



SPACE TELESCOPE SCIENCE INSTITUTE

# Newsletter

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## SMOV News

### Servicing Mission Orbital Verification Progress

Carl Biagetti and Chris Blades, [biagetti@stsci.edu](mailto:biagetti@stsci.edu), [blades@stsci.edu](mailto:blades@stsci.edu)

NICMOS and STIS were both installed during the first extra-vehicular activity (EVA-1), on February 14, 1997. As each instrument was installed by the astronauts the ground system operators commanded them through their aliveness tests, to check basic power connections, and their functional tests, to check basic instrument operations. For each instrument, teams of engineers and scientists were on hand, both at the ST Operations Control Center at Goddard Space Flight Center, and at STScI to perform immediate analysis of data from both tests. Formal pass/fail criteria had been established for each instrument and would be used to

determine the success of the installation. In a matter of a few hours from start of the EVA, both instruments were declared successfully installed. On subsequent EVAs, installation and testing of the new Fine Guidance Sensor (FGS) and Solid State Recorder (SSR) met with similar success.

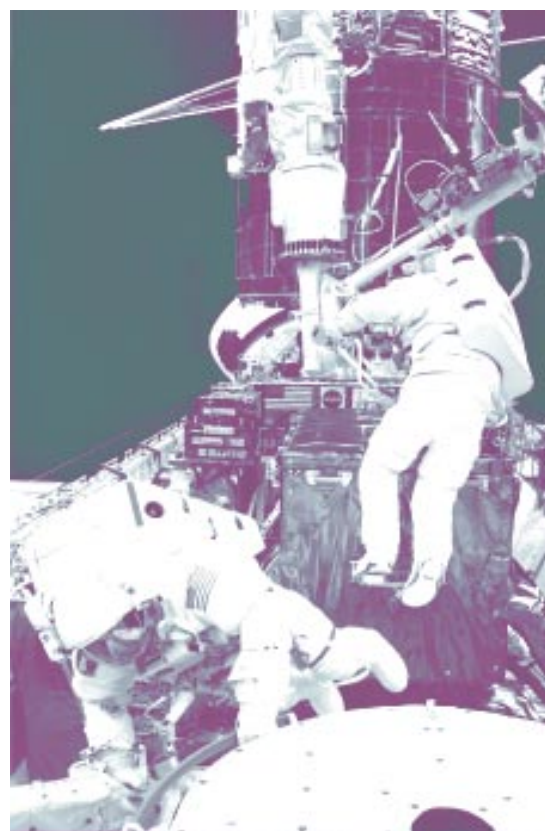
The release of the telescope from the Shuttle on Feb. 19 at 1:42 am EST marked the start of the Servicing Mission Orbital Verification (SMOV) period, during which a suite of tests for each instrument, scheduled over a 4-month period, is to be conducted with the goal of commissioning NICMOS and STIS for science operations and FGS1 for fine guidance.

We resumed science observations with WFPC2 early in SMOV, after a short recommissioning period. Of special note are images of Mars taken on March 10, 1997, with the recommissioned WFPC2. These images, taken just before Mars opposition, show the planet during transition between spring and summer in the Northern Hemisphere. These data are being used to support NASA spacecraft which are currently en route to Mars. The spectacular images have been released to the press and are seen on our home page.

On March 18, the telescope focus was adjusted by 2.5 microns in order to bring it into the normal focus range. Shortly, we expect to deploy the FOC

*continued page 3*

### STS-82 crew gets to work.



NASA Photo

*Payload Commander Mark Lee (foreground) and Steven Smith prepare the Shuttle's payload bay for their first day of Hubble servicing tasks.*

#### Editor's Note:

New information on STIS and NICMOS is coming in constantly during this period of Servicing Mission Orbital Verification (SMOV). This Newsletter is up-to-date as of April 1, but we recommend that you visit the STScI web site regularly to keep abreast of changes and new information:

- If you go to the home page (address below) you will find a link to Director's Message about NICMOS.

<http://www.stsci.edu/top.html>

- To find SMOV updates, click on "Observing with HST" then "HST Instrument Status Report."

For this issue I also asked Institute staff who went to Florida for the launch to provide some personal impressions.

# Director's Perspective

**Bob Williams**

The second servicing mission is now behind us, having been accomplished successfully, and two new instruments are installed in *HST*. STIS and NICMOS are currently undergoing testing and calibration, with initial observations to be made soon by both instruments. As outlined in another article in this issue, check-out of the many new components on the refurbished *HST* will be completed by late spring, after which the telescope will return to full-time scientific observations of Cycle 6.

The list of people who worked intensively for many months, and especially during the mission itself, to bring about the objectives of the mission is too long to enumerate here. I can attest to tremendous dedication on the part of many people associated with *HST*, and those of us who benefit from a productive telescope, which includes both professional astronomers and the public, owe them profound thanks.

By the time you read this, Cycle 6 GO observations will already have been resumed, most of which are imaging programs which had to be delayed while we attempted to complete the spectroscopic programs before both FOS and GHRS were removed from the telescope. Approximately one week of spectroscopic observations from Cycle 6 were not able to be completed before the servicing mission, primarily due to the two safemode events that occurred prior to launch, and these observations will now be carried out with STIS, where possible. We anticipate an exciting program of observations in Cycle 7, which should commence in early summer.

On a more personal note, my current term as Director has a bit more than one year remaining, and AURA recently began the process of undertaking a review of my performance as Director in order to determine its posture toward another term. I have therefore also taken this opportunity to conduct my own review of where I would like to be in the near future, and I realized that I was faced with two attractive alternatives. One was to continue on as Director of a scientifically active Institute that is immersed in fascinating *HST* data, but whose responsibilities preclude the research time that I would like to have. The other was to stand down as Director in order to provide for more personal research time and other activities. The fulfillment of being in the middle of *HST* science as Director has been such that the decision was not an easy one. But, the desire to spend more time on my own personal research is too strong for me to forestall it for five more years until after another term. At the end of this term I will have been an AURA center Director for 13 years, and it is the right time for me to pass the job on to someone else. This I will therefore do.

AURA has begun the process of conducting the search for the next Institute Director, and through the expiration of my term in August 1998 I look forward to continuing my present duties with vigor. At the same time, I anticipate my continued association with all of you, my colleagues associated with *HST* and Space Telescope Science Institute.

## IN MEMORY: Lyman Spitzer, Jr.

It saddens us to acknowledge the death of Lyman Spitzer on 31 March at his home in Princeton, NJ. He was active in research even on the day of his death, having spent that same afternoon working in his office. Lyman's influence on U.S. space astronomy and the entire *HST* project was monumental, and his persistent belief that orbiting telescopes held the key to important discoveries provided the basis for his lifelong advocacy of space observatories.

Lyman maintained a special involvement in the Institute that went far beyond his having served as Chair of Council (STIC) for a number of years. He took a personal interest in the professional development of many of the staff here, and he was unfailing in his support of the Institute's role in defining the science program of *HST*.

On a personal level, many of us had true admiration for Lyman's blend of intellectual creativity and humanity, a combination which struck us as an ideal balance for a scientist. Yet the enduring quality of the man that remains fixed in our minds when we think of our interactions is the strong sense of dignity that he always conveyed. We know of few people who maintained greater dignity in any situation. For us, Lyman's great legacy is his far-reaching vision of astrophysics and his effective example of quiet yet firm leadership.

## **Orbital Verification Process** from page 1

COSTAR mirrors as part of the full recommissioning of the FOC, and once we have checked this deployment we anticipate being able to turn on FOC science again. A recently-obtained measurement of a standard star using the FOC but without the COSTAR optics revealed a small loss (about 10%) in the sensitivity of the FOC over the last few years. This sensitivity change does not have a spectral component, and is interpreted as being caused by a loss in sensitivity of the detector in the f/96 chain. A re-optimization of this detector could provide the necessary correction.

As of this writing, the engineering activations for NICMOS and for the STIS CCD have been accomplished. We are now in the midst of a several-week iterative process of optical alignment and focus of each instrument, done in parallel with internal calibrations. The NICMOS alignment activities have indicated the development of an apparent thermal short which has caused an anomalous temperature profile, thermal expansion of the dewar, and, as a result, problems in focusing Camera 3. For details on this problem and its effect on NICMOS, see an accompanying article in this Newsletter by D. Calzetti and K. Noll.

Early in SMOV, we learned that some of the electronic circuitry in both NICMOS and STIS can be upset by particle radiation. The culprit has been identified as being a device called an opto-isolator, which is used to isolate inherently noisy circuits from those which must have low noise (e.g., detector operations and science data circuits). The basic approach that is being used to work around the susceptibility of the opto-isolators is to avoid NICMOS and STIS operations during SAA passage (we could not

observe during such passages, anyway). We shall place the instruments in a safe state during the high particle density passages. This approach is straightforward to implement and is being carried out now. For STIS, we wish to be very careful in our use of the ultraviolet detectors. High voltage is applied to those detectors and so we want to ensure that there are no upsets when observing with them.

Substantial progress has now been made in revising operational procedures. For NICMOS we are making a revision to the operations which will turn off the detectors during SAA passage. This work-around should be ready for installation by mid-April. Subsequently, we may be able to tune the SAA contour used for shutting off the detectors. A similar approach is planned for STIS, whereby we shall turn off the MAMA high-voltage during all orbits that encounter the SAA, but turn off the low-voltage only during actual SAA passages. This procedure, while safeguarding the MAMAs, will minimize both the temperature changes within STIS and the lifetime cycling. We now understand that considerable rework is required to ready STIS for these new operational procedures. A preliminary schedule has been developed which shows a ground-system test of the procedure in early April, followed by on-orbit testing two weeks later. This should allow the resumption of MAMA SMOV by the middle of May.

