National Aeronautics and Space Administration

NASA**facts**

Hubble Space Telescope Servicing Mission 4 Space Telescope Operations Control Center

Hubble's Nerve Center
The Hubble Space Telescope is kept under a watchful eye by a dedicated team of professionals at NASA Goddard Space Flight Center's Space Telescope Operations Control Center, or STOCC.

This group is called the Flight Operations Team (FOT) and is comprised of Hubble engineers and managers who work seven days a week, 365 days a year, constantly monitoring the telescope's operations.

The STOCC consists of three conjoined rooms:

- In the Mission Operations Room the FOT closely monitors the telescope's health and safety, as well as controlling flight operations. Some of the tasks they perform include in-depth subsystem analysis, simulated subsystem tests, integrating new databases, and validating new ground software and updates to flight software.
- The Mission Support Room supports nominal Hubble operations through integrated testing for ground systems software updates and engineering activities by providing off-line mission planning functions, data processing and integrated testing.
- Shortly before the Hubble servicing mission in 2008, additional engineers from the subsystems engineering group will be called upon to staff the Servicing Mission Operations Room. This Servicing Mission Operations Team (SMOT) will work in two 12-hour shifts, supporting the preparation, test and simulation for the fifth and final shuttle mission to the famed telescope.

Preparing Hubble for Servicing
Just as NASA astronauts train extensively for each shuttle mission, so do the SMOT and FOT engineers. Their highly choreographed efforts and expertise help ensure the servicing mission goes as planned.

The Flight Operations Team at NASA's Goddard Space Flight Center monitor the Hubble Space Telescope around the clock.

A few hours after the Shuttle Atlantis lifts off from Kennedy Space Center, the FOT will prepare the telescope for servicing by placing its science instruments into 'safe hold.' During this time, engineers will track Hubble and downlink necessary engineering data.

About 28 hours into the servicing mission, the team will command Hubble to close its aperture door to protect its ultra-sensitive optics. Then the team will send commands to the telescope so it obtains the required rendezvous attitude (for grappling by the shuttle arm), stows, or retracts, its high gain antennas, and repositions its solar arrays to enable the shuttle arm to grapple the telescope.

The astronauts will then secure the telescope to the shuttle's Flight Support System, which will allow them to reach all the instruments and components slated for repair or replacement. Hubble's internal power will be transferred to the shuttle during servicing.

Testing Hubble during Servicing

During the servicing mission, the SMOT engineers will perform aliveness and functional tests to ensure each instrument and component has power and operates as it should. (While the astronauts sleep, this same team will conduct additional functional tests on each installed component to determine if the astronauts need to perform additional work.)

After all servicing tasks are completed, Hubble's newly installed battery packs will be charged to full capacity. The shuttle supplied power feed will be disconnected and Hubble will operate under its own internal power.

The FOT engineers will send commands to Hubble to open its aperture door and the telescope will be released. Additional commands will be sent to deploy Hubble's high gain antennas and after orbital verification is completed, Hubble will be re-commissioned for future science observations.

Scheduling Science Observations

The Space Telescope Science Institute in Baltimore, Md. annually solicits Hubble science research proposals from the worldwide astronomical community and competitively selects the most compelling science observations to place on Hubble's science observing schedule.

The FOT engineers upload these approved observing schedules to the telescope via a network interface to NASA's White Sands Complex in New Mexico, which then transmits to NASA's Tracking and Data Relay Satellite System for uplink to Hubble. Conversely, scientific data obtained by Hubble are sent back to the GSFC by reverse path, and forwarded to the Space Telescope Science Institute via dedicated high-speed links.

Since the Tracking and Data Relay Satellite System supports several orbiting spacecraft, all commands and returning data are carefully choreographed. Hubble's command sequences are up-linked periodically and stored in the telescope's onboard computer. Hubble then executes the observations automatically at pre-scheduled times.

The final shuttle servicing mission to Hubble will enable the telescope to continue producing world-class science for five years or longer and could overlap observations performed by NASA's James Webb Space Telescope, scheduled for launch in 2013.

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FS-2007-09-090-GSFC (SM4 #07) (rev.11/07)