

ORION



JANUARY 2018



First Weld Leads to Next Giant Leap

Welding on Exploration Mission-2 crew module is underway at Michoud Assembly Facility

FIRST WELD LEADS TO NEXT GIANT LEAP



At NASA's Michoud Assembly Facility in New Orleans, technicians with Orion prime contractor Lockheed Martin welded together the first two sections of the Orion crew module for Exploration Mission-2, the first flight of Orion with astronauts which will carry them farther into the solar system than ever before. The crew module, or pressure vessel, is the primary structure that holds the pressurized atmosphere astronauts will breathe and work in while in the vacuum of deep space and is the structure upon which all the other elements of Orion are integrated. It was designed specifically to withstand the harsh and demanding environment of deep space travel, while keeping the crew safe and comfortable.

The main structure of the pressure vessel is comprised of seven large machined aluminum alloy pieces that are welded together to produce a strong, yet light-weight, airtight capsule. The first weld joined the forward bulkhead

with the tunnel section to create the top of the spacecraft. Prior to the critical first weld, engineers prepared and outfitted each of the two segments with strain gauges to monitor the reaction of the metal during the procedure. The bulkhead and tunnel were welded together with a state-of-the-art process called friction-stir welding, which produces an extremely strong bond of the two aluminum components with a uniform welded joint.

The remaining sections of the pressure vessel will continue to be welded together over the spring and summer at Michoud, incorporating the three cone panels, the large barrel and the aft bulkhead. Once completed in September, it will be shipped to the Kennedy Space Center where it will undergo assembly into the EM-2 spacecraft.

Read more: bit.ly/EM2FirstWeld

STANDING UP TO RIGOROUS TESTING

When NASA sends Orion out past the Moon for Exploration Mission-1, they can't just rely on computer models and calculated probabilities that indicate the crew module will survive the trip and perform as expected. Engineers are hard at work testing Orion's structural test article (STA), essentially a twin of Orion's crew module, service module and launch abort system, to ensure Orion will keep astronauts safe and return them home. The STA is put through tests that increase the expected pressure, vibration, and shock conditions up to 140% of what Orion is expected to encounter

during spaceflight, to prove that Orion can withstand just about anything it will encounter when traveling to the Moon and Mars. Orion Communication Representative Gary Napier and Orion STA Manager Daniel Qvale took viewers behind the scenes in Lockheed Martin's Waterton facility just outside of Denver, Colorado, to learn more about why the STA is so important.

View recording from Lockheed Martin's Facebook Live broadcast bit.ly/STAfblive



A large Orion space capsule is being recovered by a Navy ship. The capsule is white with a black window and is suspended by a blue rope. A smaller inflatable boat with several crew members is nearby, also connected to the capsule. The scene is set in the open ocean under a clear blue sky.

NASA, NAVY TEAM UP ON ORION RECOVERY OPS

NASA's Recovery Team from Kennedy Space Center just finished a week at sea off the coast of San Diego, California, testing and improving their processes and ground support hardware to recover astronauts in the Orion capsule once they splash down in the Pacific Ocean. Aboard the USS Anchorage, NASA and the U.S. Navy worked together to run through different sea conditions, time of day and equipment scenarios—putting hardware and people through their paces.

Astronaut Stephen Bowen was aboard as an observer to better understand the recovery procedures and to offer an astronaut's perspective. As a former Navy captain, Bowen has a wealth of knowledge to impart to the team—helping them better understand what the crew will experience as they are bobbing up and down in the capsule after spending time in microgravity.

During the weeklong testing, the team made strides in developing the final recovery plan and even shaved 15 minutes off their best time. When the astronauts return to Earth in Orion, recovery teams are required to retrieve them within two hours but the goal is to get to them in half that time.

The team still has several tests scheduled between now and Orion's first uncrewed flight atop the new Space Launch System rocket, known as Exploration Mission-1. The mission will pave the way for crewed missions and enable future missions to the Moon, Mars and beyond. During the flight, Orion will travel thousands of miles beyond the Moon before splashing down into the Pacific, where NASA's Recovery Team will be ready and waiting for her.

