Report of the Space Telescope Users Committee (STUC) Meeting 25 - 26 October 2006

STUC Members Present:
Martin Barstow, Martin Elvis (Chair), Eric Emsellem, Laura Ferrarese, Peter Garnavich*, Jean-Paul Kneib*, David Koo*, Mario Matteo, Patrick McCarthy, Phil Nicholson*, C. Robert O'Dell, Alvio Renzini*, Abi Saha*, Regina Schulte-Ladbeck Monica Tosi, Tommaso Treu*, Marianne Vestergaard. (Absent: David Axon, Donald York.)

Notes:
1. Each section below begins with a short summary of the presentation, and ends with comments by the STUC (*in italics*), with recommendations in **bold.**

2. Soon after the committee meeting (on 31 October) the NASA Administrator, Mike Griffin, announced that the HST Servicing Mission 4 (SM4) would go ahead, with a launch no earlier than May 2008.

The committee welcomed its 7 new members (* above).

STScI Outlook: (Director, Matt Mountain)

Director Matt Mountain reported that the HST continues to produce forefront research results. The promise of this continuing is bolstered by the hope that SM4 will be approved by the NASA Administrator later this week. [As it was, see above.] It is expected that the STScI contract will be extended to 2010. GO Grants will continue past 4/20/07 seamlessly. NASA planning projects the HST being alive (as a project) through 2016. Funding for STScI was slightly less for FY07 than requested, but NASA has accepted the STScI projected near-year budgets, although this does not obligate them to commit the funds. SM4 prospects appear to be good after two safe return shuttle flights. There will be a briefing of the Administrator soon, and a decision by Administrator Griffin is expected soon thereafter. STScI is exploring science management roles in future programs such as SNAP, and Kepler in addition to their current responsibilities for JWST. Helmut Jenker has been appointed Acting Head of Mission Office and Ken Sembach has been appointed as Project Scientist. STScI has hired its first astrobiologist, Maggie Turnbull.

HST Status: (Helmut Jenker)

There have been two ACS suspensions of operation (19 June, 23 September), both since the last STUC meeting. In the first suspension of operations the side-1 electronics failed, and a switch to side-2 was executed. The probable cause of failure is the +15V power rail DC-DC converter. In the second suspension a +35V power input was missing. It was rapidly determined that this was due to a relay failure (K1). A simple toggling of the relay restored power, so the cause was very likely particulate contamination, which has

been seen in other relays of this type. The WFC was restored on 1 Oct, HRC back 15 Oct, and the SBC is expected to be back on-line by Thanksgiving. The quick response to the 19 June failure was thanks to lessons learned from STIS failure (which took 6-8weeks). The opportunity was taken to lower WFC temperature set point from –77C to –81C. This leads to improved CTE and fewer hot pixels, at the modest cost of 0.5-1% lower throughput.

In the FY07 budget all STScI requests were fully, or almost fully funded. Higher bandwidth connections internally, but not faster internet access for community to STScI, were included.

Guide star non-acquisitions continue at an unchanged rate in 2-gyro mode. There are also 1-2% star tracker failures, and procedures are being developed to improve this situation. Restricted roll angles add to the probability of acquisition failures. Returns to same/similar locations will likely be hit again. Relaxing the orient constraints helps greatly. The total acquisition failure rate is now ~3.5% vs. 1-2% before 2-gyro mode.

[Other topics presented briefly are covered later in this report.]

The STUC thanks Helmut Jenkner for his summary of HST status and is impressed at the overall good health of the telescope and instruments at the time of the meeting. The response of the instrument teams to the two ACS anomalies was impressive and returned this key instrument back on line (twice!) remarkably quickly. ***We commend everyone involved in implementing the ACS recoveries, and for planning for such an eventuality well in advance of the failure.*** *Both the detective work to understand what happened and the actual effort to bring the instruments back on line represent an extraordinary effort by a top-notch team. The STUC was pleased to see that all other status issues were far more mundane in nature, though we note that the impending decay of the WF4 bias level is a concern. The intermittent to persistent loss of data from this detector will likely have significant science and scheduling impacts, so we agree that this issue is given appropriate attention to try to limit the amount of serious data losses prior to SM4. The STUC is pleased to see that the large observing programs are progressing reasonably, all the more remarkable given the recent ACS interruptions.* ***We encourage the telescope staff to continue to study how HST's life can be extended in old age; even if some of this work proves moot because SM4 goes ahead, it will be of use at a later time when HST truly is in its final years of operation****. One issue that appears to have affected a surprising number of STUC members, and so may indicate a wider problem, is a recent loss of observations due to HST's inability to acquire and lock on a field.* ***The STUC would like to see a more detailed summary of the success of guide star acquisitions now that we have extensive experience in 2-gyro mode operations. The STUC urges the Institute and NASA to improve the STScI internet bandwidth, which was raised as an issue at the 2005 October STUC meeting.***

