

New solar arrays ready to upgrade International Space Station's power grid

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Two new solar array wings for the International Space Station are packed inside the trunk of a SpaceX Dragon cargo capsule for launch Thursday from the Kennedy Space Center, the first pair of six upgraded roll-out panels to give the orbiting outpost a power boost.

The arrival of the new solar arrays on three SpaceX resupply missions will give the space station one of its biggest mid-life upgrades since NASA and its international partners completed large-scale assembly of the complex in 2011.

The six new solar array wings, coupled with 24 new lithium-ion batteries launched to the station on a series of Japanese resupply missions, will help ensure the lab's power system can support continued operations through 2030.

Later this month, astronauts will head outside the station on two spacewalks to install the new solar arrays over two of the outpost's existing solar panels.

"From a visual standpoint, it's big," said John Mulholland, International Space Station vice president and program manager at Boeing, which provides engineering support for the station under contract with NASA. "With the new batteries that we developed and deployed last year, that really solidifies the power going forward for at least the next decade."

The ISS Roll-Out Solar Array, or iROSA, units were built by Deployable Space Systems in Goleta, California. Redwire, a space infrastructure company based in Jacksonville, Florida, acquired Deployable Space Systems in February.

"We're quite proud to be augmenting the International Space Station's power generation capabilities so that as the ISS continues to fly, it can have sufficient power to continue to deliver great science, help support human spaceflight operations, as well as be this great platform and incubator for commercial activity," said Andrew Rush, president and chief operating officer at Redwire.

NASA procured the six iROSA wings through a \$103 million modification to Boeing's space station engineering sustainment contract signed in February 2018. The arrays are similar to the Roll Out Solar Array tested outside the space station in 2017.

The first two iROSA units are packed inside the trunk of a SpaceX Cargo Dragon capsule for liftoff at 1:29 p.m. EDT (1729 GMT) Thursday.

A SpaceX-built Falcon 9 rocket will carry the Dragon spacecraft into orbit. Assuming an on-time liftoff Thursday, the capsule is scheduled to automatically dock with the International Space Station at 5 a.m. EDT (0900 GMT) Saturday.

The Dragon cargo mission will be SpaceX's 22nd resupply flight to the space station, and the second to use a new-generation variant of the logistics capsule derived from SpaceX's human-rated Crew Dragon spacecraft.

The new solar arrays spooled up on cylindrical canisters and fastened inside the Dragon capsule's trunk weigh about 3,042 pounds (1,380 kilograms), according to NASA.

The resupply mission will also deliver experiments, food, spare parts, 10 NASA-sponsored CubeSats, and other equipment to the space station's seven-person crew. The Dragon's entire cargo load, including pressurized and unpressurized sections, weighs in at 7,337 pounds (3,328 kilograms).

While astronauts open hatches and unpack the Dragon's pressurized compartment, the space station's Canadian-built robotic arm will reach into the capsule's trunk and remove the two iROSA wings. The arm will transfer the solar arrays to a mounting bracket on the space station's power truss, which stretches as long as a football field.

That will set the stage for two spacewalks scheduled for June 16 and June 20 to install and deploy the solar arrays, which roll out like a flexible mat instead of unfurling like an accordion, like the rigid solar panels on most spacecraft.

Astronauts Shane Kimbrough and Thomas Pesquet will perform the spacewalks, each of which are expected to last about six-and-a-half hours.

The space station's huge solar array modules, which span 240 feet (73 meters) tip-to-tip, were designed for 15-year service lives. The oldest of the station's current solar arrays — built by Lockheed Martin — launched in 2000, with more pairs of wings added on space shuttle flights in 2006, 2007, and 2009.

The older solar arrays are showing some signs of degradation, as expected, according to NASA. The first pair of iROSA wings will go on the oldest solar panel module — named P6 — on the far left, or port, side of the space station.

The space station has eight power channels, each drawing from one solar array wing mounted to the research lab's long truss structure. Six of those channels will get an upgrade with the new solar arrays supplied by Boeing, Redwire, and a team of subcontractors.

Earlier this year, astronauts ventured outside the space station on two spacewalks to set up support fixtures to accommodate the new iROSA wings.

