



# Newsletter

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## Astronomer's Proposal Tools

Steve Lubow, [lubow@stsci.edu](mailto:lubow@stsci.edu)

STScI is developing a new generation of proposal preparation tools called the Astronomer's Proposal Tools (APT). These tools are based on the Scientist's Expert Assistant (SEA) project which began in 1997 at the Advanced Architectures and Automation Branch of Goddard Space Flight Center. The APT aims to improve the proposal preparation process in order to provide users with a more intuitive, visual, and interactive experience by means of state of the art technology. Another goal is to make these tools generic so that they can be easily shared for use in creating proposal preparation systems by other observatories.

Tools that are currently under development are:

- The Visual Target Tuner (VTT) was initially released in June, 2000. This tool displays *HST* apertures superimposed on sky images (right). The VTT provides capabilities to import sky images, display primary and parallel apertures, rotate apertures, centroid objects, specify excluded points and regions, display legal orientations, and display catalog overlays and object information.
- The Starview/VTT tool will allow users to graphically display the pointings and apertures for archived *HST* exposures in the VTT. With this tool, users will be able to carry out duplication checks on observations that they display in the VTT.

- The Bright Object Tool will allow users to check proposed observations for instrumental health-and-safety, as well as science problems (such as bleeding). The tool will allow users to display the results graphically in the VTT or read the results in a table.
- Exposure time calculators will be enhanced to provide graphical displays, such as exposure time as a function of signal to noise.
- Spreadsheet-like editors will be provided for users to enter proposal

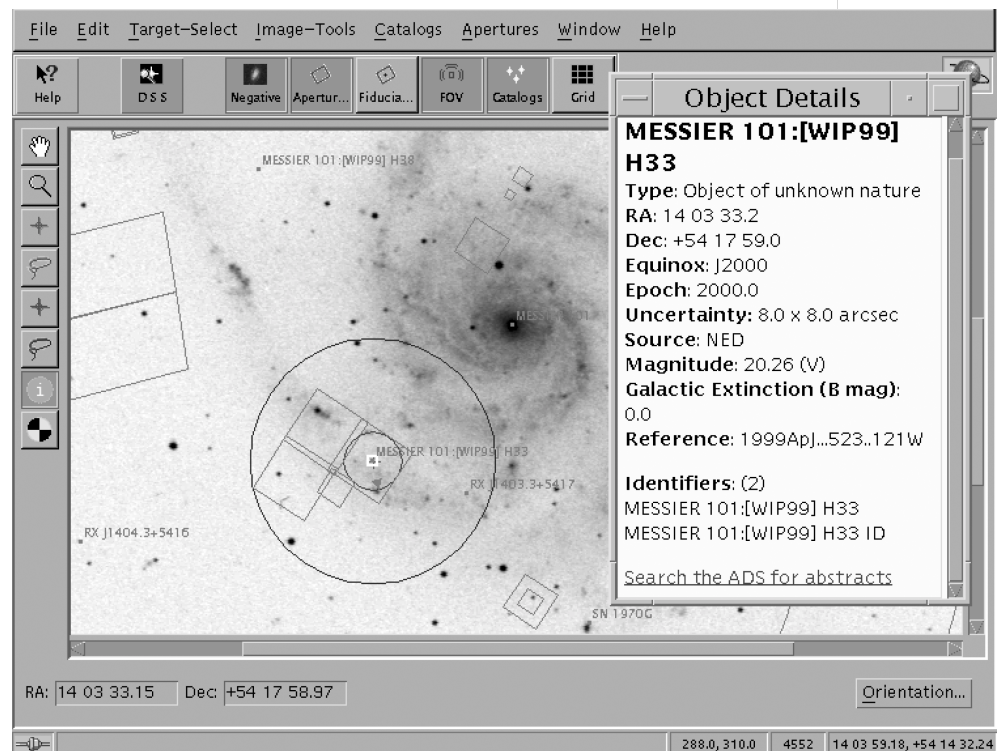
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# Cycle 10

Who got time on *HST* to do what ...

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## DIRECTOR'S PERSPECTIVE

Steven Beckwith

## Old data and new discoveries

We measure the success of the Hubble Space Telescope by its impact on scientific research and by its public impact. So we take pride when the two coincide, as they have recently in discoveries from the Hubble archive. Perhaps most noteworthy is that the two most recent discoveries of public acclaim came from old data, not new.

Joseph Dolan at Goddard Space Flight Center uncovered evidence for accretion onto a black hole by examining High Speed Photometer data nearly ten years old and applying a technique to search for the signature of matter disappearing beyond an event horizon (Dolan, *J. Bull. AAS*, 197-118.05). The signature in this case was a series of pulses emitted by clumps of gas as they break away from the innermost stable orbit around a black hole – about 3 Schwarzschild radii out – and spiral in along a set of orbits with decreasing radii. As the gas streams away from us in its orbit, its emission is redshifted and dimmed. As it circles and comes toward us, it becomes blueshifted and brightens. Each successive circle creates a pulse of decreasing magnitude, increasing width, and decreasing period until the gas descends below the event horizon and disappears without further trace. The signature is unique, because if the gas encountered a compact surface, such as that of a neutron star, the final pulse would end in a burst of energy as the gas came to a sudden stop.

Dolan searched for such pulse trains in observations of Cyg X-1, the first candidate black hole to come from early x-ray telescopes. He found two series that matched the characteristic shape and timing expected for gas going into a black hole of  $10 M_{\odot}$  or so. This was the first time such a pulse train had been seen, and it lent impetus to further observations at x-ray wavelengths, where the signatures should be even more pronounced (the signal to noise ratios of the old HSP data certainly need improvement before this work is accepted by everyone). Dolan's work found its way to the *New York Times* science section in January of this year, once again stimulating public interest in astronomy.

Adam Riess and his colleagues (Riess et al. 2001, *Ap. J.*, in press) added even more support for a non-zero cosmological constant, the "dark energy" that accelerates the expansion of the universe, with their study of a high redshift supernova discovered by Ron Gilliland (Gilliland et al. 1999, *Ap. J.* **521**, 30) in Hubble observations from 1997. SN 1997ff was identified in the Hubble Deep Field early on, and it popped up in the deep infrared images of the Hubble Deep Field north by Rodger Thomson's NICMOS team. Because the images were taken in regularly spaced observations over a few months, it is possible to get information about the supernova light curve and the change in its spectral energy distribution just after peak brightness. Photometric data on the host galaxy place SN 1997ff at a redshift of about 1.7, the highest redshift supernova ever seen.

Because it is very distant, this supernova emitted its light when the acceleration of the universe was just starting, and the effect of the dark energy should be small when comparing the supernova's apparent brightness to its redshift distance. If the dark energy did not exist, and the light from less distant supernovae was affected by intergalactic extinction (gray dust) or an evolution in the character of supernovae over cosmic times, SN 1997ff would have uncovered these effects since they would have changed the brightness vs. redshift relationship in opposite ways to the dark energy. But the brightness of SN 1997ff is consistent with the dark energy interpretation and not the other effects, and Riess and his colleagues have provided compelling evidence that the dark energy must be taken seriously.

Many of us suspect that data archives will play an increasingly important role in astronomy as the sizes of the archives grow. The National Academy's *Survey on Astronomy and Astrophysics*, the decadal survey of 2000, recommended establishing a National Virtual Observatory, linking together many data banks covering many wavelengths and instruments to enable archival research on a scale far greater than what is presently possible. A Virtual Observatory will be a grand experiment. No one has demonstrated that archival research will be important enough to justify the expenditure – some tens of millions of dollars. We have already invested several billions of dollars to get the data, including Hubble, Chandra, and SIRTf in the space community, and Gemini, Keck, ALMA, and the VLT, to mention but a few on the ground. It would seem that investing a few percent of the capital expenditures to enable future astronomers to mine the data is well worth the cost.

It is interesting that the recent archival discoveries cited above are so important to their respective research fields. The likelihood of finding a high redshift supernova in a field the size of NICMOS (55 seconds of arc) during a few months observation would seem to be very small unless the events are more common than we think. Many events may be more common than we think; we will not know until we have surveyed the universe over time as well as wavelength and space. If we can discover the previously unknown but common events by combing through data taken for other purposes, archival research may be the most efficient path to discovering new phenomena now that preliminary exploration of the spectrum has been done. The exciting discoveries from old data sets portend a bright future for old data.

Steven Beckwith  
Baltimore, March 26, 2001

## STScI Electronic Grants Management System

Ray Beaser, [beaser@stsci.edu](mailto:beaser@stsci.edu)

The Space Telescope Science Institute is pleased to announce the implementation of an electronic web-based grants management system. The system is being used to provide funding for U.S. astronomers associated with General Observer and Archival Researcher programs as well as all other programs administered by STScI.

The main features of the system are the electronic submission of budgets, performance reports, financial reports—including payment requests – and all other administrative actions such as no-cost extension and equipment requests. The system provides electronic notification of grant awards and amendments as well as real-time

access to proposal and grant status information.

The system was implemented for Cycle 10. The Grants Administration Office contacted the Authorizing Officials (AOs) of each U.S. institution with a Cycle 10 investigator to activate institutional accounts. The AOs at each institution enabled investigator accounts and assigned appropriate privileges for various functions within the system.

With the exception of a few budgets that were submitted on paper, all Cycle 10 General Observers and Archival Researchers submitted their budgets via the new electronic system. The Grants Administration Office is currently contacting the remainder of

our grantee institutions that have open *HST* grants to activate their accounts. As of July 1, 2001, the electronic submission of interim and final financial reports will be required.

The Cycle 11 budget submission deadline is expected to be mid-February 2002. If an account has not been activated for your institution, please contact the Grants Administration Office at the telephone number or email address listed below.

Information about the new grants system is currently available at the following web site: <http://gms.stsci.edu>. If you have any specific questions, please send e-mail to [gms\\_mail@stsci.edu](mailto:gms_mail@stsci.edu) or call 410-338-4200.



### **HST Recent Release: NGC 4013: A Galaxy on the Edge**

The Hubble telescope has snapped this remarkable view of a perfectly "edge-on" galaxy, NGC 4013. This new Hubble picture reveals with exquisite detail huge clouds of dust and gas extending along, as well as far above, the galaxy's main disk. NGC 4013 is a spiral galaxy, similar to our Milky Way, lying some 55 million light-years from Earth in the direction of the constellation Ursa Major. Viewed face-on, it would look like a nearly circular pinwheel, but NGC 4013 happens to be seen edge-on from our vantage point. Even at 55 million light-years, the galaxy is larger than Hubble's field of view, and the image shows only a little more than half of the object, albeit with unprecedented detail.

Image Credit: NASA and The Hubble Heritage Team (STScI/AURA)

Web Address: <http://opposite.stsci.edu/pubinfo/pr/2001/07/>

### **APT** from page 1

information in a tabular manner. The editors will have capabilities for viewing and manipulating the data in a convenient manner.

The APT will ultimately be a complete and integrated system for proposal preparation which will replace the current RPS2. The APT will provide capabilities for developing Phase 1 GO, Phase 1 Archival, and Phase 2 proposals.

In the short term, individual tools are being released that operate independently of each other. They assist in proposal preparation but do not directly generate a full proposal. We aim to release these tools on a timely basis. We hope to get feedback from users. This feedback will play an important role in guiding our efforts. Several tools have been released for use in Phase 2 of Cycle 10.

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

Paolo Padovani (on behalf of the MAST team), [padovani@stsci.edu](mailto:padovani@stsci.edu)

### Hubble Data Archive Status

The Hubble Data Archive (HDA) contains, as of March 1, 2001, 7.1 Tbytes of data. The number of science datasets now totals more than 230,000. Archive ingest has averaged 3 Gbytes/day in the past year, while the rate of data retrieval has been more than 4 times that.

### Literature links: from data to published papers

We have embarked on a project to allow archival researchers easy access to MAST-based papers directly from the archive interface. This project is well under way and actually completed for some missions, so we describe here in some detail its implementation.

The MAST archive interfaces (accessible from the MAST main page at <http://archive.stsci.edu/mast.html>) provide a list of datasets matching a given query and also return various columns with target parameters (e.g., target name, coordinates, instrument, etc.). These now include a "Ref" column, which specifies the number of published papers associated with the listed proposal ID (*HST*) or image ID (other MAST missions). Clicking on an entry in this column (other than a dash, which means that no papers referencing the proposal/image ID are available) will display the list of related papers including title, first author, and journal reference. The latter follows the Astrophysics Data System [ADS] bibliography code (bibcode) and is also a link to the ADS Abstract Service, which provides electronic access to the paper. (Note that at present only refereed papers are included.)

ADS users performing literature searches can now do the opposite, i.e., go from papers to data. A "Data" link available in the ADS abstract page, in

fact, lists the MAST observations associated with a given paper and provides a link back to MAST. This takes the user to two different web pages, depending on the mission. For *HST*, ADS users enter MAST via the proposal page, which gives the proposal abstract, the list of related papers, and a search output (up to 100 datasets) for that proposal, with links to preview files, and "mark" buttons for direct retrieval from the archive. For other MAST missions, a preview page is available which displays a plot of flux versus wavelength, lists relevant published papers, and allows the option of downloading the data in either FITS or ASCII table format.

The level of completeness of the bibliographic entries varies with the mission. For *HST*, the links include papers published between 1991 and 1997 and in 2000. Papers published in 1998 and 1999 will be added very soon. IUE, the ASTRO missions (HUT, WUPPE, UIT), BEFS1, and EUVE are complete through the year 2000, and work is on-going on Copernicus papers (FUSE papers and publications based on the other ORFEUS missions will be added eventually).

The *HST* bibliography includes all papers making original use of *HST* data including papers written both by observers and archival researchers. These 'original use' papers are identified by the STScI library searching all incoming journals for papers that use *HST* data directly without citing prior usage of those data. For the non-*HST* bibliography, on the other hand, MAST staff and IUE staff member Pat Pitts attempted to find all papers citing the use of MAST data.

