

CAA Report

1 November 2017

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CAA Co-Chairs

CAA reports to the BPA and the SSB

Disclaimer: These slides represent a personal assessment of the issues discussed by the CAA. This document should not be cited or quoted because the views expressed do not necessarily reflect those of CAA, SSB, BPA, or the NRC.

CAA Membership

- Marcia J. Rieke (NAS), Co-Chair, University of Arizona
Steven M. Ritz, Co-Chair, University of California, Santa Cruz
Jeremiah K. Darling, University of Colorado, Boulder
Megan Donahue, Michigan State University
Thomas Greene, NASA Ames Research Center
Lee W. Hartmann, University of Michigan
Vassiliki Kalogera, Northwestern University
Bruce Macintosh, Stanford University
Christopher F. McKee (NAS), University of California, Berkeley
Angela V. Olinto, University of Chicago
Mark M. Phillips, Carnegie Institution for Science
James M. Stone, Princeton University
Alexey Vikhlinin, Harvard-Smithsonian Center for Astrophysics
Eric M. Wilcots, University of Wisconsin, Madison
A. Thomas Young (NAE), Lockheed Martin (Ret.)

Most recent meeting:
October 24-25 2017

[http://sites.nationalacademies.org/BPA/
BPA_048755](http://sites.nationalacademies.org/BPA/BPA_048755)

Summary of Recent Activities

- Report on Small Explorers (SMEX) Opportunities released June 8.
 - A good existence proof that the new Statement of Task works
- An eventful and productive meeting last week:
 - Discussions with Agencies on a variety of topics, including Decadal Survey Timing and Scope (see 2 November discussion, joint with BPA). Survey preparation is the main ongoing CAA focus.
 - AAS and AIP community demographics survey data and plans
 - Science talk by committee member Vicki Kalogera on GW170817
 - Gravitational wave studies moving from physics experiments to astronomy/astrophysics observatories
- WFIRST Independent External Technical/ Management/ Cost Review (WIETR) Report presentation and discussion.

WIETR

- WFIRST Independent External Technical/Management/Cost Review.
 - O. Figueroa and P.F. Michelson co-chairs
 - Review committee included people familiar with dark energy research, coronagraphs and exoplanet research, engineering experts, management and costing experts
- See <https://www.nasa.gov/feature/nasa-receives-findings-from-wfirst-independent-review-team> and memo from Thomas Zurbuchen linked there:
 - https://www.nasa.gov/sites/default/files/atoms/files/final-wietr_memo-signed-171019.pdf
- Slides available here:
http://sites.nationalacademies.org/bpa/bpa_048755#pastpresentations
- WIETR Report not yet released.
- CAA members commended NASA for acting on the recommendations in the Mid-decadal Report and the “Evaluation of the Implementation of WFIRST/AFTA in the Context of New Worlds, New Horizons in Astronomy and Astrophysics” (Harrison) Report.

WIETR Terms of Reference (TOR)



WIETR Charter and Purpose

Terms of Reference Questions

The WIETR panel was charged by NASA SMD Associate Administrator Thomas Zurbuchen to conduct an assessment of the WFIRST Project that addressed the following questions:

- A. Are the technical requirements understood and reasonable?
 - a. Are the technical requirements aligned with the mission's science goals?
 - b. Are there any (obvious) science/technical requirements desopes that the Project should consider that could result in acceptable science return as well as lower cost, earlier launch, or reduced risk?
- B. Are the scope and cost/schedule understood and aligned?
 - a. What is the likely range of probable cost and schedule, and what are the drivers?
 - b. How do non-optimal funding profiles affect the cost/schedule of the mission? What is the impact of staying within the funding profile guidelines and KDP-A total cost guidelines?
 - c. Are there any (obvious) design/acquisition/technical trades that the Project should conduct that could result in lower cost, earlier launch, reduced cost of science and mission operations, or reduced technical risk?
- C. Are the management processes in place adequate for a project of this scope and complexity?
- D. Are the benefits of the coronagraph to NASA objectives commensurate with the cost and cost risk of development?
 - a. Are the science/technical requirements, resource (budget, schedule) allocation, and risk posture appropriate for a technology demonstration instrument?
 - b. Does the technology demonstration require a space mission?
 - c. What are the cost and schedule savings (if any) of removing the coronagraph from the mission at this stage?

This presentation focuses on the WIETR answers to TOR Question B, the answers to which encompass key aspects and findings of the other TOR questions.

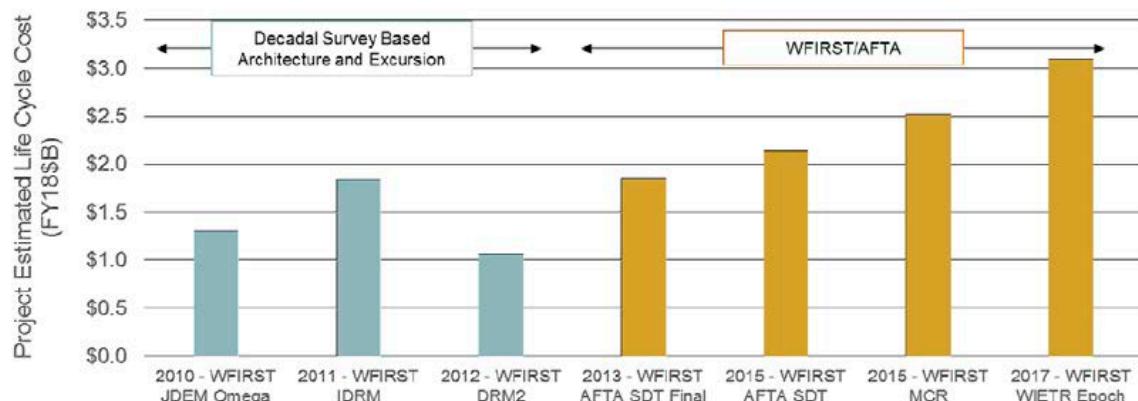
- *“The management agreement signed at KDP-A for the WFIRST life-cycle cost and the budget profile provided as guidance to the Project are inconsistent with the scope, requirements, and the appropriate risk classification for the mission.*
- *There is an urgent need (before the SRR/MDR) for NASA to conduct a top-to-bottom cost-benefit assessment to balance scope, complexity, and the available resources.”*



