

Report of the Space Telescope User's Committee (STUC)

Meeting of June 15,16, 2009

STUC Resolution regarding SM4

The STUC wishes to offer its most sincere thanks to the many people who made SM 4 possible and who made it such a spectacular success. First and foremost, we extend our deepest appreciation to the crew of Atlantis for the dedication, skill, and enthusiasm they displayed as they prepared for and expertly flew one of the most technically demanding missions in the history of the Shuttle Program. We also thank all the dedicated individuals at STScI, GSFC, JSC and NASA HQ [and contractors] who have supported the mission at every stage of its long development. Finally, we wish to acknowledge with gratitude the efforts of three individuals-- Sen. Barbara Mikulski, former NASA administrator Michael Griffin, and former STScI Director Stephen Beckwith--for their leadership during the long, difficult process in getting SM 4 approved, supported and implemented. The legacy of these efforts will be the central role HST will continue to play in the advance of our knowledge and understanding of the amazing Universe in which we live.

STUC Resolution regarding funding of HST in the post-SM4 Era

The STUC notes the considerable effort and funding that has gone into making SM4 such a fantastically successful mission and the fact that it has resulted in a more powerful, more capable, and scientifically more exciting version of HST than ever before available. Given this, the STUC is concerned that the current funding plans for STScI appear to leave the Institute little

option but to steadily reduce HST support at the pinnacle of the telescopes operational capabilities. The STUC urges that the three core legs of the HST mission--flight operations, instrument support, the GO program--continue to be funded at a level consistent with the observatory's enhanced capabilities so that this highly powerful resource can be utilized as effectively as possible.

STUC Resolution for ESA MOU Renewal

The STUC acknowledges with gratitude the long-term ESA partnership in the HST project since its inception. ESA has provided personnel, expertise, and hardware that have helped achieve the great success enjoyed by HST. Now that the current Memorandum of Understanding (MOU) between ESA and NASA is set to expire in April 2010, there is concern that this mutually beneficial relationship may end just as HST is approaching the cusp of its scientific capabilities following the very successful Servicing Mission 4 (SM4). HST is likely to a productive future lifetime of between five to eight years beyond SM4. The STUC strongly urges ESA (a) to renew its MOU with NASA in a timely fashion to continue the benefits to the European astronomical community of assured access to Hubble and of substantial influence on the governance of this project, in exchange for ESA's support of HST, and (b) that the new agreement be written to remain in force for the full duration of the HST project (at least five years), subject to reasonable exit options.

STUC Resolutions Regarding MCTP

The STUC continues its endorsement of the Multi-Cycle Treasury Program (MCTP) concept as a means of enabling powerful new observing projects during the final years of the HST

mission. We urge that the Institute propose a stringent process for proposers with the specific aim of forwarding a few key projects that have the potential for transformative changes in a range of fields. We further urge that the charge to any TAC associated with MCTP should clearly understand that they can deny all proposals if they feel these high standards are not met. The total time allocated to MCTP proposals should be limited, but the Institute should review the process with the expectation of possibly renewing the idea in the future pending the success of the first MCTP programs and taking into consideration the long-term prospects for nominal operation of HST and its instruments. The STUC encourages substantial funding for archival studies of the multi-cycle programs to expand the science impact and bring in more community participation. The STUC is concerned about the planned timing of the MCTP call for proposals and selection process. Sufficient time between the ERO from the new/refurbished instruments is imperative to allow prospective proposers to fully understand the capabilities of the instruments as they prepare the proposals. Also, although an early start on archival research of MCTP projects is highly desirable but that also should be administered in such a way that potential archival proposers have detailed access to any approved MCTP projects well in advance of the archival proposal deadlines.

The STUC notes that the implementation of the MCTP process had to, of necessity, begin before this final report was delivered by the STUC to STScI. However, many of the concerns raised in the initial part of the resolution above regarding the timing, TAC charge and overall structure of the MCTP TAC have been taken into account and are reflected in how the process has proceeded to this point.

