

# NEWSLETTER

Space Telescope Science Institute

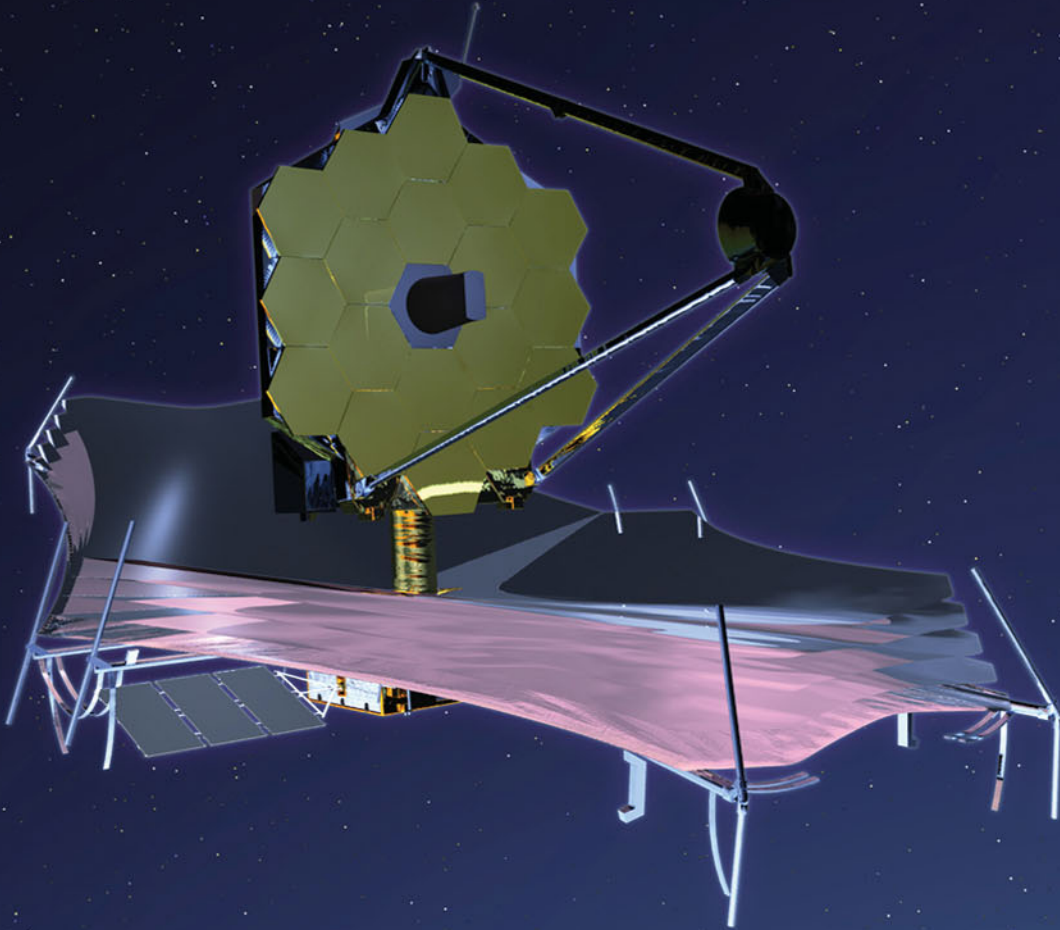


Image Credit: Northrop Grumman Space Technology.

## James Webb Space Telescope Status

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**T**he *Webb* program continues to progress according to the schedule for launch-readiness in August 2011. While there are a handful of significant hardware and operations issues which should be resolved before the Systems Design Review (SDR) this summer, NASA and the science-instrument teams have begun developing long-lead items, such as mirror segments and detectors. The Webb Science Working Group reviewed the project status in Oxnard (California) on February 2–3, 2005.

### Ariane 5 News

Although then-Administrator O'Keefe approved the use of the Ariane 5 to launch *Webb*, that decision may be revisited by the new NASA Administrator, Dr. Mike Griffin. If the Ariane is selected, it would be an important step in the extended approval process when non-U.S. launchers are used for U.S. missions. The Ariane 5 is capable of launching 6,800 kg to L2, the best performance available for a commercial launcher,

exceeded only by the Titan 4/Centaur. The European Space Agency (ESA) will provide the Ariane 5 as a major portion of its contribution to the *Webb* mission. As a timely good omen, ESA successfully launched two satellites with the Ariane 5 two days after the approval.

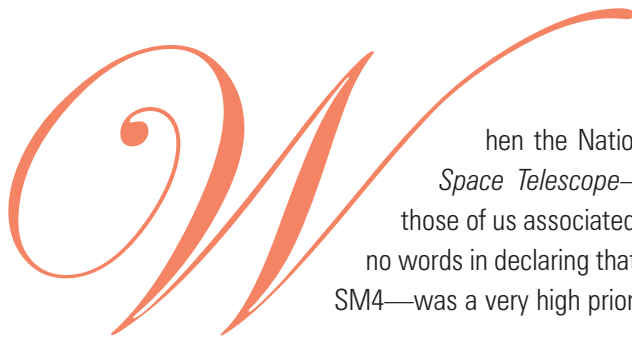
### Hardware progress

The construction of the *Webb* 6.5m primary mirror is underway. Brush-Wellman has provided a half-dozen beryllium blanks and continues on a schedule to complete all the blanks in a few years. The first segments are being light-weighted and precision-machined by Axsys Technologies, at a new facility in Cullman (Alabama). Tinsley Laboratories will test and fine-polish the individual segments at room temperature. After cryogenic testing at the X-Ray Cryogenic Facility (XRCF) at Marshall Space Flight Center, Tinsley will adjust the individual segment figures to compensate for cryogenic distortions.