We invite you to use this new service (and tell us about any paper we might have missed!). As usual, send any comments/questions/suggestions you might have to [archive@stsci.edu](mailto:archive@stsci.edu).

### On-the-Fly Reprocessing (OTFR) and You

Around the beginning of April, 2001, we will turn on a new "on-the-fly" system for archived STIS and WFPC2 data; archived NICMOS data will be affected by this system as of May or June this year. Our "on-the-fly" reprocessing system will process data from the telemetry product through conversion to a FITS file and finally to instrument calibration. This system will replace OTFC (On-The-Fly Calibration).

What does this mean to the *HST* archive user? Basically, the average *HST* archive user will not see many differences.

*So why did we do it?*

"On-the-fly" processing in general provides a better science product, as compared to the original, first cut calibrations. However, our OTFC system was cumbersome, with an extensive database change system, and OTFC could not handle data associations with multiple files, such as those for NICMOS and ACS. By processing from the telemetry files with the current pipeline software, we were able to reduce the need for an extensive change system and we will be able to handle associations in a graceful way.

*How will this system affect the archive user?*

- 1) On-the-fly calibration of NICMOS, WFPC2, and STIS.
- 2) No "original" calibration files for those instruments. We do not save them anymore.
- 3) All requests for NICMOS, WFPC2, and STIS science data will include both the raw and calibrated FITS files with updated headers.

Any questions can be directed to [archive@stsci.edu](mailto:archive@stsci.edu).

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**MAST** from page 4*StarView 6.1*

StarView 6.1, the newest version of the StarView Java application, was released in October, 2000. We appreciate any and all suggestions! Send them to [archive@stsci.edu](mailto:archive@stsci.edu). StarView is available for download at <http://starview.stsci.edu>. Existing personal installations of StarView are updated in situ, with your permission. If you access a centralized version of StarView, notify your science software manager. Future updates of both local and centralized installations will be automated, with appropriate approvals.

*We highlight some of the improvements contained in Version 6.1:*

- Data Retrievals of multiple datasets are even easier: you can select them with the mouse, shift-click to select multiple sets. Pressing the “mark” button marks all of the selected datasets for retrieval.
- Data Retrievals of *HST* data include the ability to save your account password, change your password, change your mailing address (for tapes).
- The Help menu now includes Archive Status, which for now links to the *HST* DADS status page, as well as the *HST* Archive Registration page, How-Tos and FAQs.
- The Qualifications Editor was re-written, so that it now behaves much better. The layout of the Qualifications Screen was modified to be easier to read and use.
- Qualifications can be saved to disk and loaded either into another form (as long as the fields are consistent) or into the same form on another day (for repeated retrievals of very similar types.)

- Cross-qualification of coordinates was improved: it now works faster and has more versatile input formats which are controlled through the Preferences screen.

- System manager control of automatic updates for centralized installations of StarView.

Future improvements include generalizing the retrieval and archive description module to include all of the MAST missions and coordinating StarView with the Visual Target Tuner from the Astronomer’s Proposal Tool suite. Expanding the data domain to include all of MAST is the first step needed to make StarView usable as a general search interface for any observatory archive. StarView will be a completely configurable Java search interface.

*Old StarView Versions Will No Longer Be Supported*

The X-windows version of StarView (xstarview) and the antiquated “CRT” version of StarView (starview) were turned off as of November 1, 2000. The old NCSA server which serves forms for these versions of StarView was removed to simplify maintenance and Web security. All versions numbered 5.4a and earlier no longer function.

*SV\_DADS\_RETRIEVE*

The stand-alone tool, `sv_dads_retrieve`, which can be used in user-written scripts to request datasets directly from the *HST* archive facility (DADS), will continue to work. However, as DADS is revised, this tool will have to be updated to stay apace with the changes (that include encryption conventions). Users of this stand-alone tool should stay abreast of the tool’s update which will occur in phase with the archive transitions planned over the next year.

*New Archive Medium*

Last fall the *HST* archive began using a new archive medium, magneto-optical (MO) disks, to store *HST* data. We have started a process to move all of the science data from the old medium (12 inch Sony optical platters) onto the new MO disks. As of March 1, 2001, we are about a third of the way done and estimate that it will take about a year or so to complete this process. This transition should be transparent to users, who are still able to access data from either medium. Your patience has been very much appreciated during this transition time as we gain experience with our new system.

Once this process is complete, we anticipate much faster retrieval times as all data will be available in the new MO jukeboxes.

*Improved Retrieval Times for IUE Final Archive Extracted Data Files*

The IUE Final Archive extracted data files are those most frequently requested from the MAST archive (other than *HST* and FUSE data). To improve retrieval times, the IUE Low- and High-Dispersion Merged Extracted Image FITS Files (MXLO and MXHI respectively) have been copied to disk on [archive.stsci.edu](http://archive.stsci.edu) allowing users to retrieve these data much more quickly. As before, users may retrieve data either through the IUE WWW interface or via anonymous ftp. The remaining IUE files are still available but remain in a CDROM jukebox. Users requesting other IUE files (as well as UIT and BEFS data) may need to wait a few minutes to allow the jukebox to retrieve and mount the CDROM.

## The Next Generation Space Telescope at the beginning of a new millennium

N. Panagia and H.S. Stockman

The Next Generation Space Telescope (NGST) is a large-aperture optical and infrared telescope being designed to study the properties of the first stars and galaxies born after the Big Bang and to elucidate the mysterious process of star and planet formation in our own galaxy. The high spatial resolution and low background provided by a large aperture, passively cooled telescope in an L-2 orbit are essential for these studies. Compared to current or planned observatories, NGST will have unique advantages in image quality field of view, low background light, and environmental stability. In particular, observations will be limited only by zodiacal light background for near infrared wavelengths less than 10 microns.

NGST will be a unique international facility with contributions from NASA, the European Space Agency and the Canadian Space Agency. In the recent decadal survey of astronomy and astrophysics, sponsored by the National Academy of Science (<http://books.nap.edu/catalog/9840.htm1>), NGST was ranked as the highest-priority, new initiative for the next 10 years. This ranking reflects both the exciting nature of NGST science and the recognition that NGST is technologically within reach.

The NGST project is currently in the preliminary design phase. Major studies of lightweight mirrors and detector technology developments are underway and show encouraging results, and new focal-plane assemblies for multi-object spectroscopy are being developed. Phase-A systems architecture studies are underway by industry consortia that include TRW, Ball Aerospace, Lockheed-Martin, and Raytheon Corporation.

### NGST at launch minus 8 years: Meeting cost and schedule constraints

In the light of results from costing exercises for other NASA missions,

and in preparation for issuing Requests for Proposal (RFPs) for the NGST prime contract in mid-2001, the NGST project has undertaken a detailed re-assessment of the design parameters. The principal goals are to get the most observatory capability per dollar and to launch in this decade. A major result of this exercise has been to relax the requirements on the diameter, areal density, and temperature of the primary mirror. A modest reduction in the aperture diameter can result in a stiffer mirror that still meets the launch weight constraints for more than one launch vehicle while retaining a markedly superior performance over all other telescopes. The illustration below compares the amount of time needed to make an imaging survey with a hypothetical 6.5m NGST, with *HST*, SIRTf, and a ground-based 8m telescope. Moreover, allowing the primary mirror to operate at a warmer temperature will permit active thermal control using heaters. The stiffer primary will provide better, more stable image quality at lower cost than other options. It will also enable much more complete verification of image quality and control in ground testing,

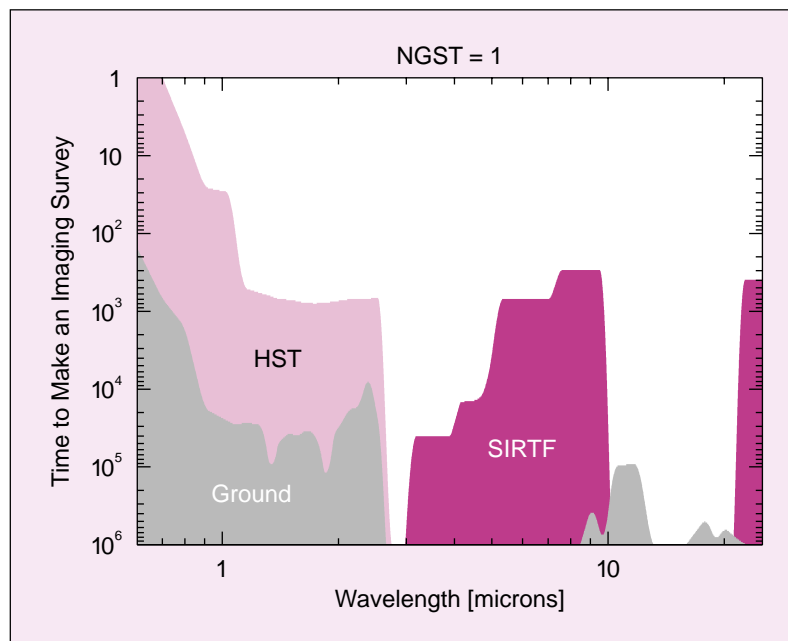
reducing the need for a flight validation experiment.

NGST will still carry three instruments: a visible/near-infrared (0.6 to 5 microns) camera with a field of view of 10 to 20 square arcminutes, a near-infrared multi-object spectrograph, and a mid-infrared camera/spectrograph. It should be stressed that concepts for NGST are still in development, and it will be up to the prime contractors to propose an observatory they can build within the cost and schedule constraints.

### Interim Science Working Group Replaces ASWG

The NGST Ad Hoc Science Working Group (ASWG) has been providing science guidance since its creation in September 1997. The ASWG was responsible for constructing the Design Reference Mission (DRM, <http://www.ngst.stsci.edu/drm>), which has been used heavily as a tool in design trade studies. The ASWG also made recommendations on the NGST instrument complement, taking into consideration the NASA, ESA, and CSA instrument concept studies,

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**NGST** from page 6

the NGST science goals, and the expected advances in ground based facilities.

The ASWG has recently undergone a metamorphosis into the Interim Science Working Group (ISWG). This group will function through the formulation phase (Phase A/B), until the instrument Announcement of Opportunity is released. The ISWG was selected in September 2000, from over 100 highly qualified applicants. The resulting committee includes observers, theorists, and instrument builders and reflects both the international nature of the project and the diverse scientific goals and capabilities of the observatory. The ISWG will work in collaboration with the NGST Project, NASA Headquarters, and the astronomical community to provide input during the formulation phase of NGST. The ISWG will help provide

**The ISWG Membership includes:**

Heidi Hammel  
Space Science Institute

George Helou  
CalTech/SIRTF Science Center

Robert Kennicutt  
University of Arizona

Robert Kirshner  
Harvard University

Rolf-Peter Kudritzki  
IfA University of Hawaii

Simon Lilly  
University of Toronto

Bruce Margon  
Space Telescope Science Institute

Mark McCaughrean  
Astrophysics Institute Potsdam

Marcia Rieke (Chair)  
University of Arizona

Massimo Stiavelli  
Space Telescope Science Institute

Edwin Turner  
Princeton University

Ewine van Dishoeck  
Leiden University

Michael Werner  
Jet Propulsion Laboratory

astronomy community input on questions relating to the science mission of NGST and will help disseminate information about NGST to the community.

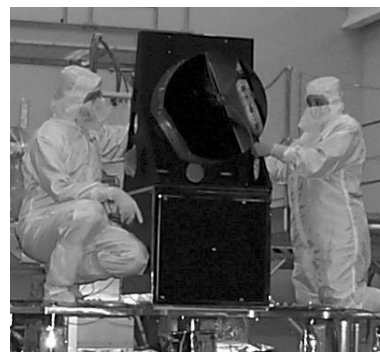
**Technology Development: Mirrors, detectors, and wavefront control**

Key technology challenges for NGST include lightweight optics, cryogenic actuators for mirror control, deployable structures, sensitive infrared detector arrays, lightweight, programmable aperture masks for multi-object spectroscopy, and coolers for the thermal infrared detectors. All have seen significant progress over the last two years.

**Mirrors**

The NGST primary mirror must be lightweight ( $\sim 20 \text{ kg/m}^2$ ) and deployable and must be capable of holding its figure at cryogenic temperatures. So far, eight designs involving five industry partners — including the University of Arizona, Composite Optics Inc, Ball Aerospace, Raytheon Optical Systems, and Kodak — have been built as prototype ultralight mirrors. The University of Arizona built a 2m “bed of nails” mirror which uses a 2mm facesheet of glass over a bed of more than 160 actuators to control the deformable surface. COI and IABG (Germany) developed a carbon-fiber, reinforced silicon-carbide, semi-rigid mirror that uses sparse actuation to control radius of curvature and tip, tilt, and piston of the mirror. Ball Aerospace built a beryllium mirror (*see figure above right*), which has recently undergone cryogenic testing at Marshall Space Flight Center to quantify the changes in figure due to temperature. The results are extremely encouraging for the concept of “cryofiguring” where interferograms taken at cryo-temperatures are used to control the last stages of polishing.

The next stage of mirror development will include fabrication and testing of larger demonstration mirrors. Three different technologies were selected for phase II of the Advanced Mirror System Demonstrator (AMSD).



Over the next two years, the three contractors will fabricate, assemble, and test full-size mirror segments, i.e. Raytheon’s “Glass Meniscus”, Kodak’s “Fused Silica”, and Ball’s “Light-weight Beryllium” mirrors. They must demonstrate manufacturing and testing techniques and show that their mirrors will be capable of adjustment once in orbit and be able to work in temperatures that vary from 300 K to 40 K.