STUC Resolution Thanking Dave Leckrone

The STUC is pleased to acknowledge, with deep gratitude, the long and fiercely dedicated service of Dave Leckrone over the past 18 years of the HST program. Dave has been one of the most loyal stalwarts of HST, through good times and bad, his leadership vital at many critical junctures to ensure that the bad times were short, and the good times were very good indeed. The STUC wishes Dave the very best as he heads on to new adventures during a well-deserved retirement, but is still saddened somewhat by the departure of such a steady, powerful advocate of the program. This is tempered by the fact that Dave's retirement from the HST program coincides with the successful completion of SM4, one of the very best of the good times, and one that he helped so much to bring about. On behalf of the entire HST scientific user community--which includes virtually all astronomers the world over--the STUC offers its sincerest 'Thank You' to Dave for his efforts in support of the HST mission.

STUC Resolution on the SM4 Supplementary Proposal Process

The STUC commends STScI for its prompt actions that maximized scientific output of HST during the difficult period between the cancelled Oct 2008 launch date for SM4, and the actual launch of the mission in May 2009. The extraordinary efforts to put out a call for supplementary proposals, review them, notify PIs and run Phase II, then schedule and execute them were truly remarkable, and helped to ensure that HST remained scientifically productive during this unanticipated and difficult transition period.

Other Summary STUC Items

1. The STUC would like to play a constructive role in the Institute's transition to the JWST era.

To this end, we request that at future meetings the Institute provide information to the STUC on issues related to JWST that are likely to affect the HST user community.

2. The STUC wishes to ensure that HST remains a priority item in the long-term plan of the US Decadal Review and will communicate this desire to the Review Chairman directly.

3. The STUC repeats its previous concerns from earlier STUC meetings regarding the imminent closing of the ST/ECF facility. This adjunct institute provides highly visible and effective outreach programs on HST and general astrophysics in Europe, and also has led the way in developing sophisticated analysis tools for HST spectroscopic--particularly ACS and NICMOS grism--capabilities. The STUC urges that the status of the ST/ECF facility be critically reconsidered before it becomes too late to viably maintain its staff and capabilities through attrition in anticipation of its planned closure in 2010.

Abbreviated STUC Meeting Minutes

Persons Present:

STUC Members: Mark Dickinson, Peter Garnavich, Jean-Paul Kneib, David Koo, Lori Lubin, Mario Mateo (Chair), Phil Nicholson, Bob O'Connell, Goran Ostlin, Abi Saha , Tommaso Treu.
(STUC Members not able to attend: Jim Green, Alvio Renzini, Marianne Vestergaard).

Other STScI/NASA Staff Present: Neill Reid (STUC Liason), Matt Mountain (STScI Director), Rodger Doxsey, Ken Sembach, Helmut Jenkner, Claus Leitherer, Jeff Kriss, Preston Burch, Dave Leckrone, Eric Smith, Loretta Willers, Mike Hauser.

Others Present: Eric Hand (Nature Publishing)

Institute Outlook (presented by M. Mountain)

“With the success of the SM4, HST has entered an interesting time.” Matt Mountain

MM reported some science highlights from STScI since the last STUC meeting. A better measurement of H_0 with a nominal 5% error was reported by Riess et al 2009, and direct images of an exoplanet were recovered in the HST archive (dating from 1998) following up its recent ground-based discovery.

MM then focused on the great success of SM4, showing some spectacular images and videos from the mission. He then discussed the plan for early release observation of the various new and repaired instruments. These ERO data will be obtained during some of the SMOV activities this summer, and will be first available at public NASA release planned for September 2009.

MM summarized the current status and plans of the JWST project. In particular, he reported the successful first tests conducted of two flight mirror segments. He noted that NIR-CAM progress had slipped and was now on a critical path and could lead to a delay of the JWST launch, currently planned for 2014. Software development have been done regarding the

preparation of JWST observations, an area where HST experience and tools (e.g. the HST Proposal Support Tool) have been useful.

The Kepler planet-finding mission and the Planck CMB experiment were launched in March 2009. Initial data from Kepler are being obtained and processed at STScI. So far, everything about this mission is running very well.

