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NEWSLETTER

Space Telescope Science Institute

Image Credit: *NASA*, *ESA*, M.J. Jee and H. Ford (*Johns Hopkins University*)
http://hubblesite.org/newscenter/archive/releases/2007/17/

Cycle 16

Proposal Review & Science Program

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There is an ancient Chinese curse: *May you live in interesting times*. As a cycle preceding a servicing mission, *Hubble* Cycle 16 was always liable to prove interesting.

Chronology

The *Call for Proposals* (*CP*) for Cycle 16 was released in early October 2006. At that time, Servicing Mission 4 (SM4) appeared likely, but had not been officially placed on the books; consequently, the *CP* indicated that Cycle 16 might be terminated as early as May 2008 by the potential SM4. In late October, the NASA administrator, Michael Griffin, confirmed that SM4 would take place no earlier than May 2008. In early January 2007, however, SM4 was rescheduled for 11 September 2008. Following internal discussions at the Institute, the Science Policies Division (SPD) and the *Hubble* Mission Office recommended that Cycle 16 should be extended, ensuring a single suite of instruments for a post-SM4 Cycle 17. The short lead-time before the Cycle 16 proposal deadline on January 26, 2006, argued against a formal announcement of this decision at that time.

The *Hubble* proposal deadline passed at 8 p.m. EST on January 26 with the submission of 747 proposals. At ~07:30 a.m. the following day, the Advanced Camera for Surveys (ACS) experienced a serious failure, disabling the wide-field channel (WFC) and high-resolution channel, and thereby rendering moot 450 of the 747 proposals. On the other hand, almost 300 Cycle 16 proposals were unaffected by the failure. The decision was made to reschedule the proposal deadline to February 9, aided by cooperation from the *Spitzer* team, which moved their deadline from February 14 to February 16, providing a modicum of breathing space for optical/infrared astronomers.

The community responded enthusiastically, and we received a total of 821 proposals, including ~350 of the original ACS programs. Following heroic efforts on the part of SPD staff, notably Darlene Spencer and Brett Blacker, the proposals were burned to CD-ROM and distributed to the appropriate TAC/panel members by February 16. This allowed panelists approximately five weeks to assess the proposals before the time assignment committee (TAC) meeting, which was held March 19–23 at the BWI Marriott Hotel. This rapid turnaround would have been impossible were we still relying on producing and distributing paper copies of the proposals.

Peer Review Process

The *Hubble* time-assignment process involves 11 panels, each consisting of 10 to 12 astronomers, and the TAC, which consists of the 11 panel chairs, two to three at-large members, and the TAC chair. The individual panelists and TAC members were recruited in August/September 2006, about seven months before the meeting itself.

The panels meet for the first three days to rank the smaller programs: general observer (GO) proposals for

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[2007] SUMMER

Proposing for Hubble Time

M. Urry, *meg.urry@yale.edu*

During Yale's spring break last March, I had the privilege of chairing the Cycle 16 *Hubble* Time Allocation Committee (TAC). For the first two days of the week-long review I circulated among the 11 panels, listening to their discussions in order to get a sense of the full range of *Hubble* science, as well as to discern any key issues or problems; for the next three days I chaired the TAC itself. Those experiences prompt me to offer a few comments about the review, and what I hope is useful advice for future *Hubble* proposers.

Hubble Space Telescope is 16 years old and counting, or nearly 30 years old if you date it from the original instrument selection—so it might be anticipated that all of the truly interesting results have been obtained and that what remains to be done is somehow more pedestrian—particularly as there have been no new instruments for a while, and one of the key instruments, the ACS, appears to be out of the near-term picture. Yet in Cycle 16 the ground truth was quite different. There was no dearth of exciting scientific proposals, and the decisions and cuts that the panels and TAC had to make were decidedly painful. I personally was very unhappy that we were unable to approve several fabulous large proposals that would have taught us something new about our world. That they were not approved says only that there were even more exciting proposals ahead in the rankings. Similarly, among the regular proposals considered by the panels were a number of innovative and interesting projects, many of which were not approved because of the proposal pressure. The scientific excitement of the *Hubble* program remains extremely high.

Hubble continues to do cutting-edge, potentially transformative science in spite of its longevity—or perhaps because of it—since over those same 16 cycles, astrophysics itself has changed dramatically. This is due, in part, to *Hubble*, with the discovery of exoplanets, the ubiquity of supermassive black holes and their key role in galaxy evolution, and the discovery of an accelerated expansion of the universe, to name just a few obvious cases. This change in the knowledge base is what makes *Hubble* science fresh and exciting. This is not to say that we don't look forward to larger apertures and more sensitive detectors, which will make far easier the exciting projects that today require enormous effort with *Hubble* (and that will enable new measurements simply not possible with *Hubble*). But with *Hubble* we can make progress now, today, in answering some of the most interesting questions ever posed, regardless of progress on future facilities. That is tremendously valuable.

Thus, the process of selecting observations to be done with *Hubble* is particularly important, and it has been carefully crafted over the years[1] to meet the following goals:

- To be fair and objective, minimizing conflicts of interest.
- To select programs of broad interest, not just those appealing to narrow sub-fields.
- To achieve a balance of small, medium, and large programs.

These goals have led to a process that, if not understood by the proposers, can pose obstacles to success—or so it seemed in this last proposal review.

First and most important, proposers must write for non-specialists—particularly for the large proposals that will be read by the TAC. The expertise of TAC members spans the full range from the solar system to the most distant reaches of the universe, so proposers need to explain why a star-formation person should care about a high-redshift galaxy, or why a cosmologist should find an exoplanet project exciting. The proposals that fare best manage to convey an exciting idea and a winning

[1] Full disclosure: the author headed the Science Program Selection Office at the Institute from 1997–2001.

strategy. A broad approach is also important for smaller proposals, since the panels also have very broad expertise. Proposals must make a winning case without relying on an in *situ* specialist to make the argument for them.

The single biggest improvement most proposers could make would be to approach their argument through the lens of a newcomer to the particular sub-field. As a specific suggestion, perhaps in the next cycle you might think about trying out your proposals on someone in a completely different area of astronomy—or even someone outside astronomy altogether—to see whether they understand and appreciate the value of the program you propose. Technical issues are, of course, important (and non-astronomers will not be able to help you with those), but if the main idea doesn't come across clearly, the reviewers may never get to the technical issues.

Second, some proposers will inevitably try to game the system, but if they misunderstand the process, they may actually harm their chances. We noted one particularly ineffective approach regarding large-ish proposals in the "medium" category. As Neill Reid explains in his article, panels receive a "subsidy" for medium-sized proposals ($\sim$25–99 orbits) to encourage approval of programs that otherwise could take up a healthy fraction of a panel's total allotment. Indeed, in Cycle 16 we saw that the subsidy worked well, leading to an overall program that was well balanced in terms of size. However, even with the subsidy, the largest medium proposals can be a lot for a panel to absorb. We saw several proposals requesting 99 orbits—this had to be a deliberate attempt to avoid being in the "large" category ($\geq$100 orbits)—yet such borderline proposals are almost certainly doomed to fail, partly because they use too much of the panel's allocation and partly because panelists perceive that the proposer is trying to avoid the TAC. The TAC felt that programs of this size should really be considered in competition with other 100-orbit proposals—that is, they felt that proposals using this much *Hubble* time really ought to be of broad interest. You can judge by the results: the Cycle 16 TAC approved a number of large proposals of roughly 100–150 orbit size, while no panel approved a 99-orbit proposal. So if your program is in the $\sim$85–100 orbit range, you are probably better off crafting a large proposal and competing in the TAC.

Finally, we thought too few archive proposals were submitted. It is typical to see a handful, or even dozens, of observing proposals that propose to do similar science, but although there are many outstanding archival proposals, there is usually only one per topic—even when we know several groups are probably carrying out similar projects already. The science would be well served by more competition among related proposals, and higher proposal pressure would more accurately reflect the true value of the *Hubble* archive as well. In turn, panels will have to be more supportive of the value of archival research—it is too easy to be seduced by the notion of new observations, or to imagine that the archival work will be done anyway, resulting in lower grades for archival proposals.

The TAC wondered whether proposers were, perhaps, concentrating their efforts on obtaining new data, and therefore had no time to write archival proposals. Accordingly, we suggested that the Institute consider delaying the deadline for archive proposals by a week or so beyond that for observing proposals, giving people time to think about exciting science to do with existing data, and time to write those proposals.

These are just a few suggestions to improve the chances of success in the *Hubble* proposal lottery. That said, there is no substitute for experience. The best way to learn the process is to serve on a review panel. Many astronomers cite their first peer review as eye opening and invaluable. The Institute staff would no doubt be happy to hear from volunteer panelists, so consider offering your services. They may need your expertise, and you will have performed an important service and helped your future proposal prospects as well.

Acknowledgements—The *Hubble* proposal review process is a model of efficiency and thoroughness, thanks largely to the professionalism and dedication of the Institute staff, notably Brett Blacker, Laura Bucklew, Karyn Keidel, Claus Leitherer, Neill Reid, Darlene Spencer, Eva Villaver, and Bob Williams. The Institute management, especially the Director, Matt Mountain, and the Science Mission Head, Antontella Nota, were deeply engaged in the process. The reviewers were an impressive group of scientists—particularly the panel chairs, who did more than their share of the hard work. We all owe them a debt of gratitude. Ω

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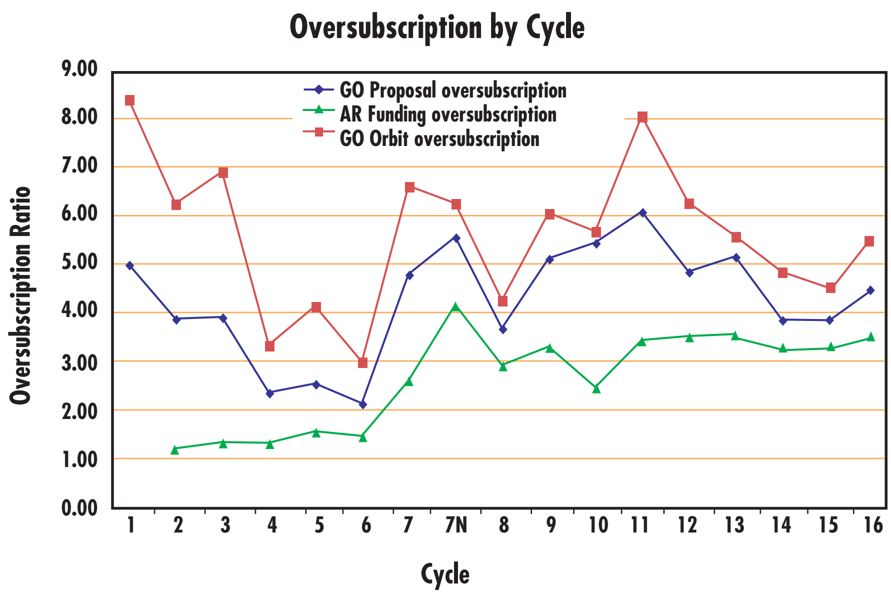
<100 orbits, archival research (AR) programs for <$150,000. The TAC meets after the panels have completed their deliberations to grade the large, Treasury, and Legacy Archive programs.

The eleven panels comprised one solar system panel, five Galactic panels (includes studies of resolved stellar populations in Local Group galaxies) and five extragalactic panels. The latter panels cover broad science areas, making it imperative that proposers write for non-specialists. As in every year since Cycle 11, we created "mirror panels" in certain subject areas, allowing us to redirect proposals to avoid conflicts of interest. This cycle, we had two mirror panels for hot stars and interstellar medium (ISM); three for cool stars, stars formation, and resolved stellar populations; two for unresolved stellar populations and the ISM in other galaxies; and two for active galactic nuclei, quasi-stellar objects (QSOs), the intergalactic medium (IGM), and cosmology.

Proposal Acceptance Ratio



Approximately 3,000 orbits are available for allocation in a typical cycle. Nominally, the panels assign two-thirds of the time, and the TAC assigns the remainder. Each panel has a specific orbit allocation, based on the number of orbits requested in the proposals assigned to that panel. In addition, there is a central pool of orbits to provide a scaled subsidy for medium-size proposals; thus, a ~30-orbit program "costs" a panel ~24 orbits, while a ~75-orbit program costs 38 orbits. We have found that this mitigates the tendency to favor small programs, and leads to a more balanced portfolio in program size.

Under the current system, the Galactic and extragalactic panels are faced with assessing 70 to 80 proposals, besides providing the panel chair with comments on TAC programs that fall within their subject area. This task would require more than 20 hours of deliberations were the panel to discuss every proposal. Consequently, we ask panelists to submit preliminary grades for proposals, and the lowest 30–35% are placed in a triage list. In Cycles 12–14, the preliminary rankings were based on grades from a subset of the panelists; in the last two cycles, following advice from the Space Telescope Users Committee (STUC), each panelist has been asked to grade all proposals submitted to their panel (except those involving institutional or person conflicts). Panelists can choose to raise a triaged proposal for discussion. In our experience, it is rare (but not impossible) for a triaged proposal to make the final cut: 2 of the 275 triaged proposals were resurrected in Cycle 16.

The exact prescription followed by each panel in their deliberations depends on the individual panel chairs. In general, all proposals—GO, AR and snapshot (SNAP)—are grouped by subject area and discussed together, ensuring comparable science rankings. Each proposal is assigned primary and secondary reviewers, who lead the discussion and are responsible for providing feedback comments. Panelists with major conflicts leave the room; panelists with institutional conflicts can participate in the discussion, but do not vote. Once all the proposals are graded, the panel reviews the ranked list for the overall science balance; as part of this process, the chair compares notes with chairs of the mirror panels to identify (and, if necessary, bring forward for panel discussion) duplications in the science program.

Once the panel deliberations are complete, the TAC meets and discusses the larger programs. In this case, the chairs bring not only their own expertise, but also the assessment of their panels; this is important, given the broad range of science topics considered by the TAC. The procedures followed are similar to those adopted at the panel level. However, depending on proposal quality, the TAC can choose to change the balance in overall orbit allocation between large and panel programs. We ask both the TAC and the panels to carefully rank proposals at least a factor of two beyond the nominal orbit allocation [just in case—*vide* the Space Telescope Imaging Spectrograph (STIS) in Cycle 13]. The final ranked lists of recommended programs are submitted to the Institute director for approval.