For the STIS CCD mode, three runs of the contamination monitoring program have been performed to date using a standard UV star. The analysis shows that the count rates have not changed since the previous week by more than 1% over the entire wavelength range of the CCD (2000 to 10000 Å). This is a reassuring result and implies that there are no detectable

contaminants inside the STIS instrument. Comparison-lamp exposures have now been taken through all the different CCD modes, and the resulting resolution maps agree exactly with values obtained from the ground. Unblended lines show FWHM values of 1.8 to 2.2 pixels.

Our SMOV commissioning of the STIS CCD has proceeded very well. The next activities in the coming two weeks include testing our ability to acquire targets in the narrow slits. Once we have demonstrated this we should be ready to start science with the STIS CCD.

The new FGS (FGS1R), installed during the servicing mission, has observed its first star and had been checked out successfully. Further optimization and alignment of the mirrors in FGS1R has been completed and the results are excellent. This new FGS is clearly and unambiguously the best FGS aboard HST. Results show that the FGS1R exhibits good S-curve morphology across most of the field, even without the aperture stop in the field, which is our normal operations for the other FGSs. Accordingly, we expect to see a 0.5 to 1.0 increase in the limiting magnitude when using FGS1R. Finally, following an analysis of the current FGS astrometer (FGS3) we were pleased to find that its performance was unaffected by any of the servicing mission activities.

## NICMOS

Daniela Calzetti and Keith Noll, calzetti@stsci.edu, noll@stsci.edu

NICMOS (the Near Infrared Camera and Multi-Object Spectrometer) was successfully installed on-board *HST* on February 14th, 1997. The aliveness and functionality tests, carried out while *HST* was still in the Shuttle, were passed without a hitch.

During the first five weeks of system monitoring and on-orbit verification (as part of SMOV), few tests were scheduled for NICMOS since thermal equilibrium for the instrument was expected to be reached during the second half of March. Therefore the engineering tests and the optical alignment tests represented the bulk of the SMOV activity for the February/March period, with most of the calibration tests clustered in April.

While on the ground, the NICMOS dewar and the detectors it encloses had been maintained a few degrees colder than the operational temperature, in order to limit the sublimation of the solid nitrogen and maintain the lifetime of the instrument (predicted to be about 4.5 years). At the same time, the filters housed in the vapor cooled shield, or VCS, were at a higher temperature than operational. During its first few weeks on orbit, the detectors in the NICMOS dewar had to passively warm up (while the VCS cooled down) to their equilibrium temperatures.

Several NICMOS engineering SMOV tests were successfully executed by mid-March. They included verification of filter wheel motion, electronic isolation of the filter wheel drive, and full functionality of the on-board computer memory.

The optical alignment activities for NICMOS were scheduled to run through the month of March, and were used to establish the best focus positions for each camera, to remove coma with tilts of the Pupil Adjust Mechanism (PAM), and to accurately determine the locations of the NICMOS apertures within the *HST* focal plane. The focus activities were divided into four parts: Pre-, Coarse, Intermediate, and Fine Optical

Alignment. Aperture positions, rotations, and pixel scales were found to be close to predicted values. Early (pre-optimal) results indicated good image quality.

In the first few days of NICMOS operations sporadic shut-offs of the detectors during passages through the most intense parts of the South Atlantic Anomaly (SAA) were reported. A further description of this problem and the solution implemented by NICMOS can be found in C. Biagetti's article on SMOV in this Newsletter. We note here that the new instrument configuration devised for use during SAA passage deals fully with the spurious resets, has no loss of efficiency or data, and is completely transparent to users.

At the beginning of March it was noticed that the VCS was cooling at a faster rate than expected. Comparison of the Pre-Alignment and Coarse Alignment optical data revealed that the expansion of the warming inner dewar had been larger than expected and it had come in thermal contact with the VCS (the next layer out in the dewar), through baffles located on the filter wheel assembly. The contact had produced a 'thermal short,' with the VCS acting as a heat source, warming up the inner dewar and causing further expansion, while itself being cooled rapidly by the consequent heat loss inwards. Data from the Intermediate Alignment Test (the last executed at the time of this writing) show that the movement of the inner dewar towards the filter wheel assembly has slowed greatly.

It is hoped that a new equilibrium situation will soon be reached, and, subsequent to that, the continuing (expected) loss of cryogenics will relax the internal stresses and the inner dewar will shrink back away from the VCS, thereby quenching the additional parasitic heat input that currently exists. The *HST* Project has appointed an expert team to investigate the behavior of the dewar and to assess the likely consequences.

There are two potential science impacts. First, as a result of the spurious expansion the focus of camera NIC3 is now outside the range of the PAM. No such problem exists for NIC1 and NIC2, whose foci remain well within the PAM range, although now at different focus settings than expected. Although future dewar relaxation may help reduce the defocus, we cannot predict when this might occur.

The second major effect is a reduction of the lifetime of the instrument. The 'thermal short' is causing nitrogen to be evaporated at a faster rate than under normal conditions. Presently (March 22nd, 1997) it is too early for a precise assessment of the impact of the 'thermal short' on the total lifetime. It depends on a number of factors, primarily whether or not the thermal short will persist as the cryogen is removed. If it does persist and we continue to lose nitrogen at the present rapid rate, the NICMOS lifetime would be somewhat in excess of two years. If the short is broken, it will be longer and could be closer to the approximately four-year lifetime originally envisaged. The *HST* Project is considering operational adjustments to achieve NICMOS science objectives within the potentially shortened lifetime.

Late in March we obtained our first estimates of the NICMOS thermal background, the emission which is intrinsic to *HST*. While the results have not yet been quantified accurately, it is clear that the good news is the thermal emissivities of the *HST* mirrors are significantly lower than the 20% assumed. This should lead to a significant gain in the quality of science at the longer wavelengths accessed by NICMOS.

Despite the concern over the thermal short, the NICMOS SMOV program remains on schedule. The optical alignment activities show that high quality images will be achieved in Cameras 1 and 2, and may be achievable in the future in Camera 3.

## Space Telescope Imaging Spectrograph

Ron Downes and Stefi Baum, [downes@stsci.edu](mailto:downes@stsci.edu), [sbaum@stsci.edu](mailto:sbaum@stsci.edu)

STIS, the Space Telescope Imaging Spectrograph, was installed on *HST* during the February 1997 Servicing Mission. Almost immediately upon the release of *HST* from the shuttle, STIS entered into Servicing Mission Orbital Verification (SMOV). SMOV will continue over the next few months until the start of Cycle 7 science. SMOV consists of a time-sequenced series of tests designed to assure functionality, test operations, refine alignments, perform adjustments, and complete the basic calibration of the instrument needed to initiate science. Early SMOV activities for STIS have been proceeding very well. Basic operations of the CCD, lamps, and mechanisms have all been checked out. The corrector has been used to perform an initial focus which already exceeds specifications, the performance of the CCD has been verified to meet or exceed specifications, early calibration spectra have been taken confirming the basic sensitivity and spectral resolution of STIS, and we have just completed a very successful first check out of target acquisitions.

During the early commissioning activities in SMOV, an electrical component (an opto-isolator) associated with the control electronics for the STIS MAMA detectors was found to be susceptible to upsets induced by high energy particles during passage through the South Atlantic Anomaly (SAA). Engineering teams have worked rapidly to characterize the nature of the upsets and provide needed changes to our operating procedures and enhancements to the STIS Flight Software. To be on the safe side, first turn-on of the high voltage on the MAMA detectors will be delayed until the solutions have been fully implemented in the flight- and ground support software. The current expectation is that this will delay the initiation of the MAMA SMOV activities by one to two months. Essentially no impact is anticipated to the science that can be done with the STIS MAMAs, and the

Phase 2 deadlines for STIS observers remain unchanged.

For the most complete and up-to-date information on STIS, please see our web page:

[http://www.stsci.edu/ftp/instrument\\_news/STIS/topstis.html](http://www.stsci.edu/ftp/instrument_news/STIS/topstis.html)

Information recently added on the page includes the SMOV calibration plan, the monthly Space Telescope Analysis Newsletter (STAN), and the STIS filter throughputs. Weekly instrument status reports are also available at:

<http://www.stsci.edu/observing/observing.html>

To support the submission of Phase II programs, we have updated our Frequently Asked Questions (FAQ) to have an area specifically for Phase II submission questions, and provided step-by-step instructions for filling out a STIS Phase II template for RPS2. We have posted the STIS Phase II Proposal Instructions and proposal examples, the STIS Phase II updates for the CCD

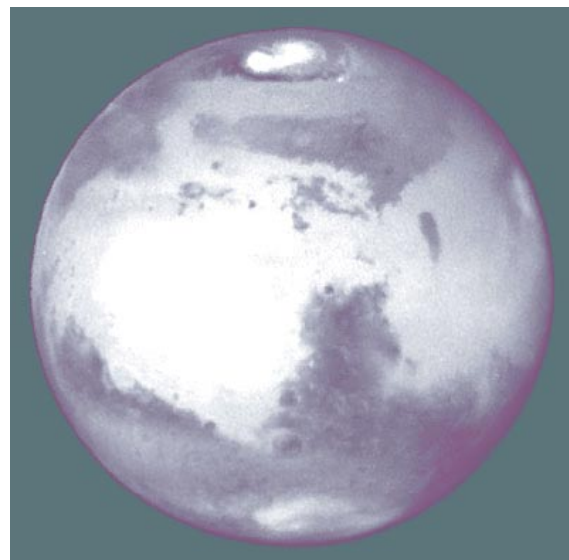
and MAMA, and several new Instrument Science Reports, including a User's Guide to Target Acquisition (ISR 97-03).

To support STIS users, we had previously (to support the Phase I submission) developed a spectroscopic Exposure Time Calculator (ETC). A new version of this ETC is available, which now allows for the specification of binning, has a larger library of input energy distributions, and has a facility for redshifting quasar spectra. We have also corrected a number of minor bugs, and have updated the instrument characteristics when appropriate. A new imaging version of the ETC is now available, which observers can use to determine exposure times for both imaging (science) exposures, as well as target acquisition exposure times. We have also developed a Target Acquisition Simulator, which observers can use in developing their diffuse source acquisitions, as well as for post-observation analysis of their target acquisition.

