June 1999 • Volume 16, Number 2

SPACE TELESCOPE SCIENCE INSTITUTE

Newsletter

Highlights of this Issue:

Barry Lasker *1939-1999*

Brian McLean and Steve Beckwith

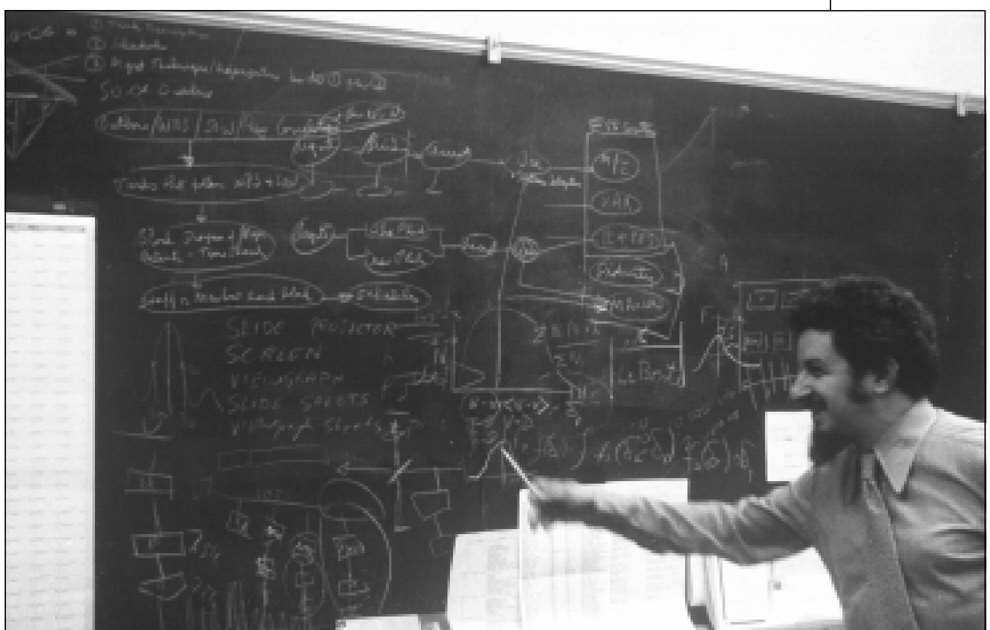


Photo: Marjorie Felser

On 10 February 1999, Barry M. Lasker died suddenly following a heart attack. Barry was an astronomer for almost 40 years, playing an important role in the creation of two of the world's most highly-respected observatories, the Cerro Tololo Inter-American Observatory in Chile, and the Space Telescope Science Institute. His work on the Guide Star Catalog and the Digitized Sky Survey significantly influenced the entire field of observational astronomy. Just before his untimely death, he learned that the American Astronomical Society had awarded him the 1999 Van Biesbroeck Prize in recognition of his long-term service to the scientific community.

Barry Lasker was born on 12 August 1939 in Hartford, Connecticut. He began his career with a Bachelor of Science degree in physics from Yale in 1961, quickly followed by a Master's degree in 1963 and a Ph.D. in 1964 in astrophysics from Princeton. After a postdoctoral position at the Hale Observatories in Pasadena from 1965 to 1967, he became a professor of astronomy at the University of Michigan, where he was acknowledged as an excellent teacher, holding this position from 1967 to 1969.

He was offered an opportunity to move to a remote, undeveloped part of Chile as one of the first astronomers for a new observatory that was to provide the U.S. astronomical community with facilities in the Southern Hemisphere. During this time, Barry was as comfortable with a soldering iron and wrench as he was performing his own observations on the interstellar medium. He was one of the early pioneers in using computers to control telescopes and instruments. In addition to his essential role in the observatory's construction and commissioning, he and his wife Sharon became an integral part of the local community. When their children, Zephrin and Alida, became old enough to attend school, they were instrumental in the creation of an American-style English-speaking school that was open to all local residents. It has since flourished and now has an enrollment of over 700 students and is highly respected.

In 1979, he began work on a major competitive proposal to NASA for the Association of Universities for Research in Astronomy (AURA) to create a research-oriented institution that would be responsible for the operation of the *Hubble Space Telescope*. Following its successful selection, he moved to Baltimore as one of STScI's first scientists in 1981. His major task was to design a system for the measurement of the positions of stars that the telescope could lock onto and guide with for every observation - Hubble recently exceeded 250,000 observations! With typical foresight,

continued page 4

DIRECTOR'S PERSPECTIVE

Steven Beckwith

Luminosity

A supernova can outshine an entire galaxy if only for a few days or weeks. Some supernovae are original heavyweights. They assemble their mass at birth and burn up their own supply of hydrogen until collapse and explosion are inevitable. Live fast, die young, leave a beautiful remnant. Others acquire their weight later in life, aided always by a collaborator, a companion star that generously gives of itself so that its partner can grow to explode in a burst of light that outshines all around it. The collaborator is ignored, and often suffers catastrophe at the hands of its main partner, who reaps all the glory. The galaxy gains an unprecedented prominence, as astronomers who had no prior interest in its existence suddenly take notice and use its distance as a metric of the expanding fabric of space-time. This notice is new. Only recently have we acquired the tools to find distant supernovae easily. Early ones were not appreciated despite their best efforts to call attention to themselves through great explosions of light, energy, and matter.

A similar outburst occurs when we issue press releases about scientific discoveries with Hubble. We call attention to the work of one or two astronomers in a press release or a televised press conference, and their world is suddenly changed, if only for a short time. Sometimes these astronomers are "heavyweights." Their work has been prominent among specialists for a long time, and everyone agrees that they are deserving of the media attention. More often, the prominence is bestowed on scientists who get lucky, whose previous work is good but not special, certainly not of supernova quality. Still more often, the attention lands upon one or two people in collaboration with many. Like the supernova's companion star, the collaborators are ignored by the press, despite the best efforts of the prominent few to include them in the story. The world likes heroes; teams are not heroes even if they are heroic.

It is too bad that the credit is sometimes distorted, landing heavily on one or two partners in a much larger collaboration. It is rarely the fault of the lucky few. They try in vain to credit their partners, but the press cares little about unseen partners. Reporters like the immediacy of those in the spotlight. Only the immediate family of the collaborators remembers their roles, anyway. Can you name the main collaborators in the discovery of AIDS? Of global warming? Of the discovery that the universe may be pervaded by a vacuum energy (Λ) as measured from distant supernovae? If you can, you are ahead of 99% of the general population, and you should know the answer to my third query (check the Ap.J. author list again; it may surprise you). Almost everyone benefits, nevertheless. The collaborators have an easier time getting grants or jobs or telescope time, once the research is seen as exciting. It is mainly a question of how much.

This prominence focuses attention on astronomy, the much larger galaxy surrounding the prominent stars. Astronomy reaps the benefit of this attention. People get interested in what we do. They can see what their tax contributions buy. Some get excited as they struggle to understand what the latest discovery means. It takes them, as it takes us, out of their daily duties and lets them ponder the imponderable.

I believe this attention is good, so long as we are honest about what we do. It is dishonest to highlight results that are known to be wrong or results of little interest, but it is generally true that the quality and future value of new results are debatable. Edwin Hubble's first estimate of the rate of expansion of the universe was wildly in error for reasons he could not foresee. Should he have announced the expansion without the measurement? Van de Kamp's "discovery" of a planet around Barnard's star was an artifact of the observations. This problem was not foreseen at the time. Should he have held off? How conservative should we be before going public? People are still interested in the results, just as we are interested in partial scores of a football game. It is the game they care about, even though it may not portend the final outcome. It is important that people care about the game.

Our Office of Public Outreach does an outstanding job of telling the public what we in astronomy do. We reap big rewards from public appreciation of and fascination with our research. It takes a professional approach: writers who can write for a general audience, media specialists who understand what visual cues will instruct, and above all an understanding of what interests the press and what excites the general public. I have heard complaints about our selection of topics or scientists although never from those selected. Some suggest that we should be more conservative, that we should wait for "proof." Sometimes we should, but proof in astronomy, unlike mathematics, is rare if it ever exists — witness the solar neutrino problem.

It is noteworthy that the press trusts our public outreach efforts. Praise accrues to astronomy when we make successes of our big projects. We are very lucky to have the support we do. But luck is sometimes manufactured, and the best way to manufacture this luck is to give our supporters value for their money. Telling them what their money buys seems like the least we can do.

Steven Beckwith, Baltimore, April 9, 1999

Van Biesbroeck Prize awarded to Barry Lasker

Brian McLean and Howard Bond

Dr. Barry Lasker was awarded the 1999 Van Biesbroeck Prize of the American Astronomical Society in recognition for his leadership and innovation in the production and distribution of the Digitized Sky Survey (DSS). Simply stated, the DSS is one of the most important astronomical research tools ever created. Its direct applications have spanned the astronomical research spectrum, including the study of the clustering of galaxies and clusters of galaxies, searches for supernovae, high-redshift quasars, and other rare objects, observational constraints on Galactic dynamics, and optical identification of sources detected at other wavelengths. The DSS, and the resulting Guide Star Catalog (GSC), have been essential in supporting the operation of the *Hubble Space Telescope* and are now being used in mission planning for other NASA and ESA programs.

Many ground-based observatories presently rely on the Guide Star Catalog for automated guide star acquisition, and the new generation of adaptive optics telescopes, including the Gemini 8m facilities and the VLT, are looking towards Barry's next generation GSC to provide critical pointing support. Astronomers now routinely use the DSS to generate relative target coordinates with sub-arcsecond accuracy, tremendously improving observing efficiency and allowing many multi-aperture spectroscopic surveys to become feasible. Indeed, one could argue that the DSS has done for astrometric calibration what the Landolt star catalog has done for photometric calibration. Finally, the DSS (on CD-ROM) has revolutionized access to these data and has, for the first time, allowed the general public and the educational community to enjoy direct "hands-on" experience with research quality astronomical images. Barry Lasker's vision and dedication have been the key reason for the success of the DSS.

Even as modern CCD mosaic cameras approach the areal coverage of a single Schmidt plate, the importance of the DSS will extend into the next century, in part because it will remain the only optical all-sky survey available for some time to come, in part for its obvious significance in validating the first results from the CCD survey programs, and, in part, for its use as a historical record in proper motion and variable object surveys.

Although large-area photographic sky surveys have existed since the 1950s, it was the development of modern high-speed plate digitizing machines that enabled the extraction of quantitative and accurate astronomical information from these surveys. The wide-spread ability to access and apply the advantages of digitized image data, however, is due largely to the efforts of Barry Lasker who led a team of STScI staff in the production of the digitized versions of 5 major hemispheric surveys (3 from the Oschin Schmidt telescope at the Palomar Observatory, and 2 from the UK Schmidt telescope in Siding Spring, Australia). Barry's ultimate objective was always the distribution of these data to both the astronomical community and the general public.

Barry's innovation in the field of sky survey digitization is demonstrated by his redesign of the STScI microdensitometer machines from manually operated single-channel, arc-lamp systems — which took 30 hours to scan a single plate — into computer controlled, multi-channel, laser-scan systems which can scan a plate in under 2 hours. The STScI facility is internationally recognized as producing some of the highest quality digitized scans in the world. For this reason, Caltech selected STScI to be the primary digitization facility for the current-epoch Palomar Sky Surveys.

Barry's leadership of his team was exceptional. He assembled and managed a technical and scientific staff with skills ranging from optical engineering and computer electronics, to extragalactic and galactic astronomy, image compression, and database management. He developed several important international collaborations to keep the program going after major NASA budget reductions.

