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Hubble Space Telescope To Get Visit from Earthly Caretakers

NASA's Hubble Space Telescope (HST) will get a scheduled maintenance visit from its Earthly caretakers. Mission STS-109 is the 27th space flight for Shuttle Columbia and is designated HST Servicing Mission 3B, the fourth Hubble Space Telescope Servicing mission.

The seven-member crew of Mission STS-109, along with several Hubble Servicing Mission payloads, will fly aboard Columbia and rendezvous with the Hubble Space Telescope, which is orbiting at approximately 314 nautical miles above Earth. Crew members will capture the telescope using the Shuttle's robotic arm and secure it on a workstand in Columbia's payload bay. During the 11-day mission, four mission specialists will perform five scheduled spacewalks to complete system upgrades to the telescope.

Primary tasks are to replace one of the telescope's four Reaction Wheels, on Hubble's spacecraft equipment bay, and replace the Solar Array 2 currently on Hubble with the Solar Array 3. The Reaction Wheels are Hubble's primary steering mechanisms. The wheels stabilize and precisely point the telescope. They are metal discs that are 2.5 feet in diameter, weigh 160 pounds each and provide steering power from zero to 3,000 rpm in both forward and reverse directions.

The Solar Array 3 consists of four large flexible solar array panels that will provide power to the observatory. The new arrays are one-third smaller in size, more efficient and will help reduce the effects of atmospheric drag on the telescope.

Additional upgrades include replacing Hubble's current Faint Object Camera with the Advanced Camera for Surveys (ACS). ACS will have 10 to 20 times more discovery power than the camera it replaces, depending on the wavelength of light being observed. The ACS comprises three different cameras with specialized capabilities. The high-resolution camera will take extremely detailed pictures of the inner regions of galaxies and will search neighboring stars for planets. The solar-blind camera blocks visible light to enhance ultraviolet sensitivity. It will study weather on planets in our own solar system. With a field of view twice the size of Hubble's current surveyor, the ACS wide-field camera will conduct new surveys of the Universe and help astronomers study the nature and distribution of galaxies in order to further understand our own Universe.

The ACS will be carried in Columbia's payload bay. The camera will be enclosed in a specially designed Axial Science Instrument Protective Enclosure that provides protection from shock and heat.

The crew also will retrofit Hubble's existing Near Infrared Camera and Multi-Object Spectrometer (NICMOS) with a new, experimental cooling system called the NICMOS Cryocooler and replace the telescope's Power Control Unit (PCU).

NICMOS has remained dormant since January 1999, when its supply of coolant was exhausted. Mission specialists will install a new Cryocooler to NICMOS in order to return it to active duty. The Cryocooler uses non-expendable neon gas as a coolant and provides high cooling capacity and low vibration. It operates as a miniature cryogenic circulator to remove heat from NICMOS and recool the infrared detectors to about minus 334 degrees Fahrenheit (minus 203 degrees

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Celsius). NICMOS uses infrared vision to probe dark, dusty, never-before-seen regions of space with optical clarity.

The PCU is the central controller of Hubble's electrical system and regulates and distributes power to the batteries, electrical components and science instruments. The PCU also safeguards Hubble from power spikes and controls battery charging.

The new power control unit will replace the original flight unit on the telescope. In order to install the new PCU, the telescope will be completely powered off for the first time since it was launched nearly 11 years ago. Spacewalking mission specialists will disconnect 36 connectors from the original PCU and re-connect them to the new PCU.

Also, a New Outer Blanket Layer Insulation (NOBL) will be installed on the telescope if time is available.

The Hubble Space Telescope was launched into Earth orbit from Discovery on Mission STS-31 in April 1990. Previous Hubble Servicing Missions were STS-61, in December 1993; STS-82, in February 1997; and STS-103, in December 1999.

During previous servicing missions, astronauts performed spacewalks to install new gyroscopes and upgraded sensors, computers and recorders. Hubble also received a new transmitter and voltage/temperature kits for the telescope's batteries. Hubble's outer surface insulation was also repaired.

