the quality of the FEIS may determine the life or death of the preferred alternative, important terms used in the FEIS should be chosen and used with care. From a specifically legal point of view, as I noted in my earlier correspondence during the scoping process, the regulations of the Council on Environmental Quality provide, at 40 CFR § 1500.1, that "NEPA procedures must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA." The terms I address below are not used in the DEIS in such a way as to provide information of high quality. To ensure that the Final EIS meets the CEQ standard, the use of these terms should be adjusted to add clarity and precision. The terms to which I refer are "culture" and "cultural," "Native Hawaiian," and "oral history."

Prior Comments

In my February 16, 2004 comments during the scoping process, I recommended that NASA avoid using the words "culture" and "cultural" because these words have no broadly accepted and established meaning, or that if they must be used,

> they be always accompanied by an explanation of what the term means in the context in which it is used; for example, if the reference is to religious practice, or to economic or subsistence activities like fishing, or to artistic expression like hula or chant, the EIS should make that clear. When public input is sought, those who provide it should be asked to be specific about what they might mean by "culture" and "cultural" and should be informed that without such detail, their comments may not be given significant weight.

My recommendation was clearly not accepted for the DEIS, and the result is a survey of cultural resources which, in its treatment of Native Hawaiian cultural issues, provides little in the way of useful data or professional opinions for those who must decide on the proposed action.

Culture

For an excellent review of the history, use and abuse of the term "culture" I recommend Adam Kuper's superb 1999 book *Culture: The Anthropologist's Account.* Much of the following two paragraphs is derived from this work.

The word "culture" has an extraordinary number of meanings. In 1951, two distinguished anthropologists, Alfred Kroeber and Clyde Kluckhorn published a book entitled *Culture: A Critical Review of Concepts and Definitions* in which they gathered 164 different definitions of the word "culture."[1] The term has been defined very broadly as "that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society,"[2] as "patterns, explicit and implicit, of and for behavior acquired and transmitted by symbols,"[3] as "any socially inherited element in the life of man, material and spiritual."[4] It has been defined more narrowly as "a rather conventional ideal of individual refinement"[5] usually with respect to the arts, music, dance and other forms of expression, as "the best that has been known and said."[6] It has also been defined as the heritage of a group, particularly the elements traditionally emphasized by the humanists, "the spiritual possessions of a group," some of which are "intrinsically more valuable, more characteristic, more significant in a spiritual

---

[1] Adam Kuper, Culture: The Anthropologist's Account (1999) 56.
[2] Id.
[3] Id. at 58.
[4] Id. at 64.
[5] Id.
[6] Id. at 9

sense than most."[7] It has been called "civilization in so far as it embodies a national genius."[8] The grandest definitions almost escape any meaning at all; Max Weber defined it at one point as "the endowment of a finite segment of the meaningless infinity of events in the world with meaning and significance from the standpoint of human beings,"[9] and as "patterns, explicit and implicit, of and for behavior acquired and transmitted by symbols,"[10] and as "a set of symbolic devices for controlling behavior, extrasomatic sources of information."[11]

Culture also has a political side, sometimes a dark one. Concepts of culture have been used to justify Nazism and apartheit[12] and to support a wide variety of political agendas.[13]

So for the government official who must deal with a request for accommodation of cultural activity or cultural practices of an individual or a group, the word has so many meanings that it really has no meaning--no objective content--at all. It often has overtones, though, of religious practice or racial identity that implicate constitutional considerations. Because those overtones, too, are complex, emotionally charged and commonly misunderstood, the FEIS should use the triggering terms of "culture" and "cultural" only with precise and explanatory language.

The inherent problems with the terms "culture" and "cultural" are aggravated in the DEIS because the terms are sometimes used without specifying whether the reference is to ancient (precontact) Hawaiian society or to the religious or social activities of modern-day individuals or groups. These are very different. Sections 3.1.2, 4.1.1, 4.2.3 and 5.1 of the DEIS also give the impression that the precontact polytheistic religion still predominates among persons of Hawaiian ancestry. Common experience in Hawai'i suggests that this is not true. If NASA or its consultants have reason to believe otherwise, it would be helpful for the DEIS to provide some more specific data as to the numbers of people who share these beliefs and who will be affected by the proposed action.

Western contact brought dramatic, radical change to the Hawaiian islands and Hawaiians were as much agents as victims of these changes. Hawai'i's early kings and chiefs accomplished a near miracle in maintaining their nation's independence while guiding and shaping the chaotic forces which focused on the islands. It was Hawai'i's own native leaders who dispensed with the "old religion" of polytheism and human sacrifice even before the arrival of Christian missionaries in 1820.[14] A generation later, it was Hawai'i's

---

[7] Id. at 65.
[8] Id.
[9] Id. at 35.
[10] Id. at 58.
[11] Id. at 98.
[12] Id. at xii-xiii
[13] *See* Jeffrey Tobin, *Cultural Construction and Native Nationalism: Report from the Hawaiian Front*, Boundary 2 21:111-133 (Spring 1994); Roger M. Keesing, *Creating the Past: Custom and Identity in the Contemporary Pacific*, The Contemporary Pacific, Vol. 1, Nos. 1 & 2, Spring & Fall, 1989 19-42
[14] 1 KUYKENDALL, THE HAWAIIAN KINGDOM (1938) pp. 65-70.

own native leaders, drawing upon but not surrendering to their Western advisors, who replaced ancient forms of governance, land management, land ownership and many aspects of economic life with Western models.[15] By the time it passed into history, the Hawaiian kingdom was a constitutional monarchy in the Western style, with a racially mixed legislature, judiciary and Cabinet governing a multi-racial nation which was fully accepted as an equal in Western diplomatic circles and boasted a literate citizenry well-educated in Western as well as Hawaiian ways.[16]

One other vital influence on Hawaiian history since Western contact was an early and continued practice of intermarriage by Hawaiians with all the ethnic and racial groups which have made Hawai'i their home over the last two hundred years and more. Intermarriage brought a multitude of cultural influences into the cultures of Hawaiians and new arrivals alike.[17]

Indeed, "Native Hawaiians," as a group defined by race or ancestry,[18] cannot fairly be said to share today *any* common language, religion, economic regime, form of self-government or other unique group-identifying features except those of the United States and the State of Hawai'i as a whole; "they" are fully and completely integrated into the larger social and economic life of the state of Hawai'i and the nation. They hold positions of power and respect at all levels of society including business, government and the arts; for example, in the past several years, Hawai'i has had a Native Hawaiian Governor (John Waihee), a Native Hawaiian state supreme court chief justice (William S. Richardson), a U.S. Senator (Daniel Akaka) and numerous state officials and members of the state legislature.

So whatever form or forms the precontact Hawaiian "culture" took before Captain James Cook arrived in 1778, it cannot be said that it persists today as it existed either at Western contact or at any time before that.

There are, of course, specific areas of Hawai'i's modern artistic and governmental life which are associated with Hawaiian history and persons of Hawaiian ancestry, such as hula, chant, taro cultivation and the protection of historic sites. It is no doubt true that some Native Hawaiians, racially defined, engage in some or all of these activities, although as noted above, since "Native Hawaiians" are found throughout the society of the state and nation at all economic, social, educational and occupational levels, their "cultural practices" vary widely. Certainly, the "cultural practices" even of those seeking to recapture the remote past do not include such "practices" of ancient Hawaiian society as the draconian *kapu* system or human sacrifice; these were abandoned at the insistence of the Hawaiian rulers shortly *before* the arrival of Christian missionaries in 1820. Equally important is that fact that persons who are not of Hawaiian ancestry also engage in hula,

---

[15] *See generally* 1 KUYKENDALL, THE HAWAIIAN KINGDOM (1938), pp. 227-334; Paul M. Sullivan, *Customary Revolutions: The Law of Custom and the Conflict of Traditions in Hawaii*, 20 U. HAW. L. REV. 99 (1998) 112-117.

[16] *See generally* 3 KUYKENDALL, THE HAWAIIAN KINGDOM (1967).

[17] ELEANOR C. NORDYKE, THE PEOPLING OF HAWAII (2nd Ed. 1989), 33, 38-42.

[18] See the discussion of the term "Native Hawaiian" in the following section of these comments.

chant, taro cultivation and historic preservation and similar activities and on the other hand, many persons of Hawaiian ancestry do not engage in them.

Thus to the extent that there is a set of beliefs, values and practices which might be called "Hawaiian" today, it is not a thing of precontact Hawai'i, but a radically evolved blend of old and new, with the new predominating, and it is ignored by many persons of Hawaiian ancestry and embraced by many who have no Hawaiian ancestry at all.

The DEIS also implies a coherence of belief and attitudes among Native Hawaiians. This is inconsistent with the views of other knowledgeable observers. For example, the following statements by George S. Kanahele, a Hawaiian scholar and businessman, highlight the difficulty of identifying what is and is not "Hawaiian culture" today:

> These are the modern Hawaiians, a vastly different people from their ancient progenitors. Two centuries of enormous, almost cataclysmic change imposed from within and without have altered their conditions, outlooks, attitudes, and values. Although some traditional practices and beliefs have been retained, even these have been modified. In general, today's Hawaiians have little familiarity with the ancient culture.
>
> Not only are present-day Hawaiians a different people, they are also a very heterogeneous and amorphous group. While their ancestors once may have been unified politically, religiously, socially, and culturally, contemporaneous Hawaiians are highly differentiated in religion, education, occupation, politics, and even their claims to Hawáiian identity. Few commonalities bind them, although there is a continuous quest to find and develop stronger ties. In short, they are as diverse in their individual and collective character as any other ethnic population.[19]

Mr. Kanahele's observations support the point made above that the "culture" of today's Native Hawaiians is not unique to them, but is fundamentally the "culture" of the State of Hawai'i and the United States. Persons of Hawaiian ancestry do not, as a group or as several groups, exist apart from the larger community of the state and nation.[20]

---

[19] George Kanahele, *The New Hawaiians*, 29 SOCIAL PROCESS IN HAWAII 21 (1982),

[20] In his introduction to Eleanor Nordyke's comprehensive study of Hawai'i's various ethnic groups (see footnote 17 above), Robert C. Schmitt, Hawai'i's former State Statistician, noted an "erosion in the availability, quality, and meaningfulness of some of our most important [data] series." He observed:

> Budget cuts have forced drastic reductions in sample sizes used in the decennial censuses, the HHSP [Hawai'i Health Surveillance Program], and HVB [Hawai'i Visitors Bureau] Basic Data Survey. The 1950 census was the only such effort in the twentieth century to collect comprehensive data on race mixture, and in 1970 the Bureau of the Census deleted the category of "Part Hawaiian," which had appeared in all seventeen official enumerations from 1849 through 1960. As a result, the 1970 census was comparable neither to its predecessors nor to the birth, death, marriage, divorce, and related statistics regularly compiled by various state agencies. Further definitional changes occurred in 1980, with still others in prospect for 1990.

NASA should therefore conclude, and the FEIS should reflect, that as to "Native Hawaiians," "they" are "us"--Americans, like all the other varied Americans in the state and the nation, mostly with mixed racial or ethnic backgrounds and sharing in the freedom and diversity of lifestyles guaranteed under the U.S. Constitution. NASA should find, and the FEIS should reflect, consistent with the U.S. Supreme Court's decision in *Adarand*

> These cutbacks in statistical programs occurred at the very time that Hawai'i's population dynamics were becoming ever more complex, further complicating a situation that was already badly tangled twenty years earlier. **Interracial marriage and a growing population of mixed bloods had been characteristic of Hawai'i since at least the 1820's, but prior to World War II most of these unions and their issue could be conveniently classified as "Part Hawaiian." For the past half century, however, all groups have participated in such heterogeneous mating.** As a consequence, according the State Department of Health, 46.5 percent of the resident marriages occurring in Hawai'i in 1986 were interracial, and 60.6 percent of the babies born to civilian couples of known race that year were of mixed race. Based on tabulations from the HHSP, fully 31.2 percent of all persons living in households were of mixed parentage--19.9 percent Part Hawaiian and 11.3 percent of other origins. Yet neither the 1970 nor 1980 censuses provided any indication of such developments.
>
> These statistical gaps, in combination with the growing complexity of demographic events, have seriously handicapped Hawai'i's demographers. **Even such a fundamental (and ostensibly simple) question as "Which groups are growing, which are declining, and by how much?" can no longer be answered, even in the most approximate terms: shifting and often arbitrary racial definitions have rendered decennial census tabulations almost useless, and annual data from the HHSP, now our sole source of population estimates by detailed race, have been marred by high sampling variation and unexplainable (and sometimes unreasonable) fluctuations in group totals.** Calculation of accurate birth, death, and other rates has consequently become exceedingly problematic. These difficulties are especially daunting in a work like the present one, which relies to an uncommon degree on accurate, consistent, and meaningful ethnic statistics. It is a tribute to Eleanor Nordyke's skill and perseverance that, in the face of such intractable underlying data, she has been able to fashion any kind of reasonable and defensible conclusions.
>
> The importance of this analysis is underscored by the irresistible impact of the changes now sweeping Hawai'i. **Not only are the state's once-distinctive ethnic groups--under the influence of pervasive intermarriage--turning into a racial chop suey, but even those maintaining a fair degree of endogamy are becoming indistinguishable from their neighbors, as their third, fourth, and fifth generations succumb to cultural "haolefication."** These trends, plus the growing irrelevance of ethnic statistics, suggests that this may be our last chance to capture the significant differences among Hawai'i's people. When these differences can no longer be charted, either because the population has become biologically and culturally homogenized or because government no longer collects meaningful data, Hawai'i's value as a social laboratory will vanish.

Robert C. Schmitt, *Introduction to* ELEANOR NORDYKE, THE PEOPLING OF HAWAI'I xvi-xvii (1989). (Bolding added.)

Constructors v. Federico Pena,[21] that each person of Hawaiian ancestry deserves the same respectful consideration of requests for accommodation of personal religious, social and esthetic preferences, as any American of any race--but not more.

Native Hawaiian

It must be noted that all the definitions of "Native Hawaiian" in Federal law (including the National Historic Preservation Act, the Native American Graves Protection and Repatriation Act and other acts pertinent to this EIS) and the definitions of "Hawaiian" and "native Hawaiian" in the law of the state of Hawai'i are based on racial classifications, or as the U. S. Supreme Court put it in its decision in *Rice v. Cayetano*[22], ancestry used as a proxy for race.

The consequence of this is most apparent when a Federal or state agency considers giving special privileges or benefits to persons of Hawaiian ancestry based on that ancestry. The Supreme Court has not wholly prohibited race-conscious legislation, but it has accepted it only reluctantly, and only in circumstances of grave necessity. Such legislation is subject to "strict scrutiny;" that is, it must be justified by a "compelling interest" and be "narrowly tailored" in duration and effect to achieve its purpose.[23]

Beyond the issue of race, affording special privileges to any person or entity based solely on the duration of residence or the accident of birth raises constitutional issues of due process, the privileges and immunities clause (*see Saenz v. Roe*, 526 U.S. 489, 119 S.Ct. 1518 (1999); *Zobel v. Williams*, 457 U.S. 55, 102 S.Ct. 2309 (1982)), and the anti-nobility clauses (see, e.g., Jol A. Silversmith, *The "Missing Thirteenth Amendment": Constitutional Nonsense And Titles Of Nobility*, 8 S. Cal. Interdisciplinary L.J. 577, 609 (1999) ("We should remember that the nobility clauses were adopted because the founders were concerned not only about the bestowal of titles but also about an entire social system of superiority and inferiority, of habits of deference and condescension, of social rank, and political, cultural and economic privilege.")). The DEIS plainly offers special consideration only to one "culture"--one inextricably entwined with a racial classification. Unequal treatment based on ancestry risks constitutional challenge, and on a more fundamental human level, draws a stark racial line between the various groups with an interest in Mauna Kea.

At the end of these comments I have appended a political cartoon by Daryl Cagle. It deserves careful consideration before any decision is taken which would allocate governmental favor on the basis of race or ancestry.

