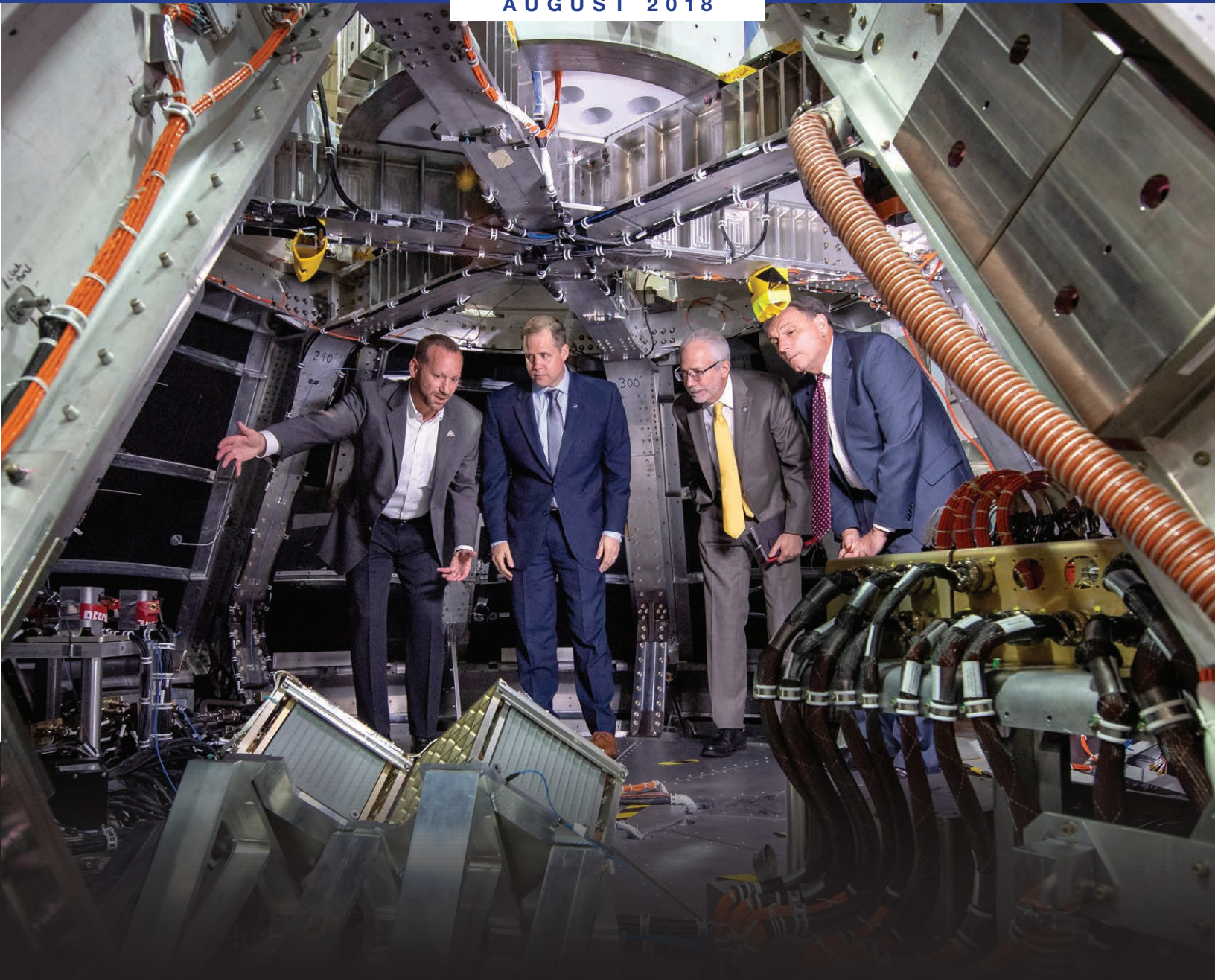


ORION



AUGUST 2018



Orion, Meet Bridenstine

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NASA Administrator Jim Bridenstine made his way around different NASA centers across the U.S. to meet employees and learn more about how each center specifically supports NASA's missions. Throughout his visits, Bridenstine saw Orion progress in the making toward NASA's missions to the Moon and Mars.

While at NASA's Johnson Space Center in Houston, Bridenstine stepped inside the Orion crew module mockup where astronauts train and engineers are working to evaluate many of the systems and hardware needed to visit the Moon. Bridenstine also learned more about the Orion crew module that will be used during the Ascent Abort-2 (AA-2) flight test taking place in April 2019. Orion AA-2 Crew Module Manager Dr. Jon Olansen, NASA Johnson Space Center Director Mark Geyer, and Orion Program Manager Mark Kirasich showed Bridenstine the inside of the AA-2 Orion module as it was being prepared for its move to NASA Glenn Research Center's Plum Brook Station in Ohio for the next stage of acoustic testing needed to verify the vehicle for the flight test.