But perhaps most importantly, the majority of Barry's achievements far exceeded the requirements of his STScI job. Indeed, had he adhered to the basics of his position, the compressed DSS CDs, the extended photometric calibrations of the DSS, the improved astrometric calibration of the DSS, the digitization of the POSS-II survey, the advanced technology scanning machines would never have been produced. Barry's dedication and contributions extend way beyond the "call of duty," The DSS, and its positive impact on astronomical research and research infrastructure, are a tribute to Barry's creativity, guidance, and selflessness (Barry's personal scientific output was a casualty of his own dedication to this exciting project).

Lasker *from page 1*

he organized an effort to obtain photographic plates of the entire sky, build a machine to digitize them and use image-processing software to detect and measure 20 million stars over the entire sky. This Guide Star Catalog was a tremendous success and since publication has become the de facto standard for the operation of most telescopes and space missions. Recognizing that the digitized images were also of great value to the community, he was instrumental in arranging for publication of these data on a set of CD-ROMs. The availability of the Digitized Sky Survey has revolutionized how astronomers in this information age plan observations or find an optical counterpart to sources detected at other wavelengths. Anyone with a computer, professional or amateur astronomer, teacher or student, can quickly display, manipulate, and measure an image of any part of the sky. The value of this survey was demonstrated most notably by using the data to investigate the progenitor system of Supernova 1987A and the recent optical identification of a gamma-ray burst source.

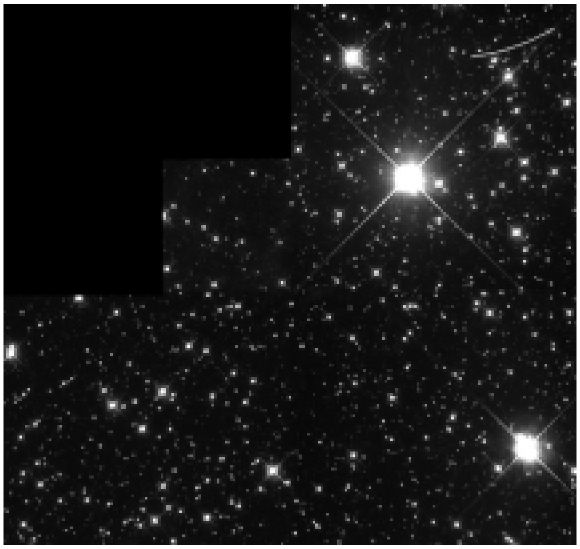
Always following his thoughts to a logical conclusion, he realized that it was necessary to measure new photographic survey plates. In combination with the original work, it would allow the creation of a much larger and more useful catalog of over 2 billion objects. This would allow serious research on the structure of the Galaxy by determining the colors and motions of stars, investigate the spatial distribution of galaxies and galaxy clusters, and provide a tool for the operation of the next generation of ground-based telescopes and space missions. When it became clear that funding was inadequate, he gradually created an international consortium of partners in order to carry out this goal. Work on both the Digitized Sky Survey II and the Guide Star Catalog II is currently in progress and will be completed in 2001.

He was always interested in promoting science in education, and took an active interest in helping wherever he could. Whenever possible, he mentored bright young high school students who came to STScI for summer positions, and recruited local college students for part time employment, giving them challenging and interesting tasks. He was also active at a local school, where he helped them refurbish and set up a student observatory.

Barry was a reserved and modest man. He was both a gentleman and a scholar in the truest sense of the expression, treating everyone with respect and giving freely of his accumulated wisdom and extensive knowledge. In addition to being a brilliant, dedicated and selfless scientist, Barry was a genuinely good person. He was committed to his family, and interested in and helpful to his many friends and colleagues. He was a professional mentor to many young scientists, providing advice and usually ending by quoting some literary passage, frequently from Dr. Seuss, to illustrate his point. His vision and kindness, his scientific and private personality will be greatly missed, but his memory will live on in the hearts and minds of those who were privileged to know him and work with him.

Friends and colleagues of Barry have added their remembrances to a web page that you are invited to visit and add to:

http://www.stsci.edu/remembering_barry/index.html



HST Recent Release: A Mote in Hubble's Eye

On April 6, 1994 NASA's Hubble Space Telescope (HST) was performing a detailed study of the Sun's nearest stellar neighbor, Proxima Centauri, using the Fine Guidance Sensors to search for small deviations in the position of Proxima Centauri that could reveal the presence of an unseen planetary companion. Rather than sit idle while this study went on, the Wide Field and Planetary Camera 2 (WFPC2) was activated using the observing strategy set out in a program initiated by Dr. Ed Groth (Princeton University) designed to make use of this otherwise wasted time. The image captured by this WFPC2 parallel observation is a typical Milky Way star field in the constellation Centaurus. Such images can be used to study the evolution of stars that make up our galaxy.

Credit: Hubble Heritage Team (AURA/STScI/NASA)

http://oposite.stsci.edu/pubinfo/pr/1999/08/index.html

Mining the *HST* Archive

Brian Espey, STScI espey@stsci.edu

What are symbiotic stars?

Symbiotic 'stars' are, in reality, binary or triple systems consisting (generally) of a hot white dwarf or sub-dwarf ($T_e \sim 100{,}000 \pm 50{,}000$ K) orbiting a more massive giant of type M, though G, K and C stars are also represented. Symbiotics are the widest separation interacting binaries known, with separations of from 1 to 10 AU, although the size of the giant star (perhaps bloated by the extra heating of its hot companion, or by intrinsic variability) can result in a Roche lobe overflow for some systems. Based on the ~150 objects known, it is estimated that there are roughly 10^4 symbiotic systems in our Galaxy alone, concentrated towards the Galactic plane. In addition, roughly a half dozen have also been detected outside our Galaxy.

Due to the differences in stellar constituents and orbital parameters, the interaction between the components and its frequency ranges from strong to relatively weak. These interaction types help to identify subclasses of the general symbiotic group. Although generally quiescent, symbiotics undergo occasional outbursts which are fueled by matter drawn from the giant star which either generates instabilities in an accretion disk about the white dwarf, or thermonuclear runaway on the white dwarf surface itself. In the case of RR Tel, which is one of the best-studied objects, the last eruption was in 1944, and the star has been fading ever since. Figure 1 shows photometry for this object obtained by one amateur which covers the nearly the entire period of the decline up to the present day.

The combination of properties in the broad class symbiotic systems permits a range of physics to be examined — the mass loss process for red giants and Mira variables, the structure and dynamics of winds from both the hot and cool components, mass transfer, accretion and outburst events, and binary evolution.

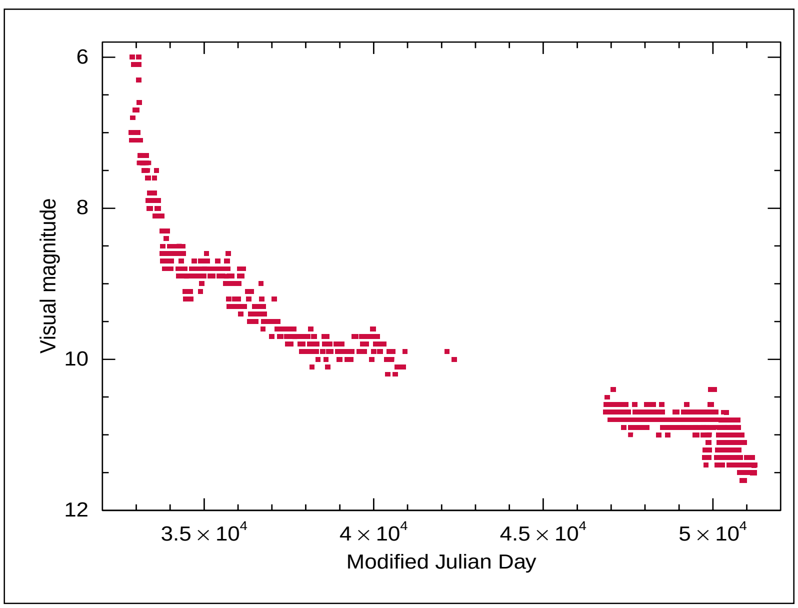


Figure 1. Visual magnitude estimates of the slow nova RR Tel derived by Albert Jones of the Royal Astronomical Society of New Zealand (Jones, private communication). The range of observations covers nearly the entire period from the star's last outburst in the 1940s to the present day.

Typical spectrum

In quiescence a typical symbiotic star spectrum shows differing characteristics depending on the wavelength region examined. In the optical and infrared the spectrum is dominated by the continuum of the red giant star and also by relatively narrow (FWHM ~10 km/s) emission lines which originate in the slow wind driven off the giant star's atmosphere and photoionized by the hot secondary. It was this incongruity of a cool star with molecular and neutral atomic absorption, and emission lines similar to those observed in planetary nebulae with hot central stars which originally led Merrill and Humason to suggest their classification of 'stars with combination spectra' in 1932. The gas density in symbiotics tends to be higher than in planetary nebulae due to the presence of the giant atmosphere.

A vast body of data is available in the Multi-Mission Archive at STScI (MAST). In the UV range covered by the *International Ultraviolet Explorer* (*IUE*) and *HST* the white dwarf continuum can be observed directly, as can both line and continuum radiation from the nebular gas. As the peak of the hot star continuum emission lies to the blue of the Lyman limit, it does not provide much information, although some symbiotics are bright enough that soft X-rays can be observed and used to set an upper limit on the temperature. However, it is the rich nebular emission line spectrum produced by the resonance, intercombination and excited level lines in the UV which permits us to determine the majority of the important parameters for the binary. Values of gas temperature, density, emitting volume and abundances, as well as Galactic extinction can be determined using these lines. The combination of archival *IUE* and *HST* spectra also provides an extra dimension by permitting changes in these parameters with outburst activity to be analyzed and to set the more

continued page 6

Archive *from page 5*

detailed recent data in context. Figure 2 shows the time evolution for selected lines observed in spectra of RR Tel. Comparison with Figure 1 shows clearly that although the overall luminosity of the binary as a whole has been falling since 1944, the ionization state of the nebular gas has been increasing, presumably as the material from the outburst thins and dissipates. Indeed, in far-UV observations made with the Hopkins Ultraviolet Telescope (HUT) Espey et al. (1995) were able to determine that the O VI 1032, 1038 Å emission lines are the strongest lines in the entire observable spectrum!

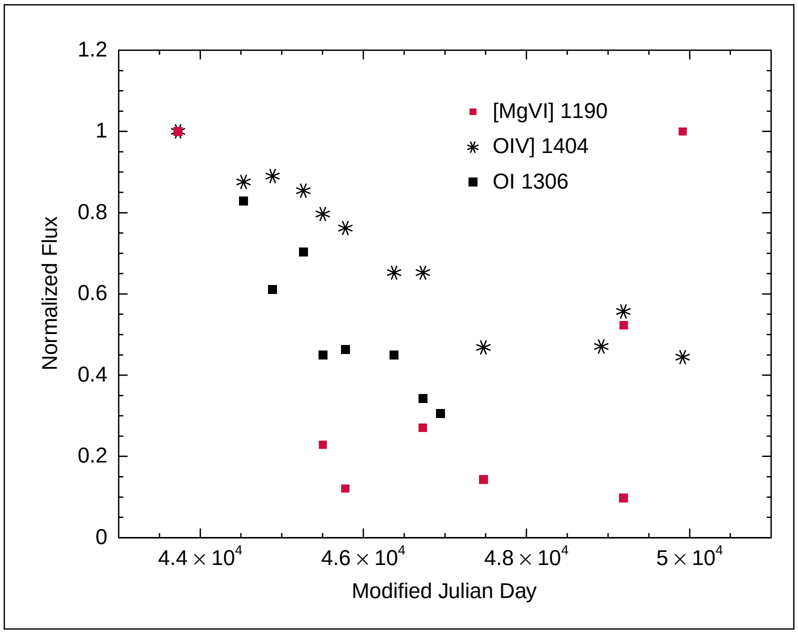


Figure 2. Observed fluxes for lines observed with the IUE satellite augmented by HST data for the most recent epoch. Note the increasing ionization of the nebular gas, illustrated by the fall in intensity of the low ionization lines, and the increase for those of high ionization.

