STScI | SPACE TELESCOPE SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

HST Perspectives on Roman Operations

Presentation to CAA/Roman NAR

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Introduction

Brief background for John MacKenty

- HST Mission Scientist since 2015 tasked with oversight and optimization of all aspects of HST
  - Previously lead STScI WFC3 team and co-lead overall WFC3 design & development (1998-2015)
  - STScI scientist since 1986 worked on WF/PC-1, WFPC2, and NICMOS prior to WFC3
- Roman involvement
  - currently Mission Scientist@ STScI
  - Chaired WFIRST Science Assessment Team (2019-2020) for NASA HQ
  - Chaired CDR for WFI/sRCS 2022
  - Member of Roman Science Interest Group (external advisory committee)
  - Member of several working groups (detectors, calibration, operations, etc.)

HST experience with competing proposals that require significantly different time allocations

- As a general purpose observatory, HST has always been expected to address a broad range of science topics and to serve the entire astronomical community
- STScI institutionalized methods to achieve this from Cycle 1
  - TAC, Key Projects, Director's time (10%) – model derived from NOAO etc.
  - Incorporated strong feedback features; evolution of TAC process
    - Space Telescope Users Committee (reports to NASA and STScI)
    - Response to input proposal pressure: TAC time allocations to panels
  - Distinct efforts to avoid "race to the bottom" with only small proposals
    - Explicit allocations to Small, Medium, and Large (reviewed by TAC of panel chairs++)
    - Consistent advice over decades to support range of proposal sizes
  - Variety of initiatives to create large projects
    - Key Projects (Ho, QSO, MDS – selected by TAC), DD (HDF, etc. – Dir w/ outside advice)
    - Multi-Cycle Treasury call outside regular TAC (30+ proposals; CANDELS, M31, Clusters)
    - Some on merits (e.g. SHoEs/Riess >1000 orbits over multiple cycles)
- Observation: Large projects either appealed to diverse TAC or led by Director

using a community process to optimize surveys

- HST Surveys have been defined in two ways
  - Competed Surveys (e.g. GOODS, CANDELS (forced merger), 3D-HST, early Key Projects, etc.)
  - Director's time (e.g. HDF, HDFS, Frontier Fields, ULLYSES)
    - Director selects a "theme" with advice from staff and outside experts
    - Committee established to define goals and survey strategy, opportunities for input
    - STScI experts (science and technical) implement project and prepare data for analysis
    - Opportunities to community for support to analyze data and add to survey (AR,GO)
- My personal experience with Frontier Fields suggests
  - Broad science inputs from community were very creative and useful
  - Essential to have internal staff implementation support
    - HST is tricky to schedule especially to limit impacts on other programs
    - Dedicated data processing and calibration teams had multiple benefits
      - Science investigations did not need to reproduce this work (level playing field)
      - Demanding observations improved calibration and methods for general proposal pool
- Roman model would incorporate external groups into all steps (consortia, PITS, etc.)

the costs associated with increasing the number of HST GO programs while keeping the number of science orbits constant

- In general, costs are strongly coupled between elements of a complex mission
  - HST operating costs do **NOT** scale linearly with: #Orbits, #GO programs, #Instruments, etc.
  - Other major factors include evolution of systems (Space craft, ground system refresh)
  - Use of complex capabilities (e.g. moving targets, risky operations, timing constraints, etc.)
- For HST, we built the system to handle a large and diverse user community from Day 1
  - Strong support for new entrants (Docs, Contact Scientists, Program Coordinators, etc.)
  - Many HST observers are experienced and/or build on existing programs
  - HST awards 150-200 new programs per year (300+ active)
- Roman SOC did an assessment in the contract proposal submitted to GSFC (for 150 vs 30)
  - Combination of HST experience and analysis of Roman specific needs
  - expect the cost difference to be of the order of several million dollars
    - Costs would likely be higher if this was implemented later

what of the HST experience should the committee consider as it thinks about the number of general astrophysics survey projects currently planned for Roman and their spread over its 5 year prime mission

- "Its hard to make predictions, especially about the future" –Yogi Berra
- HST has greatly benefited from its ability to evolve
  - Science expectations and needs change – strong internal understanding & inputs
  - Technology changes (Instrumentation, ground computers/software)
  - Community learns & grows: fantastic new ideas, analysis expertise, etc. (HST's real strength)
- Roman (in my view) needs to balance having a plan and mechanisms for change
  - A stable plan is key to programmatic success (in Phase C, any delta has costs)
  - Accept that new ideas and knowledge (astrophysical and technical) will emerge
    - E.g. WFC3 never considered exoplanets during design phase but 20% of usage!
    - Key WSAT recommendation mechanism to modify surveys during mission
  - Long term benefits can accrue from smart decisions on extended mission during development phase but accept that needs will change; does it make sense to spend now or not?
- HST's success depended upon enabling new ideas
  - Improved instrumentation, operations, data processing and analysis
  - Social change within the astronomical community in how work (KPNO&IUE to HST, Sloan, etc.)