---

[21] 515 U.S. 200 (1995).
[22] 528 U.S. 495 (2000).
[23] *See* Adarand Constructors v. Federico Pena, 515 U.S. 200, 115 S.Ct. 2097 (1995)

Oral History

It would appear that the descriptions of modern-day "Native Hawaiian culture" in the DEIS are drawn largely, and perhaps entirely, from the oral histories collected by Mr. Kepa Maly. The DEIS does not document the reliability of this information as a basis for decision-making by NASA or any other federal or state agency. It should be noted that Mr. Maly is listed on the Malama Mauna Kea web site[24] as a member of the Hawaiian Culture Committee of that organization. That site's description makes clear that the Committee is an advocacy organization for "the Hawaiian culture" as something distinct from, and perhaps opposed to, Western scientific culture.[25] The DEIS should disclose this and explain NASA's determination that Mr. Maly's role as an advocate presents no conflict with the objectivity which must necessarily underlie his role in the gathering, evaluation and presentation of cultural resource information for the DEIS.

There are other reasons to question oral histories. One of the most compelling comes from one of Hawai'i's earliest native historians, David Malo, who lived from about 1793 until 1853 and whose work "Hawaiian Antiquities"[26] is one of the very few contemporary records of Hawaiian society just before and after the arrival of Captain Cook in 1778. In the very first chapter of that work, Malo offers the following observations on the reliability of oral tradition:

> 4. Memory was the only means possessed by our ancestors of preserving historical knowledge; it served them in place of books and chronicles.
> 5. No doubt this fact explains the vagueness and uncertainty of the more ancient traditions, of which some are handed down correctly, but the great mass incorrectly. It is likely there is greater accuracy and less error in the traditions of a later date.
> 6. Faults of memory in part explain the contradictions that appear in the ancient traditions, for we know by experience that "the heart is the most deceitful of all things."
> 7. When traditions are carried in the memory it leads to contradictory versions. One set think the way they heard the story is the true version; another set thinks theirs is the truth; a third set very likely purposely falsify. Thus it comes to pass that the traditions are split up and made worthless.
> 8. The same cause no doubt produced contradictions in the genealogies (moo-kuauhau). The initial ancestor in one genealogy differed from that in another, the advocate of each genealogy claiming his own version to be the correct one. This

---

[24] http://www.malamamaunakea.org/site/hawaiianculture.php?article_id=14

[25] "The Hawaiian Culture committee has defined its objectives to include: developing Hawaiian programs that educate and preserve the Hawaiian culture; making Hawaiian program recommendations to the MKMB [the University of Hawai'i Hilo Mauna Kea Management Board] and assisting in implementation; integrating the foundation of Hawaiian culture into scientific education; and establishing a marriage between Hawaiian and Western scientific culture. (Philosophically, this committee agrees that since Hawaiian culture forms the foundation of these islands, Western culture should assimilate into Hawaiian culture.)"

[26] David Malo, Hawaiian Antiquities (Nathaniel Emerson, trans., 1951)

cause also operated in the same way in producing contradictions in the oral traditions; one party received the tradition in one way, another party received it in another way.

9. In regard to the worship of the gods, different people had different gods, and both the worship and the articles tabued differed the one from the other. Each man did what seemed to him right, thus causing disagreement and confusion..

10. The genealogies have many separate lines, each one different from the other, but running into each other. Some of the genealogies begin with Kumu-lipo as the initial point; others with Pali-ku; others with Lolo; still others with Pu-anue; and others with Ka-po-hihi. This is not like the genealogy from Adam, which is one unbroken line without any stems.[27]

This candid discussion of the fallibility of oral tradition casts doubt on the descriptions of "Native Hawaiian culture" in Sections 3.1.2, 4.1.1, 4.2.3 and 5.1 of the DEIS, which offer a picture of a single system of beliefs, practices and attitudes uniformly accepted throughout the range of persons of Hawaiian ancestry living today. According to Malo, the beliefs, practices and traditions of persons of Hawaiian ancestry varied widely even before Western contact.[28] It is hardly likely that there is any greater uniformity of beliefs, practices and attitudes today, not only because of the vastly greater range of lifestyles and attitudes among persons of Hawaiian ancestry[29] but because of the many other systems of values and beliefs represented in Hawai'i's contemporary society.[30]

Similar doubt arises when the DEIS is examined in light of the work of such academics as Jocelyn S. Linnekin[31] and Roger M. Keesing,[32] who explain how tradition and culture are not static but are redefined and even reinvented by each generation to meet social, political and other needs. The FEIS should explain how and why its static and simplistic view of "Native Hawaiian culture" is valid, or it should abandon that view altogether.

---

[27] Id. at 1-2.

[28] Malo's observations are supported by the descriptions of Hawaiian legends in Martha Beckwith's study of Hawaiian mythology which reflect, for example, the variations in the genealogies of the Hawaiian chiefly families. MARTHA BECKWITH, HAWAIIAN MYTHOLOGY 293-313 (1970).

[29] See George Kanahele's description of modern Hawaiians at footnote 19 above.

[30] *See generally* LAWRENCE FUCHS, HAWAII PONO: A SOCIAL HISTORY (1961) and ELEANOR C. NORDYKE, THE PEOPLING OF HAWAII (2nd Ed. 1989)

[31] *See, e.g.,* Jocelyn S. Linnekin, *Defining Tradition: Variations on the Hawaiian Identity,* 10 American Ethnologist No. 2, 241-252 (May 1983); JOCELYN LINNEKIN, CHILDREN OF THE LAND: EXCHANGE AND STATUS IN A HAWAIIAN COMMUNITY (1985).

[32] Roger M. Keesing, *Creating the Past: Custom and Identity in the Contemporary Pacific,* 1 THE CONTEMPORARY PACIFIC 19-42 (Vol. 1, Nos. 1 & 2, Spring & Fall, 1989)

Conclusion

The balancing of social forces which NASA and others must undertake in the course of developing Mauna Kea is a difficult task. It demands the best possible analysis of the legitimate claims of the various interested parties and individuals, and the most sensitive appreciation of the human desires and emotions involved. The DEIS description of the complex social and political tensions associated with "cultural resources" falls short of providing the thoughtful, comprehensive and balanced scholarship which is required. That deficiency should be corrected in the FEIS.

I enclose an item which may be of interest. It is an article by Scott Whitney from the September 2001 Honolulu Magazine. It illustrates in popular terms what Roger Keesing and Jocelyn Linnekin seem to be saying in a scholarly context. It concerns the term "'ohana." It is a useful reminder of the value of disciplined skepticism.

Aloha,

Paul M. Sullivan

Paul M. Sullivan
October 2, 2004

Mr. Sullivan's comments also included a cartoon illustration and an article by Scott Whitney from the September 2001 *Honolulu Magazine*. These submittals are not being reproduced because of copyright issues.

****

Response to Comment:

NASA's use of terminology throughout the EIS is consistent with the Council of Environmental Quality and the Advisory Council on Historic Preservation's guidance and standard practices in writing environmental documentation.

The EIS is based on the best available information. Your comments are respectfully noted and will be taken into consideration prior to the final decision.

Memorandum

To: Trustee Linda Dela Cruz

From: Jojo Tanimoto, Aide

Date: September 2, 2004

Re: NASA EIS

As you know, we view environmental impact statements with the "living Hawaiian" beneficiaries in mind. This EIS has made great strides in complying with the NAGPRA laws.

There are two concerns I would question:

1) PURPOSE AND NEED: (PAGE xxiii).
"NASA has a central Mission with three components:
1) to understand and protect our home planet,
2) to explore the universe and search for life,
3) to inspire the next generation of explorers.

To this end, I encouraged the Punana Leo O Kona preschool children *and their parents* to visit the Waimea facility and learn what this project is all about. I was committed to being a chaperone. The exercise was to encourage the parents to acquire better paying positions with this organization. To my dismay, they were given an appointment and then the appointment was cancelled. They tried to re-schedule and was denied. Later, the school term was over and did not re-schedule since.

I also encouraged a science major student to apply for a position with this institute. We had hopes that there would be some support system for Hawaiians trying to enter this field. Unfortunately, we knew he would not graduate for a couple of months and may not qualify for the position; but he tried. Today, he works in the hotel industry.

A

2) LAND USE AND EXISTING ACTIVITIES: (page xxi)
"***Most past, present, and reasonably foreseeable future activities*** on Mauna Kea have been consistent with State and local plans and compatible with State land use designations. The Outrigger Telescopes Project would have no incremental impact on land use."

In the past, the developers would negotiate fair market appraisal and then remove the material from the work site area for resale or distribution. The Archaeologist Responsibilities (page B-6) a) The Archaeologist will follow State Historic Preservation Division draft Hawaiian Administrative Rules for archaeological ***monitoring studies and reports***. Therefore, there seems no other method or authority to protect the sacred resources of Mauna Kea. **B**

The future, needs to include recognition that this mountain is a sacred shrine; not only in conversation, tourism print and by Hawaiians. Hawaiians need to be assured that the sacredness is not for sale unless determined so by the Hawaiian practicing beneficiaries. To this end, there is no address to removal of the sacred soil and other sacred resources when excavation takes place; only storage and holding areas. Perhaps this is due to conditions in "the lease" with DLNR and the University of Hawaii. However, it is time that this sacred shrine is given the acknowledgement it deserves. **C**

Submitted for your consideration.

Jojo Tanimoto
September 2, 2004

Response to Comment A:

NASA has called this to the attention of the Public Information and Outreach Officer at the California Association for Research in Astronomy.

Response to Comment B:

In addition to the Archaeologist, a Cultural Monitor will be on-site during construction of the Outrigger Telescopes if implemented on Mauna Kea.

Response to Comment C:

NASA has attempted to reflect in the EIS what it has been told about the spiritual significance of Mauna Kea to Native Hawaiians.

MIKE TEAGUE 8/25/2004

DEAR MR. PILCHER,

THANK YOU SO MUCH FOR YOUR PROMPT & COMPLETE MAILINGS.

I AM READING THEM CAREFULLY & WITH THE ATTENTION THEY DESERVE

I WAS LOOKING FORWARD TO THANKING YOU IN PERSON. HOWEVER, I'M NOT ABLE TO MAKE IT TO EITHER OF THE TWO PUBLIC MEETINGS HELD HERE ON THE BIG ISLAND. MY REASONS ARE TWO FOLD:

(1) NO FRIENDS TO SHARE THE DRIVE & MY PHYSICAL PAIN PROHIBITS ME FROM ALL BUT SUPPLY TRIPS.

(2) I ENJOY THE ILLUSION OF PRIVACY HERE AT H.U.V.E & HAVE NO WISH TO BE VIDEOTAPED.

I LOOK FORWARD TO MEETING YOU & YOUR LOVELY FAMILY AT SOME FUTURE DATE. DOES YOUR WORK EVER TAKE YOU TO AUSTRALIA?

Mike Teague

MIKE TEAGUE

Mine Teague
August 25, 2004

Thank you for your comments. Dr. Pilcher's work has not taken him to Australia.

Dear Dr. Pilcher

How would you like it if The Government put some kind of obseratory wherever you worship your God? Something that could be seen for a Hundred miles?

You folks don't care about Hawaii or don't try to understand Hawaiian history and culture or what it means to be Hawaiian, when people come to Hawaii and don't respect the history and culture of THIS PLACE, HAWAII. This is not just another place to plop your adventure, this is Hawaii - like no other place.

Every day we are polluted by something more from someplace else that doesn't belong here.

Please, you ask us to respect you, but you are coming to our home.

Kale Trembath.

A

To: DR. PILCHER Date 8/30/04

From: Charles (Chuck) Trembath

WHY WEREN'T THERE HEARINGS ON KAUAI? B

PEOPLE ON KAUAI WANT OUR ISLANDS CARED FOR.

WE DON'T LIKE OUR SACRED PLACES DEFACED.

HOW WOULD YOU LIKE YOUR TEMPLE OR ALTAR DEFACED.

HOW ABOUT SOME RESPECT

C. TREMBATH

Kale and Charles Trembath
August 30, 2004

Response to Comment A:

NASA has attempted to reflect in the EIS what they have been told about the spiritual significance of Mauna Kea to Native Hawaiians.

Response to Comment B:

NASA hosted six public meetings on the islands of Maui, Oahu, and Hawai‘i in an effort to receive a broad representation of oral comments. NASA also welcomed and requested written public comments from all concerned individuals and organizations regarding the proposed Outrigger Telescopes Project. To facilitate comments from people unable to attend the public meetings, hard copies of the Draft EIS were sent to each library within the Hawai‘i State Public Library System and Regional Libraries. The Draft EIS was also made available on the World Wide Web at http://www2.keck.hawaii.edu/.

September 27, 2004

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
NASA Headquarters
300 "E" Street SW
Washington, DC 20546-0001

Dear Dr. Pilcher:

We, the concerned faculty, staff and students of the University of Hawai'i at Mānoa, are united in our position in strong opposition to any further development on Mauna Kea. A

The development on Mauna Kea must stop immediately and permanently.

In addition to our opposition to any further development on Mauna Kea, we are also united in our position as academics and practitioners that the Draft Environmental Impact Statement (EIS) fails to adequately to describe the importance of Mauna Kea to the Native Hawaiian people. Mauna Kea is a place of unparalleled spiritual, cultural, historical and educational value. The Draft EIS fails to clearly emphasize these points. Furthermore, the Draft EIS fails to accurately articulate the immeasurable and irreparable damage any further development atop this most sacred site will cause the Native Hawaiian people.

Mauna Kea is the Native Hawaiian people's most sacred place. B

Mauna Kea is the piko (center) of the Native Hawaiian people's spiritual beliefs. Any development at this site is a desecration of sacred land. The existing facilities are symbols of the continuous violence committed against the Native people. A proposal for further development is akin to a proposal to tear down the Sistine Chapel to place a telescope in the Vatican. It is synonymous to a proposal to tear down George Washington's face off Mount Rushmore and replace it with a telescope. NASA would never have the audacity to make of these proposals, because of the disrespect and damage it would do to the Roman Catholic faith or the American culture. Yet, NASA somehow feels it appropriate to make sure a bold and insulting proposal when the spiritual and cultural resources destroyed are those of the Hawaiian people.

The Draft EIS fails to acknowledge the continuing importance of Mauna Kea by tempering its cultural analysis with events initiated by the arrival of Western settlers who have abused our natural resources of the last 300 years. (See Draft EIS, vii-viii.) The Draft EIS implies that the Native people were willing parties to the changes in "the relationship of the Native Hawaiians

with Mauna Kea" (Draft EIS, vii). This ignores the body of literature produced by Native Hawaiian scholars that uniformly illustrates how the Western culture was forced upon the Hawaiian people. Any changes to the relationship between the Native Hawaiian people and Mauna Kea post-contact were the direct result of colonization. Any assertion otherwise is both inaccurate and insulting. We find particularly offensive the assertion made in the Draft EIS: "The knowledge that the Outrigger Telescopes would provide would increase human understanding of the universe in the tradition of the great Hawaiian navigators." (Draft EIS, ix). We feel that the only "tradition" this project continues is the Western tradition of colonization through the theft and abuse of the Native Hawaiian people's natural resources. B

Mauna Kea is an incomparable historical and educational resource.

For over two hundred years, the Native Hawaiian people have resisted the Western world that has been thrust upon us. In the last few decades, we have begun to rebuild ourselves as a population of indigenous people and as a culture. The further development of Mauna Kea will ensure the destruction of historical and educational resources critical to the perpetuation of Native Hawaiian knowledge. The further destruction of Mauna Kea is like burning down the National Archives and all its contents. NASA admits, "Mauna Kea has a rich traditional history and many archaeological sites, including some that have yet to be discovered." (Draft EIS, xx). Yet, NASA proposed to destroyed those undiscovered educational and historical resources.

