



PHOTOS: (LEFT) This planetary nebula, located nearly 4,600 light-years from Earth, was imaged by the Hubble Space Telescope's longest-running optical camera before astronauts replaced it during May's servicing mission. **(RIGHT)** Astronaut Michael Good, STS-125 mission specialist, positioned at the end of Space Shuttle *Atlantis*' remote manipulator system, participates in an extravehicular activity to refurbish and upgrade the Hubble Space Telescope in May. NASA

Star power

Boeing employees support complex Hubble Space Telescope upgrade

By Ed Memi

With the completion of the recent Hubble Space Telescope servicing mission by the Space Shuttle *Atlantis* in late May, the telescope gained 70 times more imaging power and can continue its amazing exploration and imaging of the cosmos through at least 2014.

During the 13-day STS-125 mission, astronauts installed two new science instruments, six gyroscopes and six batteries and replaced or repaired two science instruments that had failed. The telescope now is undergoing calibrations and tests and should be ready for science observations in September. Originally launched in 1990, the large space-based observatory has revolutionized astronomy by providing unprecedented deep and clear views of the universe. This was the fifth and last shuttle servicing mission to the telescope, which is scheduled to be replaced by the James Webb Space Telescope.

Sharing in the servicing mission's success are Boeing employees who worked to ensure, through proper testing of interfaces and data systems, that the telescope's newly installed science

instruments, gyroscopes and batteries would perform flawlessly.

Boeing served as the primary integrator for four "carriers" that contained the hardware and tools for the mission. The carriers each provide multiple power and data hookups—all tested and verified by Boeing—that astronauts used after they grappled Hubble and pulled it into the shuttle's payload bay for repair.

The Boeing team delivered the carriers to the launch pad, maintained them and helped install them in the space shuttle's payload compartment for launch. Boeing engineers also designed exactly how the equipment for the mission would be installed in the payload bay.

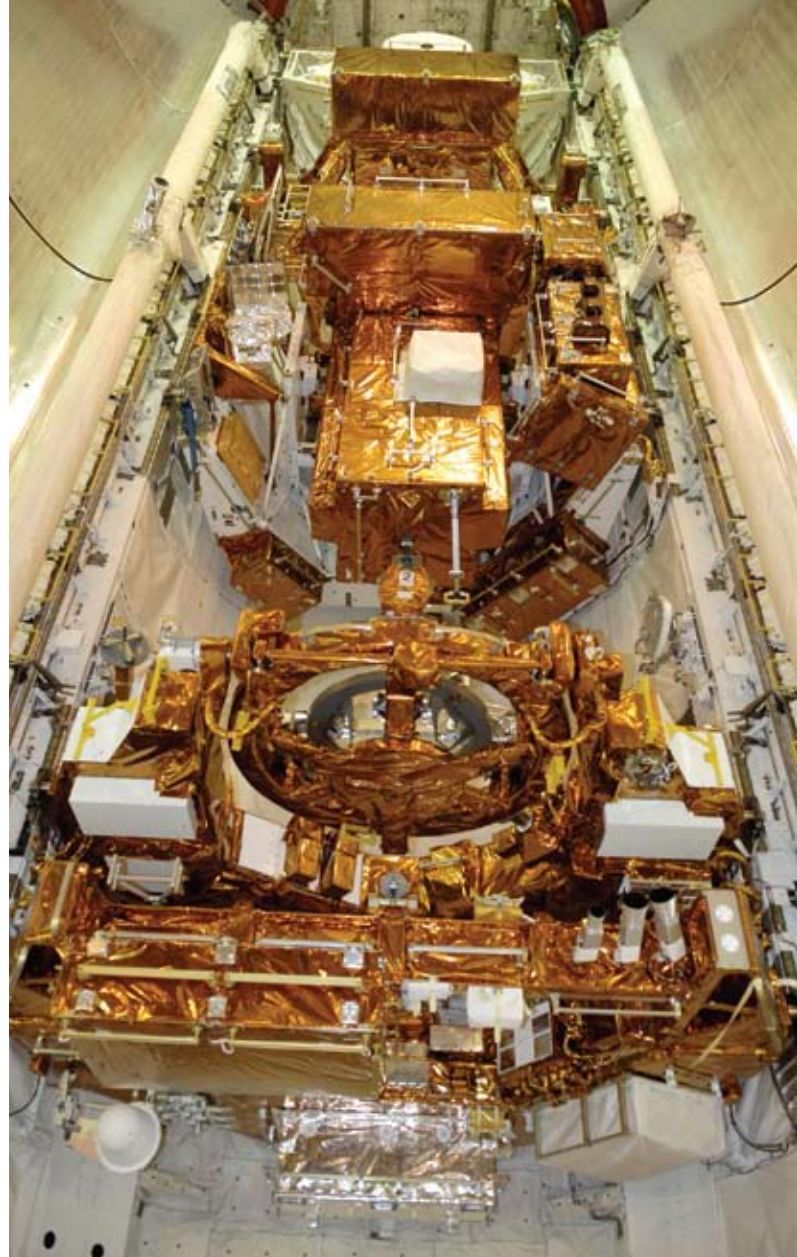
Preparing for the servicing mission proved challenging. "Hubble uses pretty much every shuttle interface from power to KU band to X-band [communications]," said Mike Dahm, lead electrical and test engineer. His team spent three days on preflight tests compared with one day for a typical space station mission.

"This was probably the most challenging payload I have



“This was probably the most challenging payload I have worked on, and it is much different than a space station payload. But Hubble has had such a profound impact on the scientific community that it is neat to be a part of it.”

– David Thompson, Boeing payload lead engineer



worked on, and it is much different than a space station payload,” said David Thompson, a Boeing payload lead engineer. “But Hubble has had such a profound impact on the scientific community that it is neat to be a part of it.”

Testing in late April mimicked the planned operation of the carriers, from berthing the telescope in the payload bay to conducting repairs on orbit and eventually releasing the Hubble.

“We have people in the flight deck of the orbiter during this testing, throwing switches and issuing onboard commands as if in orbit,” said Kent Pearson, payload test conductor for STS-125.

“We have very complex data streams between the processors on board the payload elements and the space shuttle computers, both of which use different software developed by different people,” Dahm said. Boeing also verified the connections that astronauts and ground teams would use during the mission to send data for analysis.

Joe Mounts, a flight software engineer who verifies the

payload communications interface to the space shuttle orbiter, compares his work to plugging a telephone into the wall and checking the connection to make sure he can communicate with everyone on the outside. But unlike a phone, the orbiter interfaces to the payloads are highly specialized.

Summing up why he found this particular mission so exciting, Mounts said it’s “because of all the science we are going to receive and the amazing pictures Hubble will produce.” ■

edmund.g.memmi@boeing.com

PHOTOS: (LEFT) Boeing’s Mike Dahm (left), lead electrical engineer, and Joe Mounts, Flight Software, perform the Interface Verification Test in the Launch Control Center at NASA’s Kennedy Space Center in Florida. **INDYNE (ABOVE)** Space Shuttle *Atlantis*’ payload bay is filled with hardware for the STS-125 mission to service the Hubble Space Telescope in May. Boeing was the primary integrator for the four carriers that contained hardware and tools for the mission. NASA