Hubble Facts

National Aeronautics and
Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

FS-1999-10-033-GSFC

Hubble Space Telescope Servicing Mission 3A
PLANS FOR THE FUTURE

The Hubble Space Telescope's purpose is to spend 20 years probing the farthest and faintest reaches of the cosmos. Crucial to fulfilling this objective is a series of on-orbit servicing missions. Hubble was placed in orbit on April 25, 1990, by the shuttle Discovery and subsequent servicing followed in December 1993 and February 1997. The third in the series of planned servicing missions for the Hubble Space Telescope was scheduled for June 2000. This third Servicing Mission has been separated into two flights. The first of these flights, Servicing Mission 3A, is scheduled for December 1999, and the second, Servicing Mission 3B, is scheduled for 2001. The fourth Servicing Mission is scheduled for 2003 with a "close-out" Mission in 2010.

Three instruments are currently in active scientific use on Hubble – the Wide Field and Planetary Camera 2, the Space Telescope Imaging Spectrograph, and Fine Guidance Sensor 1R, which has been designated as the prime FGS for astrometric science. Other instrument bays are occupied by the Near Infrared Camera and Multi-Object Spectrometer (NICMOS), which is now dormant due to the depletion of its solid nitrogen cryogen, the Faint Object Camera, which has been decommissioned, and the corrective optical device called COSTAR, which is no longer needed.

Servicing Mission 3A

Three gyroscopes are the minimum required for normal science operations. After three of Hubble's six gyroscopes failed, NASA managers were concerned that another gyroscope might soon fail, leaving Hubble unable to perform its science mission. An early servicing mission, Servicing Mission 3A, was scheduled for December 1999 to avoid an extended down period. Although no new Science Instruments will be installed, there are many activities planned for this mission which are important to Hubble's scientific performance.

Working in pairs on four alternating days, four EVA crewmembers will replace all six gyroscopes, a guidance sensor and Hubble's main computer. Astronauts will install a new transmitter, a solid state data recorder and attach voltage/temperature improvement kits to the six batteries. The task of applying new thermal coverings to the exterior will be started. This service call will leave Hubble repaired and improved.

Servicing Mission 3B

This servicing mission will focus on installing the Advanced Camera for Surveys and more efficient rigid solar arrays. Astronauts also will install the aft shroud cooling system. In addition, an advanced cooling system will be installed on NICMOS, which became dormant after its solid nitrogen coolant was exhausted in January 1999. The application of new external thermal coverings will be completed, if necessary.

Advanced Camera for Surveys

During this mission, astronauts will install a new science instrument, the Advanced Camera for Surveys (ACS). The Advanced Camera for Surveys will physically replace the Faint Object Camera. This new instrument is designed for survey mode imagery and discovery. It is estimated that the survey capability of the Telescope will be increased tenfold. A major objective for the ACS is mapping the distribution of dark matter throughout the universe. Several other maintenance activities are planned over four EVA days. A few of the activities are discussed below.

Solar Array III

Two large flexible solar array (SA) wings provide power to Hubble. During Servicing Mission 1, the orig-

inal European Space Agency arrays (SA1) were replaced with a new upgraded set of solar arrays, called SAII. These arrays consist of silicon cells installed on a thin layer of Kapton blanket. When the SAII wings are replaced they will have powered the Telescope for nearly 7 years.

The newest arrays (SAIII) are rigid arrays, which do not roll up and therefore are more robust. They are also smaller and more efficient and will slightly reduce the effects of atmospheric drag on the spacecraft. SAIII has several enhancements and incorporates new technology: The cells are made from gallium arsenide which are more efficient than the original silicon cells. The frames are made of lightweight Lithium Aluminum alloy tubes, in an "H"-shaped configuration. Each wing can be folded for transport, and then easily locked into place when fully deployed.

NICMOS Cooling System

The NICMOS Cooling System, an experimental mechanical cooling system, will be connected to NICMOS to return it to normal operation.

Aft Shroud Cooling System

This new system is designed to carry heat away from scientific instruments in the Aft Shroud area of the Telescope assembly and to allow the instruments to operate better at lower temperatures. The cooling system allows multiple instruments to operate simultaneously, helping the science team maintain the program's high productivity

Possible Reboost

Although the atmosphere is quite thin at satellite altitudes, it is not a perfect vacuum. Over time, all low Earth orbiting satellites feel the effects of atmospheric drag and lose altitude. If the altitude is not restored, the Telescope eventually will re-enter Earth's atmosphere. Hubble has no on-board propulsion, so the only way to restore lost altitude is by the creative use of shuttle jets. If nec-essary, Hubble will be reboosted to a higher altitude. This was done on both Servicing Missions 1 and 2.

Servicing Mission 4

Plans for the Fourth Servicing Mission are very preliminary at this time, but two Science Instruments are in development. COSTAR will be removed during this servicing mission to make room for the Cosmic Origins Spectrograph. Wide Field Camera 3 will replace the Wide Field Planetary Camera 2. Also a refurbished Fine Guidance Sensor will be installed leaving Hubble in optimum condition.

Cosmic Origins Spectrograph

The Cosmic Origins Spectrograph (COS) is a medium resolution spectrograph specifically designed to observe into the near and mid ultraviolet. COS coupled to Hubble's optics will be the most sensitive spectrograph ever flown in space. The ultraviolet region is particularly interesting for observing hot objects such as new hot stars and quasars. It is also a good region for viewing the composition and character of interstellar and intergalactic gas. COS will measure the chemical composition of the gas between the galaxies at great distances, as it was when the universe was very young.

Wide Field Camera Three

Wide Field Camera Three (WFC3) will be the last imaging camera mounted on HST. WFC3 will replace the current workhorse of Hubble, Wide Field and Planetary Camera 2. WFC3 will be a "panchromatic" camera, extending Hubble's imaging capability over an enormous range of wavelengths from the ultraviolet to the near-infrared. It will provide important backup to the ACS in visible light and will supersede the near-infrared capability of the aging NICMOS. This upgrade will allow Hubble to maintain good imaging capabilities throughout the remainder of its mission.

Fine Guidance Sensor

The Fine Guidance Sensors are systematically refurbished and upgraded. In "round-robin" fashion, one FGS per servicing mission is being replaced. The returned FGS is disassembled and refurbished, and then taken back to Hubble on the next servicing mission to replace the next FGS. By the conclusion of SM4 all three FGS's will have been brought up to optimum condition in this manner.

Closeout Mission

NASA will determine the best approach to secure the Telescope, upon the completion of Hubble's 20-year mission. Currently there are several options being considered, ranging from staying in orbit indefinitely through a large reboost, to a return to ground.

For additional information contact:

Nancy Neal
Goddard Space Flight Center
Office of Public Affairs
(301) 286-0039
Internet: http://www.gsfc.nasa.gov

Don Savage
NASA Headquarters
Office of Public Affairs
(202) 358-1600
Internet: http://www.nasa.gov