National Aeronautics and Space Administration

Hubble Space Telescope – High-Fidelity Simulator

NASAfacts

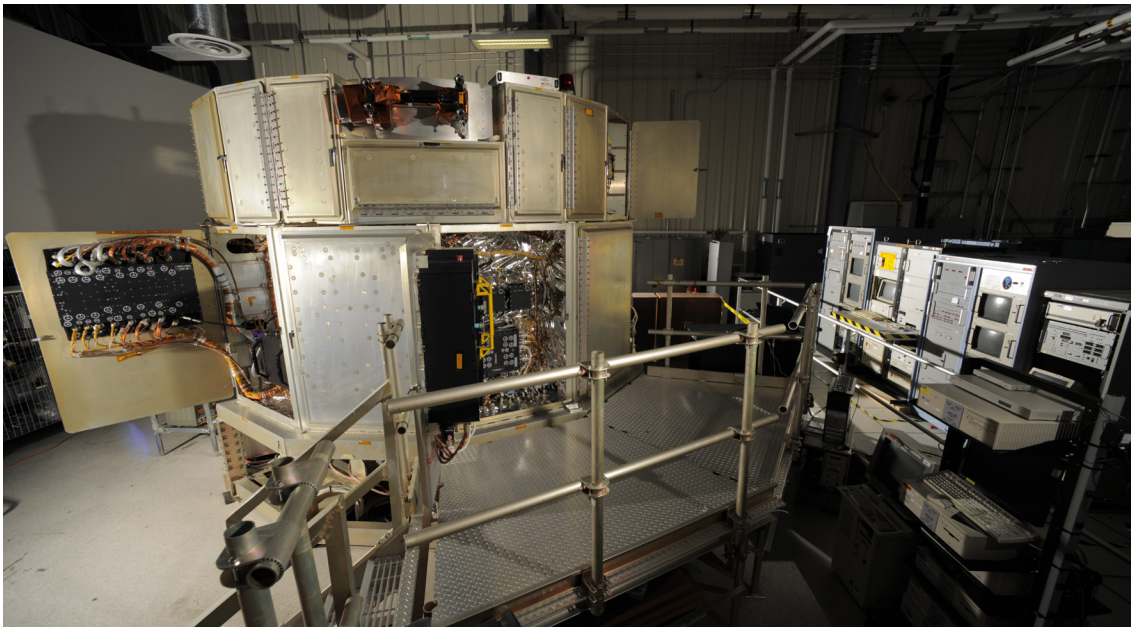
The Vehicle Electrical System Test (VEST) facility provides Hubble operations and engineering personnel with a configurable, high-fidelity simulator of the Hubble observatory and its operating environment.

The VEST is used in three primary ways. First, it is employed to troubleshoot problems seen on the spacecraft by simulating the conditions under which the anomaly was observed and to test possible solutions. Second, it is used to verify updates to the software, commands, and engineering parameters before they are transmitted from the control center to the spacecraft. This process includes a thorough test of the ground procedures used for uplinking and installing these items. Finally, the VEST is used to verify operational procedures before they are executed by the flight operations team.

The VEST consists of several distinct elements. The largest is the integrated VEST structure itself. This is a mechanical and electrical engineering model of Hubble's middle section (known as the Support Systems Module and the Optical Telescope Assembly Equipment Section) that contains the majority of the spacecraft's hardware subsystems. Mounted within the structure are spaceflight-qualified modules developed as spares for servicing Hubble on orbit, and engineering duplicates (where no spares exist) of such items as computers, data recorders, interface boxes, power control units, etc.

A second element includes specially fabricated units designed to mimic the functionality of subsystems on Hubble that are too big or require emulation of the space environment. One such area is the spacecraft's electrical power subsystem, which includes its two solar arrays, drive mechanisms (used to turn the arrays toward the Sun), and six large batteries. Another area is the attitude guidance system that controls Hubble's pointing and the observatory's motion from target to target. In this area are units that simulate Hubble's four 100-pound reaction wheels, six sensitive gyroscopes, sun sensors, and other miscellaneous components.

A third element simulates Hubble's complex science instruments—both cameras and spectrographs. In this case, large computer racks developed for each instrument known as instrument benches simulate the electronics portion of an instrument and its optical parts like filter wheels, calibration



The VEST facility uses both hardware and software simulators to replicate the operation of the Hubble observatory in orbit. In this view, the main VEST structure is seen on the left, while ancillary equipment, including some of the instrument benches, appear on the right.

lamps, and channel-select mechanisms. Additional imbedded components generate realistic science data used to conduct end-to-end dataflow tests of the larger system.

Prior to each of the five servicing missions to Hubble, the VEST structure was a critical element for ensuring the fit of new spaceflight hardware in the spacecraft. Many of the items taken aloft by the astronauts to Hubble were first installed into the VEST structure to verify mechanical, electrical, and software compatibility with the observatory. During that time, the VEST structure was located inside a large clean room whose environment was vital to maintaining the pristine condition of the hardware, as even a speck of dust could have potentially contaminated Hubble's sensitive instruments and subsystems.

Astronauts underwent training at NASA's Goddard Space Flight Center prior to each of the Hubble servicing missions. In this image the Servicing Mission 3A (December 1999) crew is seen receiving instruction from Hubble project personnel on various spacecraft subsystems. At the time, the VEST main structure was located in Goddard's large clean room.

National Aeronautics and Space Administration

Goddard Space Flight Center
8800 Greenbelt Road
Greenbelt, MD 20771

www.nasa.gov

For more information, contact:
Claire Andreoli
Office of Communications
301-286-1940
claire.andreoli@nasa.gov

Or visit the Hubble website at:
www.nasa.gov/hubble

FS-2018-08-245-GSFC (rev. 3/20)