**Detectors**

NGST requires detectors with large formats, a low dark current, and minimal readout noise. Candidates for the 0.6 to 5 micron region include indium antimonide (InSb) and mercury-cadmium telluride (HgCdTe) technologies, while arsenic-doped silicon (Si:As) holds the most promise for the longer wavelengths. The technical requirements that these detectors aim to meet are spelled out in the report of the NGST Detector Requirements Panel and summarized on the NGST web page (<http://www.ngst.nasa.gov/cgi-bin/doc?Id=538> and <http://www.ngst.nasa.gov/cgi-bin/doc?Id=641>). For the near-IR (0.6 to 5 microns), both HgCdTe (U. Hawaii/Rockwell Science Center) and InSb (U. Rochester/Raytheon) are being supported as candidate options.

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Through these contracts, multi-chip focal-plane modules will be developed, chip manufacturing will be improved, readout sensitivity will be enhanced, and potential cost drivers and cost savings will be identified. Work also continues at Raytheon and Ames on the mid-IR candidate material, Si:As. Bare readouts of the new SB-226 detector have been evaluated down to 5 K, and optimum lot splits will be identified soon. Prototype 1k x 1k Si:As hybrid arrays (27 micron pixels) have been fabricated, with excellent

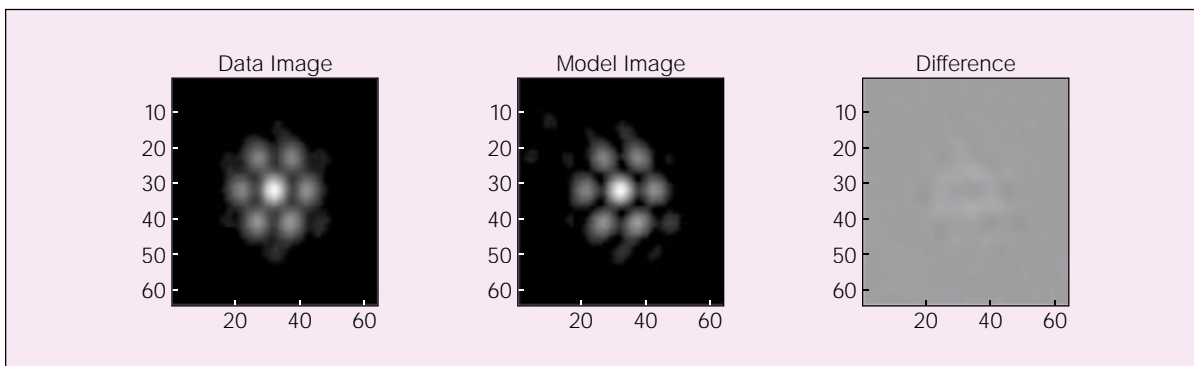
operability. Detailed low-background characterization is continuing.

**Wavefront Control Testbed**

The Wavefront Sensing and Control Testbed (WCT) is a joint project between GSFC and JPL for NGST. Its purposes are to simulate the co-phasing process for NGST, deepen our understanding of all aspects of this process, develop and improve the algorithms for sensing and control of each step, and characterize the effects of various parameters on accuracy, sensitivity, repeatability, and reliability.

WCT1 incorporates a pair of deformable mirrors for injection of controlled aberration and correction. WCT2 incorporates a small, three-segment rigid mirror assembly with tip/tilt and piston correction. The experiment suite for WCT1 is nearly complete (see figure below), and the WCT2 assembly has recently been commissioned with the demonstration of the initial co-phasing.

*This paper is largely based on an NGST flier which was distributed at the last AAS Meeting in San Diego.*



**NGST Town Hall at 198th AAS Meeting in Pasadena**

*Thursday, 7 June 2001, 1:00-2:00pm*

**T**he NGST (Next Generation Space Telescope) Project is entering an exciting new phase, one which offers important opportunities to members of the astronomical community. Having analyzed the performance, cost, and development schedule for the observatory, NASA has initiated the process of selecting the aerospace contractor that will be responsible for the final design and construction of the NGST. Beginning this year, NASA, along with its NGST partner agencies, ESA and the Canadian Space Agency (CSA), will select the scientists that will define and execute the first scientific observations with NGST and will lead and oversee the development of the observatory and its scientific instruments.

This Town Hall will begin with summaries of the project status and the viewpoint of the Interim Science Working Group (Marcia Rieke, *chair*). Senior members of the Project science team will outline the opportunities for leading the development of the Near Infrared Camera and the Mid-Infrared Camera/Spectrograph (a joint ESA/US venture). NASA plans to release an Announcement of Opportunity for these roles, observatory-level scientists, and interdisciplinary scientists on the flight Science Working Group shortly after the summer AAS meeting. We urge those interested in NGST to attend this meeting and will allocate much of the meeting for addressing questions. Before the meeting, please visit the website [www.ngst.nasa.gov](http://www.ngst.nasa.gov). To subscribe to announcements and procurement news about NGST, see the link from the NGST home page or go to <http://www.ngst.nasa.gov/News/lists/index.html>.

Organized by H.S. (Peter) Stockman NGST Study Scientist: [stockman@stsci.edu](mailto:stockman@stsci.edu)

## The Cycle 10 Review Process

Georges Meylan, [gmeylan@stsci.edu](mailto:gmeylan@stsci.edu) and Meg Urry, [cmu@stsci.edu](mailto:cmu@stsci.edu)

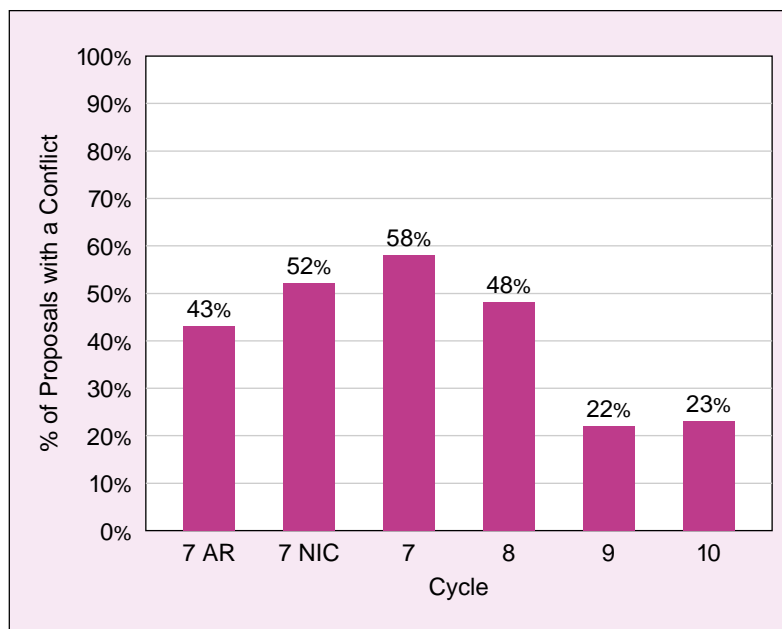
The HST Cycle 10 panels and TAC (Telescope Allocation Committee) met at STScI between November 10 and 19, 2000. The proposal review process was the same as that used a year earlier for Cycle 9, with only minor changes. With the review now fully completed, we have received extensive feedback from the panel and TAC members, as well as from the astronomical community, generally indicating strong approval for the present system and making some useful suggestions for future improvements. We briefly describe the organisation of the review process and provide some practical advice for proposers in future *HST* cycles.

### Towards Science Balance

Before Cycle 9, the balance among scientific sub-disciplines was established by proposal pressure in a sub-discipline, modified slightly by subsequent TAC discussions. Value judgments about the relative importance of any one sub-discipline versus any other were therefore made by a very large committee (of about 25 people in the TAC) representing all fields of astronomy but with little time for in-depth discussions. In Cycles 9 and 10, science balance was instead determined by in-depth discussions of experts in panels that were broader than the old 17-topic panels, but more focussed, and with far more specific expertise in the areas discussed, than the full TAC. The panels allocated all the orbits available for regular programs; the TAC allocated all the orbits available for large programs. The present panels are broad enough to cover several topics but narrow enough to have the requisite scientific expertise with the science in each of these topics.

### Conflicts of Interest

A major goal of the new process is a substantial decrease in the number of conflicts of interest. The proposals



were assigned, according to their scientific categories, to one of nine panels covering five general science areas. To minimise conflicts while still allowing experienced *HST* users to participate in the review process, we assigned two twin panels to each of four science areas, then added the Solar System panel, for which there were too few proposals to split.

As a consequence, the acceptance rate was the same for PIs who served as reviewers and those outside the process. There were also dramatically fewer instances of panelists having to recuse themselves because of conflicts of interest, leading to the constant presence of a larger fraction of panel expertise.

### More Experts

To improve on Cycle 9, we added one more expert in each panel in order to ensure the presence of one expert for each of the scientific categories covered. We were also careful to have one or more theorists per panel. The panel members were chosen to cover the entire mix of science represented

by the submitted proposals. A total of 81 experts participated in the Cycle 10 review.

In spite of the fact that twin panels had very similar scientific expertise, they came up, in a few cases, with some different mixes of science. This is expected in peer review which recognises there is no absolute "correct" way to choose proposals.

### Large and Regular Programs

Twenty-one large programs, requesting 100 orbits or more, were reviewed by the TAC only. They were discussed first before and then after the panel meetings, in order to be able to take into account comments from the expert panelists. Up to 1000 orbits were made available to these large programs and 589 were awarded, to seven programs (cuts were to eliminate duplications). Among the regular programs, requesting 99 orbits or fewer, the medium-size programs, requesting between 15-99 orbits, were favored via orbit subsidies in the review process. To encourage more submissions of large and medium-size programs, these review processes were

*continued page 10*

## Cycle 10 Review *from page 9*

heavily advertised in the Call for Proposals, the STScI *Newsletter*, and on the web.

Once again, the oversubscription rate was very high: about one proposal in five was allocated time. The acceptance rate was essentially independent of the proposal size, i.e., of number of orbits requested. Large programs were allocated eventually about 20 % of the total number of orbits available, as recommended by external advisory committees.

### **Advice for Future Cycles**

The present *HST* review process having achieved most of our goals, we plan to again use this basic structure in future cycles. This means future proposers should keep in mind several key points:

- Do not hesitate to submit Large proposals, if scientifically justified,

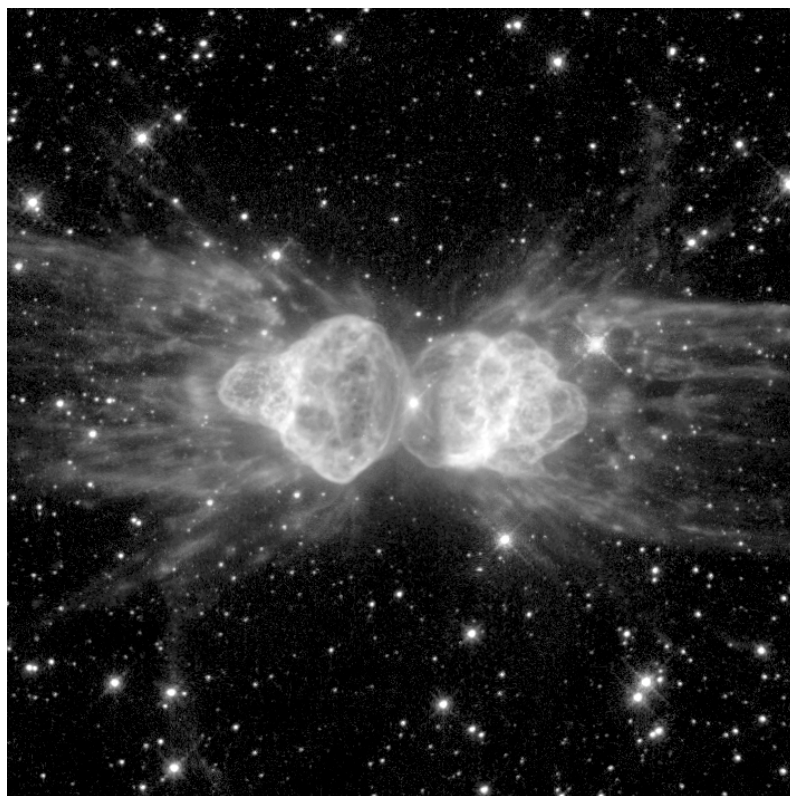
since they have the same chance of success as any other proposal (possibly even better, since in Cycle 10 one 1 in three Large proposals was granted time). The TAC discusses each Large proposal in considerable details so the winning proposals are not only of compelling scientific interest, they are well thought out and involve expert teams.

- Make the effort to address the non-expert present "the big picture". The most successful proposals set the context with sufficient background information and convincingly describe the importance of the investigation to all astronomy. Since this was an explicit criterion for evaluation, proposals could be downgraded for failing to address this point.
- Do not pad your request for time. Fewer than 5 % of the approved proposals were cut (and those only to

avoid duplicate observations): proposers either got the time they asked for or were rejected.

- Start from the science, write a compelling story for your fellow astronomers. Ask for the resources genuinely needed, and submit proposals, whatever their size.

We expect the number of proposals to increase for the next cycle because of the availability of two more instruments: NICMOS and ACS. The past high oversubscription rate (1/5) may therefore be even higher. Many truly excellent proposals have to be rejected, but remember that rejected PIs are in very good company and that many of these proposals, possibly revised according to comments from the panel or TAC, may succeed in future cycles...