Statistics

The 821 proposals submitted in Cycle 16 (or, perhaps, Cycle 16′) included 583 GO (including 4 Treasury, 33 large, and 5 collaborative *Hubble–Spitzer*), 38 SNAP, 27 survey, 115 archive, 8 Legacy Archive, and 50 theory programs. There were 383 proposals for Galactic science, 402 for extragalactic and 36 for solar system objects. In total, these proposals requested 17,200 orbits (5.5:1 oversubscription), 3,505 SNAP targets (3.5:1 oversubscription) and ~$14 million in AR funding (4:1 oversubscription).

The Cycle 16 panels and TAC recommended approving 189 programs, including 130 GO, 8 SNAP, 37 archival, and 14 theory programs. These include one GO and five AR calibration programs. In the new categories of proposal, two collaborative *Hubble–Spitzer* programs were awarded time by the TAC, but none of the survey programs were awarded orbits. The ACS solar-blind channel (SBC) garnered 450 orbits, and over 240 orbits were allocated for high-precision astrometry with the Fine Guidance Sensor (FGS).

The TAC sets the relative balance between panel programs and large programs. This year, there was unanimous assent that the panel programs were stronger than large programs near the boundary of the TAC allocation, and the TAC effectively gave time to the panels. This is a reversal from Cycle 15, when the TAC trimmed orbits from the panels to fit in an additional large program. The net result was that ~2,300 orbits were allocated to small and medium programs this year, and only ~800 orbits to large programs. No Treasury programs were awarded time.

Summary of Cycle 16 Results

Proposals	*Requested*	*Approved*	*% Accepted*	*ESA Accepted*	*ESA % Total*
General Observer	583	131	22.5%	17	13.0%
Snapshot	38	9	23.7%	1	11.1%
Survey	27	0	0.0%	0	
Archival Research	115	34	29.6%	0	
AR Legacy	8	3	37.5%	0	
Theory	50	14	28.0%	0	
Total	821	191	23.3%	18	12.9%
Primary Orbits	**17361**	**3164***	**18.2%**	**389**	**12.3%**

*Does not include 2 calibration orbits.

Science Program

Despite the limited number of science instruments, *Hubble*'s science program remains extraordinarily vibrant. Wide Field and Planetary Camera 2 has neither the sensitivity nor the areal coverage of the ACS/WFC, but the TAC/panel members took these factors into consideration in assessing the proposals, and focused on targeted programs and unique *Hubble* capabilities, rather than wide-field imaging surveys. As an example, two large programs take advantage of the unparalleled astrometric accuracy of the FGS. The first will measure parallaxes for four RR Lyraes and two W Virginis variables. Combined with the *Hubble*-based parallax for RR Lyrae itself, these observations will establish the Population II distance scale to an accuracy of 0.04 magnitudes. The second program targets four stars with multiple very low-mass companions (one brown dwarf and seven exoplanets). Orbital inclinations (and unambiguous dynamical masses) can be determined from astrometry of the host star, and *Hubble* has already acquired such data for two other systems (Gl 876 and ε Eridani). The expectation is that multiple planets will have coplanar orbits, as in the solar system, but this program offers the first direct test of that prediction.

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Instrument Statistics

Instruments	Mode	Requested Orbits	%	Approved Orbits	%
ACS/SBC	Imaging	743	3.5%	252	
ACS/SBC	Spectroscopy	402	1.9%	193	11.6%
FGS	POS	678	3.2%	177	
FGS	TRANS	72	0.3%	67	6.4%
NIC1	Imaging	1066	5.0%	120	
NIC2	Imaging	3194	14.9%	707	41.0%
NIC3	Imaging	3788	17.7%	707	
NIC3	Spectroscopy	217	1.0%	35	
WFPC2	Imaging	11282	52.6%	1566	41.0%
Total Orbits[1]		**21442**		**3824**	
	Imaging[2]		**87.66%**		
	Spectroscopy[2]		**5.96%**		
	FGS[2]		**6.38%**		

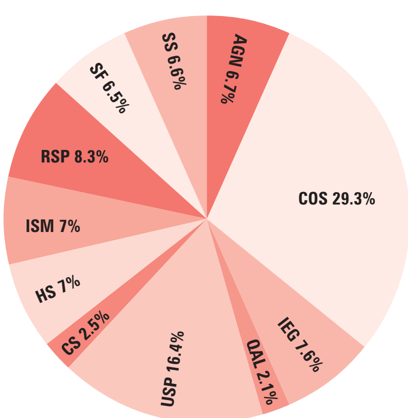
[1]Includes Coordinated Parallels
[2]Excludes Pure Parallel and Snapshot programs

Hubble is pursuing a diverse range of science programs probing the nature and frequency of planetary systems. Near-Infrared Camera and Multi-Object Spectrometer (NICMOS) coronagraphy continues to investigate the structure of debris disks around nearby stars, reaching surface brightness limits beyond the capabilities of ground-based programs. Building on previous results from *Hubble*/STIS and *Spitzer* programs, several researchers are using NICMOS grism spectroscopy to search for potential signatures of water absorption in transiting exoplanets. Within the solar system, Cycle 16 has programs studying transients in the atmosphere of Uranus, imaging the corona of Mars in the ultraviolet (UV), and investigating trans-Neptunian binaries and collisions in the Kuiper Belt.

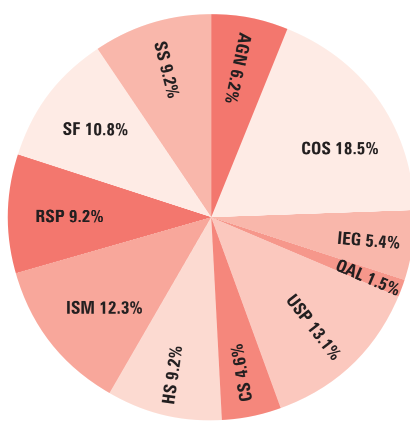
Astronomers are using *Hubble*'s UV capabilities to investigate the potential efficiency of starbursts at high redshifts as ionizers of the IGM. A number of programs target low-redshift starburst galaxies for Lyman-alpha imaging, using those galaxies as templates for Lyman-break galaxies at high redshift. The high angular resolution offered by *Hubble*, coupled with multi-band imaging by the *GALEX* satellite, allows direct investigation of the potential role of mergers in some of these systems. Moreover, *GALEX* survey data provides an initial target list for ACS/SBC imaging of intermediate-redshift ($2.7 < z < 3.3$) UV-luminous QSOs, which can probe the reionization of helium in the IGM.

Hubble continues to probe the high-redshift universe. In particular, two programs capitalize on the opportunity offered in Cycle 16 for large-scale coordinated *Hubble*–Spitzer programs. Both are combining deep NICMOS and Infrared Array Camera imaging to determine spectral energy distributions for sources with redshifts $z > 5$; indeed, several sources are z-band dropouts, with potential redshifts $z > 7$. The well-defined, stable, compact point-spread function and low background offered by space-based observations continue to give *Hubble* a substantial advantage over ground-based adaptive optics in these programs.

Orbits by Science Category



Proposals by Science Category



AGN: Active Galactic Nuclei
COS: Cosmology
IEG: ISM in External Galaxies
QAL: Quasar Absorption Lines
USP: Unresolved Stellar Populations
CS: Cool Stars
HS: Hot Stars
ISM: ISM and Circumstellar Matter
RSP: Resolved Stellar Populations
SF: Star Formation
SS: Solar System

Future Cycles

Cycle 17 will see significant changes and a number of interesting challenges. First and foremost, we anticipate a revitalized suite of instruments on *Hubble*. Two new instruments, the Wide Field Camera 3 (WFC3) and the Cosmic Origins Spectrograph (COS), are scheduled for installation during SM4. In addition, repairs are under consideration for both the STIS and the ACS/WFC. We expect all of these instruments, together with NICMOS, the FGS and the ACS/SBC, to be available for GO and SNAP proposals.

The Cycle 17 schedule is being adjusted to accommodate the placement of SM4 in September 2008. Following discussions with the Space Telescope Institute Committee, the *Hubble* project, STUC, and Cycle 16 TAC/panel members, the Cycle 17 proposal deadline will be February 29, 2008. The Cycle 17 TAC meeting will be held during the week of May 12–16, 2008. Ideally, the TAC meeting would be held closer to SM4, but we are constrained by the impact of post-SM4 calibration activities on Institute personnel.

Our schedule raises two challenges for the Cycle 17 TAC. First, the overall program selected by the TAC will need to be sufficiently flexible to cope with a variety of potential outcomes of SM4. Second, we expect that the proposal pressure for Cycle 17 will be significantly higher than in the past three cycles. The UV spectroscopic community has been largely disenfranchised since the failure of STIS; with its return, we anticipate a ~25% increase in the total number of proposals. We will address this, in part, by adding a new panel that, together with the existing solar system panel, will cover four science topics: solar system, exoplanets, circumstellar disks, and planet formation. Even with this expanded TAC, we may be faced with over 100 proposals per panel. Under those circumstances, it may be necessary to modify the preliminary grading process, perhaps by assigning two-thirds of the proposals to each panelist, and/or increase the triage fraction. These issues will be discussed with the STUC in the near future.

Proposals by Country

Country	Submitted	Approved
Australia	2	0
Belgium	5	0
Brazil	1	0
Canada	9	1
Chile	6	0
Denmark	2	0
France	18	3
Germany	19	4
Greece	1	0
India	2	0
Italy	14	4
Korea	1	0
Mexico	1	0
Netherlands	9	5
Norway	1	0
Russia	1	0
Spain	11	1
Sweden	7	0
Switzerland	5	0
UK	39	1
USA	666	170
ESA Proposals	142	18

US Proposals by State

State	Submitted	Approved
AL	6	0
AZ	50	14
CA	142	46
CO	22	2
CT	4	1
DC	29	5
FL	13	4
GA	4	2
HI	18	5
IL	14	3
IN	8	2
KY	5	0
LA	1	0
MA	43	11
MD	100	20
MI	17	5
MN	5	2
MO	2	1
NH	3	0
NJ	14	5
NM	10	2
NV	3	1
NY	36	7
OH	12	3
OK	1	0
OR	1	0
PA	36	7
SC	3	1
TN	10	4
TX	23	6
VA	8	2
WA	13	6
WI	4	1
WY	1	0

Epilogue

Defining the science program of the *Hubble Space Telescope* is one of the most important responsibilities of the Institute. The community's involvement in the TAC process is crucial, and we are indebted to the many panelists who devote their time and energy to evaluating proposals and providing feedback. We thank all of them, particularly the Cycle 16 TAC chair, Professor Meg Urry, for their hard work and invaluable assistance in this task.

In briefing the director on its recommendations, the TAC emphasized that they continue to be impressed with the quality of the science programs undertaken by *Hubble*. TAC members who have served on previous cycles affirmed that the quality of proposals submitted to this cycle has not diminished. Indeed, the panel chairs were emphatic that they had to work very hard to finalize the rankings near the orbit cutoff, and could have allocated at least 30–40% more orbits in each panel without diluting the quality of the science. They expressed confidence that *Hubble* will continue to undertake ground-breaking programs in Cycle 16, and look forward with much anticipation to its renewed capabilities in Cycle 17.

Acknowledgements

Many Institute personnel contribute to the TAC process, some at the meeting itself, others behind the scenes. Within SPD, Claus Leitherer and Eva Villaver were responsible for selecting the panelists, assigning the proposals to panels and panelists and, assisted by Bob Williams and Jeremy Walsh (Space Telescope–European Coordinating Facility), roving oversight at the TAC. The Instrument Division and the *Hubble* Mission Office provided technical support, notably with presentations by John Biretta and Ken Sembach. Twenty Institute postdocs and staff provided panel support. Brett Blacker received, organized and distributed the proposals, oversaw the proposal database, distributed the results, and prepared the statistical summaries. Finally, Darlene Spencer, assisted by Karyn Keidel, Laura Bucklew and Nyambura Kamau, with invaluable support by Joe Hann, Vickie Bowersox, and Margie Cook from the Business Resources Center, provided logistical support. Ω

