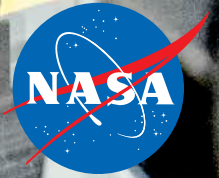


National Aeronautics and  
Space Administration



# ORION

# SAFETY FIRST

OCTOBER 2017



# PAD ABORT TEST ENSURES ASTRONAUT, GROUND CREW SAFETY BEFORE ORION LAUNCHES

NASA recently performed a series of tests to evaluate how astronauts and ground crew involved in final preparations before Orion missions will quickly get out of the spacecraft if an emergency were to occur on the pad prior to launch. This testing took place the week of Oct. 30, using the Orion mockup in the Space Vehicle Mockup Facility at NASA's Johnson Space Center in Houston. In this photo, engineers used simulated smoke to imitate a scenario in which astronauts must exit the capsule with obscured vision.

Before astronauts launch to space in Orion, they will cross the crew access arm 300 feet above the ground and climb inside the crew module with the assistance of ground personnel trained to help them strap into their seats and take care of last-minute needs. During the test, markings on the ground indicated where the crew access arm will be located to help guide the crew.

This testing is a collaborative effort between the Orion and Ground Systems Development and Operations programs. It is helping engineers evaluate hardware designs and establish procedures that will be used to get astronauts and ground crew out of the capsule as quickly as possible. Flight and ground crew are required to get out of Orion within two minutes to protect for a variety of failure scenarios that do not require the launch abort system to be activated, such as crew incapacitation, fire or the presence of toxins in the cabin. Previous egress testing at Johnson and in the Gulf of Mexico evaluated how crew will exit the spacecraft at the end of their missions after splashdown.

The first crewed test flight for the Orion spacecraft and Space Launch System rocket, Exploration Mission-2 (EM-2), is targeted to launch in the early 2020s from NASA's modernized spaceport at the Kennedy Space Center in Florida. The mission's primary goals are to demonstrate Orion's crew capabilities and the upgraded SLS rocket.

# EXPLORING OUTER SPACE IN THE PRESIDENT'S PLACE

NASA engaged families of White House staff members during the space-themed Halloween party, “Exploring Outer Space in the President’s Place,” hosted by the Eisenhower Executive Office Building on Friday, October 27. Astronaut Kay Hire shared personal stories of life onboard the International Space Station (ISS) and Astronaut Joe Acaba delivered a message directly from the ISS. NASA provided exhibits, hands-on activities, interactive displays and demonstration items for more than 400 children and 200 adults. NASA treats were handed out among Mars and lunar exhibit items where participants were able to view table top models of the Space Launch System, Curiosity and Sojourner spacecraft; experience virtual field trips to Mars and the space station; try on thermal glasses, and engage in other opportunities.