### **HST Recent Release: Astro-Entomology? Ant-like Space Structure Previews Death of Our Sun**

*From ground-based telescopes, this cosmic object -- the glowing remains of a dying, Sun-like star -- resembles the head and thorax of a garden-variety ant. But this dramatic Hubble telescope image of the so-called "ant nebula" (Menzel 3, or Mz3) shows even more detail, revealing the "ant's" body as a pair of fiery lobes protruding from the dying star.*

*Image Credit: NASA, ESA and The Hubble Heritage Team (STScI/AURA)*

*Web Address: <http://oposite.stsci.edu/pubinfo/pr/2001/05/>*

## Panels

**Solar System**

Fran Bagenal, Chair, University of Colorado  
 Jim Bell, Cornell University  
 Bill Hubbard, University of Arizona  
 John Davies, Joint Astronomy Center, Hawaii  
 Bill McKinnon, Washington University  
 James Friedson, Jet Propulsion Laboratory  
 Yuk Yung, California Institute of Technology  
 Timothy Dowling, University of Louisville  
 Mike Belton, Nat'l Optical Astronomy Observatory, Tucson

**Galactic 1**

Regina Schulte-Ladbeck, Chair, University of Pittsburgh  
 Robert Blum, CTIO, Chile  
 Dave Arnett, Steward Observatory, University of Arizona  
 Patrick Harrington, University of Maryland  
 Michael Jura, University of California at Los Angeles  
 Susan Trammell, University of North Carolina at Charlotte  
 Carole Haswell, Open University, Milton Keynes (UK)  
 Wesley Traub, Harvard-Smithsonian Center for Astrophysics  
 Kent Honeycutt, Indiana University

**Galactic 2**

Harry Shipman, Chair, University of Delaware  
 Matthew Bobrowsky, Challenger Ctr. for Space Sci. Edu.  
 Lex Kaper, Free University Amsterdam  
 John Dickel, University of Illinois at Urbana-Champaign  
 Dimitar Sasselov, Harvard University  
 Richard Rothschild, University of California at San Diego  
 Silvia Torres-Peimbert, Universidad Autónoma de México  
 Philip Massey, Lowell Observatory  
 Albert Zijlstra, European Southern Observatory (Germany)

**Galactic 3**

Marcia Rieke, Chair, Steward Observatory  
 Neill Reid, University of Pennsylvania  
 Francesco Ferraro, Osservatorio Astronomico di Bologna  
 Tom Ayres, CASA, University of Colorado  
 Neal Evans, University of Texas, McDonald Observatory  
 Marcio Catelan, University of Virginia  
 Bernie McNamara, New Mexico State University  
 Robert Mathieu, University of Wisconsin  
 Jochen Eisloffel, Thuringer Landessternwarte Tautenburg

**Galactic 4**

Alvio Renzini, Chair, ESO, Germany & University of Bologna  
 Shoko Sakai, University of California at Los Angeles  
 Rodrigo Ibata, Max-Planck-Institut fuer Astronomie  
 Michael Sitko, University of Cincinnati  
 Dennis Zaritsky, Steward Observatory  
 Nancy Evans, Smithsonian Astrophysical Observatory  
 Jeffrey Linsky, JILA, University of Colorado  
 Jennifer Wiseman, Johns Hopkins University  
 Lee Hartmann, Harvard-Smithsonian Center for Astrophysics

**Extragalactic 1**

Michael Rowan-Robinson, Chair, Imperial College, London  
 Mitchell Begelman, University of Colorado  
 Chris Pritchett, University of Victoria  
 Hermann-Josef Roeser, Max-Planck-Institut fuer Astronomie  
 Jeff Kenney, Yale University  
 Carole Mundell, John Moores University, Liverpool  
 Karen Leighly, University of Oklahoma  
 Eric Emsellem, University of Lyon  
 Roelof de Jong, University of Arizona

**Extragalactic 2**

Matthew Malkan, University of California at Los Angeles  
 Roger Davies, University of Durham  
 Zlatan Tsvetanov, Johns Hopkins University  
 Tom Statler, Ohio University  
 Jean Brodie, University of California at Santa Cruz  
 Thrinh Thuan, University of Virginia  
 Luis Colina, Instituto de Fisica de Cantabria  
 Mike Eracleous, Pennsylvania State University  
 Elena Pian, ITESRE-CNR, Bologna

**Extragalactic 3**

Hyron Spinrad, Chair, University of California at Berkeley  
 Jill Bechtold, University of Arizona  
 Chris Kochanek, Harvard-Smithsonian Ctr for Astrophysics  
 Erica Ellingson, University of Colorado  
 Ken Lanzetta, State University of New York at Stony Brook  
 Christian Vanderriest, Observatoire de Paris, Meudon  
 Julio Navarro, University of Victoria  
 Peter Garnavich, University of Notre Dame  
 Pieter van Dokkum, California Institute of Technology

**Extragalactic 4**

Wal Sargent, Chair, California Institute of Technology  
 Christine Jones, Harvard-Smithsonian Ctr for Astrophysics  
 John Tonry, University of Hawaii  
 Steve Warren, Imperial College, London  
 Steven Myers, National Radio Astronomy Observatory  
 Theresa Brainerd, Boston University  
 Rafael Guzman, Yale University  
 Laura Ferrarese, Rutgers University  
 Daniel Eisenstein, University of Chicago  
 Scott Tremaine, TAC Chair, Princeton University



CYCLE  
**10**

**Proposals by Country:**

Country	Submitted	Approved
Australia	14	4
Austria	2	0
Belgium	1	0
Canada	18	3
Chile	2	0
France	26	5
Finland	5	0
Germany	31	4
India	3	0
Ireland	4	0
Israel	2	0
Italy	17	1
Korea	1	0
Mexico	1	1
Poland	1	0
Spain	9	1
Sweden	7	0
Switzerland	1	0
Netherlands	4	3
United Kingdom	51	9
United States	706	160
Venezuela	1	0
ESA Proposals	164	26

**US PIs by State:**

State	Submitted	Approved
AL -----	10	0
AZ -----	61	17
CA -----	125	28
CO -----	26	5
CT -----	10	2
DC -----	12	1
DE -----	2	0
FL -----	1	0
GA -----	4	0
HI -----	20	4
IL -----	20	2
IN -----	10	3
KY -----	2	0
LA -----	2	0
MA -----	41	10
MD -----	155	50
MI -----	19	5
MN -----	6	1
NC -----	4	0
NE -----	1	0
NH -----	1	0
NJ -----	12	3
NM -----	8	3
NV -----	3	0
NY -----	33	9
OH -----	12	1
OK -----	4	1
OR -----	3	1
PA -----	36	6
RI -----	1	0
SC -----	3	0
TN -----	5	1
TX -----	15	2
VA -----	10	1
WA -----	12	3
WI -----	17	2
STScI ----	78	28

**Panel and TAC Orbit Trimming by Cycle**

	Median Orbits Submitted	Median Orbits Approved
Cycle 6	12	8
Cycle 7	14	9
Cycle 7N	12	12
Cycle 8	12	10
Cycle 9	15	13.5
Cycle 10	15	13

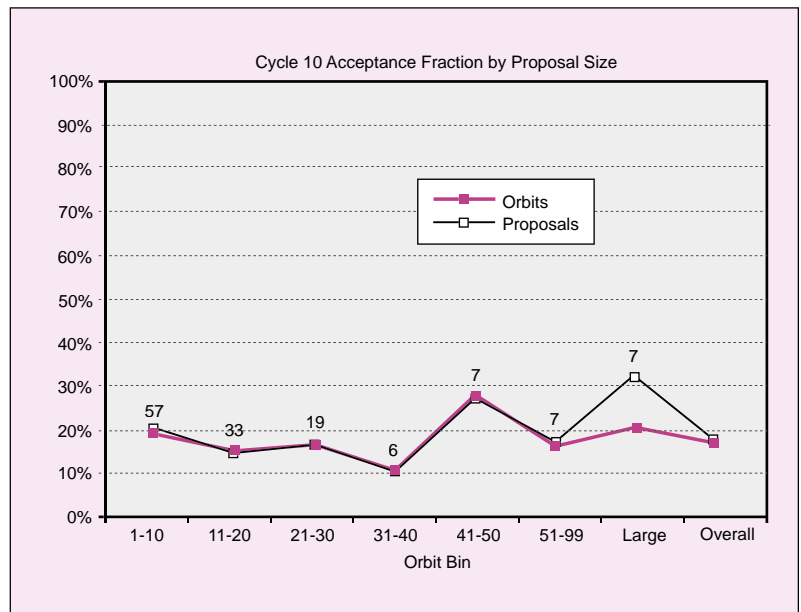
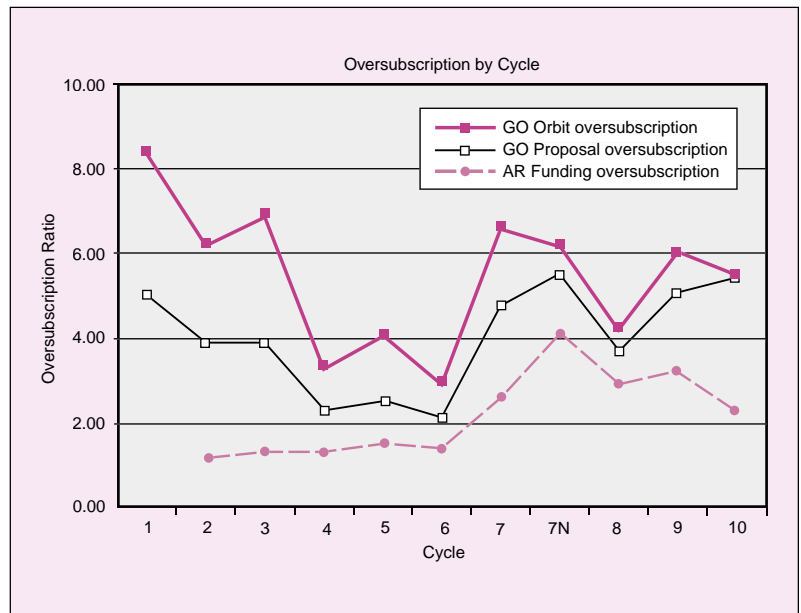
Cycle 6: 174 out of 435 Approved GO programs were trimmed (40%)

Cycle 7: 82 out of 241 Approved GO programs were trimmed (34%)

Cycle 8: 58 out of 231 Approved GO programs were trimmed (25%)

Cycle 9: only 13 out of 145 Approved GO programs were trimmed! (9%)

**Cycle 10: only 10 out of 136 Approved GO programs were trimmed! (7.4%), and these were mostly duplication issues.**





**Summary of Cycle 10 Results**

	<i>Requested</i>	<i>Approved</i>	<i>% Accepted</i>	<i>ESA Accepted</i>	<i>ESA % Total</i>
<b>Proposals</b>					
GO	736	136	18.5%	24	17.5%
SNAP	84	19	22.6%	2	10.5%
AR	87	37	42.5%	—	—
<b>Total</b>	<b>907</b>	<b>192</b>	<b>21.2%</b>	<b>26</b>	<b>13.5%</b>
<b>Primary Orbits</b>	16,236	2,918*	18	442	15.8%

\* Doesn't include 398 Parallel orbits.

	<i>Approved</i>	<i>% Total</i>	<i>Orbits</i>	<i>% Total</i>
<b>Proposals by Instrument*</b>				
FGS	11	6.1%	144	4.7%
STIS / CCD	54	30%	837 + (398)	27.2%**
STIS / MAMA	59	33%	972	31.6%
WFPC2	56	31%	1120	36.4%

\* Includes coordinated parallel as well as multi-instrument proposals.

\*\* Excludes 398 Pure Parallel orbits.

**Cycle 10 Proposal Results by Panel**

	<i>Gal1</i>	<i>Gal2</i>	<i>Gal3</i>	<i>Gal4</i>	<i>Exgal1</i>	<i>Exgal2</i>	<i>Exgal3</i>	<i>Exgal4</i>	<i>SS</i>	<i>TAC</i>	<i>TOTAL</i>
<b>Proposals Submitted</b>											
GO	107	104	95	88	86	80	62	60	33	21	736
SNAP	11	13	8	7	13	15	7	4	6	—	84
AR	5	7	4	13	9	11	12	17	9	—	87
<b>Total</b>	<b>123</b>	<b>124</b>	<b>107</b>	<b>108</b>	<b>108</b>	<b>106</b>	<b>81</b>	<b>81</b>	<b>48</b>	<b>21</b>	<b>907</b>
<b>Proposals Approved</b>											
GO	23	17	17	18	12	14	9	10	9	7	136
SNAP	4	2	1	0	5	2	3	1	1	—	19
AR	1	5	1	7	3	5	4	7	4	—	37
<b>Total</b>	<b>28</b>	<b>24</b>	<b>19</b>	<b>25</b>	<b>20</b>	<b>21</b>	<b>16</b>	<b>18</b>	<b>14</b>	<b>7</b>	<b>192</b>

**Cycle 10 Orbit Results by Panel**

	<i>Gal1</i>	<i>Gal2</i>	<i>Gal3</i>	<i>Gal4</i>	<i>Exgal1</i>	<i>Exgal2</i>	<i>Exgal3</i>	<i>Exgal4</i>	<i>SS</i>	<i>TAC</i>	<i>TOTAL</i>
<b>Submitted</b>											
	1490	1608	1747	1608	2036	1395	1733	1610	379	2630	16236
<b>Approved</b>											
	269	325	259	257	341	268	241	256	113	589*	2918
<b>Panel Fraction of Total Approved</b>											
	9.20%	11.10%	8.90%	8.80%	11.70%	9.20%	8.30%	8.80%	3.90%	20.20%	—
<b>Fraction of Orbits Approved/Submitted</b>											
	18.10%	20.20%	14.80%	16%	16.70%	19.20%	13.90%	15.90%	29.80%	22.40%	18%