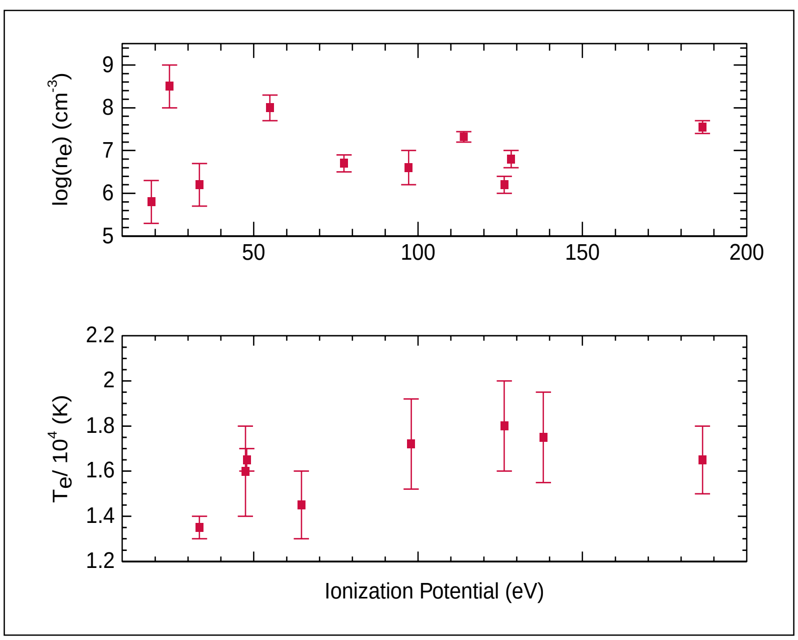


Figure 3. Preliminary estimates of density and temperature for the nebular material in RR Tel derived from UV emission lines. Note that the bifurcation in density of the lowest excitation lines which reflects structure in the nebular gas.

RR Tel has an extremely rich emission line spectrum due to the relatively high mass loss of the M5III star ($dM/dt \sim 10^{-5}\ M_{Sun}/yr$), and the temperature of the white dwarf (T = 142,000 K). It is also bright enough to permit high signal-to-noise, high resolution data to be obtained. In conjunction with my collaborators at the Queen's University of Belfast, I have been analyzing archival GHRS spectra obtained in 1995, and developing and implementing improved diagnostics that can be applied to these data. In the UV, emission lines are observed that derive from ions requiring ionization potentials of up to ~190 eV (Al^{5+}, Mg^{5+}) —much higher than those required for species observed in the optical. These high ionization diagnostics provide important temperature and density measurements for the hottest gas in the system, and thus help constrain models of the gas distribution and energetics. From a preliminary collection of results (Figure 3) we gain an overview of the density and temperature structure of material at different levels of ionization and real indications of the presence of more than one zone of cool gas. A more detailed comparison of the line profiles is in progress to study the velocity components of this material.

Our studies so far have led to a number of papers studying conditions in both the hottest and coolest gas using lines from Al II, Ne IV, Ne V, Ne VI, and Mg VI (Espey et al. 1995; Espey et al. 1996; Keenan et al. 1998; McKenna et al. 1999; Keenan et al. 1999). The results have not only have provided insight into the conditions in the RR Tel system, but also permitted us to experimentally confirm, for the first time, the wavelength separation of the [Ne IV] 1602 Å doublet and that of the [Al II] and Al II] lines near 2669 Å. Further observations with more complete wavelength coverage of RR

continued page 7

The "On-the-Fly" Calibration System

Steve Lubow lubow@stsci.edu

Currently, *HST* data are calibrated as they are received at STScI, and the raw and calibrated data are now stored in the *HST* archive (DADS). Users can recalibrate data at their home sites to take advantage of better calibration files or software. There is frequently some advantage to considering recalibration. Over 90% of the *HST* data could realize some benefit by recalibration, although the level of improvement is not always significant. For example, cameras, such as WFPC2, obtain optimal dark files about one week after the data have been calibrated and stored in the *HST* archive. To recalibrate, a user currently obtains the raw data and the recommended reference files through StarView. A user updates the raw data headers with the names of the recommended reference files, and then executes the appropriate STSDAS calibration software.

The "on-the-fly" calibration (OTFC) system at STScI will allow users to obtain data from the *HST* archive which are calibrated with the most up-to-date calibration parameters, files, and software. In most cases, this capability requires that the data be automatically calibrated at STScI when the data are requested by a user. In addition to improving calibration, an advantage of OTFC is that STScI would not need to store calibrated data for all instruments in the *HST* archive. As a result, considerable storage savings can be achieved (Hanisch et al. 1997). An OTFC system has been successfully developed for *HST* data by the CADC/ST-ECF (Crabtree et al. 1996), although the OTFC system at STScI has greater throughput, performance, and support requirements.

We plan to provide OTFC for WFPC2 and STIS in the near-term. Longer term, ACS and probably NICMOS will be supported as well. The OTFC system provides a flexible capability for STScI instrument groups to update header keywords relevant to calibration for particular datasets though a database. These changes are incorporated into the data headers, as part of OTFC processing. The WFPC2 group has identified several hundred improvements to parameters across datasets. Most of them affect early observations. The STIS group has identified considerably more changes, although most of these changes are non-critical.

OTFC will include last-change-date information on each dataset in StarView. Based on this information, users will be able to determine whether their previously-calibrated data need to be requested again through OTFC. Another feature of the system is a set of tools that assist users in carrying out their own improved calibrations. These tools allow users to change their data headers to reflect the latest parameters, including file names, in a highly automated manner, as is done in OTFC processing. These tools also allow users to customize parameters fairly easily.

Users will be able to invoke OTFC through the current user interfaces that exist to access the *HST* archive (StarView and the web interface). We will later provide details on how to use the system. We plan to provide OTFC for WFPC2 within the next several months. Its availability will be announced on the STScI archive web page. More detailed information can be found in Lubow and Pollizzi (1999) and the OTFC web page: *http://www.dpt.stsci.edu/otfc/otfc_index.html*.

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Archive *from page 6*

Tel are planned for Cycle 8 and should provide important details on the time evolution of this system. We are confident that more surprises and insights await us!

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The Status of STATUS

STATUS, the newsletter of the AAS Committee on the Status of Women in Astronomy, is now being produced at STScI by co-editors Meg Urry (cmu@stsci.edu) and Lisa Frattare (frattare@stsci.edu) and designer Kathy Cordes.

The goals of this Newsletter are to investigate the status of women in astronomy and to explore possible barriers to their progress. STATUS appears twice per year, in January and June, and is mailed free of charge to AAS members who subscribe (send your address to ssavoy@aas.org). For further details or for online issues, see www.aas.org/~cswa/pubs.html.

Report from the *HST* Project Scientist

Dave Leckrone, GSFC, dleckrone@hst.nasa.gov

HST Gyros and the Third Servicing Mission:

HST carries six gyros designed and built to meet very stringent levels of noise and accuracy — more demanding performance requirements than in any other application . Three gyros must be operational at any given time to provide *HST* with a highly precise, three-dimensional frame of reference within which to slew and to point to astronomical targets. Six gyros are on board *HST* to provide a high degree of redundancy. If fewer than three gyros are functioning, there is no physical risk to the observatory. Rather, *HST* drops into a "zero-gyro" safemode, orients its solar arrays to the Sun, and awaits a service call. However, under such conditions it is no longer possible to carry out observations — the science program ceases until 3-gyro operations can be restored.

At the time of the second servicing mission (SM2), in February, 1997, *HST* had six properly functioning gyros. No gyros were replaced on that mission, given our servicing philosophy of "if it isn't broken, don't fix it." Moreover, the mean time to a gyro failure, calculated at that time on the basis of prior history with the *HST* gyros (an admittedly very small statistical sample) was 19 years. Unfortunately, since SM2, three gyros have failed. The failure mechanism appears well understood. Each gyro package contains a viscous fluid surrounding the gyro rotor housing; electrical current to and from the gyro motor is carried by two pairs of thin wires (each about the thickness of a human hair) called "flex leads", immersed in the fluid. These wires are composed of a mixture of copper and silver. When the gyros were filled with fluid during their original construction, oxygen contamination from the air resulted in the release of bromine in the fluid. The latter reacts with copper, effectively leaching it out of the flex leads and leaving behind the silver. The resulting silver filaments are brittle and thus are more likely to break. Whether or not they do break is apparently a function of how coarse or fine the original copper granules are within the substructure of the individual flex lead — i.e. there is an element of luck in all of this.

The signature of all three gyro failures is an enhanced current powering one phase of the gyro motor, indicating that the other circuit has been interrupted by a broken flex lead. In the first two gyro failures, in 1997 and 1998, a second flex lead broke, and the gyro ceased all operation, within a few hours to a few months. This past January one flex lead on Gyro #3 broke. We do not expect the second flex lead circuit to remain intact for very long. In any event the performance of Gyro #3 is now erratic and it would be very difficult to use in routine science operations, even if the remaining flex leads survive. Therefore, we are now down to the minimum set of gyros required with no additional redundancy on board *HST*.

Servicing Mission 3 (SM3), originally scheduled for December, 1999, had recently been rescheduled to June, 2000, and reassigned to another shuttle orbiter, because of problems with the availability of our original launch vehicle (Columbia), which is also being used by the Chandra Observatory (formerly AXAF). We believe there is only about a 50% chance of reaching June, 2000, without another gyro failure. In fact, there is a 10 to 20% chance of another failure by June, 1999. It was this consideration, the possibility of up to one year of scientific downtime for *HST*, that led NASA Administrator Goldin to conclude that an "emergency" servicing mission to replace *HST*'s gyros is necessary.

Servicing Mission 3 has now been broken into two parts, SM3A and SM3B. SM3A is scheduled for launch on October 14, 1999 (at 5:42 AM, eastern time). It will consist of 3 EVAs, during which astronauts Steve Smith (a veteran of SM2), John Grunsfeld, Mike Foale and Claude Nicollier (of SM1 fame) will insert six new gyros, a new spacecraft central computer, a replacement fine guidance sensor (FGS2-R), a backup S-band transmitter, a backup solid state recorder, and a battery thermal protection kit. They'll also work on covering some of the multi-layer insulation on the exterior of the spacecraft, which was seen to be degrading during SM2.

Launch of the Advanced Camera for Surveys (ACS), the aft-shroud cooling system, the NICMOS cooling system (better known as the "cryocooler"), and new solar arrays must unfortunately be deferred to SM3B, which we hope to launch around December, 2000. The forth and final servicing mission is scheduled no sooner than July, 2003.

