Space Telescope Users Committee (STUC) Report
June 2024 Meeting, submitted July, 2024

STUC Membership

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Meeting Summary

The STUC met in person at the Space Telescope Science Institute (STScI) on June 26 and 27, 2024. Much of the discussion was devoted to the recent Hubble Operations Paradigm Change Review (OPCR) – NASA's review of potential cuts to the Hubble budget for FY25, which starts on October 1, 2024. STScI also provided clarification and detailed information about the transition to Reduced Gyro Mode (RGM) and its effect on current and future observations. Other topics included presentations on updates from the STScI Science Mission Office, the Hubble Mission Office, the Goddard HST Project, ESA, and a report on the results of recent and upcoming proposal Cycles.

At the end of the 2-day meeting, the STUC presented our conclusions in a 1-hour debrief to STScI and NASA. The STUC commended STScI on the work they are doing under difficult circumstances and acknowledged that it will continue to be difficult as further significant changes to Hubble operations will have to be implemented in the near future. The STUC also emphasized that we appreciate the great detail in the presentations and asked that our thanks be communicated to the teams that provided the information on the slides.

At this meeting, we welcomed a new chair, Harry Teplitz (Caltech/IPAC), and three new members: Annalisa De Cia (ESO), Chris Howk (Notre Dame), and Megan Reiter (Rice). We thank outgoing members Beth Biller (Edinburgh, Chair 2023), Preethi Nair (Alabama), and Kate Rubin (UCSD) for their service. For a full account, the community is encouraged to review the STUC meeting presentations, accessible through https://www.stsci.edu/hst/about/space-telescope-users-committee.

Operations Paradigm Change Review

The Operational Paradigm Change Review (OPCR) was discussed in the Hubble Mission Office update, and without slides during a longer time slot during the STUC meeting. For more information, see the STScI NASA Hubble OPCR page (here) and frequently asked questions.

The OPCR was called by NASA HQ in response to large changes in the budget from The President. The budget proposed for FY24 is $88.9, which represents a significant reduction compared to the flat budget of $98.3 that Hubble has received in previous years. The Hubble budget also includes a fixed cost of the NASA Hubble Fellowship Program (~$8M), which NASA has indicated will remain in the new budget and not be reduced to offset other cuts.

The OPCR Call was issued in March 2024 with documents from the Hubble team submitted on April 19th, which detailed four scenarios that would align with The President's budget cuts. These plans were subsequently presented to NASA HQ on May 8th and are awaiting a response and outcome as of June 27th. The OPCR has been driven solely by the budget changes and the need to rebalance the NASA Astrophysics portfolio. The budget cuts are not the result of any reduction in the science output of or demand for the observatory, both of which remain incredibly strong. The guidelines under which STScI has designed potential scenarios aim to maintain the unique optical/UV capability, the essential mission operations, community grants if possible (though at a reduced level), and support for broad community access, to avoid building in biases. It was noted that ⅓ of all proposals are led by new PIs and that keeping the high level of user support is essential to avoid biases against less experienced users.

With these in mind STScI presented four scenarios to NASA HQ which include a selection of the following changes:

- Halting of WFC3/IR operations - based on redundancy with JWST
- Halting of ACS/WFC operations - based on redundancy with WFC3/UVIS
- Halting of support for High Level Science Products (HLSP), including the hosting of community programs and archives. Any existing HLSPs will still be available, but will not be updated and no new ones will be generated.
- Reduction in support for outreach/science communication
- Potential cuts to other instruments or modes within instrument teams
- Large reduction in community Grant Funding (down to between 0 - 50% compared to Cycle 30, i.e., there is no scenario where there are no cuts to the funding), with a disbanding of the Financial Review Committee and a move to a flat formula for assigning grant funds per orbit. In addition, the future of AR grants are uncertain.
- The Telescope Allocation Committee will move to a fully virtual format

It is not yet clear how NASA will direct the Hubble project to implement changes to meet the budgetary challenges.. STScI will not make any pre-emptive changes to operations of Hubble until directed to do so by NASA. It is noted that once an instrument is no-longer supported it is not likely that it could be reinstated at a future date; so all cuts should be considered final if

implemented. All observations prior to Cycle 32 (2024 round) will be honored and will be implemented ASAP in coordination with the program PIs. The notification to the Cycle 32 proposing teams will be delivered in early July, based on all available modes (prior to the outcome of the OPCR). The results of the OPCR may require adjusting the Cycle 32 time allocation to remove infeasible programs; this will be done in coordination with the program PIs.