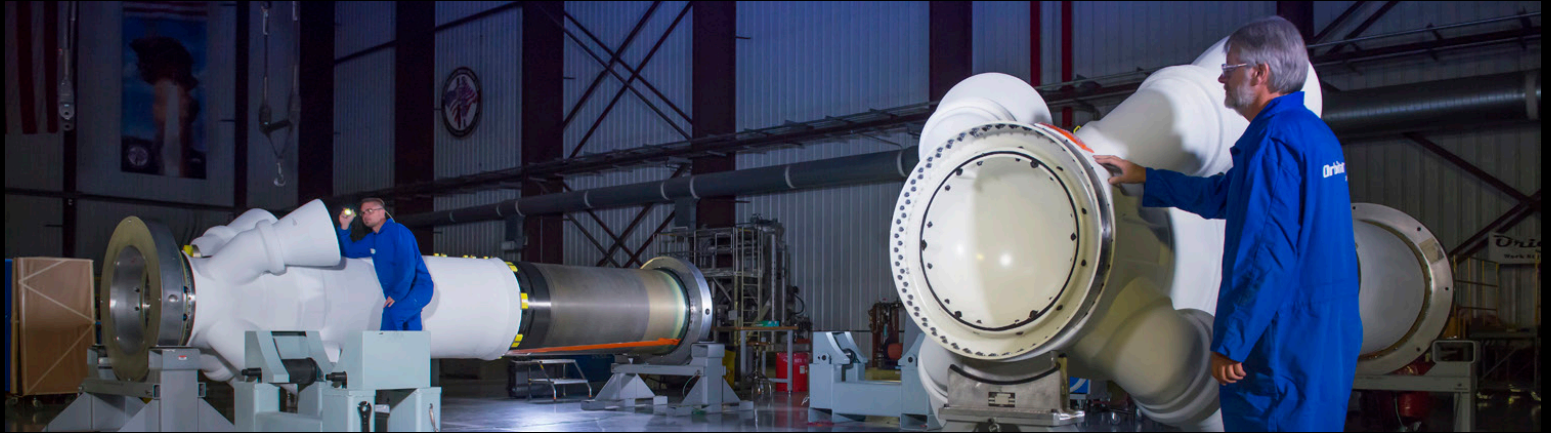
## VP PENCE AIMS TO CONTINUE AMERICA'S LEADERSHIP IN SPACE

Vice President Mike Pence recently visited Lockheed Martin’s facilities in Waterton, Colorado, where he met with their leadership and learned more about the company’s work on human and robotic space programs, including Orion’s progress toward Exploration Mission-1 and beyond. While touring, Pence experienced several of the innovative technologies Lockheed Martin is using to succeed in space exploration, including NASA’s InSight Mars lander and a virtual reality engineering lab called the Collaborative Human Immersive Laboratory.

At the conclusion of the tour, Lockheed Martin CEO Marillyn Hewson presented Pence with a flown flag from Orion’s Exploration Flight Test-1, which flew farther from Earth than any spacecraft meant to carry humans since the Apollo missions.

# ORION TESTING PAVES THE WAY FOR CREW TO EXPLORE DEEP SPACE

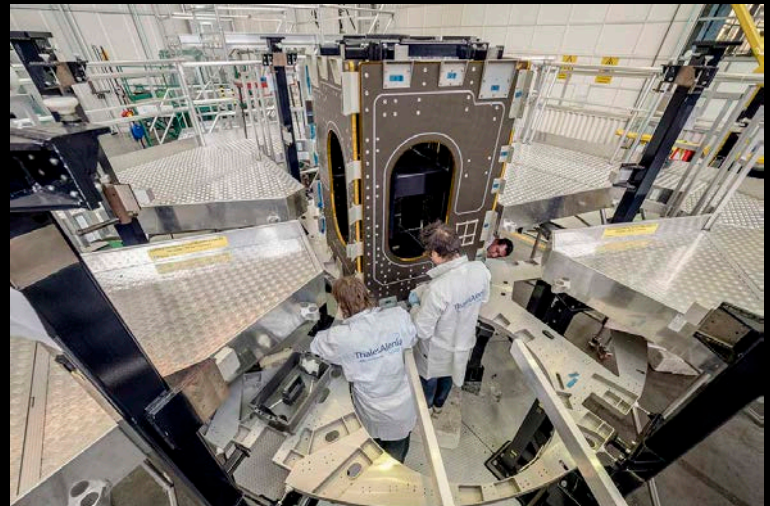
Before crew enters Orion with safety procedures and escape routes in mind, the spacecraft's electronics, heat shield, launch abort system and more will all have undergone extensive testing to ensure mission success. While crew will not travel in Orion until Exploration Mission-2, the spacecraft will travel past the Moon and will be tested in cis-lunar orbit during Exploration Mission-1 to pave the way for humans to travel to deep space. Orion team members are working hard to make sure all of the components and parts are ready to go.



Progress continues on Orion's Launch Abort System with the completion of the first two launch abort motors. Both motors have undergone final preparations and will be safely stored at Orbital ATK's Promontory, Utah, facility until ready for shipment to NASA's Kennedy Space Center before launch.



Inside the Neil Armstrong Operations and Checkout Building high bay at NASA's Kennedy Space Center in Florida, a variety of test stands, processing bays and hardware are in view. Thermal protection panels and other components for Orion are in various stages of processing. The EM-1 crew module completed its series of functional tests that demonstrated the performance of many vital vehicle systems needed for the EM-1 mission. With the completion of this test series, the crew module then undergoes thermal cycle testing which combine system operations with thermal extremes to validate that vehicle systems operate correctly when exposed to temperatures similar to those seen on orbit.