Cycle 16: TAC and Panel Members

Member	Institution
TAC Chair	
Meg Urry	Yale University
Solar System Panel	
Michael A'Hearn	Univ. of Maryland
John Clarke (Chair)	Boston University
Alan Fitzsimmons	Queens University Belfast
Amanda Hendrix	Jet Propulsion Laboratory
Erich Karkoschka	Univ. of Arizona
Melissa McGrath	Marshall Space Flight Center
Mark Showalter	SETI Institute
John Spencer	Southwest Research Inst., Boulder
David Tholen	Univ. of Hawaii
Michael Wolff	Space Science Institute
At Large Members	
Jay Gallagher	Univ. of Wisconsin
Rachel Webster	Univ. of Melbourne
ExtraGalactic Panels	
Gustavo Bruzual	CIDA
Pepi Fabbiano	Harvard-Smithsonian Center for Astrophysics
Martin Gaskell	Univ. of Nebraska
Karl Gebhardt	Univ. of Texas
Nicole Homeier	The Johns Hopkins Univ.
Rob Kennicutt (Chair)	Inst. of Astronomy , Univ. of Cambridge
Daniel Kunth	Institute Astrophysique de Paris
Isaac Shlosman	Univ. of Kentucky
Elana Terlevich	INAOE, Puebla
Brent Tully	Univ. of Hawaii
Jacqueline van Gorkom	Columbia University
Mark Whittle	Univ. of Virginia
Sara Beck	Tel Aviv University
Greg Bothun	Univ. of Oregon
Marcella Carollo	Eidgenössische Technische Hochschule Zürich
Françoise Combes	Observatoire de Paris
Mike Dopita	Australian National Univ.
Rosa González Delgado	Univ. of Granada
Christine Jones	Harvard-Smithsonian Center for Astrophysics
Miriani Pastoriza	UFRGS, Porto Alegre
Chris Reynolds	Univ. of Maryland
Ricardo Schiavon	Univ. of Virginia
Pieter van der Kruit (Chair)	Kapteyn Instituut
Steve Zepf	Michigan State Univ.
Lee Armus	Infrared Processing and Analysis Center
Rennan Barkana	Tel Aviv University
Zoltan Haiman	Columbia University
Guinevere Kauffmann (Chair)	Max-Planck-Institut für Astronomie, Garching
Jason Prochaska	Univ. of California
Blair Savage	Univ. of Wisconsin
Dave Turnshek	Univ. of Pittsburgh
Mark Voit	Michigan State Univ.
David Weinberg	Ohio State University
Tereasa Brainerd	Boston University
Xiaohui Fan	Univ. of Arizona
Chris Fassnacht	Univ. of California
Xavier Gorosabel	IAA Granada
Patrick Petitjean	Institut d'Astrophysique
Elena Pian	Oss. Astron. Trieste
Gordon Richards	Drexel University
Gordon Squires	Spitzer Science Center
John Stocke (Chair)	Univ. of Colorado
Nial Tanvir	Inst. of Astronomy, Univ. of Cambridge
Renyue Cen	Princeton Observatory
Hsiao-Wen Chen	Univ. of Chicago
Ian Dell'Antonio	Brown University
Mark Dickinson (Chair)	National Optical Astronomy Observatory
Peter Eisenhardt	Jet Propulsion Laboratory
Derek Fox	Penn State
Michael Gregg	Lawrence Livermore
Rafael Guzman	Univ. of Florida
Jason Rhodes	Jet Propulsion Laboratory
Peter Schneider	Univ. of Bonn
Kris Stanek	Ohio State University
Galactic Panel Members	
Kazimierz Borkowski	North Carolina State University
Jose Cernicharo	CSIC, Spain
Paul Crowther	University of Sheffield
Brad Hansen	UCLA
Alex Heger	Los Alamos
George Jacoby	WIYN Observatory
Ed Robinson (Chair)	Univ. of Texas
George Sonneborn	NASA Goddard Space Flight Center
Susan Terebey	California State University
Rich Townsend	Univ. of Deleware
Bruce Balick	Univ. of Washington
Rob Fesen	Dartmouth University
Patrick Hartigan	Rice University
Susana Lizano	UNAM
Anthony Moffat	Univ. of Montreal
Alberto Noriega-Crespo	Spitzer Science Center
John Raymond (Chair)	Harvard-Smithsonian Center for Astrophysics
Tariq Shahbaz	I. Astrofisica Canarias
Letizia Stanghellini	National Optical Astronomy Observatory
Chris Tout	Cambridge University
Rachel Akeson	Caltech
Carlos Allende-Prieto	Univ. of Texas
Isabelle Baraffe	École Normale Supérieure
Andrew Cole	Univ. of Minnesota
Mike Cushing	Univ. of Arizona
Mike Liu	Univ. of Hawaii
Ruth Peterson (Chair)	Lick Observatory
Jacco van Loon	Keele Univ.
David Wilner	Harvard-Smithsonian Center for Astrophysics
Hans Zinnecker	Institut Potsdam
Ian Bonnell	Univ. St. Andrews
Adam Burgasser	Massachusetts Inst. of Technology
Nuria Calvet	Univ. of Michigan
Julianne Dalcanton	Univ. of Washington
John Gizis	Univ. of Delaware
Puragra Guhathakurta	Lick Observatory
Greg Laughlin	Univ. of California, Santa Cruz
Verne Smith	CTIO, Chile
John Stauffer (Chair)	Spitzer Science Center
Kim Venn	Univ. of Victoria
Jay Anderson	Rice University
Richard Larson	Yale University
Subhanjoy Mohanty	Harvard-Smithsonian Center for Astrophysics
Deborah Padgett	Jet Propulsion Laboratory
Giampaolo Piotto	Univ. of Padova
Ata Sarajedini (Chair)	Univ. of Florida
Mike Skrutskie	Univ. of Virginia
Eline Tolstoy	Kapteyn Institute
Barbara Whitney	Space Science Institute
Sidney Wolff	National Optical Astronomy Observatory

Name	Institution	Type	Title
Archive Legacy Programs			
Anton Koekemoer	Space Telescope Science Institute	AR	Deepening the Hubble UDF—Constraining the High-*z* Galaxy Luminosity Function Faint End Slope and Reionization
Glenn Schneider	University of Arizona	AR	A Legacy Archive PSF Library And Circumstellar Environments (LAPLACE) Investigation
Rolf Jansen	Arizona State University	AR	Removing the Herring-bone Pattern-noise from *all* STIS Side-2 CCD Data: A Factor ~3 Enhancement in Sensitivity
Large Programs			
George Benedict	University of Texas at Austin	GO	The Architecture of Exoplanetary Systems
George Benedict	University of Texas at Austin	GO	An Astrometric Calibration of Population II Distance Indicators
Eiichi Egami	University of Arizona	GO	Characterizing the Stellar Populations in Lyman-alpha Emitters and Lyman Break Galaxies at $5.7 < z < 7$ in the Subaru Deep Field
William Grundy	Lowell Observatory	GO	Probing Solar System History with Orbits, Masses, and Colors of Transneptunian Binaries
Leon Koopmans	Kapteyn Astronomical Institute	GO	The Structure of Early-type Galaxies: 0.1–100 Effective Radii
Harry Teplitz	California Institute of Technology	GO	Did Rare, Large Escape-fraction Galaxies Reionize the Universe?
Daniel Wang	University of Massachusetts	GO	A Paschen-Alpha Study of Massive Stars and the ISM in the Galactic Center
Lin Yan	California Institute of Technology	GO	Revealing the Physical Nature of Infrared Luminous Galaxies at $0.3 < z < 2.7$ Using *HST* and *Spitzer*
ExtraGalactic Programs			
Sahar Allam	Fermi National Accelerator Laboratory (FNAL)	GO	A Unique High-resolution Window to Two Strongly Lensed Lyman-Break Galaxies
Scott Anderson	University of Washington	GO	New Sightlines for the Study of Intergalactic Helium: Dozens of High-Confidence, UV-Bright Quasars from SDSS/*GALEX*
Andrew Baker	Rutgers the State University of New Jersey	GO	NICMOS Imaging of Submillimeter Galaxies with CO and PAH Redshifts
John Biretta	Space Telescope Science Institute	GO	Monitoring the Giant Flare of HST-1 in the M87 Jet
Roger Blandford	Stanford University	AR	PASS: Paying Attention to the Small Structure
Rychard Bouwens	University of California - Santa Cruz	GO	Building on the Significant NICMOS Investment in GOODS: A Bright, Wide-Area Search for $z \geq 7$ Galaxies
David Bowen	Princeton University	GO	The Origin of QSO Absorption Lines from QSOs
Marusa Bradac	Stanford University	GO	A "Silver Bullet" for the Sources of Reionization
Marusa Bradac	Stanford University	GO	Two New `Bullets' for MOND: Revealing the Properties of Dark Matter in Massive Merging Clusters
Daniela Calzetti	University of Massachusetts	GO	The Role of Stellar Feedback in Galaxy Evolution
Gabriela Canalizo	University of California - Riverside	GO	The Relevance of Mergers for Fueling AGNs: Answers from QSO Host Galaxies
Alessandro Capetti	Osservatorio Astronomico di Torino	SNAP	Active Galactic Nuclei in Nearby Galaxies: A New View of the Origin of the Radio-loud Radio-quiet Dichotomy?
Rupali Chandar	Carnegie Institution of Washington	GO	The Origin of Diffuse UV Light from Spiral Disks
Douglas Clowe	Ohio University	GO	Beyond the Bullet: Direct Detection of Dark Matter in Merging Galaxy Clusters
Jeff Cooke	University of California - Irvine	GO	Mapping the FUV Evolution of Type IIn Supernovae
Asantha Cooray	University of California - Irvine	AR	IR Background Fluctuations in NICMOS Ultra and Hubble Fields and the Surface Density of First-light Galaxies
Asantha Cooray	University of California - Irvine	AR	IR Background Intensity, Anisotropy, and Lyman-alpha Sources in Large Volume Simulations of Reionization
D. Crenshaw	Georgia State University Research Foundation	AR	Determining the Inclinations of AGN using Narrow-line Region Kinematics
Arlin Crotts	Columbia University in the City of New York	GO	Confirming Light Echoes from SN 2006X in M100
Emanuele Daddi	Commissariat à l'Energie Atomique (CEA)	GO	A *Spitzer*/X-ray Candidate Cluster at $z > 2$: NICMOS Imaging
Julianne Dalcanton	University of Washington	GO	A Dark Core in Abell 520
Arjun Dey	National Optical Astronomy Observatories, AURA	GO	Morphologies of the Most Extreme High-Redshift Mid-IR-luminous Galaxies II: The `Bump' Sources
Harald Ebeling	University of Hawaii	SNAP	A Snapshot Survey of the Most Massive Clusters of Galaxies
Michael Eracleous	The Pennsylvania State University	GO	Direct Detection and Mapping of Star Forming Regions in Nearby, Luminous Quasars
Aaron Evans	State University of New York at Stony Brook	GO	An Ultraviolet Survey of Luminous Infrared Galaxies in the Local Universe
Sandra Faber	University of California - Santa Cruz	GO	UV Imaging to Determine the Location of Residual Star Formation in Galaxies Recently Arrived on the Red Sequence
Christopher Fassnacht	University of California - Davis	AR	Evolution in the Dark-matter Properties of Strong Lenses through Weak Lensing
Steven Finkelstein	Arizona State University	AR	Dust Enhancement of the Lyman Alpha Equivalent Width at $z \sim 4.5$ in the CDF-S
David Fisher	University of Texas at Austin	GO	Time Scales of Bulge Formation in Nearby Galaxies
Andrew Fruchter	Space Telescope Science Institute	GO	Location and the Origin of Short Gamma-ray Bursts
Elena Gallo	University of California - Santa Barbara	AR	Ultraluminous X-ray Sources in Elliptical Galaxies and the X-ray Binary/Globular Cluster Connection
Avishay Gal-Yam	California Institute of Technology	GO	The Nature of Radio Transients
Peter Garnavich	University of Notre Dame	GO	Sweeping Away the Dust: Reliable Dark Energy with an Infrared Hubble Diagram

Name	Institution	Type	Title
Eric Gawiser	Rutgers the State University of New Jersey	AR	Sizes and Morphology of $z = 3.1$ Lyman-alpha–Emitting Galaxies in the Extended CDF-S
Anthony Gonzalez	University of Florida	GO	Pure Parallel Imaging in the NDWFS Boötes Field
Fabio Governato	University of Washington	AR	Simulating the Evolution of the Galaxy Luminosity Function from $z = 6$ to the Present
Caryl Gronwall	The Pennsylvania State University	GO	The Nature of $z = 3$ Lyman-alpha Emitters
Timothy Heckman	The Johns Hopkins University	GO	Imaging of Local Lyman-break Galaxy Analogs: New Clues to Galaxy Formation in the Early Universe
Luis Ho	Carnegie Institution of Washington	SNAP	AGNs with Intermediate-mass Black Holes: Testing the Black Hole–Bulge Paradigm, Part II
Benne Holwerda	Space Telescope Science Institute	AR	Dust Lanes since $z \sim 1$
Esther Hu	University of Hawaii	GO	Near Infrared Observations of a Sample of $z \sim 6.5$–6.7 Galaxies
Walter Jaffe	Sterrewacht Leiden	GO	Star Formation at Large Radii in Cooling-flow Brightest Cluster Galaxies
Philip Kaaret	University of Iowa	GO	An Ultraluminous EUV Source?
Charles Keeton	Rutgers the State University of New Jersey	AR	Galaxy Shapes and Gravitational Lensing
Jean-Paul Kneib	Observatoire de Marseille	SNAP	SL2S: The Strong Lensing Legacy Survey
Karen Knierman	University of Arizona	GO	WFPC2 Tidal Tail Survey: Probing Star-Cluster Formation on the Edge
C. Kochanek	The Ohio State University Research Foundation	GO	The Wavelength Dependence of Accretion–disk Structure
Jin Koda	California Institute of Technology	AR	Dynamically Driven Star Formation in M51
Mariska Kriek	Universiteit Leiden	GO	Extreme Makeovers: Tracing the Transformation of Massive Galaxies at $z \sim 2.5$
Arunav Kundu	Michigan State University	AR	Blue Tilts and Other Properties of Halo Globular Clusters in Nearby Galaxies—Cosmological or Observational Bias?
Jifeng Liu	Harvard- Smithsonian Center for Astrophysics	GO	The Orbital Period for an Ultraluminous X-ray Source in NGC 1313
Piero Madau	University of California - Santa Cruz	AR	New Synthesis Models of the Extragalactic Ionizing Background
Sangeeta Malhotra	Arizona State University	GO	The Physical Nature and Age of Lyman-alpha Galaxies
Crystal Martin	University of California - Santa Barbara	GO	Ultraviolet Imaging of Lyman-alpha–selected Galaxies at High Redshift
Stephan McCandliss	The Johns Hopkins University	GO	Searching for Lyman-alpha Emission from *FUSE* Lyman Continuum Candidates
Gerhardt Meurer	The Johns Hopkins University	GO	The Collisional Ring Galaxy NGC 922
Kai Noeske	University of California - Santa Cruz	GO	At the Cradle of the Milky Way: Formation of the Most Massive Field Disk Galaxies at $z > 1$
Robert O'Connell	The University of Virginia	GO	Star Formation in the Perseus Cluster Cooling Flow
Christopher O'Dea	Rochester Institute of Technology	GO	*HST* FUV Observations of Brightest Cluster Galaxies: The Role of Star Formation in Cooling Flows and BCG Evolution
Eric Perlman	Florida Institute of Technology	GO	The Physics of the Jets of Powerful Radio Galaxies and Quasars
Daniel Proga	University of Nevada - Las Vegas	AR	Hydrodynamical Models of Narrow-line Regions in Seyfert Galaxies
R. Rich	University of California - Los Angeles	GO	*HST* Imaging of UV Emission in Quiescent Early-type Galaxies
Johan Richard	California Institute of Technology	GO	Escape Fraction and Stellar Populations in a Highly Magnified Lyman-break Galaxy
Vicki Sarajedini	University of Florida	AR	AGN Variability in the GOODS Fields
Brian Siana	Jet Propulsion Laboratory	GO	First Resolved Imaging of Escaping Lyman Continuum
Alicia Soderberg	California Institute of Technology	GO	Revealing the Explosion Geometry of Nearby GRB-SNe
William Sparks	Space Telescope Science Institute	AR	The Near and Far Sides of M87
Jason Surace	California Institute of Technology	GO	*HST* NICMOS Survey of the Nuclear Regions of Luminous Infrared Galaxies in the Local Universe
Nial Tanvir	University of Leicester	GO	Probing the Early Universe with GRBs
Tommaso Treu	University of California - Santa Barbara	GO	The Co-evolution of Spheroids and Black Holes in the Last six Billion Years
R. Tully	University of Hawaii	AR	TRGB Distances from Archived Data
David Tytler	University of California - San Diego	AR	Lyman-continuum Absorption and the IGM Opacity at Low Redshifts
Wei-Hao Wang	Associated Universities, Inc.	GO	NICMOS Imaging of a $z > 4$ High-redshift Ultraluminous Submillimeter Source
Rogier Windhorst	Arizona State University	AR	Fundamental Limitations in Deep *HST* Fields: Surface Brightness, Natural Confusion, and Algorithmic Biases
Lutz Wisotzki	Astrophysikalisches Institut Potsdam	GO	The Origin of the Break in the AGN Luminosity Function
Jong-Hak Woo	University of California - Santa Barbara	GO	The Mass-dependent Evolution of the Black Hole–Bulge Relations
Hao-Jing Yan	Observatories of the Carnegie Institution of Washington	GO	NICMOS Confirmation of Candidates of the Most Luminous Galaxies at $z > 7$
Stephen Zepf	Michigan State University	GO	Determining the Structural Parameters of the First Globular Cluster Found to Host an Black-Hole X-ray Binary
Galactic Proposals			
Jacob Albretsen	Brigham Young University	AR	Searching for Unresolved Binary Brown Dwarfs Using Point Spread Functions
Bruce Balick	University of Washington	GO	Expanding PNe: Distances and Hydro Models
Travis Barman	Lowell Observatory	AR	Identifying Atomic and Molecular Absorption in an Extrasolar Planet Atmosphere
Howard Bond	Space Telescope Science Institute	GO	The Light Echoes around V838 Monocerotis