MM provided his view on the STScI budget. In terms of FTE, the Institute staffing goes down steadily in the long term, with a hump for the JWST project in the immediate next few years. He emphasized that in the FY10 budget, the HST budget will have decreased by about 10 M\$ compared to FY09 forecast. MM expressed concern that there might not be adequate funding for HST instrument support compatible with demand following the very successful SM4. Finally he noted that a senior review of the HST was now on track given that SM4 has been successfully flown.

SM4 & SMOV update and Instrument Status (presented by K. Sembach)

Instrument status.

SMOV has begun with spacecraft and subsystems performing well (through Jun 15,2009), with BEA contamination requirement satisfied, outgassing continuing slowly, internal calibrations being examined, and external focus and alignment checks beginning.

FGS: there has been successful guide star acquisitions (with nominal pointing and jitter) with FGS1r and FGS3. FGS1r has been re-enabled for astrometry, and GO observations are being scheduled. Commissioning of FGS2-R2 is on schedule.

WFC3: The instrument is outgassing and is past the BEA requirement. The detectors have been cooled to operating temperature and are stable. Mechanism checkout is currently in progress, internal calibrations continue, and external calibrations begin in mind June.

COS: The instrument continues to outgas, with the pressure gauge disabled this week to lower dark noise. The detector HVs are being ramped up slowly—both detectors working well and NUV dark background several times lower than predicted. Initial COS-FGS alignment check of NUV channel completed. FUV internal calibrations will begin this week.

STIS: The CCD channel is fully operational; however, the readout of Amp B (mostly for calibrations) has high offset (understood). The other amps are nominal - read noise looks good although possible increased dark noise (warmer). Functional tests (darks, biases, flats) confirm expected performance, and GO science will begin soon. STIS-FGS alignment and focus check completed. MAMAS HVs are being ramped up, with FUV recovery complete and NUV recovery to be completed this week. Additional MAMA checks taking place.

ACS: SBC operations are nominal, and GO science and calibrations resumed. The CTE degradation is consistent with time off. WFC CCD optimization completed, with WFC calibrations (i.e. functional test, image quality, PSF check, darks etc.) continuing this week.

NICMOS: Currently there is no status change. A restart attempt will begin in late June/early July.

Observatory Focus Strategy

The telescope group is determining best OTA focus (expressed with respect to WFC focus) based on pre-SMOV + SMOV data. Each optimal instrument (COS, WFC3) focus will be determined by using OTA/WFC information to facilitate cross-instrument confocality. If a secondary move is necessary, it will occur before WFC3 ERS and GO science.

HLA Status Report (presented by H. Jenkner)

HJ began with an update from the information presented to the STUC at its Nov 2008 meeting. The biggest change from the point of the data set has been the implementation of the latest (and best possible) calibrations for all observations with WFPC2 and NICMOS.

WFPC2: The final instrument and data handbooks are being worked on. Reprocessing is 88% complete and now includes all the data ever taken with the instrument. The team is still working on finalizing the 2008/2009 calibrations. Unacceptably low WF4 biases are being flagged consistently, and a new correction algorithm has been adopted for that CCD for images that are usable.

NICMOS: The final handbooks are almost done. About 46% of the reprocessing is done, reflecting the need for some re-processing due to a keyword error discovered after reprocessing had commenced. A total of about 18% of the data processed so far had to be done again due to this problem (the 45% figure above reflects this). The pipeline has resumed operation, and is ready to accept new NICMOS data should that instrument come back on line later this year.

General HLA update

There have been two new data releases in Dec and May of past period since the last STUC meeting. The HLA presence at AAS meetings has been strong, providing personal contact between the HLA managers and programmers with users. Numerous significant interface upgrades have been provided to users in response to constructive feedback by users. The HLA team is trying to stay ahead of new data handling approaches, new approaches to presenting footprints and catalogs, etc. The database has added more products such as access to specific large-scale projects.

