

# Probe STDT Progress Program and Design Team

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for

**Keith Warfield**

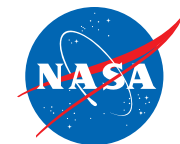
Probe Study Office

Exoplanet Exploration Program

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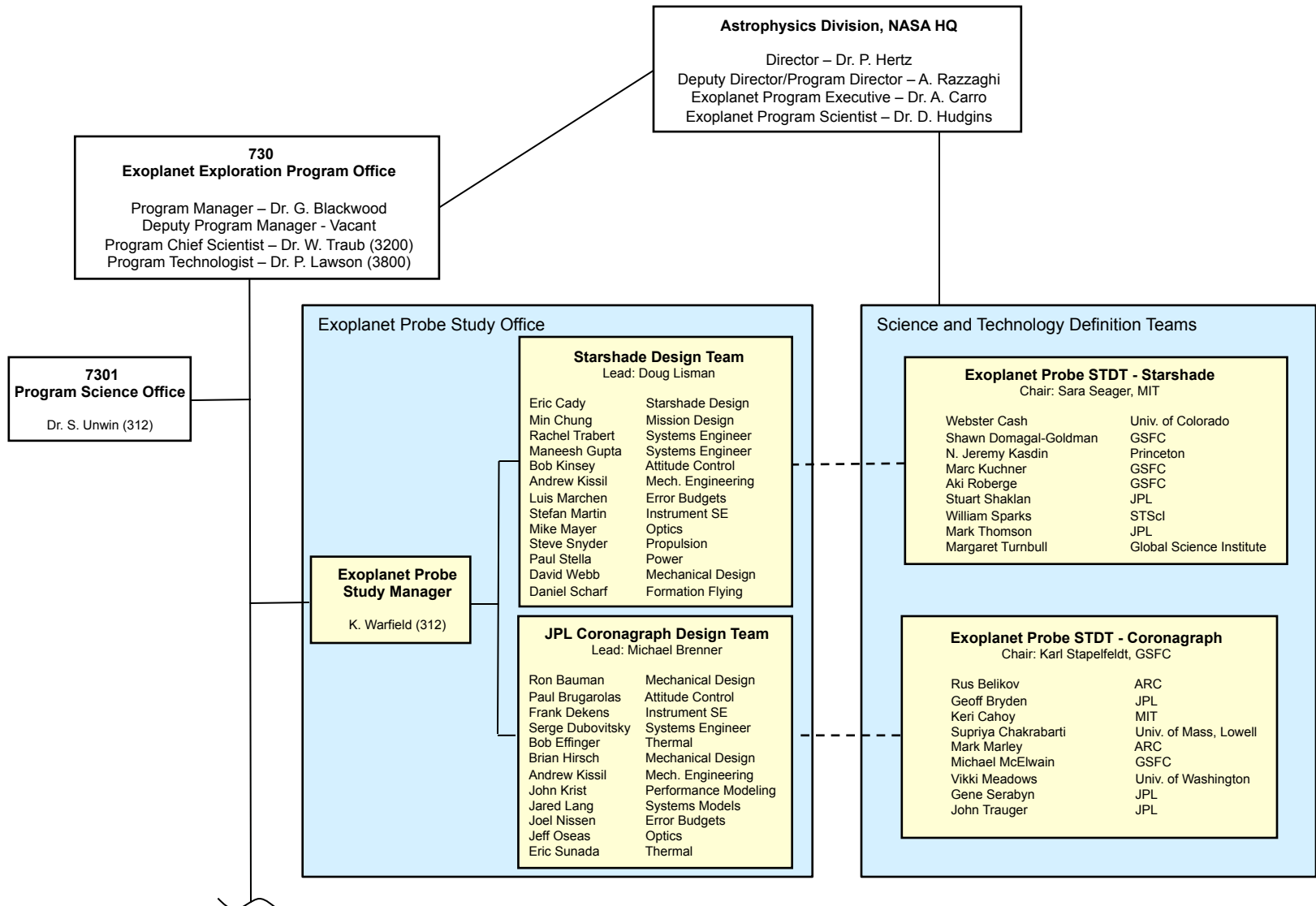
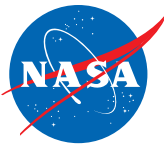
January 7, 2014