Name	Institution	Type	Title
Howard Bond	Space Telescope Science Institute	SNAP	Snapshot Survey for Planetary Nebulae in Globular Clusters of the Local Group
Tyler Bourke	Harvard-Smithsonian Center for Astrophysics	GO	A NICMOS Survey for Proplyds in the RCW 38 Massive Embedded Cluster
Bernhard Brandl	Universiteit Leiden	GO	The IMF in the Hidden Galactic Starburst W49A
Wolfgang Brandner	University of California - Los Angeles	GO	A Comprehensive Study of the Low-mass Stellar Population in the Galactic Starburst Region NGC 3603
Joel Bregman	University of Michigan	GO	The Dynamical Evolution of Globular Clusters
Nuria Calvet	University of Michigan	GO	Probing the Planet-forming Region of T Tauri Stars in Chamaeleon
Eugene Chiang	University of California - Berkeley	AR	Mass Loss from Hot Jupiters
Kristin Chiboucas	University of Hawaii	GO	Resolving the Smallest Galaxies
Arlin Crotts	Columbia University in the City of New York	GO	Defining Classes of Long-period Variable Stars in M31
Arlin Crotts	Columbia University in the City of New York	GO	Completing an Accurate Map of M31 Microlensing
Andrea De Luca	CNR, Istituto di Astrofisica Spaziale	GO	Mapping the Nebula Surrounding the Enigmatic X-ray Source at the Center of the Vela Jr SNR
John Debes	Carnegie Institution of Washington	GO	High-contrast Imaging of Dusty White Dwarfs
Andrew Dolphin	Raytheon Company	AR	WFPC2 CTE and Photometric Zero Points
Peter Edmonds	Eureka Scientific Inc.	AR	Mining the Rich Archive for 47 Tucanae
Steven Federman	University of Toledo	AR	Light Element Nucleosynthesis through Measurements of Interstellar Boron
Alex Filippenko	University of California - Berkeley	AR	The Local Environments of Supernovae
Adam Frank	University of Rochester	AR	Shedding Light on Feedback: The Interaction of YSO Outflows in L1551
Adam Frank	University of Rochester	AR	Beyond the Textbook: Temporal Systematics of Planetary Nebula Evolution
Avishay Gal-Yam	California Institute of Technology	GO	The LBV Progenitor of SN 2005gl—A New Key to Massive-star Evolution Puzzles
Douglas Gies	Georgia State University Research Foundation	SNAP	Filling the Period Gap for Massive Binaries
Ronald Gilliland	Space Telescope Science Institute	AR	Analysis of Red Giant Oscillations from a 27-Day ACS/WFC Time-Series on NGC 6397
James Graham	University of California - Berkeley	GO	Beta Pic Polarimetry with NICMOS
Edward Guinan	Villanova University	GO	The Key to Understanding RR Lyr Stars: WFPC2 Observations of a Unique LMC EB with a RR Lyr Component
Patrick Hartigan	Rice University	GO	Dynamics of Clumpy Supersonic Flows in Stellar Jets and in the Laboratory
Lee Hartmann	University of Michigan	GO	A Hard Look at Stellar Disks at the Epoch of Planet Formation
Enrico Held	Osservatorio Astronomico di Padova	GO	The Star-formation History of the Fornax Dwarf Spheroidal Galaxy
James Herald	The Johns Hopkins University	AR	Neon Abundance in Hot Central Stars of Planetary Nebulae: A New Clue to Late Stellar Evolution
Gregory Herczeg	California Institute of Technology	GO	Evaluating the Role of Photoevaporation of Protoplanetary Disk Dispersal
Roberta Humphreys	University of Minnesota - Twin Cities	GO	The Morphology of the Post-Red Supergiant IRC+10420's Circumstellar Ejecta
Markus Janson	Max-Planck-Institut für Astronomie, Heidelberg	GO	Constraining the Age of the AB Dor System
Saurabh Jha	Rutgers the State University of New Jersey	GO	Late-time Photometry of SN 2005hk: A New Kind of Type Ia Supernova
Nitya Kallivayalil	Harvard University	SNAP	Systemic and Internal Motions of the Magellanic Clouds: Third Epoch Images
Margarita Karovska	Harvard-Smithsonian Center for Astrophysics	GO	Unraveling Mira AB Accretion Mysteries
Robert Kirshner	Harvard University	GO	SAINTS—Supernova 1987A INTensive Survey
Marc Kuchner	NASA Goddard Space Flight Center	AR	Modeling Coronagraphic Images of Beta Pictoris and other Debris Disks with Gas
Konrad Kuijken	Universiteit Leiden	GO	The Mass of the Milky Way: Orbits for Leo I and Leo II: Second Epoch Imaging of Leo II
Nicolas Lehner	University of Notre Dame	AR	Highly Ionized Plasma in the Milky Way: A Benchmark for Feedback Studies in the Universe
Aigen Li	University of Missouri - Columbia	AR	Radiation-induced Grain Dynamics in Dust Disks: Radiation Pressure, Poynting-Robertson Drag, and Photophoresis
Douglas Lin	University of California - Santa Cruz	AR	Dynamical Heat Re-distribution Modeling in Hot Juipters
Michael Liu	University of Hawaii	GO	Resolving Ultracool Astrophysics with Brown Dwarf Binaries
Kevin Luhman	The Pennsylvania State University	GO	A Search for Circumstellar Disks and Planetary-mass Companions around Brown Dwarfs in Taurus
Kevin Luhman	The Pennsylvania State University	GO	Imaging Circumstellar Disks and Envelopes around Proto-brown Dwarfs
Bruce Macintosh	Lawrence Livermore National Laboratory	GO	Probing the Compact Dust Disk of a nearby Classical T Tauri Star
Derck Massa	SGT, Inc.	AR	Determining O-star Mass-loss Rates from Sulfur Wind Lines
Philip Massey	Lowell Observatory	AR	The Effective Temperatures and Physical Properties of O-type Stars at Low Metallicity
Peter McCullough	Space Telescope Science Institute	GO	Extrasolar Planet XO-2b
Bernard McNamara	New Mexico State University	AR	Establishing a Zero-motion Reference Frame for the FGS
Bernard McNamara	New Mexico State University	GO	A Search for an Intermediate-mass Black Hole in the Globular Cluster NGC 6266
Margaret Meixner	Space Telescope Science Institute	GO	SEEDS: The Search for Evolution of Emission from Dust in Supernovae with *HST* and *Spitzer*
David Meyer	Northwestern University	AR	An Archival Study of Solar System-scale Interstellar Structure
Anthony Moffat	Université de Montréal	GO	First Accurate Geometric Distance to a Galactic Wolf-Rayet Star: Knots in the Ejecta M1-67
James Muzerolle	University of Arizona	GO	The Effects of Multiplicity on the Evolution of Young Stellar Objects: A NICMOS Imaging Study

Name	Institution	Type	Title
Krister Nielsen	Catholic University of America	AR	Tracing the Wind Interface of the massive binary Eta Carinae
C. O'Dell	Vanderbilt University	GO	Calibration of the WFPC2 HeII and [SII] Filters.
C. O'Dell	Vanderbilt University	GO	Determination of Angular Expansion Velocities in the Ring Nebula
C. O'Dell	Vanderbilt University	AR	A Final Calibration of the Primary WFPC2 Emission-line Filters Using the Orion Nebula
George Pavlov	The Pennsylvania State University	GO	Optical-UV Spectrum of the Middle-aged Pulsar B1055-52
Laura Penny	College of Charleston	AR	The Effect of Metallicity on the Rotation Rates of Massive Stars
Marshall Perrin	University of California - Berkeley	GO	Dust-grain Evolution in Herbig Ae Stars: NICMOS Coronagraphic Imaging and Polarimetry
Giampaolo Piotto	Università di Padova	GO	Multiple Generations of Stars in Massive Galactic Globular Clusters
John Raymond	Harvard-Smithsonian Center for Astrophysics	GO	Imaging the Shock Precursor in Tycho's SNR
Joseph Rhee	University of California - Los Angeles	GO	NICMOS Imaging Survey of Dusty Debris around nearby Stars across the Stellar-mass Spectrum
R. Rich	University of California - Los Angeles	GO	The True Galactic Bulge Luminosity Function
Roger Romani	Stanford University	GO	A Brief Revisit of the Crab
Robert Rubin	NASA Ames Research Center	GO	Search for H-poor/He-rich Inclusions and a Solution to the Abundance, Temperature Problems
Pilar Ruiz-Lapuente	Universidad de Barcelona	GO	Improving Proper Motion Measurements of the Stars in the Field of SN 1572 with WFPC2
Steven Saar	Harvard-Smithsonian Center for Astrophysics	GO	Exploring the Early FUV History of Cool Stars: Transition Regions at 30 Myr
Ata Sarajedini	University of Florida	AR	RR Lyrae Variables in Local Group Galaxies
David Sing	CNRS, Institut d'Astrophysique de Paris	GO	The Search for Atmospheric Water in the Transiting Planet HD189733b
Edward Sion	Villanova University	AR	The Variable Magnetic White Dwarf in the Hyades Eclipsing Binary V471 Tauri
Evan Skillman	University of Minnesota - Twin Cities	AR	The Durations of Starbursts in Blue Compact Galaxies
Ian Smith	Rice University	GO	NICMOS Observations of the Microquasar GRS 1758-258
Paula Szkody	University of Washington	GO	Understanding the Long-term Impacts of Low Magnetic Accretion
Paula Szkody	University of Washington	GO	Accreting Pulsating White Dwarfs in Cataclysmic Variables
Michele Trenti	Space Telescope Science Institute	AR	Intermediate-mass Black Holes in Globular Clusters: Key Photometric Fingerprints
Gerard van Belle	California Institute of Technology	GO	Distances to Eclipsing M-Dwarf Binaries
Schuyler Van Dyk	Jet Propulsion Laboratory	GO	The Stellar Origins of Supernovae
David Weintraub	Vanderbilt University	GO	Molecular Hydrogen Disks around T Tauri Stars
Klaus Werner	Universität Tübingen, Institut für Astronomie & Astrophysik	GO	Can Mass Ejections from Late He-shell Flash Stars Constrain Convective/Reactive Flow Modeling of Stellar Interiors?
Kurtis Williams	University of Texas at Austin	GO	White Dwarfs in the Open Star Cluster NGC 188
Joshua Winn	Massachusetts Institute of Technology	GO	The Radius of the "Super-Neptune" HD 149026b
John Wisniewski	NASA Goddard Space Flight Center	GO	*HST*/FGS Astrometric Search for Young Planets around Beta Pic and AU Mic
Farhad Yusef-Zadeh	Northwestern University	GO	Proper Motion of the Remarkable Irradiated Jet HH399 in the Trifid Nebula
Solar System Proposals			
Michael Brown	California Institute of Technology	GO	Collisions in the Kuiper Belt
John Clarke	Boston University	GO	UV Imaging of the Martian Corona and the Escape of Hydrogen
Imke de Pater	University of California - Berkeley	GO	*HST* as a Jovian Climate Satellite
Heidi Hammel	Space Science Institute	GO	Target-of-opportunity Imaging of an Unusual Cloud Feature on Uranus
Erich Karkoschka	University of Arizona	AR	Comprehensive Analysis of Neptune's Features
Philippe Lamy	Laboratoire d'Astrophysique de Marseille	GO	*Hubble* Investigation of Comet 8P/Tuttle
Jianyang Li	University of Maryland	GO	Characterization of the UV-Absorption Feature in Asteroid (1) Ceres
Keith Noll	Space Telescope Science Institute	SNAP	Binaries in the Kuiper Belt: Probes of Solar System Formation and Evolution
Kathy Rages	SETI Institute	SNAP	Monitoring Active Atmospheres on Uranus and Neptune
Christopher Russell	University of California - Los Angeles	GO	Photometric Imaging of Asteroid 2 Pallas
Joachim Saur	Universität zu Köln	GO	Investigation of the Spatial and Temporal Structure of Europa's Atmospheric Emissisons
Mark Showalter	SETI Institute	GO	A Deep Search for Martian Dust Rings
Tracy Smith	Space Science Institute	AR	Diurnal Martian Ice Cloud and Ozone Maps from *HST* WFPC2 Multi-band Images
Lawrence Sromovsky	University of Wisconsin - Madison	GO	Investigating Near-Equinox Atmospheric Change on Uranus
Laurence Trafton	University of Texas at Austin	GO	Probing Uranus' Vertical Aerosol Structure at Equinox

ACS Cycle 14/15 Program Recovery

N. Reid, *inr@stsci.edu*, **K. Sembach,** *sembach@stsci.edu*; **R. Beaser,** *beaser@stsci.edu*

When the Wide Field Channel (WFC) and High Resolution Channel (HRC) of the Advanced Camera for Surveys failed on January 27, 2007, the astronomical community was deprived of the most sensitive imaging devices available at optical and far-red wavelengths. Some 121 general observer (GO) and 10 Cycle 15 snapshot (SNAP) programs were left in various stages of completion. These programs accounted for 1580 unexecuted orbits and ~1200 unexecuted snapshots.

