



A good fit

A Boeing team has made sure that space station elements fit seamlessly during assembly

By Tabatha Thompson

Imagine the frustration of buying a large appliance such as a refrigerator, lugging it home and removing the old one, only to discover that the new one doesn't fit, or the plug doesn't work with the electrical outlet.

What if that refrigerator were for the International Space Station orbiting 220 miles (350 kilometers) above Earth? The only way to return it for one that's the right size and fit would be to wait for the next space shuttle launch.

Thanks to a Boeing team, this kind of bad-fit scenario has never happened during 15 years of station assembly.

The Boeing Verification and Assembly Analysis team in Houston provides all the checks to make sure hardware headed for the space station fits seamlessly.

"Our skills can be applied to just about any project, but the obvious difference with space station is that assembly takes place on orbit; so, there's very little margin for error or chance for a redo," said John Cook, Boeing Assembly Analysis lead.

Boeing is NASA's prime contractor for the design, development and integration of all the U.S.-built elements of the space station.

Hardware integration has been one of Boeing's biggest challenges, requiring

meticulous planning and coordination, explained Mark Mulqueen, vehicle director for Boeing's International Space Station program.

"Given the cost and effort that goes into launching a piece of hardware into space, there's simply no room for error," Mulqueen said.

With more than a dozen international partners collaborating on space station construction, the team has learned to navigate differences in language, culture and technical approach.

"This team is the last check and balance to ensure that when elements are put together in space, they fit and function with one another perfectly, said NASA's Cal Brogdon, who analyzes robotics for the space station at the Johnson Space Center in Houston.

To make that happen, team members travel everywhere—from the Kennedy Space Center to Japan to Russia. They measure and inspect hardware headed for the station and enter the data into a computer modeling program that verifies all parts will fit together. Finally, the team performs a simulated on-orbit assembly.

"We simulate the on-orbit configuration for each of the elements and perform a fit-check with the cable and fluid lines that

link these elements," said Janice Hawkins, with the Cable and Fluid Assembly team. "The astronauts who will be on orbit participate in the test and run the same sequence they would at the station."

In 2009, an on-the-ground test uncovered a problem with a connection on the Italian-built observation deck, Cupola. The fluid lines were too large to allow the Cupola to connect to its permanent home on a U.S.-built node of the space station.

Engineers corrected the problem, and astronauts successfully installed the Cupola in February of this year.

The Boeing team continues its work on the space station, but has expanded its focus to include commercial cargo carrier systems now in development.

"Basically, we can apply our expertise to any integration out there," said Craig Stanton, the lead for Digital Pre-Assembly and Cable and Fluid Assembly teams. "Doesn't matter if it's a space application, a commercial airplane or just about anything else." ■

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PHOTO: Boeing Space Exploration engineers Craig Stanton (left) and Clay Stangle examine a connector for a space station component. ELIZABETH MORRELL/BOEING