Next on the tour, Bridenstine saw the work being done on Orion and the Space Launch System rocket at NASA's Michoud Assembly Facility in New Orleans. While there, he

viewed progress for Orion's first mission with astronauts, the completion of the primary structure of the Exploration Mission-2 (EM-2) crew module, also known as the pressure vessel. The pressure vessel holds the pressurized atmosphere astronauts will breathe to allow them to work in the harsh environment of deep space. It will carry the first astronauts to missions beyond the Moon on EM-2.

During his first official visit to NASA's Kennedy Space Center in Florida, Bridenstine got an up-close look at all the new facility upgrades as well as the preparation work underway for Exploration Mission-1. He met with the Orion team in the high bay of the Neil Armstrong Operations and Checkout Building and with the Exploration Ground Systems team at various locations: the Vehicle Assembly Building, the mobile launcher, the Young-Crippen Firing Room and at Launch Pad 39B.

Bridenstine then returned to Johnson at the end of August to introduce Vice President Mike Pence as he discussed the White House's support of NASA and plans for the future of America's space exploration endeavors.

Read more: bit.ly/VPjscAug18 and bit.ly/JBhtxrole

TO THE MOON, CREW!

With the arrival of the Orion pressure vessel for Exploration Mission-2 that will carry astronauts beyond the Moon atop the Space Launch System (SLS) rocket, it's almost a packed house in the Neil Armstrong Operations and Checkout Building high bay at NASA's Kennedy Space Center in Florida. The pressure vessel arrived on a super-wide transport truck at the center on August 24 and joined the Orion Exploration Mission-1 crew module in the high bay where technicians recently secured the heat shield to the bottom of the spacecraft.

The main structure of the pressure vessel consists of seven large aluminum pieces that are welded together to produce a strong yet light-weight, air-tight capsule. The pieces were joined at NASA's Michoud Assembly Facility in New Orleans using a state-of-the-art process called friction-stir welding, which produces incredibly strong bonds by transforming

metals from a solid into a plastic-like state, and then using a rotating pin tool to soften, stir and forge a bond between two metal components to form a uniform welded joint, a vital requirement of next-generation spacecraft.

The pressure vessel was loaded into the Crew Module Transportation Fixture and then lowered onto a heavy equipment semi-trailer for the nearly 700-mile journey over land to Kennedy. Efforts will now begin to prepare the pressure vessel for Orion's first crewed space flight. Initially, the crew module will be secured into a precision alignment tool and Lockheed Martin technicians will begin the work to attach the main structural components to the exterior of the module. These critical parts, made of aluminum and titanium, will provide structural strength to the pressure vessel and give the spacecraft its conical shape.



In recognition of the EM-2 crew module completion, NASA Orion Program Manager Mark Kirasich and Lockheed Martin Vice President and Orion Program Manager Mike Hawes presented deserving team members at Michoud with commendations to recognize them for their hard work and success. This included the Production Operations Team (Anna Malachias, Glen Sigur, Jerome Rownd, Mike Moreau, Jason Mouton, Mitch Boss, Tequicha Evans, Dean Frechette, and Matt Brady), the Weld Team (Ray Zibilich, Troy Alexander, Josh Fineout, Tom Kilroy, Justin Polk, and Christopher Lacoste), and the following individuals; Celia Blum, Roger Brown, Jose Bueiz, Ryan Dardar, Larry Dickson, Norman Elfer, Matt Jackson, Craig Jenkins, Tom Kilroy, Michael LeBlanc, Bruce Maquar, Frank Middleton, Vince Morales, Joseph Murphy, Troy Ohlsen, Peter Rivera, Jonathan Sonnes, Ralph Tortorich Jr., and Dave Windham.

AA-2 PRE-FLIGHT PREP WORK UNDERWAY



The Ascent Abort-2 (AA-2) Orion crew module arrived at NASA Glenn Research Center's Plum Brook Station in Sandusky, Ohio, to undergo acoustic testing. The testing will characterize how the structure will respond to the abort environment during flight. While the crew module is at Plum Brook Station, a separation ring that will connect the capsule to its booster will arrive at NASA's Johnson Space Center to be outfitted with harnesses and other necessary elements. The crew module will then return to Johnson in September and be mated with the separation ring before the two elements are then tested together and shipped to Kennedy Space Center.

