Boeing Team Helps to Create Robotic "Handshake" in Space

Two enormous robotic arms will reach out towards one another and touch in one of the most historic "handshakes" of recent times after the U.S. Space Shuttle *Endeavour* delivers the Canadian arm, "Canadarm2" to the International Space Station (ISS) this week.

The Shuttle's own robotic arm will transfer the Canada arm, on a pallet, from its berth inside of *Endeavour*, and assist in docking it to the outside of the U.S. laboratory, *Destiny*. Astronauts will perform a spacewalk to unfold the arm and clamp it to the ISS.

Once installed and checked out, the Canada arm will raise the pallet that cradled it during its flight to the ISS and hand it off to the Shuttle arm for return to the Shuttle payload bay.

"This activity represents the first ever handoff of a piece of hardware between two robotic devices in space," said David Hughes, Boeing Launch Package Manager for Flight 6A. "We've never had two robots work in tandem in space. And, to have them interact with one another is a significant milestone."

The 17.6 meters (57.7 feet) long Canada arm (also know as the "Station arm") was designed and built by MD Robotics for the Canadian Space Agency. Boeing systems engineering teams ensured successful integration of the Station arm into the ISS. The Station arm is essential to the future construction and maintenance of the ISS.

Pas de Duex in Space

The task of moving the 3,300 pound Station arm from its pallet carrier in the Shuttle bay to its location on station is a well-choreographed production performed by astronauts from inside both the Shuttle and the *Destiny* module.

On Flight Day 4, the Station arm and its carrier will be lifted from the Shuttle using the Shuttle's own arm and docked to the exterior of *Destiny*. During a spacewalk, astronauts unfold the Station arm and clamp one end onto a grapple fixture on *Destiny*. Following a series of checkout exercises, astronauts will command the Station arm to raise the pallet from *Destiny* for hand off to the Shuttle arm, which will return the pallet to the Shuttle payload bay.

Throughout this intricate process Boeing teams in Huntsville and Houston will monitor telemetry sent between the Station arm and *Destiny*. A fiber optic contingency cable, designed by the Boeing Huntington Beach team, is available for communications backup in the event the nominal cable running between the Shuttle pallet and the *Destiny* is damaged during ascent or during deployment of the Station arm.

Another device being used during this robotic handoff is the Module-to-Truss-Structure-Attachment-System, designed and constructed by Boeing. This two-part clamping mechanism will temporarily secure the pallet carrying the Station arm to the *Destiny*. It will also be used during Flight 8A, scheduled to launch next year, to temporarily hold the center truss structure in place until astronauts can fasten the truss down permanently.

The U.S. Space Shuttle *Endeavour's* mission to the International Space Station (ISS) this week marks the ninth U.S. trip to the orbiting laboratory and the most sophisticated robotic mission for the manned spaceflight program.

Boeing Company teams in Canoga Park and Huntington Beach, Calif., Huntsville, Ala., Houston, Texas, Kennedy Space Center, Fla. and Seattle, Wash., are playing a significant role in ensuring mission success.

Experiment In Space

Boeing-built payload hardware is also flying on the STS-100 mission. Two Boeing Expedite the Processing of Experiments to Space Station (EXPRESS) payload racks are being transferred on-orbit from the Multi-Purpose Logistics Module, to *Destiny*.

One of the racks contains the Active Rack Isolation System (ARIS), a sophisticated vibration dampening system which isolates microgravity-sensitive experiments in the EXPRESS ARIS rack from even the smallest vibration. Once the EXPRESS ARIS rack is installed into *Destiny*, the Active Rack Isolation System - International Space Station Characterization Experiment (ARIS-ICE) will be performing a series of tests to quantify the performance of the ARIS system on-orbit.

"ARIS performs like a very sophisticated set of shock absorbers," explained Hughes. "The technology is contained in one of the Express Racks holding station experiments. Eventually ARIS will be in multiple racks in other labs on Station."

ARIS was developed by the Flight Configuration Technology organization in Phantom Works in Seattle and constructed by the Utilization Analysis and Integration team in Huntsville. The Boeing ISS Utilization team in Houston manages the ARIS-ICE program and the hardware was built in Huntsville.

Hardware In Space

Placement of the Boeing-developed external Ultra High Frequency Antenna Deployment Mechanism (UHF ADM) makes it possible, for the first time, for astronauts performing spacewalks to communicate with those aboard the Station via the Station UHF communications system without the Shuttle being present. The UHF ADM is being attached to the *Destiny* laboratory by astronauts during a spacewalk.

Once in operation, the UHF antenna will be used for space-to-space communication; two-way voice communications between the Station and spacewalkers, the station and orbiter at close range, and between Mission Control in Houston and spacewalkers (via interface with the station S-band and Ku band systems).

A second antenna will be delivered on STS-115/11A next year as part of the P1 truss segment.

Rounding out the major hardware supplied by Boeing on this mission is the two-part Flight Releasable Attachment Mechanism, used to hold the DC Switching Unit (DCSU) in place on the shuttle sidewall during the ride into orbit, and onto the Station External Stowage Platform on-orbit. The DCSU, provided by the Electrical Power Systems team in Canoga Park, is a critical element in the station electrical power generation and distribution system.

The second of three Italian-built Multi-Purpose Logistics Modules - Raffaello, is also flying on STS-100 and is carrying to Station Boeing-provided system hardware and spare parts tucked inside Resupply Stowage Racks built by Boeing Huntsville.

STS-100 is scheduled to launch April 19 and return to Earth on April 30, following an 11-day mission.

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