NASA admits in the Draft EIS that "past and present activities on Mauna Kea have substantially and adversely impacted cultural resources." (Draft EIS, 4-69). The mitigation measures proposed are simply insufficient. (Draft EIS, 4-70). Consultation and cultural monitoring will not protect this most sacred place, therefore must be no more development on Mauna Kea. The Draft EIS even admits: "Even with all the mitigation measures discussed above, from a cumulative perspective, the potential impacts of reasonably foreseeable future activities are anticipated to be adverse and substantial." (Draft EIS, 4-70). For these reasons, this project must not be approved.

We disagree with the statement in the Draft EIS that argues that the Outrigger Telescopes project would have a small incremental impact on Mauna Kea's cultural resources. The Draft EIS states: "From a cumulative perspective, the impact of part, present, and reasonably foreseeable future activities on cultural resources on Mauna Kea is substantial and adverse. The addition of the Outrigger Telescopes would have a small incremental impact." (Draft EIS, 4-71). NASA is proposing to build and operate up to six telescopes. Any argument that proposed that this would have "a small incremental impact" is simply absurd.

According to the University of Hawai'i's Institute of Astronomy, there are already thirteen telescopes on Mauna Kea: nine optical/infrared telescopes, three submillimeter telescopes and one radio telescope. (Available at: http://www.ifa.hawaii.edu/mko/telescope_table.htm) Enough is enough. Mauna Kea is a finite resource that has already been over abused by Western development. NASA's needs can be met by developing this project at one of the alternative sites. Mauna Kea is invaluable to the Native Hawaiian people. What Mauna Kea gives the Native Hawaiian people cannot be found anywhere else in the world. And once destroyed, it can never be replaced.

We are strongly opposed to any further development on the sacred lands of Mauna Kea.

'A'ole e wāwahi 'ia ka 'āina a me ka honua no ka pono o na hōkū.
(We must not destroy the earth in pursuit of the stars.)

Signed,

Signature	Printed Name	Address
	N. Meharnaokala Hind	
	Aaron J. Silo	
	TINO RAMIREZ	
	Lisa N. Pai	
	Alapaki Luke	
	Dale J. Laber	
	REUNITAE JULIANO	
	Keali'i 'olu'olu Gora	
	Kahi Brooks	

Signature	Printed Name	Address
	Smayna Nadani Dabs-Tom	
	Carlos Anderson	
	Leialii Manoi	
	Michelle Lazo	
	Scott Kikiloi	
	Mildred L. Spencer	
	Kahiau Wallace	
	Wendell W. Perry Jr.	
	Kenai Keliikuli	
	April A.H. Drexel	
	Mālia Kaāihue	
	Pualani Kauila	
	Shane Cobb-Adams	

Signature	Printed Name	Address
	Kāiulani Akamine	
	Keoni Kuoha	
	Lilikalā Kamakeiliwa	
	LUFI A. LUTERU	
	Tiosha K. Watson	
	Levon Ohai	
	S. Nani Espinda	

Concerned Faculty, Staff, and Students of the University of Hawai‘i at Mānoa
September 27, 2004

Response to Comment A:

Your comments are respectfully noted.

Response to Comment B:

NASA attempted to reflect in the EIS what it has been told about the spiritual significance of Mauna Kea to Native Hawaiians.

Date: September 2, 2004

To: The National Aeronautics and Space Administration

From: Theone Vredenburg

Subject: Structures on the Summit of Mauna Kea, State of Hawaii

Observation: Unlike the other glaring white structures on the summit of Mauna Kea, the Japanese (Subaru) telescope appears (from Waimea/Kamuela) more as a part of the mountain; a natural formation; a tall, dark gray, rock-like form.

Explanation: The telescope is surrounded by dark metal mesh.

Request: NASA's efforts toward a requirement that all structures currently on or planned for the summit of Mauna Kea be so-camouflaged.

Reason: The glaring white structures, presently on the mountain, are extremely offensive to us because they not only deface a particularly beautiful and beloved part of our islands but they are constant reminders of the disregard in which we are held in this matter.

Theone Vredenburg

Theone Vredenburg
September 2, 2004

For an observatory to take advantage of the excellent atmospheric “seeing” at a site such as Mauna Kea, the air temperature within its building enclosure must be carefully controlled. The standard method of control is making the enclosure reflective, either by painting it white or covering it with an aluminized reflective coating. Although other approaches to thermal control have been studied, these alternative technologies are still experimental and not as mature as reflective approaches.

Subaru's appearance from lower elevations such as Waimea is due to the combination of its shape and reflective aluminum surface covering. It can appear dull grey for much of the day, but can also appear extremely bright owing to reflection of sunlight, particularly around sunrise and sunset.

NASA acknowledges in the EIS that the cumulative visual impact from past, present, and reasonably foreseeable future activities is substantial.

Date: Wed, 29 Sep 2004 15:31:42 +0900
From: Deborah Ward [redacted]
Subject: Ward response to Outrigger EIS
To: otpeis@nasa.gov
X-Accept-Language: en
X-Virus-Scanned: by NASA Headquarters Spam Firewall at mail.hq.nasa.gov

Aloha Carl,
I am in Katherine in Australia's Northern Territory, and due to a power surge, the computers in Katherine are experiencing difficulties. I have saved the last and final version of my letter as a Word document, hope you can use it as an email, as I have not been able to find a way to print it today.
Best wishes, Deborah Ward

Ward response to Outr#B1F1A.doc

September 29, 2004

Dr. Carl B. Pilcher;
Office of Space Science, Code SZ;
NASA Headquarters; 300 E Street, SW;
Washington, DC 20546-0001.

otpeis@nasa.gov or by facsimile at 202-358-3096.

Dear Dr. Pilcher,

I am an appointed member of the OMKM Management Board's Environment Committee, and member of the Sierra Club Hawaii Chapter's Conservation Committee and have participated in the State of Hawaii DLNR CDUA Contested Case Hearing.I presented oral and written testimony at the scoping pre-hearings and hearings.

I have reviewed the web version of the draft EIS for the Keck Outrigger Telescopes. I do not know if the testimony presented during the Scoping process was appended to the Draft, but since the materials presented contained pertinent and substantive data not contained in the draft, I would request that a complete compilation of these materials be attached to the final EIS. These materials included the Findings of Fact and Exceptions for the Contested Case Hearing held on the Conservation District Use Application for the Keck Outrigger Telescopes. Written testimony submitted at the public hearings should be appended and attributed to the speaker, as should the maps and data available from the USFWS/OMKM Wekiu Bug advisory committee, as described to you in detail by Dr. Fred Stone at your request. **A**

> On page xix, the draft states that "The Council on Environmental Quality NEPA implementing regulations define cumulative impacts as the incremental impacts of action when added to other past, present and reasonable foreseeable future actions regardless of what agency ...undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over time. "
>
> On page xx, it states that 'the impact of reasonably foreseeable future activities to the biological resources is likely to be moderate to substantial, and overall the cumulative impact is adverse and significant.'
>
> On page xx the Draft states "The incremental impact of the OTP is small and insignificant. Further, on balance, the Project's impact is likely to be beneficial to biological resources."

These statements are contradictory and not substantiated by any evidence. On the contrary, the highest quality of extant habitat for wekiu bug, which is the upper reaches and slopes of the summit cones, will be directly impacted by telescope construction, by tunneling and displacement of over a hundred cubic yards of cinder. Any attempt to **B**

create artificial habitat to replace the habitat damaged is based on speculation, as no biological work has been conducted to ascertain the putative success of such a project. In fact, scientists who have conducted surveys of wekiu habitat are in disagreement about the assumptions made regarding cinder size, depth, slope, and compaction of lower substrate, and have express doubts about the safety of proposed artificial habitat for the wekiu during periods of freezing temperatures. (See the CCH FOF appended during scoping) B

On page xvii, the draft states that habitat would increase. This is not substantiated by evidence. Manipulating the cinder as described has never been demonstrated, and there is no reason to conclude that it will actually create useable habitat for the wekiu.

On Page 3-20, the statement is made that pitfall traps measure activity of insects, not the size or density of their populations, Yet over and over, in following text, references are made to recovery of wekiu populations, as evidenced by a single high recording in a pitfall trap in June 2003 (see p 3-21 for example). The data has not been made available for review, nor is it published or peer-reviewed. Because it is considered proprietary, no review of the statistical rationale has been conducted. No statements regarding insect population recovery can be substantiated. C

The map on page 3-22, Figure 3-3, describes WEKIU BUG HABITAT AND ASTRONOMY RELATED FACILITIES, but the map is, in fact NOT a map of wekiu habitat, but a geological map highlighting cinder cones, and bears a fictional relationship to habitat not borne out by data. This map must be removed from the text and replaced with a map that shows accurately the densest habitat regions, in 1982,in 1997/8, and 2003. High quality habitat has been significantly impacted by telescope and road construction and related activities, and the true impact must be depicted. The map in the draft and its title is an outright falsification of data. D

It is encouraging to see that some of the criticisms leveled at the CDUA have been addressed in the draft EIS. Some of these include semiannual progress reports submitted to DLNR, OMKM and Bishop Museum (why not USFSW?) on page 4-19. E

The efforts made to gather weather data (on page 4-19) need to be described in better detail. There are sensitive and appropriate technologies available for conducting such data gathering, and these studies should be funded in full by NASA. Surely NASA scientists can provide the technical expertise to assist in acquiring the best equipment. F

It is particularly encouraging to see that NASA is committed to funding a study of the autecology of the wekiu bug, and it would be important to study the other arthropods and alien imports as well.

Finally, as a result of attending several scientific meetings in the course of my leave of absence, I have learned more about the effects of global warming on world alpine habitats. Changes in habitat as the atmosphere warms affect both alpine plant and animal species and the permafrost layer in the substrate. The impact of warming on the G

Mauna Kea summit will likely lead to a restriction of the range, making the summit cinder cones even more critical for the survival of restricted range organisms such as the wekiu. G

Additionally, the melting of the permafrost layer may change the hydrology of the summit in ways not even hinted at in the draft EIS, and the implications of resulting changes in water (and sewage effluent) flow should be addressed. H

The Draft EIS lacks a section on restoration of the site to its original condition, as required by the State of Hawaii lease to the University. The method and costs must be included in the Final EIS. DLNR/BLNR must be petitioned by UH/NASA to describe in detail the requirements and conditions for telecope removal/upgrade or replacement and conditions for site restoration to original condition at the termination of the lease, at the end of the contract, or at cancelation due to violation of the lease agreements. I

The absence of a summit-wide management plan, with an authoritative body funded and empowered to ensure compliance with mitigation addressed in the Draft EIS, continues to be a missing element. Just last month, the UH was fined for significant violations to the current agreements. This demonstrates the inability of UH or the legal fiction of OMKM to comply with its mandate. Construction of more telescopes, given demonstrated mis-management, is inadvisable. J

In conclusion, it is evident that every incremental impact is cumulative, adverse, and substantial. Adding 6 more telescopes to a sensitive habitat already damaged substantially by 13 existing telescopes is tantamount to a failure to protect our precious cultural, spiritual and environmental heritage.

Sincerely,

Deborah J. Ward

Deborah Ward
September 29, 2004

Response to Comment A:

Summaries of the oral scoping comments made at the public scoping meetings are provided in Acrobat® format at http://www2.keck.hawaii.edu/. Comments were summarized and not attributed to facilitate responding and protect individual privacy. Scoping comments were considered in the development of the EIS.

Response to Comment B:

The mitigation measures were reviewed and approved by the U.S. Fish and Wildlife Service (USFWS) and follow all the recommendations given in previous Mauna Kea Science Reserve arthropod assessments (Howarth and Stone 1982; Howarth and others 1999).

In a letter regarding the Wēkiu Bug Mitigation Plan for the W.M. Keck Observatory, Outrigger Telescopes Project at Mauna Kea, the USFWS states "The Service [USFWS] supports the recommendations in the WBMP [Wēkiu Bug Mitigation Plan] to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor use. . . We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to the wekiu bug habitat." See Volume II, Appendix A, for the letter from USFWS/Henson (USFWS 2000).

The U.S. Department of Interior (USDOI) submitted a comment letter on the DEIS stating "It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wēkiu Bug Mitigation Plan and the Wēkiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities." See the USDOI comment letter from Patricia Sanderson Port located in this Appendix.

In addition, the USDOI letter states "These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology."

Response to Comment C:

On page 3-23 of the Final EIS it is noted that "Pitfall traps measure activity of insects, not the size or density of their populations. For many insect species, the percentage of the population that is active under similar environmental conditions is roughly constant over time, and therefore changes in trap capture rates reflect changes in population size or density (Southwood 1978)." This being the case the Final EIS notes on page 3-24 that "Increasing trap capture rates measured during quarterly baseline monitoring indicate that Wēkiu bug populations appear to have increased in sampled areas since 1998 (Pacific Analytics, LLC 2002a - 2004d)."

Deborah Ward
September 29, 2004

The assertion that higher trap capture rates were experienced in only one trap, on one day in June 2003 is incorrect. In fact, throughout the three years of quarterly baseline monitoring, the average capture rates within each sampling period exceeded the rates experienced in the 1997/98 sampling. A total of 10 traps were used in each sampling period up to the 3rd quarter of 2004 when the number of traps was doubled to 20. During the 2nd quarter 2003 monitoring session, Wēkiu bug trap capture rates averaged 90.6 bugs/trap/3-days on Pu‘u Hau‘oki (median trap capture rate of 87.2) (Pacific Analytics, LLC 2003b). This is generally equivalent to the 105.6 bugs/trap/3-days recorded in 1982 on Pu‘u Hau‘oki (Howarth and Stone 1982) and much greater than the 0.2 bugs/trap/3-days recorded during a comparable period in 1997. On Pu‘u Wēkiu the 2nd quarter 2003 average trap capture rate was 11.5 bugs/trap/3-days (median trap capture rate of 6.0), about a fourth of the 1982 average trap capture rate of 40.77 bugs/trap/3-days.

The Wēkiu Bug Baseline Monitoring Reports are available to the public on the World Wide Web at: http://www.statpros.com/Wekiu_bug.html. The baseline monitoring data were provided to OMKM in 2004 and reviewed by an independent committee. In addition, articles are being prepared for submittal to refereed professional journals.

Response to Comment D:

Figure 3-3 is intended to provide the reader with a general idea of the potential *cinder cone* habitats on Mauna Kea. The figure legend and caption have been modified to reflect this more precisely. Studies have reported that Wēkiu bugs apparently prefer habitats comprising accumulations of loose cinders and tephra rocks where interstitial spaces are large enough to allow the insects to migrate downward (Howarth and Stone 1982, Howarth and others 1999, Englund and others 2002). These substrate characteristics can be found on the cinder cones that appear as orange on the figure. A 1997/98 arthropod assessment described the cinder cones in Figure 3-3 as “Potential Wēkiu bug habitats” (Howarth and others 1999). Wēkiu bugs have also been collected in habitats with other characteristics not shown on Figure 3-3 (Howarth and Stone 1982). While the highest trap capture rates have been measured on the *Summit Area Cinder Cones*, Wēkiu bugs have been observed on several of the other cinder cones listed in the figure legend, thus, these cinder cones represent habitat. Thorough sampling of many of the outlying cinder cones is not yet complete.

Response to Comment E:

The USFWS was added to the distribution list.

Response to Comment F:

During the course of baseline monitoring, data gathering techniques have been refined. Data loggers are now being used to gather microhabitat information.

Response to Comment G:

The possible impacts of global warming (*i.e.*, climate change and changing weather patterns) are identified as a potential contributing factor resulting in the decline in Wēkiu bug trap capture rates measured between 1982 and 1999. Decreasing availability and persistence of snow could potentially have detrimental impacts on Wēkiu bug distribution and abundance. Whatever the effects of climate change on Wēkiu bug populations, the incremental impact of Outrigger

Telescope construction on Wēkiu bug habitat would be small. The amount of habitat that would be disturbed by the proposed Outrigger Telescope construction is a small fraction of the amount of potential habitat available on the *Summit Area Cinder Cones*, and habitat restoration may actually increase the amount of habitat on Pu‘u Hau‘oki.