The STUC urged STScI to think about the best ways to communicate changes to the community given the likely very short timelines, especially the possibility of needing to implement changes as soon as October. STScI may be able to manage rumors by updating their website with potential changes. STScI responded by setting up this page.

Recommendations related to the OPCR

1. The STUC is concerned that STScI may be blamed for a situation that is beyond their control. We urge STScI to communicate clearly and early and to provide as much information as possible to the community.
2. The STUC appreciates STScI's effort to ensure adequate closeout of eliminated instrument modes and encourage them to prioritize the maximization of the long-term archival value. Similarly, we appreciate that STScI is working to minimize disruption to selected Cycle 32 programs whenever possible.
3. The STUC recognizes the great science potential of HLSP (usage is 10x regular data). We urge STScI to find a way to continue acceptance of HLSPs from the community. We encourage them to explore other funding avenues such as MAST or through partnerships (e.g., other NASA archives, ESA) to support this.
4. We recognize that it is important both to support the analysis of new observations and to support the vibrant archival work that is now the bulk of HST publications, so we encourage NASA and STScI to explore ways to relieve this pressure on the PI grant program by allowing other grant opportunities to support HST archival and theory projects, for example, ROSES R&A (and when appropriate Habitable World Observatory preparatory programs).
5. We urge STScI to continue work on the revitalized HSLA (not updated since 2018), using the work of the HASP team to finalize the processing of all existing data and close out the project in a way that creates high-level documentation. We also encourage a goal of automating HASP to provide co-added spectral data for new observations to the PIs and the archive. If the OCPR outcomes make this difficult through HST funding, the STUC encourages STScI to consider alternative funding opportunities to finish this work (e.g., through MAST or ROSES alternatives).

Reduced Gyro Mode

Tom Brown and John Mackenty presented information about Reduced Gyro Mode (RGM) during their presentations. With HST now operating in RGM, STScI has released a Primer:

https://www.stsci.edu/files/live/sites/www/files/home/hst/observing/_documents/HST-RGM-Primer.pdf. Additional information is available in an older 2-gyro handbook: https://www.stsci.edu/files/live/sites/www/files/home/hst/documentation/_documents/two-gyro/HST-Two-Gyro-Handbook_Version-3-2006.pdf
And in a report on the science implications for RGM from 2016 STUC presentation: https://www.stsci.edu/files/live/sites/www/files/home/hst/about/space-telescope-users-committee/presentations-and-documentation/_documents/2019_may/Gyros_Science_MacKenty_1Jun16.pdf).

An erratic behavior of one of the three gyroscopes in operation (Gyro #3) started in August 2023 and increased since last April, forcing HST to safe mode several times. Following this, HST transitioned to a Reduced Gyro Mode (RGM) in mid June, as announced by NASA on June 4. This transition does not affect the quality of HST science data quality, which have been taken with 1 gyroscope already since 2021. However, the RGM decreases HST's field of regard from 80 to 40-50%, while the solar avoidance zone has increased to 50-60%. APT visibilities will be updated for the RGM. Most notably, the RGM will limit HST's capability to observe transient events, time-constrained observations such as exoplanet transits, and coordination with other observatories. In particular, the sky area simultaneously covered by HST and JWST is expected to be quite small. Over the year, the entire sky will be available for HST observations. RGM will also decrease the maximum tracking speed from 7 to 5"/s. The RGM also impacts the efficiency and flexibility of the observations (e.g., no flip by 180 deg in the Orient specification will be possible). Although the documentation provides helpful information, detailed visibility calculations are best done using the Visit Planner in the current version of APT.

The community will be asked to minimize the constraints on their observations to increase the schedulability and the observatory efficiency. The Long Range Planning needs to be updated for the RGM. Scheduling will be done to maximize the scientific impact of the observatory, and with the additional attempt of minimizing the observational constraints in order to optimize the telescope usage.