STIS Closeout (Paul Goudfrooij)

The calibration reference files for the STIS closeout plan has been finalized and will be released to the community in November 2006. Since April 2006, publications have included articles on PSF, CTE, and sensitivity of STIS. Calibrations are now ready for the final pipeline recalibration of all the STIS data. Besides an updated flux calibration and blaze shift corrections, which can be more than 30 pixels, both wavelength calibrations and fringe flats are included, though for the former the implementation effort is still ongoing. Finally, spectral tracing, important for 2-D rectification, has been improved. The pipeline for the final recalibrations is being tested using a random 2.5% subset of the STIS database (5000 spectra) over the next month and, assuming no major corrections are needed, the recalibration of the full data set will be completed by the archive group over a 3 to 5 month period.

New off-line tasks that will not be implemented in the pipeline include: corrections to magnitudes for CTE loss in STIS CCD data; a spectral tracing option that uses the target itself; and the use of a wavelet-based algorithm rather than bilinear interpolation for 2-D rectification. The remaining and final calibration tasks will be implemented offline. These include spectroscopic multidrizzle and a physical-model based wavelength calibration to be developed by the European Coordination Facility (ECF) by fall of 2007.

The STUC recommends that, instead of leaving 2-D rectification for only post-pipeline processing by the user, consideration be given to including this process in the standard STIS recalibration pipeline. The goal should be to populate the archive with as close to directly useable data products as possible to facilitate archival research. The recalibration pipeline should adopt the optimal interpolation for a point source, as these comprise the bulk of the data. For users working with non-star targets, software to undo the standard correction and to apply different algorithms should be provided. The STUC commends the STIS group on its progress and looks forward to hearing about the completion of the final recalibration of all STIS data at its next meeting.

For all instruments it would be good to have a clear summary for users of the accuracy of the main parameters of the pipeline products.

Overview of Calibration Plans for Cycle 15 & 16: (Bill Sparks)

Calibration planning is offset from the GO cycle. A plan covering both cycles 15 & 16 is being developed, assuming a 6 month long cycle 16 prior to SM4. Several low demand modes have had their calibration 'outsourced' via the GO program. Five such programs were selected, of which only one required new observations. Some observations with the NICMOS grism have been taken of stars suitable for JWST calibration. Four A-stars, and four K-giants selected from the Spitzer target list had already been taken. To these have been added four fainter A-stars for JWST compatibility that should take the flux calibration to the ~1-2% level. White dwarfs are also observed as standards, but the IR community uses solar analogs, A and K stars, so HST should observe these for cross-calibration.

As SM4 will be no earlier than May 2008 consideration should be given to a calibration plan for a longer Cycle 16.

WFPC2 Closeout Plans: (John Biretta)

WFPC2 represents a major part of the HST legacy. In its 14 year life WFPC2 has taken ~120,000 science images, comprising ~40% of HST post-repair observations. The primary goal of the WFPC2 closeout effort is to ensure that future archival users can obtain accurate results with minimal manually applied user calibrations. This effort will include correcting know calibration issues where possible and documenting all remaining known deficiencies. The operational priority is to try to keep WFPC2 operating and calibrated up to SM4, assuming that this occurs, including the WF4 chip which has a drifting bias level. Handling the effects of charge transfer (in)efficiency (CTE) is the current greatest lien on data quality, impacting 80% of WFPC2 data. These tasks imply deferring work on the static archive to post-SM4.

A series of special calibration observations, taking a total of 68 orbits, will be taken, using the same targets as for ACS in order to facilitate cross-calibration. Priority has been given to the WF4 and CTE issues and to a final update of the instrument and data handbooks. Lower priority is being given to: refining the global HST photometric accuracy, separate from individual instruments; determining the photometric zero points to 3-4% in the blue; measuring low light flat fields; calibrating red leaks, which can be a large effect; calibrating the narrow band and ramp filters, which may be time variable due to desorption; and documenting the WFPC2 history in summary form.

The total closeout effort is estimated at 6 FTE-yr, which is similar to that for STIS and includes a 1 FTE-yr contingency. The current staffing of the WFPC2 team is 1.5 FTE, so the program will require temporarily increasing staffing levels by ~3 people which should be feasible, thanks to ESA recovering its full staffing level. Outsourcing some of the effort is another possibility.