Evolution of the *HST* Proposal Selection Process: Changes for Cycle 9

Meg Urry, STScI cmu@stsci.edu

According to hundreds of scientists involved in the proposal review, the process of selecting the *HST* science program has been extremely successful, generating a program of outstanding science being done with *HST*.

Yet after eight Cycles, the system has begun to show signs of strain. The number of submitted proposals has more than doubled, and the fundamental structure of panels and TAC has simply been scaled up commensurately, with little structural change. (See the January 1999 Newsletter for a description of the two-step panel/TAC review process for Cycle 8.)

As a result, the TAC has doubled in size, to more than 20 people in Cycles 7 and 8. Its primary responsibility has always been to establish priorities among scientific disciplines. With so many TAC members, the kind of in-depth, focused discussion needed to set these priorities has become increasingly difficult.

With so many proposals, the TAC spends most of its time debating smallish proposals in the "gray area" — not the top ranked science — and has less time to consider allocations to large proposals of 100 or more orbits, where TAC expertise is most needed.

With as many as 1300 proposals coming in, maintaining 80 to 90 proposals per panel has meant increasingly narrow science focus in each panel, a sort of "Balkanization" of the proposed science. This inadvertently encourages undue attention to minute details, at the expense of "the big picture." The quality of the science discussions declines — it must be very boring to discuss several dozen nearly identical proposals! And scientific areas are given an "entitlement" of *HST* time simply by designation of the panel topics.

The natural sociology of the proposal selection process also works against larger programs, which are increasingly seen as a vital part of the *HST* program.

These trends threaten our ability to maintain the excellence of *HST* science as we move into the second decade of operations.

Changes in the Review Process

For Cycle 9 the Science Program Selection Office (SPSO) will change the review process to address some of these concerns and to ensure that *HST* will continue to produce the best possible science with the best return for the astronomical community. Understanding the new review process will enable proposers to write more effective proposals.

The Cycle 9 process will be significantly different from the Cycle 8 process described in the January Newsletter by Mike Shara, who headed the Science Program Selection Office while I was on sabbatical last year.

Major changes include:

- Fewer panels. With more orbits to allocate, each panel will have more flexibility, especially to approve the somewhat larger proposals.

- Even fewer scientific categories. Panels will be dedicated to very broad science topics, perhaps as few as five — one for solar system, two for Galactic science, two for extragalactic science. *Hence it will be essential for proposers to describe the impact of the proposed science on astronomy in general ("the big picture").* Science balance among subtopics, previously determined by the TAC, will be achieved within the selection panels. This approach, long practiced in the high-energy astrophysics community, also simplifies the avoidance of conflicts of interest.

- TAC focus on large programs. The main role of the TAC will be to approve the best large programs (≥100 orbits), for which they will have up to 1,000 orbits to allocate. This means the TAC could approve 2 to 3 programs averaging 300 orbits each. With scientific balance achieved within the broad selection panels, the TAC will generally not address the small proposals at all. *Large proposals will therefore have an excellent chance of success, and are strongly encouraged.*

- Incentives for medium proposals. Starting in Cycle 7, there have been "orbit subsidies" to encourage panels to approve medium proposals ($\gtrsim$30 orbits). This meant that a fraction of the orbit request was not charged against the panel quota. This system worked reasonably well, leading in Cycle 8 to an

continued page 10

Special Notice: ACS and NICMOS Proposal Solicitation Update

Due to the split and subsequent timing of SM3 into SM3A and SM3B (see report from the HST Project Scientist on page 20), ACS and NICMOS observing proposals are not being solicited in the Cycle 9 Call for Proposals. We remain committed to achieving the best Hubble science program which clearly includes enabling science observing with the ACS and NICMOS as soon as they are commissioned. The current timing of SM3B severely limits ACS and NICMOS observing opportunities to the last quarter of Cycle 9. We are planning to advance the Cycle 10 solicitation and selection process and deliberately overlap the scheduling of Cycle 9 and Cycle 10 programs such that we can enable the start of ACS and NICMOS Cycle 10 program as soon as possible without delaying previously accepted Cycle 9 programs. More information on the Cycle 10 solicitation will be made available as the SM3B plans stabilize.

Selection Process *from page 9*

average acceptance rate that was independent of proposal size. Most of the community was not aware, however, that "medium" proposals were given this advantage to compensate for the panels' natural reluctance to allocate so much to one program.

For Cycle 9, we plan to implement progressive subsidies, meaning the subsidized fraction increases with size. We will adjust the algorithm from one Cycle to the next to try to keep the oversubscription rate approximately the same independent of the size of the proposal (under the assumption that quality is independent of size). *We strongly encourage proposers to ask for the observing time they need to achieve their scientific goals, without strategizing in response to perceived notions of advantages or disadvantages with respect to size.*

- Allocation of coordinated Chandra/AXAF time. Proposals of a fundamentally multi-wavelength nature, requiring both *HST* and the Chandra X-ray Observatory (AXAF), can be submitted to either the present *HST* Cycle 9 or the Chandra AO2 review. By agreement with the Chandra Science Center (ASC), STScI will be able to award up to 400 kiloseconds of Chandra observing time, and similarly the ASC will be able to award up to 100 orbits of *HST* time, to highly-rated proposals meeting the multi-wavelength criterion.

Revise and Consent

The revised procedures should lead to a stronger, better *HST* program. Proposers may want to alter their proposals in response. Specifically, here are some suggestions:

First, proposers must stress why their science is critically important and why it requires *HST*. The panelists reading the proposals will have a broader expertise — and there will be fewer specialists in the particular topic — so more introductory material may be necessary. At the same time, we can use as reviewers more expert *HST* users who in the past were excluded because they submitted too many proposals to meet our conflict-of-interest guidelines.

Second, larger proposals are strongly encouraged and are expected to be at least as successful as small proposals. The oversubscription rate for *HST* hovers around 5:1, so it is never easy to get time but *the odds of success are the same for proposals over 100 orbits and those under 10 orbits*. So if you have a project that requires a large investment of *HST* observing time, do not hesitate to propose it.

Third, science requiring both *HST* and Chandra/AXAF can be proposed to only one Observatory, eliminating the "double jeopardy" that unfairly disadvantages multi-wavelength science. Proposals should be submitted to the observatory that represents the prime science, i.e, where the predominant panel expertise (IR/opt/UV vs. X-ray) is most relevant.

Fourth, write clearly. Reviewers have always had a difficult job reading ~100 or so proposals carefully. In Cycle 9, that number may be doubled. So take the time to write clearly and coherently, explaining what you want to do and why. This is good proposal strategy whatever the review process may be.

As experience with these new procedures accumulates, we will continue to fine-tune and improve the process. Our primary goal remains to select the best possible science program for *HST*, with an appropriate scientific balance.

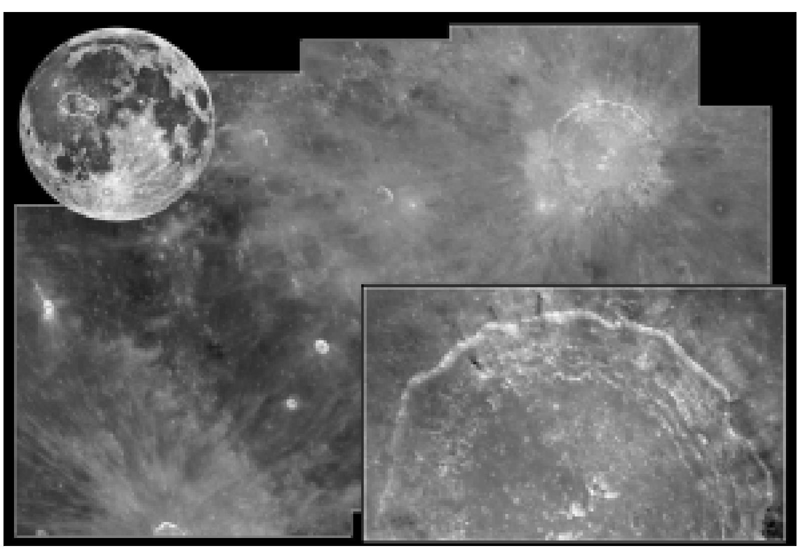
Some of the changes for Cycle 9 were suggested by experienced members of past *HST* proposal reviews and other interested astronomers. Similar input from the entire *HST* community is always very welcome.

HST Recent Release: Hubble Shoots the Moon

In a change of venue from peering at the distant universe, NASA's Hubble Space Telescope has taken a look at Earth's closest neighbor in space, the Moon. Hubble was aimed at one of the Moon's most dramatic and photogenic targets, the 58 mile-wide (93 km) impact crater Copernicus.

Credit: John Caldwell (York University, Ontario), Alex Storrs (STScI), and NASA

http://oposite.stsci.edu/pubinfo/pr/1999/14/index.html



HST Observing Status

Wayne Kinzel kinzel@stsci.edu

The 15 months since our last article (Recent Operations with *HST* and Its Instruments, January 1998), have been challenging but rewarding. During this time we successfully completed two NICMOS Camera 3 campaigns, the Hubble Deep Field-South, and the last few remaining Cycle 5 observations. In addition, tighter-than-planned restrictions to protect *HST* during the Leonid meteor storm instigated a rapid response call for ideas, selection and implementation of observations. Finally, it was a race to the finish, but we executed all NICMOS science observations before the cryogen exhaustion. We accomplished this while meeting the Independent Science Review recommendation of achieving a NICMOS observing level between 40 to 50% of the *HST* program during the NICMOS lifetime. When the NICMOS became unusable for science about the third week of December, we had averaged 47% NICMOS usage during its 18 month life. Also during this time we scheduled 22% STIS and 31% WFPC2 also meeting the ISR recommendation of at least 20 to 25% usage for each of these instruments.

Even while the challenge of completing the NICMOS observations was being met, new challenges were identified. It was recognized that when the NICMOS observations completed, and we were left with primarily WFPC2 and STIS observations to schedule, we would have a planning and scheduling problem. The problem is caused by conflicts between the two instruments over South Atlantic Anomaly (SAA)-free orbits. Because of hardware operating restrictions, STIS/MAMA observations can only be scheduled in the SAA-free orbits (generally 7 out of 15 orbits per day are not impacted by the SAA). Because of the typical visit structure, most of the WFPC2 and STIS/CCD visits also require scheduling in the SAA-free part of the day. Steps have been taken to minimize the problem: breaking long visits into smaller pieces, redefining the WFPC2 SAA contour, and automatically creating a visit structure that schedules more easily around SAA passages. As the amount of NICMOS observations being scheduled decreased, the problem was evident as we experienced an 8% decrease in the amount of prime observations scheduled per week. The steps outlined above are helping to overcome the problem and our prime observation scheduling efficiency has rebounded to the the 50% level. Note that when the rate of prime observations fell, *HST* did not sit idle. Concurrent with the reduction in prime observation scheduling, there was an increase in the scheduling of snapshot observations. As most snapshot visits are shorter than the full target visibility period, they are much easier to schedule around SAA passages than prime observations.

Since the end of NICMOS observing, we have made significant progress completing WFPC2 and STIS observations. As of early April 1999, Cycle 6 is 93% complete and Cycle 7 is 82% complete. All remaining Cycle 6 and 7 observations have been planned as early as possible given the constraints of the individual visits, and we expect that Cycle 6 will be 98% complete and Cycle 7 will be 92% complete by the nominal start of Cycle 8 in July 1999. The boundary between observing Cycles is never sharp; we start trickling in the new Cycle programs while the previous Cycle programs are tailing off. High observing efficiency is realized with a good, robust mix of observations of different sizes, types and pointings, which we achieve by deliberately blurring the cycle boundaries a bit. Our goal is to achieve a 90% completion rate of the current Cycle before the official start of the next Cycle.