The HST Pointing and Control System (PCS) was built on 1970s technology as a layered system with different degrees of accuracy. The PCS contains gyroscopes, fine guidance sensors (FGS), Fixed Head Star Trackers (FHSTs), and a redundant flight computer with dedicated low-accuracy gyroscopes. The PCS performs three roles: safety, target acquisition, and pointing stability. FGS-1 and FGS-2 are replacement units, while FGS-3 is an original unit. Fixed Head Star Trackers are not always usable when obstructed by the Earth. Pointing stability has been achieved since 2021 with a single gyro in combination with the FGS unit(s), so shifting to RGM should not have any impact on stability during science observations. In 2009, all 6 gyros were replaced, including 3 with a new design (credited to the late Henning Leidecker at Goddard) which had enhanced flex leads to resist corrosion by the fluid. Of these enhanced gyros, 4 and 6 remain healthy. Gyro 3 has been taken out of the control loop for RGM due to its high bias and frequent rate saturation events. Gyro 3 has always been "out of family" with any prior gyro on HST, and its failure mode is still not understood at all.

During the discussion, the STUC asked whether a RGM FAQ could be created to help the community get the information they want. John Mackenty said that a list was being built to share info to the Cycle 32 GOs specifically. The STUC asked whether FGS2 was fully usable despite its stickiness issue. John Mackenty said that lubricant was effectively distributed by spinning the FGS motors when stickiness issues come up approximately every 8 months. Pat Crouse said that the other FGS units are preferred for observations, but FGS3 can be used whenever necessary. RGM effects are not related to the choices of possible instrument mode cuts that come from the OPCR. The STUC asked if there would be any hope that gyro 3 might work in the future if turned back on. Pat Crouse said that it is not stuck in saturation, although it is erratic, and the gyro remains powered on for telemetry monitoring.

Recommendations related to the RGM

1. The STUC emphasized that it is important to make it easy for proposers to find info they need for Cycle 33 (though we appreciate that Cycle 32 PIs can work through their PC). We recommend including information (flags/popup/documentation) inside APT itself to caution against overly constrained observations
2. In communications, we recommend that STScI highlight that the impact on ongoing and Cycle 32 programs is small in terms of cancellation
3. We would like to commend STScI on successful communication with PIs of ongoing programs about the transition to RGM

Director's Welcome

The new STScI director Jennifer Lotz provided a welcome and introduction to the meeting, thanking everyone for participating and highlighting that this is a challenging time for Hubble. Hubble is doing great scientifically, with a record year for publications and a great response to Cycle 32. Hubble has had to transition to reduced gyro mode and that has gone smoothly. Overall, Hubble has the ability to continue to do amazing science for the next decade. However, the mission is facing a very likely budget cut. The Operations Paradigm Change Review (OPCR) took place in May. No guidance has been received from NASA yet and it is not clear when that will come. The short timescale is a worry. In principle, these cuts will take place in FY25, which starts on October 1. Changes on this time scale will be very difficult. Changes include the likely shutdown of instrument modes and significant cuts to grants. Despite these challenges, there is a lot to look forward to. Hubble is continuing to do amazing science and ⅓ of PIs are new PIs. The science Hubble does now will provide a bridge to the next flagship mission.

Science Mission Office Welcome and Overview

STScI staff changes since the last STUC meeting include Jennifer Lotz stepping into the role of Director, Nancy Levenson moving from Interim Director to Deputy Director, Marc Postman changing from Interim Deputy Director to Interim SMO Head, and Molly Peeples returning from Sabbatical to assume Hubble Policies Deputy. Upcoming changes on July 1 include Tom Brown

moving from HST Mission Head to JWST Mission Head, while Julia Roman-Duval will step up to Interim HST Mission Head.

