

Report of the Space Telescope Users' Committee (STUC) Meeting, October 2001

The Space Telescope Users Committee (STUC) met on 25th and 26th October 2001 in the Board Room of the Space Telescope Science Institute.

Attended: Marc Davis, Debra Elmegreen, Holland Ford, Suzanne Hawley, George Miley (Chair), Dave Sanders, Karl Stapelfeldt, John Stocke.

Unable to attend: James Dunlop, Chris Impey, John Kormendy, Alfred Vidal-Madjar.

1. Status of Project and SM3B Servicing Mission

The STUC complements NASA and the STScI for continuing to maintain such an efficient and scientifically productive facility, into the second decade of its operation.

Since our last meeting the main event that occurred in the operation of the telescope was a power failure in the Side 1 electronics of STIS in May 2001. A quick recovery was made and the incident had minimal impact on the observing efficiency. We congratulate the Institute and the Project on their rapid response to this problem.

Several tasks are planned for the SM3B servicing mission, of which the most important is the installation of the Advanced Camera for Surveys. The Project has been responsive to the arguments of STUC and others in keeping the installation of the NCS radiator for NICMOS in the manifest despite the many other requirements of the mission. We reiterate the importance of carrying out the NICMOS refurbishment in SM3B. As we pointed out in our previous report and our subsequent submission to the Project, IR imaging (NICMOS) is an essential complement to the ACS optical imaging for tackling several fundamental astrophysical problems.

The Cycle 11 call for proposals has resulted in the largest over-subscription of requested orbits ever experienced by the HST. This underlines the large increase in the capabilities of the HST that will directly result from its new instrumentation and the high expectations that the astronomical community have for the facility over the next several years.

Despite threats to the UPN459 budget since our previous meeting, NASA has been able to preserve GO funding at its present level. We are grateful for this and reiterate that GO funding is extremely cost-effective in ensuring the continued high scientific output of the telescope.

2. New Instruments

Presentations were given to our committee describing the state of the new instruments to be fitted to the HST during the next 2 servicing missions. These instruments (ACS, NCS/NICMOS, WFC3 and COS) will result in an enormous increase in the power of the HST and should produce many fundamental discoveries. Development of all these instruments is progressing well and generally within the present budgets. We were particularly impressed by the care that is being taken to ensure that the NCS/NICMOS will not interfere with any of the other on-board instruments. The only substantial current problem with the new instruments is the low efficiency of the near-UV gratings of the Cosmic Origins Spectrograph (COS), a problem that is at present under investigation. The recently developed non-redundancy in the STIS electronics jeopardizes the spectroscopic capabilities of the HST and has increased the importance of a timely launch of COS. STIS is now operating in a single-point failure mode, as the electronics evidently cannot be repaired in orbit.

3. Scientific Effectiveness of HST

The continuing efforts to quantify the scientific impact of the HST have progressed significantly since our last meeting. We are pleased that several suggestions made by the STUC have been adopted. The resultant data provide excellent quantitative confirmation of the uniquely high scientific impact that the HST has had and continues to have. We look forward to seeing this tool extended to investigating such matters as the relative scientific impact of archival research, GTO programs and of the various HST instruments.

4. Science Operations: Goals and Benchmarks

The STScI is continuing an analysis of the various steps that occur from proposal preparation to the production of papers. The aim of this analysis is to develop goals and benchmarks for the various steps that might lead to an improvement in the total scientific efficiency of the telescope. The STUC was shown results of a set of science operations metrics that are under consideration. We were particularly impressed by the continuously high observing efficiency of the telescope. The STUC would appreciate receiving an update on this project before the next STUC meeting and look forward to helping the Institute refine the priorities of the metrics that are of most interest for users. In addition to the operations metric study, we note that a related project is underway ("Shark Cage") in which the various processes in the HST data flow are being reviewed and optimized with particular focus on user needs and work habits.

5. Software

5.1 The Astronomers Proposal Tool.

The STUC has supported and followed the development of the APT since its inception. We are pleased to note that several of our previous suggestions have been acted upon. The present release of APT was used widely for the preparation of Cycle 11 proposals and we have received very positive feedback about this tool from the community. We look forward to the full implementation of APT, and particularly to its use as a Phase 2 preparation tool.