### ***HST Recent Release: Mars***

*The sharpest view of Mars ever taken from Earth was obtained by the recently refurbished Hubble Space Telescope. This stunning portrait was taken with the Wide Field Planetary Camera-2 (WFPC2) on March 10, 1997, just before Mars opposition, when the red planet made one of its closest passes to the Earth (100 million km).*

*Credit: David Crisp and the WFPC2 Science Team, JPL/Caltech*



## HST Programs and Observations

### Current Program Status from Presto

Anuradha Koratkar, koratkar@stsci.edu

After the successful completion of the second servicing mission, the Servicing Mission Orbital Verification (SMOV) program started on February 20 and is expected to last until mid-June 1997. A more detailed status of SMOV can be found elsewhere in this newsletter.

Our efforts are also focused on resuming Cycle 6 observing programs, which will be executed as WFPC2, FOC and FGS are recommissioned during SMOV. WFPC2 and FGS have already resumed their Cycle 6 observing, and FOC is expected to start Cycle 6 observing in early April.

While a vast majority of FOS and GHRS programs were completed before the second servicing mission, we were unable to complete some of them due to *HST* safemode events towards the end of 1996. These incomplete programs will be resubmitted using the STIS, for execution in Cycle 7. A full audit is underway and the affected principal investigators (PIs) will be notified of the number of orbits available for use on STIS, the Phase II deadline and the Program Coordinator (PC)/Contact Scientist (CS) assignments in early April.

The formal Cycle 7 starts 1 July 1997, and is expected to last through October 1998. In order to provide more individual support to our users, we have adopted a system of staggered Phase II submission due dates. All Cycle 7 PIs have been informed about their Phase II deadlines which are:

FGS, FOC and WFPC2: February 21 and 28  
 NICMOS : March 7 and 14  
 STIS CCD : March 28  
 STIS MAMA: May 9, 16 and 23  
 The Cycle 7 budget deadline is the same as the Phase II submission deadline.

As in Cycle 6, each Cycle 7 program has a primary STScI support team consisting of a PC and CS who will be supporting the PI or any other designated contact throughout the cycle. The team will specifically be reviewing proposals within 6 to 8 weeks after the Phase II deadline for scheduling constraints, duplication and other instrument-specific technical issues. Once the Phase II proposal has passed this review it will be assigned a plan window in the long range plan (LRP). Especially for the new instruments we will be learning a lot during SMOV and initial calibrations, hence we recommend that the PI defer making changes to optimize their Phase II proposal until about 10 weeks before the first visit of the program. Changes affecting the LRP (e.g., orients, target changes etc.) should not be deferred, but must be completed before a valid plan window can be assigned to the program. By following this strategy we hope to reduce the effort that PIs have to put into continuously updating their programs when new information becomes available. Because we would like to generate a robust LRP and put in a concentrated effort to optimize a science program as late as possible, the Phase II submission deadlines are very critical, and PIs were informed to adhere to them.

The Cycle 6 Phase II user survey, conducted in March 1996, gave a clear mandate to increase the RPS2 processing speed. In response to this mandate we not only made improvements to the basic controller and code of RPS2, but we also decreased the run times associated with iterating specific visits. RPS2 can now be configured to process only visits that have changed since the last run. So if a user is working to optimize the "orbit packing" on one visit, then only that

visit will be reprocessed. To ease the process of developing Phase II programs, the graphical proposal development tool, PED, not only has improved editing features, but has the ability to provide valid selection menus based on earlier PED input. PED is very useful since it eliminates the possibility of typos and selection of inconsistent modes, elements and observation set-up parameters. We expect PED usage to be higher in Cycle 7 than Cycle 6 because of the large number of observing options available with both STIS and NICMOS. Presently, we have released version 7.0 for Cycle 7 FOC, FGS, NICMOS and WFPC2 GO usage and 7.0.1 for STIS CCD users. We will be releasing version 7.1 for STIS MAMA users on March 28, 1997.

Sample NICMOS visits have been generated for the various modes available for this instrument. These examples can be accessed via the NICMOS instrument page. More STIS examples are being developed and will also be available from the STIS instrument page.

We are looking forward to a new era of *HST* science and observing challenges that will be accompanied once all the instruments are commissioned during SMOV.



## Archive Branch News

Megan Donahue, [archive@stsci.edu](mailto:archive@stsci.edu)

### Archive Status: Up and Running!

The Hubble Data Archive now contains over 2.8 Terabytes of data. The data holdings are increasing at about 1 to 2 Gbytes per day. This rate is expected to increase dramatically with the new instruments. We handle 1600 to 1900 requests for a total of about 100 Gbytes of data per month. The median time data takes between request and staging for retrieval (therefore this statistic does not account for the time it takes to ftp over the Internet) is less than 45 minutes.

### Upgrade to StarView 5.0

With the new instruments and the accompanying new database structure, significant screen changes and additions had to be made to StarView. Therefore, old versions of StarView will no longer work. If you are a distributed StarView user, download the new StarView from the web page

[http://archive.stsci.edu/dist\\_starview.html](http://archive.stsci.edu/dist_starview.html).

Register as a distributed StarView user so we can keep you updated on new developments.

### Electronic Data Distribution Means No Tape!

We are offering an "electronic" option for data distribution in Cycle 7, meaning that Cycle 7 observers could retrieve their own data instead of receiving tape and paper products in the mail. (See previous Newsletter.) Both the RPS2 manual and RPS2 templates were clear on this option. However, a typographic error in one of the Data Distribution pull-down menus in RPS2/PED suggested that "Electronic" meant "Tape Only". We want to emphasize that the "Electronic" means "NO TAPE". If you selected "Electronic" but you want a tape, please contact your Program Coordinator as soon as possible.

If you selected the electronic-only option, you will receive email

notification when your proprietary data is available for retrieval from the archive. Be sure to register as an authorized user with the archive.

### Data rights during the post-servicing mission period

The Early Release Observation (ERO) data all have a shortened proprietary period of 90 days. The public distribution of any data, including the SMOV calibration data, will occur after the first press release for the relevant science instrument. These press releases are expected to occur during March for the WFPC2 and FOC, and during the month of May for the STIS and NIC instruments. This restriction also holds for GO science data taken before the press release. That data will be embargoed from even the GO until the press release. GO proprietary periods will be revised upwards to take into account the embargo period.

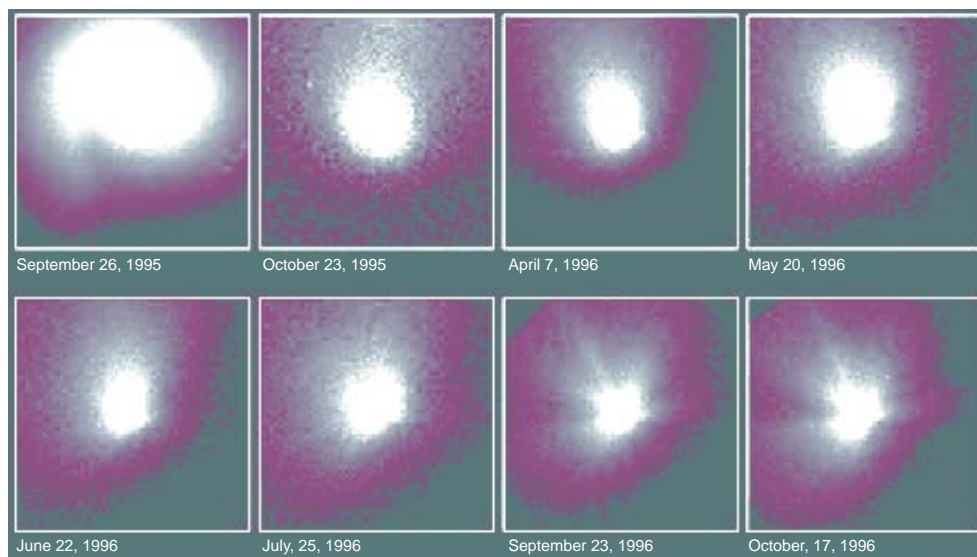
### HST Recent Release: Comet Hale-Bopp

A series of Hubble Space Telescope observations of the region around the nucleus of Hale-Bopp, taken on eight different dates since September 1995. The images chronicle changes in the evolution of the nucleus as it moves ever closer to, and is warmed by, the sun.

The first picture in the sequence shows a strong dust outburst on the comet that occurred when it was beyond the orbit of Jupiter. Fall 1996 images show multiple jets that are presumably connected to the activation of multiple vents on the surface of the nucleus.

The Wide Field and Planetary Camera 2 images were all processed at the same spatial scale of 470 kilometers per pixel, so the solid nucleus, no larger than 15 kilometers across, is far below Hubble's resolution.

Credit: Hal Weaver, JHU



## The Space Telescope Help Desk

K. Rudloff, [help@stsci.edu](mailto:help@stsci.edu)

### Overview of the Help Desk

STScI maintains a Help Desk as a service to the GO community. The Help Desk fields questions from observers on a wide variety of topics, including Phase I proposal preparation, the STSDAS software system, *HST* data reduction and analysis, and requests for technical documentation.

### When to Contact the Help Desk

As most observers are aware, all *HST* programs have been assigned Program Coordinators (PCs) and Contact Scientists (CSs) who serve as the primary contacts for each program. Questions regarding Phase II proposal preparation and scheduling of your observations can be directed to your PC or CS. Also, your CS will be your primary contact for any post-observation data analysis questions that you have. If your PC or CS is out of contact for any reason (you should receive an automatic reply to your email when this is the case), your questions can be sent to the Help Desk for quick response.

The Help Desk also fields any general questions you may have regarding *HST* data, STScI's documentation, and the installation or use of STSDAS.

If you are not sure where to send your question, you can send it to the Help Desk, which will properly direct your question.

