

STUC Report of 24-25 October 2005 Meeting

STUC Members present: D. Axon, M. Elvis (chair), E. Emsellem, P. McCarthy, R. O'Dell, R. Schulte-Ladbeck, M. Tosi, M. Vestergaard, D. York.

Unable to attend: M. Barstow, L. Ferrarese, M. Mateo

STUC welcomed a new member, Marianne Vestergaard (Steward Observatory, U. AZ). Our second new member, Mario Mateo (U. Chicago), was unable to attend this meeting.

Preston Burch: Project Status

The presentation of Preston Burch was very useful in describing the current status of the HST and plans for the future. We note that the change to a two-gyro-mode of operation has extended the date at which there is a 50% probability of availability of science operations with HST to mid-'08. This means that mid-2008 – early-2009 has become the key period for HST operations without SM4, even if a one-gyro-mode can be identified. The batteries are expected to continue to provide adequate power margins until well into 2010, therefore servicing of HST will remain possible until 2010. The plans for SM4 do not now include a de-orbit module, due to a re-evaluation of the HST re-entry date to be no earlier than 2021. This substantially reduces the cost and schedule difficulties involved with SM4 and preparations have restarted for this mission, although a final decision on SM4 awaits a successful Shuttle mission in 2006. If SM4 takes place successfully in December 2007 then HST science operations could continue through 2013.

The STUC strongly supports an early HST servicing mission (SM4).

We note that the continued operation of HST is more pressing given the expected delays in the launch of JWST, as anticipated by the J. Bahcall report.

The STUC would like to learn more detail on the potential effects of out-gassing onto the WFC3 pick-off mirror from the SLIC (a graphite-epoxy structure for holding the WFC3 during SM4).

The current SM4 cargo manifest contains elements that directly relate to the science performance of the observatory and have not been reviewed or prioritized against the other activities.

The STUC believes that extended operations should receive highest priority (Batteries, Gyros, FGS and, potentially, reboost), followed by new science instruments and STIS repair.

However we want to understand better the benefits, costs and risks involved , particularly for the STIS repair and the Aft Shroud Cooling System, and to make recommendations about their importance with respect to other SM4 activities.

In the past there have been other items on the manifest, e.g. a contingency reaction wheel assembly. We would like to ensure that we have seen a complete list in order to make an informed assessment.

The STUC would like to learn about reboost possibilities, and the cost/benefits of reboost, e.g. the effect on HST lifetime and the impact on manifest weight.

Dave Leckrone: Project Scientist Report

Leckrone discussed science issues from the point of view of GSFC.

- a) HST successfully observed the Moon at two sites, which had been visited by astronauts, as well as the crater Aristarchus. Multiband UV/optical images were used to develop representations of the surface. Colors were calibrated against rocks returned by the astronauts, as ground truth. The purpose is to look for *ilmenite*, a mineral with low binding energy for oxygen, and hence a possible source of oxygen (and hydrogen) for a moon base. The data will be made public on Oct 31.

The time (12 orbits) was obtained under a NASA policy known as **Policy 8** that allows NASA to mandate use of HST for agency goals outside of the normal HST remit. The Exploration Division requested these images to further the Moon and Mars initiative. *The committee is concerned that this opens a potentially dangerous door and sets a precedent of going around peer review.* The exercise was exciting for the participants, and the activity was very pleasing to NASA, and to GSFC in particular. The activity has already led to a re-definition of some aspects of the Lunar Reconnaissance Orbiter (due for launch in 2008) by the PI.

- b) An **Aft Shroud Cooling System** (ASCS) has been designed and built to aid in cooling the detectors of ACS.

There might be some marginal improvement in running the COS boards at the lower achievable temperatures. The effect on COS science is not clear. The ASCS will also cool STIS and the effect on the dark current of the STIS MAMA for near UV imaging and spectroscopy will be dramatic (a factor of four reduction in dark current); unfortunately, the activity to repair STIS at all is uncertain. Even though no additional funds seem to be needed for the ASCS, its installation will consume considerable time for the astronauts in training and EVA time that may threaten completion of the highest priority items.