As this is being written, the Cycle 8 Phase II program submission process is complete. 100% of all proposers submitted their programs by the deadline or were granted short extensions. Out of the submitted observations, 10% are unschedulable, and of these, 95% are unschedulable because of guide star related problems which could not be identified by the proposers prior to submission. This is a recognized issue and the feasibility of integrating a guide star availability process into a future version of RPS2 is being actively investigated. The near total lack of non-guide star related problems is indicative of the hard work of the community and the maturity of the observatory and the user tools. Our sincere thanks and appreciation go to all Cycle 8 observers for submitting their programs on time and nearly error-free. This makes our job much easier allowing us to proceed with integrating the Cycle 8 programs in the Long Range Plan.

Just when we thought we had a good handle on the integrating the Cycle 8 programs into the Long Range Plan, NASA announced that the first part of the third servicing mission (SM3A) will launch on October 14, 1999. (See elsewhere in this Newsletter for more details.) Currently, it is expected the servicing mission and the subsequent observatory verification will last about a month. To allow for launch delays, we must plan and schedule *HST* observations as if no servicing mission were occurring. Once the servicing mission is under way, the existing short term schedule and that section of the Long Range Plan is void. Thus any visit that is assigned plan windows that intersect the mid-October to mid-November 1999 time frame can be expected to be delayed by the servicing mission if the launch occurs on schedule. This instability to the Long Range Plan is unavoidable. We are

continued page 14

HST Education/Public Outreach Grant Program

Carol Christian carolc@stsci.edu

NASA's Office of Space Science (OSS) has developed a comprehensive approach to providing educational outreach to all educational levels, with particular emphasis on pre-college education, as well as enhancing the public understanding of space science. One of the primary goals of the education/public outreach mission is to encourage partnerships and collaborative efforts between astronomy and space science professionals and the education community. The *Hubble Space Telescope* (*HST*) Cycle 8 Educational/Public Outreach Grant Program is an opportunity created by OSS for *HST* Guest Observer/Archival (GO/AR) Cycle 8 Call for Proposals to help the efforts of researchers to build partnerships and collaborations as a way to disseminate *HST* research findings to the education community and the public.

The NASA OSS Origins Education Forum provides educational products and materials created through NASA funding and relevant to the Origins Theme. *HST* is the flagship NASA Origins mission, and the URL for the Forum Web site is *http://origins.stsci.edu*. The Forum also has the responsibility, shared with other NASA OSS Education "Ecosystem" members, to assist proposers in identifying appropriate professional educators, institutions and local, regional and national programs that can benefit E/PO programs through strong linkage.

Through the Origins Forum Web site, users can find out about other funding opportunities, such as the IDEAS Grant Program, and there is also a suite of "Recommended Practices" for E/PO programs, including evaluation methods, examples of successful projects, links to a network of resources, expertise and mechanisms. The Forum is the natural home for products and project descriptions related to the Origins Themes, such as the *HST* Cycle 8 E/PO Grant Program.

HST Cycle 8 E/PO Grants

Title	*Last Name*	*Institution*	*Education Category*
Mice Monsters and Other Celestial: A Space Safari	Smith	U.Colorado	Information Science Education
Hubble Space Telescope Outreach for the Masses	Cochran, Robinson, Sneden	U. Texas at Austin	Public Outreach/Understanding of Science
Research-Based Science Education with the HST	Rector	National Optical Astronomy Observatories	Educational Programs on the Internet
Low-Cost Television as a Hubble Outreach tool	Margon	U. Washington	Public Outreach/Understanding of Science
The Brilliant Lives of Massive Stars	Bennett	U. Colorado	Curriculum/Product Development
Active Galaxies and Other Improvements ... Penn St	Brandt	Penn State Astronomy	Student/Teacher Workshop
Black Holes for Everyone	van der Marel	STScI	Public Outreach/Understanding of Science
Value-Added Educational Tutorials for HST Data	Borne	Raytheon STX/GSFC	Educational Programs on the Internet

An Assessment of User Support at STScI

Brad Whitmore whitmore@stsci.edu

One of the four pillars of the STScI Strategic Plan is to provide excellent support for our customers, the users of the *Hubble Space Telescope*. To fulfill this responsibility, we need to stay in close touch with *HST* observers to make sure that we are spending our limited resources to provide support for the services that are most important to our users. The User Support Assessment Project was commissioned with the goal of performing a general evaluation of our current user support in order to identify areas where perceived deficiencies may exist, to identify the most-valued aspects of user support, and to estimate the cost/benefit ratios of the various services. An additional goal was to explore possibilities for streamlining user support so that we can begin transitioning a few people to begin working on the Next Generation Space Telescope initiative.

With these goals in mind, an oversight committee was formed during the summer of 1998 to conduct the user support assessment. The group consisted of: Ray Beaser, Megan Donahue, Daniel Golombek, Anuradha Koratkar, Chris O'Dea, Dick Shaw, Myron Smith, Elyse Wagner, and Brad Whitmore (Chair). Rudi Albrecht (ECF) and Bruce Balick (U. of Washington) also helped put the survey together.

A two-stage approach was adopted for the assessment. The first step was a web-based user survey advertised via e-mail in October, 1998. Approximately 350 individuals filled out the survey, roughly twice as many as with previous, more specialized surveys. In general, the survey indicated that *HST* users were quite satisfied with the user support provided by STScI. For example, on a scale of 1 = excellent, 2 = good, 3 = fair, and 4 = poor, when asked 'What is your overall assessment?,' the average was in the good range (2.05) with a range from 1.53 to 2.46.

1.53	Data Distribution
1.80	Services of the Grant Support Office
1.80	Phase I Development, Tools, Submission
1.92	Help Desk
1.93	Starview and Archive Web Interface
1.98	Program Coordinator and Contact Scientist Support
2.11	Data Reduction Pipeline
2.21	Instrument Calibration and Characterization
2.25	Analysis Software Support
2.30	TAC Process
2.30	Proposal Development Tools (RPS2)
2.46	Scheduling of Observations

It was clear from the written comments that the NICMOS difficulties had an important effect on these results. In particular, the need to rearrange the observing schedule to accommodate a larger fraction of NICMOS observations than originally planned, which led to delays in scheduling WFPC2 and STIS observations, is believed to be the primary reason for the rating for scheduling. According to the survey, the two areas which could use more resources are calibration (especially NICMOS) and scheduling. One area where people felt that fewer resources might be required is the generation of paper products and data tapes, since most people are now downloading their data over the web.

The second step of the User Support Assessment Project was the formation of three focus groups to help interpret the survey and to study various aspects of user support in more detail. The following three groups were formed with roughly equal participation from STScI and from the external community:

continued page 14

1. Proposal Processing and Scheduling System
Chair: Anuradha Koratkar

STScI Members
Stefano Casertano
Andy Gerb
Keith Noll
Tony Roman
David Soderblom

External Members
Amanda Bosh
Gary Bower
Michael Crenshaw
Zoltan Tsvetanov
Jeff Valenti

2. Calibration, Analysis, and Archival Support
Chair: Christopher O'Dea

STScI Members
Henry C. Ferguson
Timothy Kimball
Gerard A. Kriss
Gerard Williger

External Members
Thomas Ayres
Carl Grillmair
Ruth Peterson

3. Software Support for Users
Chair: Dick Shaw

STScI Members
Robert J. Hanisch
Stephen Hulbert
Alexander Storrs
Megan Donahue
Jeremy Walsh

External Members
Rudolf Albrecht
Matt Bobrowsky
Patrick Shopbell
Susan Terebey

User Support *from page 13*

The resulting recommendations represent a melding of the survey results, the work of the focus groups, and discussions within the oversight committee. They include:

Recommended improvements:

- Increase support in the area of infrared astronomy and related instrument support.
- Improve organization and indexing of paper and web-based documentation.
- Improve proposal processing software and related tools.

Recommended cutbacks:

- Reduce production of paper products and data tapes.
- Streamline proposal processing tasks.
- Reduce support for certain software analysis applications.

Items for further consideration:

- Consider outsourcing calibration of some infrequently used modes and analysis tasks.
- Consider reduced support of redundant instrument modes.
- Consider reduction of contact scientist program for established instruments.

Some of these items are already being implemented (e.g., increase IR support, reduce production of paper products) while others are undergoing further consideration.

We would like to take this opportunity to thank everyone who filled out the survey in October, and to especially thank the members of the focus groups who put a great deal of time into this effort. We believe it will be an important tool for helping STScI chart its course over the coming years.

The 1999 Hubble Fellows

Howard Bond bond@stsci.edu

The selection process for the 1999 Hubble Fellows was recently completed. We received 140 applications last November, and the candidates were ranked by a national-level committee that met at STScI in January. The ten new Fellows are the following:

Name	*Ph.D. Institution*	*Host Institution*
Amy Barger	Cambridge 1997	University of Hawaii
Daniel Eisenstein	Harvard 1996	University of Chicago
Zoltan Haiman	Harvard 1998	Princeton University
Brad Hansen	Caltech 1996	Princeton University
Andrey Kravtsov	New Mexico St. 1999	Ohio State University
Ben Oppenheimer	Caltech 1999	UC Berkeley
Eric Richards	Virginia 1999	Arizona State University
Krzysztof Stanek	Princeton 1996	Center for Astrophysics
Scott Trager	UC Santa Cruz 1997	Carnegie Observatories
Pieter van Dokkum	Groningen 1999	Caltech

The Hubble Fellows come to STScI annually to present summaries of their research at the Hubble Fellows Symposium. The Symposium is scheduled tentatively for October 14-15, 1999, and all interested persons are invited to attend. Further information will be posted at our web site, *http://www.stsci.edu/stsci/hubblefellow.html*.

The application deadline for the Hubble Fellowships commencing in the autumn of 2000 will be November 8, 1999. Again, further information will be available this summer at the above web site.

Observing Status *from page 11*

attempting to minimize the instability as much as possible. We have identified visits that are restricted to schedule only in the planned time frame and are in the process of working with the observers so the programs, if possible, may be modified now. In addition, we are attempting to place easily scheduled visits in the affected time frame so when the visits are moved, they will not necessarily be delayed until the end of the cycle or later. Finally, the planning process is also complicated by the fact that Fine Guidance Sensor #2 is being replaced during this servicing mission and will be unavailable for guiding until after the first of the new year. Even given these new additional requirements, it is expected the Long Range Plan containing the majority of Cycle 8 observations will be published in the first half of May 1999.

NICMOS Cryocooler Independent Science Review

Mike Hauser *hauser@stsci.edu*

The mechanical cryocooler system being developed by the *HST* Project to extend the usable life of the NICMOS instrument has received an important endorsement from the science community. An Independent Science Review Committee, convened on March 4 to 5 by STScI at the request of the *HST* Project, noted that the scientific capabilities of NICMOS retain certain important advantages over adaptive optics systems on ground-based telescopes. The Committee concluded that, at least in the era between the planned installation of the cryocooler and the fourth *HST* Servicing Mission (roughly 2001 to 2004), NICMOS will be the scientific instrument uniquely able to address, in the near-infrared, a number of major astronomical questions dealing with the solar system, evolution of stars and galaxies, and cosmology. The Committee recommended installation of the cryocooler, now scheduled for servicing mission SM3b, subject to satisfaction of the usual technical and flight-readiness reviews planned by the *HST* Project and NASA. They also noted that, assuming NICMOS operates successfully with the cyrocooler, the question of whether to continue operation of NICMOS beyond the fourth servicing mission should be addressed at a future time when conditions on *HST* are better known (e.g., whether there is a wide-field infrared camera in WFC3, and whether there is adequate power to keep all operable instruments running), as well as when capabilities of ground-based systems with adaptive optics can be reassessed.