### What Information to Send to the Help Desk

In order for us to answer your question quickly and efficiently, it will help us if your message includes some background information in addition to a detailed description of your question. For instance, inquiries about your *HST* program or questions of a general nature should include your proposal number and PI name (if relevant), and the instrument/mode you are working with. For STSDAS questions, relevant information to include in your message would be your hardware platform, operating system, your current version

of STSDAS, and details about error messages.

These examples show the type of basic information that can help us quickly diagnose the problem and identify the appropriate expert to handle the question.

### What to Expect When You Contact the Help Desk

The Help Desk incorporates the use of tracking software, which will send you an automatic reply as soon as your email is received. You will notice a "Call Number" (i.e.; CNSHD#####) in the subject line which is used for keeping track of your call from inception to closure, making sure that your question is not lost or forgotten along the way.

The Help Desk is staffed by well qualified Data Analysts from each of the instrument and software groups. The Help Desk personnel will read your message and, unless the question can be answered right away, forward it to the appropriate expert. The expert will then correspond with you directly until the question is resolved. We endeavor to answer all questions as quickly as possible, but if the question is involved it may take us several days to research the answer. If it will take us more than 2 working days to answer the question, we will notify you of our

progress to date and give you an estimate of when you can expect a definitive answer.

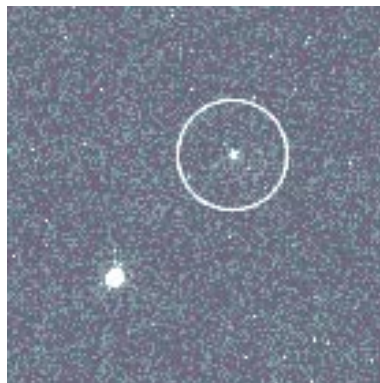
The Help Desk tracking software allows us to continually build a database of questions and answers so that answers to previously asked questions can be quickly found and relayed to the user. The database is also used to identify problems that users are encountering, which facilitates improvements and updates to current documentation. Lists of Frequently Asked Questions (FAQs) are created and regularly updated based on the questions that are received on the Help Desk. All documentation, including the FAQs, are made available to users via each instrument's WWW pages (accessible from the STScI WWW pages:

<http://www.stsci.edu>

This Help Desk system provides a mechanism for us to continually improve the quality of support that we provide to the user community.

### How to Contact the Help Desk

Email: [help@stsci.edu](mailto:help@stsci.edu) Phone (Mon - Fri, 8am to 5pm):  
1-800-544-8125 (inside the US)  
1-410-338-1082 (local or international callers)



### HST Recent Release: Gamma Ray Burst Source Imaged

On March 26, *HST* observed the optical counterpart of a Gamma Ray Burst, originally discovered by the Italian-Dutch BeppoSAX satellite. The remnant, imaged initially by ground-based observations but grown too faint to be resolved from the ground, dimmed from 21st to below 23rd magnitude in eight days. Hubble's observations clearly show that the visible GRB source has two components: a point-like object and an extended feature.

Credit: K. Sahu, STScI



## Instrument News

### Dithering in the Rain

Andy Fruchter and Richard Hook, [fruchter@stsci.edu](mailto:fruchter@stsci.edu), [hook@eso.org](mailto:hook@eso.org)

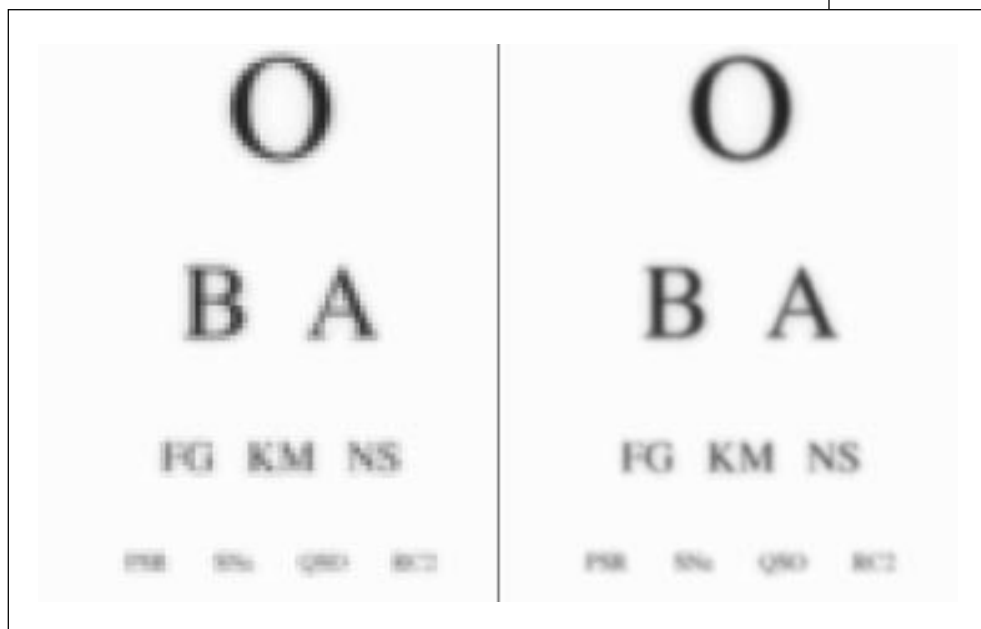
Although the optics of WFPC2 now provide a superb PSF, the detectors at the focal plane undersample the image. This problem is most severe on the three wide-field (WF) chips, where the width of a pixel equals the FWHM of the optics in the the near-infrared, and greatly exceeds it in the blue. While much high-spatial-frequency information in the image is permanently destroyed by smearing with the response of the “fat” pixels, the quality of the image can nevertheless be greatly improved by combining sub-pixel dithered images. In sub-pixel dithering, the pointing of the telescope is moved by small, non-integral pixel amounts between exposures. Each of the pixels from the different exposures can then be thought of as sampling a final, higher-resolution image, which is the “true image” of the sky convolved with the optical PSF and the pixel-response function of the CCD. If the dithers are particularly well-placed, one can simply interlace the pixels from the images on a finer grid, but in practice imperfect offsets, and the effect of the geometric distortion on offsets as small as one arcsecond, can make interlacing impossible.

A standard simple linear technique for combining shifted images, descriptively named “shift-and-add,” has been used for many years to combine dithered infrared data on a finer grid. However, shift-and-add convolves the image once again with the “fat” pixel, causing an additional loss of resolution, and producing highly correlated noise. In addition, shift-and-add does not naturally handle geometric distortion and is difficult to use in the presence of missing data (e.g., bad pixels and cosmic rays).

One can in principle use non-linear techniques, such Richardson-Lucy Bayesian image reconstruction, to combine dithered images. However, in

addition to being unable to handle the geometric distortion and the varying shape of the PSF across the WFPC field of view, the present implementation of this technique in STSDAS is limited by typical computing capabili-

technique - interlacing - to the old-standby, shift-and-add. The degree to which one must depart from interlacing and move towards shift-and-add is determined by the nature of the input data. Drizzling naturally handles both



*An Astronomical Eye Chart. On the left is simulation of effects of the WFPC2 optics and CCD sampling on an “Astronomical Eye Chart.” On the right is an image reconstructed by interlacing dithered simulated WFPC2 observations of the eye chart. This figure shows the substantial gain in image quality that can be obtained through the linear combination of dithered data.*

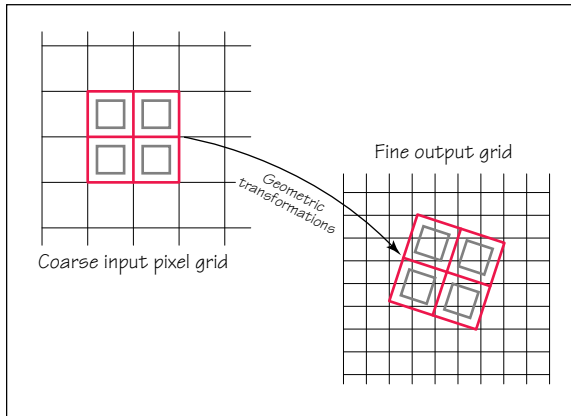
ties to combining either small regions of many images, or the entire image of only a few dithers. Most importantly this technique, like all non-linear techniques, directly exchanges signal-to-noise for image resolution, making it inappropriate for imaging faint sources.

For the reduction of the Hubble Deep Field, we developed a new linear technique known formally as “variable-pixel linear reconstruction” and informally as “Drizzling.” Drizzling can be thought of as a continuous set of linear functions that vary smoothly from the optimum linear combination

missing data and geometric distortion, and can largely remove the effect on photometry produced by the geometric distortion of the WFPC camera. Furthermore, when provided with input weighting images, Drizzle combines data in a statistically optimal fashion.

