

# ORION



JULY 2018



## Orion Lands at the White House

Orion Exploration Flight Test-1 spacecraft stars in a Made in America event.

# ORION LANDS AT THE WHITE HOUSE



NASA's Exploration Flight Test-1 Orion spacecraft landed front and center on the White House South Lawn for the Administration's Made in America Product Showcase on July 23. This spacecraft successfully completed an orbital flight test on December 5, 2014, that went farther into space than any spacecraft built to carry humans had traveled since 1972.

NASA Administrator Jim Bridenstine and Lockheed Martin Orion Program Manager Mike Hawes were on site at the event to provide Orion program and NASA exploration mission updates to President Trump, Vice President Pence, cabinet members, and other elected officials who attended.

During the event, the White House hosted companies from all 50 states to share the stories of what American companies are making, how it is impacting the economy, and what breakthroughs in technology have been recently discovered. Lockheed Martin, NASA's prime contractor for Orion, works

with more than 1,000 suppliers and small businesses from all 50 states and Puerto Rico to design, test and manufacture components for the spacecraft.

There are three Orion spacecraft currently in production for upcoming missions, beginning with Exploration Mission-1 when Orion will travel to the far side of the Moon and back during a three-week journey. Welding for the Exploration Mission-2 crew module pressure vessel is complete at NASA's Michoud Assembly Facility in New Orleans, Louisiana, and will be delivered to NASA's Kennedy Space Center in Florida in August to begin final assembly for Orion's first crewed flight. Companies are also currently fabricating parts for Exploration Mission-3. With components from companies nationwide, Orion truly is America's spacecraft.

Read more: [bit.ly/EFT1atWH](https://bit.ly/EFT1atWH) and [politi.co/2w6Vxli](https://politi.co/2w6Vxli)

# ORION ESM ENGINE DANCES THE HULA



The European Service Module (ESM) for NASA'S Orion spacecraft is currently being tested at Airbus Space Systems in Bremen, Germany. The team is fully concentrating on the various tests that are ongoing, which recently included a set of tests of the Thrust Vector System. In July, the team successfully completed a test of the engine gimbal system. During a series of tests, the nozzle of the Orbital Maneuvering System engine was swung in different

directions and at different speeds to show if all signals from the electronic system are correctly interpreted, and whether all mechanical components are working as planned. The Thrust Vector System performed well, as shown in the post-test analysis video. The next big milestone will be the leak proof test.

Learn more: [bit.ly/OrionHula](https://bit.ly/OrionHula)

# TEAM POWERS ON AA-2 ORION



The team of engineers working on the Orion test article for the Ascent Abort-2 (AA-2) flight test has outfitted the vehicle with all the components it needs for flight and powered it on for the first time the week of July 8.

Powering on the vehicle is a major milestone toward the flight test and ensures the crew module works in an integrated fashion. Powering up Orion is a lot more complicated than simply flipping on a switch. The multi-day, incremental process began with teams applying power to the power distribution unit to ensure all the pins in the unit have the right voltages. One by one, additional systems were connected and powered to ensure that the vehicle is healthy and providing the right data. Engineers have positioned all of the core avionics, outfitted the data instrumentation, and routed and clamped almost 11 miles of harnessing inside Orion.

Ascent Abort-2 is a full-stress test of Orion's Launch Abort System (LAS) planned for April 2019. It is the only remaining flight test of the active LAS before flying crew on Orion beginning with Exploration Mission-2. The LAS is essential for spaceflight systems designed to carry humans to the Moon and beyond. The system is built to propel Orion and its crew to a safe distance away from the Space Launch System rocket if an emergency arises during launch or ascent.

Now that the power-on activity is complete, engineers are moving right into simulating the flight test, including ground support milestones, the prelaunch countdown and flight profile, followed by testing to verify that the vehicle will perform as expected. Upon completion of testing, technicians will have a few mechanical elements to finish integrating before the crew module is rolled on its side to verify its weight and center of gravity, both of which have to be the same as the Orion that will carry crew to deep space to ensure the April flight test provides accurate data for a mission abort scenario.