DR3 was released in May, 2009, with the most complete datasets ever released in the HLA. This release also has improved overlay capabilities with selected other catalogs (e.g. Galex, Spitzer sources). This release also includes newly reprocessed NICMOS and WFPC2 data available at the time. Also, much expanded ACS grism data are available, a very useful utility. This release also includes expanded WFPC2 source lists based on automated analyses by DAOPHOT and SExtractor. These lists seem reasonable in terms of completeness and precision, but there is some mismatching. For example, SExtractor does not go as deep as DAOPHOT in general. Finally, DR3 also includes some of the first HLA attempts at producing Mosaics based on multi-visit data. This is proving more involved than any standard analysis and, so far, requires some degree of 'hands-on' effort for each field. So far, about 3-5 fields are available, but prospects for having 50-100 mosaics ready this calendar year are good.

The immediate future plans for the HLA include: Extending DR3 work (reprocessed images from WFPC2 and NICMOS). More mosaics, more NICMOS. Start to meld in new instrument data. In the future, a plan is evolving to move away from discrete data releases and

instead provide more steady enhancements to the database, possibly supplemented with new capabilities releases periodically. Future 'releases' will also aim to add Chandra, Spitzer etc. data to the footprint data and possibly to future mosaic releases (similar to the beautiful Spitzer+HST mosaic of the Galactic Center).

Science Policies (Presented by C. Leitherer)

Cycle 16 supplementary observations

The delay of SM4 and the failure of NICMOS back in Fall 2008 created a significant gap in the observing schedule. The Institute took rapid action to ensure high scientific productivity of the Telescope. First, snapshot programs were accelerated and asked to change target lists for optimal visibility during the gap. Second, directors discretionary proposals were solicited and implemented. Third, a supplemental call for proposal was issued in November 2008 and a number of new programs were approved and executed between February 2009 and SM4. The response from the scientific community to the supplemental call was extraordinary, resulting in oversubscription of a factor of 17. The programs were evaluated by an ad-hoc time allocation committee chaired by Rob Kennicutt. Seventeen programs were approved covering a broad range of science from exoplanets to cosmology. The approved programs were executed with high completion rates (~80%) and have been terminated with SM4. The STUC commended the institute for prompt actions that maximized scientific output of the Telescope during this difficult period.

ACS/HRC NICMOS conversions

The institute also took action in relation to current uncertainty of the fate of NICMOS and the unavailability of ACS/HRC. Highly complete programs (90%) were terminated. Those that can only use NICMOS will be terminated if NICMOS remains unavailable. Approved programs which were deemed executable with WFC3 or ACS/WFC were transferred after consultation with the PIs. For a small fraction of the programs PIs were asked to submit justification for a possible conversion. In all cases PIs were given the opportunity to appeal via TTRB. After this process there are only 8 NICMOS programs for a total of 84 orbits remaining in cycle 17. The process resulted in a net gain of orbits due to the higher efficiency of WFC3 over NICMOS for some science applications. The STUC is glad to see that this transition was carried out with the goal of preserving the original science of approved programs and in consultation with the PIs.

MultiCycle Treasury Projects (presented by N. Reid)

The STUC was presented with a plan to send out a call for large multi-cycle proposals, which can be allocated up to 750 orbits per cycle, spanning a total period more than 2 years. An individual accepted program would have an allocation more than 400 orbits. The time to do this would come from what is now the Treasury Program (500 orbits/yr) and DD allocation (250 orbits/yr). Community interest in such a program has been verified by a previous call for white papers.

The initial plan is to have a submission deadline in October, that is separate from the regular TAC cycle (see Resolution above). The selection is to be done in two rounds: first an initial down-select, followed by a second round of specific technical questions to the proposers, with a final decision and announcement by February '10. Successful programs would be available for

ARCHIVAL research immediately, and can be proposed for in Cycle 18, whose submission deadline is slated for March '10.