The STUC is pleased that the Institute is looking carefully at final calibrations for WFPC2, recognizing that WFPC2 represents a large part of the HST Legacy and agrees that instrument closeout is an important Institute activity. The STUC agrees that the WF4 bias problem and CTE are top priorities (in this order). We worry though that the FTE requests may be underestimated. If resources are not available to accommodate all the calibration plans, we suggest that priority be given to obtaining data, leaving archival analysis and software development for later. The STUC also encourages future calibration plans to develop more complex metrics that could be used to weigh the cost-benefit of one calibration program against another, both within a given instrument, and also between instruments. *The number of observations is only one metric and the gain in calibration accuracy is another. Even the simple number of observations can be misleading, as pure parallels have less science value than targeted observations.* ***The STUC encourages STScI to develop a science case for post-flight calibration of WFPC2 once it is returned to Earth****. The program indicates that this may*

be possible if a strong science case can be made. ***The STUC also suggests that future synergies with COS/WFC3 calibrations be looked into.*** *Is there any WFPC2 observation that may help future COS/WFC3 calibrations?*

NICMOS Plans: (Keith Noll, for Nor Pirzkal)

During the September 2006 calibration review a calibration plan was approved for which the NICMOS team was allocated a significant amount of HST observing time (134 orbits) to address six issues that should be addressed before SM4. These calibrations will serve (a) as in-depth investigation of a newly discovered, fully correctable rate-dependent non-linearity (reported at the April 2006 STUC meeting), and time-dependent changes in the monitored broad band flat fields; (b) to re-measure the distortion in the three NICMOS detectors to update the pre-NCS (NICMOS cooling system) measurements; and (c) as preparation for the future implementation of both WFC3 and JWST. The distortion and flat field correction programs will be part of the contingency NICMOS close-out process, In addition to the programs addressing the rate-dependent non-linearity (20 orbits) and the flat field (15 orbits) issues, the following specific issues will be studied: the non-linearity associated with grism observations (6 orbits), a determination of the plate-scales of the NICMOS detectors to a precision of 18.8 mas, i.e., 1/4 of NICMOS2 pixel size (4 orbits); and improving the defined sensitivities of the three grism modes, by extending the spectroscopic (26 orbits) and imaging (20 orbits) database of primary and secondary standard stars. These standard star observations will be important for future IR capabilities on HST, JWST and JDEM. A NICMOS 'closeout' plan including FTEs and products, like that presented for WFPC2, will be developed.

The STUC commends the NICMOS team for their excellent and efficient work on identifying the current problems and providing solutions as well as for their anticipation of future needs. The STUC would like to hear about the closeout plan at the next meeting*. We note that NICMOS flat field and distortion correction observations were not made for an interval of years****. We suggest that a checklist of observations be made for all instruments that can be checked annually to avoid such gaps developing in the future.***

Post SM4 Instrument Complement: (G. Kriss)

Post SM4 HST will have 6 operating instruments [COS, WFC3, ACS, STIS, NICMOS, FGS]. As staffing levels will not increase, the addition of two new instruments requires prioritization of STScI activities among the instruments and their many observing modes. The science capabilities unique to each instrument were described: *ACS*: coronography, polarimetry, the highest resolution imaging with HRC, high throughput optical imaging, grism spectroscopy with R-100 over a wide field, tuneable ramp filters with wavelength widths of 2-10% over a 70" field of view, UV filters in the Solar Blind Channel (SBC).

STIS: high spectral resolution [R= 45,000 – 110,000] ultraviolet spectroscopy, high spatial resolution UV and visible spectroscopy. *NICMOS:* Long wavelength (λ >1.8 μm) near infrared imaging; high resolution near infrared imaging; near infrared coronography & polarimetry, filter selection for λ <1.8μm. *FGS*: precision astrometry.

STScI currently offers either 'Standard instrument/mode support': calibration, data processing, documentation, user support, or 'No support': shared risk use of modes with no SNAPs, or ToOs allowed with bright object checking. Users must propose calibration observations. STScI proposes to introduce a new level of 'Minimal support' in which basic calibration data will be taken but not fully analyzed. Users will have to do the calibration themselves, documentation will be minimal, and user support cannot be assumed. This would apply only to instruments/modes for which there is no proposal pressure.

Looking at historical usage to project likely usage given the new instrument complement the Institute estimates: COS 16%, WFC3 34%. ACS/WFC 26%, ACS/HRC+SBC 7%, NICMOS/all modes 4.3%, STIS/all modes 12%. These estimates predict numerous modes with ~0.1% - 5% usage levels. At what level should the new minimal support kick in, and at what level should 'no support' begin?

The Institute proposes the following allocation:

1. 'Standard support' for ACS/WFC, ACS/HRC, ACS/SBC (imaging+grisms); STIS/E*H, STIS/E*M, STIS/CCD*L,*M. [* = outsourcing possible], FGS*
2. 'Minimal support' for low usage modes – STIS/UV*L, M, STIS/NUV-IMG, STIS/NUV-Prism, STIS/COR*; Most NICMOS modes - NIC1, NIC2, NIC1,2/POL*, NIC2/COR*, NIC3/(λ>1.8 μm)
3. 'No support' (but available): STIS/FUV-IMG, STIS/CCD-IMG. Other NICMOS modes.

This is a first cut allocation only. The intention is to review and revise the support levels based on observing pressure at the TAC, and again after SM4 once we know what instruments and modes are actually available.