The spacecraft will soon be shipped to NASA Glenn Research Center's Plum Brook Station in Sandusky, Ohio, where it will undergo several weeks of acoustics testing. It will return to NASA's Johnson Space Center in September for integration with the separation ring that connects the crew module to its booster, and then transported to NASA's Kennedy Space Center for integration with the booster for launch.

Read more about the power on:  
[bit.ly/ChronPowerOn](https://bit.ly/ChronPowerOn)

Read about the AA-2 Jettison Motor which recently passed a key milestone on the way to AA-2 :  
[bit.ly/July18AA2](https://bit.ly/July18AA2)

# AA-2 GROUND TEST MOTOR ARRIVES AT KSC

The Ascent Abort 2 (AA-2) flight test ground test motor (GTM), an SR118 inert solid rocket motor, arrived at NASA's Kennedy Space Center in Florida on July 19. The GTM arrived by truck to Kennedy's Rotation, Process and Surge Facility (RPSF) Surge 1 where it will be inspected and prepared for transport to Space Launch Complex 46 (SLC-46) at Cape Canaveral Air Force Station for mechanical fit testing.

This motor will not be used for flight, but will be used to certify flight hardware assembly in preparation for the AA-2 flight test targeted for April 2019. During the test flight, the booster will launch from SLC-46, carrying a fully-functional Launch Abort System (LAS) and a 22,000-pound Orion test vehicle to an altitude of 31,000 feet and traveling at more than 1,000 mph. The test will verify the LAS can steer the crew module and astronauts aboard to safety in the event of an issue with the Space Launch System (SLS) rocket when the spacecraft is under the highest aerodynamic loads it will experience during a rapid climb into space. NASA's Orion and Exploration Ground Systems programs and



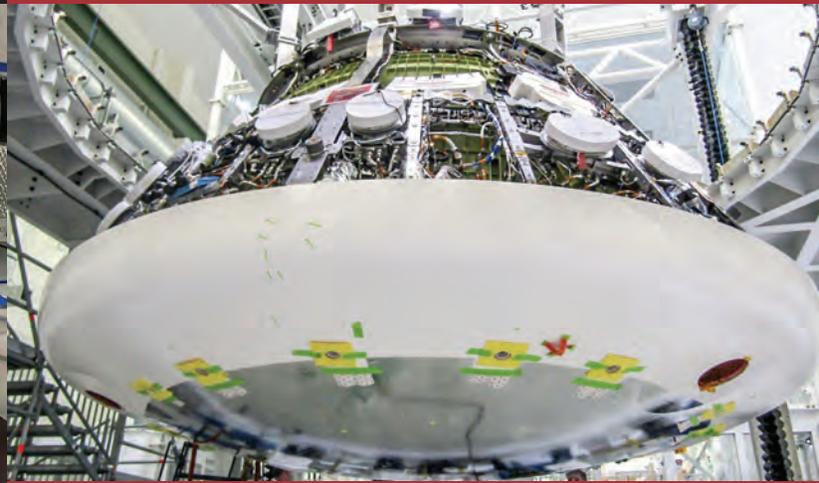
their contractors from Jacob's and Northrop Grumman, in conjunction with the Air Force Space and Missile Center's Launch Operations Branch, are performing the pathfinding exercises for AA-2.

## ORION INTERNS STEP INSIDE



Orion interns at NASA's Johnson Space Center participated in a round of Human-in-the-Loop testing in the Orion medium fidelity mockup in Houston. Orion team members rigorously test new mechanisms and objects the crew will need when traveling to space, and make decisions on what is probable for use and what should be changed before bringing astronauts into the mockup for their recommendations. The interns were able to help with some early-concept ideas to determine if the space and orientation of the vehicle worked with the new designs.