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# The Future of Hubble

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When the National Academy of Sciences committee on the Future of the *Hubble Space Telescope*—the Lanzerotti committee—issued its final report in December, those of us associated with the telescope breathed a sigh of relief. The committee minced no words in declaring that a fifth servicing mission to *Hubble* as originally planned by NASA—SM4—was a very high priority for the nation.

They were equally clear about the preferred method to upgrade the telescope: a space shuttle flight to *Hubble* will have the best chance of mission success of the available options and will pose no more risk to the astronauts than a flight to the space station, almost 30 of which were planned by NASA.

And yet, *Hubble* faces an uncertain future. The House of Representatives' Science Committee held a hearing on February 2 to look into the question of *Hubble* servicing; Chairman Boehlert's opening statement emphasized his concern about the costs of continuing *Hubble*'s mission. President Bush's budget request for the next fiscal year, released on February 7, included no funds for *Hubble* servicing. NASA Administrator, Sean O'Keefe, declared that using a space shuttle was still too risky. He took the Lanzerotti report's criticism of robotic servicing as a reason to declare that there were no options for servicing *Hubble*, although there has been considerable progress on robotic servicing since the report was written. NASA declared that *Hubble* would continue to operate for a few more years, perhaps until 2007 or 2008, after which it would cease operations as its gyroscopes failed.

The uncertainty about *Hubble* coincides with a general uncertainty about NASA's future support for space science under the new exploration initiative, "Moon, Mars, and Beyond." The projected NASA budgets show a decrease in funding for astronomical research (i.e., "Beyond") to free up money for new initiatives, such as the Crew Exploration Vehicle. *Hubble* is just one of many programs affected by the new vision. Our colleagues in x-ray astronomy, gravity-wave detection, and dark-energy research saw their programs delayed, in some cases indefinitely. The community of astronomers fears a trend away from the programs that have brought NASA so much public acclamation toward the space engineering feats that have been difficult to sustain owing to a lack of clear purpose and, therefore, public support.

Popular reaction to this shift gives us reason to be hopeful that public support of space science will persuade NASA to alter its course a little and continue supporting its successful space science program, including *Hubble* servicing. Recent editorials in the *New York Times*, the *Boston Globe*, the *Houston Chronicle*, and the *Baltimore Sun* sharply criticize the decision not to service *Hubble*. A few members of Congress, notably Senator Barbara Mikulski and Congressman Mark Udall, have stated their public support to restore funding for another servicing mission. The President has nominated and Congress has confirmed Michael Griffin as NASA administrator. Dr. Griffin has a background in space science and an understanding of what it has done for NASA. He will have a chance to reassess the benefits of *Hubble* servicing and start with a clean slate.

Is *Hubble* doomed? I do not believe so. It is still at the height of its powers, and it will remain so for many years to come if we can service it and install new instruments. The next servicing mission, SM4, received the unqualified endorsements of two Nobel-prize-level committees (headed by John Bahcall and Louis Lanzerotti), in addition to NASA's own Space Science Advisory Committee. Several different measures of scientific and public impact rank *Hubble* as the most productive of all NASA's missions. It is popular with the press and the general public as an international icon of scientific achievement—waiting patiently for a visit to keep going. As a nation, we plan to send the shuttle into space many more times. I believe that we can easily send one mission to *Hubble*, and I would not rule out robotic servicing before the NASA team has had a chance to show what they can do. I remain optimistic that when the national debate on the content of the new NASA program is concluded, we will see a continuation of *Hubble* as one of the best things NASA can do. Ω

Another test at the XRCF will verify that the segment figures are correct for the 30–50° K *Webb* operating temperatures.

The Near Infrared Camera (NIRCam) detector fabrication is ongoing at Rockwell Scientific Corporation in Camarillo (California), and the characterization of these devices under flight-like conditions has started. Based upon successful testing of a cryogenic Application-Specific Integrated Circuit (ASIC) clock-generator and signal processor, also developed by Rockwell, the NIRCam team has chosen the ASIC system over the more traditional room-temperature electronics and necessary long signal lines. We anticipate that the Near Infrared Spectrograph (NIRSpec) and Fine Guidance Sensor (FGS) teams will also choose ASICs, which can be closely integrated with the HgCdTe detectors. The NIRCam beryllium bench is under construction.

The last of the science instruments to be designed, NIRSpec and FGS are now mature, and subcontracts have been issued for their various components. The Micro-Shutter Array, used for slit selection, is also successfully continuing in its development. The first Mid-Infrared Instrument (MIRI) detectors have been produced by Raytheon and perform near the flight requirements; JPL selected Lockheed-Martin ATC to design and build the MIRI solid-hydrogen dewar.