*The STUC welcomed this clear and well-justified presentation on the wide choice of instruments and modes that will be available post SM4. It was made obvious which instruments and modes were unique capabilities and where there were overlaps. With such a wide choice**, the STUC supports the implementation of the 'minimal support' mode for calibration of observing modes. The STUC also endorses the preliminary recommendations as to where priority should be given. We emphasize, though, that the crucial point is that the level of support be science driven and can be changed. The STUC would like to hear how this is working out in practice at the next meeting, including how the calibration issues will be approached for Cycle 17.** *The proposal to "outsource" some of this support was also welcomed as a way to ensure that less widely used, but still important modes, could be made available.*

While considerable detail was presented on the modes of the current instruments, less information was given on COS and WFC3. ***It would be useful for the STUC to see a complete overview of the expected HST instrument complement at the same level of detail.*** *This would aid consideration of the resource issues associated with the overall calibration effort. At the moment consideration of calibration seems to be highly compartmentalized, within specific instrument teams. Moving towards a post-SM4 situation* ***it would seem appropriate to identify more common areas of interest between instruments and establish as many common calibration standards as possible.*** *Standards that are well characterized in one wavelength range can be useful in different wavebands, particularly if they can be modeled reliably.*

When staff resources are under pressure, with so many calibrations required, it may be more efficient to organize effort on a wavelength range basis, dealing with several instruments together, rather than by individual instruments. This would take advantage of common areas of expertise between instrument teams. Are there lessons learned from earlier instrument calibration efforts that can help improve or streamline those efforts for the new instruments?

COS [Tony Keyes]

COS is a high throughput spectrograph for point sources with a ~1" PSF. COS was delivered in April 2004 and has undergone semi-annual functional tests since then.
The STIS-like, and ACS-like low voltage power supplies (LVPS), some which have failed on-orbit, were replaced in COS with higher rated versions by September 2006. A new thermal/vacuum (T/V II) test is now ongoing (October 2006), science tests will follow in November 2006. The user support and ground systems are well along in development. The COS APT is under development; the bright object locator will include the GALEX near-UV and far-UV source catalogs; a mini-handbook will be complete in October 2006, with the full Instrument Handbook being ready by Spring 2007 for the Cycle 17 call for proposals (CP). Web site. Science exposure and calibration commanding preparations are complete. Most steps of the CALCOS pipeline have been tested against real instrument data.

The COS gratings are mounted on a rotating assembly (OSM) with 4 settings. There is an OSM drift over a few hours amounting to 3-6 pixels, 1-2 resolution elements. (This is a settling at the micro-inches level, comparable with the lubricant thickness. The photon counting nature of the COS detectors allows a correction to be made by flashing on the internal calibration lamps for 5 sec, 4 - 5 times during first 2 hours of each observation. This mode of operation is called 'TAGFLASH'. The calibration lamp data does not overlap the instrument data but, even if it did, the few seconds of data with the calibration lamps on can be excised after the fact in data analysis. TAGFLASH is now coded and partially tested. T/V II data will be needed for a final test. The calibration lamp life when using TAGFLASH is conservatively estimated at 6 years/lamp, and there are 2 lamps. The most likely lifetime is twice this estimate, so lamp lifetime is not an issue. The OSM drift may be a 1 g effect, so will be tested on-orbit to see if it persists. Even if there is no

effect, the intention is to keep TAGFLASH as the normal mode, since this saves performing wavecals and so saves ~8% of observing time per observation.

The Institute has good coordination with Instrument Development Team (IDT, PI Jim Green). The on-orbit check-out after installation during SM4, the 'Servicing Mission Orbital Verification' (SMOV), timeline needs a 'delta' requirements review because of the 3 year delay in launch. Full planning begins 1/4/2007, with a review during April 2007, and generation of the full SMOV program in the March-September 2007 time frame.

STUC compliments the COS teams on the terrific progress they have made readying the instrument for SM4. *The implementation of the TAGFLASH mode is commendable. Preparatory work that will serve users - the development of the CALCOS pipeline, of the APT, and of the first instrument - has been progressing well.*

WFC3 [John MacKenty]

Re-integration of WFC3 is now underway following the installation of upgraded LVPS. One of the main electronics boxes (MEB 2, essentially a computer) would not start up. The fault has been traced and requires only that one resistor be swapped out. The thermal load model for WFC3 was found to be off by 30%, requiring 80 W of additional heating. The filter issues have all been resolved and the UV ghosts fixed. The glass chipping experience with F588N has led to this filter being replaced with clear glass (F200LP). A filter of some type was needed to maintain mass balance in the assembly. Replacement of F588N would have taken 7-10 weeks, which was unavailable. The IR grisms have been replaced, fixing the rotation and focus alignments. F093W has been replaced with F140W in the IR channel. The current timeline, aiming for a 1/1/08 SM-4 readiness, has the SM ground test scheduled in February 2007; T/V #2 schedules for early March 2007 with the old IR detector (IR2, FPA64) and lasting for 2 months; and T/V #3 in the late Summer of 2007 (utilizing a new IR detector), lasting for 6 weeks.