We have now improved the code used in the HDF, making it more versatile, user-friendly and far less CPU-intensive. Drizzle is also being incorporated into an STSDAS package known as “dither,” which is being developed by Ivo Busko and Andy

*continued page 10*



*The Drizzle Method. Drizzling combines images by reducing the size of the input pixel and then averaging the input pixel onto an output fine grid, using an input weight mask (not pictured). The original pixel size is shown in dark outline, the reduced pixel is the shaded square. When the input pixel is reduced to a point and the dithered positions are on a regular grid, the process is equivalent to interlacing. If no reduction is applied and the original pixel size is retained the method is equivalent to shift-and-add.*

### **Dithering** from page 9

Fruchter. The dither package will also have scripts that will aid the user in determining offsets between images. The dither package will be incorporated into the next release of STSDAS. However, individuals who wish to use Drizzle in the near future can directly retrieve the code from

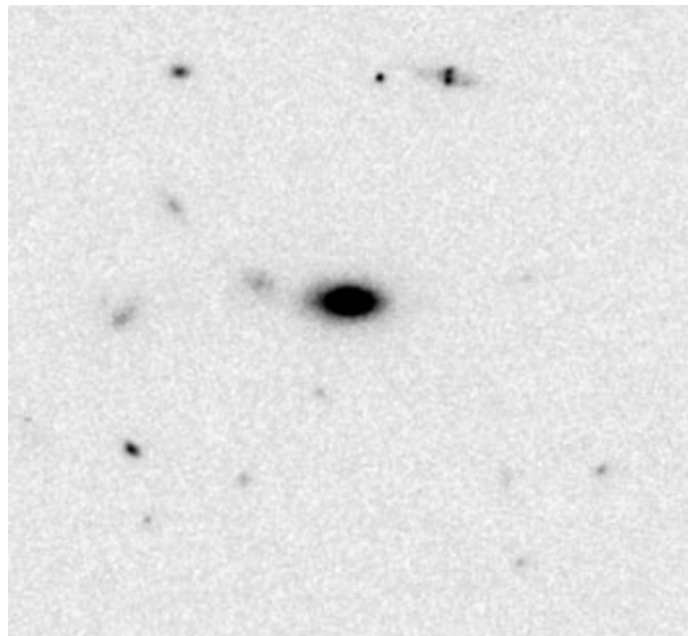
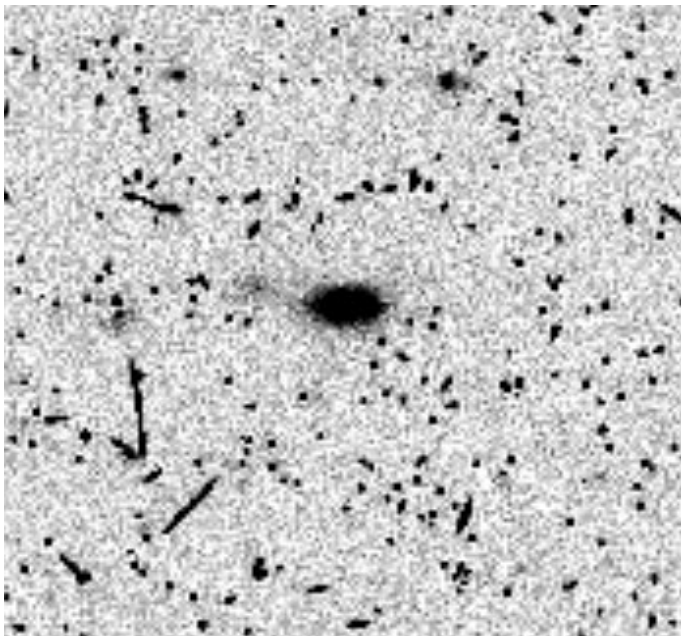
<http://www.stsci.edu/~fruchter/dither/dither.html>.

We are presently writing code that will allow Drizzle to be used to remove cosmic rays from dithered undersampled data in which no two exposures are taken at the same position. As shown in Figure 3, we have made great progress in this pursuit. The most basic aspects of this code are available on the Internet as part of the Drizzle release, but we expect a suit of scripts to aid users in the dynamic removal of cosmic rays to be added to STSDAS.

While Drizzle is a versatile and powerful program, it is not a panacea. It can introduce ~1% errors in photometry, and excess noise in the shape of the PSF, limiting its ability to be used with PSF-fitting software. Furthermore, we do not know whether dynamic cosmic ray removal will be able to achieve stellar photometric accuracy in typical data sets to better than a few percent. Nonetheless, we believe Drizzle is appropriate for use in a large fraction of dithered *HST* observations. Individuals interested in further information on Drizzle can read an on-line "poster paper" at:

[http://www.stsci.edu/~fruchter/dither\\_drizzle.html](http://www.stsci.edu/~fruchter/dither_drizzle.html)

A full description of the Dither algorithm will be submitted to the PASP in the near future.



*Dynamic Removal of Cosmic Rays. The image on the left is a section of a raw WF image of the field of SA22 taken as part of Len Cowie and collaborator's studies of high redshift galaxies. On the right is the result of combining twelve separately dithered images using Drizzle, and the code which we have developed for the removal of cosmic rays, which is known as Blot.*

## Close-Out for the First-Generation Spectrographs

Tony Keyes and David Soderblom, [keyes@stsci.edu](mailto:keyes@stsci.edu), [soderblom@stsci.edu](mailto:soderblom@stsci.edu)

*HST*'s first-generation spectrographs, the Faint Object Spectrograph and the Goddard High Resolution Spectrograph, were removed from the telescope during the recent servicing mission, replaced by the capabilities of STIS. Like similar missions in the past, the FOS and GHRS leave a rich archive of observations that can serve as a foundation for additional future research.

The current groups at STScI that support the FOS and GHRS will no longer exist after September 30, 1997. Help will continue to be provided to approved Archival Researchers (ARs) by Contact Scientists in the STIS Group, but past experience has shown that technical knowledge rapidly dissipates once people are reassigned.

This is only natural since their new work has their full attention.

We have the responsibility of providing documentation for the FOS and GHRS for future users of their data. Obviously this documentation needs to be as self-explanatory and self-supporting as possible if the archival data are to continue to have practical value. To realize that goal of completeness and self-sufficiency in the documentation, we are addressing the following needs between now and September:

- First, we are completing various "loose ends" of calibrations so that both spectrographs will be fully characterized. This work is nearly complete and is partly described in the reports for these instruments.
- Second, we have gone through the portions of the current Data Handbook that pertain to the FOS and GHRS and have identified those parts that need or can benefit from augmentation or rewriting. A new Data Handbook will result that will be for just the heritage instruments (HSP, WFPCI, FOS, and GHRS).
- Third, we are examining the ways in which documentation can be more useful to the user, particularly through on-line help.
- Fourth, we are now beginning the actual work of writing and rewriting the 1997 Data Handbook.

## Director's Discretionary Programs

This is an update to the list of approved programs presented in the previous Newsletter.

*The following programs were accepted as Director's Discretionary (DD) programs in 1996 as part of Cycle 6:*

| <i>PI</i>     | <i>Institution</i>             | <i>Title</i>  |
|---------------|--------------------------------|---|
| K. C. Sahu    | STScI                          | HST Observations of the Gamma-Ray Burster 970228              |
| A. Storrs     | STScI                          | Observations of Comet 1997 BA6                                |
| I. Shapiro    | Center for Astrophysics        | NASA/Stanford Gravity Probe B Experiment                      |
| S. Perlmutter | Lawrence Berkeley Lab.         | Deceleration Parameter from High-Redshift Type Ia Supernovae  |
| B. P. Schmidt | Mt. Stromlo and Siding Springs | Measuring $q_0$ with Type Ia Supernovae                       |
| M. M. Shara   | STScI                          | Spectrographic Observations of the Brightest Knot in GK Per   |
| I. Smail      | Univ. Durham                   | AC114 Central region Observations                             |
| S. A. Stern   | Southwest Research Inst.       | Pre-Perihelion Observations of Comet 46P/Wirtanen             |
| H. E. Bond    | STScI                          | Observations of Nova-Like Object in Sagittarius               |
| S. Rosen      | U. Leicester                   | The Accretion Region and Accretion Flow of QS Tel             |
| P. C. Frisch  | U. Chicago                     | GHRS Observations of Eta UMa                                  |
| G. D. Schmidt | U. Arizona                     | Scattered Emission from the Active Nucleus Buried in NGC 4258 |

*The following have been approved in 1997 as part of Cycle 7:*

|               |                      |   |
|---------------|----------------------|---|
| W. B. Sparks  | STScI                | Infrared Imaging of 3CR Radio Galaxies  |
| M. Giavalisco | Observatories of CIW | Observation of the Rest-Frame Optical Morphology                              |
| G. Gilmore    | U. Cambridge         | The Formation and Evolution of Rich Star Clusters in the LMC                  |
| K. C. Sahu    | STScI                | Determination of the Mass Function of a Globular Cluster through Microlensing |

# Instrument News

## Fine Guidance Sensors

Ed Nelan, nelan@stsci.edu

### FGS1R

During March, 1997, we completed an assessment of the new Fine Guidance Sensor (designated FGS1R), and made adjustments to its articulating fold-flat #3 (FF3) to optimize its performance. The S-curves, which are the interferometric signature of an object observed by the FGS, have been obtained at five points distributed azimuthally across the pickle's radial centerline, with four points off the radial centerline. These observations provide information on the field dependency of the S-curve characteristics, and ultimately on the ability of the FGS to acquire and track stars as a guider in the pointing control system (PCS), and as an astrometric science instrument as well.

One important result is that FGS1R should be able to operate as a guider using the F583W filter. No other FGS has been able to do this, and this means that it will be possible to use guide stars which are about one magnitude fainter than was previously possible.

Results also show that near-ideal  $x$ - and  $y$ -axis S-curves will be achieved at the pickle center. This will represent a significant improvement over the current HST astrometer (FGS3) for the detection and resolution of multi-component star systems with small angular separations. As the illustration shows, the much sharper  $x$ -axis S-curve of FGS1R is a dramatic improvement over that in FGS3. (Both FGS3 and FGS1R appear to have near-ideal  $y$ -axis S-curves.) Simulations suggest that FGS1R should be able to resolve binaries with stars only 10 milliarcsec apart even when the secondary is 3 magnitudes fainter than the primary. By comparison, FGS3 cannot resolve well below about 20 mas for much smaller magnitude differences. Also note that we expect FGS1R to detect, if not resolve, stars separated by as little as 5 mas when the magnitude difference is 2 or less.

Next month STScI will begin the commissioning of FGS1R as a guiding instrument and begin the detailed assessment of its performance as a science instrument.

