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SPACE TELESCOPE SCIENCE INSTITUTE

Newsletter

Highlights of this Issue:

- Users Committee Report — *page 6*
- Servicing Mission Details — *page 7*
- NASA Medal to Bob Williams — *page 11*

A Big Start to Cycle 8: A Search for Planetary Companions in the Globular Cluster 47 Tucanae

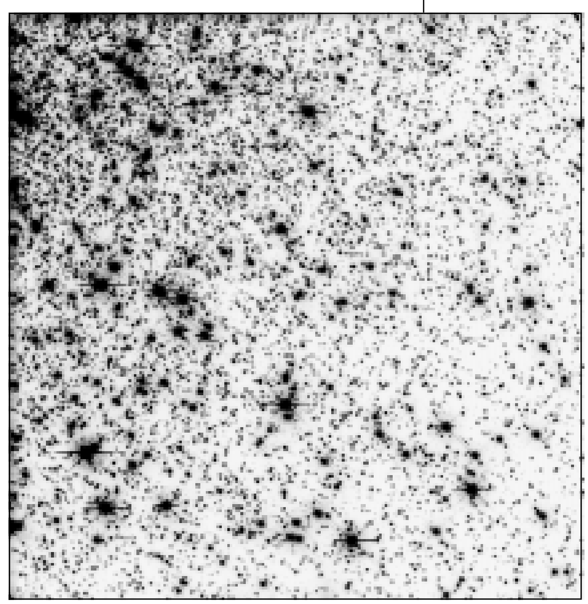
Peg Stanley, STScI pstanley@stsci.edu

From July 3 through July 11, 1999, we spent 8.3 consecutive days of *HST* observing on a single GO program. The primary goal is a search for planetary companions in close orbits around main sequence stars in 47 Tuc. Program 8267 (PI Ron Gilliland; see page 3) represents the single largest allocation of *HST* time to a General Observer through the TAC process. While the program was considered "scientifically risky" in that planets are not yet known to exist in globular clusters, *HST* is uniquely capable of providing the requisite high-dynamic range, time-series photometry. Using transit signals from WFPC2 time-series photometry (along with parallel STIS CCD images), about fifty such systems are expected to be detected with planetary radii errors of only 2 to 4% from the signal depth, and accurate periods from at least two transits. Follow-up radial-velocity spectroscopy from the VLT and/or Gemini should provide velocity measurements for the best 25% of candidates to provide planetary masses. Many other science applications are expected to follow from these extensive observations, such as *U*, *V*, and *I* imaging well down the white dwarf cooling sequence in the cluster core, and a definitive survey for eclipsing binaries.

Implementing this program presented big challenges. The problem was to find a way to use SAA-impacted orbits efficiently without STScI fully hand-crafting the observations. This program had an absolute minimum science requirement of four 160s exposures per orbit. To let the PI to do the crafting himself, he was given access to Special Requirements in RPS2 that are normally available only to Program Coordinators within STScI. Once the scheduling date was determined, the PI was supplied with an ephemeris. Observations were crafted by the PI to fit the timeline using the new Special Requirements. After submission, the proposal was put on a test calendar with no problems. Each week the proposal was tested with the new orbit file and fit very well around the slight fluctuations in SAA passages. Only one orbit out of 120 needed to be reworked when a previously SAA-free orbit was affected by a 59s SAA passage, requiring one visit out of 19 to be reprocessed.

Another significant challenge was determining the timeframe for execution of the program. With specified roll constraints and the need for long-duration target visibility intervals, the preliminary best time for execution was identified as mid-October 1999. The announcement of the SM3A schedule quickly nixed that scheduling window. Sixteen separate Long Range Planning runs were executed for analysis of the impact of placement of the program at 10 distinct observing windows within the Cycle 8 observing plan. The analysis of these observing windows concentrated on finding the period of least impact to other *HST* observations while meeting the specific program requirements.

When dedicating this much time to a single target, it was deemed prudent to invest some on-orbit time verifying the guide stars for the program. 47 Tuc is not an easy guide star field due to the overabundance of stars (there are too many "spoilers," close doubles that prevent the FGS from locking). A single good guide star pair was initially



Co-added image for WF3 F555W data. This is the least-crowded of the WFPC2 CCDs, and contains several thousand stars for which time series signal to noise should support planet searches via detection of periodic transit signals of 1 to 6% lasting for 2 to 4 hours.

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DIRECTOR'S PERSPECTIVE

Steven Beckwith

Local pride dictates that the most interesting problems require the Hubble Space Telescope for their solution. This little fiction is useful to maintain enthusiasm for our mission, but it is, unfortunately, not an intellectually honest approach to science. The successful launch of the Chandra advanced x-ray observatory at the end of July reminds us of the tremendous potential for breakthrough research with different facilities looking at different wavelengths. We expect Chandra to be an outstanding success and a huge boon to astronomy. Astronomy has been changed profoundly by the pioneers who develop observing techniques and wavelength regions other than those favored by the mainstream. The most interesting problems may be those we have yet to discover for want of looking.

That is why the Space Telescope Science Institute and the Chandra Operations Center are exchanging blocks of observing time to offer their communities the opportunity for multi-wavelength observations. The Hubble program will get 400,000 seconds of observing time on Chandra to award to outstanding proposals that combine Hubble and Chandra observing, with the emphasis on Hubble. Chandra will receive 100 orbits of Hubble time to award for programs with an emphasis on x-rays but a need for Hubble, as well. Starting in Cycle 9, you can propose a Hubble program that requires Chandra observations, as well. The entire program will be considered by a single time allocation committee. If you are proposing to Chandra, consider the benefits of using Hubble for your program, too. Rather than trying to beat them, we prefer to join them for our collective success.

Cooperation vs Competition

The scientific potential is great. Many problems depend on observations of physical processes at different wavelengths for a complete solution. The study of galactic nuclei comes to mind: the central engines are often powerful sources of x-rays, whereas a lot of the luminosity is absorbed by dust and reradiated at infrared wavelengths. The study of young stellar objects would be incomplete without radio observations of the clouds, submillimeter and infrared observations of the disks, optical and ultraviolet data on the stars and winds, and x-ray studies of the jets and coronae. No doubt most complex astrophysical objects will need a multi-faceted approach for their understanding. We can expect such approaches to become more important as astronomy matures beyond the exploration stage.

The social benefits could be equally great. One cannot help but notice the divisive effects of wavelength chauvinism in the planning exercises for major new facilities. It becomes difficult to prioritize expensive new projects on the basis of 'pure' scientific merit, when so many workers in any one subfield (read waveband) feel the need to support that subfield at all costs to preserve their livelihoods. As scientists, we do not want to be perceived as fighting to preserve obsolete skills, especially since the tenure system preserves most of us from the worst pressures of the marketplace. Making access to different wavelengths easy by application to a single committee already knowledgeable in the problems traditionally within UV and optical astronomy will allow our users to broaden their skills. They will gain an appreciation for how the other side lives that should be useful to keep their science vital.

We plan to include SIRTF in this exercise when it is launched. By combining these great observatories, we want to demonstrate that astronomers know how to couple the most expensive facilities for the good of science. In principle, this approach could include ground-based observatories, although only the public facilities will be able to combine resources with the publicly supported spacecraft. If you think this would be a good idea, drop me an e-mail. Each observatory director with whom I have spoken is eager to see if we can make the whole much greater than the sum of the parts.