The IR detectors remain under development. IR1 (FPA129) has the substrate removed, and so has a lower background (the proton glow is reduced), but needs 4 months to complete. The enclosure parts are nearly complete for IR3 (FPA148 from Teledyne Imaging Sensors [formerly Rockwell Scientific]). A selection from this batch will be made in late November 2006. It will take 7 months to package the chosen detector at Ball Aerospace. There is already one promising part (detector chip), which has no tail of high dark rate pixels, where in previous parts this tail comprised 10% of pixels; the QE is 85% (peaking at 88%) across the whole 1.0-1.7 μm band pass. Several more good parts are anticipated by mid-November.

Calibration is being undertaken at the component level (filters, detectors). System level calibrations will be undertaken during T/V, SMOV and during specific Cycle 17 calibration observations. TV#2 will be used to calibrate the UVIS channel, and TV#3 to calibrate the IR channel. New calibrations will be based on ACS, NICMOS. The IR bias

shift vs. bus voltage (due to changing voltages while taking data) will be calibrated; a new 'deep survey mode' UVIS and IR channel determination of biases and darks is being considered but is time consuming. Is this needed? WFC3 has 69 filters so, while some points will be calibrated for all filters, the whole field cannot be calibrated for all filters, but only for the most used ones. UV calibration tests must be made on the ground as there is no on-orbit UV calibration source on WFC3.

A delta review of the SMOV will be held in December 2006. The implementation schedule is under development with the goal of enabling early GO science ~3 months post SM-4. WFC3 cannot be turned on for 3 weeks after SM4 due to outgassing, after which both channels must be cooled down. As there is no UV WFC3 pick-off mirror protection door, scheduling procedures need to ensure bright earth avoidance.

The STUC is concerned that WFC3 re-integration appears to be running close to SM4 as vacuum tests will be done as late as August 2007. *The criteria for choosing the best IR detector for flight were unclear.* ***The STUC would be happy to help in giving scientific input to the selection of the flight chip, based on the science trades to be made. Deep Survey mode calibrations are surely desirable, as deep observations will surely be a significant part of the WFC3 science program.***

Cycle 16 Plans: [Neill Reid]

Cycle 16 will continue to SM4, and Cycle 17 will begin after SM4, whenever this should occur.

No obvious gaps identified in the cross-observatory science program at the Great Observatories meeting in Pasadena (May 2006). There was a widespread feeling that larger joint programs should be possible that avoid the double jeopardy of being approved by two TACs independently. Cycle 16 will attempt this for HST/Spitzer. [Chandra will not be included as the perceived need is less urgent, and because the Chandra review is out of phase with the other two Great Observatories, making for logistical problems.]

This objective will be achieved by adding the ability to propose Large programs for *both* HST and Spitzer in one proposal. These Large programs will be defined as those that require *both* >50 hours on Spitzer *and* >70 orbits with HST. (Note that this is less than the normal 100 orbit criterion for HST.) Small joint programs will still be allowed as before. The Institute expects < 20 - 25 proposals. A notice of intent is required by December 1. The TAC will award up to 300 orbits HST (~1/3 of the Large program allocation, from which this time will be taken), and up to 500 hours of Spitzer time. There will be a joint TAC, using members of the two TACs, by telecon ~1 week before HST TAC in March 2007. The HST and Spitzer TACs must ratify recommended allocations. The relevant panels will need to be aware of any program overlaps, as for normal panels.

Statistical programs, in which a large number of objects of a sample are observed briefly, are a valuable means of doing astronomy. However there are fewer snapshot (SNAPs) opportunities in 2-gyro mode. To respond to this, the Institute has created a new category of 'GO Survey Programs'. A proposer would submit M targets for N orbits, where M>N, so that not all can be observed. This oversubscription allows the STScI schedulers to select an optimal subset for efficient scheduling of the observatory. All observations must be <48 min/orbit, fully unconstrained, and well distributed in RA. Visits need not necessarily be identical. By making better use of SAA affected orbits the total number of science orbits/year should be increased, in the range 25-200 orbits, probably >100 orbits. The best locations for making use of SAA affected orbits are at high northern declinations (>~ +75deg.). A User Information Report (UIR) will be issued giving details on how to optimize target locations. The number of orbits proposed will determine a proposal's normal/large program status, not the number of targets. The orbits gained will be used as a pool for survey programs, adding 15-20% to each panel. The snapshot program rules will then be changed to make better use of scheduling gaps by requiring <40min, including acquisition, and no prioritizing will be allowed. The expectation is that there will be ~200 fewer SNAPs.