## EM-1, SHIELDED FROM THE HEAT



The Exploration Mission-1 heat shield was mechanically mated to the crew module at the Operations and Checkout building at NASA's Kennedy Space Center in July. As the spacecraft returns to Earth at a speed exceeding 25,000 mph, the heat shield will be responsible for protecting the rest of the vehicle as it encounters nearly 5,000-degree Fahrenheit heat during reentry. It will also test updates made to the heat shield since the 2014 Exploration Flight Test-1 to ensure the spacecraft is ready to bring humans to the Moon and back home safely beginning with Exploration Mission-2.

# ORION PARACHUTES CHALK UP ANOTHER TEST SUCCESS IN ARIZONA



The parachute system for Orion, America's spacecraft that will carry humans to deep space, deployed as planned after being dropped from an altitude of 6.6 miles on July 12 at the U.S. Army Proving Ground in Yuma, Arizona. Data from the successful seventh drop in a series of eight qualification tests will help NASA engineers certify Orion's parachutes for missions with astronauts.

This was the final test using a special dart-shaped test article. The last test in the series, scheduled for September, will use a capsule-shaped test article representative of the spacecraft NASA will use on Orion's upcoming missions, including the first crewed mission, Exploration Mission-2.

When deployed, each of Orion's three main parachutes expands to 116 feet in diameter and contains enough fabric to cover 80 yards of a football field, but is carried aboard Orion in containers the size of a large suitcase. For storage, the parachutes are compacted with hydraulic presses at forces of up to 80,000 pounds, baked for two days and vacuum sealed. Once packed, they have a density of about 40 pounds per cubic foot, which is roughly the same as wood from an oak tree.

# SNOOPY GEARS UP TO RETURN TO THE MOON



NASA and Peanuts Worldwide are joining forces to collaborate on educational activities that share the excitement of Science, Technology, Engineering and Math (STEM) with the next generation of explorers and thinkers. The collaboration, formalized through a Space Act Agreement, provides an opportunity to update the Snoopy character by Charles M. Schulz, for space-themed programming with content about NASA's deep space exploration missions, 50 years after its initial collaboration began during the Apollo era.

With NASA's involvement, Peanuts will work on content for Astronaut Snoopy, including a STEM-based curriculum for students about America's deep space exploration objectives and interactive ways to celebrate next year's 50th anniversary of humans first setting foot on the Moon. Peanuts began sharing its updated space-themed activities at the Comic-Con International: San Diego conference in July.

NASA has shared a proud association with Charles M. Schulz and his American icon Snoopy since Apollo missions began in the 1960s. Schulz created comic strips depicting Snoopy on the Moon, capturing public excitement about America's achievements in space. In May 1969, Apollo 10 astronauts traveled to the Moon for a final checkout before lunar landings on later missions. Because the mission required the lunar module to skim the Moon's surface to within 50,000 feet and "snoop around" scouting the Apollo 11 landing site, the crew named the lunar module Snoopy. The command module was named Charlie Brown, Snoopy's loyal owner.

The agency's Silver Snoopy award is given by NASA astronauts to employees and contractors for outstanding achievements related to human flight safety or mission success. Receiving one is regarded as a high honor for outstanding performance.

NASA is leading the next steps of human exploration into deep space where astronauts will build and begin testing the systems near the Moon needed for lunar surface missions and exploration to other destinations farther from Earth, including Mars. Exploration Mission-1 will be the first integrated test of NASA's deep space exploration systems: the Orion spacecraft, Space Launch System (SLS) rocket and the ground systems at Kennedy Space Center in Cape Canaveral, Florida. The first in a series of increasingly complex missions, Exploration Mission-1 will be an uncrewed flight test that will provide a foundation for subsequent missions with crew, and demonstrate our commitment and capability to extend human existence to the Moon and beyond.

To kick off the renewed partnership, Snoopy revealed his new orange spacesuit during the San Diego Comic-Con. Members of the Peanuts Worldwide team and a few key NASA employees joined for a panel which explored the history of Peanuts and NASA, as well as what is to come for the beagle and his friends as they aim to teach students more about deep space.

Read more: [bit.ly/PeanutsNASAJul18](https://bit.ly/PeanutsNASAJul18)

# ROCKET WOMEN FIRE UP CROWD AT OSHKOSH AIR SHOW



Six female professionals who are leading America's next-generation space exploration programs recently participated in a forum at EAA AirVenture in Oshkosh, Wisconsin. Several hundred individuals attended the forum and heard from these women about the exciting developments they are working on for human space exploration.