Steven Beckwith, Baltimore, August 2, 1999

GO-8267 Status at Data Receipt + 6 weeks

Ron Gilliland, STScI gillil@stsci.edu

The data volume and initial processing steps for this project share many similarities with the Hubble Deep Field program. The first significant goal in the data processing is to stack all of the available images, taking into account the extensive sub-pixel dithering to create deep co-added, over-sampled images in each bandpass. The total exposure times are: WFPC2 F336W (14,360 s), F555W (101,760 s), F814W (104,480 s); STIS/CCD CLEAR (123,794 s), and LONGPASS (130,600 s) in the primary exposures (160s for WFPC2 V & I, 187 and 200s for the STIS filters), with a few additional short exposures and large dither cases. Even though the CCDs were read out a large number of times, most of the data for deep imaging purposes is limited by the "sky" background from observing in such a rich star field (the PC is on the cluster core).

With about 650 well-dithered at the sub-pixel level frames to combine in each bandpass, the data are ideal for supporting combinations which restore all possible resolution (given the initial undersampling). The resulting co-added stacks are simply exquisite with FWHM (full frame average) of stars in PC1 F555W at 0.062" and in WF2 0.128" (used the PI's software approach, e.g. see Gilliland, et al. 1999, ApJ, 521, 30-49, with tweaks appropriate to these unique data). When operating with literally tens of thousands of stars at S/N in the range of 100 to 400 and 1,289 primary time series exposures, many details become important in the analyses that can be ignored for most programs. As an example, the apparent plate scale changes over the course of *HST* orbits by about 2.5 parts in 10,000, producing differential registration errors of 0.10 pixels (center to edge on WF CCDs). With *HST*'s sharp under-sampled PSFs, this variation is essential to take into account for the ultimate time-series extractions and is also very important in the deep-image combination in maintaining the sharpest possible PSFs across the full field of view.

The science team will release all processed data products (co-added images, time-series frames cleaned of cosmic rays, and the some 10^8 photometry measures on individual stars in each frame) by next July. As a part of the stacking process, we now have identified all cosmic rays over the frames and developed frame-to-frame registration models (x,y offsets, rotation and plate scales) good to order 0.001 pixel.

Having just completed the data stacking, the science team can now use these for pursuing various science projects and also use these to provide a complete list of stellar objects to be used in producing time-series photometry extractions. To date most effort has gone into starting with the basics (e.g., deriving new darks) and applying the over-sampled image stacking and initial processing to create star lists (and hence color-magnitude diagrams from these deep exposures). A next major analysis effort will go into accurately handling the PSF variations that result from telescope breathing; again, given these unique data, these are very obvious and will be important to understand in detail. Satisfying the ultimate goals of our project is still a fair distance off with the need to extract precise time series for about 90,000 stars and, for the brighter half of these, analyze each of the resulting 1,289 point time series for the possible signature of multiple transits. The transit search will involve cross-correlating each time series with all possible transit signatures (range of periods and phases) that we are sensitive to (planets with orbital periods up to 5 days and Jupiter's radius). Over the next several months, I and many members of the science team will be actively pursuing the many steps needed to extract results from our data.

Search for Planetary Companions *from page 1*

identified and a short acquisition test was executed on 1 June 1999, which resulted in a failure to acquire the FGS2 star. With manual effort, an FGS1 star was identified as an alternate guide star to the failed FGS2 star. Time was running out to test this new guide star pair, so the opportunity was taken to insert the new acquisition test into an upcoming flight calendar that was already being reworked to accommodate a Target of Opportunity observation. This second guide star acquisition test was successfully executed on June 9, 1999.

While the work done up front to test schedule this program eased the task of flight scheduling it, there remained the challenge of handling the enormous data volume of this program. Early runs of the Mission Scheduler were performed to determine the on-board data management and communications contacts requirements. With only one working SSA transponder on *HST*, a daily repeating pattern was seen in the Solid State Recorder (SSR) volume: the total volume rose quite high over an eight-hour period when no dumps were possible, then dropped to near zero as the dumps were scheduled. It was clear from this pattern that the 3 to 4 dumps each day which brought the volume down from ~80% capacity were very important. Extraordinary efforts were required during the final schedule processing to manage the data volume. Numerous communications contact shortfalls existed and science data loss was imminent. After negotiations failed to provide adequate service, the GSFC Network Control Center recommended use of the

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Wide Field Camera #3 Filter Selection Process

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In 2003, *HST* will have completed 3/5 of its extended scientific mission. To secure a robust imaging capability through the end of the *HST* mission, NASA has funded the Wide Field Camera #3, to be launched in 2003 as a replacement for WFPC2. In keeping true to its goal of addressing many astronomical topics, the WFC3 will consist of a UVIS channel (two 2048 × 4096 CCDs, 160 arcsec square field of view) with enhanced sensitivity in the blue (accessible wavelength range 2000 to 10000 Å) and an IR channel (HgCdTe 1024 × 1024, 140 arcsec square) with near-IR sensitivity from 8000 Å to 1.8 microns. Details of the instrument design and predicted throughput may be found at the GSFC WFC3 and the STScI web sites (see below for URLs).

The approach to the development of WFC3 is unique in that it is built as a "facility instrument", optimized for community-wide flexibility, and built by an Integrated Product Team (IPT) rather than the usual Investigation Definition Teams that have produced previous *HST* instruments. The Science IPT, a consortium that has no guaranteed observing time, includes Ball Aerospace, STScI, GSFC, and JPL. Science advice is provided by the WFC3 Scientific Oversight Committee (SOC), a group of experienced scientists who represent the Optical, UV and IR communities, and who donate their time and efforts to support the program.

STScI, together with the Goddard *HST* WFC3 Project and the WFC3 SOC, hosted a special workshop on July 14, 1999, at STScI to address the filter selection for WFC3. For a very successful workshop and for donating their time, we want to thank the speakers, the participants of the workshop, and those that provided input to us via the web-based Discussion Board and through direct email. Workshop participants provided their input to the WFC3 SOC, who then put together the preliminary list of filters; they are currently in the process of refining filter characteristics (e.g., cutoffs, rejection requirements, transmission details, widths, etc).

Fourteen speakers covered topics during the morning session that included stellar populations, high redshift objects, solar system filter needs, narrow-band filters for shock-environments, H II and emission line regions, the Sloan Filter set, supernovae, photometric systems, galaxy evolution, and a review of the ACS filter philosophy. The afternoon discussion sessions, facilitated by SOC members, addressed three topics: Broad and Medium Band filters, Narrow-band, and Specialty filters.

The preliminary list of WFC3 filters are listed on the web sites. We encourage the community to visit these web sites for more information on WFC3, for workshop proceedings, community input, and lists of Workshop participants, SOC members, and WFC3 team members. As the Filter Definition Process matures, updates will be posted.

GSFC:
http://wfc3.gsfc.nasa.gov/

STScI:
http://www.stsci.edu/instruments/wfc3/wfc3-filter_workshop.html

Women in Astronomy

There will be a Special Session on the Status of Women in Astronomy at the January 2000 AAS meeting (Saturday, January 15, 10:00 AM), organized by Meg Urry (STScI), Claude Canizares (MIT), and Priscilla Benson (Wellesley, and Chair of the AAS Committee on the Status of Women in Astronomy). Short talks by Urry, Canizares, and Lotte Bailyn (MIT), will be followed by a panel discussion moderated by Steve Beckwith (STScI Director).

