

ORION



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Success! Final Orion Airdrop Test Complete

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The Navy Helicopter Sea Combat Squadron #23 from North Island Naval Air Station located on Coronado Island, California participated in the test and will be the helicopter squadron providing the helicopters that cover the descent and landing phase for EM-1, with their primary objective of collecting engineering quality imagery in support of meeting the flight test objectives. This drop test was an opportunity to train the imagery personnel as well as to perform an in-flight functional test of the newly installed NASA provided and operated gyro stabilized system externally mounted 8K video camera.

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Over the course of eight qualification tests at the U.S. Army's Yuma Proving Ground in Arizona, engineers have evaluated the performance of Orion's parachute system during normal landing sequences as well as several failure scenarios and a variety of potential aerodynamic conditions to ensure astronauts can return safely from deep space missions.

The system has 11 parachutes, a series of cannon-like mortars, pyrotechnic bolt cutters, and more than 30 miles of

Kevlar lines attaching the top of the spacecraft to the 36,000 square feet of parachute canopy material. In about 10 minutes of descent through Earth's atmosphere, everything must deploy in precise sequence to slow Orion and its crew from about 300 mph to a relatively gentle 20 mph for splashdown in the Pacific Ocean.

The parachute system is the only system that must assemble itself in mid-air and must be able to keep the crew safe in several failure scenarios, such as mortar failures that prevent a single parachute type to deploy, or conditions that cause some of the parachute textile components to fail.

During the final test, which took place Sept. 12, a mock Orion was pulled out from the cargo bay of a C-17 aircraft



flying higher than 6.5 miles. The protective ring around the top of Orion that covers the parachute system was jettisoned and pulled away by the first set of Orion's parachutes, then the remaining parachutes were deployed in precise sequence.

Additionally, Orion parachute engineers have also provided considerable insight and data to NASA's Commercial Crew Program partners. The knowledge gained through the Orion program has enabled NASA to mature computer modeling of how the system works in various scenarios and help partner companies understand certain elements of parachute systems. In some cases, NASA's work has provided enough information for the partners to reduce the need for some developmental parachute tests, and the associated expenses.

Orion will first fly with astronauts aboard during Exploration Mission-2, a mission that will venture near the Moon and farther from Earth than ever before, launching atop NASA's Space Launch System rocket—which will be the world's most powerful rocket. The parachutes for Orion's upcoming uncrewed flight test, Exploration Mission-1, already are installed on the vehicle at Kennedy Space Center in Florida.

View the full test here: bit.ly/OrionDropTestFBLive

FASTER THAN A SPEEDING ROCKET

In this episode of *Houston, We Have A Podcast*, Jon Olansen and Jenny Devolites discuss the critical Ascent Abort-2 test of Orion's launch abort system, which is designed to activate within milliseconds if a failure occurs while the Space Launch System (SLS) rocket is ascending into orbit. Essentially, it has to propel the crew module away at a rate faster than the rocket's ascent speed. The Orion AA-2 crew module and AA-2 launch abort vehicle are set to test the launch abort system and verify its functions for all future Orion and SLS flights that will take astronauts on deep-space missions.

Listen to the podcast: go.nasa.gov/2S9l0Du



AA-2: STACKED AND ON TRACK!



In just a few months, the Ascent Abort-2 (AA-2) flight test team will verify that Orion's Launch Abort System can quickly propel the crew to safety in the event of an issue with the Space Launch System during a future launch. The system's abort and jettison motors are now in the Launch Abort System Facility at NASA's Kennedy Space Center in Florida, and are joined by the metallic motor adapter truss assembly recently shipped over from NASA's Michoud Assembly Facility in Louisiana. The crew module will soon be sent from Houston to start the vehicle integration process.

The AA-2 crew module successfully completed acoustic testing at NASA Glenn Research Center's Plum Brook Station in Sandusky, Ohio, and has returned to NASA's Johnson Space Center in Houston to be connected to

the separation ring. This ring relies on four bolts that are connected to the computers within the crew module, which will indicate when they need to release and let the capsule fall back to the ocean after the capsule has been successfully pulled to a safe distance away from the Space Launch System during an emergency. Once the separation ring and crew module are connected, they will go through testing to make sure that everything is working correctly before being transported to Kennedy. Once there, all elements will be integrated and readied for the official AA-2 flight test next spring.

Read more about AA-2 Crew Module's return to Houston: bit.ly/HChronSeptAA2

ORION'S EM-1 SERVICE MODULE INTEGRATION COMPLETED



During September at the Airbus integration hall in Bremen, Germany, technicians installed the last radiator on the European Service Module for NASA's Orion spacecraft, marking the module's finished integration.