Response to Comment H:

Although there has been a significant amount of speculation about an extensive permafrost layer at some unknown depth beneath the summit, none has ever been found and indirect evidence of such a layer also does not exist. On a local scale (meaning tens of feet in dimension), frozen sections may occur and one such location has, in fact, been identified. However, at that scale, it is not hydrologically significant. Therefore, there is no hydrologically significant permafrost and the "melting" of such a layer is not an issue.

Response to Comment I:

The End of Lease event in 2033 could result in a variety of outcomes. The State of Hawai‘i, through its Board of Land and Natural Resources and the University of Hawai‘i, will decide upon a course of action at the expiration of this lease. The potential impacts associated with the decommissioning and demolition of the observatories on Mauna Kea are addressed in Section 4.2.15.2 of the EIS.

Response to Comment J:

The absence of a summit-wide management plan is a State matter and beyond the scope of the EIS. The University of Hawai‘i paid the fine associated with the violations and by receipt of a letter on October 21, 2004 addressed to Robert McLaren, Associate Director of the University of Hawai‘i Institute for Astronomy (UH IfA), from Samuel Lemmo, Administrator of the Office of Conservation and Environmental Affairs, it was determined that all violations have been adequately resolved (UH IfA 2004h).

Tom Whitney • *Documentary Photographer & Graphic Designer*

29 September 2004

Carl Pilcher, Office of Space Science
NASA Headquarters, 300 E. Street, SW
Washington, DC 20546-001

RE: Comments on Draft EIS for Outrigger Telescopes Project

Dear Dr. Pilcher,

I am a documentary photographer who has followed contemporary Hawaiians doing cultural ceremonies on the Mauna Kea. A collection of these photographs and other art work became a museum exhibition at the Lyman Museum in Hilo and at the Bishop Museum in Honolulu. The exhibition, "Mauna Kea - The Temple," focused on the spiritual connection of contemporary Hawaiians to what they view as their most sacred mountain. Various brief views of some Hawaiian participants can be examined in the Honolulu Advertiser review of the exhibition which is included in Appendix A. Further, I described in detail what the exhibition involved in a paper "Communicating the Hawaiian Spiritual Perspective in the Mauna Kea, The Temple, Exhibition," which is included as Appendix B.

First I want to address the cultural disconnect I observed in the hearings. Many Hawaiians provided testimony that was emotionally compelling - for other Hawaiians and sympathetic non-Hawaiians

including myself. *While they were speaking English, unfortunately they were speaking in an evocative, emotive, spiritual and behavioral language that is unknown to the EIS preparers who don 't have a vocabulary (of words and behavior) that includes the Hawaiian concepts.* It is as if the Hawaiians are playing a shadow game on this stage - which is NASA's stage. There is an invisible cultural communications barrier separating the two groups. ***To resolve the issues NASA needs to make an extra effort to listen carefully.***

I personally support astronomy, but not at the cost of disrespect for the Hawaiian culture. I know from considerable experience in extensive negotiations with developers as an environmentalist in Sacramento, California, that improvements from both perspectives, the environment and development, can occur with good faith negotiation between groups that have equal power at the negotiating table. Where this does not occur the groups with lesser power will be constantly trying to undercut any unilateral decisions that are made, causing interminable delays. What is missing here is good faith negotiations among equals.

In developing these comments, I have asked myself how NASA might *leave a legacy of using rocket science and technology to help resolve some spiritual problems here on Mauna Kea.*

Reduce the visual impact on landscapes and view planes

I am a resident of Hilo and live on the slopes of Mauna Kea and can see the sunrise on the mountain every morning from my property when the clouds do not obscure the top of the mountain. On the top of the mountain I see the little white dots indicating the telescopes and find them objectionable because I know I don't need to see them. Thus I have a personal stake in the disturbance of the view plane

These two photographs illustrate the effectiveness of camouflage. In the photograph on the right the uncamaflaged yellow trailers relaly stand out on the landscape, like the telescope shells do. If you blur your eyes, the structures on the left are barely distinguishable from the earth, the others pop right out. The photographs are from the web site: http://science.howstuffworks.com/military-camouflage3.htm.

This photograph shows the two telescopes on the left which have a received a quick attempt at simulating camouflage using the colors of the surroundings. From a distance the two on the left would tend to disappear. To Hawaiians, the Keck telescope on the right would stand out 50 miles away at Pu'ukohola in Kawaihae. Like white salt on an open wound that can cause pain, the sight of the white telescopes causes spiritual pain. Why continue the aggravation?

and the landscape.

Having attended many meetings and Hawaiian ceremonies, I am aware that Hawaiians feel that their heritage has been stolen during the past forty years of telescope development on the mountain.

One of the recurring comments is a negative one about the "ping pong balls" defacing the sacred mountain. These are visible in the Hilo area and as far as Pu'ukohola Heiau in Kawaihae, the site of solemn Hawaiian cultural ceremonies.

In previous comments I suggested that you **find ways to minimize the visual impact of the reflective, apparently white telescope domes**. While not going to the heart of the issues that rankles Hawaiians, it is one small way that the presence of telescopes could be less constantly visually intrusive. You have suggested this kind of idea is within the realm of your possible action when you suggested that you could paint a telescope in California to overcome local objections to visual impacts. Why not follow through with the same idea here?

I note that the project design of the outriggers does pay attention to making the appearance of the base of the outriggers blend with the surrounding landscape, but has done nothing to camouflage the offensive appearance of the telescope shells.

A

The military has used camouflage to protect its troops; ships use camouflage; **in this spiritually embattled situation, the telescope shells merit camouflage to blend in with their surroundings**. For guidance, I have included in Appendix C the article "Militaries Study Animals for Cutting-Edge Camouflage" by James Owen for National Geographic News. One homely bit of advice on camouflage from a web site for buck hunters * is: "**try to match the surroundings of the area** you hunt as best you can." I hope this is not too low-tech for NASA, but you should seriously try this. It does not require rocket science. **Each of the four**

* <http://pabucks.com/huntingcamouflage.html#Choosing%20Camouflage>

outriggers should experiment with a different camouflage theme. If they are not uniform this will probably be good and fit smart camouflage strategy because repetitive patterns as seen with the white shells would not occur.

It is likely that there may be some opposition on an aesthetic and symbolic (and non-rational) basis from the astronomy community to this idea. The white telescope domes are an icon of astronomy, which is a noble profession. But is it noble and professional to conduct one's business on the sacred ground of an ancient and honorable culture and do so as a disrespectful visitor? Is it noble and professional to build on someone else's sacred land and blatantly advertise one's presence, in effect inciting of the wrath and pent up frustration of the surrounding culture, as the white domes do?

The photograph above is one from the Keck website that illustrates the concept of interferometry. Keck and NASA could also perhaps try to use it as an illustration of how the white color of the telescopes blends into the surrounding landscape. We want to demolish that inference with the following analysis. The view presents is one only possible from an airplane flying at 13, 700 feet, not from surrounding areas on the ground and in Hilo, Waimea and Kawaihae. Given the dark sky in the illustration, from a lower vantage point the white domes would stand out. The clouds in the background of the illustration are not landscape, but cloudscape. The snow on the ground is not a constant feature on Mauna Kea, but only last a few weeks, usually. It does not show compliance with current UH Master Plan color guidelines.

A

The Master Plan for the Mauna Kea Science Reserve on June 16, 2000 talks of the importance of the color of the surfaces of the telescopes** (I have added emphasis):

> "Colors: Color plays an important part in visibility and thermal impacts. **Color choices should seek to minimize the visual impact of the facility from surrounding areas.** While it is understood that the mitigation of thermal impacts on observatory functions is an important consideration, **domes should be colored to aid in masking and blending facilities into the natural landscape.** The following strategies are to be employed:
>
> - For ridge facility domes, a combination of detailed geometrical design, surface treatment (i.e. reflecting vs. non-reflecting) and color (blues and grays) to minimize visibility against the daytime sky.

**http://www.cfht.hawaii.edu/News/Projects/NGCFHT/MPlan.html

- For base sections, use browns and other earth colors to blend facilities with the natural cinder cone surroundings.
- For off-ridge facility enclosures use colors and patterns such as the mottled brown tones of the surrounding lava landscape.
- **Color** concrete utility pull boxes installed along underground utility routes, antennae pads and **miscellaneous structures with mottled brown tones to blend with the surrounding lava landscape**. No raw, uncolored concrete surfaces are to be allowed."

It would appear that the existing Keck domes, acknowledging that they were probably planned before the Master Plan was adopted, do <u>not</u> appear to be consistent with the simple language color guidelines of the Master Plan as can be observed in the unchanged right hand part of the lower photograph on the page 2:

1. The domes *do not* blend in to the natural landscape.
2. The reflective almost-white domes *maximize* instead of minimize the visibility from surrounding areas.
3. It would appear that surrounding smaller structures do not follow the spirit of the guidelines that smaller structures should blend with the surrounding landscape.

A

While the Master Plan guidelines acknowledge that "mitigation of thermal impacts on observatory functions is an important consideration" in its recommendation of colors that blend into the natural landscape, we are concerned that telescope designers may make arguments that the white domes are necessary using the mitigation of thermal impacts approach. Given the advances in insulation technology that are available today, and the possibility that requiring more sophisticated insulation than a white dome might require could add to the construction cost, any added expense should be considered simply as a cost of doing business in this unique environment.

So it would probably be a mistake for the Keck Outriggers to be following the color guidelines for the original Keck telescopes. We could find no comments in the Draft EIS relating to this issue of colors and the proposed Keck Outrigger domes.

It would probably be useful for Mauna Kea Management to perform a "visual audit" using the new Master Plan color guidelines to assess the compliance of existing telescopes to "minimize the visual impact of the facility from surrounding areas" and "masking and blending facilities into the natural landscape." Such an audit could recommend steps each telescope might take to come into compliance. While technically existing telescopes were built before the guidelines, and thus

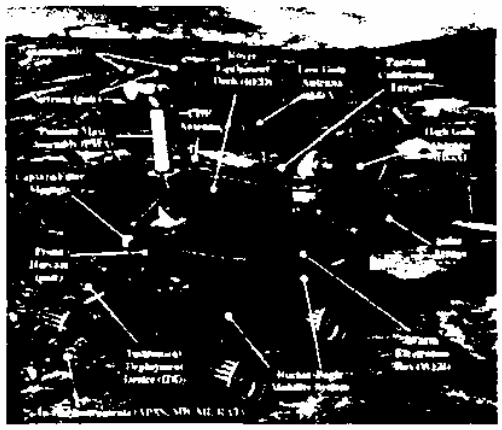
might be "grandfathered in," nevertheless those existing white telescope continue to be a point of contention and changes should be scheduled.

Clean Power for Mauna Kea

Community members expressed concern which I share at the Hilo EIS hearing on the issue of power generation for the mountain. Many people assume that astronomy is a clean industry in that it does not pollute the air.

But of course the power used on the mountain is generated down below thus does contribute to air pollution and the other problems related to power generation.

If we are to look at a transformation, as alluded to by Judge Heen in the Hilo EIS hearing, one area to examine is NASA itself.



NASA Mars Spirit Rover

The flat panels on the Spirit Rover on Mars - a recent NASA success story - are covered with photovoltaic cells which convert sunlight to electricity to power the electric vehicle it is. Other devices can examine the sub surface soil which we will examine later.

We also note that reliance on oil for energy production is a large factor in the *United States military concern with the Middle East, with continuing impacts on* the land of Hawai'i with its 30 military facilities. This can also be seen in recent headlines announcing Defense Department budgeting of $30 million for expansion of the Puhakoloa Training Area by 26,000 acres on Parker Ranch land.

So clean (non-petroleum) energy is not only a national defense issue, it is a cultural issue in that defense is taking Hawaiian land for military uses and the there is unhealthy fouling of Hawaiian air for energy production.

I recommend an evaluation of energy use at Keck now and with the addition of the Outriggers. This would be termed an energy audit: all systems and daily cycles of energy usage. It would include evaluation of and recommendations for conserving energy use. Include also energy-use evaluations of new equipment to be purchased, in order to choose the most efficient. And include planning and implementation estimates for non-fossil fuel energy source production. B

Then it makes sense to recommend that **a minimum of 50% of Keck's daytime energy needs be provided by use of photovoltaic cells, or in combination with other alternative sources, like wind.** 50%, because it is a realistic pilot program;

because photovoltaics only work during the day; and because the energy supply for the telescopes must be reliable.

B

We don't mean a merely token, public relations effort, we mean a model for other astronomy facilities. We see it a demonstration project showing how the U.S. Government is setting an example for the private sector of reducing our dependence on foreign oil. And the site of the power generation could perhaps be evaluated for placement on the edges of the Training Area, if that occurs, to minimize use of otherwise productive land for farming.

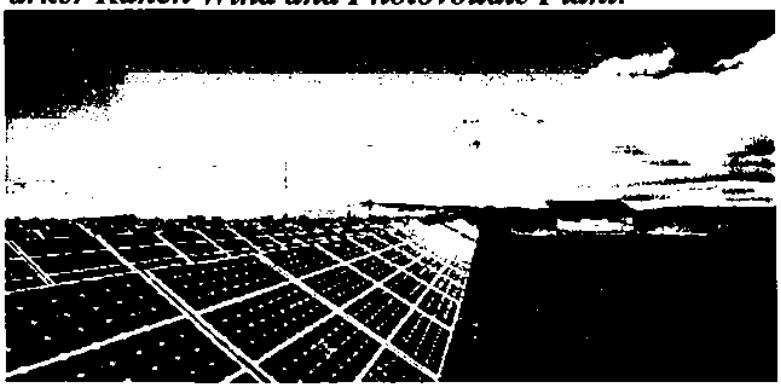
Local Hawaii Implementations Show Demonstrated Feasibility

The peak electrical demand at the W. M. Keck Observatory is about 440 kilowatts (kW). The potential capacity for the observatory is 1,000 kW, and it uses about 44 percent of that capacity. The power comes from the Hawaii Electric Company (HELCO).

The typical electric bill for Keck at the summit averages is around $100,000 a month, paid for by the California Association for Research in Astronomy, a non-profit organization funded by the University of California, Caltech and NASA.

PowerLight Corporation's Parker Ranch Wind and Photovoltaic Plant.

In August 1999, Parker Ranch and PowerLight Corporation teamed up to develop the world's largest hybrid solar energy project It uses state of the art technology to convert available renewable energy resources - sun and wind - into electricity to supply water to livestock. Using natural resources reduces the amount of energy required from fossil fuel utility stations, thus saving the environment while reducing Parker Ranch utility costs.



PowerLight Corporation's Parker Ranch wind and photovoltaic plant - not far from Keck headquarters.

The project, consisting of 175 kW of photovoltaic and 50 kW of wind plant technology, generates more than 90 percent of the daytime electrical power needed to provide drinking water for Parker Ranch's livestock in the Mauna Kea, Mana and Keamuku grazing areas. It is controlled by a Supervisory Control and Data Acquisition (SCADA) system. The SCADA system provides the intelligence to maximize the efficiency of the hybrid system by matching electrical load to avail-

able solar energy. Money saved from reduced utility bills more than covers the amortized cost of the solar energy water pumping system.

Over the life of the project, the environment will be saved from the effects of burning 30,000 barrels of oil and emitting 20,000 tons of C02. It is equivalent to providing energy for more than 1,000 homes.

Another PowerLight PV system will cover 10,000 square feet of the Mauna Lani Bay Hotel's rooftop. Over its life, the 100 kW project for the Mauna Lani Bay Hotel will displace approximately 14,500 barrels of oil that would otherwise be imported and burned to generate the same amount of electricity necessary to operate the 350-room hotel.

Can NASA Can Meet NASA's Own Criteria - Which It Has Broadcast to the World to Justify the Space Program?

We can see from the description above of energy technology already developed on the ground not far from Keck headquarters, that use of such technology could meet all of NASA's technology transfer goals, shown in bold below - for NASA itself.