We would like to recover as much science as possible from the orphaned ACS programs, and our expectation was that many science goals might still be achieved, in large part, with other *Hubble* instruments, particularly the Wide Field and Planetary Camera 2 (WFPC2) and, in fewer cases, the Near Infrared Camera and Multi-Object Spectrometer (NICMOS) and ACS Solar Blind Channel (SBC). Nevertheless, a direct transfer of programs from ACS to WFPC2 would entail addressing several important issues—lower performance (reduced angular resolution, decreased charge transfer efficiency), 2.5 times longer exposure times, and increased number of pointings to match areal coverage. A typical ACS program executed to a comparable level on WFPC2 would demand 7.5 times more orbits. If applied to all Cycle 15 ACS programs, new programs in Cycle 16 would effectively be eliminated. Therefore, we constructed a review process that was designed to provide fair and objective program assessments, while taking due account of the logistical constraints.

The review process

In reviewing the Cycle 15 programs, the key question that needed to be addressed is "Can the science goals described in the original proposal, and sanctioned by the Cycle 15 TAC, be achieved using alternative *Hubble* instrumentation?" The process adopted was designed to answer that question. It combines procedures used to deal with failed observations on *Hubble* programs (*Hubble* observation problem reports) with procedures employed in reviewing Space Telescope Imaging Spectrograph programs after that instrument failed in August 2004. We distributed a description of the process to all ACS principal investigators (PIs) on January 31, 2007.

We gave a number of programs expedited reviews. We declared all Cycle 14 SNAP programs complete, as well as all programs that had acquired more than 90% of their observations. We stripped ACS coordinated parallel observations from eight programs. The primary concern for the coordinated parallels was scheduling; substituting WFPC2 for ACS parallels would require a change in spacecraft orientation and a rework of the long-range schedule. These summary decisions are subject to appeal, and indeed two proposals have since successfully presented a science case for substituting WFPC2 parallels without changing the orient requirements.

We expedited reviews for several programs with time-critical observations required before the end of February. These included observations scheduled to coincide with the *New Horizons* encounter with Jupiter, coordinated *Hubble* and *Chandra* observations of the M87 jet, and imaging of variable objects, including Cepheids and V838 Mon. All of these programs were reviewed by the Telescope Time Review Board (TTRB) and re-scheduled as quickly as possible.

The remaining proposals were reviewed in a three-step process:

1. Each proposal was given independent technical assessments by two members of the Instruments Division. Those reviews considered how the science goals outlined in the original proposal might be recovered using other *Hubble* instruments, and answered a standard set of questions: Were the appropriate observing modes and filters available? Could the required angular resolution and/or sensitivity be achieved? Would additional orbits be required?
2. A separate panel of five institute scientists, chaired by Bob Williams, undertook a feasibility assessment for all proposals. Based on the technical assessment and the availability of sufficient resources, the panel recommended each program for either transfer or termination. Those recommendations were communicated to the director, Matt Mountain, who informed the PIs.
3. If a program was rejected, we gave the PI the opportunity to submit an appeal via a standard program change request. This option allowed for novel strategies to achieve the science goals outlined in the original proposal. All such appeals were reviewed by the TTRB.

Programs whose appeals were rejected by the TTRB were formally terminated. However, the timing of the ACS failure was such that we were unable to complete the review process before the Cycle 16 deadline.

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Consequently, PIs of terminated programs did not have the opportunity to submit revised programs for consideration by the Cycle 16 TAC. (This was not the case when STIS failed in Cycle 13.) We therefore provided affected PIs with the opportunity to submit proposals for director's discretionary (DD) time. While restricted to the original ACS-based science, such proposals could present revised goals that are in better accord with the current suite of *Hubble* instruments. These new proposals were reviewed by panelists from the recent TAC, to place the proposed science in the broader context of the Cycle 16 science program.

Results

The technical reviews for all programs were completed by March 1, and the feasibility reviews were completed by March 15. Including time-critical programs, 71 programs (69 GO and 2 SNAP) were recommended for transfer and 60 programs (52 GO and 8 SNAP) for termination. The TTRB has considered 34 appeals; 18 programs were accepted (16 GO and 2 SNAP) and 16 rejected. We have received seven DD proposals, which have been reviewed by members of the Cycle 16 Time Assignment Committee; 2 proposals were accepted, one was accepted partially, and 4 were rejected.

The review process is now complete. In total, approximately 70% of the original ACS science program has been recovered by transferring observations to WFPC2, NICMOS or the ACS SBC.

Grant information

Hubble grants are tied directly to the reduction and analysis of *Hubble* observations. Consequently, the ACS failure has impacted the funding level for some Cycle 14 and 15 programs, as ACS PIs have been informed by the Institute's Grants Administration Office.

There has been no reduction in funding for programs that were transferred, or that were 85% complete at the time of termination. PIs with terminated programs between 75% and 85% complete have been asked to provide information on whether all the science goals can be achieved, and if the full level of funding is required. PIs of programs that acquired some data, but less than 75% of the observations, are being asked to submit a revised budget with a justification for the funding level. Finally, programs that acquired no data have been asked to return unexpended funding; they will not receive any additional funds. We recognize that these changes can have important consequences, and those considerations will be taken into account when revised budgets are reviewed by the financial review committee. Ω

Logistics

In addition to the authors of this article, numerous Institute personnel were involved in the review and recovery of ACS programs, including:

INS coordination:
Diane Karakla, Marco Sirianni, Linda Smith, Nolan Walborn
INS technical reviews:
John Biretta (WFPC2 performance) Tom Brown, Stefano Casertano, Marco Chiaberge, Andy Fruchter, Ron Gilliland, Dave Golimowski, Roland van der Marel, Andre Martel, Massimo Robberto, Marco Sirianni, Ed Smith, Linda Smith, Bill Sparks, Massimo Stiavelli, Nolan Walborn
Feasibility panel:
Harry Ferguson, Claus Leitherer, Knox Long, Eva Villaver, Bob Williams
Scheduling:
Dave Adler, Ian Jordan, Denise Taylor, Bill Workman
Program coordinators:
William Januszewski, Shelley Meyett, Beth Perriello, Tony Roman, Galina Soutchkova, Alison Vick
Telescope time review board:
Howard Bond, Stefano Casertano, Dave Soderblom, Linda Smith, Bill Sparks, Denise Taylor, Bill Workman, Duccio Macchetto, Kailash Sahu
Grants:
Dana Hairsine, Paula Sessa, Elyse Wagner
(Rush) Phase II preparations:
Anton Koekemoer and the NICMOS team, Keith Noll and the *Hubble* Heritage team

Servicing Mission 4 Overview

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Servicing Mission 4 (SM4) has three major goals to enhance and extend the *Hubble* science program. The first is to increase *Hubble*'s scientific capability by installing two advanced instruments: a new panchromatic camera, the Wide Field Camera 3 (WFC3); and an efficient ultraviolet spectrograph, the Cosmic Origins Spectrograph (COS). The second goal is to restore *Hubble*'s previous capabilities by repairing onboard instruments, which will ensure their complementary observations and synergisms with the new instruments. The third goal is to upgrade observatory systems—gyroscopes, batteries, a Fine Guidance Sensor (FGS), new thermal blankets—so that *Hubble* can last to 2013 or beyond. If these objectives are achieved, the shuttle astronauts will leave *Hubble* at the height of its powers—with six working scientific instruments and a new lease on life.

In addition to these improvements, astronauts will install a capture mechanism to aid in the de-orbit of *Hubble* after the end of science operations.

Immediately after the failure of the Advanced Camera for Surveys (ACS) in late January 2007, NASA began studying the feasibility of performing ACS repairs on SM4. Even with WFC3 installed, astronomers had been counting on the continuity of ACS's unique scientific capabilities. As Ed Cheng reports in a companion article, the ACS repair concept is making good progress. Similar planning is underway for repairing the Space Telescope Imaging Spectrograph (STIS). NASA has not yet given the go-ahead to include either the ACS or the STIS repair in SM4, and the final decisions are not imminent. The technical hurdles are very high, of course, to ensure astronaut safety and a reasonable chance of success. In addition, the total time available during SM4 for extravehicular activities (EVAs) by astronauts is very limited. Therefore, it is by no means certain that any instrument repairs will ultimately be attempted.

For all servicing missions, contingency plans are developed in anticipation of any event that might lead to a shortened servicing schedule with fewer EVAs. Contingency plans take many factors into account, with astronaut safety being of prime importance. An important element in formulating the plans is a community-based assessment of the relative scientific priority of the science instruments.

At their April 2007 meeting, NASA asked the Space Telescope Users Committee (STUC) for advice on the relative scientific priorities of the tasks of repairing STIS and ACS during SM4. The STUC consulted with the *Hubble* user community on this issue, soliciting responses to this question: Which instrument, ACS or STIS, should have the higher priority for repair, based on scientific considerations?

The STUC responded to the *Hubble* project and the Institute director on May 15, 2007. The main points can be summarized as follows:

- There is strong scientific support in the community for repairs to both instruments.
- There was a modest majority in favor of STIS among the members of the community who replied to the STUC request for input.
- The STUC themselves had a slight majority in favor of ACS, but recognized that other considerations (technical factors, scheduling issues, cost) may play a greater role in deciding the priorities in the final EVA schedule.

The full details, including the letter from the STUC, can be found at **http://www.stsci.edu/institute/stuc/apr07-presentations**/.

COS & WFC3

COS has completed its second thermal vacuum (TV) testing at Goddard Space Flight Center, while the WFC3 is preparing to start its second TV in June.

At the Institute, we continue to prepare for the installation of COS and WFC3. We expect to issue the Cycle 17 *Call for Proposals* in early December 2007, with a Phase I deadline of February 29, 2008. With a September 2008 launch, Cycle 17 will include the new instruments, COS and WFC3, and the operating heritage instruments—Near Infrared Camera and Multi-Object Spectrometer (NICMOS), an FGS used for astrometry, as well as STIS and/or ACS if the repair of either or both is achieved on SM4. The time allocation panels and committee will meet in May 2008, and we expect to set the Phase II deadline at the beginning of July 2008. Following launch and orbital verification activities in the fall of 2008, we expect to start Cycle 17 scientific observations before the arrival of 2009.

http://www.nasa.gov/mission_pages/*Hubble***/servicing/index.html** is the official NASA site for *Hubble* servicing missions. Ω

ACS Repair

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Almost immediately after the anomaly in the Advanced Camera for Surveys (ACS) occurred on January 27, 2007, the *Hubble* project assembled a team to examine the options for repair. Over the course of the following month, the ACS repair team worked in concert with the anomaly review board to discover the nature of the fault and developed some basic strategies for restoring ACS functionality. At the end of February, a specific option was chosen for further study, and a system concept review was conducted on March 28, 2007. This summer, the team is preparing the repair concept for the next *Hubble* servicing mission, and awaiting final approval from NASA Headquarters for implementation.

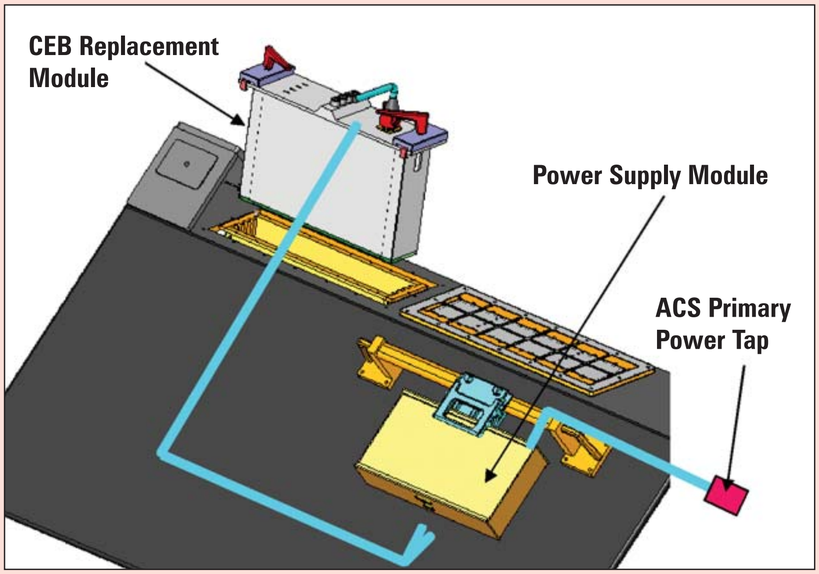

Figure 1: Mechanical layout of the ACS repair concept.

It is truly remarkable that a repair concept was conceived and developed in so short a time—even while the details of the fault and the exact status of the instrument were still being investigated. This accomplishment was facilitated by the repair team's strategy to only pursue solutions that were reasonably independent of credible failure modes. In other words, the process concentrated on solutions that bypassed suspect subsystems and components.

The limited amount of time available for extravehicular activity (EVA) by astronauts has been another driver. While the failure(s) are likely confined to the ACS's low-voltage power supply (LVPS), a direct repair of that subsystem—removing the covers, replacing the failed unit, and restoring the covers—would require too much EVA time. Fortunately, there is another solution.