Approved Observing Programs for Cycle 10

**Galactic Programs**

Bahcall	GO	Institute for Advanced Study	Observing the Next Nearby Supernova
Balick	GO	University of Washington	Outflow Collimation in Bipolar Symbiotic Nebulae
Bally	GO	University of Colorado	Are there Large Dust Grains in Orion's Proto-Planetary Disks?
Benedict	AR	University of Texas at Austin	Calibrating the Optical Field Angle Distortions of FGS1r
Benedict	GO	University of Texas at Austin	FGS Astrometry of the Extrasolar Planet of Epsilon Eridani
Bennett	GO	University of Colorado	Mapping the Chromosphere of the K Supergiant in the Eclipsing Binary 31 Cygni
Bianchi	GO	The Johns Hopkins University	The UV interstellar extinction in nearby galaxies: M33
Blair	GO	The Johns Hopkins University	Transition from Non-radiative to Radiative Shocks in the Cygnus Loop
Bond	AR	Space Telescope Science Institute	Post-AGB Stars and the Population II Distance Ladder
Bond	GO	Space Telescope Science Institute	Sakurai's Nova-like Object: Real-Time Monitoring of a Stellar Thermal Pulse
Bond	GO	Space Telescope Science Institute	Dynamical Masses of White Dwarfs from Resolved Sirius-Like Binaries
Bowen	SNAP	Princeton Observatory	A SNAPshot Survey of Absorption Lines from High Velocity Clouds in the Milky Way
Bregman	GO	University of Michigan	Ultraluminous X-Ray Sources and Intermediate Mass Black Holes
Brown	GO	Goddard Space Flight Center	The Late Evolution of Low-Mass Stars: a Deep UV Color-Magnitude Diagram of M32
Calvet	GO	Smithsonian Astrophysical Observatory	Accretion in the planet-forming disks of the TW Hya association
Cameron	GO	University of St Andrews	The densely spotted photospheres of active cool stars
Charbonneau	GO	Harvard-Smithsonian Center for Astrophysics	Direct Detection of an Extrasolar Planet in Reflected Light
Charlton	AR	The Pennsylvania State University	Looking Out From the Galaxy
Cordes	GO	Cornell University	Evolution of the Bow Shock in the Guitar Nebula
Corradi	GO	Isaac Newton Group of Telescopes	Expansion distances to the symbiotic Miras He 2-104 and He 2-147
Crotts	GO	Columbia University	The UV Light Echo of Shock Breakout During SN 1987A
Davidson	GO	University of Minnesota	Critical spectroscopic variations in Eta Carinae
Deliyannis	GO	Indiana University	Boron Constraints on Slow Mixing in Low Mass Stars
Deliyannis	GO	Indiana University	Boron in G64-12: Higher Big Bang Lithium or Signature of the Nu-Process?
Dfissen	GO	Université Laval	Physical Parameters of the Erupting Luminous Blue Variable NGC 2363-V1
Dufton	GO	Queen's University of Belfast	The iron abundance in the Magellanic Clouds and Bridge
Evans	GO	Center for Astrophysics	Cepheid Masses: Y Car
Garcia	GO	Smithsonian Astrophysical Observatory	Black Hole X-ray Transients and X-ray Binaries in M31
Garnavich	SNAP	University of Notre Dame	Light Echoes and the Nature of Type Ia Supernovae
Garnett	GO	University of Arizona	Giant H II Regions and the Connection with Starbursts and Diffuse Ionized Gas
Grady	GO	Eureka Scientific	T Tauri Star Coronagraphic Survey: A PMS Protoplanetary Disk Census
Grindlay	AR	Harvard-Center for Astrophysics	A Complete Study of Binaries and X-ray Sources in the Globular Cluster 47 Tucanae
Groot	GO	Harvard-Smithsonian Center for Astrophysics	The Distances to AM CVn stars
Guinan	GO	Villanova University	LMC Eclipsing Binaries with Cepheid Components: The Key to the Extragalactic Distance Scale
Guinan	GO	Villanova University	The Best Brown Dwarf Yet?: FGS Astrometry of the Companion to the Hyades Eclipsing Binary V471 Tau
Gull	AR	Goddard Space Flight Center	Characterizing the CCD Spectroscopic Point Spread Function in STIS
Harrington	GO	University of Maryland	NGC 2610: A Benchmark for Photoionization Physics
Harrison	GO	New Mexico State University	FGS Parallaxes of Cataclysmic Variables: Understanding Their Peculiar Secondary Stars
Hawley	GO	University of Washington	Transition Region Emission in Very Low Mass Stars

## Approved Observing Programs for Cycle 10

Heap	GO	Goddard Space Flight Center	Solar UV Radiation and the Origin of Life on Earth
Hester	GO	Arizona State University	Evolution of Star Forming Environments in H II Regions
Hinkle	GO	NOAO	V605 Aql: Sakurai's older brother
Holberg	AR	University of Arizona	An Archive Analysis of a Decade of HST White Dwarf Spectra
Holtzman	AR	New Mexico State University	Comparisons of Local Group Stellar Populations: Construction of a Public Database
Horch	GO	Rochester Institute of Technology	The Masses and Luminosities of Population II Stars
Hawk	GO	The Johns Hopkins University	Understanding the Warm Ionized Medium of the Galactic Halo
Johns—Krull	GO	University of California	Resolving Molecular Hydrogen Disks Around T Tauri Stars
Jordan	GO	Universitaet Kiel	Calibrating convection efficiency with quasi-molecular features in magnetic white dwarfs
Jura	GO	University of California, Los Angeles	Circumstellar Gas Around HR 4796A
Kenyon	GO	Smithsonian Astrophysical Observatory	The Black Hole (?) in BG Gem
King	GO	University of California, Berkeley	Trigonometric Parallax of the Globular Cluster 47 Tucanae
Kirshner	GO	Harvard College Observatory	SINS: The Supernova Intensive Study—Cycle 10
Knezek	GO	Space Telescope Science Institute	The Evolution of Extreme Gas Rich Galaxies
Koenigsberger	GO	UNAM-Instituto de Astronomia	The Wind-Wind Interactions in HD 5980
Lawrence	AR	Hofstra University	HST Archival Imaging of the Light Echo of SN 1987A
Lecavelier des Etangs	GO	Institut d'Astrophysique de Paris, CNRS	Spatial distribution of the gas inside the Beta Pic disk
Lennon	GO	Isaac Newton Group Telescopes	Understanding high-redshift and starburst galaxies: A UV spectroscopic survey of B-stars in the SMC
Livio	GO	Space Telescope Science Institute	Imaging the Dust Disk around Epsilon Eridani
Lundqvist	GO	Stockholm Observatory	Spectrum and pulse profile of PSR 0656+14 in the near-UV
Maiz-Apellaniz	GO	Space Telescope Science Institute	Objective-Prism Spectroscopy of Massive Young Clusters
Malumuth	AR	Raytheon ITSS/Goddard Space Flight Center	Using the HST Archive to Study the Optical Counterparts of Chandra X-ray Point Sources
Marsh	GO	Southampton University	The Evolution of Cataclysmic Variable Stars
Martin	GO	Institute for Astronomy	Fundamental properties of L-type dwarfs in binaries
Massa	GO	Raytheon ITSS	Determination of the Distances and Masses of 3 Galactic Cepheids
Massey	GO	Lowell Observatory	The Mass-Luminosity Relationship for High Mass Stars: Resolving the 'Mass Discrepancy' with HST
McNamara	GO	New Mexico State University	Getting to the Core of The Matter: The Inner Region of M15
Mirabel	GO	CEA-Service de Astrophysique	Is GRO J1655-40 a runaway Black Hole?
Nelan	GO	Space Telescope Science Institute	The Post-CE Status of the Massive WD Binary LB11146
Nelan	SNAP	Space Telescope Science Institute	An Interferometric Harvest of Double Degenerates
O'Brien	GO	Space Telescope Science Institute	Test of a New Observational Method for Stellar Seismology
O'Dell	GO	Vanderbilt University	Fine Scale Temperature Fluctuations in Gaseous Nebulae
Padgett	SNAP	California Institute of Technology	Disks and Envelopes of Nearby Nebulous Young Stellar Objects: A Snapshot Survey
Pavlov	GO	Pennsylvania State University	The Spectrum and the Light Curve of the Nearest Millisecond Pulsar
Romani	AR	Stanford University	Diagnosing the UV Pulse of the Crab: HST Spectropolarimetry in Context
Romani	GO	Stanford University	The Thermal Glow of Gamma Ray Pulsars
Saha	AR	NOAO	Faint Photometric Standard Fields for HST
Sahai	GO	Jet Propulsion Laboratory, Caltech	A YSO-like pulsed astrophysical jet and bipolar nebula in a dying star: WFC2/STIS study of He2-90
Sahai	GO	Jet Propulsion Laboratory, Caltech	High-Velocity Collimated Outflows and Equatorial Toroids in Cool Stars: A Study of V Hydrae and $\pi^1$ Gru
Sahai	SNAP	Jet Propulsion Laboratory, Caltech	Toward Understanding the Bipolar Geometries of Preplanetary Nebulae with High-Velocity Polar Flows

Approved Observing Programs for Cycle 10

Sahu	AR	Goddard Space Flight Center	Determining D/H Ratios and Physical Conditions in Local Interstellar Gas Using White Dwarf Probes
Schultz	GO	Space Telescope Science Institute	High Speed Photometry of the Transiting Planet HD 209458b
Shaw	SNAP	Space Telescope Science Institute	Survey of the LMC Planetary Nebulae
Smartt	GO	Institute of Astronomy	Direct imaging of the progenitors of massive, core-collapse supernovae
Smartt	SNAP	Institute of Astronomy	An archive to detect the progenitors of massive, core-collapse supernovae
Soderblom	GO	Space Telescope Science Institute	Completing the Astrometric Orbit for a Pair of Pre-Main Sequence Low-Mass Stars
Stanghellini	GO	Space Telescope Science Institute	Planetary Nebulae in the LMC: a study of stellar evolution and Populations.
Stapelfeldt	GO	Jet Propulsion Laboratory	Resolving New Examples of Edge-on Young Stellar Object Disks
van Kerkwijk	GO	Utrecht University	Optical Counterparts of Isolated Neutron Stars
van Zee	GO	Herzberg Institute of Astrophysics	The Stellar Population of UGCA 292, An Extreme Low Metallicity Galaxy
Vida-Madjar	GO	Institut d'Astrophysique de Paris, CNRS	HI Detection of an Extra-Solar Planetary Atmosphere
Welsh	GO	San Diego State University	Flares, Magnetic Reconnections and Accretion Disk Viscosity
Welly	GO	University of Chicago	Variable Interstellar Absorption toward HD 219188 — Probing the Structure of an Interstellar Cloud
Wiseman	GO	The Johns Hopkins University	Helical Flows and Rotation in Protostellar Jets
Woodgate	AR	Goddard Space Flight Center	The Deep Coronagraphic STIS Point Spread Function
Yusef-Zadeh	GO	Northwestern University	A WFPC2 Study of Proplyds and a Protostellar Condensation at the Center of M20
Zurek	AR	American Museum of Natural History	The Stellar Populations Archive: Globular Clusters

Large Programs

Fruchter	GO	Space Telescope Science Institute	The Origin and Physics of Gamma-Ray Bursts
Kulkarni	GO	California Institute of Technology	Gamma-ray burst progenitors: probing their environment
Perimutter	GO	Lawrence Berkeley Laboratory	Cosmological Parameters from Type Ia Supernovae at High Redshift
Sahu	GO	Space Telescope Science Institute	A Census of Planets in the Globular Cluster M22 and the Galactic Bulge
Schmidt	GO	The Australian National University	Tracing the Cosmic Expansion to $z > 1$ with Type Ia Supernovae
Tripp	GO	Princeton University Observatory	A Survey for Missing Baryons in Highly Ionized Intergalactic Gas at Low Redshift
Windhorst	GO	Arizona State Univ., Physics & Astronomy	Closing in on the Hydrogen Reionization Edge of the Universe at $z < 7.2$ with deep STIS/CCD Parallels

Solar System Programs

Bell	GO	Cornell University	A Global Search for Alteration Minerals on Mars
Brown	GO	Caltech	A Search for Kuiper Belt Object Satellites
Cruikshank	GO	Ames Research Center	Composition of Saturn's rings, and its variation with location
Evans	AR	Gibbel Corporation	Asteroid Trails in the HST Archive II
Feldman	GO	The Johns Hopkins University	Spectroscopic Imaging of the Atmosphere of Callisto
Karkoschka	GO	University of Arizona	Spatially Resolved Spectroscopy of Uranus and Neptune
Krasnopolsky	AR	The Catholic University of America	Middle Ultraviolet Spectroscopy of Pluto and Charon
McGrath	AR	Space Telescope Science Institute	Io's UV Emissions, 1994-1996
Merline	GO	Southwest Research Institute	UV/Visible Spectroscopy of Asteroid 762 Pulcova and its Newly-discovered Moon
Noll	SNAP	Space Telescope Science Institute	Photometry of a Statistically Significant Sample of Kuiper Belt Objects

Approved Observing Programs for Cycle 10

Spencer	GO	Lowell Observatory	Io's Prometheus Plume and the Composition and Spatial Distribution of Io's Atmosphere
Sromovsky	AR	University of Wisconsin-Madison	The structure of Neptune's zonal bands
Stern	GO	Southwest Research Institute	Observations of Comet Borrelly to Support the New Millennium/DS1 Flyby Occurring 23 September 2001
Weaver	GO	The Johns Hopkins University	UV Spectroscopic Investigation of a Bright, Newly Discovered Comet