ESA's European Service Module will provide power, water, air and electricity to NASA's Orion spacecraft. The service module is now complete for Orion's first mission, Exploration Mission-1, that will do a lunar fly-by without astronauts to demonstrate the spacecraft's capabilities.

Much like closing the bonnet on a car, with the radiators in place technicians can no longer access the inside of the service module, symbolically ending the assembly and integration of the module.

Technicians worked 24 hours a day in three shifts to complete the service module's assembly and the last stages of its extensive testing. Engineers put the module through its paces with functional tests that included checking the newly installed radiators and testing the propulsion system with its intricate pipelines that deliver fuel and oxidizer to the spacecraft's 33 engines.

The service module will soon be packed and flown to NASA's Kennedy Space Center in Florida. Orion's solar wings will be shipped separately, also from Bremen. At Kennedy, the module will be stacked together with Orion's crew module and crew module adapter.

More tests await the Orion spacecraft at NASA Glenn Research Center's Plum Brook Station in Sandusky, Ohio, where it will be put in the world's largest vacuum chamber to simulate spaceflight as well as being subjected to acoustic tests to simulate the intense vibrations Orion will endure when launched on the world's largest rocket, the Space Launch System.

Meanwhile, technicians in Bremen are not resting as work on the second European Service Module for Exploration Mission-2 is already well under way. The structure is complete and over 11 kilometers of cables are being meticulously placed in preparation for the computers and equipment that will keep astronauts alive and well for Orion's first crewed mission.

IVANKA TRUMP STEPS INTO ORION



During a visit to NASA's Johnson Space Center in Houston, Advisor to the President Ivanka Trump was joined by NASA Administrator Jim Bridenstine to receive a briefing on the Orion spacecraft that is preparing to launch humans further into space than ever before. As home of the Orion program,

Johnson has an integral role in the design, development and testing of Orion and its launch abort system that will make Orion the safest human spacecraft ever built. Pictured above from left to right are NASA Astronaut Nicole Mann, Trump, and Orion Crew & Service Module Manager Lara Kearney.



ORION SUITS TAKE A SLED RIDE

The Orion team completed one week of suited Anthropomorphic Test Device (ATD) sled testing at the Wright Patterson Air Force Base in Ohio. Specific suit design prototypes evaluated included the helmet support assembly, foot restraint clips, and communication cap. Acceleration impulses and seat orientations were selected to represent Orion water landings and abort scenarios that are considered to have the highest risk for crew injury. These tests provided information on how the seats in Orion and prototype suits react to the different possible situations of landing, ensuring that when astronauts do return from Exploration Mission-2, they will arrive home safely.

NASA SHINES AT DIAMOND ANNIVERSARY EVENTS



NASA's future still shines bright as the agency turns 60 and reflects on its past accomplishments while looking forward to its future endeavors to further advance our nation's aeronautics and space exploration pursuits.

NASA held Space Flight Awareness honoree events in Washington, D.C., Sept. 18-20, to honor more than 120 employees from all NASA centers and many of their industry teammates. The special event included an awards

ceremony, tours of Goddard Space Flight Center and the Steven F. Udvar Hazy Center Air & Space Museum, and a celebration of NASA's 60th Anniversary with a reception at the Ronald Reagan Building.

NASA Astronauts Randy Bresnik, Jeanette Epps and Shannon Miller attended to recognize and congratulate all the honorees for their outstanding achievements. Several Orion team members were among the honorees.

SUPPLIER SPOTLIGHT

MRI TECHNOLOGIES, INC.



MRI engineers work with the Orion crew module adapter in NASA Kennedy's Operations & Checkout Building.

MRI Technologies, Inc. (MRI) is a woman-owned small business located in Houston, Texas, and Littleton, Colorado that specializes in engineering, planning and integration. Nineteen of their 115 employees work directly for the Orion program to provide engineering support for hardware and engineering life cycle support across the program. One specific example of their contributions to the program hardware includes their work on the Orion crew module adapter which serves as the connection between the crew module and service module during flight. MRI's life cycle support includes the capture and management of technical data as the data evolves through the life cycle of the Orion program, including requirements, drawings, and design decision packages. Before Orion, MRI had experience supporting the Space Shuttle, International Space Station, and extravehicular space suit programs along with a variety of satellite and science programs. Along with being purposeful about the work they provide for the Orion program, MRI maintains a strong presence in the communities they serve

by supporting educational organizations, local families, individuals and seniors in need.



MRI employees volunteering for cleanup duty in a neighborhood impacted by Hurricane Harvey.

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NASA'S NEW SPACECRAFT
FOR HUMAN EXPLORATION:

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OCTOBER 2018

Launch Abort System QM-1 Jettison Motor Test Orion

Project Mars Winners Debut with First Man

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