As the environment of the instruments has changed in that a previous heating trend in the aft shroud has now ceased, it is not clear that the ASCS is still needed. A study is underway to assess the performance gains from deploying the ASCS with a report due in December 2005.

- c) The repair of STIS was discussed (and, in more detail, later by Preston Burch). Dave Leckrone asked for STUC input to the science case for returning STIS to service. The institute is preparing a white paper, due Nov. 6, 2005. *STUC will be happy to comment on the report. We were concerned about the short turnaround needed for this response on an issue of great interest to the Users.*

Rodger Doxsey: HST Status and outlook

The observations of the Deep Impact encounter on July 4 2005 were very complex to plan but were highly successful.

The Policy 8 observations of the Moon (see D. Leckrone report above) were even more complex to plan and used features of the JPL-derived MOSS (moving objects support system) software not before employed for HST. The observations required 3-gyro mode, and entry into Two-gyro-mode was delayed for 2 weeks.

Two-Gyro-mode became operational on Aug 29 2005, and the performance is excellent with early results matching expectations from test runs. At present 72.75 orbits/week are being scheduled in comparison with a mean 3-gyro-mode rate of 80 orbits/week. The expectation was 68.5 orbits/week for Two-Gyro-mode. Two-gyro-mode has a 1-2% failure rate for targets acquisitions. This rate should be maintained as slight relaxations of the constraints are implemented, although a reduction in the pool of targets through the cycle will work against these gains. A test of the moving target software worked well. Observations for cycles 13 and 14 are following the normal completion track. Only two observations appear to be impossible in Two-Gyro-Mode (These are coronagraphic observations with 2 roll angles within an orbit.)

The STUC is very pleased and impressed by the implementation and results of Two-Gyro-Mode and congratulates the whole team who worked on this important project.

One-gyro mode has been investigated and would require no major scheduling system changes. The one-gyro-mode operation plan will be reviewed in early November, with a flight test anticipated for Fall 2006

The NICMOS exposure time calculator (ETC) gave overly optimistic results from late summer 2004-April 2005. A 0.08mag photometry zero point discrepancy for faint UDF galaxies is being investigated. 79 supplementary orbits taken from Director's Discretionary Time were awarded to Cycle 14 proposals affected.

The change of telescope focal length with temperature ("breathing") has been known since launch, making the PSF time dependent. New ACS/HRC data is being used to calibrate this effect leading to the possibility that the PSF can be better modeled.

When queried it was confirmed that CCD4 of WFPC2 has recently developed a bias problem that is potentially fatal. The cause of the problem is not yet clear but examination of the record indicates that this had occasionally occurred during the last six months.

The STUC would like to learn how much the Cycle 14 and uncompleted earlier programs are affected by the failure of this detector, and how STScI intends to handle those approved programs.

The STUC wishes to hear the WFPC2 closeout plan at the April 06 STUC meeting.

With the reactivation of SM4 STScI will be involved in several activities not anticipated a year ago. The readiness of COS and WFC3 pipelines is reported to be close to operational with end-to-end tests being the main outstanding item. The Institute will commence writing the instrument handbooks and building the exposure time calculators, as well as a bright object avoidance tool for COS during FY06 and FY07.

The STUC wishes to receive STScI and COS and WFC3 Instrument Team presentations at the April 2006 STUC meeting on calibration plans, pipeline software and operations.

At the November 2006 STUC meeting STScI volunteers to present a resources plan for WF3, for which the Institute forms the science team.

The software team at STScI has been reduced by 23 FTEs due to FY05 and FY06 budget cuts, which were taken mostly in staff. The STUC is concerned about this reduction in capability and wish to follow the situation closely.

As a result of this reduction in force, no major software upgrades or major new software projects (on the scale of Two-Gyro-Mode) will be possible, and no major hardware upgrades (similar to the archive enhancement) can be undertaken.