Technicians at Thales Alenia in Turin, Italy, are working on the primary structure of the European Service Module that will carry astronauts in Orion beyond the Moon during EM-2. The European Space Agency (ESA) and its contractors are providing Orion's service module for its first two missions atop the Space Launch System rocket. NASA is working with domestic and international partners to solve the great challenges of deep space exploration.



Keith Williams, Orion's European Service Module avionics integration lead, recently spoke at the 11th annual European Space Agency Workshop on Avionics, Data, Control and Software Systems. He presented on how verification and validation is a fundamental process in the design and development process, Orion's progress, and the avionics integration and verification approach.



Nujoud Merancy, NASA engineer, recently spoke with students at Haller Middle School about the Orion spacecraft and its mission and her journey to NASA. She gave the students advice and suggestions on how they can achieve their goals, and answered their questions about spaceflight, and Orion.

# ORION TEAM INSPIRES GLOBALLY



Carlos Garcia-Galan, Orion Mission & Systems Integration lead, recently presented at the Internet of Things (IOT) Solutions World Congress in Barcelona, Spain. He shared with attendees information on NASA's human spaceflight exploration plans, including Orion's missions to deep space, and new technologies and IOT connections to future spaceflight.



Jessica Vos, Orion crew support equipment system manager, attended the Society of Women Engineers 2017 Annual Conference in Austin, Texas to share Orion's progress and talk about networking opportunities at NASA. Participants were able to meet with Jessica and other NASA leaders to learn more about the roles women play in future space flight and how they can get involved.



An Anaren team member demonstrating wire bonding during lab tour.

# ORION PROGRESS ON THE EAST COAST

Orion team members from NASA and Lockheed Martin visited suppliers in New York and Connecticut to meet employees working on Orion, give an update of Orion’s progress, and recognize those who were making an exceptional difference. The team visited Anaren in Syracuse, New York; Ensign-Bickford Aerospace & Defense in Simsbury, Connecticut and UTC Aerospace Systems in Windsor Locks, Connecticut. Anaren is developing custom hybrid microelectronics for the Orion spacecraft, Ensign-Bickford manufactures pieces that are integral to launch abort and mission safety for Orion, and UTC Aerospace Systems contributes to the Orion environmental control and life support systems.

More about visit to UTC Aerospace Systems: <http://bit.ly/FOXOrionCT>





Orion program representatives visited team members at Honeywell in Clearwater, Florida, to get updates on progress and recognize employees for their valued contributions in the development of avionics and guidance flight hardware in support of EM-1. The team delivered 45 flight hardware components in the last three months in support of Orion initial power on, including vehicle management computers, power and data unit cards, inertial measurement units, Global Positioning Satellite receivers, and a barometric altimeter. Honeywell has delivered over 90% of its EM-1 flight hardware to date.

NASA Langley's Orion team hosted Orion Program Manager Mark Kirasich and Deputy Program Manager Charlie Lundquist on October 17. The program leadership met with the Ascent Abort-2 team and saw crew module hardware. An All-Hands event was held for the Langley Orion team where leadership shared large-scale program updates and commended Langley team members for their contributions with notable work on the launch abort system, hatch acoustic testing, heat shield testing and other systems.

# POPULAR MECHANICS FEATURES ORION ENGINEER

Cody Kelly, Orion spacecraft's post-landing survival equipment subsystem manager, was featured in Popular Mechanics as a recipient of their Breakthrough Awards. As a young man growing up in the small, rural blue-collar town of Bandera, Texas, Kelly was an avid reader with an early passion for human spaceflight, particularly following the effort and energy of a dedicated NASA workforce returning to flight after the Space Shuttle Columbia tragedy. Kelly was only 15 years old, but that event sparked an interest in safety, prevention and helping people in need—and giving back to his community. Popular Mechanics editorial assistant, James Lynch, said they selected Cody not just for his many accomplishments in his early career, but also for his innovations that are helping to keep astronauts safe.