STATUS, the CSWA newsletter is produced at STScI by co-editors Meg Urry (*cmu@stsci.edu*) and Lisa Frattare (*frattare@stsci.edu*) and designer Kathy Cordes. STATUS appears twice per year, in January and June, and is mailed free of charge to AAS members who subscribe (send your address to *ssavoy@aas.org*). For further details or for online versions of recent issues, see *www.aas.org/~cswa/pubs.html*.

Search for Planetary Companions *from page 3*

"spare" communications satellite TDRS-171, solving the data volume problems. The program acquired 1,331 exposures with both WFPC2 and STIS for a total exposure count of 2,662. The total volume of data written to the SSR was 114 Gbits, a factor of three over the normal volume.

The OPUS pipeline produced all regular data products for this program within the normal time frame and with no extra resources devoted to it. Disk space reserved for data assessment did fill up on Sunday, July 11 (OPUS is not staffed on weekends), but the pipeline automatically suspended some processes to avoid uncontrolled disorder. Full processing was resumed Monday morning. The last science products were submitted to the archive on Tuesday morning, and data assessment was completed on Wednesday, July 14.

PI Ron Gilliland has completed an initial inventory of the data, indicating he "got what he asked for" and is extremely pleased with the quality of the data and the process and support of the STScI. He now faces the most challenging part of the program: analyzing this extremely large data set!

The Globular Cluster NGC 6093 (M80)

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In July, 1999, the Hubble Heritage Project released an image of the globular cluster M80 (NGC 6093) (see Figure 1), one of the most massive and densest of the 146 known Galactic globular clusters. This image was created using the data from two independent studies which fortuitously were different in orientation by about 180 degrees.

One team of astronomers (Ferraro, Paltrinieri, Rood and Dorman) have used *HST* to image M80 in the ultraviolet and found a very large population of blue stragglers stars (BSS) in the core (1999, ApJ 522,1). M80 was previously unknown to contain BSS but these new results show that M80 has more than twice the number of BSS than any other globular cluster surveyed thus far.

The other team of astronomers (Shara, Zurek and Drissen) have used *HST*, to search for dwarf novae and the counterpart of old nova T Sco. A UVsource has been discovered at the position of T Sco (Figure 2). A spectrum of this object has been obtained with STIS/*HST* and is being analyzed. Two dwarf novae have also been discovered in this data set (Figure 3) placing the number of known cataclysmic variables in this cluster at three. This study has also found a number of faint UV sources at about the brightness of the dwarf novae in quiescence (Figure 4). The exact nature of these objects is as yet unknown.

Cataclysmic Variables and BSS are thought to be enhanced in dense stellar regions as a result of collisions and mergers. The dense core of M80 is a place where many collisions should be occurring and may still be occurring. The large number of BSS suggest that collisions may produce these objects.

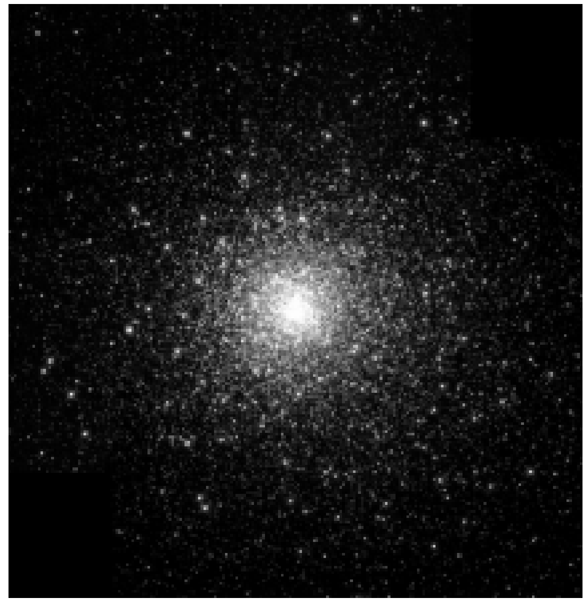
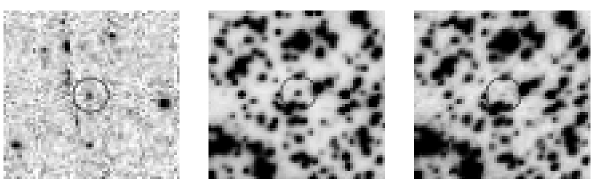
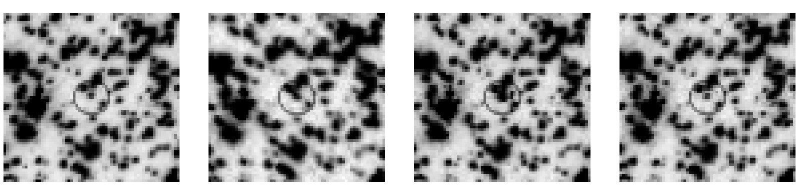


Figure 1: Image of NGC 6093 (M80). The filters F336W, F439W, F555W and F675W were used.

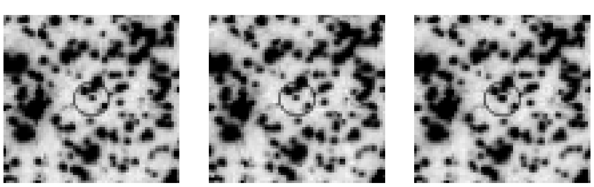


2a 2b 2c

Figure 2 : Images of T Scorpii in the filters (a) F160BW, (b) F336W, and (c) F439W. These images clearly indicate how blue the object is.



3a 3b 3c 3d



3e 3f 3g

Figure 3 : Time sequence in F336W of one of the two dwarf novae discovered in M80. It is seen in eruption on 19/08/97 and appears to be entering another eruption on 29/09/97.

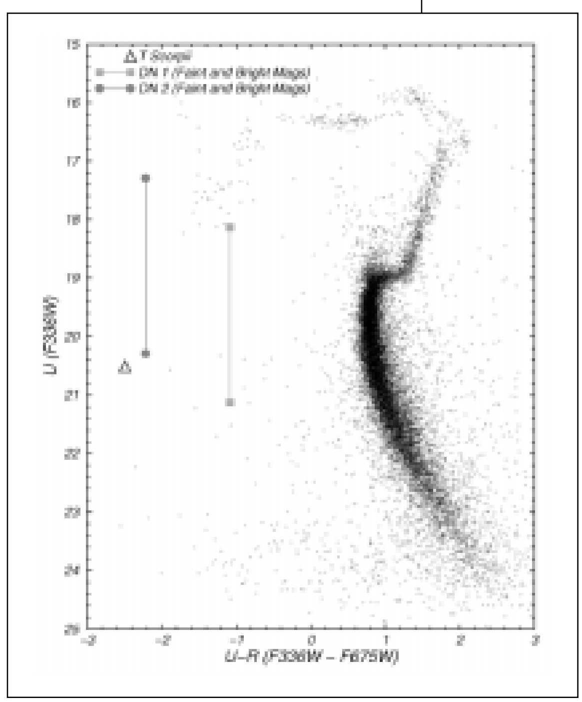


Figure 4: A U (F336W) - R (F675W) color-magnitude diagram. T Scorpii is indicated by the triangle. The two dwarf novae are plotted with peak and quiescent magnitudes. Note the objects at about the same color and brightness as the dwarf novae.