The selected repair concept replaces the CCD electronics box (CEB) in the ACS's Wide Field Channel (WFC). The replacement CEB will be powered by a replacement LVPS, one completely independent of the failed unit. The replacement CEB will communicate with the WFC CCD—as well as with the rest of the instrument for command and data—via the edge connectors in the original CEB. The replacement LVPS draws power from the ACS primary power connectors, accessed via a splitter cable installed by the astronauts.

While the highest priority is restoring the WFC, the ACS repair concept also provides a path for restoring the High Resolution Channel (HRC). In this scenario, the repaired LVPS would provide power to the original power bus, accessed at the WFC CEB. The HRC CEB is wired in parallel with this power bus, which means that, in principle at least, it could be powered up and operated with power from the new LVPS. There is some risk that the fault(s) in the LVPS shorted the power harnesses, which would defeat restoring the HRC. There is also a possibility of increased noise in the HRC when operated in this mode. These issues are currently being studied by ground testing.

In summer 2007, the ACS repair team is working hard—preparing for reviews, detailing designs, prototyping, and proving concepts—to understand the feasibility of restoring the ACS for science. This understanding will inform a later decision by NASA Headquarters on whether or not to approve the ACS repair for execution on SM4.

Ed Cheng is the principal investigator for ACS repair. Ω

WFC3 Status

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WFC3 has been fully reassembled following repairs and re-testing of various subsystems, including the filter complement and electrical components. The team has successfully conducted the first round of compatibility testing with the ground version of the *Hubble* electronics and computer systems. They have also performed the acoustical test. After a weeklong round of instrument optical alignment and calibration in ambient conditions in April, the team is set for a two-month period of thermal-vacuum (TV) testing that starts in June 2007.

WFC3's ambient testing resolved a variety of issues discovered during testing in 2004. The CCD cross-talk has been fully corrected. The optical ghosts found in various filters have been reduced. The CCD charge-injection capability, intended to mitigate charge-transfer inefficiencies due to radiation damage after several years on orbit, has now been successfully operated. Uniform illumination by the internal flat-field lamps has been verified.

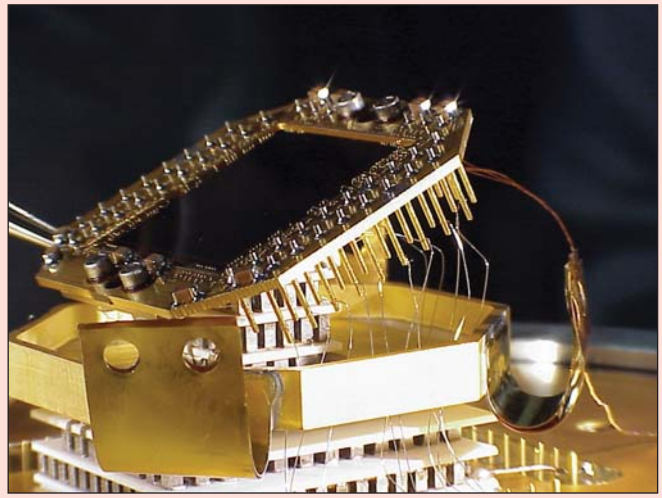

Figure 1: Infrared focal plane mounted on its six-stage thermal electric cooler, prior to installation of the cold baffle. Image courtesy of Ball Aerospace.

Great progress has been made with the quality of the WFC3's infrared detectors. Ball Aerospace has delivered the first detector with the Cd-Zn-Te substrate removed, an improvement that eliminates the risk of excess dark background from proton-induced glow in the substrate. The detector vendor (Teledyne, formerly Rockwell Scientific) has subsequently manufactured several additional devices with substantially improved quantum efficiency and dark current, resulting in outstanding performance for the infrared channel (see Figure 2). Ball Aerospace is in the process of packaging two of these parts, and the better one will be installed in the instrument in fall 2007, prior to the third TV test. Ω

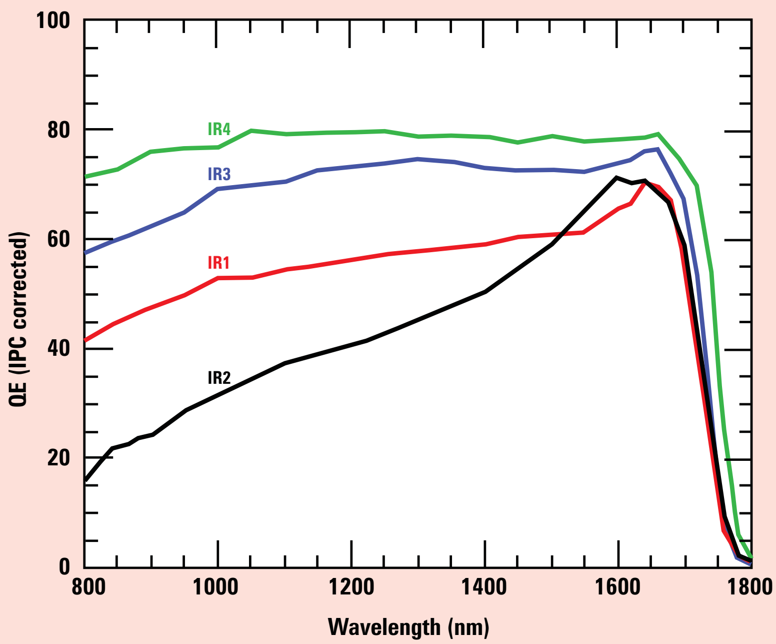

Figure 2: Quantum efficiencies of the WFC3 infrared detector packages show recent improvements. The IR2 detector assembly [focal plane array (FPA) 64] contains old technology subject to substrate glow. IR1 (FPA129), IR3 (FPA150), and IR4 (FPA165) show the higher quantum efficiency of the new technology. IR3 and IR4 also show considerably better dark current properties than IR1.

A team of astronomers is releasing one of the largest panoramic images ever taken with *Hubble*'s cameras. It is a 50-light-year–wide view of the central region of the Carina Nebula, where a maelstrom of star birth—and death—is taking place.

Hubble's view of the nebula shows star birth in a new level of detail. The fantasy-like landscape of the nebula is sculpted by the action of outflowing winds and scorching ultraviolet radiation from the monster stars that inhabit this inferno. In the process, these stars are shredding the surrounding material that is the last vestige of the giant cloud from which the stars were born.

The immense nebula contains at least a dozen brilliant stars that are roughly estimated to be at least 50 to 100 times the mass of our Sun. The most unique and opulent inhabitant is the star Eta Carinae, at far left. Eta Carinae is in the final stages of its brief and eruptive lifespan, as evidenced by two billowing lobes of gas and dust that presage its upcoming explosion as a titanic supernova.

The fireworks in the Carina region started 3 million years ago when the nebula's first generation of newborn stars condensed and ignited in the middle of a huge cloud of cold molecular hydrogen. Radiation from these stars carved out an expanding bubble of hot gas. The island-like clumps of dark clouds scattered across the nebula are nodules of dust and gas that are resisting being eaten away by photoionization.

CARINA Nebula

http://hubblesite.org/newscenter/archive/releases/2007/16

The hurricane blast of stellar winds and blistering ultraviolet radiation within the cavity is now compressing the surrounding walls of cold hydrogen. This is triggering a second stage of new star formation.

Our Sun and our solar system may have been born inside such a cosmic crucible 4.6 billion years ago. In looking at the Carina Nebula, we are seeing the genesis of star making as it commonly occurs along the dense spiral arms of a galaxy.

The immense nebula is an estimated 7,500 light-years away, in the southern constellation Carina the Keel (of the old southern constellation Argo Navis, the ship of Jason and the Argonauts, from Greek mythology).

This image is a mosaic of the Carina Nebula assembled from 48 frames taken with *Hubble Space Telescope*'s Advanced Camera for Surveys. The *Hubble* images were taken in the light of neutral hydrogen. Color information was added with data taken at the Cerro Tololo Inter-American Observatory in Chile. Red corresponds to sulfur, green to hydrogen, and blue to oxygen emission.

Image Credit: *NASA*, *ESA*, N. Smith (*University of California, Berkeley*), and The *Hubble* Heritage Team (*STScI/AURA*)

COS Status

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Institute efforts are intensifying as we prepare to operate the Cosmic Origins Spectrograph (COS) in Cycle 17. The COS tools for estimating exposure times and evaluating the field-of-view (FOV) for bright-object protection (BOP) are in their final testing and will soon be integrated into the Astronomer's Proposal Tool (APT). The BOP tool will include an option to list *GALEX* targets present in the COS FOV, because the *GALEX* flux values are definitive for assessing a target's safety.

Led by their principal investigator, Dr. James Green, over the next few months the COS science team will collaborate with the Institute to craft calibration and characterization programs for science verification after SM4. Meanwhile, we are improving COS science operations with new analysis of the data from the highly successful 2006 thermal vacuum testing. In particular, our evaluation of the calibration lamp sequences for the innovative and efficient TAGFLASH time-tag mode has prompted changes to instrument commanding that will improve data quality. TAGFLASH is the default observing mode for COS.

The Institute has developed a complete suite of programs to test the end-to-end performance of the ground systems for COS and WFC3 during the upcoming servicing mission ground test at Goddard Space Flight Center.

The Institute has also prepared a COS information brochure in PDF format on the Institute's COS website. (**http://www.stsci.edu/hst/cos/documents/COS_Brochure_18apr2007.pdf**) Ω

Setting Hubble Servicing Priorities

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Recently the *Hubble* program asked the Space Telescope Users' Committee (STUC) to develop recommendations regarding the relative scientific priorities of the Cosmic Origins Spectrograph (COS) and Wide Field Camera 3, the two new instruments on the manifest for Servicing Mission 4. We also asked the STUC to weigh in on the relative scientific priorities of repairing the Space Telescope Imaging Spectrograph versus repairing the Advanced Camera for Surveys (ACS). In both cases, one is offered "Sophie's Choice." Consequently, I'm always reluctant to instigate such a discussion in the community. Each instrument or activity has its own strong constituency. Each surely has compelling scientific justification, otherwise it would not have been considered for flight in the first place. The prospect of starting an astronomical "civil war," as the various advocates "duke it out," is not pleasant, especially because these relative scientific priorities, thankfully, are unlikely to be invoked during the actual mission. Nevertheless, they are a necessary evil.

A common misconception among scientists during preparation for every servicing mission is that the relative scientific priorities dictate the sequence of tasks to be performed by the astronauts during their spacewalks (EVAs). The most important job is done first, the second most important done second, etc. Actually, this is true only to second or third order. From the viewpoint of *Hubble* servicing, the most precious expendable resource in orbit is the limited number of hours available for EVAs. Most missions are comprised of five EVAs pre-planned to be six hours in duration. It's not unusual for an EVA to run longer if needed (and EVAs have run well over eight hours), but the absolute limit is set by consumables in an astronaut's space suit—especially the LiOH used to scrub CO_2 out of the oxygen the astronaut breathes. The physiology of each individual and the demands of different tasks cause a good bit of variability in the rate at which these consumables are depleted. Pre-flight planning must account for these variations and allow the crew to complete their tasks and to return to the airlock with margin to spare in their consumables—hence the six-hour rule for planned EVA activities. One or two extra "unscheduled" EVAs are provided near the end of each mission to allow the astronauts to respond to problems that may arise, either problems with the equipment they have installed or problems in re-deploying *Hubble*. However, the content of these unscheduled EVAs cannot be pre-planned. They are there for use only for contingencies.

The prime imperative in planning the schedule for *Hubble* servicing tasks is to package the content of the EVAs in the most efficient way possible, to maximize the chance that every task will get done. Planning and pre-mission training focuses on such minutia as the design of tools to simplify EVA tasks, ease of astronaut access to tools, the quickest path to the work site on *Hubble*, minimization of time-consuming telescope rotations and door openings, and the efficient choreography of the activities of the two EVA astronauts (one attached to the remote manipulator arm, one tethered as a "free floater") so that they work together when needed, or work separately when parallel tasks are possible. As an example, in considering how we might approach the repair of ACS, we have sketched a plan where COS insertion and ACS repair are performed during the same EVA. The same set of doors in *Hubble*'s Aft Shroud and the same rotation angle of the telescope give access to both instruments. Scheduling both jobs on the same spacewalk avoids wasting time in multiple rotations and door openings. Mission EVA packaging efficiency usually trumps relative task priorities in laying out the timeline.

During Servicing Mission 1 in 1993, the highest-priority scientific task identified prior to the flight was insertion of the Wide Field and Planetary Camera 2 (WFPC2) with its corrective optics. However, WFPC2 insertion was executed according to plan during the third of five EVAs, following the gyro and solar array replacements. So, why set scientific priorities if the mission planners are just going to "ignore" them in laying out the EVA schedule? Actually, they are very important. Prior to every mission, *Hubble* managers, engineers, and scientists work hard to think of anything and everything that has a non-negligible probability of going wrong. For every anticipated contingency, detailed responses are planned and documented. Some contingencies could require a shortened mission. Suppose a problem arose after launch and the Space Shuttle Program told us that they would be able to execute only one EVA, or two, or three, instead of the originally planned five? Each of these scenarios must be thought through and pre-planned many months before the shuttle lifts off the pad. If we were given only one EVA day, what tasks would we ask the astronauts to do, and what tasks would we (painfully) have to give up? The same question applies to a two-, three-, or four-EVA contingency scenario.

So far, we've only had to invoke a contingency plan for a curtailed mission once, just prior to SM3A in late December 1999. NASA did not want a shuttle in orbit during the famous Y2K boundary. Consequently, we dropped a series of repairs of the spacecraft's multi-layer thermal blankets shortly before launch and condensed the mission to three EVAs. This allowed *Discovery* to land prior to Y2K, with ample margin, on December 27, 1999.

A corollary to "Murphy's Law" is that the contingency that arises during a servicing mission will be the one we didn't plan for. That certainly happened during SM3B when John Grunsfeld's spacesuit cooling system sprang a water leak, delaying by about two hours the start of the highly challenging EVA 3, with its change-out of *Hubble*'s power control unit and the associated powering down of the entire spacecraft. On hand during the crisis were engineers, scientists and managers at Johnson Space Center (JSC) and at Goddard, who had been trained during many grueling hours of mission simulations to work together as a team and to make good decisions. In real-time emergencies like this we are always cognizant of the mission priorities, and those are folded into the discussions of the mission management team, along with many other factors related to crew safety and spacecraft performance.

