Shuttle Columbia to Return Home for Checkup, Rejuvenation

NASA's Space Shuttle Columbia is scheduled to arrive at its Boeing birthplace tomorrow morning (weather permitting) atop a NASA 747 Shuttle Carrier Aircraft to begin approximately 10 months of inspections, maintenance and upgrades that could be described as a high-tech spa for spaceships: part makeover, part weight loss clinic and part medical checkup.

More than 350 Boeing technicians and engineers at the company's Reusable Space Systems Assembly, Integration and Test Facility--most veterans of previous Shuttle construction and modification work--will disassemble, inspect, repair, improve, reassemble and test much of America's first operational Shuttle orbiter. And while the vehicle that emerges from this desert hangar next year won't look noticeably different on the outside, inside she'll sport nearly 80 major modifications designed to provide NASA and Shuttle astronauts with safer, more reliable and more efficient vehicle performance and expanded mission capabilities well into the next century.

Highlights of the work include installation of a new high-tech cockpit, an improved navigation system, and numerous safety, operational, reliability and turnaround enhancements ranging from better protection against space debris, to numerous measures to reduce Columbia's weight, thereby increasing the vehicle's payload capacity to orbit.

"In essence, every time a Shuttle leaves Palmdale, America gets a new, safer, improved Shuttle orbiter: one that is revitalized, more operationally fit and outfitted with the latest technologies," said Rick Stephens, Boeing RSS vice president and general manager.

Shuttle orbiter major modifications (OMMs) are typically performed on each vehicle approximately every three years. The work is being conducted for Shuttle prime contractor United Space Alliance. Contract value is not yet final.

Stephens said astronaut safety is paramount to the Palmdale workforce. "Every employee in Palmdale understands the importance of the work they do," he said. "They know their ultimate customers are the men and women who fly these incredible spacecraft. And they take personal accountability for ensuring their safety though quality workmanship. Our record in that regard has been consistently impressive. Nevertheless, we remain obsessed with continuous improvement to do our work safely, faster, better and cheaper." Stephens said an expanded training regimen is being adopted for work on Columbia and all subsequent vehicle modifications. Included are awareness training, videos, an enhanced orbiter entry/access class, computer-based training and orbiter orientation training. In addition, each employee is required to complete a detailed certification procedure.

The highlight of this OMM will be installation of a $9 million "glass cockpit" called the Multifunction Electronic Display Subsystem (MEDS), the second such fleet installation following a similar effort on Atlantis last year. Technicians will replace Columbia's four existing cathode-ray tube screens and numerous mechanical gauges and instruments with nine full-color, flat-panel displays. This will allow Shuttle crews to operate with the convenience and control of the most advanced commercial and military flat-panel display technology available today.

Developed by Honeywell Space Systems, Phoenix, Ariz., MEDS is a space-qualified adaptation of the display technology used on the Boeing 777. It will provide Shuttle crews with easy access to vital information through the two- and three-dimensional color graphic and video capabilities of its onboard information management system. Information will be interchangeable between screens, allowing crews to select the display format that best suits the needs of their particular mission.

MEDS eliminates obsolescence concerns and is less expensive to maintain than present electro-mechanical devices. Besides reducing maintenance costs, MEDS will reduce vehicle weight and power consumption, improve Shuttle reliability and performance and improve Shuttle safety by simplifying cockpit panels and providing a redundant display capability. MEDS is also capable of future upgrades.

Columbia also will be installed with a single Global Positioning System (GPS) satellite navigation receiver and prepared for future installation of a triply-redundant GPS system that may eventually replace the current system. GPS will provide more accurate and capable vehicle attitude and location data and reduce Shuttle program costs by eliminating ground stations.

Several modifications to Columbia are designed to accommodate the possibility of supporting International Space Station (ISS) missions in the future. Included are electrical and structural provisions for modifying the orbiter's docking system, increased cooling and power capacities, a wireless video system that will support payload requirements for near-term ISS missions by documenting the assembly process, and upgrades to the ship's UHF space communications system. Columbia will retain its internal airlock.

Operational enhancements include increasing Columbia's load-carrying capability; upgrades to thermal protection system tiles and blankets; orbital maneuvering system/reaction control system thruster performance improvements; and a series of measures to reduce the orbiter's weight. Most notable among the weight savings will be the removal of approximately 1,000 pounds of development flight instrumentation wiring unique to Columbia that was used during the fleet's first flights to monitor Shuttle performance. Safety and reliability enhancements include provisions to protect the orbiter's cooling system and the leading edges of the wings from space debris, a partial structural fortification of the crew module floor to increase the crew's

probability of surviving a hard landing and enhancements to the vehicle's hydraulic system.

During five months of structural inspection, technicians will scour Columbia using the latest technologies to search for possible fatigue, corrosion, or broken rivets or welds.

In support of ongoing USA and NASA fleet inspections, an extensive inspection of Columbia's electrical wiring system will be performed. All accessible wiring harnesses will be inspected and abrasion protection applied to any area where wires/harnesses could, or do, contact any screw head/tail, rivet tail or other sharp or protruding metal edges. In addition, selected harnesses enclosed in convoluted tubing will be removed, disassembled, evaluated, reassembled and reinstalled to validate the NASA inspection criteria currently being used on Shuttles Discovery and Endeavour. Tests will be conducted to confirm resistance to damage, vibration, shorting and age-related degradation.

Boeing Palmdale personnel also will perform preflight vehicle checkouts, significantly reducing the time required to process Columbia for her next flight.

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