Read more: bit.ly/NavyTestJan18

NEW YORKERS WORK ON ORION

In January, Lockheed Martin Orion Deputy Program Manager Larry Price and NASA Orion Production Operations Demand Management Lead Doug Lenhardt visited Orion supplier Moog Space and Defense Group in New York. During the visit, Price and Lenhardt were able to see first-hand the progress Moog has made on various integral pieces of hardware they are providing for NASA's Orion spacecraft and Space Launch System (SLS) in preparation for deep-space exploration missions. This includes the components responsible for regulating ammonia in the

system that will keep the crew and service module at the correct temperatures. Moog also produces the actuators and control electronics which help steer the launch abort system, as well as components that ensure the vibrations and shock transferred from the SLS are mitigated so that the crew module withstands the intense loads of a launch. Price and Lenhardt met with employees, gave them an update on Orion's progress toward Exploration Mission-1, and thanked them for their hard work on NASA's space exploration programs.



MILE HIGH CITY MAYOR GETS 60,000- MILE FLOWN FLAG

Denver Mayor Michael Hancock was presented with a Colorado state flag that flew in space aboard Exploration Flight Test-1 (EFT-1) in December 2014. During EFT-1, Orion traveled 60,000 miles into space, reaching an altitude of 3,600 miles and returning to Earth at more than 20,000 mph during its first space flight. This mission successfully tested Orion's hardware before building the spacecraft that will travel past the Moon in Exploration Mission-1.

APW TEAM KEEPS ORION WIRED FOR POWER



The Avionics Power and Wiring (APW) team had an extremely successful 2017 and was recognized at their annual review and planning meeting. As a team, they successfully delivered over 70 percent of Orion's avionics hardware to Kennedy Space Center, where they were installed into the Exploration Mission-1 (EM-1) crew module and the crew module adapter, which connects the crew module to the service module. The team was also able to deliver 16,875 solar cell assemblies, 3,600 solar cell interconnects, and critical network interface cards to the European Space

Agency and Airbus in Germany to support assembly of the Exploration Mission-2 service module. It was a significant achievement to get these components built, delivered, and acceptance-tested in time to be installed and used in large-scale testing of the crew and service modules, maintaining a consistent and productive test campaign in preparation for EM-1. Several members of the team received Orion Program Manager Commendations for their extraordinary combination of dedication and technical, programmatic, and critical leadership skills within the APW team.

SUPPLIER SPOTLIGHT

ALL POINTS LOGISTICS, LLC



All Points Logistics, LLC, is a Service Disabled Veteran Owned Small Business that provides engineering and software development services for the Orion spacecraft. All Points has 325 employees who have delivered crucial support to various NASA exploration programs, such as the International Space Station, Space Launch System, and Exploration Ground Systems. With 62 employees specifically dedicated to the Orion Program, All Points

has supported Orion through human factors and logistics engineering as well as simulation software development at various locations around the country. With a company culture dedicated to education, each of All Points main offices partners with local universities and primary education to give back to the communities they work in and increase knowledge in the Science, Technology, Engineering and Math (STEM) fields.





ORION GETS TECHNICAL

At the annual global stage for innovation, Consumer Electronics Show (CES), NASA's booth allowed innovators and business leaders to learn more about Orion and other programs leading the way to deep space exploration. Business leaders and pioneering thinkers were able to hear about the breakthrough technology Orion is using to travel beyond the Moon on Exploration Mission-1, and take astronauts farther than they have ever gone before on Exploration Mission-2. Jared Daum, Orion parachute engineer, spoke with Steve Sheridan, reporter for NosillaCast podcast, about NASA, the Orion spacecraft and the technology that will ensure astronauts get safely to and from their missions throughout the solar system.

View the interview: bit.ly/OrionCES18

HOUSTON WE HAVE A PODCAST

Listen as Orion team members share progress updates and how NASA is keeping astronauts safe and comfortable when they travel on Exploration Mission-2. In "A Rocket on a Rocket," Wahab Alshahin, a NASA Guidance, Navigation and Control engineer, talks about what a launch abort system is, how it works, and why it is necessary to send humans to space. In "3 Weeks in a Capsule," Jessica Vos, Crew System engineer talks about how astronauts will live in the Orion capsule for the first crewed missions around the Moon that will be about three-weeks in duration. Astronauts are already training and preparing for these future deep-space missions that will span months or even years.

A Rocket on a Rocket: go.nasa.gov/2E3howl

3 Weeks in a Capsule: go.nasa.gov/2sgVchl



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