The STUC had extensive discussions about this, both with the presenters, as well as in executive session. Several details were clarified in these discussions, and the outcomes and recommendations are listed below:

1. Make sure that the AO reflects the notion that this is currently planned as a ONE TIME OPPORTUNITY, with no commitment to carry this mode in the future (nor any implied restriction against repeating the process should MCTP prove highly successful and popular);
2. The STUC is concerned about the timing: an October submission deadline is not sufficient for dissemination of performance information for WFC3 and COS to the astronomical community. Best use of this opportunity would surely come with understanding how the new capabilities these instruments bring perform on orbit. In the STUC's view, the ability to do ARCHIVE proposals in C18 is not as compelling as making sure that the Multicycle proposals are optimal. On the other hand, the STUC noted that an early start for this program is highly desirable, since that is the best guard against the lifetime of the telescope and its instrumentation. Also, it would be good for proposers of C18 to know what the multi-cycle treasury programs are. Looking at it overall, the STUC leans on the side of the argument that making these huge allocations before on-orbit performance data can be studied openly by the community would be both sub-optimal scientifically, and seen as unfair by the community;

3. Successful multi-cycle treasury proposals should have demonstrable differences with respect to current large proposals, justifying the inevitable mortgage they will place on available time in future cycles to address new areas of science as they emerge. The bar on selecting a multicycle program must be set very high in terms of compatibility with unique HST capabilities, complementarity with likely JWST science programs, the clear necessity of a large dataset to complete the science goals, and long-term impact over as broad a range of fields of astrophysics as possible or major impact in a narrower range of fields.

ECF Update (Presented by H. Jenkner)

Helmut Jenkner, on behalf of Robert Fosbury (head of ST-ECF) reported on ST-ECF activities. This presentation covered the ECF organisation and activities and again highlighted the fact that ESA has decided to close ECF by the end of 2010. ECF has been responsible for the European outreach activities related to HST, and the activities have been merged with the ESO outreach section. The activities involve press releases and so called 'Hubblecasts' available on the internet. ECF also has the important task to develop calibration support and data analysis software for WFC3 slitless grism spectroscopy, including documentation and user support.

Progress on this work was presented.

ECF hosts the European HST archive, which is in the process of being integrated with the ESO archive. ECF is also involved in the development of the Hubble Legacy Archive (HLA), particularly involving spectroscopic data access, display and analysis. ACS and NICMOS grism data products have now been added to the HLA using ECF tools.

The tasks after SM4 involve continued WFC3 grism support, continued HLA processing of ACS spectra, archive operation in cost efficient manner and integration with the ESO archive, and outreach. The planned shutdown of ECF in 2010 is problematic, especially for the continued support of grism observations and calibration. While the outreach and archive roles of ECF could be taken over by, e.g. ESO (where ECF is physically located), the grism support involves critical know-how that must be transferred, and grism support activities need to be developed at STScI.

The STUC expressed its concern--reiterated from previous STUC meetings—regarding the closing of ECF and fears that it may be detrimental for the HST visibility in Europe, the European involvement in HST and future missions, including JWST.

The STUC also is of the opinion that it is important that ESA urgently renews the MOU between ESA and NASA regulating the ESA involvement and contribution to HST, and that the MOU is renewed for longer periods than 2 years (A STUC resolution has been drafted expanding on this position).

NASA HQ Perspectives (presented by E. Smith)

Overview of NASA missions within Astrophysics

ES noted that so far, 2009 has been a very good year for astrophysics; Lots of various missions including ESA missions Herschel & Planck are operating. It also represents the first time that three balloon programs are operating at the same time. And we are only half way through the annual cycle at this stage.

ES presented a summary of specific mission highlights. Two programs are in the Formulation category: Nustar passes phase B to phase C as of yesterday (June 15, 2009) and Astro-H, a new X-ray mission is proceeding in coordination with Japan's space astrophysics program. In 2010, astronomers will have more working satellites than at any other time in NASA's history. Perhaps not surprisingly, there is a large drop in the number of missions thereafter.

WISE has moved to a Dec '09 for launch from original Nov '09. Many sounding rocket and balloon missions are still to come this calendar year. Opportunities originally planned for JDEM and Explorer (SMEX) this year will both be pushed to next year. There is no launch vehicle available after the Delta rockets for MIDEX missions, so none are being planned.

ES reported that Erick Young is new science mission operations director for SOFIA and that SOFIA's mission life is planned to extend to 2030(!).

Broad Budget Issues and Discussion

The implications for NASA in the FY10 budget are still unclear. There is some deferment going on in anticipation of the Decadal review report which may strongly impact decisions regarding JDEM and SIM in 'future mission' funding lines.