The AA-2 abort test booster pathfinder stacking operations are also ongoing at Space Launch Complex 46 on Cape Canaveral Air Force Station in Florida. This dry run for pad stacking operations will verify that the mechanical components of the test booster can be assembled, handled and lifted at the launch pad and integration facility. This is also to check the length of harnesses and ducts inside the aeroshell tiers. The aeroshells, which simulate the outer diameter of the service module, cover the entire length of the abort test booster. The AA-2 flight test will verify that the Launch Abort System (LAS) can steer the Orion crew module, and future astronauts aboard, to safety in the event of a life-threatening incident shortly after liftoff. During

the test, a booster, carrying a fully functional LAS and a 22,000-pound Orion test vehicle, will launch to an altitude of 31,000 feet, traveling at more than 1,000 mph.

Read more about the AA-2 crew module testing at Plum Brook: on.wkyc.com/2oNeDtq



SUCCESSFUL TEST PROVES IMPORTANT STEP TO SAFEGUARD ASTRONAUTS

NASA successfully tested the approach to collect and retrieve valuable data in support of an upcoming test of the abort system for the agency's Orion spacecraft. Engineers developed ejectable data recorders that will collect data during the AA-2 flight test, which is meant to evaluate Orion's ability to get astronauts safely away from the rocket if there is a problem during their climb to space. By ejecting the recorders before the Orion test article hits the water, the team can quickly and efficiently recover the recorders for faster access to the data without having to recover the spacecraft and extract the recorders.

During a recent drop test, the recorders were released from a helicopter 5,000 feet in the air and splashed into the Atlantic Ocean off the coast of NASA's Kennedy Space Center. The floating devices were then located through beacons transmitting GPS coordinates and scooped up with fishing nets by NASA personnel operating marine boats.

Learn More: [go.nasa.gov/2M8bQnl](https://www.nasa.gov/2M8bQnl)



TESTING VERIFIES COMMUNICATIONS FOR ORION MISSIONS BEYOND THE MOON



Engineers recently completed a series of tests of the Orion communications system to ensure the spacecraft and mission controllers in Houston can flawlessly communicate through NASA's satellite networks in space and on the ground when Orion and its crew are far from Earth on missions to the Moon and beyond.

The most recent evaluations in the series, known as SpaceCom, took place in mid-August and involved testing between a lab at Orion prime contractor Lockheed Martin's facility near Denver that replicates Orion's computer, wiring and avionics systems configurations, and NASA's Mission Control Center in Houston. Spacecraft telemetry, files, commands and video were sent and received through the Deep Space Network (DSN) to and from mission control.

The DSN is typically used for communications with deep space robotic spacecraft but has not been used for human spaceflight missions since the Space Shuttle Program.

The testing included communications during Exploration Mission-1 scenarios such as from the pre-launch countdown through the point at which Orion data is relayed through the DSN, operations in lunar orbit, handover between the DSN and the Space Network during Orion's trajectory from the Moon back toward Earth, and post-splashdown operations. Previous testing as part of the SpaceCom series also verified communications through the Space Network satellites and Near Earth Network ground station at Cape Canaveral. Personnel at the Huntsville Operations Support Center at NASA's Marshall Space Flight Center in Alabama also supported the tests to verify they can receive data from the Space Launch System rocket. The testing marked a busy time for communications tests for deep space human exploration missions. Engineers at the SLS Engineering Support Center at Marshall recently concluded voice tests to ensure teams across the country such as flight controllers in Houston, launch controllers in Florida and engineer teams at several locations including in Huntsville can communicate by voice.

The testing was the final checkout of communications between Orion and NASA's networks before testing with the vehicle for EM-1 is conducted in the fall at the agency's Kennedy Space Center in Florida.

ORION TEAM BREEZES THROUGH THE WINDY CITY



Orion team members visited Chicago to meet with local suppliers, conducted a panel at The Adler Planetarium and participate in the annual Chicago Air & Water Show.

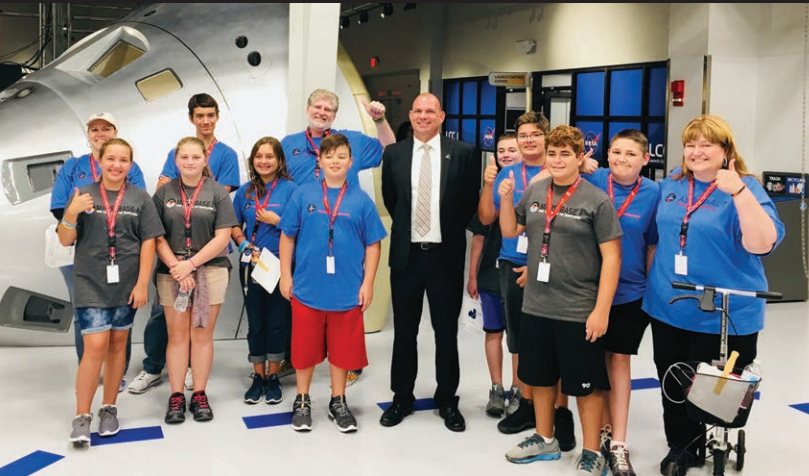
The Adler After Dark August 16 event was themed “Xtreme Camping” and Orion fit right in. Lockheed Martin Deputy Program Manager Larry Price, NASA Space Launch System (SLS) Dry Structures Spacecraft Test Article Test Lead Heather Haney, Aerojet Rocketdyne Executive Director for Space Joe Cassady and NASA Exploration Ground Systems (EGS) Project Activist and Support Branch Chief Mary Hanna spoke to a packed house during a panel led by NASA SLS Strategic Communications Manager Marica Lindstrom. During the panel, they spoke about the progress being made to get humans into deep space, to camp as no one has before. Following their panel, Northrop Grumman Vice President of NASA Exploration Programs and former