Space Telescope Users Committee Report

George Miley, STUC Chair

Effectiveness of STUC

STUC met on June 10 and 11, 1999. Because four new members, including a chairperson, had been appointed to STUC since the last meeting, the functioning and effectiveness of STUC was discussed at length, together with Steve Beckwith, the STScI Director, and Dave Leckrone, the *HST* Project Scientist.

The purpose of STUC is to advise the STScI Director and the *HST* Project Scientist from the users' perspective on the normal operations of the observatory and to recommend changes and improvements to both instrumentation and procedures in order to maximize scientific productivity.

To carry out this task effectively, it was decided that STUC should concentrate on its core mission and in general avoid duplicating the detailed work and discussions of the many other committees which are involved either in an advisory or an oversight role in the *HST* project.

One of the most important areas in which STUC can contribute to the project during the next few years will be in evaluating the radical changes that will have to be made to the operation of the *HST* in order that NGST start-up can be funded from a constant budget. STUC will advise on prioritizing the difficult trade-offs that will arise. In view of the demise of the Science Working Group, it was felt that it would also be useful for STUC to consider scientific priorities in certain cases concerning instrument developments and for determining the instrumental modes that will continue to be supported on Hubble.

Several measures are being taken to improve the effectiveness of STUC.

1. Future meetings will focus on in-depth discussions of particular issues relevant to the core STUC mission.

2. Oral presentations of information about the project as a whole will be de-emphasized at meetings. Presentations will be directed towards seeking STUC advice and, if possible, pose questions for STUC to consider.

3. Sub-groups of STUC have been set up for the various relevant areas of interest. These sub-groups will (i) help define the inputs needed for STUC to consider these issues (ii) ensure that the most important aspects of an issue are discussed (iii) prepare first drafts of the written advice to be incorporated into the reports (iv) formulate advice on issues needing a quick response which may arise from time to time between normal STUC meetings (v) provide conduits through which users

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Portfolios of STUC Members

(I) INSTRUMENTAL ISSUES

(including supported observing modes, calibration outsourcing and specific data analysis)

ACS/WFPC2:
Debra Elmegreen
Chris Impey
Sergio Ortolani

COS/STIS:
Hal Weaver
Bruce Woodgate

NICMOS:
Pat McCarthy
Felix Mirabel
Dave Sanders

WFC3:
Bruce Balick
Jay Frogel
Susan Terebey

(II) OPERATIONAL ISSUES:

Proposal Handling and Scheduling:
Sergio Ortolani
Bruce Woodgate

Software Analysis Tools:
Bruce Balick
Susan Terebey

TAC:
Chris Impey
Dave Sanders

Targets of Opportunity:
Felix Mirabel
Hal Weaver

Planetary Issues:
Hal Weaver

Archive:
Chris Impy

GO Funding:
Bruce Balick
Debra Elmegreen
Jay Frogel

The Next Servicing Missions for *HST*: SM3a and SMOV3a

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HST's Third Servicing Mission (SM3), until recently scheduled for mid-2000,had originally been designed to provide for the upgrade of the observatory's scientific capabilities, the restoration of lost scientific capabilities, and the replacement or refurbishment of degraded spacecraft subsystems.

- The scientific upgrade was to result from the installation of the Advanced Camera for Surveys (ACS) in the axial position currently occupied by the Faint Object Camera (FOC), which would be removed and returned to Earth. Restoration of scientific capabilities was to be achieved by inclusion of the NICMOS Cooling System (NCS) which would, after the mission, allow the revival the NICMOS instrument.
- The Pointing Control System (PCS) would benefit from a refurbished Fine Guidance Sensor (FGS-2R) and a complete replacement of the current complement of gyroscopes used for spacecraft rate sensing.
- The Data Management System (DMS) was to be enhanced with the change-out of the DF-224 computer, used for spacecraft control, with a 486 replacement. Also, one of the original mechanical tape recorders, now outmoded by the great increase in telescope data volume, would be replaced by a second Solid State Recorder (SSR-3), whose 12 Gb capacity enables it to serve as a back-up to the previously-installed SSR-1.
- The Electrical Power System (EPS) would be upgraded by replacement of the current solar arrays with new, more efficient ones (SA III) which will serve to increase spacecraft power while reducing servicing risk and orbital drag. Additionally, control of spacecraft battery temperatures will be improved by the installation of the Voltage/ Temperature Improvement Kit (VIK).
- The Thermal Control System (TCS) would be greatly enhanced by the addition of an Aft Shroud Cooling System (ASCS) which will guarantee years of three-instrument parallel science through reduction of aft shroud instrument temperatures. In addition, telescope ambient temperatures would be reduced by the replacement of the degraded Multi-Layer Insulation (MLI) at several external points on the spacecraft.
- The Communications subsystem would be restored to its original capability by the replacement of the failed S-Band Single Access Transmitter (SSAT).

Obviously, this was to be an ambitious servicing mission requiring six full extra-vehicular activities (EVAs) to accomplish all the replacements and refurbishments. Plans however changed drastically on April 20, 1999, with the hard failure of gyro 3. With this failure, *HST* was reduced to three operating gyros (out of an original complement of six), the bare minimum for pointing control accurate enough for scientific operations. While the reason for this and the previous gyro failures was understood to be related to a particular lot and fabrication process, the remaining operational gyros were not subject to this flaw. Nonetheless, any additional gyro failures would mean the end of *HST* science until new gyros could be installed. For this reason, the *HST* Project requested and was granted a "contingency" mission, scheduled for October, 1999, for the primary purpose of replacing all six gyros. Once authorized, this new mission afforded the opportunity to off-load the heavily booked SM3 with, in addition to the gyros, any other replacements and refurbishments which would be ready by October.

As a result, the original SM3 is now divided into two missions; SM3A, scheduled for October 14, 1999, and SM3B, scheduled, as of this writing, for late 2000.

SM3A is scheduled to install of all six replacement gyros, the refurbished FGS-2R, the VIK, the 486 computer, SSA transmitter, and the SSR. In addition to these installations, the MLI repair is scheduled as a lower priority, as is the opening of the NICMOS valves to allow venting in preparation for the installation of the NCS in SM3B.

All other installations and refurbishments, including the science upgrades, i.e., ACS and NCS/NICMOS, are scheduled for SM3B. Also, SM3B will include an orbital reboost to restore some of *HST*'s orbital altitude.

SM3A will be performed in Shuttle Mission STS-103 (Shuttle flight #97) using the Shuttle Orbiter Discovery (flight #27). Launch is scheduled for 5:42 a.m., EDT October 14, 1999, with a launch window of 42 minutes, from Pad 39B at the Cape. The launch duration is a little less than 10 days, with landing scheduled for October 24, 3:20 a.m., also at the Cape. The mission commander is Curtis L. Brown. The other six crew members are Pilot Scott J. Kelly, and Mission Specialists Steven L. Smith, C. Michael Foale, John M. Grunsfeld, Claude Nicollier (Switzerland/ESA), Jean-Francois Clervoy (France/ESA). (More details on this and other missions can be found at: *http://www-pao.ksc.nasa.gov/kscpao/schedule/schedule.htm*)

On flight day 3, a little more than 48 hours after launch, the Shuttle will rendezvous with and capture *HST*. (The observatory will continue doing science observations up until just a few hours prior to this point.)