There is no expectation of any ACS failure but, with side 1 inoperable and ACS accounting for 80% of primary orbits, prudent contingency planning is needed. Post-SM4 this contingency becomes unnecessary, as no instrument is expected to be so dominant in the program. Large backup programs (>70 orbits) are thus needed on an accelerated timescale, and these have been called for, following discussion with a STUC sub-committee on the rules. They should be of wide interest, and would carry no proprietary time. Few constraints can be allowed. A deadline of 5 pm (EST) on 3 November has been set. As of October 25 zero proposals have been received, i.e. on track. The Cycle 15 TAC will be reconstituted to choose from < 25 proposals. (If more are submitted then STScI and the STUC will select 25 for the TAC to consider.) The aim is for selection by December 1, and 4 January 2007 for phase II submission. The Cycle 16 TAC can comment on the selection and ask for a second call if needed.

The Cycle 17 schedule is uncertain. If SM4 were January 2008, with the SMOV occupying February 2008, then observations would begin in March 2008, (with WFC3 following in May08). To accommodate this possibility CP17 could be issued in July 2007, 3 months ahead of time. This would require the documentation to be ready early. Alternatively, the Institute could keep to the current schedule, as a TAC held in March 2008 would know the in-flight list of available instruments. COS GTO time could be used to fill gap before Cycle 17 targets become available. The Institute could require phase II early for Large GO programs, so that they can be used immediately, thus minimizing the number of teams affected. If SM4 stays on an April schedule then the TAC won't know about on-orbit instrument availability, and so will need more ranked proposals. If SM4 happens in August 2008, HST will use a whole year of cycle 16. The ACS, NICMOS fraction of cycle 17 (2-3 months) will be used to begin cycle 17.

The STUC is supportive of the changes made to the Cycle 16 call for proposals*. The addition of "large" coordinated HST-Spitzer programs (> 70 orbits of HST time) and (>50 hours of Spitzer time) is a good step towards ensuring that critical science will be carried out with Spitzer before the end of its lifetime. While GO Survey programs will negatively affect regular snapshot programs (with a ~20% decrease of the number of orbits allocated to Snaps - from ~1000 to ~800),* ***the STUC finds that the more optimal allocation of orbits that will result from this implementation, and the guarantee that a specified number of GO survey targets will be observed*** *(as opposed to the case of Snapshot programs)* ***is a good improvement.*** *[The name may be misleading, as there are surveys that are not snapshots.] Finally****, the STUC approves of the appointment of a joint HST-Spitzer TAC in evaluating the coordinate HST-Spitzer proposals.***

The STUC commends the contingency planning efforts that are being carried out to ensure that no loss of observing time will take place in the event of a catastrophic failure of the ACS, *while hoping that it proves unnecessary****. Prudent planning proved its value with ACS anomalies. It was noted that two weeks after the first ACS failure, the observing efficiency was reduced from the nominal 72 orbits per week to about 20-25 orbits per week - a situation that clearly should be avoided in the future. The problem is critical since ACS accounts for 80% of the primary orbits.*** ***The released call for backup WFPC2/NICMOS/FGS proposals is therefore sensible and timely. The TAC also approves of the decision of asking the Cycle 16 TAC for input on whether a new call for backup proposals will be necessary.***

*The STUC notes that only a small delay in SM4 from the earliest date of January n 20008 will bring the cycle back to the regular schedule [indeed, on October 31 the NASA Administrator announced a launch for SM4 no earlier than May 2008], in which case option 2 would be appropriate****. Thought should be given to a slip from May by several months, potentially including phasing the TAC to be after SM4.*** *However, it is felt that asking for Phase II at the same time as Phase I will put too much burden on the users, and should be avoided. Proposers should be encouraged to turn around their Phase 2.*

Status of the Program: [Preston Burch]

HST is still operating above 40% efficiency even in 2-gyro mode.
The failure of ACS side 1 has led to the upgrade of the COS, WFC3 electronics.
The battery charge capacity loss rate of the last 2 years has stopped in the latest measurements. An improved calibration of remaining charge has been implemented so that the battery situation can be better monitored.

The most likely SM4 timeframe is April-June 2008, but the program is working to a January 4 2008 readiness. The 'Mission of Opportunity' flight 125 (nominally April 17 2008) is the likely SM4 slot. There are 7 other flights currently manifested before 125. The Administrator's decision on SM4 is expected on October 31. [As was indeed the case.]

The replacement batteries are in cold storage. Although they have exceeded their nominal shelf life there is no sign of degradation in their function. Three Gyro units [RSU 1005,10061007] have been tested, and a transistor changeout performed. RSU1004 is in development. The STIS repair planning effort is going well, with only 1 EVA day needed in the new plan. It has not been decided which FGS to replace, though it will probably be FGS2. A new over-voltage protection kit has been developed to ensure against a low probability contingency.

The HST repair schedule requires 5 days of EVA out of 11 mission days. Planning is for 1 spare HST day, 1 spare Shuttle day. Tile inspection will be carried out early in the flight. Options for lower EVA-days options must be decided in advance of launch. A 1 EVA-day option would likely be gyros + 1 instrument, as the batteries appear to have longer life expectancy than previously. The many options will be worked only after the SM4 decision. The Project expects to present the details at the next STUC meeting.

