



STScI | SPACE TELESCOPE
SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

HST Senior Review Preparations

Rachel Osten

STUC meeting, Nov. 6, 2017



The Purpose of NASA's Senior Review

Congressionally mandated

- Independent, comparative reviews of operating missions to maximize the scientific return from these missions within finite resources
- NASA uses the findings from the Senior Review to define an implementation strategy and give programmatic direction to the missions and projects concerned through the next four fiscal years.

This established practice was codified in the NASA Authorization Act of 2005 (Public Law 109-155), Section 304(a): “The Administrator shall carry out biennial reviews within each of the Science divisions to assess the cost and benefits of extending the date of the termination of data collection for those missions that have exceeded their planned mission life time.”

from NASA response to 2016 Senior Review for Astrophysics Operating Missions



HST in the Senior Review

History

- 2012 was first Senior Review for Hubble
 - 9 missions (incl. HST) reviewed in full panel
 - Info and panel report: <https://science.nasa.gov/astrophysics/2012-Senior-Review-Operating-Missions/>
- 2014
 - Separate panel each for HST, Chandra; full review
 - Info and panel report: <https://science.nasa.gov/astrophysics/2014-Senior-Review-Operating-Missions/>
- 2016
 - Separate panel each for HST, Chandra; “Delta” review
 - Info and panel report: <https://science.nasa.gov/astrophysics/2016-Senior-Review-Operating-Missions>



HST in the Senior Review

Report covers a broad range of topics related to scientific results, use of resources

- Scientific results
- Scientific productivity
- Observatory operations
- Science operations
- Budget & staffing

The important scientific return of HST, along with good stewardship of resources in both mission operations and science operations, have been called out in all three of the Senior Reviews in which Hubble has participated.



HST in the Senior Review

From NASA's response to the 2016 Senior Review:

Hubble Space Telescope

The Hubble mission is directed to continue planning against the current budget guidelines. Any changes to the guidelines will be handled through the budget formulation process. The Hubble mission will be invited to the 2018 Astrophysics Senior Review. Current planning is that the 2018 Senior Review for Hubble will be another incremental review, not a full review.



Prioritized Mission Objectives

Each review has required description of Prioritized Mission Objectives

- Broken up into science objectives (2014, 2016 shown here) and technical mission objectives (2014 shown here)

Table 4.1: Technical Mission Objectives

- 1) Keep Hubble's instruments and subsystems healthy and safe so that great science can continue out to 2020 or beyond.
- 2) Mitigate known instrument or system degradation in a manner consistent with maximizing science.
- 3) Identify and, if practical, implement operational efficiencies that reduce costs without compromising science, or enable new science within the current cost profile.

Table 1.3: High-priority Mission Science Objectives

2014 Prioritized Mission Science Objectives and Number		2016 Prioritized Mission Objectives	Hubble Strategic Objectives		NASA Objectives		Proposal Section
			UV Initiative	JWST Prep Science	NASA SMD Science Plan	New Worlds, New Horizons	
	2016 Status: First Results	New Community-driven Objectives					
2.1 Measure Hubble Constant (H_0) to 1% precision	Published (2016)	Map galaxy formation at the cosmic dawn and high noon (2.3, 2.4)*		✓	A2	1	2.1
2.2 Characterize SN Ia evolution at $z > 1.5$ to constrain dark energy equation of state	Published (2014)	Map star formation and gas in the Milky Way and nearby galaxies (2.6, 2.9)*	✓	✓	A2	1	2.2
2.3 Map cluster dark matter and observe structure in high-redshift galaxies	Published (2014)	Explore the diversity of exoplanet atmospheres and their host stars (2.7)*	✓	✓	A3	2	2.3
2.4 Measure cosmic variance and galaxy evolution at high redshift	Published (2016)	Watch the dynamical and chemical evolution of the outer planets and their satellites (2.8)*	✓		A2 A3	2	2.4
2.5 Detect isolated, stellar-mass black holes	Initial results	New Community-enabling Objectives					
2.6 Map the star-formation history of M31	Published (2014)	Extend master catalog of sources observed by Hubble (2.10)*			A1 A2	3	2.5
2.7 Measure water vapor in exoplanet atmospheres	Published (2014)	Enhance spectroscopic science return of Hubble archives (2.10)*	✓		A1, A2	2	
2.8 Explore the solar system and find new constituents	Published (2014)	Create full-depth mosaics on all fields imaged by Hubble (2.10)*			A1, A2	2 3	
2.9 Explore circumgalactic and intergalactic environments	Published (2014)	Enable new archive queries through target-oriented access (2.10)*	✓		A1 A2	3	
2.10 Create a Hubble Source Catalog	Version 1 released	Expand science through mission support and joint programs (2.1–2.9)*	✓	✓	All	All	2.6
* Follows on from the numbered 2014 High-priority Mission Objectives.							