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SM3a and SMOV3a *from page 7*

Then, on flight day 4, approximately sixty-six hours into the mission, the first of four six-hour EVAs, one per day, will commence. This first EVA is scheduled to include installation of the replacement gyros, the VIK, and the opening of the NICMOS vent valves. The next day, the second EVA will see the installation of the 486 computer and the refurbished FGS-2R. EVA-3 will provide for the installation of the SSA Transmitter and the new SSR. It will also allow the first set of MLI upgrades on the external surfaces of bays 5-10. The fourth EVA will consist of a set of optional tasks, to be performed on a non-interference basis, that include more MLI replacement on the telescope's forward shell and light shield, and other lower priority activities such as installation of handrail covers and aft shroud latch replacement for +V2 doors.

Following the installation of the new devices, the astronauts and the ground operations personnel will conduct aliveness tests to confirm proper connector seating and basic aliveness, as well as functional tests to verify basic mission-critical functions.

HST is released from the Shuttle on flight day 8 and two days later the Shuttle returns to KSC. While SM3A consists of a substantial list of varied activities and installations, the minimum success criterion is the installation of four of six gyros. Replacement of all six gyros will constitute a fully successful mission.

At the point of release from the Shuttle early on October 21, the suite of activities and tests to recommission the observatory for normal operations begins. This suite of tests and the period in which they are performed are called the Servicing Mission Observatory Verification (SMOV).

In general, the goal of any SMOV plan associated with *HST* servicing consists of the timely recommissioning of the Observatory for science operations. In the case of SM3A, this goal takes the form of the commissioning of the FGS2r as a newly installed instrument, the recommissioning of the existing science instruments which, in this case, include the WFPC2, STIS, and FGS-1R (as the current astrometer). It also includes the recommissioning of any spacecraft subsystems affected by servicing. In this case, the goal includes commissioning of the new gyros into the PCS system, re-verification of the DMS with the new computer and SSR, and re-verification of the EPS following the VIK installations. The TCS and overall ambient temperatures will be monitored after the MLI upgrades. A major goal of any SMOV is the demonstration of any new or restored scientific capabilities of the observatory by means of a program of Early Release Observations (EROs). In this case, the ERO program will consist of a pair of WFPC2 observations designed to show that Observatory science is unaffected by the SM3A "contingency" mission.

For reasons due primarily to contamination concerns, e.g., outgassing of new devices, and residual substances left over from the servicing mission itself, these SMOV commissionings occur over a period of weeks, and in some cases, months. Meanwhile, various types of science operations can resume as each corresponding science capability gets recommissioned. The basic SMOV plan, as of this writing, is as follows: Release occurs early on October 21 with the V1 axis pointing into the southern Continuous Viewing Zone (CVZ) in order to avoid exposing the telescope optics to the sunlit portion of the Earth. This Bright Earth Avoidance (BEA) period lasts for 12 days, during which the PCS system is checked out and normal attitude control is initialized.

Also during the BEA period, the WFPC2 undergoes a decontamination process and an initial cool-down process accompanied by UV monitoring to verify the absence of any excess contamination effects. Meanwhile, STIS is undergoing its engineering initialization and check-out (including darks and biases). Shortly following the completion of the 12-day BEA period, the calibration of the new gyros is complete and the observatory is ready to perform the EROs and to resume science operations, using the WFPC2 and STIS CCD, in the first week of November. In parallel with these science observations, several other SMOV calibrations for WFPC2 and STIS will be performed. STIS MAMAs will be recommissioned for science in the mid-November timeframe. SMOV activities for commissioning the new FGS will take considerably longer to complete. The FGS2r will be commissioned for tracking guidestars in late December, while the last FGS SMOV activities will occur in February of next year.

By that time, detailed planning for SM3B and SMOV3B, currently scheduled for December 2000, will be well underway.

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can raise issues that might be relevant for STUC.

If there are matters which individual users feel may be of interest for attention by STUC, I ask them to contact a member of STUC who has responsibility for the relevant issue. The portfolios of STUC members are listed below. We would appreciate if users would contact STUC members about questions of general interest, but not about particular problems of individual users.

NGST Instrument Concept Studies

Knox S. Long (STScI) and Matt Greenhouse (NASA/GSFC)

For the past several years, the Ad-hoc Science Working Group (ASWG) for NGST has, with community input, been developing a design reference mission (DRM) describing what are today the highest priority science objectives for NGST: see *http://www.ngst.stsci.edu/DRM.html*. In addition, NASA, ESA, and the Canadian Space Agency (CSA) have funded a variety of studies intended to reveal instrument approaches that best enable these science objectives. The results of these studies will aid negotiation of a plan to allocate responsibility for providing specific scientific instruments among NASA, ESA, and CSA. The results will be evaluated as follows:

- Detailed concept study reports will be submitted to the NGST project during September. They will be evaluated for science capability by a science review panel consisting of the ASWG and for technical and cost feasibility by a separate technical panel. The charters for these review panels are available at *http://ngst.gsfc.nasa.gov/cgi-bin/pubdownload?Id=469*. A STScI-sponsored, near-infrared spectrograph study panel will provide additional findings to the ASWG; *http://www.ngst.stsci.edu/nir_spec_study99/nir_summary.html*.
- Prior to these panel reviews, a public presentation of these studies will made by the study PIs during Sept. 13-15th at the NGST Science and Technology Exposition: *http://ngst.gsfc.nasa.gov/science/meetings/WHannouncement.html* in Hyannis, MA. This symposium will provide a forum in which the review panels and the NGST Project can listen to public comment on the study results.
- The review panel findings will include recommended flight instrument suites for the NGST and will form the basis for a report issued by the NGST project scientist, John Mather, to NASA Headquarters. This report will be available for public comment and will also be the subject of an NGST special session at the January AAS meeting.
- This Project Scientist report will provide input to a subsequent negotiation led by NASA Headquarters for allocation of responsibility to provide flight instruments to NASA, ESA, and CSA through proposal solicitations to their respective science communities. Instruments allocated to NASA will be solicited from the US science community through a NASA announcement of opportunity (AO) during FY02.

NGST Design Work Begins

NASA's Goddard Space Flight Center recently awarded two $14 million contracts for Next Generation Space Telescope (NGST) phase 1 design and development work. On July 8, 1999 Goddard selected Lockheed Martin and the partnership of TRW/Ball Aerospace.

Phase 1 awardees are expected provide a detailed design concept as well as a technology development and infusion plan. The comprehensive technology plan must demonstrate that the technology needed for the proposed design (1) will work, and (2) can be built given NGST's strict cost constraints.

The plan also must describe the steps taken to reduce technical risk. The phase 1 contracts will last 26 months, with options for two consecutive 3-month extensions. A source evaluation board will begin the process of selecting a single design for NGST toward the end of the phase 1 performance period.

NGST, which will succeed the Hubble Space Telescope, may be launched as early as 2007.

The Space Telescope Science Institute played a key role in the early mission concept studies and was recently selected by NASA to manage the science and mission operations for NGST.