The NICMOS Cooling System (NCS), using a Reverse Brayton-Cycle Cryocooler, has been under development by the Project since early in 1997 when it was discovered that a thermal short in the NICMOS dewar would greatly reduce the lifetime of the stored solid nitrogen coolant. The review Committee, chaired by Martin Harwit, included George Carruthers, Judy Cohen, Bob Fosbury, Fred Gillett, Richard Harms, Jeff Linsky, Claire Max, and Richard Wainscoat. The review was also attended by the Principal Investigators (or their representatives) of all present and future *HST* instruments. This review was a follow-up to one held in September, 1997, also chaired by Martin Harwit, which had concluded that a cryocooler had sufficiently important potential for space astronomy that development should be pursued at least through a test flight in space, reserving for consideration at a later date the question of whether such a cooler should be installed on *HST* to extend the life of the NICMOS instrument.

Much has been learned since the first review. The NCS was developed and flown on the space shuttle on the Hubble Orbital Systems Test (HOST) platform in October 1998 (the flight which included crew member John Glenn). In that flight, the NCS performed as desired, achieving an operating temperature of 75.8 K with good stability, in spite of warm and variable thermal conditions in the shuttle bay relative to those expected on *HST*. Observers who have used the NICMOS instrument are publishing exciting scientific results, demonstrating the powerful capabilities of the instrument for low-background, high spatial resolution, and high dynamic range measurements. The NICMOS instrument characteristics (noise, response, and image quality) were monitored over the range of temperatures expected with NCS operation, during the warm-up of the instrument, which began January 4, 1999. Analysis of these results shows that NICMOS, when cooled with the NCS, should meet or very nearly meet its previous capabilities. For comparison, a careful assessment of the current and expected capabilities of large ground-based telescopes equipped with adaptive optics systems was carried out by Claire Max. Though early results from such systems are impressive, the NICMOS has clear complementary advantages when it comes to sky coverage, low background at J and H bands, and quality and stability of its point spread function.

There remain a number of technical issues to be resolved related to the performance of NICMOS with the NCS, or to possible impacts on other *HST* instruments or the spacecraft. The Committee generally endorsed the Project's plans for dealing with these issues, both pre-launch and during the servicing mission in which the NCS is installed. The Project expressed a clear policy that the NCS would not be left installed unless it was demonstrated that it could be put in a state which would do no harm to other systems, and the Committee strongly endorsed this philosophy. The Committee further acknowledged that the NCS is properly viewed as an experiment, for which high probability of success cannot be guaranteed.

STScI staff who played a major role in preparing for this review, in addition to our entire NICMOS Instrument Group who were responsible for all aspects of NICMOS operations and characterization, include Larry Petro, our Cryocooler Instrument Scientist, Antonella Nota, the NICMOS Instrument Group leader, who provided the assessment of NICMOS behavior during the warm-up period, Keith Noll, who provided an up-dated normal NICMOS performance characterization, and Michael Fall, who provided an overview of scientific accomplishments with NICMOS to date. Rodger Thompson (U. of Arizona), the NICMOS PI, provided an additional description of NICMOS capabilities and science. Ed Cheng, the *HST* Project Scientist for Flight Systems and Servicing, described the NCS performance on the HOST mission and its current status.

The full report of the Committee can be found on the Web at *http://www.stsci.edu/observing/nicmos_cryocooler_isr1999.html.*

The First STScI Institute Fellow: Sally Oey

The 1998 STScI Institute Fellow, our first, is Sally Oey. Sally returns to the Institute via a circuitous route, after being a Summer Research Assistant with Dave Soderblom in 1985. Upon graduating from Bryn Mawr College in 1986, she worked for two years with Belinda Wilkes, Martin Elvis, and Harvey Tananbaum at CfA, before beginning her graduate studies at the University of Arizona. She completed her Ph.D. thesis in 1995, working primarily with Rob Kennicutt, and also Phil Massey (NOAO), on the stellar content and dynamics of superbubbles around OB associations in the Large Magellanic Cloud. From 1995 to 1998, she held an Institute Postdoctoral Fellowship at the Institute of Astronomy, University of Cambridge, U.K.

Sally Oey

Sally's work focuses on the feedback mechanisms from massive star populations, which have broad relevance to galaxy evolution and the multiphase interstellar medium. Her thesis tested the evolutionary model for superbubbles created by the stellar winds and supernovae of OB associations. More recently, she and Cathie Clarke (IoA, Cambridge) investigated the superbubble structure and phase balance of the entire ISM in star forming galaxies. With various coworkers, Sally has also been studying the ionization and properties of HII regions and the warm, diffuse, ionized medium in galaxies. She is currently completing a project on the ionization and emission-line diagnostics of HII regions with classified stellar contents. At STScI, she plans to continue expanding her work to address the connection of massive star feedback to galactic superwinds and galactic chemical evolution.

HST Recent Release: Multiple Generations of Stars in the Tarantula Nebula

In the most active starburst region in the local universe lies a cluster of brilliant, massive stars, known to astronomers as Hodge 301.

Hodge 301, seen in the lower right hand corner of this image, lives inside the Tarantula Nebula in our galactic neighbor, the Large Magellanic Cloud.

This star cluster is not the brightest, or youngest, or most populous star cluster in the Tarantula Nebula -- that honor goes to the spectacular R136. In fact, Hodge 301 is almost 10 times older than the young cluster R136.

But age has its advantages; many of the stars in Hodge 301 are so old that they have exploded as supernovae. These exploded stars are blasting material out into the surrounding region at speeds of almost 200 miles per second. This high speed ejecta are plowing into the surrounding Tarantula Nebula, shocking and compressing the gas into a multitude of sheets and filaments, seen in the upper left portion of the picture.

Note for your calendar; Hodge 301 contains three red supergiants - stars that are close to the end of their evolution and are about to go supernova, exploding and sending more shocks into the Tarantula.

Also present near the center of the image are small, dense gas globules and dust columns where new stars are being formed today, as part of the overall ongoing star formation throughout the Tarantula region.

Credit: Hubble Heritage Team (AURA/STScI/NASA)

http://oposite.stsci.edu/pubinfo/pr/1999/12/index.html

FGS News

Ed Nelan nelan@stsci.edu

With the approach of *HST*'s Cycle 8 observing season, the specification of the plan to commission and calibrate FGS1r as the new science astrometer has been completed. The plan includes a modest program to monitor and verify the stability (i.e., repeatability) of FGS1r's interferograms, a program to monitor changes of the instrument's distortion and scale across its 69 square arcminute field of view, and two special calibration programs. One of the special calibrations addresses the Optical Field Angle Distortion, or OFAD. Calibrating the OFAD is essential for enabling sub-milliarcsecond relative astrometry from Position Mode observations. The other special calibration addresses the change of the instrument's interferograms as a function of a star's spectral color. Experience with FGS3 shows that, in order to reliably deconvolve the blended interferograms of the components of close binary systems (with separations of less than 30 milliarcseconds), it is necessary to use reference interferograms from point sources that match the color of the stars to within a *B–V* of 0.3. This calibration is especially important for Cycle 8 since the FGS science program includes observations of even closer spectroscopic binary systems to derive visual orbits.

WFPC2 News

John Biretta biretta@stsci.edu

WFPC2 continues to perform well after 5 years on-orbit. Imaging with WFPC2 currently makes up roughly 50% of the *HST* observation program, and the backlog of proposals is quickly dissipating.

A recent examination of the Charge Transfer Efficiency (CTE) problem shows that it continues to increase much as predicted early last year for faint images. In the worst-case scenario of a short exposure on a faint star (<20s exposure, <50 ADU in the image, little or no sky background, Y=800 on the CCDs), a target can appear about 40% fainter than shortly after launch. Fortunately, for more typical exposures (>300s) the higher background greatly reduces the CTE loss and minimizes the problem for most science exposures. The time-dependent correction equations previously derived appear to remain valid, though work is underway to further improve their accuracy.

Other recent calibration activities include installing new contamination correction tables in SYNPHOT, and generating new super-bias, super-dark, and flat field reference files. A recent report (ISR WFPC2 99-01) shows that the internal flats are quite stable, except for previously known long-term variations. We are also testing the "Calibration-on-the-Fly" system which will automatically recalibrate data when they are requested from the archive. This system should become publicly available for WFPC2 data later this year.

Work is underway to develop the Cycle 8 calibration plan. The anticipated program consists mostly of routine monitors which are similar to those in previous Cycles. In addition, there will be special observations to test the UV flat-fielding, the UV plate scale, CTE effects on extended targets, photometry of very red stars, and further tests of the linear ramp and polarizer filters. There will also be several experiments to see whether a "noiseless" preflash might reduce CTE and similar photometric anomalies. Planning is also underway for health and safety monitoring, as well as calibration verification, during and following the upcoming Servicing Mission 3A. As always, observers are welcome to suggest new calibrations, and to comment on existing plans.

Processing of Cycle 8 GO proposals is proceeding smoothly. As of this writing, most have been reviewed by a contact scientist and enabled for scheduling. In preparation for the Cycle 9 Call for Proposals, we plan to release a new update to version 4.0 of the WFPC2 Instrument Handbook, which would replace the previous Cycle 8 update.

Further information on these topics can be found at our WWW site, *http://www.stsci.edu/ftp/instrument_news/WFPC2/wfpc2_top.html* or by contacting *help@stsci.edu.*

Results from the NICMOS Warmup

Torsten Boeker boeker@stsci.edu

As mentioned in the last STScI Newsletter, NICMOS exhausted its cryogen early this year. Immediately after depletion, the instrument started to warm up rapidly, at a rate of about 7 Kelvin per day. It has by now completely equilibrated with the rest of the *HST* environment, and is stored in the OPERATE state until the installation of the NICMOS Cooling System (NCS) during Servicing Mission 3b in late 2000. The NCS is a mechanical cryocooler with a closed-loop circuit that will allow NICMOS operation at temperatures around 75 K, starting in Cycle 10.

continued page 18

INSTRUMENT NEWS

NICMOS Warm-up *from page 17*

Since NICMOS functioned at temperatures around 62 K for most of its on-orbit life in Cycle 7, the instrument will have to be recalibrated once the final operating temperature is established. In order to provide potential NICMOS users with reliable performance estimates for Cycle 10, an extensive monitoring program was executed over the course of the warm-up period, which offered a unique chance to observe the NICMOS behavior at the temperatures expected for operation with NCS. The program was activated on 15 November 1998, after completion of the NICMOS science program. The data were analyzed in a near real-time fashion in order to monitor the health of the instrument and to allow timely reaction to any mechanical changes in the NICMOS dewar. For safety reasons, motion of the filter wheels was prohibited after the detectors reached a temperature of 78 K. For higher temperatures, only dark data are available.