### FGS3

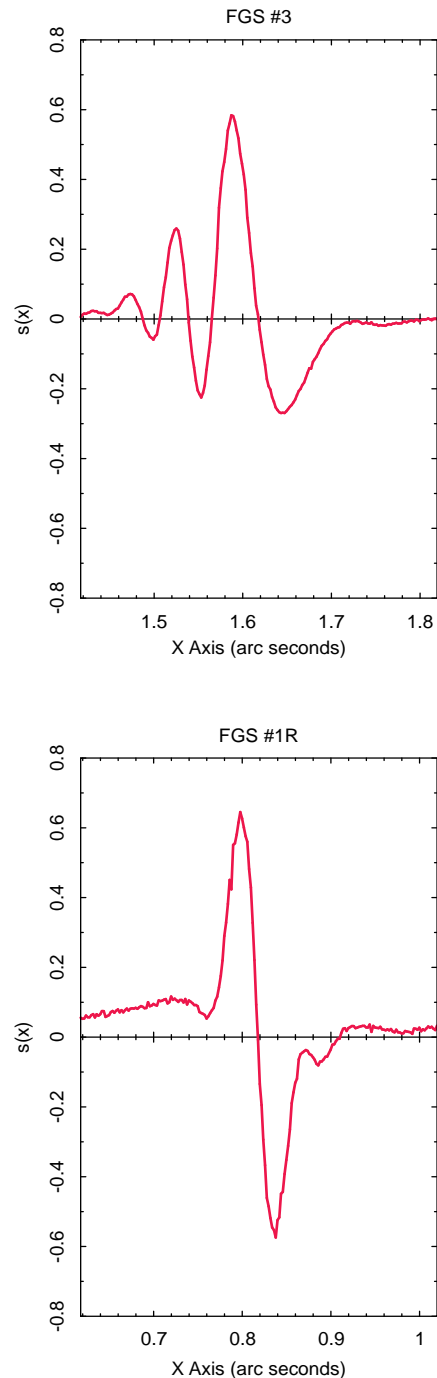
In March STScI resumed using FGS3 as a science instrument. The first assessment of its post-Servicing Mission performance was carried out by comparing the relative positions of stars in the

*continued page 13*

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For up-to-date information on HST's science instruments, check ST ScI's web pages. You may also wish to subscribe to one or more STANs (Space Telescope Analysis Newsletters). Subscriptions are done through a listserver, the instructions for which may be found on each instrument's web page.

### Comparison of FGS #3 and FGS #1R Single Star S-Curves



# Instrument News

## **FGS3** from page 12

pickle, measured during a routine execution of the ongoing monthly Long Term Stability (LTSTAB) test, to those measured by a pre-Servicing Mission LTSTAB. The measured positions of the stars from these two orbits (97\_031 and 97\_070) agreed to within 1 milliarcsec (rms) over the entire pickle, an excellent result. We conclude from this that the optical field angle distortion (OFAD) in FGS3 has not been measurably affected by the servicing mission, and therefore POSITION mode astrometry science programs using FGS3 can be safely resumed.

The TRANSFER mode standard star UPGREN69 will be observed in the first week of April. Comparison of those S-curves to pre-servicing mission measurements will demonstrate if the activities of the mission have brought about changes to the instrument which render the TRANSFER mode calibration library obsolete for post-SM observations. We anticipate that no change will be seen.

## **Faint Object Camera**

*Robert Jedrzejewski, rij@stsci.edu*

The Faint Object Camera has had a fairly quiet past few months, but the SMOV calibration activities are now complete and we can expect the camera to return to regular science operations by early April. For the Second Servicing Mission, the COSTAR FOC arms and the Deployable Optical Bench were retracted, to be re-deployed on February 22 (bench) and March 21 (arms). The intervening period allowed us to take some images of a spectrophotometric standard star without COSTAR in the beam, providing information about whether any degradation of the throughput over the years since the First Servicing Mission is arising in the COSTAR mirrors or the FOC.

Apart from reminding us of how bad the point-spread function appears without the COSTAR correction, the measurements were useful in that they revealed a small (~10%) drop in sensitivity of the FOC over its full wavelength range. Since COSTAR was not in the beam, and since WFPC2 has not seen a similar drop, we can rule out COSTAR and the OTA as the site of any throughput degradation. Our (infrequent) throughput monitoring program had revealed a similar drop in throughput over the past 12-18 months, but the small number of measurements had not established a high degree of significance before now.

We suspect that the apparent throughput drop has occurred in the intensifier stage, and it is possible that a small adjustment of the high voltage settings might restore the performance. A test is planned to evaluate the engineering performance of the FOC; meanwhile users should have no need to alter their observing programs since a 10% drop in efficiency does not have a significant impact on any science return.

After the COSTAR FOC arms were redeployed, they were aligned to optimize the image quality in the F/96 camera. After a small tilt (to remove residual coma) and focus adjustment to achieve confocality with WFPC2, the imaging performance of the FOC remains superb, with a Strehl ratio at 486nm, when considering low-order aberrations only, of 97%.

## **Faint Object Spectrograph**

*Tony Keyes, keyes@stsci.edu*

The FOS continued to perform very well until it was removed from HST on 14 February. FOS "last light" occurred at approximately 10:06 UT on 11 February (SM97 launch + ~6 hours). All FOS closeout calibration observations, including detailed "drift flat" observations and sensitivity monitors, were successfully completed prior to the servicing mission. Not all FOS science programs were completed prior to SM97.

Visits from approximately 22 FOS programs remained unexecuted at removal, and have been identified as candidates for carryover. PIs will be notified directly by STScI concerning the details for scheduling with the new SIs.

The STScI FOS support group has diminished in size due to the needs of STIS and NICMOS. Nonetheless, Contact Scientist assignments will not change. Effective 1 March 1997, the FOS Group consists of myself as Instrument Scientist and Ed Smith as Data Analyst. Our effort for the balance of FY97 is intended to provide the important information that users of FOS archive data will require in the future. These plans are discussed in more detail in an accompanying article in this Newsletter.

We are currently working on a final update to the FOS sensitivity calibration that will include post-COSTAR time-dependencies and the influence of new aperture-dependent flat fields for all supported modes at all epochs. As part of this effort, we have identified a modest color-dependent change in FOS/BL G130H sensitivity affecting most observations obtained after April, 1996. Please refer to the FOS WWW Advisory page for a complete description.

Additionally, we are working on

- Final polarimetry calibration summary including new post-COSTAR algorithms to be included in STSDAS/CALFOS.
- A guide to modeling of scattered light within the FOS as a function of object color.
- Precise re-definition of the FOS internal/external wavelength offsets.
- Observationally-determined LSFs.



# Instrument News

## Goddard High Resolution Spectrograph

David Soderblom, [soderblom@stsci.edu](mailto:soderblom@stsci.edu)

The GHRS performed at a high level in its last months on orbit, nearly completing all the observations assigned to it. Unfortunately, at 23:59 EST on February 5 the computer on *HST* shut the GHRS down because it was drawing too much current. An intensive analysis of the engineering data took place over the subsequent day and a half, with the conclusion that the fault probably was a short-circuit in a deflection coil on the Side 2 detector. The nature of the fault was such that the GHRS was judged to be non-operational. The pressure gauge within the GHRS showed a rise during the last few seconds that data were taken, suggesting that the short may have resulted in the release of some gaseous material. Subsequent analysis of observations from the other SIs showed no evidence for contamination, however.

This was an unfortunate end to an otherwise excellent record of instrument performance and productivity. Very few observations were lost because this failure took place only a few days before launch of SM2, but among those were a special test that was to observe two standard stars in the far ultraviolet with the COSTAR mirrors withdrawn. This was to try to determine the source of losses in sensitivity in the far-UV (below Lyman-alpha) seen since Side 1 was restored in 1994.

Elsewhere in this Newsletter is an article describing close-out work being done for the FOS and GHRS. Here I conclude by noting that the STScI GHRS Group now consists of D. Soderblom (Instrument Scientist) and Lisa Sherbert (Data Analyst). GOs should continue to direct questions about their GHRS observations to their Contact Scientist, or they may send mail to [help@stsci.edu](mailto:help@stsci.edu).

I would like to take this opportunity to thank the many people who contributed to making the GHRS the success it was. They include Jack Brandt, Sally Heap, and the other members of the Investigation Definition Team and their associates at GSFC and elsewhere; Dennis Ebbets, Harry Garner and others at Ball Aerospace, and STScI employees too: Ron Gilliland, Doug Duncan, Laura Ferrarese, Howard Lanning, Al Schultz, Claus Leitherer, Melissa McGrath, Joe Skapik, Wayne Baggett, Anne Gonnella. If I have forgotten anyone I apologize, of course.

## WFPC2

Brad Whitmore, [whitmore@stsci.edu](mailto:whitmore@stsci.edu)

The WFPC2 continues to operate very well, and with the successful completion of the servicing mission behind us, the WFPC2 observing program is now in full swing. Post servicing

mission calibration observations indicate essentially no change to the WFPC2 characteristics. Immediately following the servicing mission there was evidence that the contamination rate was about 70% higher than our normal rate (measured in F170W). Based on the higher contamination rate, the frequency of routine decontaminations (i.e., warming the WFPC2 to +22 C for several hours) has been increased to once every two weeks. We expect the contamination growth rate to eventually return to pre-service mission values, and will return to the nominal decontamination frequency of once every 4 weeks at that time. Most importantly, the throughput following the March 4 decontamination matches the pre-SMOV values to much better than 1%. An Instrument Science Report summarizing the full range of calibration observations taken during the servicing mission should be available in the coming months.

Observations taken both before and after the servicing mission indicate that the focus position has been, on the average, slightly high (+4 microns) since the last focus move on October 30, 1996. An implication of this result is that the desorption rate of the optical telescope assembly has apparently slowed down. While this focus position is only slightly larger than our normal limits used in the past, it was felt that a small focus move was in order since a large fraction of the observations planned for this spring use the WFPC2. Hence, a focus move of -2.4 microns was made on March 18. Please keep in mind that the focus for any individual WFPC2 observation may vary by +/- about 3 microns due to "breathing." For more details see the new Instrument Science report "Impact of Focus Drift on Aperture Photometry" (WFPC2-97-01) available via the WFPC2 homepage.

A library of *observed* WFPC2 Point Spread Functions (PSFs) is now available as a resource for projects where PSF characterization or PSF subtraction is required. A WWW interface provides a means of sorting through and selectively choosing and retrieving only those PSFs of interest. All PSFs are kept online and all are retrievable via the PSF Library Search tool. The PSFs in the Library were extracted from observations taken as part of STScI's routine calibration programs. There are plans to include composite PSFs and higher S/N PSFs in the near future. There are currently over 2000 PSFs in the Library, primarily for the F336W, F439W, F555W, F606W, F675W, and F814W filters. Note that simulated PSFs using the TinyTim software can also be used in many cases.