Multi-Mission Archive at the Space Telescope Science Institute (MAST) News

Paolo Padovani padovani@stcsi.edu

Hubble Data Archive Status

The Hubble Data Archive contains, as of July 1 1999, 6.6 Tbytes of data. The number of science datasets now totals about 189,000. Archive ingest has averaged 3.5 Gbytes/day in 1999. The aging optical Sony disk jukeboxes have required significant repair and maintenance during the months of May and June. Under these circumstances, data retrievals may take a little longer than usual or may require a second request. This will change with the migration of the entire archive to the new magneto-optical system, scheduled for next spring. In the meantime we are working hard with Sony and its vendors to provide more robust fixes to the hardware, and we have increased the priority of the migration project to minimize time spent in this less-than-optimal state.

PDF "Paper Products" on the Web

A new World Wide Web (WWW) interface allows users to search for, and display, the *HST* observation summaries now offered only in Portable Document Format (PDF). These documents, formerly available only in hardcopy form and referred to as the *HST* "paper products," provide a quick first look at the data, drawing on information in the data quality (PDQ) file. The WWW interface is available at http://archive.stsci.edu/hst/pdf_home.html. The page can be used to select search criteria to locate particular PDF files. The PDF documents are password-protected (unless the proposal is a calibration program) and users will need their archive name and password to access documents. This interface is not available to general archive users but only to PIs of *HST* programs. Note that, as of August 1, general production of paper products in hardcopy form has been terminated. These can still be provided if needed in special cases.

MAST ROSAT Interface

Many astronomers still think in terms of observing bands and consider themselves, for example, radio, optical, infrared, or X-ray astronomers. This "narrow-band" view will have soon to change given the many all-sky surveys at various wavelengths already available and the many more in progress. Multiwavelength astronomy allows researchers to take a global approach to astronomical problems, not to mention the huge increase in the selection efficiency of samples for specific classes. As a first step towards a retrieval interface that crosses the boundaries between two data centers, MAST is proud to announce its new ROSAT interface. Available at *http://archive.stsci.edu/rosat/*, this interface provides access to the ROSAT Master observations log (ROSMASTER) at the High Energy Astrophysics Science Archive Research Center (HEASARC) as a service to our optical/UV community. The MAST ROSAT interface is in fact very similar to the other MAST interfaces, so MAST users should find it easier to access the ROSAT archive through this channel. ROSAT, the Roentgen Satellite, was an X-ray observatory developed through a cooperative program between Germany, the United States, and the United Kingdom. The satellite was designed and operated by Germany and was launched by the United States on June 1, 1990. It was turned off on February 12, 1999. ROSAT data cover the 0.1 to 2.4 keV range (or 5 to 124 Angstroms). The ROSAT Master observations log can be searched on a variety of parameters, ranging from position and object name to exposure time and PI name. Selected data can then be retrieved. Various data products are available, such as abstracts, FITS files (which allow one to extract images, light curves, and spectra), calibration files, and images in GIF format in different bands. The page provides links to various HEASARC WWW pages which give information about the ROSAT mission, data analysis documentation and software, and the ROSAT archive.

MAST to Archive FUSE Data

We are happy to announce a new addition to the missions archived at MAST: the Far Ultraviolet Spectroscopic Explorer (FUSE). FUSE, a NASA-supported mission, was successfully launched on June 24, 1999, to explore the Universe using the technique of high-resolution spectroscopy in the far-ultraviolet spectral region. The Johns Hopkins University has the lead role in developing and operating the mission, in collaboration with the University of Colorado at Boulder, the University of California at Berkeley, the Canadian Space Agency (CSA), and the French Space Agency (CNES). FUSE is part of NASA's Origins Program under the auspices of NASA's Office of Space Science. FUSE will cover the 905 to 1195 Angstrom spectral region and obtain pointed observations of hot and cool stars, solar system objects, active galactic nuclei, supernova remnants, and planetary nebulae. MAST will be the FUSE archive site, providing access to both proprietary and public FUSE data. The MAST FUSE interface can be accessed at *http://archive.stsci.edu/fuse/*.

Archive Manual

A new and revised version of the Archive Manual (version 7.0) is available. It provides the information a user needs to access the STScI archive via its two user interfaces: StarView and the WWW interface. A completely new chapter describes the WWW interface and briefly the various MAST datasets. The description of the StarView screens is now up-to-date and On-The-Fly Calibration (OTFC; see below) screens are also discussed. The manual is available on the WWW

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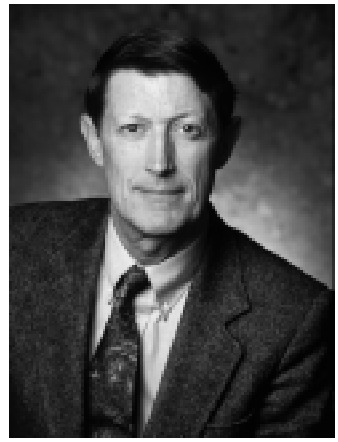
NASA Distinguished Public Service Medal to Bob Williams

NASA recently awarded their Distinguished Public Service Medal, NASA's highest award to a civilian, to Dr. Robert Williams of STScI for his efforts as Director and for his leadership of the Hubble Deep Field observations. The following is taken from the citation:

This award is in recognition of extraordinary scientific leadership on the *HST* Program and outstanding contributions to astronomical science. Dr. Robert Williams served from 1993 to 1998 as the Director of the Space Telescope Science Institute (STScI), which has principal responsibility for the science operations and for the conduct of the science program of *HST*. STScI is widely viewed as a major national scientific institution and one of the most successful organizations of any kind affiliated with NASA. Dr. Williams played a major role in establishing and solidifying its eminence. During his tenure, Dr. Williams accomplished the remarkable management feat of presiding over a reduction in the budget and size of the STScI while at the same time dramatically improving the efficiency and productivity of *HST*'s science program. Moreover, he converted STScI into a truly "user friendly" organization, accomplishing major simplifications of the systems through which individual astronomers use *HST* to acquire cutting-edge astronomical observations, and substantially improving the Institute's personal responsiveness to its users. At the same time, Dr. Williams conceived and led one of the most important scientific initiatives to be undertaken with the *HST* — the Hubble Deep Field (HDF). Using Director's Discretionary observing time, and broadly involving the scientific community, Dr. Williams and his team acquired the deepest image of the Universe ever obtained at optical wavelengths. These observations (which were immediately released as public, non-proprietary data available to all) provided an entirely new and unexpected picture of the deep Universe. They have pro-foundly affected modern studies of the large-scale structure of the Universe and the evolution of galaxies. These observations also caught the interest of the general public and increased their awareness in NASA and science. Dr. Williams' contributions to the *HST* Program, to NASA and to astronomical science are of the highest order and fully merit the award of the Distinguished Public Service medal.



Bob Williams

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at *http://archive.stsci.edu/hst/documentation.html*. A choice of on-line (HTML), PDF, or Postscript is offered. The PDF version includes active hyper-links and should be preferred over the on-line version, as some chapters might take some time to load.