Given this new situation the *STUC reiterated the potential of a 'contributed software' web site as a means for delivering interim solutions to users, albeit with prominent caveats about the unsupported status of the code.* Software (and supporting memos, papers and URLs) can be provided by users and by STScI staff without the considerable overhead of making the code sufficiently robust to work in an automatic pipeline. This requires an understanding of these limitations by users.

The STUC was surprised at the low Internet bandwidth available at STScI, which has led to the use of shipping hard drives by mail to deal with large archival project data requests.

Faster data rates are common at other observatories, including the other Great Observatories. Lack of high-speed access restricts the science that can be undertaken with HST data now, and will do so far more after SM4.

We urge STScI and GSFC to work together to improve Internet infrastructure at the Institute to Internet 2 levels.

Bob Fosbury: European Coordinating Facility (ECF)

Bob Fosbury has recently been appointed Director of the ECF, replacing Piero Benvenuti who has moved to head the Italian National Institute for Astrophysics (INAF).

The ECF in Garching has now returned to its previous level of 12 FTE, from a peak of 21 FTE that was part of ESA's JWST contribution. The ECF specializes in spectroscopy, in particular for STIS and slitless spectroscopy with NICMOS, and now ACS.

The major effort recently has been on STIS wavelength calibration, including new lamp calibration measurements at NIST, which has led to 5 times better accuracy, from 0.5 pixel errors to 0.1 pixels.

Another focus of ECF activities has been the Hubble Legacy Archive, with an emphasis on processing techniques rather than Virtual Observatory capabilities.

The ECF will continue to work with STScI on STIS in new SM4 context.

The ECF is willing to present regularly to STUC. *STUC welcomes this offer.*

Paul Goudfrooij: STIS Close Out Plan

The improvement in 2d-rectification of spatially resolved spectra will be of lasting value for HST spectroscopy. Due to the return of SM4 and cuts in personnel, *STUC urges the Director to revisit the manpower needs to be devoted to the STIS close out calibration plan. In particular it may be prudent to concentrate primarily on the delivery of high effort items, specifically improved wavelength calibration files and 2d-rectification, and to redeploy personnel to ramping up for COS and WFC3. More elaborate work on CTI and absolute flux calibration appear to be more of more marginal value.*

STIS team members met with Kris Davidsen to discuss his Treasury team's enhancements to STIS processing, following the recommendation of the STUC. STUC is interested to know the status of non-standard observing mode observations (discussed at the March 2005 STUC meeting) in this new plan.

STUC heard that the ASCS (see D. Leckrone presentation, above) would decrease the MAMA photocathode temperature from 35C to 25C, reducing dark current by factor of 4. For STIS UV spectroscopy this would lead to significant gains in echelle mode, which comprised some 60% of STIS observations prior to failure, and make NUV imaging better than WFC3. At this time it is clear that a more comprehensive study of these potential gains and the implied trades, needs to be undertaken before any decision is made to remove ASCS from the SM4 manifest.

John Mackenty: WFC3 Report

Mackenty reviewed progress with WFC3. There was a single-point failure point in the electronics controlling the SOFA on the UVIS side. There are also some problems with a few of the filters on the UVIS channel. The SOFA has been removed and most of the filters with bad ghosts or light leaks have been remade and improved. The primary outstanding issue relates to the IR detector. There is a flight-qualified detector, but there are potential liens on the mechanical stability of the detector and radiation-induced backgrounds. A new batch of detectors has been fabricated that solve both problems and have excellent QE. However, these detectors have a substantial fraction of high dark-current pixels (20% - 40%). The WFC3 team would like to commission in new batch of detectors that would address all of these problems. The discovery potential, (=solid angle x sensitivity) relative to NICMOS3, of the new lot could be as high as 35 in the J band and in narrow-band applications.

The STUC believes that the scientific potential of improved WFC3 IR detectors not least as a pathfinder for JWST, justifies the procurement of a new batch of detectors.