**Extragalactic Programs**

Arav	AR	UC Davis	AGN outflows: Ionization Equilibrium and Abundances in Seyfert UV absorbers
Baldwin	AR	Michigan State University	Probing the High Redshift Universe with Quasar Emission Lines
Bechtold	GO	University of Arizona, Steward Observatory	Molecular Hydrogen in the Damped LyAlpha Absorber of Q1331+170
Bechtold	GO	University of Arizona, Steward Observatory	The Pattern of Heavy Element Abundances in a Damped LyAlpha Galaxy
Becker	GO	University of California, Davis	Identifying Damped Lyman-alpha Galaxies at z~1
Bershady	GO	University of Wisconsin-Madison	Galaxy Mass and the Fate of Luminous, Blue Compact Galaxies at z~0.6
Bertola	GO	Dipartimento di Astronomia, Università di Padova	Accurate determination of the BH mass in early-type disk galaxies
Bretta	GO	Space Telescope Science Institute	Proper Motions in Extragalactic Optical Jets
Boeker	SNAP	Space Telescope Science Institute	A Census of Nuclear Star Clusters in Late-Type Spiral Galaxies: II - Spectroscopy and Stellar Populations
Brown	GO	Goddard Space Flight Center	Star Formation Triggers and Chemical Reprocessing in I Zw 18
Bureau	GO	Sterrewacht Leiden	Black Holes and Bars: A Recipe for Making Bulges?
Calzetti	GO	Space Telescope Science Institute	Calibrating Star Formation: The Impact of Environment
Chandar	AR	The Johns Hopkins University	Are Young Globular Clusters Forming in Quiescent Spiral Galaxies?
Chapman	GO	Carnegie Observatories	Using Optically Faint Radio Sources to Pinpoint Dusty Proto-galaxies
Connolly	AR	University of Pittsburgh	Galaxy Spectral Energy Distributions at High Redshift
Crotts	AR	Columbia University	Transverse Structure in the Lyman Alpha Forest and a Program to Measure the Cosmological Constant
Djorgovski	SNAP	California Institute of Technology	A Snapshot Survey of the Optically Selected Type-2 Quasars
Dolphin	AR	National Optical Astronomy Observatories	Properties of Young Clusters in Spiral Galaxies
Dunlop	GO	University of Edinburgh	Measuring the masses of high-z quasar host galaxies
Ebeling	GO	Institute for Astronomy	Measuring the mass distribution in the most distant, very X-ray luminous galaxy cluster known
Ellis	SNAP	California Institute of Technology	Imaging the Host Galaxies of High Redshift Type Ia Supernovae
Elmegreen	AR	Vassar College	Archival Study of Acoustic Nuclear Spirals in Galaxies
Eriben	GO	Max-Planck-Institut f. Astrophysik	Resolving the Puzzling Dark Mass Concentration in Abell 1942
Falco	GO	Smithsonian Astrophysical Observatory	HST Imaging of Gravitational Lenses
Ferguson	GO	Space Telescope Science Institute	Investigating the Formation History of Spiral Galaxy Halos
Ferruit	GO	CRAL — Observatoire de Lyon	Probing the structure of the shocks in the narrow line region of M 51
Gladders	GO	University of Toronto	A New High-z Galaxy Cluster with Extraordinary Lensed Arcs From Multiple Sources
Gregg	SNAP	University of California, Davis	A Next Generation Spectral Library of Stars
Halpern	GO	Columbia University	Tidal Disruption of Stars by Massive Black Holes in Galaxy Nuclei: After the Flare
Hammer	GO	DAEC, Observatoire de Paris-Meudon	The nature of the most luminous star-forming galaxies in the redshift range 0.4 to 1.5
Hines	SNAP	The University of Arizona	Host Galaxies of Obscured QSOs Identified by 2MASS
Hogan	AR	University of Washington	Demography of High Redshift Type Ia Supernovae and Their Progenitor Populations
Im	SNAP	University of California, Santa Cruz	STIS UV Snapshot Observation of Nearby Star Forming Galaxies
Impey	GO	University of Arizona	Host Galaxies of Gravitationally Lensed Quasars

Approved Observing Programs for Cycle 10

Impey	GO	University of Arizona	Quasar Absorbers and Large Scale Structure
Koo	AR	University of California	HST + Keck Study of Disk Systems in Galaxy Cluster C10024+16 at Redshift $z = 0.39$
Koo	AR	University of California, Santa Cruz	The Ages of Very Red Spheroids and Bulges and Associated Disks at Redshifts $z \sim 0.8$
Koratkar	SNAP	Space Telescope Science Institute	Variability in the UV Spectrum of 3C 279: Testing Models for the Gamma-Ray Emission in Blazars
Kriss	GO	Space Telescope Science Institute	Simultaneous HST, Chandra and FUSE Observations of Intrinsic Absorbers in AGN
Kundu	AR	Yale University	The Dynamical Evolution of the Globular Cluster System of M87
Leighly	GO	The University of Oklahoma	Exploratory Observations of a New Bright Quasar
Letherer	GO	Space Telescope Science Institute	An Ultraviolet Spectroscopic Survey of Star-Forming Galaxies in the Local Universe
Leonard	GO	University of California at Berkeley	The Cepheid Distance to NGC 1637: A Direct Comparison with the EPM Distance to SN 1999em
Miller	GO	University of Michigan	O VI Gas as an Indicator of the Diffuse Web of Baryons
O'Connell	GO	University of Virginia	Spatially Resolved Spectroscopy of Super Star Clusters in the M82 Starbursts
Perlman	GO	University of Maryland, Baltimore County	The Structure and Physics of Extragalactic Jets
Pettini	GO	Institute of Astronomy	The $z = 0.93$ DLA in the Gravitationally Lensed QSO HE 0512-3329: a Test of Dust Bias in DLA Samples
Pogge	GO	The Ohio State University	STIS Spectrophotometry of Nearby Seyfert 2 Nuclei: Can we eliminate the Seyfert 2 class?
Rathatunga	AR	Carnegie Mellon University	Cosmic Shear at Cosmological Distances
Rauch	AR	Carnegie Observatories	Constraints on the Metal Enrichment History from Observations of Highly Ionized Gas
Reimers	GO	Hamburger Sternwarte	Baryons in intermediate redshift ( $z > 1$ ) OVI absorbers
Rich	GO	University of California at Los Angeles	High Spatial Resolution Spectroscopy of the Massive Globular Cluster G1
Richstone	GO	University of Michigan	The Fundamental Plane for Nuclear Black Holes
Richstone	GO	University of Michigan	The Biggest Black Holes
Ridgway	AR	The Johns Hopkins University	Radio-quiet Quasar Hosts from $z = 0.3$ to $z = 3$
Sarajedini	AR	Wesleyan University	AGN in the Groth Survey Strip: A Variability Study
Sasselov	AR	Harvard-Center for Astrophysics	Pushing the limits of variable stars detection with HST
Smith	GO	University of Arizona	The Ultraviolet Properties of Obscured QSOs
Stoeckle	AR	University of Colorado, Boulder	Determining the Statistical Properties of the Local Ly-alpha Forest
Tonry	GO	Institute for Astronomy	Cepheid Distances to Early-type Galaxies
Treu	AR	Space Telescope Science Institute	The Fundamental Plane of field early-type galaxies from $z \sim 0.7$ to $z=0$
Tully	SNAP	University of Hawaii	Local Galaxy Flows and the Local Mass Density
Urry	AR	Space Telescope Science Institute	The Host Galaxies of Radio-Loud AGN: Removing the Luminosity-Redshift Degeneracy
Urry	GO	Space Telescope Science Institute	The Physics of X-Ray/Optical Jets
Urry	GO	Space Telescope Science Institute	Evolution of the Host Galaxies in Low-Power AGN
Verdoes Kleijn	GO	Leiden Observatory	Kinematics of emission-line gas disks in radio-quiet galaxies
Webb	GO	University of New South Wales	D/H in Lyman Limit absorbers with simple velocity structure
Webb	SNAP	University of New South Wales	A Lyman Limit snapshot survey: the search for candidate D/H absorbers
Webster	GO	University of Melbourne	Microarcsecond Imaging of a Gravitationally Lensed QSO: 2237+0305
Willott	GO	University of Oxford	The Relationship Between Radio Luminosity and Radio-Loud AGN Host Galaxy Properties
Wilson	GO	University of Maryland	Synchrotron self-Compton Emission from the Radio Hot Spots of Cygnus A
Windhorst	SNAP	Arizona State University	Mid-UV SNAPSHOTS Survey of Nearby Irregulars: Galaxy Structure and Evolution Benchmark
Wisotzki	GO	Institut fuer Physik, Universitaet Potsdam	A Damped LyAlpha System in a Close Separation Lens
Zheng	SNAP	The Johns Hopkins University	UV Detectability of Bright Quasars in the Sloan Fields
Zirm	GO	The Johns Hopkins University	Fossil Gaseous Halos of Massive Galaxies at $z \sim 1$

## PyRAF: a Python-based command language for IRAF

Perry Greenfield and Richard L. White, [greenfield@stsci.edu](mailto:greenfield@stsci.edu)

Both STScI programmers and *HST* users would benefit from tools that would make it easier to develop more powerful, flexible, and user-friendly data analysis software. We believe, however, that any effort to enhance or replace our software environment cannot succeed unless we retain the ability to use the great variety of useful tasks that already exist in IRAF, STSDAS, and TABLES.

The cornerstone of the Science Software Group's plans for the future is our project to develop a new command language for the IRAF environment. We've based the new command language on Python, a free, portable, object-oriented scripting language. The new command language, PyRAF, is itself written almost entirely in Python, and PyRAF scripts are Python scripts. The new command language provides a number of advantages: it has an improved interactive environment, much more powerful scripting capabilities, and the ability to integrate 3rd party non-IRAF-based software and libraries far more easily. Eventually, we intend to add IDL-like array manipulation, plotting, and image display capabilities. It is our hope that ultimately we (and many of our users) will write most applications in PyRAF rather than C, Fortran, or SPP.

We chose Python over other, better-known scripting languages primarily because it is easier to learn and read, has better support for interactive use, and is better suited to writing large applications. Even though it is not the most widely used language, Python is well established and has a sizable user base that is growing rapidly. Python is heavily used by many businesses, including Hewlett-Packard, Lawrence Livermore National Laboratory, Google, and Industrial Light and Magic. By basing our command language on a well-supported scripting language, we benefit enormously from its large developer community and the

extensive libraries available for it. While for our users this does mean learning another language, it is a language that has general use well beyond astronomical data reduction. Python can be used in place of shell scripts, awk, Perl, and similar tools.

The PyRAF interactive environment is intentionally very similar to the existing IRAF CL. In fact, with very few exceptions, IRAF tasks can be invoked from the command line with exactly the same syntax as is used in IRAF CL. (Only PyRAF scripts must use Python syntax.) Nearly all IRAF tasks and scripts can be run, including those that use IRAF-compatible image display programs. PyRAF fully supports IRAF interactive graphics tasks. All IRAF hardcopy graphics devices are available.

PyRAF's enhanced interactive environment includes a number of conveniences not available in the standard IRAF CL:

- Command line recall using the arrow keys
- Command and filename completion using the tab key
- A GUI-based parameter editor
- A GUI help window available simultaneously with the parameter editor
- Multiple graphics windows and the ability to recall previous plots
- Improved window focus handling

As a scripting environment, PyRAF has a number of significant advantages:

### *Error handling*

- IRAF CL scripts die if any task fails and do not indicate where it stopped. On the other hand, Python has excellent exception handling. Untrapped errors result in a message indicating on which line in the script the error occurred, and exceptions

can be caught and handled within the scripts. PyRAF can even be used to debug IRAF CL scripts!

### *A scripting language that provides:*

- Ease of learning and comprehension.
- Convenient and useful data structures such as lists and dictionaries.
- Rich string manipulation and pattern-matching facilities (including Unicode).
- Well designed object-oriented capabilities (while still allowing simple procedural scripts or programs.)
- Extensive documentation and support. In addition to the good documentation provided with Python, many books on Python have been published (more than 20 at last count with more on the way). The developer community provides a wealth of information and help through usenet news groups and mailing lists. Commercial support is available.

### *Numerous libraries including:*

- Graphical User Interface tools.
- OS access (file and directory manipulation, system environment, etc.).
- Internet and networking tools (HTML & XML parsing, mail handling, ftp and telnet, etc.)
- Profiling and debugging modules.

*Ability to link in existing C, C++, or Fortran code.*

PyRAF provides an excellent means of integrating non-IRAF software (astronomical or otherwise) with IRAF tasks.

PyRAF has been available internally at STScI and at a few test sites since spring 2000. The Science Software Group released a generally available

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## Project Scientist's Report

D. Leckrone, GSFC, [dleckrone@hst.nasa.gov](mailto:dleckrone@hst.nasa.gov)

### Servicing Mission 3B

**O**n September 28, NASA formally announced the selection of the four astronauts who will conduct the five EVAs currently planned for the next *HST* servicing mission, STS-109. This is a very strong group, well up to the challenges posed by Servicing Mission 3B. The crew is led by Hubble servicing veteran (and high-energy astrophysicist) John Grunsfeld. John has flown on three previous shuttle flights. In December 1999, he performed two spacewalks to service Hubble during servicing mission 3A (STS-103). In practice runs in the Neutral Buoyancy Laboratory at Johnson Space Center in Houston, John has developed the techniques for changing out Hubble's Power Control Unit (PCU). His work has given us high confidence that this challenging maintenance task can be carried out safely and successfully in less than one EVA. We're feeling a lot better about it!

Joining John Grunsfeld are two other veteran astronauts, Jim Newman and Richard Linnehan, and one rookie, Mike Massimino. Newman, whose Ph.D. is in Physics, has flown on three shuttle missions since 1993. In 1998 he performed three spacewalks on the first International Spacestation assembly mission. Interestingly, Linnehan's background is as a

veterinary surgeon and his previous two shuttle flights have focussed on Life Sciences experiments. It is said that, when Richard was first contacted about his selection for the next Hubble repair mission, he was in Southeast Asia attaching prosthetic limbs to elephants whose legs had been blown off by land mines! Clearly he brings a lot of experience to our mission in applying fine manual dexterity to large, bulky objects - perfect for *HST* servicing!! Although STS-109 will be Mike Massimino's first shuttle flight, he has proven to be one of the most accomplished EVA trainees in a rigorous testing program organized by John Grunsfeld. Mike holds a Ph.D. in Mechanical Engineering.

SM3B will initiate an exciting time for astronomy. The new Advanced Camera for Surveys (ACS) will finally get its chance to show us its mettle with over twice the field of view of WFPC2, sampled with PC-like angular resolution, and with substantially greater throughput. And with the experimental new technology of the NICMOS cryocooler, we have reasonable prospects for reviving Hubble's near-infrared capabilities. After replacing the current solar arrays with smaller, more efficient rigid arrays, we will be leaving Hubble with plenty of electrical power for the remainder of the mission (as well as a "new look"). And the changeout of the aforementioned Power Control Unit

will assure that we can take full advantage of all those watts without fear of a major electrical system failure in the future.