Laura Watkins provided updates on some previous STUC recommendations:

- The Exclusive Access Period (EAP) Survey Analysis was completed in December 2023 and the final report is available online; no changes to the EAP for HST programs are expected at this time. The JWST and HST Equitable Data Access and Team Recognition Advisory Committee has been assessing the community responses as well as considering mechanisms to preserve recognition for proposal teams in a more open-access environment; their report is expected by the end of 2024.
- The Strategic Exoplanet Initiative Working Group submitted their final report in April 2024; it is available online. Their key recommendation is a DD concept to survey the atmospheres of rocky M-dwarf exoplanets, and they additionally recommend support for a JWST comprehensive, high S/N panchromatic atmospheric survey of planets built from GO-driven programs. An internal working group and an external advisory committee will be set up to implement the DD program.
- The Long-Term Variability Monitoring Strategies Working Group submitted their final report in May 2024; it is available online. Their key recommendations include a JWST DD program for high-redshift transients targeting Population III supernovae as well as a number of policy considerations for submission, review and execution of long-term science programs. An internal working group and an external advisory committee will be set up to implement the DD program, and a committee will be set up to investigate the policy recommendations.

Additional updates regarding STUC recommendations were scheduled for later presentations.

Hubble Mission Office Presentation

Tom Brown presented updates on Hubble operations, including the OPCR and RGM. With over 1000 publications in 2023, the scientific return of HST is at its highest. The demand for HST continues being very high, with an oversubscription of 6:1, remaining strong also after the launch of JWST.

HST is working to complete Cycle 31 observations. Cycle 32 will start 4-6 weeks later than expected, in November instead of October 1st, to allow some adjustments for the transition to RGM. The notification to the Cycle 32 proposing teams will be delivered in early July, based on all available modes (regardless of the OPCR). The results of the OPCR may require adjusting the Cycle 32 time allocation to remove infeasible programs. Operational changes will not take place before NASA's request. Users will be warned in advance.

The observing efficiency of Cycle 31 has been particularly low (from the normal 89 orbits/week to 45 orbits / week while troubleshooting the erratic gyro), causing a delay of 929 orbits, which is significantly larger than usual. Most cycle 29/30 large programs have been completed. The execution of exoplanet and solar system programs have been slower than usual due to scheduling constraints in RGM. Different ways to minimize the observing constraints and thereby increasing the feasibility for scheduling were discussed. Time or Orient constraints may need to be justified in the proposals and/or in APT.

Instruments continue operating nominally after two decades, with moderate degradation. Software for updating their characterisation is in current development. COS LP5 & LP6 planning on lifetime expectations was significantly reduced by frequent and long observations of bright objects with S/N above 40. A policy limiting the S/N to 30 will be added to address this.

Recommendations related to the Hubble Mission Office

1. In future reporting the STUC feels that it will be important to normalize historical comparisons for changes in instrument and/or funding availability

GSFC Hubble Project Update

The Goddard HST Project update was given by Jennifer Wiseman and Pat Crouse. Dr. Wiseman noted that Hubble's scientific output is still incredibly strong as it approaches its 35th launch anniversary, and that it represents a vital component of NASA's Flagship portfolio. She highlighted new work done by citizen scientists to study asteroids in Hubble imaging, which identified 1700 asteroid trails, of which more than 1000 were new discoveries. Hubble data were part of more than 1000 scientific papers over the last year. The Hubble program has been an innovator in fostering scientific inclusivity, leading the charge in dual-anonymous proposals that have diminished the gender disparity in proposal acceptances and led to roughly one-third of recently accepted proposals being led by first-time PIs.

Hubble is now operating in reduced gyro mode (RGM), removing the erratic Gyro 3 from the command loop in order to avoid the safing events that were driven by its use. The remaining gyros are of the "enhanced" type expected to have good reliability for the foreseeable future. The STUC commends the project for the significant effort required to enable this mode and implement the program changes for existing and newly-approved programs.

RGM puts more load on the Fine Guidance Sensors (FGSs), requiring more FGS coarse track cycles. The team is monitoring the FGS compensation error performance and looking at potential changes to the guide star acquisition logic that would reduce this pressure. The team is preparing for an aperture door test on July 8, an annual test in response to the lack of redundancy after the failure of the motor failure in 2021. The team is developing an approach to re-enable B-side operations of the Science Instrument Command and Data Handling system. Software development is continuing through the end of 2024, with a goal of enabling the capability by September 2025.

