Hubble Facts

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The Hubble Space Telescope Second Servicing Mission (SM-2)

ASTRONAUTS PREPARE FOR SPACEWALKS

To prepare for the February Space Shuttle mission to service the Hubble Space Telescope for the second time, the crew of STS-82 trains for the four scheduled spacewalks primarily at three NASA facilities across the country: The Johnson Space Center in Houston, Texas; the Marshall Space Flight Center in Huntsville, Alabama; and the Goddard Space Flight Center in Greenbelt, Maryland.

An astronaut trains in the Weightless Environment Training Facility at JSC

Spacewalk — or extravehicular activity (EVA) — training allows Astronauts Mark Lee, Joe Tanner, Greg Harbaugh and Steve Smith to practice the tasks that are scheduled during the four planned EVAs. The same training practices prove invaluable on all missions that include spacewalks, including the first Hubble Servicing Mission in December 1993 that saw five spacewalks conducted to service the telescope.

Mission Commander Ken Bowersox and Pilot Scott Horowitz will watch over Space Shuttle Discovery's systems while Flight Engineer Steve Hawley operates the remote manipulator system (RMS), or robot arm throughout the spacewalks. Bowersox was pilot on the first servicing mission and also operated the arm during several of the servicing tasks. Hawley used the RMS to deploy HST on its initial flight, STS-31, in April 1990.

RMS training for spacewalks such as those planned for the upcoming second servicing mission is different from non-spacewalk flights in that it requires maneuvering astronauts around the payload bay and to worksites on the telescope. While one of the spacewalking astronauts remains a -free-floater- in the payload bay, the other rides on a foot restraint work platform mounted on the end of the arm. This person generally is in charge of carrying large replaceable hardware to and from the HST.

To prepare for the spacewalks, the EVA astronauts train underwater for many hours in the 40-foot deep Neutral Buoyancy Simulator at the Marshall Space Flight Center and in the 25-foot deep Weightless Environment Training Facility at the Johnson Space Center (JSC). The newest weightless training facility called the Neutral Buoyancy Laboratory also located at JSC, will be used for the final month of underwater training for the Hubble mission. The NBL is about three times larger

than the other water tanks and can be used to simulate an entire spacewalk at one end while underwater training for another mission can be conducted at the other. This will become quite useful as training for the assembly of the International Space Station ramps up.

The water tanks allow the astronauts to practice the HST servicing procedures in pressure suits underwater under neutrally buoyant conditions that simulate weightlessness. Assisted by safety divers, the crew members train with full-sized mockups of the telescope and protective carriers that contain the replacement instruments and tools.

Technicians in Goddard's Clean Room install foot restraints on HST's Flight Support System.

The STS-82 EVA crew members also receive classroom instruction on the various orbital replacement units (ORUs) along with hands-on familiarization with the actual flight hardware. The Hubble ORUs are modular components, mounted in equipment bays around the circumference of the telescope. These components are designed to be replaced or repaired as needed.

Another training aid used by the crew in preparation for the second servicing mission of the Hubble Space Telescope includes the Precision Air Bearing Floor (PABF) at JSC, which allows the instrument mockups to float on a cushion of air to simulate mass handling of large ORUs in the space environment. This allows the astronauts to practice carefully guiding the instruments into their proper locations. Similar in operation to an air hockey table, the PABF provides two degrees of freedom and closely matches the feel of moving large objects around in space.

Virtual reality is another EVA training tool. Astronauts wear a virtual reality device over their eyes to visualize themselves in various EVA scenarios. The use of virtual reality as a training aid was found to be of benefit during training for the first servicing mission as a tool for choreographing verbal cues between the spacewalking astronauts and the crew inside operating the shuttle's robot arm.

While training at Marshall Space Flight Center allows end-to-end training for spacewalks in its water tank, JSC concentrates on not only training the crew, but also training the flight control teams that will oversee the mission from the Mission Control Center, and Goddard Space Flight Center's Space Telescope Operations Control Center. In addition to the simulation training at Marshall and JSC, the crew also travels to the Goddard Space Flight Center for hands on training using HST servicing mission hardware. At Goddard, the crew becomes familiar with the actual flight instruments, carriers and enclosures as they come together for final testing and integration. The crew practices servicing tasks on this hardware with specially-designed mission-specific tools.

The astronauts conduct much of their work at Goddard's Spacecraft Systems Development and Integration Facility which is the largest known cleanroom of its kind in the world. This 10-story chamber can simultaneously hold two full-sized shuttle payloads. With more than a million cubic feet of space, two 35-ton cranes, and a wall of 1,500 air filters, the room provides a super-clean environment for testing and integrating flight hardware. Within the cleanroom are the High Fidelity Mechanical Simulator, which mechanically simulates the axial and radial bays of Hubble, and the Vehicle Electrical Systems Test Facility, which simulates HST's electrical systems.

For additional information contact:

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