Now that our EVA crew has been named, we are able to establish a launch-readiness date of October 15, 2001 for the SM3B mission. However, there remain some uncertainties about the availability of Space Shuttle Columbia in this time frame. Currently Columbia is undergoing a major overhaul in Palmdale, CA. This includes extensive repairs of wiring problems, similar to those carried out recently on all the other orbiters in the fleet. The longer than expected repair process could force a further delay in SM3B to February or March of 2002. However, our colleagues at NASA Headquarters are currently trying to negotiate a "swap" of launch dates with another mission that is now ahead of us in the queue for flight on Columbia so as to prevent such a delay. Launch delays are especially bad news for the *HST* (and Office of Space Sciences) budget. Previous launch slips have cost the *HST* program many millions of dollars, drawn from our contingency funds. Any future slips would threaten our ability to pay for future instruments, WFC3 and COS. Needless to say, we wish Code S all the best in attempting to stem this serious drain on the resources available for *HST*.

### PyRAF from page 19

beta version in January 2001. We are still improving the installation process; the current beta version is easily installed on Solaris or Linux systems but requires more effort on other systems. We will eventually support all platforms on which STSDAS is supported. (Note that Python itself also

runs on platforms not supported by IRAF, such as Windows and MacOS.) While we will continue to enhance the IRAF features of PyRAF, we have also started work on the IDL-like capabilities. This includes a full-functioned FITS I/O module, improved array manipulation facilities, and plotting

and display tools. Finally, we have begun developing our own scripts and applications in PyRAF, including a new drizzle script that will be much more powerful and flexible than the current CL script. More information about PyRAF is available at <http://pyraf.stsci.edu>.

## Advanced Camera for Surveys (ACS)

Mark Clampin, [clampin@stsci.edu](mailto:clampin@stsci.edu)

The Advanced Camera for Surveys (ACS) is the next generation of imaging instrumentation for the Hubble Space Telescope (*HST*). ACS has three imaging channels optimized for wide field, near-UV and far-UV imaging. The Wide Field Channel (WFC) will offer a  $\sim 200 \times 200$  arcsec field of view with peak throughput of  $\sim 40\%$ , including the OTA. The near-UV channel is optimized for imaging in the near-UV and features fully sampled imaging in the visible (0.025 arcsec/pixel). The Solar Blind Channel (SBC) is optimized for far-UV imaging and low dispersion spectroscopy ( $R \sim 100$ ).

ACS has completed integration of its flight detectors and has recently completed the process of image alignment checking. It has also started with its ground calibrations. During these tests, internal and external flat fields will be obtained for all detector and filter combinations so that a pre-launch calibration of ACS can be developed in the coming months. The instrument will now be delivered to the Goddard Space Flight Center where it will start a series of final tests, including a thermal-vacuum test. Due to a re-evaluation of the Servicing Mission 3B schedule, it has been necessary to drop the installation of the Aft-Shroud Cooling System (ASCS) until Servicing Mission 4 (SM4). Consequently, ACS will run for the first two years using only passive cooling within the aft-shroud of *HST*. Thermal modeling suggests that this would not be a problem for ACS until after SM4, when the Cosmic Origins Spectrograph (COS) is installed. The CCD detectors will initially only run a degree or two warmer resulting in little change in the dark current rates for the first few years of science operations. The thermal-vacuum test will validate the instrument's performance in this new thermal environment. Following SM4, ACS will operate with the external radiator installed as part of the ASCS.

The ACS will be offered to GOs for the first time in Cycle 11. Current details on the instrument's expected performance are summarized in the ACS Instrument Handbook, with late-breaking news on the ACS web pages.

## Near-Infrared Camera and Multi-Object Spectrometer (NICMOS)

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NICMOS, the Near-Infrared Camera and Multi-Object Spectrometer, is a cryogenic instrument and provides the only infrared capability currently on board *HST*. NICMOS operated successfully from February, 1997 to January, 1999 (Cycles 7 and 7N), using solid  $N_2$  ice as a coolant. NICMOS has been inactive since January 3, 1999, after depletion of the  $N_2$ . The instrument will be re-activated with an active cooling system (the NICMOS Cooling System) during servicing mission SM3B, currently scheduled for the end of 2001.

NICMOS offers imaging, spectroscopic, polarimetric, and coronagraphic capabilities at infrared wavelengths (0.8 to 2.4 microns) in three cameras, NIC1, NIC2, and NIC3. The three cameras have different magnification factors, with Field of Views of  $11 \times 11$  arcsec,  $19.4 \times 19.4$  arcsec, and  $51.2 \times 51.2$  arcsec, and pixel sizes of 0.043, 0.076, and 0.20 arcsec, respectively. Two of the three cameras, NIC1 and NIC2, are nearly parfocal, and can be used for simultaneous observations; their Fields of View are about 33 arcsec apart. NIC3 has a separate focus, and when operations are resumed, its optimal focus is expected to be slightly out of the range of the Pupil Alignment Mechanism, the mechanism that controls the focus of the instrument. This is a consequence of a plastic deformation of the NICMOS dewar which also caused a thermal short soon after installation on the telescope and led to the reduced lifetime of the cryogen. However, the NIC3 best achievable focus is well suited for science observations, showing less than 10 to 15% loss in the encircled energy in a 0.2 arcsec (1 pixel) radius, as compared to the optimum focus.

During its first operational period, the three NICMOS detectors operated at a temperature around 60 K, with a slow upward trend from 59.5 K to  $\sim 62$  K, as the  $N_2$  sublimated. After the installation of the NCS, NICMOS is expected to operate at a higher detector temperature, the exact value of which is still uncertain. That temperature depends critically on many factors: the actual NCS on-orbit performance, the parasitic heat load on the NICMOS dewar and on the NCS, the temperature attained by the heat-rejecting external radiators, and the thermal gradient within the NICMOS cryostat. Current estimates suggest it will be somewhere in the range  $\sim 75$  to 86 K with a best estimate of 78.5 K. Because of this range for the operating temperature,

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predictions of the instrument performance are also somewhat uncertain.

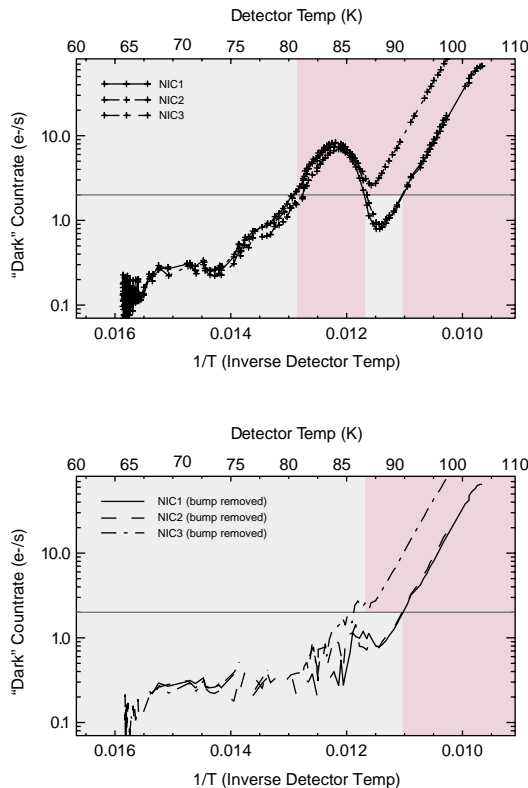
The detector dark current increases with temperature. When solid nitrogen was in NICMOS, typical values were  $<0.05$  e-/s. Predictions for the dark current under NCS operations depend not only on the actual detector temperature but also on whether a dark current excess observed during the instrument warm-up is present or not (see the June 1999 STScI Newsletter and Figure 1).

During the last days of operation, in January 1999, while the instrument was warming up after the cryogen depletion, the dark current showed a transient enhancement (see top panel of figure below) that exceeded the expected exponential profile in the temperature range of about 75 to 86 K. This excess reached its peak around 82 K, with a dark current that was about one order of magnitude higher than the expected trend (compare top and bottom panels of the figure). A 'valley' in dark current values was also observed between ~86 K and ~90K, which marks the transition to the standard exponential profile. Since the nature of the dark current excess remains unexplained, we cannot predict whether it will be present during future NICMOS operations,

and we have to await on-orbit testing. After the NCS is installed on *HST* and its performance established, we will attempt to operate NICMOS at the minimum stable detector temperature for which the dark current is ~2 e-/s or less. While this is higher than during the previous NICMOS life, it is still low enough to not significantly impair NICMOS' science capabilities. The temperature range for which the dark current remains below this threshold is highlighted in magenta in the figure, both with (top) and without (bottom) the dark current excess.

The DQE of the NICMOS detectors operating at ~75-86 K is expected to be higher than that at ~60-62 K, with a typical increase of ~40-65% at 1.1 micron, ~30-50% at 1.6 micron, and 20-25% at 2.2 micron. In terms of sensitivity, the higher DQE partially compensates for the increased dark current. The decrease in overall performance relative to Cycles 7 and 7N is expected to be small, with a worst-case loss in limiting magnitude of ~0.3 mag for long exposures below ~1.7 micron.

We are therefore looking forward to a renewed NICMOS and another scientifically productive period of near-infrared observations with *HST*.



**WFPC2**

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**W** FPC2 remains *HST*'s workhorse imaging instrument, at least for the time being. It continues to perform well and averages about one thousand images per month. Its seven years in the harsh space environment are, however, slowly taking their toll. This is evidenced by the slowly increasing CTE problem in the CCD detectors and by the recent anomaly in the shutter operation. Here we discuss these issues. We also report on the updated WFPC2 Instrument Handbook.

Degradation of the Charge Transfer Efficiency (CTE) in the WFPC2 is an increasing concern for observers, and considerable efforts are being made to study its effects. The most notable effects are on point-source photometry where the ongoing radiation damage cause an ever increasing fraction of counts to be lost during the readout process. For example, at the current epoch we expect that a faint (100 electrons total) point source at the center of one of the Wide Field CCDs will lose approximately 19% of its counts during readout in a typical broadband exposure (e.g., 300s, F555W filter, as

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measured in a typical 2-pixel-radius aperture). The signal-to-noise ratio for such an image is four, so this 19% loss begins to become significant. If one is dealing with photometric averages across many targets, the 19% systematic loss could, of course, be quite important. Larger effects will be seen for very short exposures, or narrow-band and UV filters where there is less sky background, or for targets farther from the readout amplifier. For example, a similar image exposed for 300s in F656N but near pixel (X,Y) = (800,800) will lose about 60% percent of its counts to CTE. This will have a severe impact on the photometry, as well as on the detectability of this target. (More specific simulations can be performed using the CTE estimator tool at our web site.)

For small targets, the best way to minimize CTE is to place the target near the CCD readout amplifier, as this minimizes the number of charge transfers. For the Wide Field Camera (WFC), this can be achieved by placing the target at the WFALL aperture, which is near pixel (133,149) on the WF3 CCD. For the Planetary Camera, this can be achieved by using POS TARG -12.3,-12.5 with PC1-FIX which will place the target on PC1 CCD near pixel (150,150). We note that in general, the WFC CCDs will have higher background counts, and hence lower CTE, than the PC1 CCD, and hence can be expected to give somewhat better photometric performance on faint targets.

Another method of reducing CTE is to pre-flash the CCDs so as to increase the background counts in the science image. This could, in principle, be achieved using various internal lamps inside WFPC2. However, for the vast majority of science programs, the added photon noise and overheads contributed by the preflash will make this unattractive. Preflashing may be useful in situations where photometric accuracy and uniformity is of paramount importance and detection of faint targets is not an issue. We have also performed tests of a noiseless preflash technique where the CCDs are preflashed and cleared before the science exposure, but this appears to give only a modest reduction in CTE. Apparently most of the electron traps responsible for CTE in the CCDs are short lived (milliseconds) and are not quenched by a preflash occurring one minute before the science exposure (Schultz, Heyer, and Biretta, WFPC2 ISR 01-02).

For many observers, the most promising technique is to apply photometric corrections during data analysis. Whitmore, Heyer, and Casertano published a series of

corrections in December, 1999 (PASP 111, 1559). More recently Dolphin et al. (PASP 112, 1397) have published an independent set of corrections. In general, their results are in good agreement with those of Whitmore, et al. and are consistent within a few hundredths of a magnitude. At the faintest levels, the corrections diverge, and we believe the Whitmore corrections are probably more accurate due to having many more faint stars in the sample. For the time being, it appears the best results would be obtained by using the Dolphin corrections above 100 target electrons (their model has less scatter) and the Whitmore, et al. corrections at fainter levels. A more detailed comparison of these corrections is underway and will be reported on the WFPC2 web page soon.

Besides these photometric effects, CTE also appears to cause modest distortions in the shapes of images. Reiss (WFPC ISR 00-04) has studied the effect of CTE on the profiles of faint galaxies by comparing images taken near and far from the readout amplifier. The main effect is for charge to be preferentially lost from the side of the target nearest the readout amplifier. The side of the target farthest from the readout amplifier appears to suffer little or no loss of charge. This, of course, will tend to cause artificial asymmetries in the shapes of targets. Work is underway to develop a model which can predict, and possibly correct, these effects.

In August, 2000, WFPC2 began experiencing anomalous exposures in which the shutter failed to open properly thus resulting in loss of occasional science images. The problem was traced to an encoder wheel/phototransistor that senses the position of the shutter. This sensor is polled by the WFPC2 computer prior to each exposure. In late August this sensor began to sporadically report that the "A" shutter blade was closed when, in fact, it was open. The WFPC2 computer, being confused about the shutters' state, would then cancel the exposure leading to a blank image. Since only about 0.2% of the images were affected, we continued to operate the camera while the problem was being studied.

In late October we began seeing a more serious problem where two mis-readings in a row would lead to the "A" shutter blade attempting to close, even though the "B" blade was already closed, hence causing a collision of the two shutter blades. Since there was some potential for this to damage the mechanism, we suspended WFPC2 observations on 1 November 2000.