ES noted that there appears to be little new funding available to start new mission in the next few years, and astrophysics may have to wait until after JWST is launched for new starts. Adding to this outlook is the pricetag for SOFIA (about \$2.955B to end of operations) over its long anticipated lifetime. There are no substantial cost savings anticipated in combining JDEM with EUCLID.

Mike Hauser noted that the integral of future funding curves ranges from about \$4B through \$20B through 2020, totals that represent in some way a target funding range for the astrophysics community to set priorities for new missions or to extend HST beyond its nominal 2014 mission end. Present forecasts suggest that HST has a 50-50 chance of up to 2 years of operations beyond 2016.

ES noted that astrophysics can expect only 1 NEW flagship mission over the next decade within current budget constraints, though these admittedly remain uncertain. He also pointed out that astrophysics had a continually larger percentage share of the NASA budget from the 1980s to 2000, but that increase has probably ceased. With respect to HST specifically, ES noted that the share of funding to STScI for HST drops significantly through FY14.

HST's future is certainly related to the success of SM4, but also to its next senior review. These may help provide some new funding to extend its mission. Overall, NASA management likes the HST program for its positive visibility and scientific productivity. It was pointed out by Dave Leckrone that a future manned or robotic service mission would be needed to attach the de-orbit hardware on HST. A manned visit would have to be with the Constellation launch, a complicated option that is being studied. There is likely considerable pushback to future servicing missions both from Congress and at many levels in NASA.

ES pointed out that a Cosmic Origins Project Office is to be established this summer with its main task to be to negotiate the levels of support for the JWST, HST, Spitzer, SR&T, and SOFIA. Immediate cuts to are likely as OMB has reduced funds for support that goes to GO programs. In this regard, ES noted that many astronomers, especially with interest in other missions, look at the relatively high operations cost for HST (\$80M or more/year) as a place to

extract additional funding for other programs. Thus, maintaining HST science support funding will continue to be a battle despite support by STUC. The current HST funding plan has about \$35M in FY14 for STScI , with the GO program getting about \$25M - \$30M. Flight operations cover the rest. \$40M. Some HST support will come from JWST directly as that program supports HST activities that will directly benefit the later mission.

Technical SM4 Summary (Presented by P. Burch and D. Leckrone)

Burch and Leckrone presented details on Servicing Mission 4. The Mission was very successful and exceeded expectations. The EVA timeline, based on training experience in the Neutral Buoyancy Tank, was filled with activities, and there was little margin for error. Nonetheless, despite several dramatic challenges posed by balky bolts, all tasks were successfully completed. Following the failure of the SIC&DH in October 2008, installation of a replacement unit became a high priority and was accomplished during EVA-1.

WFC3 and COS were installed during EVA-1 and EVA-3, respectively. ACS and STIS repairs were successful, thanks to extensive pre-mission practice and planning. All three gyro packages were replaced, but replacement unit #1007 would not seat properly, so a substitute was used. This means that only three of the six new gyros contain the enhanced flex lead designs intended to provide extended gyro lifetimes.

All new and repaired equipment passed early aliveness and functional tests, with the exception of the High Resolution Camera channel of the ACS. This had been anticipated to have a low probability of recovery because the detailed nature of the damage to its electronics was not known.

SMOV tests are under way on all instruments except NICMOS. COS has made its first external target observation. WFC3 has been cooled down to its operating temperature(s), and the first external observations are scheduled soon. Only one side of the electronics packages for ACS and STIS have been repaired, so these are now zero-fault-tolerant. HST now has the most powerful complement of instruments in its history.

Final STUC Issues

Five STUC members are rotating off after this meeting: Jean-Paul Kneib, Peter Garnavich, Alvio Renzini, Marianne Vestegaard and Phil Nicholson. The Institute and remaining STUC members all offered their sincere thanks to these individuals for their service on the Committee. Mario Mateo agreed to extend his term by one meeting to make the future rate of turnover in the Committee more manageable in the coming year.

The next STUC meeting is planned for Nov 12-13 at STScI.