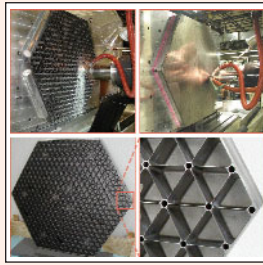
### Losing weight

Like many of us, the *Webb* team is wrestling with a weight problem. Even with the launch capabilities of the Ariane 5, the most recent mass estimates indicate that *Webb* needs to lose about 300 kg before the next major review. Importantly, this includes the appropriate amount of contingency mass that must be held in reserve at this stage of the program (>20%). The overage appears to be due to the cumulative effects of a number of moderate design choices, which have improved the overall reliability of the observatory. Nevertheless, NASA and Northrop Grumman Space Technologies are looking at a wide range of solutions, most of which do not compromise *Webb*'s science capabilities.

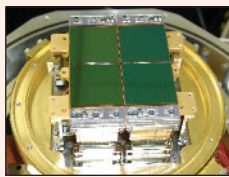
### Operational issues

The sunshield design for *Webb* makes it possible for scattered- and specularly-reflected light from the Earth and the Moon to elevate the background at some orbital phases and orientations, although the estimated contributions are generally lower than the zodiacal background. Nevertheless, for some particular illumination paths near the jagged edge of the 18-segment primary mirror, the secondary mirror can reflect light from the Moon into the focal plane and significantly increase the infrared background. One approach to reducing the problem is to further optimize the orbit of *Webb* by reducing the amplitude of excursions about the L2 point, both within the Earth-Sun plane and tangential to it. The rare times that the Moon peers over the primary mirror can be anticipated and eliminated during the scheduling process. (The scattered light from galactic stars—and particularly the galactic center—is usually more significant than the contributions from the Earth and Moon.)

The sunshield has another indirect effect on *Webb* operations: the accumulation of angular momentum due to radiation pressure. Radiation pressure is the dominant torque on the observatory. For some off-nominal attitudes, it can saturate the telescope's reaction wheels in a matter of days. NASA, Northrop Grumman Space Technology, and the Institute are studying how to minimize the number of momentum dumps required and their affect on the L2 orbit. For instance, if long, deep-field observations can be scheduled symmetrically around the nominal attitude, the angular momentum accumulated during the first half of an observation, preceding the nominal attitude, would be largely compensated by the accumulation—equal in size but with the opposite sign—during the second half of the observation, following the nominal attitude. Previously, we were not planning to actively manage spacecraft resources and *Webb* scheduling to such a level of detail. Even if our scheduling creates such a momentum-balanced program, a failed observation before the deep



**Figure 1:** Various processing steps at Axsys Technologies of a beryllium primary mirror segment for *Webb*. The upper left panel shows the backside light-weighting. The upper right panel shows the optical surface figuring. The bottom panels show the final back-side grid structure (left) and a detail of the thin beryllium ribs and attachment points (right).



**Figure 2:** Four 2k x 2k near-infrared engineering arrays produced by Rockwell Scientific Corporation. The arrays are mounted and "buted" together and are ready for testing in a dewar. This configuration is used in the short-wavelength channel of NIRCam.

*Continued*  
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field (possibly due to a failed guide star acquisition) could easily shift the schedule and unbalance the angular momentum accumulation.

We plan to study the problem of momentum management using the Science Operation Design Reference Mission (SODRM). This tool simulates one year of *Webb* science, based on the Science Requirement Documents, and includes a variety of programs with realistic targets and detailed observations of these targets. Using the SODRM, we will use different scheduling approaches to manage the build-up of angular momentum while maintaining good science efficiency. Alternatives to actively managing the momentum build-up include increasing the capacity of the reaction wheels and optimizing the placement of thrusters to reduce their influence on the L2 orbit. We anticipate that this issue will be resolved before the SDR.  $\Omega$

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## ACS News

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**F**ollowing the failure of the Space Telescope Imaging Spectrograph (STIS), the Advanced Camera for Surveys (ACS) now performs some seventy percent of the observations with the *Hubble Space Telescope*. The resulting data continue to produce many exciting discoveries.

David Ardila (Johns Hopkins University), John Krist (Jet Propulsion Laboratory), and their team of co-investigators used the coronagraph on the ACS High Resolution Channel (HRC) to detect and image the dust disks around two nearby stars (<http://hubblesite.org/newscenter/newsdesk/archive/releases/2004/33/>). One of the stars, HD 107146, is a sun-like star, whereas the other, AU Microscopii, is a smaller red dwarf. The *Hubble* images of both stars reveal a gap in the disk, where planets may have swept up dust and cleared a path. These findings may offer snapshots of the process by which our own solar system evolved—from its dusty and chaotic beginnings to its more settled present-day state.