During Mission STS-109, the crew also will conduct several tests and experiments while in space. The Single String Global Positioning System test will use a modified military Global Positioning Satellite (GPS) receiver processor and the existing Orbiter GPS antennas. This experiment will demonstrate the performance and operations of the GPS during Orbiter ascent, on-orbit operations, and entry and landing phases.

Shuttle Columbia's crew members will also participate in a Sleep-Wake Actigraphy and Light Exposure During Spaceflight experiment. During the mission, crew members will wear state-of-the-art Actilight watches. The experiment will monitor the crew's sleep-awake activity and light exposure patterns experienced in flight. The data collected will help to better understand the effects of space flight on sleep as well as aid in the development of effective countermeasures for both short- and long-duration space flight.

The Crew

Scott D. Altman will serve as commander on Mission STS-109, his third flight in space. He was born in Lincoln, Ill., but considers Pekin, Ill., to be his hometown. Altman served as pilot on Mission STS-90 in April 1998, a 16-day Spacelab flight, and Mission STS-106 in September 2000, a mission that prepared the International Space Station for the arrival of its first permanent crew.

Pilot **Duane "Digger" Carey** will make his first space flight aboard Columbia. He was born in St. Paul, Minn. He received a bachelor of science degree in aerospace engineering and mechanics and a master of science degree in aerospace engineering from the University of Minnesota-Minneapolis. During his career in the United States Air Force he worked as an F-16 experimental test pilot at Edwards Air Force Base, Calif.

John M. Grunsfeld (Ph.D.) will serve as payload commander/mission specialist 1. His previous space flights include Mission STS-67, the second flight of the Astro observatory; STS-81, the fifth mission to dock with Russia's Space Station Mir and the second to exchange U.S. astronauts; and Mission STS-103, designated Hubble Servicing Mission 3A. Dr. Grunsfeld performed two spacewalks during Mission STS-103 to successfully install new instruments and system upgrades on the Hubble Space Telescope.

Nancy Jane Currie (Ph.D.) will serve as mission specialist 2. A veteran of three space flights, she has logged more than 737 hours in space. She served as flight engineer on Mission STS-57 in 1993, STS-70 in 1995 and STS-88 in 1998, the first International Space Station assembly mission. During Mission STS-88, Dr. Currie operated the Shuttle's robotic arm to connect the first American-made module, Unity, to the first Russian-made module, Zarya. She was born in Wilmington, Del., but considers Troy, Ohio, to be her hometown.

Richard M. Linnehan (DVM) will serve as mission specialist 3. A veteran of two space flights, Linnehan flew as a mission specialist in 1996 on Mission STS-78, the Life Sciences and Microgravity Spacelab mission and longest Space Shuttle mission to date. Linnehan served as payload commander on Mission STS-90, a Neurolab mission. He was born in Lowell, Mass., and holds a doctor of veterinary degree from The Ohio State University College of Veterinary Medicine.

James H. Newman (Ph.D) will serve as mission specialist 4 aboard Columbia. A veteran of three space flights, Dr. Newman has logged more than 32 days in space, including four spacewalks totaling more than 28 hours. He served as mission specialist on Missions STS-51 in 1993, STS-69 in 1995 and STS-88 in 1998. He was born in the Trust Territory of the Pacific Islands but considers San Diego, Calif., to be his hometown. Dr. Newman has a master of arts degree and a doctorate in physics from Rice University.

Michael J. Massimino (Ph.D) will serve as mission specialist 5 aboard Columbia on his first space flight. He was born in Oceanside, N.Y., but considers Franklin Square, N.Y. to be his hometown. He holds a doctorate in mechanical engineering from the Massachusetts Institute of Technology. Dr. Massimino worked at McDonnell Douglas Aerospace in Houston, Texas, as a research engineer where he developed laptop computer displays to assist operators of the Space Shuttle remote manipulator system. NASA selected him as an astronaut candidate in May 1996.