* **Stimulates our economy.** A local company gets business in an emerging field.
* **Increases competitiveness within the private sector.** We were impressed that it is the largest hybrid photovoltaic-wind installation in the world, relatively near the Keck, headquarters - good selling points for an emerging business and NASA public relations.
* **Gains visibility within the technical community.** NASA couldn't help but look good, showing that it in doing its part in the thrust toward energy independence.
* **Benefits professionally and financially.**
* **Promotes innovation and creativity with NASA technology**. Definitely meets this criterion.
* **Allows the use of NASA's vast technical resources.**

We also note that The Rancho Seco photovoltaic array in Sacramento, California, is the world's largest, single site, photovoltaic power plant and now generates 3.9 megawatts - about four times the capacity requirements for Keck.

Mitigation Issues Demand Clarification from a Cultural Perspective

First I would like to take note here of a comment made at the Hilo EIS scoping hearing. Judge Walter Heen, after acknowledging that he had been hired as a consultant to NASA, commented to the group that he had recently finished reading a

book called the "Paradigm Conspiracy." It talked among other things about Nazi Germany and how the Nazis felt that "when you destroy a culture, you can manipulate them." "What has happened," he said, "is that the Hawaiian culture has almost been destroyed. What we need to do is rebuild the Hawaiian culture. Perhaps this effort can be the beginning of a transformation."

I and others also heard you, Dr. Pilcher, say that you wanted this effort to become a model for how NASA could relate to a community. So, many people looked for evidence of new approaches in the DEIS that would honor both Judge Heen, yourself and NASA. After its publication, most were disappointed.

I also note the following comments in a letter to NASA by David Lovell of the Royal Order of Kamehameha I, where his organization took a stance somewhat at odds with the prevailing Hawaiian community opinion that wants no more development on the mountain. "The Ali'i Nui and Grandmaster of the Royal Order of Kamehameha 1, Gabriel Makuakane, has decreed: "There shall be no further development of any kind on Mauna Kea.

Lovell stated: "As the Kahu Po'o I am empowered by the Ali'i Nui to make the following statement of exception:

"Development may be continued if it is done intelligently, with compassion and sensitivity to the Hawaiian people and their culture, and with extreme care for the fragile environment, and when:

"• Substantial alterations are made to proposed cultural mitigations.
"• Hawaiians are chosen by Hawaiians to negotiate the cultural mitigations.
"• Hawaiians form majorities on cultural mitigation committees.
"• Approaches to environmental pollution are transformed, including sewage treatment, Wekiu Bug mitigation and toxic materials handling.
"• All mitigations are guaranteed over the life of the project and funded with normal escalators for inflation.
"• All mitigation funds be awarded to the Royal Order of Kamehameha I, Office of the Kahu Po'o, to be used for the benefit of the Hawaiian people, without conditions.

I commend the original Royal Order letter for your rereading. **The comments in their letter set the stage for identifying new cultural approaches by NASA to Hawaiians - which have been totally ignored in the DEIS, so far as I can see.**

Hawaiians Should Make Cultural Mitigation Decisions Affecting Hawaiians

This I believe is one of the central issues. As a result of the previous Environmental Assessment process a Section 106 Historic Preservation Consultation for the Keck Outriggers resulted in a Memorandum of Agreement that was developed and signed by its "signatories." This will govern cultural mitigation issues if the Outriggers are approved.

"Signatories" included NASA, the Advisory Council on Historic Preservation, the Hawaii State Historic Preservation Office, the University of Hawaii, the California Association for Research in Astronomy, and the California Institute of Technology. Notice there is not one Native Hawaiian organization.

Many Hawaiians feel that the MOA needs to be totally renegotiated.

Consultation needs to occur on a new MOA which is not so blatantly patronizing and distrustful of Hawaiians.

Since NASA is a "signatory" to the existing MOA, NASA should consult with Hawaiians, and consistent with the MOA, Section V, A. 1, to "propose amendments to the other Signatories and Concurring parties," etc., consistent with the following recommendations. C

A big problem is that this MOA dealing with cultural issues is presumed by signatories to be valid and controlling *even though it was not signed by Hawaiian organizations not connected with the University of Hawai'i.* A number of organizations were invited to be "concurring parties" with lesser status: no power to amend the MOA or, apparently determine its terms. Organizations invited to be concurring parties and not signing include the Office of Hawaiian Affairs, Hawai'i Island Burial Council, The Royal Order of Kamehameha I, Mauna Kea Anaina Hou and Hui Mālama I Nā Kūpuna o Hawai'i Nei. Ahahui Ku Mauna, set up by the University, did sign the document as did Mauna Kea Management as Concurring.

There is a conflict in two of the WHEREAS clauses in the MOA: The sixteenth one indicates that Concurring Party status is achieved only through signing this MOA. Yet the second clause asks concurring parties, while they may not approve of the Undertaking, to agree that "the provisions of the MOA are an appropriate means to mitigate effects on cultural resources. . ."

Independent Hawaiian organizations have not signed on because do NOT believe that "the provisions of the MOA are an appropriate means to mitigate effects on

cultural resources." But these are the organizations that need to be consulted.

Examine the seventh WHEREAS clause, indicating "NASA recognizes that human burials exist in the summit region of Mauna Kea."

Contemplate that you are trying to do this project in the burial grounds of the highest-born of Hawaiians, in an area considered to be the highest level of heaven on earth, according to Hawaiians: - and you do not want to give Hawaiian any substantive decision-making involvement in how you trample their temple? C

Put behind you the legalities and lawyerly slights of hand you could get away with that might evade the issue. We ask that you show the good faith that could be imputed to Dr. Pilcher's words in his comments during the EIS hearing in Hilo, "We want to be an example of how to work with a community on a project." We assume he meant a shining, good example.

The Concurring Parties (who did not sign) are a good representative group of Hawaiian organizations that were asked to participate in the MOA, and should continue to be consulted, but they need to be given voting power to assist in structuring the terms, and not be asked to sign a document they do not agree with, written and approved by non-Hawaiians. ***In any other venue, this would be a matter of common sense.***

The key issue is that the **decisions on culturally sensitive issues should be made by Hawaiians**. Hawaiians should choose Hawaiian members of the decision-making body. Other culturally sensitive issues that may arise in the EIS process should be solved in a similar manner. Anything else is rank, outright paternalism, unacceptable. D

Among the issues to be considered are criteria for, appointment of, and duties of the Cultural Monitor. The MOA calls for the California Association for Research in Astronomy to do this – prima facie an inappropriate entity to be responsible for this. CARA knows more about appropriate Hawaiian oversight than Hawaiians do? Ridiculous. CARA could handle the paperwork, meeting arrangements for consultation, etc., but the decision making on hiring Hawaiian personnel should be made by Hawaiians.

Hawaiians should review and approve the cultural monitoring plan developed by the Cultural Monitor in consultation with CARA before it goes to the other parties.

There should be elimination of or substantial modification to the following sentence (emphasis added): "For safety purposes, all communication for the pur-

pose of cultural orientation between project personnel and the Cultural Monitor will be scheduled and overseen by the CARA Construction Manager."

The Cultural Monitor can be the recipient of an adequate safety orientation by the Construction Manager, which should be sufficient to cover safety issues. In addition the Cultural Monitor can be briefed about the (fairly obvious) necessity not to interrupt construction personnel when they are working, but to talk with them if they are interested only during breaks.

In countless possible situations with no likely safety issue present, for one obvious example, during lunch and break times, the Cultural Monitor will have opportunities to talk with project personnel about cultural orientation issues on an informal basis. It is likely that this informal communication will be the most meaningful way to communicate the cultural issues, and respond to questions so requiring that "all communication . . .with project personnel" be scheduled should be eliminated. D

Requiring that all cultural communication be overseen by the Construction Manager in context of the above (a) would be a huge waste of time of the Construction Manager. It demonstrates a basic distrust of Hawaiian people by the telescope managers. It is patronizing and should be eliminated

The Hawaiian Cuncurring Parties Should Have Involvement in Appointment and Duties of the Archeologist CARA could handle the paperwork, meeting arrangements, etc., but the decision making, including determining qualifications and the appointment of the Archeologist should reside with Hawaiians, through a single point of contact, perhaps the Royal Order's Kahu Po'o, or a committee, including the project manager, and other "signatory" representatives, but the majority of which consists of members of the Concurring Parties group. E

There should be Hawaiian decision-making involvement in approving the "Inadvertent Discovery of Human Remains and Archeological Properties Monitoring Plan. (MOA I.B.2.a.) F

There should be Hawaiian decision-making involvement in determining the content and activity relating to the briefing, orientation and training materials (MOA I.A.1. I.B.) for all personnel including the "specially scripted training video tape for workers," content of "cultural interpretation" and materials.

The briefing of personnel should be expanded from covering only "Native Hawaiian objects, artifacts and remains," to include information about historical and contemporary Hawaiian cultural attitudes about Mauna Kea and allowance of time for questions and answers and discussion with workers to lead to a more complete understanding of Hawaiian cultural issues. G

CARA could handle the paperwork, meeting arrangements, etc., but the decision-making should reside through the single point of contact, the Kahu Po'o, or a committee, including the project manager, and other "signatory" representatives, but the majority of which consists of members of the Concurring Parties group. G

There should be changes to how the "Off-Site Mitigation Measures" (MOA III. 1.) are handled. The MOA proposes: "NASA, in consultation with Office of Mauna Kea Management will fund. . . an initiative that deals with preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians . . ."

This money, $2 million if the project is approved, is a constructive attempt for this facility to deal with the what seems for NASA and the University of Hawaii to be an extremely difficult and challenging cultural issue that doesn't fit into existing procedural categories.

But it would be a mistake to think of it as a onetime buy-off, or a ten-year scheme as has been suggested, to fend off current complainants or as an adequate compensation for or mitigation of the forty years of aggressive appropriation of Hawaiian sacred ceded lands by a University manifesting indifference to the culture as documented by the State's Auditor in 1998.

The Hawaiian culture is world renowned and hallowed for (a much misunderstood) "aloha," an openness and willingness to share (long inappropriately exploited by the tourist industry) – but it is also a culture unwilling to tolerate for long those who only want to take. The continuing indignity and injustice of $1 per year leases to mega million dollar facilities on hallowed Hawaiian sacred ground **will continue to rankle through the decades to come until steps are taken to bring the scales of justice into balance.** H

Just as the cultural impact of the project will continue at some level for as long as the project exists, ***so should the initiative continue to fund the cultural mitigation on some level as long as the project exists, with normal escalators for inflation.*** (We refer you to NASA's own Inflation Calculator, if you are unclear how to proceed here: www.jsc.nasa.gov/bu2/inflate.html. The particular index to be used could be determined by NASA and a committee similar to that described above.) **And Hawaiians should continue to control how the money is spent.**

Where is the faulty logic in this? When one pays rent or lease payments for a house, one does not tell the owner of the property (the Hawaiians, in this case) how to, or under what conditions they can spend the money, or that the rent or lease payments will continue for only a few years, and then will stop and the house will continue to be occupied by the renter who will not make any more payments. Yet this is what NASA is trying to do.

The MOA states: "The group (chosen by the University) . . .will "inform NASA as to what types of opportunities or goals will best benefit Hawaiians, including native Hawaiians . . . The working group will be asked to prioritize their proposals."

One of the problems that Hawaiians perceive is that mitigations thought appropriate by NASA administrators, astronomers and university people are not considered appropriate by the average Hawaiian. For example, in one Hawaiian's view, mitigation funding should go to jobs, day care (to enable people to get to jobs), health care and education.

NASA should provide the funding to a nonprofit (perhaps set up as recommended by the Royal Order of Kamehameha I in its original letter) at the beginning of each calendar year. It becomes a regular budget item in perpetuity with normal escalators for inflation. The nonprofit will be open to input from the community, and then prioritize its own list of proposals and fund them as appropriate. Thus Hawaiians will be responsible to Hawaiians for how the mitigation money is spent - through the years. H

The MOA states: "Funding is subject to the availability of appropriated funds in accordance with Federal law (e.g. the Anti-Deficiency Act). Such funds will be allocated to the proposals as prioritized by the working group until available funds are exhausted. . . ." This sounds like mitigation funding would be put at the end of the line, and might not get funding.

The mitigation funds should be provided first – in a manner similar to lease or rent payments for a house. You pay at the beginning of the month, or year, not when and if there is money left after everything else is taken care of. No payment; you get served with a notice of eviction notice.

The dispute resolution section of the MOA states "1. Should any Signatory or Concurring Party object at any time to the manner in which the terms of this MOA are implemented, NASA shall consult with the objecting party(ies) to resolve the objection. (etc.)." **In the next version of the MOA, Hawaiian parties, whether they agree to the terms of the MOA or not, need to have the same status as signatories to seek amendments to the MOA.** I

Identify Burial Sites Using Geophysical Means

One of the devices on NASA's Spirit Rover allows it to examine the soil of Mars. I would suggest employing a similar concept on Mauna Kea. Identifying the presence of burials and artifacts associated with them is an area of continuing J

concern on Mauna Kea and elsewhere in Hawai'i.

We notice that NASA is already examining the soil on Mauna Kea. In "Soil Disturbance on Mars and Mauna Kea," a paper by Richard V. Morris and Douglas W. Ming, NASA Johnson Space Center; Trevor G. Graff, Arizona State University; and Pablo McLoud, Mauna Kea Ranger, OMKM, UH Hilo, the authors observe that "The ideal way for planetary scientists to study the Martian surface and its climate is to go there. Some day this will happen. In the meantime, and as a part of a necessary activity before humans travel to Mars, planetary scientists study places on the Earth that are like the Martian surface.

Geoscan Research RM15 + MPX15 multiplexing electrical resistance meter**

"The summit region of Mauna Kea Volcano is one of the few places on the Earth that is similar to what we currently know about the surface of Mars. The similarity extends from climate to the composition of the rock and soil. Both climates are cold and arid. Both compositions are volcanic basalt. *(etc.)*"*

Demonstrating the usefulness of the technologies of geophysical analysis can show a useful technique to employ and provide employment for local people who could perhaps systematically survey the entire astronomy precinct.

Archeological geophysical surveys of the construction site should be undertaken before construction begins.

These technologies can be understood with reference on the web on the following web site from which the photograph above was taken: <North American Database of Archeological Geophysics>. (Another web search term: Geoarcheology.) Methods include electrical resistivity surveys, ground penetrating radar and other techniques.

The abstract in Appendix D identifies their use in identifying buried artifacts and

* NASA web site

** <North American Database of Archeological Geophysics>

bones of a highborn native individual in Texas, possibly in the 1500s.

"Geophysical survey methods provide cost-effective means for the acquisition of archaeological information relevant to a number of domains:

- Management and planning maps of archaeological sites can be created that document their basic subsurface structure and the layout of features;
- Primary data for settlement pattern research and analysis can be obtained when details of a site are clearly mapped;
- The placement of expensive excavations and testing programs can be guided to features of potentially greater interest, producing large cost savings in site explorations;
- Geophysical methods are nondestructive, preserving the resource for future generations. Non-invasive examination of culturally sensitive burial, sacred, or ceremonial sites can be achieved." *

J

Traditional Cultural Properties, and Traditional and Contemporary Native Hawaiian Cultural Practices

I am concerned that there has been no apparent resolution of the issue of contemporary cultural practices of Hawaiians relating to the honoring of their ancestors on Mauna Kea. Though it not an immediate concern of the EIS, it is troubling that the University, and we understand, the Bishop Museum, which has received funding to examine and articulate contemporary cultural protocols, have not moved with more activity to involve contemporary practitioners in open examination of these issues.

Contemporary Hawaiian practitioners pray at the wooden lele (altar) at the highest point on the mountain.

Protect the Sacred Water.

The nearest term to wealth in the Hawaiian language is waiwai. The word for water in Hawaiian is wai. This relationship shows the cultural respect and importance the Hawaiian people attributed to water and its essence.

The divine Kanekawaiola, revered in Hawaiian traditions as the creator and protector of all fresh water, holds a special place in the traditions of Mauna Kea because the "waters of life" were generated there. Poliahu, although best

* NASA web site

known for her snowy kinolau (divine manifestation and bodily forms), is also of the water.