5.2. PYRAF

The developments of PyRAF and of new data analysis tools (including PyDrizzle) being developed in the Python environment are proceeding well. The first official PyRAF release is scheduled for January 2002. We shall be interested in learning about feedback from future users.

As mentioned in our previous report, a sub-group of STUC (Marc Davis, Suzanne Hawley and John Kormendy) will be happy to help with setting priorities for future application software development. Because writing software code should be relatively easy within PyRAF, we suggest that the Institute consider outsourcing the development of a sub-set of future applications software to expert users.

5.3 New STScI Website

The STUC was pleased with the new appearance of the STScI website and the easy-to-use navigation tools that allow users and the general public to explore the large range of material now on-line at the Institute. The new web structure should allow for more efficient posting and interlinking of documents and data.

5.4 Multi-Platform Support.

We reiterate the recommendation made in our last report that multi-platform capabilities (e.g. Linux, MAC) be incorporated into the development of STSCI software systems and note that the Institute is working towards implementing this recommendation.

6. Cycle 11 Call for Proposals

The STUC were presented with an overview of the statistics of submitted Cycle 11 proposals.

The response to the Cycle 11 AO has been overwhelming, with the number of orbits proposed reaching an all-time high. The large over-subscription is a vivid illustration of the continued enthusiasm for the potential of the HST. Community response to the new Treasury and Theory program categories appears to have fulfilled the vision that led to these new initiatives.

STUC discussed whether specific measures should be taken to take account of the large Cycle 11 over-subscription, e.g. allocating more than a year of available telescope time. Given the ground rules of the Cycle 11 AO, we do not think it advisable to allocate additional time for the normal small, medium and large proposals. However, special actions may well be appropriate in the case of Treasury Proposals. These proposals form a new category and are often multi-year in character. We would not expect many additional ideas for such proposals on the timescale of a year. Hence, provided the Cycle 11 TAC judges the Treasury proposals to have sufficient scientific merit, we would support allocating more observing time to them than nominally available over a one year period. This measure could be coupled with the omission of this category of proposals from the Cycle 12 AO and could enable a coherent suite of such projects to be initiated. Further, we suggest that the guidelines for the relative fractions of time to be allocated to the different classes of proposals should not be interpreted too rigidly in the Cycle 11 allocation process.

STScI's planned experiment with reduced TAC feedback to Cycle 11 proposers was again discussed at length within the STUC. Some STUC members reported that an informal canvassing of their colleagues had resulted in negative opinions about the proposal to cease automatic feedback of all TAC comments. The STScI reiterated and clarified the procedures and policies that would be followed. All proposers will receive quartile ranks. For the large and Treasury categories, TAC comments will still be automatically sent. Further, TAC comments will be sent upon request to all proposers, once the Cycle 11 decisions are announced. The proposed measure is just one of many being considered, with the eventual goal of streamlining the proposal procedures and reducing the time between proposal submission and observation. The STUC urges that Cycle 11 notification letters include information on how proposers can request TAC comments, if desired. We look forward to reviewing the results of this experiment as part of a general assessment of the Cycle 11 TAC procedures at our next meeting.

The STUC note that the Institute are considering instigating a general review of TAC processes in preparation for Cycle 12. We would welcome such an initiative and would be happy to participate. Some issues for consideration include (i) finding ways to reduce the large amount of work currently required of individual TAC and panel members, (ii) the desirability of providing incentives for TAC participation (e.g. consultancy fees) and (iii) possible changes to the Phase I proposal schedule and dates. The impact of proposed changes in the TAC process on the phasing and duration of grant program funding should be considered before deciding to implement them.

7. Archive

We reviewed various activities being carried out at the Institute in support of archival research. As illustrated by the steadily growing usage, the HST archive is a vital resource for the community. Users generally find the HST archive easy to use. The STUC supports the concept of the multi-

mission archive (MAST) in which the expertise developed in creating the HST archive is being exploited for the benefit of other missions. For example, the Sloan Digital Sky Survey "early data release" archive is extremely easy to access from MAST and its inclusion as a service of the STScI has been well received by the community.