The presentation also included details of the HST program budget. Guidance from the 2022 Senior Review recommended a flat $98.3M budget, with the NASA Hubble Fellows Program (NHFP) removed from the HST program budget. In reality the current and projected budgets through FY2028 are significantly lower; with the NHFP continuing to be funded through the HST program, these represent roughly 16% to 25% cuts to the operational and grants budget. The grants program, in particular, was reduced on short notice from as much as $30M in previous cycles to $15M in Cycle 31.

ESA Update

Chris Evans gave an update from the ESA Office comprising 30 personnel at STScI, with an expectation that this staffing level will continue. ESA recently hosted a successful conference focusing on HST and JWST science in Porto, Portugal, and the synergy between these two observatories. This includes new opportunities for HST followup of JWST discoveries at shorter wavelengths. Updates to the eHST archive showed an impressive combination of Gaia and HST data, including a new spectral viewer that may be further adapted for other data sets (and could be especially powerful for Euclid). The 2024 ESA Distinguished Lecture at STScI was presented by Dr. Orlagh Creevey on June 18, titled “Hidden gems in the Hertzsprung-Russell diagram.” Outreach from the ESA Office is a key strength, with recent highlights including a joint Euclid/HST/JWST view of the Horsehead Nebula, and the continuing popular Picture of the Week. The STUC appreciates the ESA Office updates and the strong enduring partnership.

Cycle 31 Mid-Cycle, Cycle 32 Update, and Cycle 33 Plans

The STUC heard a report from the Science Mission Office (SMO) with an update on the Mid-cycle 31 review, Cycle 32 review, and plans for Cycle 33.

The Mid-cycle 31 review yielded results consistent with previous mid-cycle reviews. A persistent gender imbalance, favoring male PIs over female PIs, in the mid-cycle reviews has been noted.

The STUC was presented with results from the Cycle 32 review, which are preliminary because these results are still in the process of being finalized before being announced to the community. The STUC was pleased to see that the new “Transients” review panel generated positive feedback from its chair and panelists. The STUC was also pleased to see that the RGM had minimal impact on the Cycle 32 science program.

Looking to the future, STScI presented plans for the Cycle 33 review to be conducted in 2025. The STUC expresses no objections to the proposed changes to the process, including removing the IGM and LSS external panels (because many such proposals are now being submitted to JWST calls), reducing page limits (following feedback from reviewers and for consistency with JWST and other calls), and developing a fully virtual review process all the way up to the executive committee (EC) level (to minimize travel costs). In addition, STScI presented a plan to issue guidance on the use of generative artificial intelligence (GAI), based in part on NSF policy.

Finally, during a couple of the STScI presentations, including this one, an idea was proposed to explore a new category of proposals to allow for groups of alternate targets. The goal would be to expand scheduling flexibility by offering a small number of choices for each target within a program. For example, if five QSOs with different characteristics are needed, but there are several options for each set of characteristics, then a program could allow for proposing targets in groups. This would in turn make scheduling more flexible, as long as each group was spread out on the sky. Such a program would have to allow longer visits than a SNAP program, in order to maximize utility. STScI stated that the feasibility of such a program has not yet been evaluated.

Recommendations related to the proposal cycles

1. The STUC encourages STScI to investigate the gender imbalance seen in mid-Cycle results (e.g., by considering the differences in subfields and pools of proposers in the mid-cycle pools relative to the standard proposal pools).
2. The STUC also notes that the continued use of only two genders in figures and tables could create a false impression of insensitivity on the part of STScI. We encourage STScI to continue to succinctly emphasize when presenting such data that collection of demographic data is subject to legal limitations.
3. The STUC particularly agrees with the benefits of shorter proposals, and we encourage STScI to clearly communicate to both proposers and reviewers about this change.
4. The STUC appreciates STScI’s effort to provide guidance on GAI tools, in the current absence of direction from NASA more broadly, and we recommend looking the journals in our field and related ones when developing useful guidelines.
5. The STUC encourages STScI to explore the feasibility of an “alternate target” category of GO proposals.