A team of astronomers led by C. Robert O'Dell (Vanderbilt University) combined ACS Wide Field Channel (WFC) images of the well-known Helix Nebula with measurements from ground-based optical and radio telescopes to infer the speed and direction of the outflows of material from this dying star (<http://hubblesite.org/newscenter/newsdesk/archive/releases/2004/32/>). Somewhat surprisingly, the observations indicate that the Helix consists of two gaseous disks oriented nearly perpendicular to each other. It appears that the disks formed during two separate epochs of mass loss by the dying star. The inner disk was formed about 6,600 years ago; the outer ring, about 12,000 years ago. This indicates that the structure of this planetary nebula—and possibly others—are even more complex than was previously believed.

Yuri Izotov (Kiev Astronomical Observatory, Ukraine) and Trinh Thuan (University of Virginia) used ACS to image the galaxy I Zwicky 18 (<http://hubblesite.org/newscenter/newsdesk/archive/releases/2004/35/>). This is the most metal-poor galaxy in the local universe. Previous *Hubble* observations had demonstrated the existence of Asymptotic Giant Branch stars. However, the new ACS data show no clear evidence for Red Giant Branch stars. The galaxy may therefore be as young as 500 million years. This “late-life” galaxy offers a rare glimpse into what the first diminutive galaxies in the early universe might have looked like.

Other ACS images recently released to the public include a beautiful image of the barred spiral galaxy NGC 1300 (<http://hubblesite.org/newscenter/newsdesk/archive/releases/2005/01/>); an image of the young star formation in the nebula NGC 346 of the Small Magellanic Cloud (<http://hubblesite.org/newscenter/newsdesk/archive/releases/2005/04/>); and images of the continuing expansion of the light echo around the star V838 Monocerotis (<http://hubblesite.org/newscenter/newsdesk/archive/releases/2005/02/>).

We continue to make important progress in the calibration of the ACS. A team led by Marco Sirianni (ESA/STScI) and consisting of members of the ACS Instrument Definition Team and the Institute, completed a study of photometric transformations and zero-points for the ACS filters. They submitted a paper on the results to the *Publications of the Astronomical Society of the Pacific* (available from <http://www.stsci.edu/hst/acs/analysis/transformations>). The paper provides coefficients to translate ACS photometry to other photometric systems. Coefficients are provided for transformations between Wide Field Camera (WFC) and HRC, from ACS to Wide Field and Planetary Camera 2 (WFPC2), and from ACS to the Landolt *UBVRI* system. In general,




**Figure 1:** The barred spiral galaxy NGC 1300. At 5.5 x 5.5 arcminutes, this is one of the largest *Hubble* images ever made of a complete galaxy. It was unveiled at the January 2005 American Astronomical Society meeting in San Diego. The image highlights the starlight, glowing gas, and silhouetted dark clouds of interstellar dust in the galaxy.

two sets of transformations are available: the first based on observation of two star clusters and the second based on synthetic photometry. The paper discusses the accuracy of these transformations and their sensitivity to details of the spectra being transformed, such as extreme color (intrinsic or due to reddening or redshift) or an unusual spectral energy distribution. The paper also contains a cookbook for photometric calibration and detailed information about the aperture corrections for point source photometry with the ACS zero-points.

In another study, Adam Riess used ten epochs of 15-tile ACS/WFC mosaics of the Hubble Deep Field North, obtained over a period of two years in the F850LP filter, to study the photometric stability of the WFC (*ACS Instrument Science Report 2004-17*; <http://www.stsci.edu/hst/acs/documents/isrs/isr0417.pdf>). The data were originally obtained for the science goal of finding type Ia supernovae at  $z > 1$ . A multi-variate linear regression was performed to data for 371 stars. This yields a determination of the time-dependent components of parallel and serial Charge Transfer Efficiency (CTE) degradation, as well as constraints on any time-dependent sensitivity variations. The inferred CTE losses are consistent with those previously determined from calibration observations of the globular cluster 47 Tuc. Interestingly, the data indicate a decrease in the overall sensitivity of the WFC at a rate of  $0.004 \pm 0.001$  magnitudes per year. This is consistent with results from ongoing analysis of 47 Tuc data. Sensitivity variations of similar size have been detected previously with the other *Hubble* instruments. A very slow build-up of contaminants on the primary mirror could be the root cause.

In November 2004, we released a new version of the STSDAS software package. It includes a stand-alone version of the redesigned MULTIDRIZZLE software. Since August 2004, this software has produced the geometrically corrected, cosmic-ray cleaned, combined drz.fits images generated by the *Hubble* data archive for ACS. The new STSDAS version of MULTIDRIZZLE adds functionality, including the abilities to combine WFPC2 data and to convert between three coordinate systems: (ra,dec) on the sky, (x,y) on the drizzled (drz.fits) pipeline output products, and (x,y) on flat-fielded (flt.fits) pipeline output products.

In January 2005, we released a new version of the *ACS Data Handbook* ([http://www.stsci.edu/hst/acs/documents/handbooks/DataHandbookv4/ACS\\_longdnhcover.html](http://www.stsci.edu/hst/acs/documents/handbooks/DataHandbookv4/ACS_longdnhcover.html)). The primary addition with respect to the previous version is a full discussion of the pipeline implementation of the MULTIDRIZZLE software.

As always, we recommend that users regularly check the instrument web pages for the latest information. For questions, send email to the Institute Help Desk at [help@stsci.edu](mailto:help@stsci.edu). 