The final list of mission priorities is formalized by NASA Headquarters several months prior to launch. However, preliminary prioritization begins well in advance of that time and becomes progressively firmer during the year leading up to the mission. A mature list of mission priorities is needed to inform the detailed planning of mission contingencies, astronaut training in the neutral buoyancy laboratory at JSC, and mission simulations involving the entire servicing team. Although it's not easy to modify mission content in the final months prior to launch, we have enough flexibility to allow that in some circumstances. During SM3B in 2002, a replacement reaction wheel assembly (RWA) was added to the manifest only three months prior to the flight. By that time, the EVA efficiency had been so well optimized that a $\sim$45 minute slot was found into which the RWA change-out would fit. Obviously, we try to avoid such last-minute changes to mission content.

In the internal discussions and debates about mission priorities, the *Hubble* program seeks and values the input of the scientific community. The NASA *Hubble* program and project scientists and the director of the Institute, working with the STUC, are responsible for assuring that the community's interests are well represented. During the missions, these same individuals are on duty in the customer support room at JSC, monitoring every moment of every EVA and assisting in the decision process as contingencies arise and mission re-planning becomes necessary. It is the current, painful discussions with the scientific community about relative scientific priorities that enable us to be effective members of the mission team. Ω

Perspective from NASA Headquarters

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We have entered the budgeting season at NASA Headquarters, and are working on the Astrophysics Division's submission to the President and Congress for fiscal 2009.

We have a new front office in the Science Mission Directorate and a new division director for astrophysics. Alan Stern is associate administrator for science, effective April 2. Colleen Hartman stays on as the deputy. John Mather joins us as the new chief scientist for the directorate, and has a number of assistants to help with our broad science portfolio. Yvonne Pendleton from Ames Research Center has come to help streamline and improve the research and analysis process, and Andrew Cheng from the Applied Physics Laboratory of the Johns Hopkins University now acts as the deputy chief scientist for space science. Paul Hertz continues in his role coordinating our solicitations—announcements of opportunity and NASA research announcements. Todd May from Marshal Space Flight Center comes to us as the new deputy for flight programs.

Focusing on the Astrophysics Division, Jon Morse is our new division director, effective April 2. Rick Howard returns to his role as the deputy of the division.

To support the planned mid-September 2008 launch date, the *Hubble* Servicing Mission 4 (SM4) activities continue to be the focus of a lot of hard work at Goddard Space Flight Center, the Institute, and NASA Headquarters. The summer months will be especially busy at the neutral buoyancy facility, where astronaut training continues. The Wide Field Camera 3 is being reintegrated and is undergoing thermal vacuum testing. Work continues on the possible on-orbit repair of the Advanced Camera for Surveys and the Space Telescope Imaging Spectrograph.

We are just over a year from the SM4 launch. We have accomplished a lot, but there is still much to do. We here at Headquarters are gratified that a tremendously talented team is in place to get us to the launch pad at Cape Kennedy on time. Ω

ACS Report

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The Advanced Camera for Surveys (ACS) is now only operating with the solar blind channel (SBC). The two CCD-based channels, the wide-field camera (WFC) and the high-resolution camera (HRC) are inoperable, due to a failure of the power supply for the side-two electronics that occurred on January 27, 2007. In June 2006, the primary, side-one electronics suffered a short in the CCD electronics box, so there is no way to operate the CCD-based channels. The side-one circuitry of the SBC has not been affected.

We are working to improve the photometric correction for change transfer efficiency (CTE) losses and to fully characterize performance when operating on side two. The latter is needed for data acquired during the last six months of WFC operations.

Assuming the ACS WFC and HRC will be restored, we are planning the functional tests and calibrations that will be required before the ACS can resume science operations after the upcoming servicing mission.

R. Gilliland and R. Bohlin have re-analyzed the pixel-to-pixel flat-field changes for the WFC (ACS ISR 07-01). Between anneals, a population of pixels with lowered quantum efficiency (QE) develops, which is largely reset by the next anneal. The QE deficits are twice as large in the blue as in the red. The pixels with low QE recover 90% of their losses after a few monthly anneals, but never recover fully.

J. Mack and collaborators provided new zero-points for the WFC under side-two operations (ISR 07-02). Following the recovery of ACS in July 2006 by using side-2 electronics, the temperature of the WFC detector was lowered from –77°C to –80°C in order to mitigate CTE and hot pixels. A revised detector QE curve and a new set of photometric zero-points have now been computed for

WFC observations obtained at the new operating temperature. These zero-points must be applied manually until the new QE curves are implemented in SYNPHOT.

During Cycle 16, the SBC will account for about 12% of *Hubble* observing time, almost two times more than in previous cycles. We are collaborating with the Space Telescope–European Coordinating Facility to provide a general QE update and red-leak characterization of the SBC. We are updating the ACS data pipeline as we complete these analyses.

At the Institute, the ACS and WFPC2 teams in the instrument division have merged into a new ACS-WFPC2 team (AWT), to share resources and expertise for the calibration challenges of both instruments. Ω

For further information visit:

ACS Web page: **http://www.stsci.edu/hst/acs/**
ACS Bulletin Board: **http://forums.stsci.edu/phpbb/viewforum.php?f=14**
WFPC2 Web page: **http://www.stsci.edu/hst/wfpc2/**
WFPC2 Bulletin Board: **http://forums.stsci.edu/phpbb/viewforum.php?f=20**

For any question about ACS or WFPC2 please consult the bulletin boards or send e-mail to help@stsci.edu.

WFPC2 Report

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The Wide Field and Planetary Camera 2 (WFPC2) was installed during the first servicing mission in December 1993, and continues to operate remarkably well, still producing first-rate science after more than 13 years in orbit. WFPC2 will serve as *Hubble*'s primary camera for visible imaging in Cycle 16, accounting for 40% of the time allocation. The newer Advanced Camera for Surveys (ACS) had performed this role, but after the failure of its CCD channels earlier this year, many ACS programs were reconfigured for the WFPC2.

The single most important performance issue for WFPC2 is degraded charge-transfer efficiency (CTE) in the CCD detectors. This problem results from radiation damage accumulated over the instrument's many years in space. Radiation damage creates charge-trapping sites within the CCDs, causing images to lose significant amounts of charge during readout. The amount of charge loss depends on many factors, including the brightness and size of the target, brightness of the sky (or other) background in the images, the distance on the detector from the target to the CCD readout amplifier, and the epoch of the data. Losses are modest for long exposures in broad filters having significant background light. For example, a faint star image (100 electrons or $V \sim 27$) in a 600-second F606W exposure near the center of a CCD in mid-Cycle 16 will lose 15% to 20% of its counts during readout. The worst-case scenarios for CTE losses are faint point sources in images with very low background light located at high-*Y* coordinates on the CCDs. For example, a similar exposure of a faint stellar source (100 electrons) in the F656N filter near the top of a CCD ($Y \sim 800$) might lose as much as 80% of its counts during readout. It is very important to be aware of potential CTE losses when planning observations and analyzing data.

CTE effects can be greatly reduced by properly planning the observations. If possible, targets should be placed near the CCD readout amplifier; this usually can be arranged for single targets or small numbers of targets. Pre-flashing with internal lamps can also reduce CTE losses, though the increased background noise will, in most cases, offset the benefits.

Most observers will need to correct for CTE losses during data analysis. Correction equations have been derived by several groups; details and various web tools for correction are available through the WFPC2 website. While the corrections were derived at earlier epochs, recent tests indicate they should still be valid during Cycle 16. CTE losses have increased roughly linearly with time while WFPC2 has been on-orbit.

The only other significant anomaly in WFPC2 is an instability in the WF4 CCD amplifier. However, with proper management of the camera temperature and new calibrations, we anticipate the WF4 anomaly will have little or no impact on science observations. In this anomaly, the gain of the WF4 CCD amplifier goes low and fluctuates over of tens of minutes. While the most obvious symptom is a reduction of the bias level in WF4, the photometry also "goes faint," and horizontal streaks appear in the images. The

Continued page 24

WFPC2 Report from page 23

anomaly is very sensitive to temperature, and by periodically lowering the operating temperature of WFPC2, we can minimize the anomaly and keep WF4 in a usable state. If the gain goes low enough, blank images can occur; several hundred blank images occurred in 2005, but there have been no further blank images since we began lowering the WFPC2 temperature in January 2006. The last temperature reduction was performed in March 2007, and the next one is expected in mid-August 2007. So far, the temperature reductions have been very successful and have kept WF4 operational, with the bias levels and photometry near normal. The temperature reductions do have some side effects—mainly that the relative positions of the four CCDs change by about 0.01 arcsecond at each reduction; but this effect should impact only the most critical astrometric programs, and is easily corrected.

Our current plans are to automatically correct the photometric errors related to the WF4 anomaly within the calibration pipeline. In the worst-case scenario of very low WF4 bias levels, the photometry can be as much as 30% low at A-to-D converter gain 7, and 60% low at gain 15. However, the gain error appears to be a unique function of the WF4 bias level and pixel value, and hence is readily corrected. A new version of the WFPC2 calibration software, CALWP2, with capabilities to correct the WF4 photometry, has already been installed in the calibration pipeline. The calibration tables needed to drive the corrections are being finalized, and should be released over the summer. Preliminary indications are that the corrections will be accurate to better than 1% in most situations. Ultimately, images obtained through the *Hubble* archive will be automatically corrected for the WF4 bias and photometric errors.

The final problem related to the WF4 anomaly is the appearance of faint, horizontal, background streaking throughout images with about 1 DN peak-to-valley amplitude. Preliminary IRAF correction scripts, which will work well for images that are mostly "empty," are available via the WFPC2 website. Work is underway to develop a more robust correction, which might eventually be installed in the calibration pipeline.

In summary, the primary issue for current WFPC2 observers will be CTE losses, which can usually be managed by careful observation planning and correction during data analyses. All other aspects of WFPC2 continue to perform extremely well.

Regarding data archive products, one difference between the ACS products and those for WFPC2 is that WFPC2 does not include a combined image product—neither so-called CRREJ (simple cosmic-ray rejection) nor Drizzling (alignment and stacking) products are automatically provided. However, the observer can easily perform these tasks. We have recently released a series of cookbooks, which are available through the WFPC2 website, to aid observers in combining their images.

We anticipate that Cycle 16 will be the final cycle for which WFPC2 will be available; it is expected that WFPC2 will be replaced by WFC3 in September 2008 during Servicing Mission 4. In an effort to improve and finalize WFPC2 calibrations, we have undertaken a series of special closeout calibration observations, summarized as follows.

CTE effects will be at their greatest levels during Cycle 16, and a program is underway to assess its effects as a function of target brightness, target size, and background light. CTE effects for extended targets have not been characterized in detail, and an extensive program is planned to measure these effects on galaxies, through observations of Abell 1795 and the *Hubble* Deep Field–North. New standard star observations will be made in all filters, including the specialized ramp filters and polarizer filters. Observations of several star clusters and late-type stars will also be made to improve photometric calibrations relative to ground-based telescopes and other *Hubble* instruments. Detailed measurements of red-leaks in blue and UV filters have not previously been made on-orbit, and are now planned. Improved measurements of geometric distortions are planned from the ultraviolet to the far red. In addition, various upgrades to the pipeline calibration are planned to improve the "ease of use" for future archival users (WF4 corrections, corrections for time-dependent ultraviolet throughput, estimates of CTE losses, etc.). Ultimately, we plan to perform a "final" re-processing of all the WFPC2 images and replace the current on-the-fly calibration system with a set of static products that are served out to *Hubble* archive requests.

Finally, we note the ACS and WFPC2 teams in the instrument division at STScI have merged into a new ACS-WFPC2 team, to share resources and expertise for the calibration challenges of both instruments. Ω

For further information visit:

WFPC2 Web page: **http://www.stsci.edu/hst/wfpc2/**
WFPC2 Bulletin Board: **http://forums.stsci.edu/phpbb/viewforum.php?f=20**
For any question about WFPC2 please consult the bulletin board or send e-mail to help@stsci.edu.

Makeover of Spectral Catalogs for SYNPHOT

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SYNPHOT is the general-purpose package for synthetic photometry that is included in the IRAF STSDAS package. Several atlases of both observed and model spectra are available in FITS table format for use in SYNPHOT. These spectra have been in SYNPHOT for ten or more years, and are now quite dated. That fact—and awareness that the fourth-generation instruments, the Cosmic Origins Spectrograph and the Wide Field Camera 3, are just around the corner—have led us to revisit the SYNPHOT database. We have concluded that *Hubble* science demands newer and better spectral catalogs, and we have begun work to achieve that objective.

With input from members of the community, an Institute working group has identified new spectra for the SYNPHOT database. We have updated documentation to reflect and explain the changes. In some cases, we have propagated the changes into the exposure time calculators (ETCs), to help general observers better prepare for their observations. All the changes will be in place and available to the community well before the new instruments are installed on the upcoming servicing mission. Documentation will be revised and updated as the new files are put in place.

The working group recommended adding a subset of the currently available stellar spectral-energy distributions, stellar atlases, and catalogs to replace or supplement current offerings. The priority is new material to benefit a majority of users, rather than coverage of all possible types of objects and environments.

Available spectra	*Recommendations*	*New spectra*
Hubble calibration spectra	update, add cool stars	--
Kurucz 1993	replace with newer models	Castelli and Kurucz 2003
Bruzual	eventually remove	Pickles 1998
Gunn & Stryker 1983	eventually remove	---
Bruzual et al.	eventually remove	---
Jacoby, Hunter & Christian 1984	eventually remove	---
Bruzual & Charlot 1995	eventually remove	links to GISSEL and Starburst99 web sites
Kinney & Calzetti	extend wavelength range	---
Buser & Kurucz 1979	eventually remove	---
AGN atlas	update	---
Galactic atlas	update	---
---	---	BASEL Library
---	---	New Generation Spectral Library

They also recommended flagging older catalogs as obsolete, but keeping them available—with detailed information for users on the benefits of the newest spectral material. This will allow comparison checks between older and newer spectra.