More about Cody: <https://go.nasa.gov/2i60hUN>



## THERE'S NO PLACE LIKE HOME: KANSAS STATE HELPS ASTRONAUTS RETURN TO EARTH

A mock space capsule has landed at Kansas State University. In this built-to-scale model of the Orion spacecraft, student “astronauts” practice emergency escape maneuvers while a university kinesiology team studies their health and fitness levels. The university research team — led by Carl Ade, assistant professor of exercise physiology, and Thomas Barstow, professor of exercise physiology — is using a NASA grant to tackle a major challenge for long-duration space missions: the return to Earth. The researchers are evaluating the strength, cardiovascular health and aerobic capacity which astronauts require for an end-of-mission landing or an emergency escape. “If we can figure out how to keep an astronaut healthy in this extreme environment, we can translate that to life on Earth,” Ade said. “This research is really helping both individuals: the astronaut and those here on Earth.”



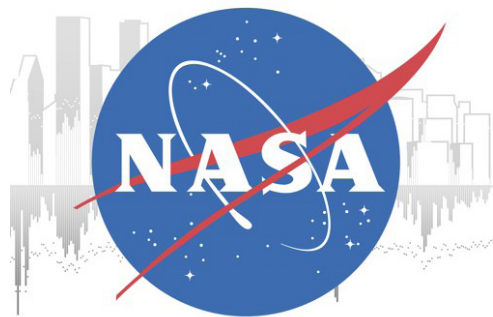


Supporting this effort is the Lockheed Martin Manufacturing & Engineering teams led by Mark McCloskey and Frank Middleton, respectively. Key NASA personnel include Butch Wilmore (NASA Astronaut), Jimmy Spivey (NASA Flight Operations Directorate, assistant director for Exploration Programs), Terri Ryan (NASA Engineering lead), Scott Belbin (NASA Mechanical Ground Systems Equipment lead), Matt Galeano (NASA Materials and Processing) and Kent Beringer (NASA Exploration Mission-2 Spacecraft Production lead).

# ASSEMBLING ORION TO PROTECT CREW

Just outside New Orleans on October 24, the EM-2 Crew Module Manufacturing Readiness Review was successfully completed at NASA's Michoud Assembly Facility (MAF). The Orion MAF team is responsible for the pressure vessel structure that will protect Orion's crew throughout missions into deep space. This extensive review is performed to ensure the Orion MAF team has the personnel, resources, equipment, tooling,

and flight hardware thoroughly prepared to execute from first-weld all the way through shipment to NASA's Kennedy Space Center for launch. The Orion MAF team has gone through this process for previous mission milestones such as the Ground Test Article development and Exploration Flight Test-1. They will continue to be a vital team during preparation for the first crewed launch of Orion, EM-2.



**HOUSTON** | WE HAVE A  
PODCAST

## HOUSTON WE HAVE A PODCAST

"Houston We Have a Podcast" is the official podcast of NASA's Johnson Space Center in Houston. Episode 17 features Nujoud Merancy, Mission Planning and Analysis lead for the Orion spacecraft. Merancy talks about Orion, how it will work, what kinds of tests are being done to prepare it for future missions, and where in space it will travel.

Listen Here: <http://go.nasa.gov/2iIjvYB>

# SUPPLIER SPOTLIGHT

## Avatar Machine



Avatar Machine, located in Fountain Valley, California, is a family-owned machine shop providing precision machining services to the aerospace industry since 2008. Avatar's 23 employees are cross-trained in a variety of capacities to be able to work projects for several clients, including parts for Orion. Currently, Avatar is manufacturing eight backbone panels for the Orion EM-2 spacecraft and has already delivered six of them. Employees take pride in their final projects and are excited that their contributions are helping to support future deep space exploration.

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

NASA's Orion Blog . . . . . [Blogs.NASA.gov/Orion](http://Blogs.NASA.gov/Orion)  
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## **NOVEMBER**

Orion EM-1 Update  
Ascent Abort-2 Flight Test Update  
Orion Life Raft / Survival Equipment Evaluations  
Turin, Italy ESA / Airbus Event