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# HUBBLE

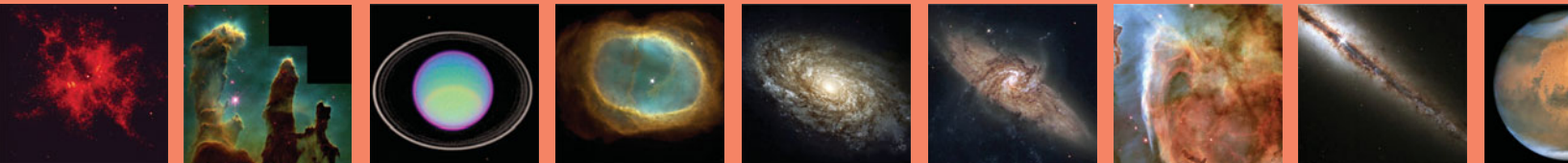
## Space Telescope

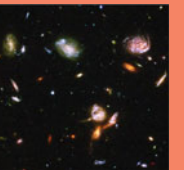
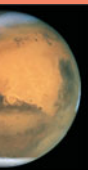
CELEBRATE

The *Hubble Space Telescope* has taken astronomers past the boundaries of space and time to reveal the universe in all of its glory. Having investigated more than 22,000 cosmic objects, and taken 700,000 exposures since it first opened its gaze to the heavens, *Hubble* continues to astound, illuminate and enrapture all who wonder at the mysteries of the cosmos.

The first glimmering idea of a telescope in space arose in the 1960s. It finally became reality 1990 when *Hubble* launched into orbit aboard Space Shuttle Discovery. The first years, marked by flawed optics that blurred the telescope's vision, confronted rough sailing. But the 1993 repair mission to solve the problem was a resounding success, and over the next several years *Hubble* would help answer many of the deepest astronomical questions of our time.

The age of the universe, the existence of worlds around other suns, the source of violent gamma-ray bursts, the presence of dark energy—*Hubble's* observations have contributed significantly to all of these puzzles and more. As 15 years of *Hubble* history recedes into the past, we look forward to the discoveries to come and the future mysteries that await.





# M51

The graceful, winding arms of the majestic spiral galaxy M51 (NGC 5194) appear like a grand spiral staircase sweeping through space. They are actually long lanes of stars and gas laced with dust.

This sharpest-ever image—taken in January 2005 with the Advanced Camera for Surveys aboard NASA's *Hubble Space Telescope*—illustrates a spiral galaxy's grand design, from its curving spiral arms, where young stars reside, to its yellowish central core, a home of older stars. The galaxy is nicknamed the Whirlpool because of its swirling structure.

The Whirlpool's most striking feature is its two curving arms, a hallmark of so-called grand-design spiral galaxies. Many spiral galaxies possess numerous, loosely shaped arms which make their spiral structure less pronounced. These arms serve an important purpose in spiral galaxies. They are star-formation factories, compressing hydrogen gas and creating clusters of new stars. In the Whirlpool, the assembly line begins with the dark clouds of gas on the inner edge, then moves to bright pink star-forming regions, and ends with the brilliant blue star clusters along the outer edge.

Some astronomers believe that the Whirlpool's arms are so prominent because of the effects of a close encounter with NGC 5195, the small, yellowish galaxy at the outermost tip of one of the Whirlpool's arms. At first glance, the compact galaxy appears to be tugging on the arm. *Hubble's* clear view, however, shows that NGC 5195 is passing behind the Whirlpool. The small galaxy has been gliding past the Whirlpool for hundreds of millions of years.

As NGC 5195 drifts by, its gravitational muscle pumps up waves within the Whirlpool's pancake-shaped disk. The waves are like ripples in a pond generated when a rock is thrown in the water. When the waves pass through orbiting gas clouds within the disk, they squeeze the gaseous material along each arm's inner edge. The dark dusty material looks like gathering storm clouds. These dense clouds collapse, creating a wake of star birth, as seen in the bright pink star-forming regions. The largest stars eventually sweep away the dusty cocoons with a torrent of radiation, hurricane-like stellar winds, and shock waves from supernova blasts. Bright blue star clusters emerge from the mayhem, illuminating the Whirlpool's arms like city streetlights.

The Whirlpool is one of astronomy's galactic darlings. Located 31 million light-years away in the constellation Canes Venatici (the Hunting Dogs), the Whirlpool's beautiful face-on view and closeness to Earth allow astronomers to study a classic spiral galaxy's structure and star-forming processes.

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





**WHIRLPOOL** GALAXY  
and companion



**EAGLE** Nebula

# M16

Appearing like a winged fairy-tale creature poised on a pedestal, this object is actually a billowing tower of cold gas and dust rising from a stellar nursery called the Eagle Nebula. The soaring tower is 9.5 light-years or about 57 trillion miles high, about twice the distance from our Sun to the next nearest star.

The edge of the dark hydrogen cloud at the top of the tower is resisting erosion, in a manner similar to that of brush among a field of prairie grass that is being swept up by fire. The fire quickly burns the grass but slows down when it encounters the dense brush. In this celestial case, thick clouds of hydrogen gas and dust have survived longer than their surroundings in the face of a blast of ultraviolet light from the hot, young stars.

