NASA PHOTO

Astronaut Robert Curbeam, STS-116 mission specialist, works with the port overhead solar array wing on the International Space Station's P6 truss during the December mission's fourth spacewalk. Curbeam and other astronauts worked to guide the array wing neatly inside its blanket box.

Creativity in space

Shuttle crew to apply past lessons to fold arrays on space station

By Amanda Smoke

Who knew the ancient art of paper folding would one day come in handy assembling the International Space Station?

Like origami artists, Space Shuttle *Discovery* astronauts carefully wiggled, nudged and folded the station's delicate, gold-colored solar arrays into position during the STS-116 mission in December. The intricate procedure wasn't an art exhibit: It was meant to retract the station's P6 port-side solar array, to provide enough clearance for the P4 solar array to begin tracking the sun's motion.

This month when Space Shuttle *Atlantis* heads for the ISS, STS-117 mission objectives will feel familiar, since similar maneuvers will be performed. The crew will install the Boeing-built S3 and S4 truss segments, unfurl new solar arrays and retract another set of old solar arrays. This time around, astronauts will apply learnings from the previous mission.

Fully deployed, the array's 32 massive panels extend 120 feet (36.6 meters) along a system of guide wires. They're designed to fold up like an accordion and retract along the wires into large storage boxes at the bottom of the arrays. The process may sound simple. But folding an array that's been extended for six years is similar to folding a well-used road map into its original position.

The first attempt to retract the arrays was automated from inside the ISS. But minutes into the process, hinges between the delicate array panels folded in the wrong direction and had to be redeployed slightly, then retracted again. As the retraction continued, excessive tension caused the guide wires to become snagged, and the arrays draped over the blanket box below.

On the ground, Boeing engineers were troubleshooting the problem and advising NASA's mission control on next steps. Boeing Extra Vehicular Activity (EVA) & Crew Systems Integration team members were also working to verify the tools the space-walking astronauts would use were safe and compatible with the electrically charged elements of the solar arrays.

"On-orbit operation is a 24/7 thing, so we were constantly working with NASA to determine what happened and correct it," said Carter Reznik, Boeing lead for the ISS Structures and Mechanisms team.

At the end of the first spacewalk, only 17 panels had been retracted. The retraction was not complete, but it was enough to allow the crew to move forward with the second and third spacewalks—during which they reconfigured part of the station's power system and readied the ISS for future additions of laboratory modules.

A fourth spacewalk was added to the mission, giving the astronauts another chance to unstick the arrays manually. The crew inside the ISS used the station's robotic arm to position the spacewalking astronaut close to the array. Seven hours later, the job was done, followed by high-fives and cheers at Mission Control.

This time around, Mission Control will begin the process by automatically retracting the set of arrays one panel at a time while astronauts watch from inside the station. They will be prepared to assist with folding the arrays during the mission's second spacewalk, using tools that proved most effective on STS-116.

"We learned so much from the last EVA and the crew debriefs that confirmed what we saw," said Dan Sweeney, Boeing Solar Array Specialist, ISS Structures and Mechanisms. "The opportunity is there to be much more efficient." ■

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