The details of the program as well as the data analysis are described in the Instrument Science Report (ISR) NICMOS-99-001. The main results are summarized here:

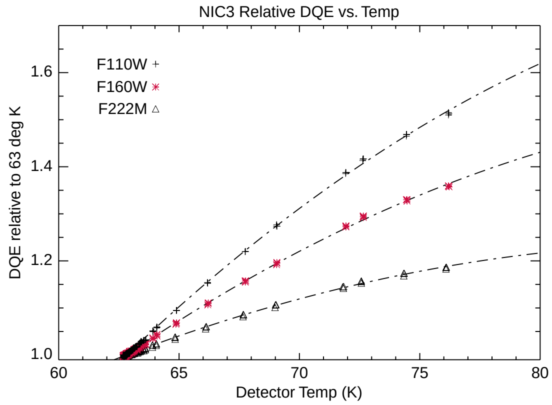
1) The average detective quantum efficiency (DQE) at 75 K is increased by about 45% at 1.0 µm, 33% at 1.6 µm, and 17% at 2.2 µm (Figure 1). In addition, detector regions with low sensitivity show a larger DQE increase than high sensitivity regions, so that the array response is effectively flattened compared to Cycle 7. This will improve the accuracy of photometric measurements with NICMOS.

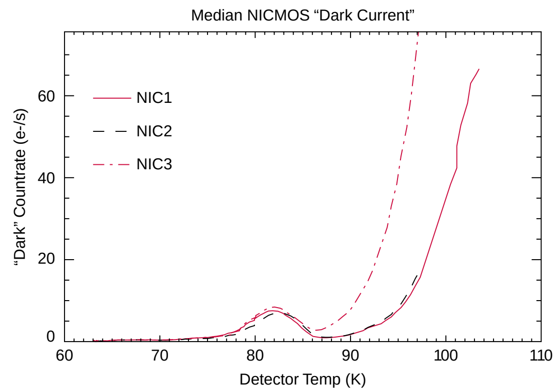
2) The focus position of the three cameras showed no change up to a temperature of 67 K, beyond which no further data are available. The reason for this lack of data is that the warm-up rate was higher than expected so that filter wheel motion had to be inhibited prior to the next scheduled focus sweep.

3) The dark current showed an unexpected — and as of yet unexplained — increase at temperatures between 75 and 90 K (commonly referred to as the "bump", see Figure 2). Because the dark exposures taken over this temperature range show flat-field structure, the current assumption is that the bump is due to a photonic signal from inside the detector material. A possible explanation — rather speculative at this time and awaiting additional laboratory testing — is the release of energy from cosmic ray hits which has been stored inside the detector material, similar to the annealing process known from CCD chips. An important question is whether the bump will be observed again during the NCS cooldown. Based on the warmup data, the NICMOS dark current for Cycle 10 is expected to be higher by factors between 5 and 25 relative to Cycle 7, depending on whether or not the bump will recur.

4) All other instrument characteristics are either unchanged or can be easily corrected in instrument operations or pipeline processing.

continued page 19





NICMOS Warm-up *from page 18*

Based on these results, we expect the future NICMOS sensitivity to be comparable to that seen in Cycle 7. For example, a deep 2000 second exposure with Camera 3, as taken during the Hubble Deep Field campaign, will reach about 0.2 magnitudes fainter if the dark current bump is not observed, and about 0.3 magnitudes less faint, if the dark current follows the same trend as during warm-up.

In summary, NICMOS in combination with the NCS will roughly maintain its scientific performance, and will continue to provide a unique infrared capability onboard *HST*. This was recognized also by the Independent Science Review Board, which recommended the installation of the cryocooler and the continued availability of NICMOS for science observations. (For details, see Mike Hauser's article elsewhere in this Newsletter.)

Spectrographs News

Gerard Kriss *gak@stsci.edu*

Entering its third year of operation, STIS is settling comfortably into the role of a mature instrument. Nearly all calibrations are either based on, or are consistent with, data obtained in flight. Operations are continuing smoothly, and at a high rate: roughly 50% of all *HST* observations are now performed using STIS.

A recent operational change to enhance science was implemented in March 1999. The placement of images on both MAMA detectors was adjusted, and the location of first-order spectra on the FUV-MAMA was moved to the lower half of the detector, below the repeller-wire shadow. Prior to this adjustment, images on the MAMAs were not well centered, and the full area of the detectors was not illuminated. In March we adjusted the Mode Select Mechanism (MSM) offsets to center images better in the vertical direction. (Horizontal centering cannot be adjusted well with the MSM.) On the FUV-MAMA, a region of high background in the upper-left quadrant becomes significant at high temperatures. We therefore changed the default location for first-order L and M-mode spectra to lie below, rather than above, the repeller-wire shadow at the center of the detector. This should improve the signal-to-noise ratio at short wavelengths in spectra of faint objects.

The STIS pipeline software has been operating robustly. Our plans for the next release of CALSTIS consist mostly of enhancements and tools, rather than bug fixes. In development are a spectrum splicer, an optimal extraction tool, and a tool for correcting scattered light in echelle spectra. Calibration tweaks that are under development include a plan to produce weekly bias files, which will help remove trails from hot pixels, especially in short-exposure images and spectra, and correction of a slight temperature dependence in the FUV-MAMA sensitivity.

In preparation for Cycle 9, we are updating our instrument handbook with the latest calibration data. Changes to last year's Version 2.0 will be minor; most updates to sensitivities and throughputs are less than 10%. When writing your Cycle 9 proposals, however, make sure to check out new instructions for slitless spectroscopy, dithering strategies to avoid spatial undersampling, recommendations for avoiding excessive cosmic ray contamination, and a discussion of charge-transfer inefficiency. Regarding the latter point, we note that at low background levels, the charge loss can be as high as 10% for a pixel at the center of the chip containing 100 electrons.

On the FOS front, the ST-ECF is poised to implement a re-calibration of the entire set of archival data using a corrected wavelength scale, an improved dark-subtraction algorithm, and flat fields complete to the end of FOS life. By the end of this year, these data will be archived and accessible to the user community. Once this task is complete, the flux calibration will be re-examined, and a fully re-calibrated data set will be placed in the archive by the spring of the year 2000.

Wide Field Camera 3 – Scientific Oversight Committee

Steve Beckwith, Director & Duccio Macchetto, Associate Director for Science Programs macchetto@stsci.edu

Approximately one year ago NASA approved the development of the WFC3 for installation in the HST on the 2003 Servicing Mission.The WFC3 will be built as a facility instrument and thus will not have a PI nor a traditional Investigation Definition Team.Instead a Scientific Oversight Committee (SOC) was established to define the scientific aims and to ensure that the broad interests of the scientific community are represented during the development.

The primary task of the SOC,whose current membership is shown below, is to advise the HST Project and STScI in all areas of scientific performance of WFC3.It has met five times since July 1998.

The WFC3, which is described in more detail in *http://wfc3.gsfc.nasa.gov*, was primarily intended to be a replacement for the WFPC2 to ensure that the HST will continue to have superb imaging capabilities during its lifetime (2010).

A number of scientific bodies, including the HST Second Decade Committee, the ST Institute Council, the ST Users Committee, the Time Allocation Committee and the NASA Origins Subcommittee have recommended to NASA that a near-IR channel be added to the baseline concept. The near-IR channel will operate in the 1-1.9 micron range and will use a 1k × 1k Hg:Cd:Te detector. This addition is in the final NASA approval cycle.

In view of this exciting new possibility we would like to augment the membership of the SOC to include three additional experts in IR astronomy.

A team of scientists and engineers from within the HST Project at GSFC and from the STScI is responsible for the day to day activities associated with the WFC3 project. This team is led by an Instrument Scientist (Ed Cheng) and an Instrument Manager (Thai Pham), both from GSFC, and a Deputy Project Manager (Marc Rafal) and Deputy Project Scientist and Operations Scientist (John MacKenty) from STScI.

The SOC provides broad scientific oversight and guidance to the WFC3 project. In particular, it is expected that the SOC will define the key scientific objectives achievable by WFC3, within the constraints of its main characteristics, e.g., optical configuration and detectors. The SOC will:

a) define the key scientific goals for WFC3, in particular, define a representative set of scientific programs to be used in the development of a Design Reference Mission.

b) define the main scientific success criteria for WFC3, and help determine the technical trade-offs and assess performance against these criteria.

c) recommend the set of filters to be incorporated in the WFC3 for the optimal execution of the scientific program (broad community input will be sought as part of the SOC's deliberations on this issue).

d) participate in the selection of the flight and spare detectors, including the trade-offs of the performance parameters (QE, read noise, cosmetics, etc.) and scientific objectives.

e) assist in the prioritization of major operational modes.

f) participate in the major project reviews.

It is expected that the SOC will meet an average of 4 to 5 times each year. Since WFC3 is to be built as a facility class instrument, there will be no guaranteed observing time for the SOC members or any other scientist. Travel and incidental expenses will be covered, but we ask the members of the SOC to be willing to serve on this committee as a service to the astronomical community and as their representatives.

We invite scientists interested in participating in the SOC to submit a short (2-3 pages maximum) letter or email with their personal qualifications and a description of their expertise in the scientific and technical areas associated with the Infrared Red channel of the WFC3, outlining the contributions they expect to make to the successful completion of the project. The letter or email should be sent to Dr. Duccio Macchetto at the STScI by May 7 ,1999.

The new SOC members will be selected by a peer review panel , whose task will be to evaluate the qualifications and the scientific merits of the proposed contributions .We expect those selected to be available to participate in the next SOC meeting scheduled for July 15 and 16 at the STScI.

WFC3 SOC MEMBERSHIP

B.Balick
H.Bond
M.Carollo
M.Disney
M.Dopita
J.Frogel
J.Hester
J.Holtzman
G.Luppino
R.O'Connell (Chairman)
F.Paresce
A.Saha
J.Trauger
A.Walker
R.Windhorst
B.Whitmore

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

Paolo Padovani padovani@stsci.edu

Hubble Data Archive Status

The Hubble Data Archive reached the 6 Tbyte mark last January, and, as of 1 April 1999, includes 6.2 Tbytes of data. The number of science datasets now totals about 180,000. Archive ingest has slowed somewhat after the completion of the NICMOS science program, with an average ingest rate around 4 Gbytes/day in the past four months.

HST Duplication Checking on the World Wide Web

Many of our readers have probably had to check their proposed *HST* observations against the catalog of previously executed or accepted programs to see if some of their observations would qualify as duplications. (An observation is defined as duplicating a previous one if it is on the same astronomical target or field, with the same or similar instrument, a similar instrument mode, similar sensitivity, similar spectral resolution, and a similar spectral range.) Until recently, this had to be done either by going through the Planned and Archived Exposures Catalog (PAEC) ASCII files, or by using StarView. Now you can do this on the World Wide Web. Namely, a form at *http://archive.stsci.edu/hst/duplication_checking/* allows a user, by simply entering her/his proposal ID or name, to check for duplications among Cycle 7, 8, and 9 proposals. This is especially useful for Cycle 6 and 7 PIs, who are now required to check for programs conflicting with their own observations. For more complex duplication checking, you can use the form at *http://archive.stsci.edu/cgi-bin/duplication*.

StarView Release 5.4a

StarView 5.4a was released in March. To avoid problems with both searches and retrievals, we recommend that users update any locally-installed StarView software. Installation instructions are available at *http://archive.stsci.edu/hst/distributed_starview.html*. The main new features of this release include added functionality for the On-The-Fly Calibration for internal testing (see the article by S. Lubow on page 7), and updates to reflect database structure changes.