On-The-Fly Calibration

In the June 1999 issue of the STScI Newsletter, Steve Lubow described the On-The-Fly Calibration (OTFC) system which will allow users to recalibrate *HST* data on-the-fly using the most up-to-date calibration parameters, files, and software. The system is ready for internal use at STScI and should soon become available to the general public. Initially, only WFPC2 and STIS data will be processed in the OTFC pipeline. Eventually OTFC may be applied to NICMOS and future instruments data. OTFC is slated to be the only means of retrieving calibrated ACS (Advanced Camera for Surveys) data. OTFC requests can be made through a modified version of the <Retrieval Request - File Options> StarView screen or via the archive WWW interface, once OTFC is released externally. Also, dedicated StarView screens for each instrument can be used to extract more information about the recalibration. These screens are also useful for the user interested in following all the steps of the recalibration and in matching each step with its corresponding calibration file. The Instrument OTFC screens will be accessible from the <*HST* Instrument Searches> screen or the StarView [Searches] menu, but we note that the <Retrieval Request - File Options> screen should fulfill the needs of most users.

INSTRUMENT NEWS

Fine Guidance Sensors

Ed Nelan nelan@stsci.edu

After a two-year monitoring program, FGS1r has finally seen first light as a science instrument. Being used as an astrometer in Position Mode to measure the wobble of a star due to the tugs of its planetary companion (PI Forveille), FGS1r successfully acquired and accurately measured the relative positions of nearby reference stars as faint as 16th magnitude. But a more dramatic debut was its high-angular-resolution Transfer Mode observation of the young star system V853 Oph (PI Simon). From a lunar occultation observation, this 14th magnitude object had been known to be a triple system composed of a close pair with a separation of about 0.015" and a more distant 0.4" companion. However, observations with FGS3 failed to reliably resolve the close pair. But FGS1r's observation clearly detected all three stars and found the close pair to have a separation of about 0.020". Follow up observations of this interesting object will allow the PI to determine the orbits and fractional masses of the three young stars. These early successes show that the instrument is performing as expected and bode well for more challenging Cycle 8 FGS proposals.

In other FGS news, STScI is in the process of preparing the tests that will be used to commission the newest fine guidance sensor, FGS2r, to be installed in Hubble during the October 1999 servicing mission. Like FGS1r, it is equipped with the articulating mirror assembly, or AMA, which will allow ground controllers to precisely align the interferometer with the telescope's optical system. (Due to *HST*'s spherically aberrated primary mirror, near-perfect alignment is critical for an FGS's performance.) FGS2r, which was the original FGS1 removed from *HST* in the Second Servicing Mission, has also been refurbished with new servo shaft bearings to extend its mechanical life for the duration of the *HST* mission. In subsequent issues of this Newsletter we will follow the progress of the commissioning and operation of FGS2r.

Spectrographs Group

Gerard Kriss gak@stsci.edu

STIS continues to operate nominally. Of special note is the recent verification that spectral resolving powers as high as 180,000 to 225,000 are possible with STIS, as reported by IDT member Ed Jenkins at the Chicago AAS meeting. Observations of bright stars using the "Jenkins" slit (0.03"×0.05") and the highest resolution echelle mode, E140H, show that unsaturated absorption lines have full-width half-maxima of 2.0 to 2.5 high-resolution pixels. We note that special processing is required to fully realize such results, however. Data must be reprocessed in high-resolution mode by the user, and proper analysis requires careful treatment of the highly modulated odd-even pattern in the high-resolution MAMA flat field. (The default for the STIS pipeline is to first bin the MAMA pixels 2×2 into low-resolution mode. This mostly eliminates the odd-even modulation.) Routine procedures for analysis of high-resolution data will be developed over the next year.

As part of our continuing efforts to provide better user support, the new electronic version of the STIS Instrument Handbook, V3.0, is online in both PDF and HTML formats. Paper copies are available on request from *help@stsci.edu*, but we encourage use of the electronic formats as we ourselves find them more valuable in our own work. In this version we have incorporated extensive hyperlinking to other documents and internally within the handbook so that the reader can find detailed information more easily and quickly. You should also find that the index is greatly improved, and electronically linked as well.

Many users are aware that echelle-mode observations with STIS are frequently affected by scattered light that is inadequately corrected by STIS calibration pipeline software. Charles Bowers and Donald Lindler of the STIS IDT have developed a software tool that robustly removes the scattered light. This IDL tool is currently not suitable for use by the general user community, but the IDT is working with us to generate code and reference files that would make the echelle scattering tool compatible with the the STIS calibration pipeline software and available as a user-supported task in STSDAS. We anticipate having a scattering correction task ready for release approximately in January 2000.

Further work on the FOS wavelength calibration by the Space Telescope European Coordinating Facility shows that recalibration of the wavelengths in FOS

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spectra should provide an accuracy of 1 pixel (1 quarter-diode). Much of the scatter observed previously that had been attributed to filter grating wheel non-repeatability is actually due to an incorrect implementation in the flight software used to correct the geomagnetically induced image motion problem (GIMP). The ECF is currently developing a software tool that will back out the in-orbit GIMP correction, re-do it correctly, and generate the correct wavelength vector. Re-delivery of re-calibrated data to the archive has been delayed from this fall into the next year, but ECF anticipates being able to distribute the wavelength correction tool sometime this fall.

Wide Field Planetary Camera 2

John Biretta, STScI biretta@stsci.edu

Cycle 8 observations are now well underway, and programs remaining from previous cycles are quickly being completed. WFPC2 imaging currently makes up about 50% of the *HST* observation program. The instrument continues to perform well. A few observers have begun to notice very faint vertical trails on brighter stars and cosmic rays in short exposure images; these are merely a manifestation of the slowly increasing CTE effect (see related items below).

A new update to the WFPC2 Instrument Handbook was recently released for Cycle 9; it replaces the previous update and is intended to be read with v. 4.0 of the Handbook (June 1996). The update focuses primarily on the photometric performance, including the excellent long-term photometric stability, and the Charge Transfer Efficiency (CTE) and long vs. short exposure effects. It also includes updates on the PSF properties, the known variations in aperture corrections vs. focus and field position, and on the dark current, which has increased significantly since WFPC2's installation. It also summarizes the latest improvements in the Drizzle software package which is used to reconstruct dithered images. Details of the Cycle 7 and 8 calibration plans are also given. The Update, in various formats, is available on the WFPC2 WWW site.

The Cycle 8 calibration program is underway. As in the past, part of the program consists of routine monitors and decontamination (decon) procedures. The decons will continue to be performed on a monthly basis, to remove the UV contaminants and anneal hot pixels. The monitoring programs will be used to track the health and performance of the cameras via internal exposures (biases, darks, flats, kspots), Earth flats, and external exposures. We point out two papers which will appear in PASP on WFPC2 calibration; both describe corrections for various low-level photometric effects. Whitmore, Heyer, and Casertano have written a paper summarizing the evolution of the Charge Transfer Efficiency effect in the WFPC2 CCDs. The CTE effect causes targets farthest from the CCD readout register (large Y pixel values) to have slightly lower counts relative to those near the readout register. Their paper includes corrections which can be applied to stellar photometry. (Details of the CTE effect have been described in previous Newsletters.) Anderson and King have written a paper describing corrections for the 34th row effect, which results from a manufacturing error in the CCDs which caused pixels in every 34th row to be a few percent too small. This induces systematic errors in photometry at the 0.01-0.02 mag level for about 6% of all stars, as well as periodic errors in astrometry for all stars with a maximum amplitude of 0.03 pixel. Both papers are available on the WFPC2 WWW site.