For reference to these and other WFPC2 materials please access the WFPC2 homepage via:

[http://www.stsci.edu/ftp/instrument\\_news/WFPC2/wfpc2\\_top.html](http://www.stsci.edu/ftp/instrument_news/WFPC2/wfpc2_top.html)

## Institute News

## Launch of SM2: A Personal View

Tony Keyes, keyes@stsci.edu

Perhaps the first concrete indication that we were in for a spectacularly different experience was the willing acceptance of a 7 pm bedtime by our daughters Sarah, 8, and Hannah, 4. Launch of STS-82, the Second Hubble Servicing Mission, was scheduled for 3:56 am and our invitations clearly stated that our buses would depart at “2:00 am sharp.”

Somehow we all slept well. I attribute that primarily to the day’s earlier activity. Together with other STScI and Goddard families we had toured several areas of the Kennedy Space Center (KSC) including a thrilling opportunity to stand just outside the fence of Pad 39A and view (and repeatedly photograph and video) the shuttle Discovery from about 300 yards away. While at the pad our daughters managed to discover several shells mixed in with the filler rocks at the base of the fence; these “shuttle shells” are now among their most prized possessions.

The alarm went off at midnight. The day had been cloudy and gray, rain had fallen a couple of times, but the sky was now clear. Our brief ride to the bus pickup was uneventful, but we got one of the last parking lot spaces at 1:15! As 2:00 approached, our bus, and presumably the dozen or so others, filled with people and the sounds of routine conversation, yet once the bus engine started all conversation abruptly ceased.

Our route took us through some gated areas of KSC in order to avoid much of the jammed traffic headed to the public viewing area on the Causeway. The kids had the good sense to sleep for almost the entire trip. Eventually, we arrived at the Static Test Road Viewing Site which appeared to be about three miles due south of the pad. We stepped off the bus and onto an initially dimly lit gravel path along an embankment or

levee that led through the scrub bushes and trees.

My wife, conditioned by millions of years of primate evolution and an unspecified number of decades enriched by unsolicited reptilian close encounters, was silently attentive to the possibilities of snakes and alligators lurking in the shadowy vegetation. (We had seen a baby alligator on the earlier tour and there were those prominent signs in the KSC Visitor Center parking lot — “CAUTION: Drainage Ditches Infested With Poisonous Snakes.”) I, on the other hand, was reminded of a Friday night high school football crowd — people were milling back and forth along a path under now bright incandescent lights, the air was cool and slightly crisp, the sky was crystal clear(!), several tiers of bleachers were filling up with blankets, coolers, and spectators, and occasionally the NASA commentary and shuttle communications came over the loudspeakers. Off in the distance, but well illuminated, stood Discovery.

The time was about 3:10 and a planned hold at about T minus 20 minutes was starting. We moved away from the bleachers and lights to a vantage point on a slight rise that was nearest the shuttle. Along with many others we spread out our blankets in the darkness near the front of the crowd. I learned only later that a sizeable contingent of STScI people were just 20 feet away. Time moved very quickly. The hold ended and the countdown proceeded rapidly to the next planned hold of five minutes duration at T minus 9 minutes. In the darkness there were stereotypical conversations between photographers wondering about the best exposure and aperture setting for liftoff — I listened attentively.

The time from the T minus 9 hold to launch remains a blur to me. I hurriedly loaded new film into my camera, attempted some very high

magnification zoom video, and mostly traded binoculars back and forth with Nancy and the kids. With about a minute to go, some very nice people in front of us formed a corridor so that Sarah could see the shuttle clearly; Nancy held Hannah; I held two cameras somehow not thinking of the impossibility of using both at liftoff. (In fact, after a couple quick shots, I just watched.)

At about T minus 7 seconds the shuttle main engines started. As viewed through my telephoto lens, a brief, smoky-red flickering appeared, then it took on a bluish cast. At zero the solid rocket boosters (SRBs) ignited and a bright yellowish light lit up the vicinity of the pad like daylight. The color of the exhaust is not captured adequately in any video or photograph I have ever seen. To my eye, an intense yellow-golden pillar extended down from the SRBs as the shuttle rapidly rose into the sky. Adjectives escape me in trying to describe this sight. The roll maneuver began quickly and Discovery simply left in a hurry.

During the ascent I remember many impressions: the distinctive crackling sound finally reaching us, the wonder on the face of our youngest as the shuttle rose higher and higher, the heart-wrenching “go at throttle up” command, the orange ember of a spent SRB falling away, a mysterious blue plume trailing the distant shuttle, the tiny disappearing star as the shuttle climbed away to orbit, and my daughter Sarah’s continuing questions throughout.

Lastly, one final impression colors all my memories — it was over so very, very, quickly.



NASA Photo

## Remembering the Launch of the First Servicing Mission

Matt Lallo, lallo@stsci.edu

As you may remember, the first night's launch attempt was scrubbed after the 1 hour window due to high winds at the Shuttle Landing Facility (shuttle runway), and an 800 ft long ship in the restricted ocean area east of KSC! The launch window is such that right around the close of it, *HST* passes directly overhead of KSC. So as the disappointed crowd of spectators began packing up to try again 24 hours later, we were treated to the most beautiful satellite I'd ever seen, passing across the zenith, at least mag -2 or -3, *HST* soared overhead, flaring

to outrageous brightness as it caught a sun-glint, as if calling down to the hopelessly grounded shuttle that it's missed an important appointment. "Here I am passing by...you missed me...better luck next time." What a feeling to actually see the very thing that so many of us devote so much to. To look upon a thing we know and understand only through a telemetry stream.

24 hours later the shuttle turned a tropical night into day, and an orbit later, back at one of those unmistakable Cocoa Beach motels, I sat on the

beach as the clear sky brightened with twilight, and watched as *HST* once again passed overhead, brilliant silver in a purple and red sky. This time however, a few minutes later, Endeavour appeared, in hot pursuit, compelled by celestial mechanics to an historic rendezvous. I watched as the shuttle moved smoothly toward the eastern horizon, into bright twilight over the Atlantic, where it eventually faded from my sight.

These were unforgettable images that no photo could possibly interpret.

## The New Hubble Library from ExInEd

Robert Brown, rbrown@stsci.edu

Continuing their development of new ways to communicate the ideas and results of space exploration, the staff of the Exploration in Education (ExInEd) program at STScI has recently published a new CD-ROM entitled The Hubble Library of Electronic PictureBooks. This latest ExInEd publication is an exceptional learning tool for home and school. Fun for all ages, the 16 Electronic PictureBooks on the CD-ROM include: Gems of Hubble 3.0, which presents and explains 60 of the most notable *HST* images; Windows on Orion: A Multiwavelength View of the Stars, an in-depth guide to the Orion Nebula as seen in various wavelengths; Endeavour Views the Earth, a world tour based on Space Shuttle images; and Space Art by Kids, a collection of the winning entries from a nation-wide art competition for children. All Electronic PictureBooks include descriptive captions for every image they contain, as well as ancillary reference materials, such as glossaries, indexes, tutorials, etc. The CD-ROM also includes more than 25 minutes of astronaut video presented with an attractive and easy-to-use interface.

The Hubble Library is cross-platform, meaning it will run on all computers with the MacOS® or Windows® operating systems that have at least 5 megabytes of available RAM. Retailing at \$39.95, the CD-ROM is available for purchase from the Astronomical Society of the Pacific at 800-962-3412, and from NASA's Central Operation of Resources for Educators (CORE) at 216-774-1051, ext. 293.

Individual Electronic PictureBooks, as well as other innovative products and literature from ExInEd, may also be downloaded for free from ExInEd's newly expanded WWW page at URL: <http://www.stsci.edu/exined/>.

Contact ExInEd directly for more information by sending E-mail to: [exined@stsci.edu](mailto:exined@stsci.edu), or by writing to: ExInEd, Special Studies Office, Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218.

## The Digitized Sky Survey: Photometric Calibrations

Jesse Doggett, doggett@stsci.edu

Photometric calibrations for the three primary photographic surveys which make up the Digitized Sky Survey (DSS) are now available. These calibrations consist of a lookup table for each photographic survey and are accurate to approximately 0.5 magnitudes. The calibrations are available in the form of PostScript plots, ASCII tables, and FITS file binary tables.

The program GetImage 2.0 may be used with these tables to extract images from the DSS into FITS files which contain the appropriate photometric calibrations. Astronomical software packages with FITS capability may then access the photometric calibrations for image analysis. The calibration files, the alpha release of GetImage 2.0, and associated documentation may be obtained from the World Wide Web through

<http://www-gsss.stsci.edu/dss/dss.html>.

## A New AURA Board

Goetz Oertel

At its April 1996 annual meeting, the Board of Directors of AURA, Inc. voted to amend and restate the By-laws. This was the most important change since the consortium was chartered in 1957. The Board also adopted a transition plan that put the new structure in place on July 1, 1996, on an interim basis. It also created an "interim" Board and empowered it to oversee the transition and to conduct the affairs of the corporation for one year until a new Board, elected at this year's annual meeting, takes over on July 1, 1997.

The new Board will have thirteen Directors, a number that will not change if additional member institutions join. Twelve will be elected by the "Member Representatives" and will serve staggered three-year terms. The other will be the President, ex officio.

The Member Representatives who are appointed to AURA by the member institutions will be "stake-holders" in the consortium. Member Representatives will meet annually, will hold the Board accountable, and will elect the new Board. Representatives from international affiliates will have an equal voice on all matters.