NASA, beyond nodding and figuring that this is amusing but irrelevant cultural information, should take it seriously and do something about it.

A contemporary Hawaiian cultural practitioner, who observes ancient protocols, greets the sunrise at Lake Waiau.

I and others recommended that a cumulative effects analysis and a complete mapping and dynamic modeling of the hydrology of Mauna Kea be included in the EIS. Long a perplexing question, it is constantly referred to in testimony by Native Hawaiians. What happens to snow melt water and other precipitation? Where do streams originate and flow? What is the underground hydrologic system there?

Where does the water that feeds Lake Waiau come from? Is it being polluted from waste dumping by the telescopes? A cumulative analysis should include this type of study. K

We note that ratios of oxygen isotopes in natural water act can as fingerprints that can be used to trace the source of the water. Perhaps such analysis could lead us to greater knowledge of the origin of our sacred water in Lake Waiau.

Bethany Hamilton, Class of 2004, Washington University in St. Louis, Department of Earth and Planetary Sciences, has "been working to develop a predictive hydrologic model of Lake Waiau, a small lake in the glacial-volcanic landscape of the summit of Mauna Kea, Hawaii. Using data from a nearby weather station, D/H (deuterium/hydrogen) and 18 O/ 16 O isotope ratio measurements, lake level measurements, and topographic information, I've constructed a computer model which gives daily predicted values for lake level and lake isotope ratios."*

Perhaps NASA could contact Ms. Hamilton and ask for her analysis, and use it or similar analysis and show respect to this Hawaiian cultural sensitivity.

In closing, I would like to acknowledge the November 12, 2003, MESSAGE FROM THE ADMINISTRATOR of NASA , Sean O'Keefe, in honoring American Indian and Alaska Native Heritage Month.

"During the month of November, NASA joins other agencies and organizations

* *Obtained from the Washington University web site*

throughout the United States in celebrating National American Indian and Alaska Native Heritage Month. The theme for this year's observance is Strengthening the Spirit, a fitting tribute to peoples whose spirit means so much to our Nation's heritage and culture.

"The Native American spirit represents a shining light of hope and resolve. As we pause during American Indian and Alaska Native Heritage Month to honor our first Americans, let us all draw on that spirit as we face the challenges and opportunities facing NASA and our country.

I would ask that you as this project's leader, Dr. Pilcher, take seriously Mr. O'Keefe' words. I assume they were not meant only to apply during November 2003.

You have an opportunity to leave a legacy of using rocket science and technology to help resovle some spiritual problems here on Mauna Kea. Such an idea may seem incongruous to many, but it is not. I have tried to make some constructive suggestions to achieve this.

L

Respectfully Submitted ,

Tom Whitney

Tom Whitney

Tom Whitney
September 29, 2004

In addition to written comments, Mr. Whitney provided other documents which were not reproduced in the EIS because of copyright issues. They included a *Honolulu Advertiser* article entitled "Spirit of Mauna Kea", and documents entitled "Communicating the Hawaiian Spiritual Perspective in the Mauna Kea, The Temple, Exhibition", "Militaries Study Animals for Cutting-Edge Camouflage", and "Geophysical Investigations at the Kaufman-Roitsch Site."

****

Response to Comment A:

For an observatory to take advantage of the excellent atmospheric "seeing" at a site such as Mauna Kea, the air temperature within its building enclosure must be carefully controlled. The standard method of control is making the enclosure reflective, either by painting it white or covering it with an aluminized reflective coating. Although other approaches to thermal control have been studied, these alternative technologies are still experimental and not as mature as reflective approaches.

Because the Outrigger domes are relatively small (approximately 10.7-m (33-ft) high), they will in any case be barely discernable from locations below Mauna Kea with site lines to the Keck Observatory (*e.g.*, Waimea). Outrigger Telescopes that are seen projected against the existing white Keck Telescopes domes will be less visually intrusive colored white (*i.e.*, blending with their background) than with an alternative exterior treatment.

Response to Comment B:

The EIS has been modified in response to this comment. See Section 4.1.8 to review added text.

Response to Comment C:

The Memorandum of Agreement (MOA) was developed in good faith by NASA and signed in accordance with the Advisory Council on Historic Preservation regulations.

NASA consulted with an extensive number of individuals from the Native Hawaiian community and other organizations. Many of the suggestions provided by these Native Hawaiian organizations and individuals were incorporated into the MOA.

Response to Comment D:

The Concurring Parties that did not sign the MOA are considered to be among the organizations known as Consulting Parties. The MOA collectively refers to Consulting Parties as those parties invited to be Signatories and Concurring Parties to the MOA, whether or not they sign or formally concur. The Consulting Parties will be afforded the opportunity to review and comment on cultural sensitive issues, including selection of the Cultural Monitor.

It is NASA's intent that the selection of the Cultural Monitor be mutually acceptable to both the California Association for Research in Astronomy (CARA) and the Native Hawaiian

community. NASA would welcome the community's participation in identifying appropriate individuals.

Response to Comment E:

The Archaeologist has been selected by CARA in consultation with the State Historic Preservation Division (SHPD) and the Office of Mauna Kea Management (OMKM). The Archaeologist's qualifications are presented in the MOA provided in Appendix B of the EIS.

Response to Comment F:

Prior to construction, an Inadvertent Discovery of Human Remains and Archaeological Properties monitoring plan will be developed by the Archaeologist in consultation with the Cultural Monitor. CARA will comply with draft State Historic Preservation Division Rules (Titles 13-275, 13-279, and 13-280). CARA shall submit this plan for review by NASA and all Consulting Parties. Thereafter, CARA shall submit the plan to the State Historic Preservation Officer (Hawai'i SHPO) for approval.

NASA proactively completed a Draft Burial Treatment Plan specifying procedures to deal with an inadvertent discovery of human remains. Following an initial informational presentation of the Draft Burial Treatment Plan to the Hawai'i Island Burial Council (Council) in April 2004, public burial notices were placed in local newspapers in early May and an amended Draft Plan was submitted to the Council. The plan was discussed at the Council meeting on August 19, 2004. The members of the Council expressed their general agreement with the procedures recommended in the Burial Treatment Plan for monitoring during the Outrigger Telescopes construction and for treating any human remains uncovered during construction. Because no actual burials are known to be present, the Council took no action actually approving the plan or its procedures, concluding that this would be beyond its purview at this time.

Response to Comment G:

CARA will provide the Consulting Parties an opportunity early in the development of the training videotape to provide ideas on subject matter that should be discussed and highlighted. CARA will afford the Consulting Parties an opportunity to review the draft script and preview the videotape before the videotape is produced in final form. The Consulting Parties will also be afforded an opportunity to review and comment on written interpretive materials concerning the cultural significance of Mauna Kea. See Appendix B for additional information.

Response to Comment H:

Decisions as to administrative and management issues for Mauna Kea are the responsibility of OMKM. The Outrigger Telescopes Project mitigation is not intended to address 40 years of action. The purpose of the mitigation is to limit the incremental impact of the Outrigger Telescopes Project. The issue of payments associated with ceded lands is one for the State of Hawai'i to address.

The MOA states that the $2 million shall be used for the "preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians…" Subject to that limitation only, the citizen's working group is free to identify and prioritize uses of the funds.

MOA states that "Such funds will be allocated to the proposals as prioritized by the working group until available funds are exhausted." NASA does not intend to substitute its judgment for that of the working group.

The Anti-Deficiency Act proviso is legally required for NASA commitments.

Response to Comment I:

Your comment is respectfully noted.

Response to Comment J:

This is an interesting idea. Ground penetrating radar (GPR) is a technology that may be applicable to searching for subsurface disturbances such as burials. (This technology has not been used on NASA's Mars rovers.) Upon request, NASA will provide the contact information of groups using and developing this technology. Anyone desiring to apply this technology on Mauna Kea should contact one of these groups to explore feasibility.

Response to Comment K:

The precipitation data used in the EIS is the measured precipitation at the summit. These data account for all forms of precipitation throughout the day and night, not just the fraction that is snow or becomes snowmelt. See Sections 4.1.5 and 4.2.5 of the EIS for additional information on hydrology.

Response to Comment L:

Thank you. Your suggestions are respectfully noted.

OUTRIGGER TELESCOPES PROJECT
COMMENTS FORM

NASA welcomes and encourages written public comments on environmental impacts and concerns (including historical, archeological, and traditional cultural issues) and proposed mitigation associated with the proposed Outrigger Telescopes.

Your comments will be reproduced in the Final EIS for the Outrigger Telescopes Project. If you prefer that your name not be published with your comments, please express that desire in the comments section below. NASA will not publish your address in the Final EIS.

Your comments may be written on this form and left at the registration desk. Or, you may send your comments to Carl B. Pilcher, Program Executive, Science Mission Directorate, Universe Division, NASA Headquarters, 300 E Street SW, Washington, D.C. 20546-0001. Comments must be provided in writing and received by NASA on or before 4:30 PM Eastern Daylight Time September 30, 2004; fax (202-358-3096) or e-mail (otpeis@nasa.gov)

Commenter's name: Hayden Winchester

Commenter's full address (street, city, state, and zip code): Ø

Date: 9/2/04

Place an X in this box if you wish to receive copies of future environmental planning documents on the proposed Outrigger Telescopes Project (including the Record of Decision) that NASA distributes to the public. ☐

Comments: I am not fully informed on this projected development concerning increasing NASA interest in Mauna Kea as a observatory location. nor do I claim to hold any degree or certification to comment intelligibly on NASA within the context of science. However, I do know my history. I know that from day 1 the Hawaiian people have been subject to massive land loss and, consequentially, the massive loss of life. My argument is cultural and historical, but more importantly it is ethical.

Mauna Kea stands tall as the most sacred and prestigious physical presence that Hawaiian people hold. ~~dear their hearts~~. Because of its elevation, Mauna Kea is considered to be the most ~~as a~~ optimal position for space exploration.

This idea, however, is extremely problematic. Mauna Kea can be given no less respect for its cultural significance as a place of worship, or what most would commonly compare to a church. A church w/o structure, however, equals a church w/o recognition or chance. We must, though, give Hawaiian culture its due respect. We cannot w/ clear conscience continue to support initiatives or actions that perpetuate the already morbid history of our host culture. We must all remember that we are visitors. We must remember that our actions, though economically and politically favorable, have an adverse effect on these friendly stewards of the land. Why should Hawaiians expect any favorable outcome given our (state and Fed) continued abuse of these island people who simply want to care for the land. Respect the Hawaiian people. Respect their voice. Respect Mauna Kea and stop the build-up of their most precious ancestor, the 'āina.

Hayden Winchester
August 9, 2004

Your comments are respectfully noted.

Subject: Concerned About the Future of Mauna Kea
Date: Mon, 27 Sep 2004 15:57:01 -0700
Thread-Topic: Concerned About the Future of Mauna Kea
Thread-Index: AcSk5UzsccljQG//QtqbpBkSqVqB3Q==
From: "Christina Wong"
To: <otpeis@nasa.gov>
X-Virus-Scanned: by NASA Headquarters Spam Firewall at mail.hq.nasa.gov

Dear Dr. Pilcher,

I am writing to you today because I am very concerned about the future of
Mauna Kea. I and many know for a fact that NASA is not living up to its own
past and present Environmental Impact Statement and is neglecting the
cultural and ecological significance of Mauna Kea. NASA needs to start
viewing Mauna Kea and the island of Hawai'i with more respect and work with
the community in finding a "better plan" in order for astronomical research
to continue without environmental destruction. Mauna Kea is an extremely
special place not solely because it provides us with insights on outerspace,
but also because it is home to sacred Hawaiian temples and rare insect
species that reside nowhere else in the world. It is ignorant and
disrespectful of this organization to revolve its management plan around
only its own interests. NASA is a government organization funded by the
people of the United States of America and as a citizen of this great nation
I would like to see NO MORE DEVELOPMENT on Mauna Kea. Also could you please
read the following attachment.

Sincerely a Concerned Citizen,

Christina Wong

Content-Type: application/rtf;
name="Mauna_Kea_Public_Comment.rtf"
Content-Description: Mauna_Kea_Public_Comment.rtf
Content-Disposition: attachment;
filename="Mauna_Kea_Public_Comment.rtf"

Mauna_Kea_Public_Comment.rtf

Deadline for written comments is September 30, 20

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
NASA Headquarters
300 "E" Street SW
Washington, DC 20546-0001

Aloha Dr. Pilcher:
Mauna Kea is a profoundly holy and sacred temple. The summit area has been developed, paved, bulldozed and occupied by the telescope industry for 30 years. Tl existing footprint expands over twenty facilities. The Goddess Poliahu, who resides c the summit, has been paved, graded and changed forever. The native Wëkiu bug ha been nearly wiped out, the view plane of the summit, on which an important religious practice is dependent, has been destroyed. Cultural sites have been routinely destroyed.

According to NASA's own Draft Environmental Impact Statement past and prese telescope activities on Mauna Kea have, "substantially and adversely impacted cultural resources." NASA further admits, "future activities on the summit would continue the substantial and adverse impacts on cultural resources."

Any additional development on the mountain is unacceptable to the people of Hawai'i.

♣ There is no Mauna Kea management plan, which is necessary to guide proposals and management needs of the summit region.
♣ The DEIS was hastily done, ignores important data, includes shoddy science and does not adequately address the combined effects of existing and proposed expansion.
♣ Lake Waiau and Hawai'i Island's principal aquifer are threatened by existing and proposed activities.
♣ NASA has identified the Canary Islands as a viable alternative for this project.
♣ NASA's expansion plans would open the door to even more development, including a thirty meter telescope, being proposed for the untouched northern slope.

There has been unencumbered development on the summit for thirty years. Enough enough. **NO More Development.**

I support the position that there should be no further development on the sacred summit of Mauna Kea.

Signed,
Christina Wong

Address:

Deadline for written comments September 30, 2004
e-mail to: otpeis@nasa.gov
fax: (202) 358-3096

Christina Wong
September 27, 2004

Your comments are respectfully noted. Please see the responses to Kūlani ‘Akahi’s comment letter with regard to your attached letter.

KATS YAMADA

Dr. Carl B. Pitcher
Office of Space Services, Code SZ
NASA Headquarters
300 E Street SW
Washington, D.C. 20546-3096

Dear Dr. Pitcher;

The construction of the NASA observatory atop Mauna Kea as suggested by your DEIS is an abomination of the legal system and designed in total disregard of the laws of the state of Hawaii. The lands on which the observatory and its outriggers are to be constructed are lands held by the State of Hawaii, designated as conservation district and placed in the protective subzone since it consists of lands occupied by an endangered specie. When you prepared the DEIS, you failed to take into consideration the fact that you will be required to:

1. comply with all of the laws of the State of Hawaii, including applying for a Conservation District Use Authorization. A

2. The laws of the State of Hawaii mandates that all land uses provides for the protection of all endangered species and their associated ecosystems.

3. The Hawaii State Legislature has adopted a statement of necessity which requires that protection of endangered species and their associated ecosystems be given the highest priority.

4. Since the project site is inhabited by the Wekiu bug, the project intends to mitigate the impact to critical habitat of the insect by translocating the endangered species to adjacent sites. The Hawaii statutes prohibits the taking of the site currently occupied by the insects. Furthermore, there exists no definitive scientific or practical evidence that such translocation can and will continue the life struggle for the endangered specie. Also the Hawaii statutes do not permit the translocation of the species and instead requires that the endangered species and its associated ecosystem be protected and preserved. B

5. Because the land belongs to the State of Hawaii, and is in the "protected" sub zone of the conservation district, the proposed land use requires the approval of Board of Land and Natural Resources. The CDUA does not permit the Board to evaluate the mitigation to the endangered species, but by its own rules and regulations requires the Board to only evaluate the impact of the proposed land uses on the endangered species and its associated ecosystem. C

6. The Hawaii statutes and the Hawaii Supreme Court's decisions reiterates time and again that the laws including rules and regulation legally adopted by the administrative agencies be given full effect to the plain meaning of the rules when the rules themselves are not ambiguous.