The STUC is pleased with NASA's progress on WFC3, but is worried that the program has only a 2-month contingency for a Nov 2007 launch. We believe that NASA urgently needs to provide adequate resources to complete WFC3 for SM4.

Duccio Macchetto: Cycle 15 & future cycles

HST continues to be the most productive instrument in astrophysics, with a total number of 5165 refereed papers (66% from GO programs and 40% from archival ones, about 300 and 200 per year, respectively).

The call for Proposals (CP) for Cycle 15 was released on October 6 2005 and all information can be found on the STScI web page. The deadline for applications is on January 27 2006. Panels and TAC will meet on 20-24 March 2006. The 'previous programs' section of the proposal form is eliminated in Cycle 15.

As usual the TAC will select Treasury and Large programs, while panels will select smaller programs. All panelists should read also the large programs and give inputs to their chairpersons. Clarified instructions, in the form of a short checklist, will be given to panel members. These changes address the STUC concerns at the March 2005 meeting.

In cycle 15 there will not be a special category for coordinated HST and Spitzer or Chandra proposals, because none was proposed last year. As Spitzer cycle 4 may be the final cryogenic cycle for Spitzer, and hence its long wavelength capability, a public joint workshop on coordinated HST/SST proposals for HST Cycle 16/Spitzer Cycle 4 is planned for May 2006, in Pasadena.

For future cycles, the Institute will evaluate the technical performance of HST and its

instruments in advance of each CP, to provide the applicants with the proper information. They may consider (not in C15, though) different ways of scheduling programs, depending on the expected lifetimes of the required instruments.

Brad Whitmore: Late Cycles of HST

In the past, STScI and the STUC have insisted that the peer review process of the TAC is the best way to choose the best science to be performed on HST. If SM4 does not occur the question arises of how HST science could be optimized for a Legacy. An emphasis on completing programs rather than maximizing on-target time may be appropriate. Are there HST programs that future facilities (e.g. JWST, ALMA, Con-X, 30-meter telescopes) will need to carry out their key science? There is commonality with the issue of joint Great Observatories noted in Duccio Macchetto's presentation (above).

The STUC endorses the suggestion of holding a science workshop in spring/summer 2006 to find potential synergies of HST with the other Great Observatories and with facilities now under construction or in advanced planning phases. Martin Elvis and Pat McCarthy volunteered to join the SOC.

Matt Mountain: Director's Perspective

The STUC welcomed the new STScI Director, Matt Mountain.

In an executive session the STUC asked for his views on the role of the STUC. In summary he requested that we give the Users' perspective on all HST issues by prioritizing them in clear and concise resolutions.

We discussed the format of future STUC Meetings in order for the STUC to have greater insight and influence on issues of concern to users:

- Place presentation material on a new password protected STUC web site, following the STIC model, about 1 week in advance of the meeting. The goals are (1) to save presentation time now used for information only purposes, (2) to give the STUC members more time to consider the issues, and (3) to provide more time for discussion of issues during the meeting.
- Add an "HQ update" from J. Wiseman or her representative.
- Consolidate the considerable overlap of material in the Director's outlook, Project status and Project Scientist report.
- Have the Director welcome the STUC but not give an extensive report.
- Instead to have a regular Executive Session with the Director after lunch on the first day.
- Move more Executive Session to just before lunch, before the Executive Session with the Director.
- Hear more on calibration and software issues, which are the area in which users have most expertise. We wish to begin with a walkthrough of COS,

- WF3 pipeline & calibration plans to ensure readiness for SM4.
- With SM4 now likely, the STUC would like to hear presentations from Instrument scientists for COS, similar to those on WFC3.
- STUC members need to mix informally with STScI staff in order to hear concerns and gain new and unofficial perspectives. Currently we stay in the boardroom all the time. We might, for example, take lunch down in the cafeteria.

Digest of STUC Statements in this Report:

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Date of Next Meeting:

The STUC agreed to meet next on Wednesday-Thursday, 19-20 April 2006.

END