Ingest of UV Archives at MAST

All MAST data are accessible via World Wide Web pages which contain links for users to search the database, obtain help, retrieve data, and get access to on-line documentation and analysis software. Until recently, not all databases were physically stored at MAST. The International Ultraviolet Explorer (IUE) Final Archive, for example, was accessible via links to the NASA Data Archive and Distribution Service (NDADS) system at the National Space Science Data Center (NSSDC). We are currently in the process of storing all data at STScI by copying MAST databases to CDROMs. As of April, IUE (NEWSIPS), HUT, WUPPE, and UIT data have all been successfully ingested into our juke-boxes. These amount to about half a Terabyte of data (uncompressed). One of the positive effects of having all MAST data stored on-site will be the possibility of direct retrievals for MAST datasets (see below).

Direct Retrievals for ASTRO Datasets

New interfaces for the three Astro missions in MAST (HUT, WUPPE, and UIT) have been installed. These new interfaces allow the user to retrieve data directly to her/his disk simply by “clicking” on the dataset name. No username or password is required. Datasets may be downloaded as .tar, .tar.gz, .tar.Z, or .zip files. This system will be the model for the delivery of all CDROM-based MAST data, which are currently being ingested into the MAST juke-boxes. The ASTRO missions are available on MAST at *http://archive.stsci.edu/astro*.

Soon to come at MAST ...

- StarView II, a Java-based World Wide Web tool to access to *HST* data
- *HST* “Paper” products on the World Wide Web
- CDROMS for GOs

Wide Field Camera 3 Filter Workshop

*The Wide Field Camera 3 Project, Science Oversight Committee, and the STScI plan to host a workshop in Baltimore on 14 July to provide a forum for community input to the selection of filters for the WFC3 instrument. Additional details will be provided by e-mail to the HST community and posted to the WFC3 web pages. (**http://wfc3.gsfc.nasa.gov/** and **http://www.stsci.edu/ftp/instrument_news/WFC3/wfc3.html**) in early May. WWW and e-mail mechanisms for community comment will also be provided.*

Beatrice Tinsley Prize Awarded to Bob Williams

Dr. Robert E. Williams was awarded the Beatrice M. Tinsley prize in recognition for his leadership in the design and execution of the innovative Hubble Deep Field (HDF) campaign. The HDF images have been nothing short of remarkable and clearly herald a new era in observational cosmology. The HDF program has sparked extensive work by many groups on the nature of the morphology of extremely faint galaxies, the cosmic star formation history, the origin of the optical extragalactic background, and the identification and study of a "statistical" sample of z~3 galaxies. The HDF has also provided an important constraint on the stellar composition of the halo of our own galaxy.

Although the success of the HDF campaign can be attributed to many people both within STScI and around the world, its origins are clearly traced to Bob's fascination with and recognition of the superb imaging capabilities afforded by *HST*. Bob took a bold step in allocating 150 orbits of Director's Discretionary *HST* time to the study of galaxy evolution. He convened an advisory panel of distinguished extragalactic researchers to assist him in determining the specific goals of the HDF program, and then went on to establish and lead the Hubble Deep Field team, consisting primarily of STScI staff, in the planning and execution of the program and in the reduction and distribution of the data to the entire community. It was Bob who also felt most strongly that the data must be made public almost immediately and in a research-ready format in order to maximize the scientific return.

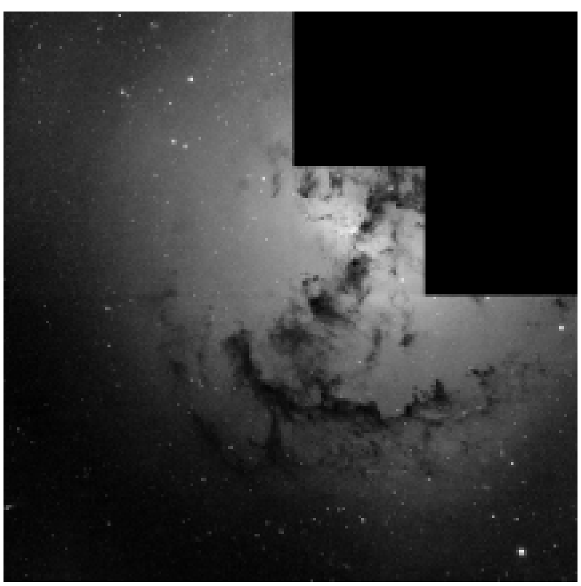
And succeed it did. To date, there have been over 65 published research papers which use the HDF dataset in one way or another. We can think of no other recent extragalactic dataset that has generated such an output within such a short time. The HDF has fired the imaginations of the public as well having been featured in dozens of popular magazines and television programs. It is safe to say that the HDF datasets will be one of the legacies of *HST*, originating, in large part, from the inspiration and foresight of Bob Williams.

Below is the abstract from the first HDF publication. Bob intentionally opted not to participate in the many subsequent research papers based upon the data he made possible. Given the impact the HDF has had, however, we feel this single publication is sufficient support for this nomination.

Williams et al. 1996, "The Hubble Deep Field: Observations, Data Reduction, and Galaxy Photometry," AJ, 112, 1335.

Abstract

The Hubble Deep Field (HDF) was a Director's Discretionary program on *HST* in Cycle 5 to image an undistinguished field at high Galactic latitude in four passbands as deeply as reasonably possible. These images provide the most detailed view to date of distant field galaxies and are likely to be important for a wide range of studies in galaxy evolution and cosmology. In order to optimize observing in the time available, a field in the northern Continuous Viewing Zone was selected and images were taken for ten consecutive days, or approximately 150 orbits. Shorter 1 to 2 orbit images were obtained of the fields immediately adjacent to the primary HDF in order to facilitate spectroscopic follow-up by ground-based telescopes. The observations were made from 1995 December 18-30, and both raw and reduced data have been put in the public domain as a community service. We present a summary of the criteria for selecting the field, the rationale behind the filter selection and observing times in each band, and the strategies for planning the observations to maximize the exposure time while avoiding Earth-scattered light. Data reduction procedures are outlined, and images of the combined frames in each band are presented. Objects detected in these images are listed in a catalog with their basic photometric parameters.



HST Recent Release: Hubble Finds More Evidence of Galactic Cannibalism

This beautiful, eerie silhouette of dark dust clouds against the glowing nucleus of the elliptical galaxy NGC 1316 may represent the aftermath of a 100 million year old cosmic collision between the elliptical and a smaller companion galaxy.

The picture was taken in April of 1996 with the Wide Field Planetary Camera 2. The color rendition was constructed using separate images taken in blue and red light. NGC 1316 is located 53 million light-years away in the constellation Fornax. The field of view shown is about 12,000 light-years across.

Credit: Carl Grillmair (California Institute of Technology) and NASA

http://oposite.stsci.edu/pubinfo/pr/1999/06/

HST Recent Release: Hubble Clicks Images of Io Sweeping Across Jupiter

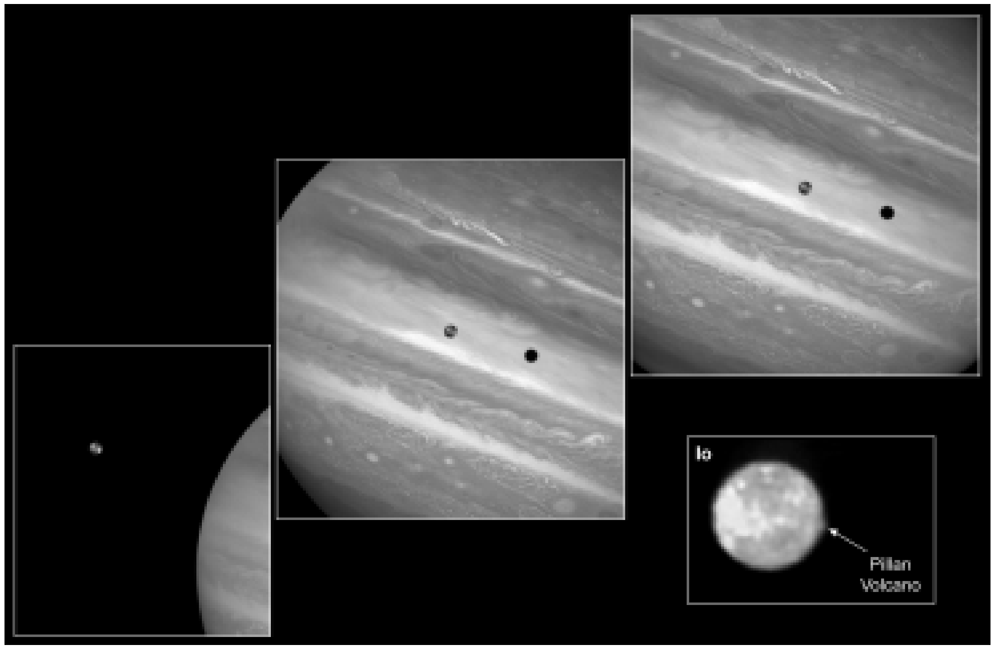
While hunting for volcanic plumes on Io, NASA's Hubble Space Telescope captured these images of the volatile moon sweeping across the giant face of Jupiter. Only a few weeks before these dramatic images were taken, the orbiting telescope snapped a portrait of one of Io's volcanoes spewing sulfur dioxide "snow."

These stunning images of the planetary duo are being released to commemorate the ninth anniversary of the Hubble telescope's launch on April 24, 1990.

The three overlapping snapshots show in crisp detail Io passing above Jupiter's turbulent clouds. The close-up picture of Io (bottom right) reveals a 120-mile-high (200-kilometer) plume of sulfur dioxide "snow" emanating from Pillan, one of the moon's active volcanoes.

Credits: John Spencer (Lowell Observatory) and NASA

http://oposite.stsci.edu/pubinfo/pr/1999/13/index.html



Calendar

Cycle 9

Call for Proposals issued	June, 1999 (tentative)
Phase I proposals due	September 11, 1999 (firm)
Proposers notified	December, 1999 (tentative)
Phase II Proposals Due	February, 2000 (tentative)
Routine Observing Begins	July, 2000 (tentative)

Meetings and Symposia

WF3 Filter Workshop	July 14, 1999
Hubble Fellows Symposium	October 15-15, 1999 (firm)

Servicing Mission 3

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

Editorial Note

This issue of the STScI Newsletter is dated June, 1999. We will still publish four numbers per year and they should reach you in March, June, September, and December. This change in schedule has been done, in part, so that proposal-related news reaches you at the best time.

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.

Robert Fosbury *(Editor)*
Space Telescope — European Coordinating Facility

Karl Schwarzschild Str. 2
D-85748 Garching bei München
Federal Republic of Germany

E-Mail: rfosbury@eso.org

Contents

How to contact us:

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

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

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

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

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

George Miley (chair), Sterrewacht Leiden,
miley@strw.leidenuniv.nl
Bruce Balick, U. Washington
Debbie Elmegreen, Vassar College
Jay Frogel, Ohio State University
Chris Impey, U. Arizona
Pat McCarthy, O.C.I.W.
Felix Mirabel, CEA-CEN Saclay
Sergio Ortolani, Padova
Dave Sanders, U. Hawaii
Sue Tereby, Extrasolar Research Corp.
Harold Weaver, JHU
Bruce Woodgate, GSFC

The Space Telescope Science Institute *Newsletter* is edited by David Soderblom, to whom correspondence may be sent (*soderblom@stsci.edu*). To record a change of address, please contact Ms. Nancy Fulton (*fulton@stsci.edu*).

Design and layout: John Godfrey
Production Assistance: Pat Momberger and Trish Pengra
Editorial Assistance: Jack MacConnell

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STScI N-99-02