These women are leading development of major spacecraft systems for NASA's Orion spacecraft, Space Launch System rocket and launch operations to ensure our astronauts get to the Moon, then Mars and back home safely – every mission. They shared that, in less than a year, NASA will launch its Ascent Abort-2 flight test then soon after launch Exploration Mission-1, sending a human-rated spacecraft farther than any has traveled since 1972.

After they described the challenging and meaningful work they do, the audience asked questions to learn more about

these exciting programs. The prime contractors for these systems have participated in forums at Oshkosh for six years, and the women's panel continues to be a favorite.

Participants in the forum included: (left to right) Charlie Blackwell-Thompson, launch director for NASA's Exploration Ground Systems Program at NASA's Kennedy Space Center; Erica Sandoval, principal Launch Abort Motor manufacturing engineer at Northrop Grumman; Tiffany Williams, Orion senior program manager at Aerojet Rocketdyne; and Marcia Lindstrom, panel moderator and SLS Communications lead at NASA's Marshall Space Flight Center; Heather McKay, Orion Launch Abort System manager at Lockheed Martin Space; Amanda Gertjeansen, SLS Program master scheduler at Boeing.

## FORMER ASTRONAUT LOCKHART INSPIRES ORION TEAM



Paul Lockhart, former NASA astronaut and retired Air Force Colonel and pilot, visited with Orion employees at Lockheed Martin Space near Denver on July 9. Lockhart, who piloted STS-111 and STS-113, spoke about his experience on the two shuttle missions and

the importance of continuing to send humans into deep space and on to Mars. That evening, Lockhart hosted a dinner for Orion interns, thanking them for their hard work over the summer.

## BRUTALIZING A REPLICA TO ENSURE ORION SAFETY

Recently, WIRED reporter Sarah Scoles took a behind-the-scenes look at what Lockheed Martin is doing in Colorado to test Orion and ready it for Exploration Mission-1 and beyond. She got a glimpse at the teamwork necessary to put the Structural Test Article, Orion's twin, through tests that push its integrity and strength to its limits. These simulations are critical so when the actual Orion spacecraft travels to the Moon and farther into deep space, it will be ready for the harshest of situations and ensure that our astronauts will return home safely.

Read more: [bit.ly/WIREDOrionSTA](http://bit.ly/WIREDOrionSTA)



# SUPPLIER SPOTLIGHT

## COBHAM MISSION SYSTEMS



Cobham Mission Systems, based in Orchard Park, New York, designs and manufactures life support components critical to crew safety and survival in Orion and the Space Launch System. One set of their components are used in the propulsion system to keep liquids sealed and separated until they are needed to propel Orion to its deep-space destinations. Other components they provide are used in the Environmental Control and Life Support System within Orion's European Service Module to provide and manage

the oxygen, nitrogen and water the astronauts need during their missions. Cobham was no stranger to the space game before working on Orion, as their regulators have been part of Mercury, Gemini, Apollo, Space Shuttle and other important programs in NASA's human spaceflight history. Their team takes pride in knowing that their valves and components are enabling the next generation of astronauts to venture farther into space than any have ever gone before.

FOLLOW THE PROGRESS OF  
NASA'S NEW SPACECRAFT  
FOR HUMAN EXPLORATION:

- Twitter ..... [Twitter.com/NASA\\_Orion](https://twitter.com/NASA_Orion)
- Facebook ..... [Facebook.com/NASAOOrion](https://facebook.com/NASAOOrion)
- Flickr ..... [Flickr.com/NASAOOrion](https://flickr.com/NASAOOrion)
- Tumblr ..... [NASAOrion.tumblr.com](https://NASAOrion.tumblr.com)

# AUGUST 2018

- Orion Team Meets New NASA Administrator
- EM-2 Crew Module Takes Shape
- KSC Unveils New Education Center
- Chicago Air & Water Show