The options for parallel observing by multiple instruments, post-SM4, are limited by power, not downlink capacity. These could be mitigated by, for example, reducing NICMOS operations seasonally. WFC3 and ACS can certainly be operated together. STScI will hold a pre-SM4 planning workshop, including the use of parallels.

WFPC2 will be returned to Earth in the sealed WFC3 container, and so in principle can be re-calibrated on the ground. A strong science case is needed to put funds to this purpose.

An upgrade of the internal STScI network was approved and the upgrade completed. The upgrade of the STScI to users bandwidth [see Oct 2005 STUC] has not been addressed as yet.

Status of the Project: [David Leckrone]

The second ACS failure was due to a relay, very likely due to particulate contamination blocking the toggle switch, which has happened before with same type of relay. But a toggling action might, with very low probability, have caused a major short, so great care was taken to investigate this possibility, and no route was found. As no one could think of more actions to take, D. Leckrone made the decision to go ahead, and upper management concurred. The operation was successful.

Deciding SM4 priorities – COS vs. WFC3 – in the case of curtailed EVA activity is a scientific “Sophie’s choice”. Fortunately it is highly unlikely that this choice will have to be made, but nonetheless this contingency must be planned for, although doing so is a very divisive process. The loss of redundancy on ACS influences WFC3 priority, just as the loss of STIS affects the priority of COS. However, the possibility of the STIS repair does not influence the COS priority, because STIS repair would be first science instrument item to be taken off the manifest in case of reduced EVAs. The priority

decisions should be based on the scientific case, not on history. The Project needs a science case for the relative priorities for SM4 from the STScI by Spring 2007. A clear exposition of the rationale is more valuable than the absolute ranking. The process will be that STScI will draft white papers (5-6 pages) making the case for each instrument. The STScI teams will include both COS PI team members and STUC members. These reports will then be circulated to the STUC, and discussed, first via email, and finally at the STUC meeting next spring.

There is a worse choice: what if HST lifetime is limited without new batteries? Then the choice would be between the current suite of instruments with new batteries and gyros for a long life, or new instruments with no new batteries, and hence a short life. This situation resembles the SM3b decision between the NICMOS cooler and new gyros.

The STUC will appoint a individuals to interact with the white paper writing teams at STScI and will help make this decision as a whole committee, based on the projected impact and uniqueness of the science cases made in the context of the health of HST and its instruments. ***The STUC volunteers for assisting with the STScI science white papers are: Mario Matteo and Alvio Renzini for WFC3; Martin Barstow and Peter Garnavich for COS.*** *Should retiring STUC members be included in the distribution to make use of accumulated history of involvement?*

The STUC *was surprised at the change in battery life projections and* ***would like to hear more on the batteries status at the next meeting.***

HQ: [Jennifer Wiseman]

Input from the STUC on instrument prioritization for SM4 contingencies is valued at HQ as part of the ongoing discussion. A televised press conference on HST results on transiting planets in the Galactic bulge was successful, and was the first televised Hubble press conference for a while.
On the FY07 budget the STUC should note that NASA is currently operating on a continuing resolution. HST is not doing badly, but other missions are in trouble. The post-SM4 'development' funds listed under HST are mostly for operations, not new instrument development. Operations costs include substantial TDRSS allocations.
It is unclear how the re-formation of the NASA advisory committees will affect HST. The committees want to monitor HST operations costs, which could be important in the case of substantial SM4 delays, and may have influence over decisions for other missions.

Jennifer Wiseman is moving to GSFC to become head of the Exoplanets and Stellar Astrophysics Laboratory, in the Astrophysics Division. Jeff Hayes will take up her responsibilities as Hubble Program Scientist at NASA HQ.

The STUC thanks Jennifer for her service to HST and wishes her well in her new position. The STUC welcomes Jeff Hayes as Hubble Program Scientist.

Thanks [Matt Mountain, Jennifer Wiseman, Jeff Hayes]

Following a photo session of the STUC, the Director and Hubble Program Scientists gave a round of thanks to the outgoing STUC chair and STUC members.
The outgoing STUC chair and STUC members were suitably pleased. Thanks.

New STUC Chair:

The Director announced that the new STUC Chair would be Pat McCarthy, of the Carnegie Observatories, Pasadena, California.

Date of Next meeting: April 12-13 2007 (Thursday – Friday).

Feedback to the Director and the Project: [Martin Elvis, STUC Chair]

The STUC chair presented the comments listed above, and summarized below, to the Director. Unfortunately, due to urgent SM4-related business the Project representatives could not be present. The STUC fully recognizes the greater importance and urgency of SM4 business. (!)