We complement the STScI on their on-going study of possible Hubble archive and reprocessing enhancements (SHARE). The STUC received a description of this activity together with a preliminary list of priorities for future enhancements several days before our meeting, with a request for feedback. Based on this document we make the following suggestions and comments:

1. As a general guideline, instrument-specific tasks should be prioritized higher than scientific applications that depend on interpretative assumptions (e.g. photometric redshift estimations).
2. We regard the combination of images to produce a wide-field mosaic as the most important of the tasks specified in the preliminary list
3. The improvement of the accuracy of relative positions to facilitate mosaicing should have high priority. Improving the absolute positional accuracy, although a laudable goal, seems difficult to implement at present.
4. There was considerable interest within STUC for Item 7 in the report, in which the history of data (and calibrations) would be used to minimize time-dependant calibration errors and enhance reprocessed data.

Implementing such tasks should be coordinated with the STECF and other groups involved in reprocessing HST data. The SIRTf Science Center is already planning to add mosaicing, source extraction and detector time history modules to its calibration pipelines. It would be beneficial for the STScI and the SIRTf Science Center to share ideas on these and other data processing tasks of mutual interest. Further, we note that some envisaged SHARE tasks are well suited for outsourcing, particularly since they are likely to be relevant for Cycle 11 large and Treasury proposals.

We were presented with options for future projects designed to enhance the post-operational archive. We suggest that the relative archival usage of the various instruments should be the major driver in determining priorities for such projects. We deferred detailed discussions of the various options until the next meeting, in which we would welcome an additional presentation on such activities from the STECF.

8. The Future Hubble

The overwhelming response to the Cycle 11 proposal cycle coupled with an uncertainty in the launch date for the NGST lead the STUC to suggest that a reevaluation of the strategy for maintaining the HST over the next decade would be appropriate. Serious consideration should be given to the cost effectiveness of taking proactive measures to ensure that the performance of the HST is kept up to modern technological standards until at least such time as the NGST is likely to be scientifically productive. Given the ambitious technological hurdles that need to be overcome and the history of large space projects, we believe that it is uncertain whether the NGST will be producing science by 2010, the year that the HST is presently envisaged to cease operating.

Further, as a result of its recent problems, STIS has become a single-string instrument whose future lifetime is uncertain. By 2007 the STIS and ACS CCDs will have accumulated respectively 10 and 5 years of radiation damage. We believe no new instruments are fitted to the HST after 2004, its capabilities and competitiveness will severely degrade.

New instruments have consistently improved HST's capabilities by a factor of ten or more relative to the instruments they replace, and for a lower cost than previous instruments. During the next 3 years, the Advanced Camera for Surveys, the Wide-Field Camera 3 and the Cosmic Origins

Spectrograph will enhance the discovery potential of the HST enormously. The scientific impact of these instruments is likely to be largest during the first 2 - 3 years of operation. We therefore suggest that equipping the HST with one further additional instrument in about 2007 is desirable to maintain the HST as a leading astronomical facility in the pre-NGST years.

The cost of a new HST instrument amounts to only about 10% - 15% of the cost of a servicing mission. An Announcement of Opportunity for a scientific instrument to be fitted to the HST in a servicing mission following SM4 could therefore be an extremely efficient way of producing fundamental astronomy, since it would exploit the ~\$2 billion investment that NASA has made in Hubble. We suggest that NASA balance the cost effectiveness of such a measure with that of funding other missions. The STUC Chairperson will write a letter to the Director of the NASA Astronomy and Physics Division suggesting consideration of such matters.

A crucial element in assessing the cost effectiveness of keeping the observatory operating at a high technical level during the period 2007 - 2010 and beyond is a consideration of limitations to its lifetime. Analyses of (i) the failure expectation of the various components of Hubble, (ii) the factors that limit the life of the telescope infrastructure and (iii) possible measures that could extend its lifetime are relevant. We therefore suggest that the Project conduct a careful engineering study to investigate these matters and, if possible produce a costed plan for prolonging the life of the HST until 2012. We would appreciate receiving feedback about this matter from the Project at the next meeting of the STUC.

9. Next Meeting

The dates of the next STUC meeting will be 15 and 16 April 2002. Meanwhile, we send our best wishes and appreciation to all those that will be involved in SM3B servicing mission. Besides SM3B, possible items for consideration at our next meeting include (i) review of the Cycle 11 TAC procedures (ii) update on the archive and STECF projects (iii) HST Science operations metrics.