
STScI | SPACE TELESCOPE SCIENCE INSTITUTE
EXPANDING THE FRONTIERS OF SPACE ASTRONOMY
HST2025 – Preparing the ground
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Background

- SM4 was designed to achieve a 5 year extension of HST science (i.e. 2009-2014)

- HST2020 Vision was a process to consider options for science until 2020 (almost there!)
  - UV Initiative
  - JWST preparations
  - COS 2025
  - ULLYSES

- Best engineering analysis predicts ~80% probability of science operations beyond 2025

- This talk to start discussion with STUC: What are some of the issues that need to be considered to make the most of this potentiality?

Three broad areas to consider

- Science
  - Exoplanets
  - Transients
  - Large Programs
  - JWST
  - Archives
- HST Performance
  - Pointing Control System
  - Science Instruments
  - Other issues
- Budget

Science Changes: Increasing demand for Exoplanets

- Growing science community provides increased proposal pressure
- HST has unique strengths but relative values shift with new facilties
- Synergy with JWST observations (e.g. UV and Visible)
- TESS discoveries
  - Need to validate sources prior to JWST observations?
  - Advisory committee in place (Daniel Apai, chair)
- Significant impact on Long Range planning process
  - Due to uncertain HST ephemeris beyond ~10 weeks
  - Creates manual work and rescheduling of other science

Science Changes: increasing demand for Transient followup

- Exciting area of science with upcoming major new sources of targets
  - LIGO, ZTF, LSST, etc.
  - Early indications are that science value (esp UV) increase strongly as a function of how quickly HST can respond (LIGO committee)
- HST currently limits numbers of disruptive Target of Opportunity (ToO) observations (1 Ultra-rapid; ~10 rapid) per year
- Disruptive ToO's impact observatory efficiency
  - Less than optimum schedule (fewer orbits per year)
  - Significant amount of manual processing impacts scheduling of other science and other operational activities
- Do we need to revisit decision mechanisms
  - DD vs TAC ToO programs
  - Bright Object Protection checking
  - Impact on other scheduled science (either A or B gets observed with last minute decision)
- Mechanisms for working with external communities (LIGO, LSST, etc.)

Science Changes: New types of Large Programs

- ULLYSES impacts lifetime of COS FUV Detector
- Potential for other large UV programs
- Support for UV in the JWST era
  - Save capability for future balanced against risk of losing it

- Will there be other large programs?
  - What types of impacts on HST or ground system?

Science Changes: Working with JWST

- JWST may well increase demand for HST observations
- How do these two observatories work together?

Science Changes: Future of Archives

- Legacy for HST
  - Capturing the knowledge together with the data
  - Assuring long term value
- How is the nature of archives evolving
  - AWS
  - Software tools and development approaches
- Interaction of other datasets and archives
  - E.g. GAIA astrometry into HST headers

Observatory Changes: Pointing Control System

- Expected to be most vulnerable technical aspect of HST
- Reduced GYRO mode reduces science return ~25%
  - 10% fewer orbits
  - Less schedule flexibility; reduced field of regard
- Hybrid modes to overcome various failures
  - Cost both time and key resources to develop
- Possible changes in proposal selection process to improve efficiency in RGM
  - Avoid too large a fraction of targets in one part of the sky
  - Interactions with ToO (and time critical?) observations
- Trade decisions
  - E.g. jitter vs GYRO lifetime (we accepted higher jitter to prolong use of G2)
- Single FGS guiding options (preserve lifetime versus some degraded science)

Observatory Changes: Science Instruments

- ACS and STIS are single string
- COS and WFC3 fully redundant
  - Side switch plans in place
- Issues in mitigating decline in performance
  - CTE, COS/FUV
  - Science and observation planning; calibration work
- Failures impact some areas of science disproportionally
  - Considerable overall redundancy but changes require work by GO's and STScI
- Current hedge is science of LRP "tail"
  - Past experience with transitioning proposals when possible
- Future concern:
  - Balance between support for working SI's and closeout/AR support

Observatory Changes: Other possible issues

- Data volume constraints (recorders or transmitters)
  - Pure parallel observations
  - Value of coordinated parallels; review process
- Power system (e.g. solar array motions)
  - Limited field of regard and scheduling constraints
- Unknown/unpredictable issues
  - Motivates maintaining knowledge and skills of team

Budget Changes: Limitation of Resources

- Flat budget scenario implies ~20% fewer staff in 2025
- What are the “core” capabilities that MUST be preserved?

Conclusions

- The challenge:
  - Balancing resources, observatory decline, and science opportunities
- What else should be considered in these areas?
- RISK: a decision made under uncertainty or incomplete information