Astronaut Brian Duffy spoke about his experiences in space during his missions aboard the space shuttle and International Space Station.

The team then met with Chicago area suppliers to provide them with updates on the Orion, EGS and SLS programs, and to spark conversations on future needs and innovative solutions for deep space exploration missions. The suppliers that attended were a testament to the fact that that Orion, SLS and EGS systems are being built around the country by America’s skilled engineering and manufacturing workforce.

Some of the team also took part in the annual Chicago Air & Water Show to share the excitement of space exploration with students, military and families who wanted to learn more about how NASA will get humans to the Moon and Mars and how they can play a part in future space exploration.

NEW KSC ASTRONAUT TRAINING EXPERIENCE IS OUT OF THIS WORLD!



Florida students and teachers from local middle schools joined Lockheed Martin, Delaware North and NASA officials for the the grand opening of the Astronaut Training Experience (ATX) at the Kennedy Space Center Visitor Complex in August. ATX uses immersive simulation technology to transport participants to Mars, train them to live and work in the harshest environments and teach them what it's like to travel to the Red Planet. Over lunch, Lockheed Martin engineers participated in a meet-and-greet with the students and teachers, where they shared their own educational and professional backgrounds and answered questions.

Learn more: bit.ly/ATXopenKSCVC

SCOUTS COMPLETE FIRST VIRTUAL REALITY MERIT BADGE WITH ORION



Orion virtual reality (VR) software provided by Lockheed Martin was featured in launching the Boy Scouts of America's new Virtual Reality merit badge experience. This took place at a gathering of 6,000 youth from across the United States at the National Order of the Arrow Conference at Indiana University on August 3. The Mission: Mars VR Experience used Future Flight Mars VR to send Scouts on a flight aboard Orion to Mars as part of an initiative to integrate Augmented Reality and VR to enhance Scouting's achievement programs. Over 500 Scouts participated in the journey, many of whom experienced VR for the first time.

ORION'S SURVIVAL KIT FOR DEEP SPACE

When a spacecraft built for humans ventures into deep space, it requires an array of technical features to keep it and a crew inside safe. Both distance and duration demand that spacecraft must have systems that can reliably operate far from home, be capable of keeping astronauts alive in case of emergencies and still be light enough that a rocket can launch it. Since spacecraft will encounter more radiation, less communication, and have longer to travel to return home than spacecraft headed to Low Earth Orbit and the International Space Station, new technology is essential for Orion to carry crew safely into deep space.

To accomplish this feat, Orion has built-in technologies that enable the crew and spacecraft to explore far into the solar system. This includes systems to live and breathe, proper propulsion, the ability to hold off the heat, radiation protection, and constant communication and navigation.

Learn more about these five essential technologies: go.nasa.gov/2NWu1yn

SUPPLIER SPOTLIGHT

TAYLOR DEVICES, INC.



Taylor Devices, Inc. (TDI), a small business located in North Tonawanda, New York, provides the Orion program with hardware that protects the Orion crew module against the rigorous shock and vibration that is present during launch and flight. Taylor also provides shock absorption hardware pieces used in the Space Launch System rocket and Orion's Launch Abort System, ensuring that from top to bottom NASA's new exploration systems are ready to withstand the effects of a blast off into deep space.

Founded in 1955, the TDI team has built hardware for all of NASA's human space flight programs, including the

Apollo, Space Shuttle, and Commercial Crew Programs. Developed initially for NASA, TDI has converted their rocket science innovations into large seismic dampers which are helping to save lives by improving structures to withstand earthquakes here on Earth. Throughout their 63-year history, TDI employees have taken pride engaging in the challenging development of new products for NASA, enabling humans to explore farther into deep space than they have ever been before.

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NASA'S NEW SPACECRAFT
FOR HUMAN EXPLORATION:

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SEPTEMBER 2018

Orion's Parachutes Qualified for Human Space Flight
Jettison Motor Gets Qualified for Flight
NASA Turns 60