Inside the gaseous tower, stars may be forming. Some of those stars may have been created by dense gas collapsing under gravity. Other stars may be forming due to pressure from gas that has been heated by the neighboring hot stars.

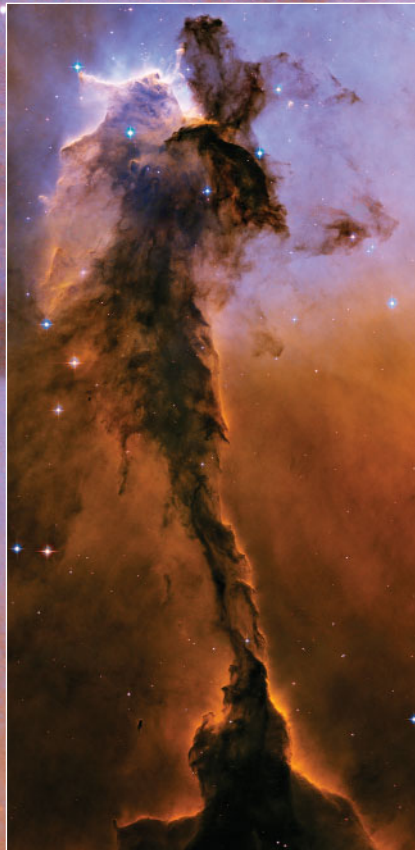
The first wave of stars may have started forming before the massive star cluster began venting its scorching light. The star birth may have begun when denser regions of cold gas within the tower started collapsing under their own weight, making stars.

The bumps and fingers of material in the center of the tower are examples of these stellar birthing areas. These regions may look small, but they are roughly the size of our solar system. The fledgling stars continued to grow as they fed off the surrounding gas cloud. They abruptly stopped growing when light from the star cluster uncovered their gaseous cradles, separating them from their gas supply.

Ironically, the young cluster's intense starlight may be inducing star formation in some regions of the tower. Examples can be seen in the large, glowing clumps and finger-shaped protrusions at the top of the structure. The stars may be heating the gas at the top of the tower and creating a shock front, as seen by the bright rim of material tracing the edge of the nebula at top, left. As the heated gas expands, it acts like a battering ram, pushing against the darker cold gas. The intense pressure compresses the gas, making it easier for stars to form. This scenario may continue as the shock front moves slowly down the tower.

The dominant colors in the image were produced by gas energized by the star cluster's powerful ultraviolet light. The blue color at the top is from glowing oxygen. The red color in the lower region is from glowing hydrogen. The Eagle Nebula image was taken in November 2004 with the Advanced Camera for Surveys aboard NASA's *Hubble Space Telescope*.

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



# News from the Multi-mission Archive at Space Telescope

R. Somerville, [somerville@stsci.edu](mailto:somerville@stsci.edu), for the MAST team

**A**s of February 1, 2005, MAST contained 22.6 Tb of data. In January 2005, we archived 16 Gb/day on average, and users retrieved an average of 62 Gb/day. In February, median DADS retrieval times were around 30 minutes, with on-the-fly reprocessing (OTFR) requests taking a median time of about 0.7 hours and non-OTFR requests taking about 0.15 hours.

## MAST User Survey

MAST conducted a User Survey in January 2005 to inform us about users' needs and help prioritize our plans for improving and expanding our archive services. We thank all the users who took time to respond to the survey. We received responses from 288 users, of whom 254 (88%) were not Institute employees and 34 (12%) were. You can browse the results of the survey at [http://archive.stsci.edu/surveyresults/survey\\_jan2005.html](http://archive.stsci.edu/surveyresults/survey_jan2005.html). We have responded to some of the comments at <http://archive.stsci.edu/surveyresults/response2005.html>.

The survey asked questions to characterize MAST usage and to determine the platforms and browsers of MAST users. Other questions solicited input on various tools and services that MAST has implemented or may implement in the future. The following are some highlights from the survey.

The most commonly accessed missions are *Hubble*, the Digital Sky Survey, and *Far Ultraviolet Spectroscopic Explorer (FUSE)*, in that order. However, 35% of the respondents access archival data from legacy missions such as *International Ultraviolet Explorer (IUE)*, *Extreme Ultraviolet Explorer (EUVE)*, *ASTRO*, *Orbiting and Retrievable Far and Extreme Ultraviolet Spectrometer (ORFEUS)*, *Copernicus*, and VLA–FIRST (Very Large Array–Faint Images of the Radio Sky at Twenty-one centimeters).

Since 2004, the fraction of users with Linux and OS-X based operating systems has increased, and the fraction using Solaris has decreased.

In the 2004 survey, users were unhappy with the retrieval times for *Hubble* and *FUSE* data. The performance of the Data Archive and Distribution System (DADS) has improved significantly over the past year. In the 2005 survey, 31% of respondents were "completely satisfied," and 48% were "mostly satisfied." Only 4% were "very dissatisfied." Nevertheless, it is clear that a significant fraction of our users would like even faster retrievals.

The majority of users who responded to the survey (54%) preferred online help or a web-based tutorial to a traditional-style paper manual.