The working group has also reviewed how spectra are offered for use in the ETCs. Based on their recommendations, the new spectra will be included in the ETC's menus, and the pullout menus will report stellar type and provide information on temperature and gravity.

The upgrade of the SYNPHOT spectral catalogs is a work in progress. The table gives the currently available spectra, recommendations of the working group, and the planned libraries and catalogs of new spectra.

The model spectra of Castelli and Kurucz (2003) and the observed spectra by Pickles (1998) are already in place. For detailed descriptions of those spectra, we refer the user to ftp://ftp.stsci.edu/cdbs/cdbs2/grid/ck04models and ftp://ftp.stsci.edu/cdbs/cdbs2/grid/pickles, and the AA _ README files therein.

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SYNPHOT
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Useful information can also be found in the SYNPHOT Data User's Guide (**http://www.stsci.edu/hst/HST_overview/documents/synphot/hst_synphot_cover.html**), which currently pertains only to the heritage catalogs, but will be updated in fall 2007 to include the newer spectra.

The new catalog database will be available for installation from the SYNPHOT webpage: **http://www.stsci.edu/resources/software_hardware/stsdas/synphot**/, where the Pickles and Castelli and Kurucz spectra are already available.

We expect all changes to be in place, with all new spectra available, by fall 2007—with the possible exception of the New Generation Spectral Library.

We invite the scientific community to propose further improvements of spectral catalogs for SYNPHOT. Ω

Note: The following references refer to atlases in the table; for more complete information about all atlases as listed in the table, please refer to Appendix A of the SYNPHOT Data User's Guide.

References

Kurucz R. 1993, ATLAS9 Stellar Atmosphere Programs and 2 km/s grid. Kurucz CD-ROM No. 13. Cambridge, Mass.: Smithsonian Astrophysical Observatory

Castelli, F. & Kurucz, R. L. 2003, Modelling of Stellar Atmospheres, IAU Symposium 210, eds. N. E. Piskunov, W. W. Weiss, and D. F. Gray. *ASP*. p. A20

Pickles, A. J. 1998, *PASP* 110, 863

Gunn, J. E. & Stryker, L. L. 1983, *ApJS* 52, 121

Jacoby, G. H., Hunter, D. A., & Christian, C. A., 1984, *ApJS* 56, 257

GISSEL: **http://www.cida.ve/~bruzual/bcXXI.html**

Starburst99: **http://www.stsci.edu/science/starburst99**/

BASEL Library: **http://tangerine.astro.mat.uc.pt/BaSeL**/

NGSL: **http://lifshitz.ucdavis.edu/~mgregg/gregg/ngsl/ngsl.html**

Institute Educator Leads Workshop for British Queen

Queen Elizabeth II learned about NASA education in May when she visited NASA's Goddard Space Flight Center in Greenbelt, MD. Bonnie Eisenhamer, the *Hubble Space Telescope* Formal Education Manager at the Space Telescope Science Institute in Baltimore, MD, led an education workshop for local middle school students during the Queen's Goddard visit.

The Goddard Education Office asked Ms. Eisenhamer to develop and lead the workshop, called "Exploration: From Questions to Discoveries." She was selected because of her expertise and background in developing *Hubble Space Telescope* education materials and workshops.

"This was an opportunity for the Queen and her husband, the Duke of Edinburgh, to see how NASA science is used to train the next generation of explorers," Ms. Eisenhamer said.

The workshop activities explored how scientists use light to study the Earth and the universe. Students learned about light by participating at three learning stations in hands-on, inquiry-based activities by researching information to answer specific questions. The exploration questions were: "What is the relationship between light and exploration?"; "Why do we use light to study Earth?"; and "How is light used to explore the universe?"

Each learning station offered students first-hand experience in learning how science, technology, engineering, and math (STEM) skills are needed to answer scientific questions and make new discoveries, Ms. Eisenhamer explained. Among NASA's educational goals, she said, are translating science data into relevant, interactive education materials and activities that will inspire students to pursue careers in science, technology, engineering, and math.

Hubble Fellowship Program

M. Fall, *fall@stsci.edu*

The Institute awarded 12 new Hubble Fellowships to begin in September 2007. The new Fellows and their host institutions are listed in the table.

Hubble Fellowships are awarded annually to outstanding young scientists engaged in theoretical, observational, or instrumental research related to the *Hubble* mission. The fellowships provide three years of salary and other support at U.S. host institutions of the Fellow's choice (subject to a maximum of one or two new Hubble Fellows per institution per year). More information about the program, including a list of past Hubble Fellows, is available at **www.stsci.edu/institute/org/spd/hubble-fellowship/hubble-fellow-overview**.

The selection committee, chaired by Rocky Kolb (Chicago), met at the Institute in January and selected the new Hubble Fellows from a pool of 195 applicants. The other members of the committee were Stefi Baum (RIT), Claire Chandler (NRAO), Daniel Eisenstein (Arizona), Sangeeta Malhotra (Arizona State), Ken Sembach (STScI), Frank Shu (UCSD), Linda Sparke (Wisconsin), Kris Stanek (Ohio State), and Michael Rauch (OCIW).

Hubble Fellows present the results of their research annually at a symposium at the Institute. This is also an opportunity for them to meet each other and the Institute staff involved with the program. This year, the symposium was held on April 2–4. The scientific program, abstracts, and webcasts of all the talks are available at **www.stsci.edu/institute/conference/hubble_fellows**.

We plan to select approximately 12 new Hubble Fellows next winter for positions to start in September 2008. Details of the application process will be announced on the Institute website this summer. Eligible candidates must have received a PhD in astronomy, astrophysics, or planetary science on or after January 1, 2005. There are no restrictions on country of origin or citizenship.

After five years as head of the Hubble Fellowship program, I have recently stepped aside, and am currently on sabbatical leave from the Institute. The program is now in the very capable hands of my successor, Ron Allen. Ω

2007 Hubble Fellows

New Fellow	*HF Host Institution*
Sean Andrews	SAO
Beth Biller	Hawaii
Judd Bowman	Caltech
Marusa Bradac	UC Santa Barbara
David Kaplan	MIT
Daniel Kasen	UC Santa Cruz
Ivo Labbe	Carnegie Obs
Mercedes Lopez-Morales	Carnegie DTM
Jonathan Pritchard	Harvard
Dominik Riechers	Caltech
Alicia Soderberg	Princeton
Jay Strader	Harvard

Webb Passes Non-Advocate Review of Technology

P. Stockman, *stockman@stsci.edu*

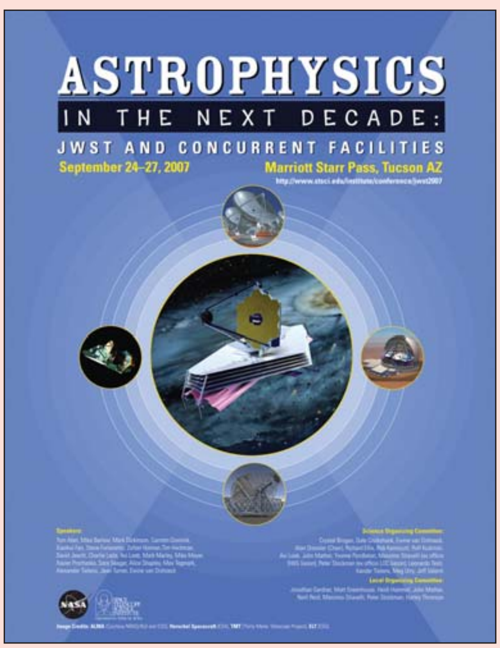
On March 23, 2007, the non-advocate review team (NRT) reported to NASA Headquarters that its late-January review of technology for the *James Webb Space Telescope* had successfully met its objectives. Agreeing with the *Webb* project's readiness assessment, the NRT found that nine of the ten key technologies now meet their performance goals in launch or flight-like conditions, as appropriate. The passing technologies are:

- near-infrared detectors (Hg-Cd-Te);
- cryogenic controllers and signal processors for the detectors;
- mid-infrared detectors (Si-As);
- microshutters for the Near-Infrared Spectrograph;
- cryogenic heat switch;
- sunshield membrane and coatings;
- wavelength-sensing and control mechanisms and software;
- primary mirror beryllium segments and mounts; and
- cryogenic backplane structure.

The NRT had identified "residual risks" for some of the passed technologies, and these will be tracked and reported at future reviews.

The cryocooler for the Mid-Infrared Instrument (MIRI) is the only technology that the NRT found *not* to have met its goals, particularly its cooling performance and control of vibrations. Nevertheless, the NRT stated that "an [new] approach was identified and actions were taken to bring the MIRI cryocooler technology to TRL-6 maturity. This has been successfully completed." (TRL-6, or technical readiness level 6, denotes that the technology has achieved the required performance in all relevant launch and space environments).

NASA Headquarters has accepted the NRT report, clearing the way for the NRT's Preliminary Design Review of *Webb* in March 2008. Ω



September Workshop

This meeting, *Astrophysics in the Next Decade*: JWST *and Concurrent Facilities*, which is hosted by STScI and NASA/GSFC, will engage the broad science community in a discussion of science enabled by *JWST* and concurrent orbital and ground-based facilities. It will describe and stimulate work on the theoretical foundations for astrophysics in the next decade. During 2008, we will produce a reviewed and edited book containing a compilation of the talks and synopses of the discussion periods. We plan that this book will be written in a graduate level pedagogical fashion to yield a reference text of lasting value for astronomers who will be developing investigations for the *JWST* and its contemporary facilities.

For more information please visit:
http://www.stsci.edu/institute/conference/jwst2007/

Kathryn Flanagan is New Webb Mission Head

P. Stockman, *stockman@stsci.edu*

The Institute has appointed Dr. Kathryn Flanagan as the *James Webb Space Telescope* mission head. Dr. Flanagan will be responsible for the development and operations of the Institute's *Webb* Science and Operations Center. The largest space observatory ever developed, the *Webb* is scheduled for launch in June 2013.

Dr. Flanagan is currently principal research scientist at the Massachusetts Institute of Technology's Kavli Institute for Astrophysics and Space Research.

Dr. Flanagan brings extensive experience in space mission development and instrument engineering to the Institute. She has worked on three NASA flight instruments, and was responsible for the ground calibration of the High Energy Transmission Gratings, one of the instruments onboard the *Chandra X-ray Observatory*. During her association with *Chandra*, she worked with Northrop Grumman Space Technology, NASA's prime contractor building *Webb*. She is now leading a team developing new spectrometers for the *Constellation-X* mission, while continuing as an active member of the *Chandra* gratings team.

"*JWST* is a leap forward in our ability to study the universe. The mission is a challenge both scientifically and technically. I am very excited about the opportunity to lead the *JWST* Mission Office at STScI, as my background and involvement in NASA's Great Observatories provides a bridge to a broader community."

Figure 1: Dr. Kathryn Flanagan, the new *Webb* Mission Head at STScI.
Image Credit: *NASA*, *MIT Kavli Institute for Astrophysics and Space Research*, and *STScI*

Dr. Flanagan has worked closely with NASA Headquarters and has co-chaired two NASA strategic-planning documents, the 2005 NASA roadmap for Universe Exploration and the 2006 NASA Astrophysics Division Roadmap. In 2005, Dr. Flanagan also served on the science assessment team that reviewed and prioritized *Webb*'s science capabilities.

Dr. Flanagan joins the Institute in September. Ω

STELLAR FIREWORKS
Are Ablaze in Galaxy NGC 4449

http://hubblesite.org/newscenter/archive/releases/2007/26/

Image Credit: *NASA*, *ESA*, A. Aloisi (*STScI/ESA*), and The Hubble Heritage (*STScI/AURA*)-*ESA*/Hubble Collaboration

Hundreds of thousands of vibrant blue and red stars blaze in this image taken by NASA's *Hubble Space Telescope*. Hot bluish-white clusters of massive stars are scattered throughout the galaxy, interspersed with numerous dustier, reddish regions of current star formation. Massive dark clouds of gas and dust are silhouetted against the starlight.

NGC 4449 has been forming stars for several billion years, but currently it is experiencing a star-formation event at a much higher rate than in the past. This unusually explosive and intense star-formation activity qualifies as a starburst. At the current rate, the gas supply that feeds the stellar production would only last for another billion years or so.

It's likely that the current widespread starburst was triggered by interaction or merging with a smaller companion. NGC 4449 belongs to a group of galaxies in the constellation Canes Venatici. Astronomers think that NGC 4449's star formation has been influenced by interactions with several of its neighbors.

Hubble Photographs Grand Design Spiral Galaxy M81

The sharpest image ever taken of the large "grand design" spiral galaxy M81 was released at the American Astronomical Society Meeting in Honolulu, Hawaii. A spiral-shaped system of stars, dust, and gas clouds, the galaxy's arms wind all the way down into the nucleus. Though the galaxy is located 11.6 million light-years away, the *Hubble Space Telescope*'s view is so sharp that it can resolve individual stars, along with open star clusters, globular star clusters, and even glowing regions of fluorescent gas. The *Hubble* data was taken with the Advanced Camera for Surveys in 2004 through 2006. This color composite was assembled from images taken in blue, visible, and infrared light.

http://hubblesite.org/newscenter/archive/releases/2007/19/
Image Credit: *NASA*, *ESA*, and The Hubble Heritage Team (*STScI/AURA*)

Contact STScI:

The Institute's website is: **http://www.stsci.edu**
Assistance is available at *help@stsci.edu* or 800-544-8125.
International callers can use 1-410-338-1082.

For current Hubble users, program information is available at:
http://presto.stsci.edu/public/propinfo.html.

The current members of the Space Telescope Users Committee (STUC) are:

Pat McCarthy (chair), Carnegie Observatories, *pmc2@ociw.edu*

Martin Barstow, U. of Leicester
Laura Ferrarese, NRC-CNRC
Peter Garnavich, U. of Notre Dame
Jim Green, U. of Colorado
Jean-Paul Kneib, OAMP
David Koo, UCSC
Mario Mateo, U. of Michigan
Phil Nicholson, Cornell U.
Robert O'Connell, U. of Virginia
Alvio Renzini, INAF
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To record a change of address or to request receipt of the Newsletter, please send a message to *address-change@stsci.edu*.

ST-ECF Newsletter

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

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