From July 1, 1996, until June 30, 1997, the Executive Committee as elected or designated in April 1996 serves as the Interim Board. The old Board has become the "Member Representatives" which includes the present Directors-at-Large (now termed "Representatives-at-Large") until their terms expire during the next three years. Councils will continue to provide oversight and advocacy for the Centers: the Observatories Council for NOAO and the Space Telescope Institute Council for STScI. Their functions remain the same for now but are being strengthened through new charters that will be adopted this year. Council members are elected by the Board, from a slate approved by the Member Representatives, and will

come from among the Member Representatives and from the broader astronomy community.

The restructuring has several effects: the new Board will be smaller and can, as a whole, act more decisively because it will number thirteen instead of the former forty-one (twelve Directors-at-Large, one Director from each of twenty-eight member institutions, and the President ex officio). In the new Board, all Directors except for the President will be elected. By contrast, only twelve "Directors-at-Large" in the old Board were elected, the remaining twenty-eight were appointed - one by each member institution. When the Member Representatives elect the new Board, they will have greater flexibility: only four of the twelve new Directors must be from among the Member Representatives, and only four must be from outside that group. By comparison, the old Board includes only twelve elected "Directors-at-Large" while twenty-eight were appointed. The Board has also strengthened the role of international affiliate members and their representatives by giving them voting rights.

As a consequence of the restructuring, perceptions of conflicts of interest

should be less likely to arise. First, appointment to AURA by a member institution no longer automatically places the appointee on its Board of Directors; it makes her/him a Member Representative with a voice and a vote in electing the Board. Further, because each new Director will be intimately involved in the affairs of the consortium, s/he will be more aware of situations in which perceptions of conflict of interest could arise.

The Board's action was preceded by in-depth analysis and recommendations from a special committee that was chaired by former Director and Vice Chair Dick Rossi and included Vice Chair Dick Zdanis, former Chair Bob MacQueen, former Director Bob Kraft, current Representative-at-Large Art Walker, and Morton Roberts.

The Board and several of its committees carefully reviewed the advice of this committee and adopted a comprehensive restructuring proposal at a special meeting in January 1996. Extensive revisions of the By-laws, and a transition plan, were developed last spring. The Board enacted the new structure at its regular annual meeting on April 23, 1996, on the eve of the sixth anniversary of the launch of the Hubble Space Telescope.

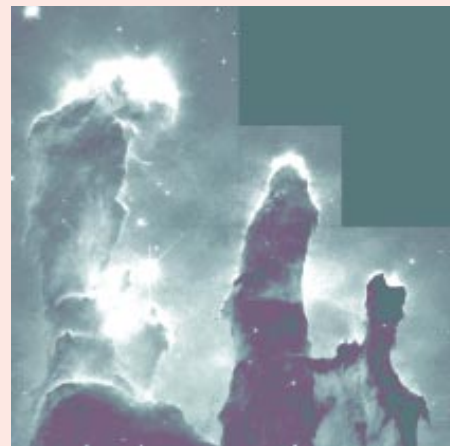
### **HST Image Photos available**

***Interested in purchasing large sized photographs of HST images?***

***Check out this Web site for sizes and prices***

Photographs are available in black and white as well as color through an online order form from Newell Colour Lab at:

[www.lainet.com/newell/order.html](http://www.lainet.com/newell/order.html)



## Tenure for Bill Sparks

William B. Sparks was recently granted tenure as Associate Astronomer at STScI. He came to the Institute as an ESA Fellow in 1986, and then joined the STScI staff as an AURA



Assistant Astronomer in 1988. During his time here he has been an Instrument Scientist for WFPC and FOC, Project Scientist for the Early Release Observations from the First Servicing Mission, Data Quality Project Scientist, and Lead of the Observatory Support Group. He is

presently Lead of the NICMOS Group.

Bill was born in 1956 in an industrial town on the northeast coast of England. He traces his interest in astronomy at least as far back as age 5, enjoying the dark skies over his family's cottage in the moors. A career in astronomy was a goal, but tempered by the realization of how few positions there were. He pursued a degree in mathematics at Trinity College, Cambridge, where he finished in 1977. He spent a year in a masters program at the University of Sussex before starting a Ph.D. at University College, Cardiff (University of Wales), in the Department of Applied Mathematics and Astronomy. He completed his degree in 1982, working with Michael Disney.

Before coming to STScI Bill spent two terms as post-doc at the University of Sussex. His research has focussed on observations and theory of galaxies, especially radio galaxies. This has led to studies of the interstellar media of radio elliptical galaxies, optical jets of radio galaxies, an alternative model for cooling flows, and determinations of geometric distances to galaxies. Bill is an active user of HST, and is now part of the science team for the Advanced Camera for Surveys.

Four children, all less than six years old, occupy most of the rest of his time, but indoor soccer is still pursued.

And his love of dark skies and the country remains: he lives about 30 miles north of Baltimore.

## The 1997 *HST* Calibration Workshop with A New Generation of Instruments

**September 22-24, 1997**

**Space Telescope Science Institute, Baltimore, Maryland**

The Second Servicing Mission has brought a major change in the complement of Science Instruments on *HST*. The Faint Object Spectrograph (FOS) and the Goddard High Resolution Spectrograph (GHRS) have been replaced by the Space Telescope Imaging Spectrograph (STIS) and the Near-Infrared Camera and Multi-Object Spectrometer (NICMOS); one of the Fine Guidance Sensors has also been replaced with an upgraded unit (FGS1R). The Third *HST* Calibration Workshop will help to capture the resulting changes and new capabilities for the *HST* user community.

As we enter the archival phase for FOS and GHRS, all of their final calibrations should be at hand. The meeting will provide a forum to wrap up any outstanding calibration issues and present a complete view of those instruments.

For the new instruments, it will be an opportunity to present the major results of the Servicing Mission Orbital Verification phase, with the first indication of their performance for the general astronomical community. With the large number of approved Cycle 7 programs for STIS and NICMOS, we expect a sizable and extremely interested audience for up-to-date news on the instruments.

For the continuing instruments, FOC and WFPC2, the two-year interval since the previous Calibration Workshop means considerable updates on calibrations, on our understanding of the instruments, and on new observing and reduction techniques.

In summary, the following topics will be included in the Third *HST* Calibration Workshop:

- Preliminary results of the calibration and status of the new instruments (NICMOS, STIS, and FGS1R).
- Closure information on the calibration history of FOS and GHRS.
- Up-to-date calibration results for the continuing instruments (FOC and WFPC2).
- New pipeline and analysis software.
- An advanced look at future instruments.

The Third *HST* Calibration Workshop will be held over three full days at STScI, and will include invited talks, contributed posters, and splinter sessions for more detailed technical discussions.

Proceedings of the Third *HST* Calibration Workshop will be published before the end of 1997.

For expressions of interest, please check the web page at:

<http://www.stsci.edu/stsci/meetings/cal97>

(look under the STScI home page) or e-mail to [cal97@stsci.edu](mailto:cal97@stsci.edu).



## Looking Beyond Boundaries

In an innovative experiment called "Looking Beyond Boundaries," thousands of people from around the world watched the exciting events of the Hubble Space Telescope Second Servicing Mission unfold through live interviews with scientists and engineers made available through the World Wide Web.

In a collaborative effort, STScI and the Exploratorium, a cutting-edge, hands-on science museum in San Francisco, produced live webcasts twice each day during the servicing mission, February 11-20, 1997. Using a sophisticated multi-media center located right in the heart of the museum, "explainers" discussed the Hubble and daily mission activities while showing downlink mission video from NASA TV, videoconferenced and telephone interviews with scientists and engineers from STScI and other organizations, and animated sequences and slides from an extensive archive

provided by STScI. Museum visitors interacted with the experts, asking questions on topics ranging from the telescope and its servicing to the possibilities for finding life elsewhere in the universe.

The sixty-minute sessions were disseminated over the Exploratorium's web site. Approximately 20,000 people viewed the program each day of the ten day mission and the audience response was overwhelming. One satisfied viewer wrote,

"Hi. Please excuse the adrenaline but I hope you'd like to know it's 9:30 in the evening here in Islington, North London, and I'm listening to a PERFECT audio track, participating in your student audience...you can't see me but I wanted you to know I'm there—to say thank you for the technical magic carpet you are weaving."

Shortly after the servicing mission, the Exploratorium was recognized at the International Meeting of Museums

on the Web as having the best educational website and the best overall website. "Looking Beyond



"Boundaries" was selected as an example of the website's excellence.

The Office of Public Outreach looks forward to future opportunities to showcase Hubble through experiments with emerging information technologies.

### Calendar

#### Cycle 7

Phase II proposals due                      Check the Cycle 7 Phase II Proposal Instructions

Start of science observations              1 July 1997 (approximate)

#### Cycle 8 (tentative):

Call for Proposals issued                      October 1997 (tentative)

Phase I proposals due                          February 1998 (tentative)

#### Meetings and Symposia

STScI May Workshop                          6 to 9 May 1997  
The Hubble Deep Field

Space Telescope                                  12 to 13 May 1997  
Users Committee

HST Calibration Workshop                      22 to 24 September 1997

The Space Telescope — European Coordinating Facility publishes a quarterly newsletter which, although aimed principally at European Space Telescope users, contains articles of general interest to the *HST* community. If you wish to be included in the mailing list, please contact the editor and state your affiliation and specific involvement in the Space Telescope Project.

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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](mailto: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](mailto: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:

Fred Walter (chair), SUNY Stony Brook,  
[fwalter@sbast1.ess.sunysb.edu](mailto:fwalter@sbast1.ess.sunysb.edu)

John Bally, U. Colorado

John Clarke, U. Michigan

Alex Filippenko, U.C. Berkeley

Bob Fosbury, ESO

Marijn Franx, Kapteyn Astron. Inst.

Laura Kay, Barnard College

Regina Schulte-Ladbeck, U. Pittsburgh

Ted Snow, U. Colorado

Rodger Thompson, U. Arizona

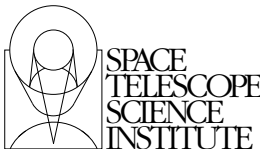
John Trauger, JPL

Will van Breugel, Lawrence Livermore

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