Summary and Conclusion

- The WIETR found the following:
 - Technical requirements are understood but incompatible with the guideline resources provided to the Project and are therefore unreasonable.
 - Scope and cost are not aligned.
 - Key internal processes are adequate, but NASA governance and application of policy need improvement.
 - There are benefits to developing coronagraph technologies that are consistent with NASA’s longer-term objectives for the Exoplanet Exploration Program (ExEP). Accommodation of the coronagraph, however, has been a mission system design and programmatic driver through formulation and will continue to be a driver, with concomitant risks, to the primary mission well into the WFIRST verification and validation program.
- The WIETR concludes therefore that although the scope is understood, as designed, the risks to the primary mission of WFIRST are significant and therefore the mission is not executable without adjustments and/or additional resources.

WFIRST Project's Design Model Costs from Decadal to Current (FY18\$B)



Attribute	WFIRST Decadal	WFIRST IDRM	DRM2	AFTA SDT	SDT Update	@ MCR	2017 WFIRST WIETR Epoch
Concept Constraint	Decadal Survey Concept	Follows Decadal Survey	Minimize Cost	Incorporate AFTA Telescope	Add Coronagraph	Same Architecture	Same Architecture
Telescope dia	1.5 m	1.3 m	1.1 m	2.4 m	2.4 m	2.4 m	2.4 m
Payload Complement	NIR/Vis Imager, NIR Spec + FGS	NIR/Vis Imager, NIR Spec + FGS	NIR Imager/Spec + FGS	NIR Imager/Spec + IFC-Spec	NIR Imager/Spec, IFC-Spec, AGS + Coronagraph	NIR Imager/Spec, IFC-Spec, AGS + Coronagraph	NIR Imager/Spec, AGS + Coronagraph
Orbit	L2	L2	L2	Inclined GEO	Inclined GEO	L2	L2
Serviceable?	No	No	No	Yes	Yes	Yes	Yes
Dry Mass	2,424 kg	2,336 kg	1,868 kg	4,520 kg	4,861 kg	6,877 kg	7,324 kg
Launch Veh.	Atlas V 511	Atlas V 511	Falcon 9 v1.1	Atlas V 541	Delta IV-Heavy	Delta IV-Heavy	Falcon 9-Heavy
Lifetime	5 years	5 years	3 years	5 years	5 years	6 years	5 years

NOTES:

1. The bar chart is provided to illustrate the evolution and differences in scope and other parameters.
2. All estimates prior to WIETR are based on ideal budget profiles at a pre-Phase A level of maturity.
3. 2010 WFIRST JDEM Omega Cost Analysis and Technical Evaluation estimate was \$1.9B (FY18\$).
4. The 2017 – WIETR column shows the Budget Option 1, as submitted by the Project in FY17 (PPBE19), which constrains the profile in FY18 and FY19.

WFIRST Moving Forward

- See Zurbuchen memo. NASA HQ directed the Project to undertake a design modification study to reduce mission cost and complexity, while still meeting/exceeding science priorities in the 2010 Decadal (NWNH), and to report in February. The coronagraph will be classified as a technology demonstration.
- The CAA anticipates hearing from the WFIRST Project and NASA HQ about proposed changes and science capabilities at, or prior to, its March meeting.

WIETR Membership

Member	Affiliation	Consultants	Affiliation
Peter Michelson	Co-Chair – Stanford Univ/CTS		
Orlando Figueroa	Co-Chair – NASA Retired/CTS		
Dan Woods	Executive Secretariat – NASA SMD	Bob Kellogg	Aerospace Corp
Bob Bitten	Aerospace Corp	Eleanor Ketchum	National Reconnaissance Office
Roger Brissenden	Harvard-Smithsonian/CTS	Tom Magner	Applied Physics Laboratory
David Charbonneau	Harvard-Smithsonian/CTS	Michael Paul	Applied Physics Laboratory
Eileen Dukes	CTS	Justin Yoshida	Aerospace Corp
Daniel Eisenstein	Harvard-Smithsonian/CTS	Joan Zimmermann	Ingenicomm, Inc.
Dave Kusnierzewicz	Applied Physics Laboratory		
William Green	Caltech – Retired/CTS		
Lynne Hillenbrand	Caltech		
Anne Kinney	W.M. Keck Observatory/CTS		
James Lloyd	Cornell University/CTS		
Dimitri Mawet	Caltech/CTS		
Gary Rawitscher	NASA SMD		
Mark Saunders	NASA – Retired/CTS		
Pete Theisinger	Jet Propulsion Laboratory – Retired/CTS		

Additional Items

- Continuing attention to Mid-decadal Report recommendation:
 - **RECOMMENDATION 3-2: The NSF and the National Science Board should consider actions that would preserve the ability of the astronomical community to fully exploit the Foundation's capital investments in ALMA, DKIST, LSST, and other facilities. Without such action, the community will be unable to do so because at current budget levels the anticipated facilities operations costs are not consistent with the program balance that ensures scientific productivity.**

Discussion