Many of the respondents (68%) had not used or were not aware of the VizieR/MAST cross-correlation tool. Of those who had used the tool, 54% found it "extremely useful." Even more (77%) had not used or were not aware of the scrapbook tool, and about 54% who had used it found it "extremely useful." A lower percentage (47%) had not used or were not aware of the High Level Science Products (HLSPs), but 65% of those who had used them found them "extremely useful."

The majority of respondents (59%) thought it was "extremely important" or "moderately important" to make MAST data accessible using standards developed by the Virtual Observatory (VO). About a third of respondents were aware of some of the existing VO services and tools available at MAST.

Users could also enter free-form comments, which are particularly helpful to us. We welcome feedback from our users at any time. Please send comments or suggestions to [archive@stsci.edu](mailto:archive@stsci.edu).

## MAST Users' Group Meeting


The MAST Users' Group (MUG) held its annual meeting on February 17, 2005. The current MUG members are Ann Zabludoff (Chair), Tom Ayres, Anton Koekemoer, Jeff Newman, Sandhya Rao, and Aki Roberge. The MUG provides us with valuable feedback from the user's perspective, helps to set priorities, and suggests directions for future enhancements to the archive. You can read the MUG's report for 2005 (and earlier years) at <http://archdev.stsci.edu:8080/mug/>.

## New High Level Science Products (HLSPs)

We have added CoolCAT—an echelle spectral catalog of late-type stars from *Hubble's* Space Telescope Imaging Spectrograph (STIS)—to our collection of HLSPs. CoolCAT is the product of an Archival Legacy Program (9550) by Thomas Ayres. See <http://casa.colorado.edu/~ayres/CoolCAT/> for more information.

Another new HLSP is from the Grism-ACS Program for Extragalactic Science (GRAPES) project. GRAPES is based on slitless spectra obtained by the ACS in the Hubble Ultra-Deep Field (HUDF) during Cycle 12 (PI Sangeeta Malhotra, proposal 9793). Users can download the GRAPES HLSP via FTP or their browser. The MAST GRAPES web page (<http://archive.stsci.edu/prepds/grapes/index.html>) contains links to the GRAPES project web site, a list of the data, and a link to a page with browsable spectra developed by the GRAPES team.

#### **New Web-Based Tutorial Available**

Many of our users just visit MAST to download their data. However, MAST provides many sophisticated tools to seek, browse, and cross-correlate data. If you have a specific task that you do not know how to accomplish, or just would like to learn more about the capabilities of the MAST interface, visit our new web-based tutorial at <http://archive.stsci.edu/tutorial/index.html>. You will find a general overview to help you navigate the newly reorganized MAST website, a guide to the various interfaces, a summary of MAST tools, hints for seeking and retrieving data, and a guide to further documentation. 

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## **Full Test of Two-Gyro Mode**

**R. Doxsey**, [doxsey@stsci.edu](mailto:doxsey@stsci.edu)

In February 2005, the *Hubble* operations team conducted a successful flight test of the full two-gyro pointing mode. They had conducted short tests of various sub-sets of the mode over the prior year, but the February test was the first of the full mode in an operational manner. The test ran for three full days and included both tests of scientific performance and engineering tests of the new pointing-control laws. It also verified the modifications we made to the Institute's scheduling systems to support two-gyro mode, and the entire test was performed with the operational software and procedures that will be used whenever *Hubble* is in this mode.

It was not necessary to turn off one of the gyros for the test. Although all three gyros were left running, the flight software in two-gyro mode uses the data from only two of them (in this case, gyros 2 and 4). In fact, the data from all three gyros will be used post-facto to determine the actual pointing error throughout the test.

The test involved many slews, guide-star acquisitions, and science observations. From the perspective of the science program, the most important measurements were the effect of increased jitter on the point-spread function (PSF) and the impact on the success rate for guide star acquisitions. The jitter performance of two-gyro mode was excellent. A review of data from the Advanced Camera for Surveys and the Near Infrared Camera and Multi Object Spectrometer found no detectable increase in the measured PSFs from that seen in three-gyro mode. This result agrees with the engineering measurements of the jitter and is better performance than expected. The guide-star acquisition performance was also quite good. Of the 36 acquisitions and re-acquisitions, 31 were completely successful. Two of the failures appear to be due to bad guide stars, about the number expected. The other three cases identified a minor problem in roll control, which was identified early in the test and accommodated; this problem will certainly be resolved before routine use of two-gyro mode begins.

Our congratulations, and deep appreciation, to the *Hubble* systems, pointing control, and flight software engineers at Goddard Space Flight Center, who have developed this mode. 

# Hubble Fellowship Program

Michael Fall, [fall@stsci.edu](mailto:fall@stsci.edu)

**H**ubble Fellowships are awarded annually to outstanding young scientists who are engaged in research related to the *Hubble* mission. The research may be theoretical, instrumental, or observational, either space-based or ground-based. The fellowships provide three years of salary and other support at U.S. host institutions of the fellows' choice (subject to a maximum of one or two new Hubble Fellows per institution per year).