In an effort to save resources, the archive branch is discontinuing mailing of image hard copies to observers. These so-called "paper products" are now available, instead, as electronic Adobe Portable Document format (PDF) files on the STScI Archive WWW site. The content of the files is identical to the previous paper products, and they can be displayed using the Adobe Acrobat Reader.. The WWW interface offers several search options for the PDF files, including proposal number, PI name, target name, data set name and observation date. The files are password protected (unless the proposal is a calibration program) and users will need their archive name and password to access them.

The various documents mentioned above are available at the WFPC2 WWW site at: *http://www.stsci.edu/ftp/instrument_news/WFPC2/wfpc2_top.html*

INSTRUMENT NEWS

Hashima Hasan Goes to NASA Headquarters

After fourteen years at STScI, Associate Scientist Hashima Hasan is leaving the Institute to take up a full time civil service position as Discipline Scientist for Ultraviolet, Visible, and Gravitational Astrophysics at NASA Headquarters in Washington D.C. She was earlier in that position for four and one-half years, from 1994 to 1998, part of that time on leave from STScI and part on assignment under the Intergovernmental Personnel Act.

Hashima Hasan

Hashima's path to astronomy and the Institute has not been a simple one. She was born in 1950 in Lucknow, India, about 300 miles southeast of New Delhi. Lucknow is the capital of Uttar Pradesh, the most populous state of India. She grew up there, attending a school run by Catholic nuns at a convent, in part because Indian schools were just getting established in the years after independence. Her family was Muslim, a small minority in India. This school was taught entirely by women, and it was very difficult to find science teachers in those years. One of the nuns taught biology, but finding qualified teachers for physical sciences was especially difficult. Nevertheless, Hashima was in the first class in her high school to get a science-oriented education. In addition to her own abilities, she was supported in this by her family. Her father had a master's degree in physics, although he became a civil service administrator, a position that required frequent relocations. As a result Hashima stayed in Lucknow with her mother and grandparents. Her mother's uncle was a chemist with a degree from Oxford, and he strongly influenced her mother, which was reflected in her. Her interest in nature and science dates from childhood, although restrictions as an adolescent kept her from going out at night to see the sky.

On leaving high school, Hashima took an examination administered by Cambridge University, and she placed in the first (top) division. Staying in Uttar Pradesh, she had an intermediate education in science, followed by an intermediate examination, in which she also placed in the first division. She then went to Lucknow University, being one of eleven women in her class in physics, math, and chemistry. She completed her bachelor's in 1968, placing again in the first division. She went on to Aligarh University to complete a master's in theoretical nuclear physics in 1970 with an Atomic Energy Scholarship from the government.

She stayed at Aligarh to start a graduate research program in nuclear physics but had an opportunity to go to Oxford on a Commonwealth Fellowship in 1973. She completed her D.Phil. in theoretical nuclear physics in 1976. She returned to India as a post-doc at the Tata Institute of Fundamental Research for two years, then took a lectureship in the Physics Department at Poona University, in 1978, where she taught graduate courses for one year.

At this point her life grew much more complex. She was married in 1979 to an Indian who was a research biochemist in the US, and so she moved with him to North Carolina, but, with a dependent visa, could not get a paying job. She arranged a non-paying collaboration with physicists at Duke University on electron scattering experiments, as they needed a theoretician to help interpret their data. They helped her get a student visa so she could at least get paid in part for her work. Once her husband got work permits, she was able to apply to the Environmental Protection Agency to pursue a project on air pollution in Denver.

In 1982 she bore her first child, a son. The next year her husband got a job in Bombay, so they returned to India and she returned to Poona University, from which she had been on indefinite leave. Working apart from each other just didn't work out, and so she obtained a fellowship to support scientists returning from overseas and went to the Bhabha Atomic Research Center in Bombay. A second son was born in 1984, and she and her husband decided to return to the US. Her husband had a job at the JHU Medical Institutions in Baltimore. and so she looked in this area for a job for herself. JHU's Physics Department had just become Physics and Astronomy, and Hashima contacted Colin Norman, whom she knew from Oxford days. He suggested she apply to STScI; this was 1985. Her first work here was with Chris Burrows on the optical modeling software known as TIM. She was gradually able to work in time to do research and was given a position on the parallel track in 1988. She has studied the dynamics of barred galaxies, and most recently secondary bars, partly in collaboration with Colin Norman.

As the above description shows, Hashima has not had much time for outside activities, but she is fond of reading mysteries (as well as astronomy).

Hubble Fellowship Competition for Year 2000

Howard Bond bond@stsci.edu

STScI announces the continuation of the Hubble Postdoctoral Fellowship Program, in co-operation with astronomical institutions throughout the United States. The Program provides opportunities for postdoctoral research on problems that are broadly related to the scientific mission of the Hubble Space Telescope, and compatible with the interests of the Host Institutions. Both observational and theoretical research can be supported. The program is open to applicants of any nationality, who have earned (or will have earned) their doctoral degrees after January 1, 1997, in astronomy, physics, or related disciplines. The Fellowships are tenable at U.S. institutions where *HST*-related research can be carried out. The duration of the Fellowships is up to three years, including an initial appointment of one year, and extensions contingent on annual performance reviews and availability of NASA funding. Subject to funding levels, up to about 10 new Hubble Fellows will be appointed this year, through grants to United States institutions. There will be a limitation on the number of new Fellows per Host Institution.

The Announcement of Opportunity, which includes program policies, application instructions, and forms, is available on the World Wide Web at *http://www.stsci.edu/stsci/hubblefellow.html*. All applicants must follow the detailed instructions given in the Announcement. Questions may be sent to *hfellows@stsci.edu*.

The application deadline is November 8, 1999. The new Hubble Fellow appointments are expected to begin on or about September 1, 2000. Women and members of minority groups are strongly encouraged to apply.

Calendar

Cycle 9

Phase I proposals due	September 10, 1999 (firm)
Proposers notified	December 1999 (tentative)
Phase II Proposals Due	February 2000 (tentative)
Routine Observing Begins	July 2000 (tentative)

Meetings and Symposia

Hubble Fellows Symposium	November 22-23, 1999 (firm)
HST Users Committee	November 4-5, 1999 (firm)

Servicing Mission 3

Launch of *HST* Servicing Mission 3A	October 14, 1999 (tentative)

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How to contact us:

First, we recommend trying our Web site: *http://www.stsci.edu* You will find there further information on many of the topics mentioned in this issue.

Second, if you need assistance on any matter send e-mail to *help@stsci.edu* or call 800-544-8125. International callers may use 1-410-338-1082.

Third, the following address is for the *HST* Data Archive:
archive@stsci.edu

Fourth, if you are a current *HST* user you may wish to address questions to your Program Coordinator or Contact Scientist; their names are given in the letter of notification you received from the Director, or they may be found on the Presto Web page *http://presto.stsci.edu/public/propinfo.html*.

Finally, you may wish to communicate with members of the Space Telescope Users Committee (STUC). They are:

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miley@strw.leidenuniv.nl

Bruce Balick, U. Washington
Debbie Elmegreen, Vassar College
Jay Frogel, Ohio State University
Chris Impey, U. Arizona
Pat McCarthy, O.C.I.W.
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Sergio Ortolani, Padova
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Bruce Woodgate, GSFC

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