There are substantial citations of the Hawaii Supreme Court and the Intermediate Court of Appeals holding to this decision. In short, the Board can only apply the "plain language" of its rules and regulation and cannot look at mitigation as a means of evaluating the impact to the endangered species.

That the lands in question belong to the State of Hawaii and that the laws of the State of Hawaii will govern its use is unquestionable. Yet you only chose to follow the requirements of NEPA in total disregard of the EIS requirements and the laws of the State of Hawaii. NEPA apparently permits the translocation of endangered species. Hawaii's laws do not. D

The laws of the State of Hawaii involved are as follows:

1. The Hawaii Legislature in adopting chapter 195D made specific "Findings and declaration of necessity." It states in HRS 195D-1 as follows:

> "Since the discoveery and settlement of Hawaiian islands by man, many species of aquatic life, wildlife, and land plants that occurred naturally Only in Hawaii have become extinct and many are threatened with extinction, Primarily because of increased human use of the land and disturbance to native ecosystems.
> All indigenous species aquatic life, wildlife, and land plants are integral parts of Hawaii's native ecosystems and comprise the living heritage of Hawaii, for they represent a natural resource of scientific, cultural, educational, environmental, and Economic value to future generations of Hawaii's people.
> To insure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems, it is necessary that the State take positive actions to enhance their prospects for survival."

2. In order to implement their specific findings, the legislature also adopted HRS 195D-5(d) which states:

> "In carrying out programs authorized by this section, <u>priority shall be given to the conservation and protection of those endangered aquatic life, wildlife, and land plant species and their associated ecosystems,</u> whose extinction within the State would imperil or terminate, respectively, their existence in the world." (Emphasis added)

3. The environmental Policy enunciated in chapter 344, HRS, provides in 344-4(3)(A) as follows:

> "(3) Flora and fauna.
> (A) Protect endangered species of indigenous plants and animals..."

4. Article XI, Section 1, of the Hawaii State Constitution provides as follows:

> "CONSERVATION AND DEVELOPMENT OF RESOURCES
>
> Section 1. For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawaii's natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and utilization of these resources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self sufficiency of the state.
>
> All public natural resources are held in trust by the State for the benefit of the people."

In order to carry out the mandate of the constitution, the legislature adopted the meaning of "conserve and conserving" as using all "methods and procedures for the purpose of increasing and maintaining populations aquatic life, wildlife and land plants."

Recently the Hawaii Supreme Court construed the constitutional provision as "the people of this state have elevated the public trust doctrine to the level of a constitutional mandate. IN RE WATER USE PERMIT APPLICATIONS, 94 Haw. 97; 9 P. 3rd 409 (2000) at page 131.

5. Chapter 13-5, Hawaii Administrative Rules which deals with the issuance of Conservation District Use Authorization requires the Board of Land and Natural Resources to determine (among other criteria) whether "The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region." The rules, which has the force and effect of law, does NOT provide for the mitigation of those impacts in order to qualify the applicant for the permit. Therefore, any construction of the site of the wekiu bug will be in violation of law.

One last item which deserves mention is the callous manner in which the University has permitted the construction of more and more facilities on Mauna Kea despite the protest of large members of the community. Promises made years ago by Donald Hall for the construction of the first facility have fallen by the way side years ago. Protest made years ago about the mercury vapor lamps and hunters driving up on the mountain creating dust were addressed years ago. Yet with the advent of the stryker training grounds being established in adjacent PTA, with the driving of the 18 T vehicle on dirt roads, nothing is mentioned of it. It appears that the construction of the "spider" facility will not end the construction period but will go on until every bit of the mountain has a facility on it. The university is NOT a good steward of the land and the lease it holds should be terminated.

E

". . .along came a spider
And sat down beside her,
and . . . '

Submitted,

KATS YAMADA

Kats Yamada
September 17, 2004

Response to Comment A:

California Association for Research in Astronomy (CARA) would implement the Outrigger Telescopes Project and be subject to all applicable Federal and State statutes and regulations, permits issued by State and local agencies, and mitigation measures specified in the NASA Record of Decision (ROD).

No on-site construction or installation of the Outrigger Telescopes would occur until all permits and approvals are obtained. The University of Hawai‘i's responsibility to acquire a Conservation District Use Permit and the Federal Government's responsibility to complete the National Environmental Policy Act process are separate and independent processes.

Response to Comment B:

The Wēkiu bug is a candidate for listing under the Endangered Species Act. The mitigation measures were reviewed and approved by the U.S. Fish and Wildlife Service (USFWS) and follow all the recommendations given in previous Mauna Kea Science Reserve arthropod assessments (Howarth and Stone 1982; Howarth and others 1999).

In a letter regarding the Wēkiu Bug Mitigation Plan for the W.M. Keck Observatory, Outrigger Telescopes Project at Mauna Kea, the USFWS states “The Service [USFWS] supports the recommendations in the WBMP [Wēkiu Bug Mitigation Plan] to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor use. . . We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to the wekiu bug habitat.” See Volume II, Appendix A, for the letter from USFWS/Henson (USFWS 2000).

The U.S. Department of Interior (USDOI) submitted a comment letter on the DEIS stating “It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wēkiu Bug Mitigation Plan and the Wēkiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities.” See the USDOI comment letter from Patricia Sanderson Port located in this Appendix.

In addition, the USDOI letter states “These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology.”

Response to Comment C:

See Response to Comment A.

Kats Yamada
September 17, 2004

Response to Comment D:

A Federal EIS must be prepared in compliance with federal law. See also Response to Comment A.

Response to Comment E:

See Section 4.1.7.2 of the EIS for information regarding traffic and transportation of large construction vehicles.

Based on the *U.S. Army Corps of Engineers (USACE) Environmental Impact Statement for the Transformation of the 2nd Brigade Combat Team in Hawai'i*, the Stryker vehicles will be operating at the Pōhakaloa Training Area (PTA) and the Military Vehicle Trail between PTA and Kawaihae Harbor. They will not be traveling in the Hilo direction or on the road to or past Hale Pōhaku (USACE 2004).

9/30/04

Dr. Carl B. Pilcher
Office of Space Science, Code SZ

I asked Mauna Kea about the telescopes and got the following:

Allignment with Cosmic Law	# of Telescopes	
48 (Failure)	17	unacceptable - Mauna Kea may take matters into its own hands and reduce the number of telescopes to 2 or 3 within 5 years
65 (Poor)	13	
71 (Acceptable)	10	
85 (Good)	6	
100	0	

Passing on this information to you

hi

Eric R. Yamamoto
September 30, 2004

Your comment is respectfully noted.

Harry Kim
Mayor

Christopher J. Yuen
Director

Roy R. Takemoto
Deputy Director

County of Hawaii

PLANNING DEPARTMENT

101 Pauahi Street, Suite 3 • Hilo, Hawaii 96720-3043
(808) 961-8288 • Fax (808) 961-8742

August 26, 2004

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
NASA Headquarters
300 E Street, SW
Washington DC 20546-0001

Dear Dr. Pilcher:

Subject: Draft Environmental Impact Statement
Outrigger Telescopes Project
TMK: 4-4-15:9 & 12, W. M. Keck Observatory site, Mauna Kea, Hawaii

This is in response to your letter dated July 28, 2004 letter requesting our comments on the Outrigger Telescopes Project proposed for the W.M. Keck Observatory site on Mauna Kea.

Please note our current address for all future correspondences. Further, other than our letter dated January 13, 2004, we have no additional comments to offer.

If you have questions, please feel free to contact Esther Imamura or Larry Brown of this office at 961-8288.

Sincerely,

CHRISTOPHER J. YUEN
Planning Director

ETI:pak
P:\WPWIN60\ETI\EAdraft\Pre-consul\NASA2maunaKeaPilcher44015009012.doc

Hawai'i County is an equal opportunity provider and employer.

Christopher J. Yuen
August 25, 2004

Thank you for providing your current mailing address. Your previous comments have been respectfully noted.

Conservation Council for Hawai'i
P.O. Box 2923
Honolulu, Hawai'i 96802
(808) 593-0255 phone, fax
info@conservehi.org www.conservehi.org

September 30, 2004

Dr. Carl B. Pilcher
Office of Space Science, Code SZ
300 E St., SW
NASA Headquarters
Washington, DC 20546-0001

Re: Comments on Draft Environmental Impact Statement for the Outrigger Telescopes Project Mauna Kea Science Reserve, Island of Hawai'i

Aloha. This letter provides comments by the Conservation Council for Hawai'i on the Draft Environmental Impact Statement for the Outrigger Telescopes Project Mauna Kea Science Reserve, Island of Hawai'i, by the National Aeronautics and Space Administration, July 2004. CCH is a science-based, non-profit, environmental organization dedicated to protecting native species and restoring native ecosystems for future generations.

General Comments

1. Past construction of telescopes and associated infrastructure on Mauna Kea occurred with little regard for unique cultural and natural resources. Agencies charged with protecting the public interest ignored the destruction and failed to enforce the law.

2. We appreciate recent efforts on everyone's to address the significant concerns relating to development of the Mauna Kea summit. However, we find the DEIS vague in many areas, unsupported by scientific evidence, and otherwise deficient, violating the spirit and letter of the law. We request that a revised DEIS be prepared for public review and comment. **A**

3. Development of the Mauna Kea summit is one of the most controversial land use issues in recent times. The Executive Summary does not identify the "areas of controversy (including issues raised by agencies and the public), and the issues to be resolved," as required by federal regulation, 40 CFR § 1502.12. The body of the DEIS does not identify specific issues and concerns raised by the public. A thorough summary of the EIS scoping process would be useful. Without such a summary, the public and decision-makers have no way of determining whether the DEIS covers all of the significant issues associated with the proposed action, as required. 40 CFR § 1501.7. **B**

4. Why is there only one letter in the NEPA Consultations section in Volume II of the DEIS? Is there documentation of any other communication between NASA and local, state, and federal agencies, citizen organizations, and the scientific community during the scoping process or preparation of the DEIS? **C**

5. We also request that better maps be included in any revised DEIS so that the public and decision-makers are better able to evaluate the direct, indirect, and cumulative effects of the proposed action. For example, it is difficult to determine the location of existing and proposed development in relation to the boundary of the Astronomy Precinct and in relation to the various cinder cones at and near the summit. In addition, it is not clear from the DEIS where, specifically, the project site is located in relation to Pu'u Hau'oki. Is the project site on the crater rim, on the crater floor, or at a high-elevation location near Pu'u Hau'oki? **D**

Specific Comments

Our comments below pertain only to the biological resources of the Mauna Kea summit.

1. There is no mention of a pending petition by KAHEA: The Hawaiian-Environmental Alliance to list the wekiu bug as an endangered species with critical habitat designation. The petition was filed with the U.S. Fish and Wildlife Service on May 23, 2003. The Service is in violation of the federal Endangered Species Act by failing to respond to the petition within the legally required time frame.

2. There is no mention of the Wekiu Bug Scientific Data Review Committee, established by the Office of Mauna Kea Management in the fall 2003. The Committee comprised scientists with expertise in the wekiu, other native Hawaiian invertebrates, Mauna Kea summit ecology, and bio-statistics. The Committee found that several threats to the wekiu exist, including present or threatened destruction, modification, or curtailment of wekiu habitat; overuse of wekiu habitat; predation; alien species; global climate change; and inadequacy of existing regulatory mechanisms to protect the wekiu. The Committee also found that there was sufficient data to warrant keeping the wekiu on the candidate endangered species list and listing it as a threatened or an endangered species (June 17, 2004 memorandum from the Committee to the U.S. Fish and Wildlife Service). The DEIS does not include the Committee's findings or all of the data relied upon by the Committee. **E**

3. The DEIS should include a table summarizing the results of surveys of the wekiu at and near the summit over the past 20 years or so. The DEIS should also include a thorough discussion of the relative densities of wekiu in different areas within the occupied habitat. **F**

4. We question the qualifications and credibility of the scientist who prepared the wekiu mitigation and monitoring plans for NASA. No scientific literature is cited in either plan. The scientist has published little, if any research in peer-reviewed scientific journals. He does not appear to be working closely with other scientists, and he does not appear to have the respect of his peers. NASA must insure the professional integrity – including scientific integrity – of the discussions and analyses in the DEIS. 40 CFR § 1502.24. We are puzzled as to why NASA insists on using this consultant when there are qualified scientists based in Hawai'i.

5. Who are the scientists at Pacific Analytics? What are their credentials and qualifications? How much time have they spent in Hawai'i conducting research prior to being hired by NASA? What is the extent of collaboration between Pacific Analytics and scientists at the University of Hawai'i, Bishop Museum, U.S. Fish and Wildlife Service, and other institutions? Is the methodology used by Pacific Analytics the same methodology used by the University, Museum, Service, and other institutions? Are Pacific Analytics and Hawai'i-based scientists and establishing a mutually agreed upon methodology, and are they sharing information? **G**

6. The proposed mitigation for the wekiu is questionable. The DEIS does not include any evidence to support the claim that the proposed restoration of wekiu habitat will be successful. Has similar mitigation been done elsewhere? **H**

7. The DEIS (mitigation plan in Volume II) states that NASA will restore approximately 0.069 ac as mitigation for past destruction and in exchange for permission to construct four, possibly 6 outrigger telescopes on the summit. The proposed restored habitat appears to include only the amount of land destroyed by proposed Telescopes 2 and 3, plus a little extra for past destruction. The calculation does not include mitigation for any areas affected by the underground infrastructure associated with Telescopes 2 and 3; heavy equipment damage; proposed Telescopes 1 and 4; and possibly Telescopes 5 and 6. Why not? Assuming the proposed restoration could be accomplished successfully, it is insufficient to make up for the loss of wekiu habitat by past and proposed construction. Furthermore, the proposed restoration should not be based on only the amount of land destroyed, but the quality of the destroyed habitat as well (i.e., density of wekiu supported by that habitat). **I**

8. The DEIS states that restoration will occur on the floor of Pu'u Hau'oki, an area adjacent to JB5 at Telescope 2, and an area adjacent to Telescope 1. How were these locations chosen? Do any of these locations currently support wekiu? How will the restored areas be affected by the proposed action. **J**

9. The DEIS states that cinder excavated from the project site will be screened, washed, and dumped in the proposed restoration areas. Do wekiu occur in the cinder at the project site? If so, where is the impact analysis for the excavation of cinder from the project site? If wekiu do not occur at the project site, what is the evidence to support NASA's belief that wekiu will occupy the restored habitat? **K**

10. The DEIS states that the wekiu mitigation plan was prepared in collaboration with the U.S. Fish and Wildlife Service. Who, specifically, in the Service was involved in preparing the mitigation plan, and what was the level of involvement? We request peer-reviews of both the proposed mitigation and monitoring plans, and publication of the reviews in the revised DEIS. **L**

11. What is the relationship between the proposed mitigation plan and any efforts by the U.S. Fish and Wildlife Service to enter into a Candidate Conservation Agreement with the State of Hawai'i? What is the status of those discussions? **M**

12. There is little discussion of the other 10 native arthropods on the summit and no impact analysis of the proposed action on these animals. Where do these animals occur? What kind of habitat do they occupy? How will the proposed action affect these animals and their habitat? Federal regulation requires that, if there is incomplete or unavailable information, the EIS must include a statement that such information is incomplete or unavailable, and a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant impacts on the environment. 40 CFR § 1502.22. **N**

13. The methodologies used by NASA to support its claims relating to the wekiu and other native arthropods are not identified in the DEIS or are vague at best. It is improper to rely on the consultant's observations and to merely list unpublished monitoring reports in the References section of the DEIS as the bases for the required environmental analyses. The DEIS must "identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement." 40 CFR § 1502.24. **O**

14. The DEIS contains no impact analyses of the use of water and soil stabilizers to control dust. Instead, the discussion is restricted to the consultant's unsubstantiated opinion and wishful thinking. The DEIS must be "concise, clear, and to the point, and shall be supported by evidence that agencies have made the necessary environmental analyses." 40 CFR § 1500.2(b). **P**

15. How much water will be used to suppress airborne particulate matter, and how frequently will it be applied? What is the scientific basis for claiming that the wekiu will benefit from the addition of water to its habitat? Is water a limiting factor in increasing wekiu populations? What is the evidence to support NASA's claim that several dust-suppressing soil stabilizers are considered environmentally friendly and appear to be free of residuals that can harm native arthropods? Which specific soil stabilizers might be used in the proposed action? What do the stabilizers consist of, and do any of them contain residuals that might harm native arthropods? **Q**

16. Will all vehicles, equipment, cargo, and construction materials be washed and inspected? If so, when and where will this occur? The DEIS states that a "trained biologist" will be in charge of inspecting everything transported to the site. Will this be sufficient? What is the procedure if the trained biologist is unavailable on any given day? Will the transport of vehicles, equipment, and materials, and construction at the project site cease? We recommend that a team of qualified individuals monitor transport and construction to insure compliance with all required procedures. **R**

17. What "appropriate action" will be taken to limit the impact of accidental spills of hazardous waste? The DEIS is improperly vague in this regard. **S**

18. The DEIS is also vague in its analysis of impacts to native arthropods by non-native species. For example, what level of predation of native arthropods by non-native spiders occurs at the present? Is sweeping the webs of alien spiders with a broom the only non-toxic method for controlling these species? Is this method currently employed at the summit? If so, how effective is it? **T**

Mahalo nui loa for the opportunity to comment on the DEIS. We look forward to reviewing a more comprehensive and accurate document.