In addition to the points above the STUC:

- Encourages the European Coordinating Facility, represented at this meeting by Jeremy Walsh, to present their 4-year plan at the next STUC meeting, which will be after their ESA/ESO review.
- Would like to hear a briefing on post-SM4 parallel observing options.
- Would appreciate a more detailed review of the COS, WFC3 calibration plans, on the ground, during SMOV and through cycle 17.
- Feels it would be timely for the STUC to get an overview of STScI resource allocation plans for the post-SM4 era.

For clarity the STUC comments from the discussion are repeated below:

- We commend everyone involved in implementing the ACS recoveries, and for planning for such an eventuality well in advance of the failure.

- We encourage the telescope staff to continue to study how HST's life can be extended in old age; even if some of this work proves moot because SM4 goes ahead, it will be of use at a later time when HST truly is in its final years of operation.

- The STUC would like to see a more detailed summary of the success of field acquisitions now that we have extensive experience in 2-gyro mode operations.

- The STUC urges the Institute and NASA to improve the STScI Internet bandwidth, which was raised as an issue at the 2005 October STUC meeting.

- The STUC recommends that, instead of leaving any 2-D rectification for only post-pipeline processing offline by the user, consideration be given to including this process in the standard STIS recalibration pipeline. The goal should be to populate the archive with as close to directly useable data products as possible to facilitate archival research. The recalibration pipeline should adopt the optimal balance of wavelet and bilinear interpolation for a point source, as these comprise the bulk of the data.

- The STUC commends the STIS group on its progress and looks forward to hearing about the completion of the final recalibration of all STIS data at its next meeting.

- For all instruments it would be good to have a clear summary for users of the accuracy of the main parameters of the pipeline products.

- As SM4 will be no earlier than May 2008 consideration should be given to a calibration plan for a longer Cycle 16.

- The STUC is pleased that the Institute is looking carefully at final calibrations for WFPC2, recognizing that WFPC2 represents a large part of the HST Legacy and agrees that instrument closeout is an important Institute activity. The STUC agrees that the WF4 bias problem and CTE are top priorities (in this order). We worry though that the FTE requests may be underestimated. If resources are not available to accommodate all the calibration plans, we suggest that priority be given to obtaining data, leaving archival analysis and software development for later. The STUC also encourages future calibration plans to develop more complex metrics that could be used to weigh the cost-benefit of one calibration program against another, both within a given instrument, and also between instruments.

- The STUC encourages STScI to develop a science case for post-flight calibration of WFPC2 once it is returned to Earth.

- The STUC also suggests that future synergies with COS/WFC3 calibrations be looked into.

- The STUC commends the NICMOS team for their excellent and efficient work on identifying the current problems and providing solutions as well as for their anticipation of future needs. The STUC would like to hear about the closeout plan at the next meeting.

- We suggest that a checklist of observations be made for all instruments that can be checked annually to avoid long gaps between calibration measurements developing in the future.

- The STUC welcomed this clear and well-justified presentation on the wide choice of instruments and modes that will be available post SM4

- The STUC supports the implementation of the 'minimal support' mode for calibration of observing modes.

- The STUC also endorses the preliminary recommendations as to where priority should be. We emphasize, though, that the crucial point is that the level of support be science driven and can be changed. The STUC would like to hear how this is working out in practice at the next meeting.

- It would be useful for the STUC to see a complete overview of the expected HST instrument complement at the same level of detail as for WFC3.

- It would seem appropriate to identify more common areas of interest between instruments and establish as many common calibration standards as possible.

- The STUC is concerned that WFC3 re-integration appears to be running close to SM4 as vacuum tests will be done as late as August 2007.

- The STUC would be happy to help in giving scientific input to the selection of the flight chip, based on the science trades to be made. Deep Survey mode calibrations are surely desirable, as deep observations will surely be a significant part of the WFC3 science program.

- The STUC is supportive of the changes made to the Cycle 16 call for proposals

- The STUC finds that the more optimal allocation of orbits that will result from the implementation of GO Survey programs, and the guarantee that a specified number of GO survey targets will be observed is a good improvement.

- The STUC approves of the appointment of a joint HST-Spitzer TAC in evaluating the coordinate HST-Spitzer proposals.

- The STUC commends the contingency planning efforts that are being carried out to ensure that no loss of observing time will take place in the event of a catastrophic failure of the ACS

- The released call for backup WFPC2/NICMOS/FGS proposals is sensible and timely. The STUC also approves of the decision of asking the Cycle 16 TAC for input on whether a new call for backup proposals will be necessary.

- Some thought should be given to dealing with an SM4 slip from May 2008 by several months.

- The STUC volunteers for assisting with the STScI science white papers are: Mario Matteo and Alvio Renzini for WFC3; Martin Barstow and Peter Garnavich for COS.

- The STUC would like to hear more on the batteries status at the next meeting.

- The STUC thanks Jennifer for her service to HST and wishes her well in her new position. The STUC welcomes Jeff Hayes as Hubble Program Scientist.

Meeting adjourned.

==========