# Probe Studies



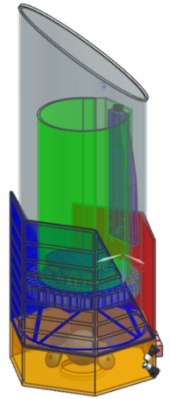
- NASA Astrophysics Division – through ExEP – has chartered 2 Science and Technology Definition Teams (STDTs) with developing Probe-class (<\$1B) exoplanet direct imaging mission concepts
  - Concepts address recommendations called out in the 2010 Decadal Survey
  - Missions will serve as backup options to AFTA
  - Also serves to define the direct imaging technology development roadmaps needed to make direct imaging missions viable for the 2020 Decadal Survey
- As part of the concept development effort, STDTs must:
  - Deliver an Interim Report on their respective concepts to NASA and the National Academies' CAA before March 2014
  - Deliver a Final Report to NASA and the CAA before January 2015
    - Concepts must be ready to begin Phase A by 2017
    - All developmental technologies must be at TRL 5 by 2017 and TRL 6 by 2019
  - Provide design information to Aerospace Corp. in support of their efforts to develop a Cost and Technical Evaluation (CATE) report to HQ by end of Feb. 2015
- Each STDT is supported by its own Design Team
  - Design Teams are comprised of JPL engineers and provide satellite design and analyses services to the STDT

# Exoplanet Probe Study Organization Chart

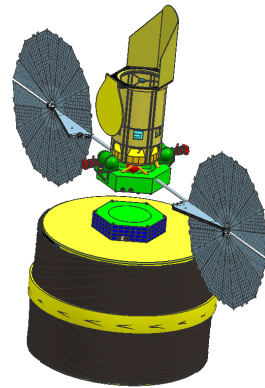


# Progress to Date

- STDTs have met jointly 3 times since the study June kick-off
  - Teams hold regular telecons to discuss the design issues and assignments
- To Date the STDTs have:
  - Defined the science goals and high level performance requirements
  - Completed most architecture trades
    - Most of the two mission architectures have been settled
    - Selection of the final coronagraph design and final DRMs remain open
    - Detail design of the imagers and spectrometers also remain open
  - Defined the interim baseline design and the Design Reference Mission (DRM)
    - Neither the interim baseline design nor the DRM are final – they are an initial “existence proof” of a mission with worthwhile science that meets the charter’s programmatic constraints



EXO-C



EXO-S



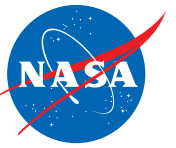
- CATE Estimate Goal
  - CATE is attempting to satisfy a NASA requirement for a 70/30 cost estimate...a cost estimate with only a 30% chance of being over run
- How the CATE is implemented
  - CATE uses industry standard cost estimation tools for an initial estimate then layers on additional costs for “threats”
    - “Threats” come in 3 flavors: schedule, mass (or other technical resources), and launch threats
  - Aerospace has an independent (non-advocate) position as the estimator
    - But they still need to work closely with the Design Teams to ensure that a misinterpretation of assumptions or design data does not enter into their independent estimate.
  - Aerospace will produce three CATE estimates for each STDT
    - The CATE and Design Teams will reconcile all CATE estimates before releasing
    - Only the final estimate will be delivered to NASA HQ
  - Aerospace has already provided an initial assessment of our current concepts and their view (non-quantitative) on the cost risks that exist with each concept
    - Aerospace also provided guidance on what they view as low risk margins

# Work Ahead

## (The Next 6 Months)

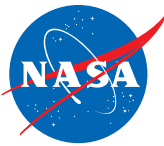


- Deliver the Interim Report
  - The report is due to HQ on 2/18/14 in close to final condition
  - The STDT chairs will brief ExEP and HQ about the time of the delivery to HQ
  - The STDT chairs will brief the CAA on the report at the CAA meeting on 3/3 or 3/4
  - The Interim Report will be cleared for unlimited release and made available to the CAA in March 2014
- Complete the 1<sup>st</sup> CATE
  - Initial independent cost estimate will be due in late February or early March
  - Will factor into the final baseline design
- Down select to the final baseline designs and DRMs
  - STDTs will determine the best spacecraft design and mission observational strategy based on science return and implementation feasibility
- Technology Development Plan
  - The STDTs will develop detailed tech. development plans as required in the Charter
  - Drafts of the plans will be completed in the summer of 2014; final versions will be ready in time for the 1<sup>st</sup> draft of the final report



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# Backup



# Key Assumptions

- Baseline concepts will be < \$1B FY15
  - Estimate will include all mission costs for phases A-F including launch
  - Contributions are not allowed
- Launch Vehicles - Only the NLS II launch vehicles are to be used
- Mission Reliability will be class B per NPR 8705.4
- Contingency (heritage-based expected growth) and Margin (unexpected growth)
  - Contingency: 2% for build-to-print, 15% for modified design, 30% for new design
  - Margin: 25% on mass and power; 100% on data storage
- Minimum Propellant
  - Concepts must carry enough propellant to achieve either their primary science goals or to support 5 years of operations, whichever is greater.
    - Operations beyond primary science (extended mission) are not included in the cost estimate



# Report Development Schedule