A selection committee met at the Institute in December 2004 to review the 135 applications for the Hubble Fellowships to commence this autumn. The committee members were Phillip Armitage (University of Colorado), Lars Bildsten (Kavli Institute for Theoretical Physics), Julianne Dalcanton (University of Washington), Michael Eracleous (Pennsylvania State University), Gillian Knapp (Princeton University), Melissa McGrath (STScI), Catherine Pilachowski (Chair, Indiana University), Michael Shara (American Museum of Natural History), Jacqueline van Gorkom (Columbia University), and Mark Voit (Michigan State University).

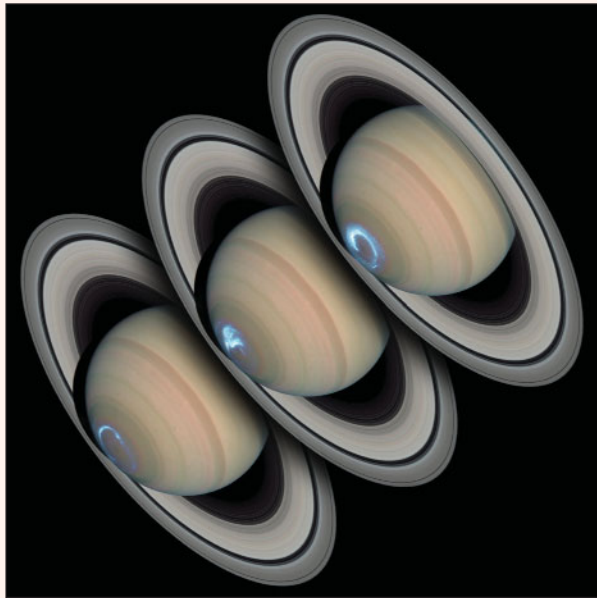
The new Hubble Fellows are listed in the accompanying table.

Hubble Fellows present the results of their research annually at a symposium held at the Institute. The last symposium was held December 9–10, 2003; the next will be held April 7–8, 2005.

We plan to select approximately 12 new Hubble Fellows next winter for positions to start in autumn 2006. Details of the application process are given in the *Announcement of Opportunity*, available at <http://www.stsci.edu/stsci/hubblefellow/ao.html>. To be considered, applications must conform to these instructions. The deadline for receipt of applications will occur in early October 2005. Eligible candidates must have received their PhD degrees on or after January 1, 2003. Ω

## 2005 Hubble Fellows

<i>New Fellow</i>	<i>PhD Institution</i>	<i>HF Host Institution</i>
Alison Coil	UC–Berkeley	Univ. of Arizona
Jeremiah Darling	Cornell Univ.	Univ. of Colorado
Michael Gladders	Univ. of Toronto	Carnegie Observatory
Jasonjot Kalirai	Univ. of British Columbia	UC–Santa Cruz
Mark Krumholz	UC–Berkeley	Princeton Univ.
Jeong-Eun Lee	Univ. of Texas	UC–Los Angeles
Milos Milosavljevic	Rutgers Univ.	Caltech
Rachel Osten	Univ. of Colorado	Univ. of Washington
Seth Redfield	Univ. of Colorado	Univ. of Texas
Kris Sigurdson	Caltech	Institute of Advanced Study
Christy Tremonti	Johns Hopkins Univ.	Univ. of Arizona

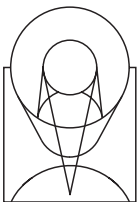


## Saturn's Dynamic Auroras

**T**he dancing light of the auroras on Saturn behaves in ways different from how scientists have thought possible for the last 25 years. New research by a team of astronomers led by John Clarke of Boston University has overturned theories about how Saturn's magnetic field behaves and how its auroras are generated.

<http://hubblesite.org/newscenter/newsdesk/archive/releases/2005/06/>

**Image Credit:** NASA, ESA, J. Clarke (Boston University), and Z. Levay (STScI)



## Contact STScI:

The Institute's website is: <http://www.stsci.edu>  
Assistance is available at [help@stsci.edu](mailto: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://www.stsci.edu/hst/scheduling/program\\_information](http://www.stsci.edu/hst/scheduling/program_information)

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

Martin Elvis (chair), Harvard-Smithsonian CfA, <a href="mailto:elvis@cfa.harvard.edu">elvis@cfa.harvard.edu</a>	
David Axon, RIT	C. Robert O'Dell, U. Vanderbilt
Martin Barstow, U. of Leicester	Regina Schulte-Ladbeck, U. Pittsburgh
Eric Emsellem, CRAL	Monica Tosi, OAB
Laura Ferrarese, Rutgers U.	Donald G. York, U. Chicago
Pat McCarthy, OCIW	

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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](mailto:address-change@stsci.edu).



## ST-ECF Newsletter

**T**he 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.

**Richard Hook (Editor)**

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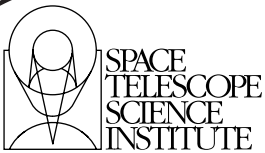
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# Calendar

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Space Telescope Institute Council meeting at STScI .....	9-10 June, 2005
Webb Science Working Group meeting in Edinburgh, UK .....	14-15 June, 2005
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Cycle 14 EPO grant proposals due .....	19 August, 2005



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