Sincerely,

Marjorie Ziegler

Marjorie Ziegler
Executive Director

Marjorie Ziegler
Conservation Council for Hawai‘i
September 30, 2004

Response to Comment A:

NASA believes the analyses presented, which are based on the best available information, adequately support the conclusions drawn.

Response to Comment B:

NASA has made every effort to address all scoping comments that are within scope of the EIS. Summaries of the oral scoping comments made at the public scoping meetings are provided in Acrobat® format at http://www2.keck.hawaii.edu/. The Executive Summary has been amended to identify the primary issues of environmental controversy and those to be resolved. A discussion of the scoping process has been added to Chapter 1 of the EIS. Comments were summarized and not attributed to facilitate responding and protect individual privacy.

Response to Comment C:

The title of Appendix A in Volume II of the EIS was changed to more accurately reflect its content. Chapter 8 in Volume I of the EIS provides a list of all individuals and organizations consulted. This list includes, but is not limited to, parties who were sent a copy of the Notice of Intent to Prepare an EIS, and/or a copy of the Draft EIS.

Response to Comment D:

See Figure 2-9 in Volume I of the EIS which shows the location of the W.M. Keck Observatory on a topographic map in relation to Pu‘u Hau‘oki.

Response to Comment E:

NASA reviewed the Wēkiu Bug Scientific Data Review Committee’s report and new information was added to Section 4.1.2 of the EIS.

Response to Comment F:

NASA believes that the written text of the EIS better captures and explains the results and conclusion of these surveys than would a table.

Response to Comment G:

The principal consultant from Pacific Analytics, LLC has been Dr. Gregory Brenner.

Dr. Brenner earned a B.A. from Occidental College in 1974, a Masters of Science degree in Biology from Cal Poly in 1990, a Masters of Science degree in Statistics from Oregon State University in 1994, and a doctorate in Entomology from Oregon State University in 2000.

From January 1995 until August 1998, Dr. Brenner was employed as an invertebrate ecologist for the United States Geological Services (USGS), Biological Resources Division (BRD). His duties for that job included conducting investigations on ecology and restoration of native Hawaiian ecosystems in Hawai‘i, with special emphasis on the arthropod fauna of Hawai‘i. He investigated the status and distribution of rare invertebrates in protected Hawaiian ecosystems and elsewhere in the Pacific. The focus of his work was on the importance of native and alien invertebrates in Hawaiian ecosystems, and to determine the relationships of invertebrates to host

plants and native bird populations. He studied the disturbance to native arthropod communities caused by predators and other invaders or ecological disturbances. His duties also included advising federal and state agencies in Hawai‘i on biological findings and assisting them in setting Hawaiian invertebrate research priorities. During the time he was a resident of Hawai‘i he cooperated and communicated with the Federal, State, and private research and resource management groups, especially those working in Hawai‘i.

During the course of his work at USGS/BRD Dr. Brenner assisted several research scientists in Hawai‘i with insect conservation planning and ecosystem monitoring design. He participated in and led several arthropod surveys including those of the U.S. Fish and Wildlife Service Refuge in South Kona, Kaho’olawe Island, Mamane forest on Mauna Kea, the U.S. Naval Reserves in Guam, and others. He conducted research on the impact of biological control agents and insect pest species on native Hawaiian insects, and on the ecology and biology of Hawaiian insects. He attended several Hawai‘i Conservation Conferences, presenting posters and papers on his research, and organized the 1998 “Invertebrate Conservation in Hawai‘i: Developing a Strategy” symposium. He also participated in several Hawai‘i Conservation Forums where threats to native Hawaiian invertebrates were discussed, and helped develop strategies for the conservation of Hawaiian ecosystems.

Dr. Brenner was the USGS/BRD Principal Investigator during the 1997/98 Wēkiu Bug study, assisting with study design, analyzing data, and contributing to ecological interpretation of collected data. He was later contracted by the B.P. Bishop Museum to coordinate and prepare the 1999 report entitled, “An Arthropod Assessment within Selected areas of the Mauna Kea Science Reserve” prepared for the University of Hawai‘i Institute for Astronomy. During the two years of this study he helped plan and conducted field research studying the ecology, habitat requirements, and distribution of Wēkiu bugs. At this time he also conducted a comprehensive library search of all Wēkiu bug related scientific literature, and became very familiar with the current state of scientific knowledge about the Wēkiu bug.

Prior to his work with NASA, Dr. Brenner had spent more than five years conducting research and consulting on native Hawaiian arthropods.

The methodology used by Dr. Brenner to monitor Wēkiu bugs during Wēkiu Bug Baseline Monitoring is substantially the same as that used by all other scientists studying the Wēkiu bug. The Wēkiu bug sampling protocol, prepared by Dr. Brenner, was approved by a group of scientists convened by the Department of Land and Natural Resources (DLNR) in September 2001. The group included scientists from the U.S. Fish and Wildlife Service (USFWS), B.P. Bishop Museum, Smithsonian Institution, and University of Hawai‘i. Dr. Brenner has continued to refine this methodology, and, as a result, has developed a live-trap that reduces trap mortality to about 2% of the bugs captured. Previous methodologies used traps that caused between 40% - 100% mortality.

The data collected from Wēkiu Bug Baseline Monitoring is shared with the Office of Mauna Kea Management (OMKM), who is coordinating efforts to compile and evaluate all Wēkiu bug-related information. Dr. Brenner has attended meetings convened to discuss Wēkiu bug ecology to which he was invited. He freely discusses the information he has gathered with other interested scientists from the USFWS, B.P. Bishop Museum, Smithsonian Institution, and others.

Marjorie Ziegler
Conservation Council for Hawai‘i
September 30, 2004

Response to Comment H:

The mitigation measures were reviewed and approved by the USFWS and follow all the recommendations given in previous Mauna Kea Science Reserve arthropod assessments (Howarth and Stone 1982; Howarth and others 1999).

In a letter regarding the Wēkiu Bug Mitigation Plan for the W.M. Keck Observatory, Outrigger Telescopes Project at Mauna Kea, the USFWS states “The Service [USFWS] supports the recommendations in the WBMP [Wēkiu Bug Mitigation Plan] to minimize project impacts to endemic arthropods on the Mauna Kea summit and minimize the impacts to this high-altitude environment from alien species introductions, garbage generation and collection, and visitor use. . . We believe each of the recommendations made in the WBMP will greatly minimize the possibility of negative impact to the wekiu bug habitat.” See Volume II, Appendix A, for the letter from USFWS/Henson (USFWS 2000).

The U.S. Department of Interior (USDOI) submitted a comment letter on the DEIS stating “It is apparent from this DEIS that considerable thought and effort have been given to minimizing impacts to wekiu bug habitat in and around the proposed construction area. At present, only about 800 square feet of habitat will be disturbed during construction. In addition, the Wēkiu Bug Mitigation Plan and the Wēkiu Bug Monitoring Plan address additional concerns on impacts for the OT construction activities.” See the USDOI comment letter from Patricia Sanderson Port located in this Appendix.

In addition, the USDOI letter states “These plans outline actions to minimize all identified impacts, describe a program to restore lost habitat at a ratio of 3:1, and systematically monitor long-term changes in wekiu bug populations in the area near the construction site. While habitat restoration for the wekiu bug has never been attempted and success is not guaranteed, the proposed actions identified in the DEIS and the two plans should greatly minimize impacts to the bug and promote greater understanding of its biology and ecology.”

Response to Comment I:

The Wēkiu Bug Mitigation Plan, Volume II, Appendix D, of this EIS does not state that NASA will restore approximately 0.069 ac, nor does it state that restoration is mitigation for past habitat disturbance. It states on page D-2 that “Restored areas will total at least three times the total area damaged by new construction.” Page 4-18 of the EIS reports that “The proposed restoration effort would encompass an area of at least 0.024 ha (0.057 ac)”. The calculations for the amount of habitat restoration are based on estimates of habitat disturbance that would occur during construction of the Outrigger Telescope Project. Construction activities will be monitored and the actual amount of habitat disturbance will be used to determine the minimum amount of habitat restoration to be completed (in a 3:1 ratio). The proposed restoration areas are not limited to areas disturbed by Outrigger Telescope construction, but also include habitat areas disturbed by previous construction activities that are no longer considered to be viable Wēkiu bug habitat.

Construction and installation of Outrigger Telescopes 1 and 4 does not involve disturbance of current Wēkiu bug habitat. The mitigation is intended to compensate for the small about of

habitat disturbance of Outrigger Telescopes 1 and 3. The mitigation is not intended to encompass past and future projects.

Response to Comment J:

The locations for habitat restoration were selected based on availability of previously disturbed habitat with a potential for successful restoration. The areas had to be those that would not be disturbed by observatory operations after restoration is completed. The restoration areas had to be located adjacent to currently occupied habitat so that Wēkiu bugs could migrate into the newly restored habitat. The proposed restoration areas do not currently support Wēkiu bug populations, although some Wēkiu bugs may forage there. Restoration of Wēkiu bug habitat will occur after site preparation is completed. Once restored, the areas will not be disturbed by any construction-related or operational activities. Protective barriers and educational signs will be placed nearby to discourage future disturbance.

Response to Comment K:

Cinder that will be excavated from the site was compacted during the construction and operation of the W.M. Keck Observatory, and Wēkiu bugs do not occur there. The scientific basis for Wēkiu bug habitat restoration can be found on page 4-20 of the EIS. See also Response to Comment H.

Response to Comment L:

The EIS does not state that the Wēkiu Bug Mitigation Plan was prepared in collaboration with the USFWS. It is stated on page 4-18 that “The habitat restoration portion of this plan has been developed in conjunction with the USFWS and other scientists familiar with Wēkiu bug ecology, . . .” Dr. Steve Miller, USFWS Honolulu, and other scientists discussed modifications to the habitat restoration plan in a meeting held in June 2004. The Wēkiu Bug Mitigation Plan and Wēkiu Bug Monitoring Plan were reviewed by USFWS. In that review the USFWS supported the proposed mitigation and monitoring actions with the belief that they “will greatly reduce the possibility of negative impact to Wēkiu bug habitat.” (See Volume II, Appendix A, USFWS 2001). See also Response to Comment H.

Response to Comment M:

NASA has no involvement in discussions between USFWS and the State of Hawai‘i.

Response to Comment N:

Detailed quantitative information about the ten other native arthropods that are thought to be residents of the summit of Mauna Kea is unavailable. These arthropods are new to science and have not been described as species. However, the Wēkiu Bug Mitigation Plan addresses all of the potential stresses to the natural ecosystem on the summit of Mauna Kea from the proposed Outrigger Telescopes Project and would reduce potential impacts on the other native Hawaiian arthropods present as well. In addition, of the ten other native arthropods found within the summit area, six have also been found in the *Area Below the Summit Area Cinder Cones* (Howarth and others 1999). Any impact to these arthropods would be similar and likely proportionate to any impact to the Wēkiu bug. The remaining four arthropods, which include

two species of mites and two species of sheetweb spiders, have been found only on the *Summit Area Cinder Cones* (Howarth and Stone 1982; Howarth and others 1999). However, it is unlikely that the Outrigger Telescopes Project would have any reasonably foreseeable significant adverse effect on these species. See Sections 3.1.3.1, 3.1.3.2, and 4.1.2.2 for more details.

Response to Comment O:

The analyses contained in the EIS are based on the best available scientific information. The results of Wēkiu Bug Baseline Monitoring are reported quarterly with copies sent to DLNR, OMKM, and USFWS. The quarterly reports are available on the World Wide Web at: http://www.statpros.com/Wekiu_Bug.html.

Response to Comment P:

An analysis of water use for dust control is provided in Section 4.1.3.2 of the EIS. Other dust control measures, including the use of environmentally safe soil stabilizers, are discussed in Section 4.1.10.2.

Response to Comment Q:

Moisture is considered a potential limiting factor for Wēkiu bugs. It has been hypothesized that Wēkiu bugs are susceptible to dehydration (Ashlock and Gagne 1983), and use humid hiding places when the habitat is dry (Howarth and Montgomery 1980). Wēkiu bugs have been found to be most abundant where they can migrate downwards to moisture (Howarth and Stone 1982). Water that is used for dust suppression can increase the humidity where it is applied, thereby creating favorable conditions for Wēkiu bugs.

Many dust-suppressing soil stabilizers are manufactured. Some may be environmentally safe and therefore appropriate for use at the Outrigger Telescopes Project construction site. For example, Harvard University research found that the soil stabilizer, NaturalPAVE® XL, is suitable for environmentally sensitive areas such as bird sanctuaries and riparian corridors. NaturalPAVE® XL has been used in several state and national parks including the Lorance Creek Natural Area in Arkansas, the Running Eagle Falls Nature Trail in Glacier National Park, Montana, and the Pinnacles National Monument in California. NaturalPAVE® XL has also been favorably reviewed in the Green Building and Design Recommendations at the University of Wisconsin – Madison.

Item 6 of the Wēkiu Bug Mitigation Plan (Volume II, Appendix D) describes when and under what conditions soil stabilizers would be used. Soil stabilizers considered for use would be professionally reviewed, and only those found to be environmentally safe would be used.

Response to Comment R:

Please see page 4-14 and Wēkiu Bug Mitigation Plan (Volume II, Appendix D) items 12 and 13 for a description of inspection requirements, and information about where and when vehicles, equipment, and materials will be inspected. All items will be inspected before proceeding up the Mauna Kea Access Road. A sufficient number of trained biologists will be available for inspections.

Marjorie Ziegler
Conservation Council for Hawai‘i
September 30, 2004

Response to Comment S:

Sections 3.1.5.2 and 4.2.6.2 of the EIS describe the actions the Mauna Kea facilities have taken to handle hazardous materials carefully and respond appropriately in the unlikely event of a spill.

Response to Comment T:

The level of predation of native arthropods by non-indigenous species is unknown. It has been hypothesized by scientists studying the Wēkiu bug that alien species can impact native arthropods on the summit (Howarth and Stone 1982; Howarth and others 1999). Interdiction through inspections is one of the best methods to prevent the introduction of alien species. Much effort would be spent washing and inspecting equipment, vehicles, and construction materials to prevent the introduction of alien species. However, if some still manage to escape detection and arrive at the construction site, the methods described in the Wēkiu Bug Mitigation Plan (Volume II, Appendix D) should reduce the likelihood that they would become established there.

NP-2005-01-396-HQ