The roll-out solar arrays will stretch 63 feet long and 20 feet wide (19-by-6 meters), about half the length and half the width of the station's current solar arrays. Despite their smaller size, each of the new arrays will generate about the same amount of electricity as each of the station's existing solar panels, Rush told Spaceflight Now.

A mounting bracket will plug the new arrays into the station's power channels and rotary joints, which keep the solar wings pointed at the sun as the spacecraft races around Earth at more than 17,000 mph. The new arrays will be angled 10 degrees from the old solar panels.

"They'll be positioned there essentially right in front of the existing solar arrays, canted at a small angle," Mulholland said in an interview with Spaceflight Now. "The existing solar arrays will still be able to feed power along with the new solar arrays, so we're just trying them in together electrically."

Boeing's subsidiary Spectrolab is supplying the high-energy solar cells for the six new arrays, and Deployable Space Systems is in charge of building the structure for the new solar wings, including the canister and frame that will extend to hold the solar array blankets in place.

NASA says each roll-out solar array can produce more than 20 kilowatts of power. Four more iROSA wings will launch on future Cargo Dragon missions in 2022 and 2023.

When all six new solar arrays are installed, the space station will still have one uncovered pair of its existing panels. Those wings, along with the arrays partially covered by the new wings, will continue generating around 95 kilowatts of power. Combined with the 120 kilowatts from the new roll-out panels, that will bring the space station's total power production capacity to 215 kilowatts.

The power system upgrades over the next couple of years will restore the space station's electrical grid to the same output as when the original arrays were first installed, NASA said. That represents a 20% to 30% increase over the current power levels.

"Commercial users are coming on board that are looking for power that that we didn't even dream of back in the mid-90s," said Kenny Todd, deputy manager of the space station program at NASA's Johnson Space Center in Houston.

"The technology really has gotten to the point that we can do something like these roll out solar arrays," Todd said. "They're not as big as the ones that we previously deployed, and yet we can get even more power out of them."

NASA will use similar roll-out solar array designs on the core module of the planned Gateway mini-space station in orbit around the moon, a key element of the space agency's Artemis program to return astronauts to the lunar surface in the 2020s. NASA's robotic Double Asteroid Redirection Test, or DART, spacecraft will also use a smaller version of Redwire's roll-out solar array.

Rush, Redwire's president, said the roll-out solar array unrolls using strain energy in the composite booms supporting the solar blanket, eliminating the need for motors to control deployment. The carbon fiber booms are rolled back against their natural shape for storage during launch. Once teams send the command to deploy, the structure unrolls as the booms release tension.

"This roll-out architecture is a much simpler architecture than the more traditional approaches," Rush said.

The roll-out arrays can also fit into a more compact canister for launch, allowing SpaceX's Cargo Dragon capsule to carry two solar wings at a time.

At the end of the Dragon cargo mission, astronauts will load the capsule with equipment and experiment specimens for return to Earth. The spacecraft will undock from the space station around July 20 and head for a splashdown off the coast of Florida, where SpaceX teams will retrieve the capsule and return it to Cape Canaveral for refurbishment ahead of another mission.

Redwire, meanwhile, will continue work on the next fourroll-out solar arrays for the International Space Station.

Since its founding in June 2020, Redwire has acquired seven companies, including Deployable Space Systems and their-space manufacturing firm Made in Space.

“We are focused on enabling the next generation of space infrastructure,” Rush said in an interview. “We are excited to be participants in this kind of second golden age of space that we think is really a step change in how we, as society, use space.

“Over the last year we’ve brought together, so far, about seven small businesses into Redwire with some really deep deployable structures and systems expertise, with great expertise in in-space manufacturing and assembly, digital engineering, and sensors and navigation components,” Rush said.

Redwire, through its acquisition of Made in Space, plans to launch a small satellite named OSAM 2, formerly known as Archinaut One, in late 2022 or early 2023 to demonstrate 3D printing of solar array booms in orbit

The company is also supplying avionics for Firefly Aerospace’s Blue Ghost commercial moon lander and is building the solar sail for NASA’s Solar Cruiser technology demonstration mission.

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