* Follows on from the numbered 2014 High-priority Mission Objectives.



Next Senior Review

Changed to 3 year cadence; next review expected 2019

EXTENDING SCIENCE

NASA's Space Science Mission Extensions and the Senior Review Process

Committee on NASA Science Mission Extensions

Space Studies Board

Division on Engineering and Physical Sciences

A Report of

The National Academies of

SCIENCES • ENGINEERING • MEDICINE

Recommendation: NASA should conduct full Senior Reviews of science missions in extended operations on a 3-year cadence. This will require a change in authorizing language, and NASA should request such a change from Congress. The Earth Science Division conducts annual technical reviews. The other divisions should assess their current technical evaluation processes, which may already be sufficient, in order to ensure that the divisions are fully aware of the projected health of their spacecraft, while keeping these technical reviews moderate in scope and focused on changes since the preceding review. (Chapter 3)

One Hundred Fifteenth Congress of the United States of America

AT THE FIRST SESSION

*Begun and held at the City of Washington on Tuesday,
the third day of January, two thousand and seventeen*

An Act

To authorize the programs of the National Aeronautics and Space Administration,
and for other purposes.

*Be it enacted by the Senate and House of Representatives of
the United States of America in Congress assembled,*

SEC. 513. ASSESSMENT OF SCIENCE MISSION EXTENSIONS.

Section 30504 of title 51, United States Code, is amended
to read as follows:

“§ 30504. Assessment of science mission extensions

“(a) ASSESSMENTS.—

“(1) IN GENERAL.—The Administrator shall carry out triennial reviews within each of the Science divisions to assess the cost and benefits of extending the date of the termination of data collection for those missions that exceed their planned missions’ lifetime.



Next Senior Review

Changed to 3 year cadence; next review in 2019

- Timeline expected:
 - Request for Proposals from HQ spring/summer 2018
 - HST-P & STScI work on proposal fall 2018
 - Red team review Nov./Dec. 2018
 - Proposal due Jan. 2019
 - Site visit Feb-March-April 2019
 - Report comes out June-ish



Next Senior Review: STUC input

2016 Hubble panel recommended developing higher level Prioritized Mission Objectives (PMOs) to more fully represent the scope of science done by the user community

As a Great Observatory, Hubble's science is driven by the community: PMOs have been taken as representative of the broad and far-reaching science investigations undertaken by GOs

- Develop PMOs at a higher level, focussing on the unique aspects of Hubble. Possibilities include:
 - UV initiative
 - Target of Opportunity observing capability
 - Treasury proposals
 - Responding to reports by various committees: exoplanet, Europa, fundamental physics
 - Community-enabling objectives reflect the increasing use of Hubble's archive for impactful science



Next Senior Review: STUC input

2016 Hubble panel recommended developing higher level prioritized mission objectives to more fully represent the scope of science available to the user community

We would like to involve members of the STUC in this, as representatives of the user community

- Review prioritized mission objectives
- STUC chair member of red team review



Streamlining Science Operations

Science operations area is already lean, from many years in orbit, long-standing flat budgets

We are currently looking across all sectors of science operations; no one obvious area (lots of small epsilons)

- Proposal processes, incl. grants
- Planning & scheduling
- Instruments & observatory
- Tools & archives

Example: changes to Phase II flow

- Enforce deadlines (predictability to PC work timeline, CS review timescale)
- Fewer restrictions (affects planning & scheduling; easier to put in long range plan)
- Justify special requests in Phase I (decreases back & forth between PI, PC, CS, TTRB)



EXPANDING THE FRONTIERS OF SPACE ASTRONOMY