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Due to heroic efforts by people at GSFC, JPL, Lockheed, and STScI, a remedy was quickly found. It was noticed that, while the position sensor gave an incorrect reading when polled by the WFPC2 computer 30 microseconds after activation, it did give the correct position in a telemetry report taken 170 microseconds later. While most of the WFPC2 programming was coded in read-only memory, there are occasional branches to a small RAM area. The solution was to use one of these RAM branches to activate the shutter position sensor 10 milliseconds before it is read by the computer thus giving the phototransistor more time to respond. The RAM patch was installed on November 8th, and an extensive series of tests was run with no unexpected side effects being seen. Normal science observations were resumed a few hours later, and no further shutter anomalies have been seen.

While the problem appears to have been mended, the exact cause is still not entirely clear. Much evidence points to radiation damage to the phototransistor causing its response time to slow, while other evidence points to mechanical wear in the encoder wheel linkage, leading to misalignment of the wheel relative to the phototransistor. The problem continues to be investigated using archival WFPC2 data, telemetry data, and laboratory tests of similar components, though so far there is every reason to believe the problem will remain fixed.

Version 5 of the WFPC2 Instrument Handbook was released in June, 2000 to support Cycle 10 proposers. This version includes new material on CTE, new geometric/astrometric corrections, updated throughput values and photometric stability, new material on PSF subtraction and aperture corrections as a function of field position, updated *HST* focus history, and current information on observing strategies. It also contains performance comparisons to ACS, NICMOS, and STIS. We anticipate releasing an updated version in June 2001 to support Cycle 11 proposals.

**Fine Guidance Sensors (FGS)**

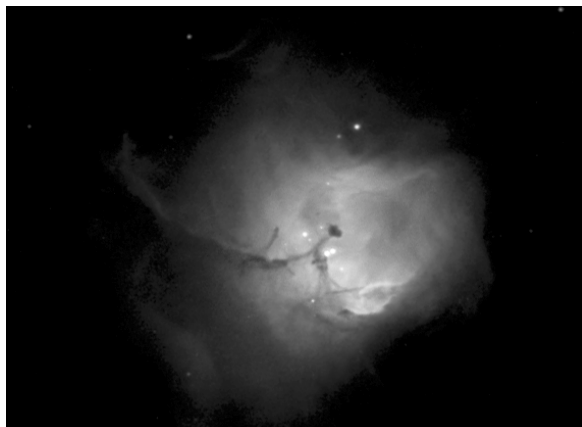
*Ed Nelan, nelan@stsci.edu*

All three of *HST*'s Fine Guidance Sensors are operating nominally. The newest of the three, FGS2r, completed its first year in orbit in December, 2000. Its performance and characteristics have been monitored over this time. As expected,

desorption of water from its graphite-epoxy composites has changed the alignment of its interferometric elements with respect to the *HST* optical axis. This has caused mild degradation of the instrument's interferograms, but not by an amount that impairs its ability to acquire and track guide stars reliably. Furthermore, the rate of change appears to have slowed significantly over the last 4 months which builds confidence in our expectation that FGS2r will continue to provide excellent service to the observatory.

FGS1r continues to perform well as *HST*'s astrometric science instrument. Recent modifications to the flight software, which commands the instrument in its high angular resolution TRANSFER mode, has enabled the use of scans as short as 0.3 arcsec to resolve very close binary systems. This allows for more scans to be completed in a given observing window thereby yielding the highest possible S/N ratio and effectively extending the use of this observing mode to objects as faint as  $V = 16$ . (In the past longer scans were needed because the x and y axis fringes were not centered in the scan path.)

The data for two major calibration proposals for FGS1r were acquired in late December, 2000. These are the optical distortion and the lateral color calibrations. The first calibrates an effect whereby the measured relative positions of stars in the FGS changes as the star field is translated and/or rolled in the instrument's field of view. The lateral color test calibrates the shift of a star's measured position in the field of view as a function of its color, a result of the beam having passed through refractive elements in the FGS1r optical train. Both of these tests could only be executed in the December 20 to December 26 time period when the sun angle on *HST* allowed for the use of unconstrained telescope roll angles. (They had originally been scheduled for December 1999, but their execution was precluded by the servicing mission SM3A.) These data will be analyzed by STScI and by members of the original Astrometry Team at the University of Texas at Austin. When the analysis is completed, FGS1r will be fully commissioned as a science instrument. And once the FGS calibration pipeline is updated to include the results of these tests, all astrometry science data acquired with FGS1r since the beginning of Cycle 8 can finally be fully processed.



**HST Recent Release:  
Hubble Peeks into a Stellar Nursery in a Nearby Galaxy**

*The Hubble telescope has peered deep into a neighboring galaxy to reveal details of the formation of new stars. Hubble's target was a newborn star cluster within the Small Magellanic Cloud, a small satellite galaxy of our Milky Way. The picture shows young, brilliant stars cradled within a nebula, or glowing cloud of gas, cataloged as N 81.*

*Credit: NASA and The Hubble Heritage Team (STScI/AURA)*

*Web Address: <http://opposite.stsci.edu/pubinfo/pr/2000/30/>*



**HST Recent Release: A Bird's Eye View of a Galaxy Collision**

*What appears as a bird's head, leaning over to snatch up a tasty meal, is a striking example of a galaxy collision in NGC 6745. The "bird" is a large spiral galaxy, with its core still intact. It is peering at its "prey," a smaller passing galaxy (nearly out of the field of view at lower right). The bright blue beak and bright, whitish-blue top feathers show the distinct path taken during the smaller galaxy's journey. These galaxies did not merely interact gravitationally as they passed one another; they actually collided.*

*Image Credit: NASA and The Hubble Heritage Team (STScI/AURA)*

*Web Address: <http://opposite.stsci.edu/pubinfo/pr/2000/34/>*

## Spectrographs Group

*Gerard Kriss, [gak@stsci.edu](mailto:gak@stsci.edu)*

**S**TIS continues to work well. We have been tracking the read noise in the STIS CCD, and it has remained stable at 4.4 electrons for GAIN=1. Our latest round of measurements of the charge transfer efficiency (CTE), performed in the fall of 2000, indicate continued and significant deterioration. Comparing the results to prior measurements, we see that the CTE is decreasing by ~15% per year on average. Slight background levels of only a few electrons do significantly improve the CTE. As a result, broad-band imaging observations are not as seriously affected as spectroscopic observations of faint objects. For observations of faint, compact targets, we now offer pseudo-apertures that place the target at a default position closer to the end of the long slits (at row 900 on the CCD). This can decrease CTE losses by up to a factor of 5. Full details on STIS CTE performance and the use of the new pseudo-apertures are currently available in the Cycle 10 Phase 2 update (available on the web), and they will be included in version 5.0 of the STIS Instrument Handbook, to be released in June 2001. Further analyses of CTE effects on imaging and spectroscopic observations of extended objects (e.g., galaxies) are underway, and they will be reported as STIS Instrument Science Reports on the web.

On-the-fly Calibration (OTFC) has been working smoothly since last June; soon STIS data will be available through the On-the-fly Reprocessing (OTFR) system. The principal benefit of OTFR will be the ability to start with the first stage of raw data file production. This will ensure that header parameters are calculated and entered correctly, and it will also enable us to fix a number of problems evident in Time-Tag data for STIS. These problems most notably include large jumps in the time series, gaps due to data losses that can be prevented, and problems with data taken in observations that experienced buffer wrap-arounds due to the BUFFER-TIME parameter being set incorrectly. The first release of OTFR is expected in April 2001. This first release will incorporate the scattered-light correction for STIS echelle-mode spectra that was described in the last newsletter. Software updates that will enable the time-tag data corrections is targeted for implementation by June 2001.

## Anne Kinney leaves STScl for NASA

Anne Kinney left STScl last year to become Origins Theme Director at NASA Headquarters. Anne first came to the Institute as an FOS post-doc in 1985 and then became an Assistant Astronomer (and FOS Instrument Scientist) in 1988. She was promoted to Associate Astronomer with tenure in 1994.

Anne grew up in Lancaster, Wisconsin, where her father, a lawyer, would show her the constellations he'd learned as a Navy navigator. She received her bachelor's in physics and astronomy from the University of Wisconsin in 1975, spent a few years at the University of Copenhagen, and then did a Ph.D. with Patrick Huggins and Al Glassgold at New York University. Her thesis looked at the Baldwin Effect in quasars in the ultraviolet and in x-rays, and she finished her degree in 1984. She was briefly a post-doc at Northwestern University before coming to STScl.

We bade Anne farewell last year with mixed feelings of sadness at her leaving and appreciation for what she has done here and will do for the community in her new role at NASA.

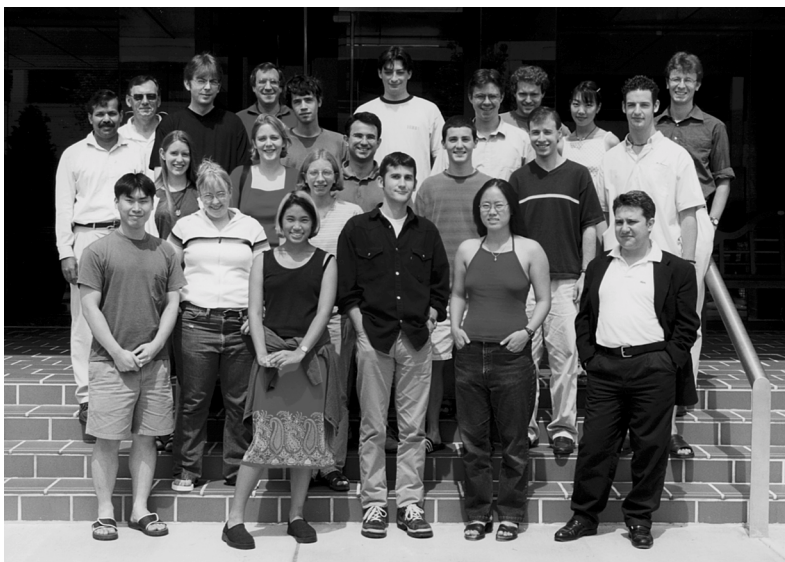


Steve Beckwith and Anne Kinney

## STScl Summer Student Program in 2000

David Soderblom, SSP Coordinator, STScl

Twenty students came to the Institute last summer to work with our staff scientists on research projects for ten weeks. They came from a number of U.S. colleges and universities, as well as from five other countries (see the table below). We're looking forward to working with almost as many this year, with an even broader international representation. Those interested in the program can learn more by going to: <http://www.stsci.edu/stsci/summer.shtml>.



### Summer Student Program 2000 Participants

Name	School	STScl Supervisor
Jay Abbott	Univ. Hertfordshire	Brian Espey
Jules Blundell	Liverpool John Moores	David Soderblom
Milan Bogosavljevic	Univ. Belgrade	Massimo Robberto
Teddy Cheung	Brandeis Univ.	Meg Urry
Erin Claunch	Virginia Military Inst.	Massimo Stiavelli
Adam Fallon	Macalester College	Jeff Valenti
Michael Fine	Colgate Univ.	Mauro Giavalisco
Andrew Humphrey	Univ. Hertfordshire	Jerry Kriss
Lauren McCann	MIT	Melissa McGrath
Elizabeth McGrath	Vassar College	Kailash Sahu
Madeline Reed	Columbia Univ.	Antonella Nota
Rachel Scheinerman	HS	Megan Donahue
Joao Souza Leao	UFSC Brazil	Claus Leitherer
Rebecca Stanek	Case Western Reserve	Torsten Boeker
Chiharu Tanihata	U. Tokyo	Meg Urry
Mamie Thant	HS	Chris O'Dea
Richard Whitaker	St. Andrews	Keith Noll
Laura Whyte	Univ. Hertfordshire	Harry Ferguson
Diane Wong	McGill Univ.	Chris Blades
Brandon Woods	HS	Harry Ferguson

### **HST Recent Release: "X" Marks the Spot: Hubble Sees the Glow of Star Formation in a Neighbor Galaxy**

The saying "X" marks the spot holds true in this Hubble telescope image. In this case, X marks the location of Hubble-X, a glowing gas cloud in one of the most active star-forming regions in galaxy NGC 6822. The galaxy lies 1.6 million light-years from Earth in the constellation Sagittarius, one of the Milky Way's closest neighbors. This hotbed of star birth is similar to the fertile regions in the Orion Nebula in our Milky Way Galaxy, but on a vastly greater scale. The intense star birth in Hubble-X occurred about 4 million years ago, a small fraction of the approximate 10-billion-year age of the universe.

Image Credit: NASA and The Hubble Heritage Team (STScI/AURA)

Web Address: <http://opposite.stsci.edu/pubinfo/pr/2001/01/>



## Calendar

### Cycle 11

Call for Proposals issued	June, 2001 (tentative)
Phase 1 proposals due	September 7, 2001 (firm)
Proposers notified	December, 2001 (tentative)
Phase 2 Proposals Due	February, 2002 (tentative)
Budgets Due	February, 2002 (tentative)
Routine Observing Begins	July, 2002 (tentative)
<b>Space Telescope Users Committee</b>	April 19-20, 2001
<b>Servicing Mission 3B Launch</b>	November 29, 2001 (tentative)



## ST-ECF Newsletter

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>.

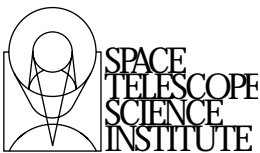
Finally, you may wish to communicate with members of the Space Telescope Users Committee (STUC). They are:

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James Dunlop, Royal Obs. Edinburgh  
Debbie Elmegreen, Vassar College  
Holland Ford, JHU  
Suzanne Hawley, U. Washington  
Chris Impey, U. Arizona  
John Kormendy, U. Texas, Austin  
Dave Sanders, U. Hawaii  
Karl Stapelfeldt, JPL  
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