

ORION



JUNE-JULY 2019



Ascent to Artemis

Orion Prepares for Flight

'SPECTACULAR!' AA-2 PROVES IT CAN SAVE CREW



The Ascent Abort-2 flight test of Orion's launch abort system (LAS) lifted off from Cape Canaveral Air Force Station on Tuesday, July 2, and successfully demonstrated that it can out run a speeding rocket and pull astronauts to safety in the event of an emergency during ascent to orbit. During the three-minute, 13-second flight, a test version of the Orion crew module launched at 7 a.m. EDT from Space Launch Complex 46 on a modified Peacekeeper missile procured through the U.S. Air Force and built by Northrop Grumman.

The Orion test spacecraft traveled to an altitude of about six miles, at which point it experienced high-stress aerodynamic conditions expected during ascent. The abort sequence triggered and, within milliseconds, the abort motor fired to pull the crew module away from the rocket.

Its attitude control motor flipped the capsule end-over-end to properly orient it, and then the jettison motor fired,

releasing the crew module for splashdown in the Atlantic Ocean. Abort was initiated with the test spacecraft traveling at about 760 mph. Maximum speed was about 1,000 mph, and peak altitude was hit at just under 44,000 feet.

The 12 ejectable data recorders, which were ejected in pairs about 20 seconds after jettison, were recovered from the ocean approximately an hour later. The data recorders are a backup communication system. Each recorder features a beacon and transmitter to assist boats in retrieval. Analysis of the information will provide insight into the abort system's performance.

The test is another milestone in the agency's preparation for Artemis missions to the Moon that will lead to astronaut missions to Mars.

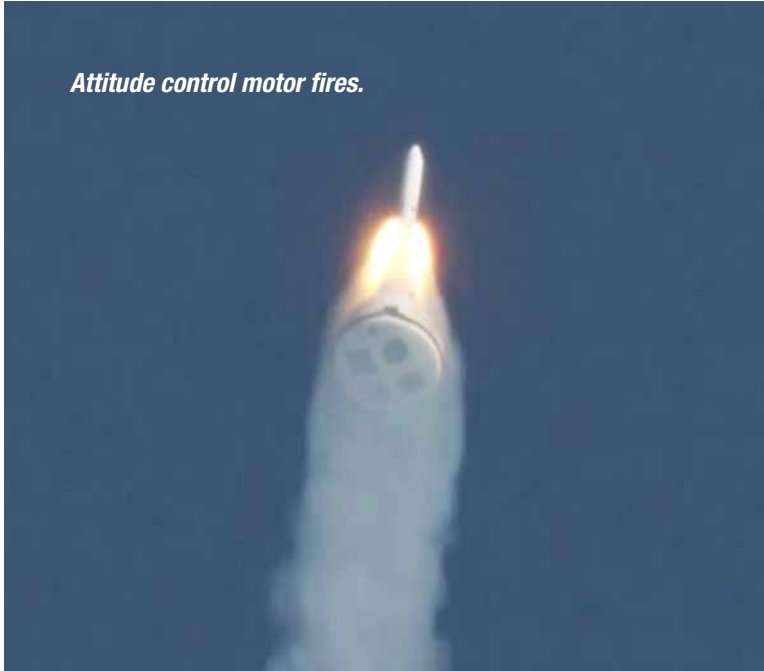
LAS in ascent prior to abort sequence initiation.



Abort motor fires, pulling crew module away from the launch vehicle.



Attitude control motor fires.



Attitude control motor reorients the LAS to safely separate from the crew module.



Jettison motor fires, separating the LAS from the crew module.



The crew module sized and weighted to represent Orion makes its decent after a successful test.





Crowds gather to watch the Ascent Abort-2 launch.



Orion program managers Mark Kirasich (NASA) and Mike Hawes (Lockheed Martin) monitor flight test progress from Hangar AE during Ascent Abort-2.



The Orion Ascent Abort-2 test team was all smiles in Hangar AE following the successful flight test.



Ascent Abort-2 test conductor Jennifer Devolites in Hangar AE at Cape Canaveral Air Force Station.



Orion team members celebrate a successful flight test.

VP UNVEILS MOON BOUND ORION ON MOON LANDING ANNIVERSARY



Vice President Mike Pence visited the Neil Armstrong Operations and Checkout Building at NASA's Kennedy Space Center in Florida on July 20 to commemorate the 50th anniversary of the agency's Apollo 11 Moon landing and announce to America the completion of NASA's Orion crew capsule for the first Artemis lunar mission.

He was joined on stage by Florida Governor Ron DeSantis, NASA Administrator Jim Bridenstine, Apollo 11 Lunar Module Pilot Buzz Aldrin, Kennedy Center Director Robert Cabana, Lockheed Martin Chairman, President and Chief Executive Officer Marilyn Hewson, and Rick Armstrong, son of Apollo 11 Commander Neil Armstrong. Before going to the Operations and Checkout Building, the Vice

President, Aldrin and Armstrong visited Kennedy's historic launch pad, 39A, where the Apollo 11 mission lifted off.

NASA's goal 50 years ago was to prove the agency could land humans on the Moon and return them safely to Earth. The goal now is to return to the Moon in a sustainable way to prepare for sending astronauts to Mars.

Artemis 1 will launch NASA's Orion spacecraft and Space Launch System (SLS) rocket around the Moon to test the system and pave the way for landing the first woman and the next man on the Moon in five years, as well as future missions to Mars.



Engineers recently completed building and outfitting the Orion crew module at Kennedy. The underlying structure of the crew module, known as the pressure vessel, was manufactured at NASA's Michoud Assembly Facility in New Orleans and shipped to Kennedy, where teams have integrated thousands of parts into the crew module and conducted tests to certify all of its systems for flight.

Orion's European Service Module, which will provide the power and propulsion for Orion during the mission, also is complete. Contributed by ESA (European Space Agency), the service module was manufactured by Airbus in Bremen, Germany, and shipped to Kennedy in November 2018 for final assembly and integration. Engineers have begun operations to join the crew module to the service

module, and teams are connecting power and fluid lines to complete hardware attachment.

Once the two modules are joined, engineers will prepare it for a flight inside the agency's Super Guppy aircraft to NASA's Plum Brook Station in Sandusky, Ohio. Testing at Plum Brook will ensure the joined modules can withstand the deep space environment.

When testing in Ohio is complete, the spacecraft will return to Kennedy for final processing and inspections. Teams then will fuel the spacecraft and transport it to Kennedy's iconic Vehicle Assembly Building for integration with the SLS rocket before it is rolled out to Launch Pad 39B for the launch of Artemis 1.

U.S. SECRETARY OF EDUCATION TOURS JSC

U.S. Secretary of Education Betsy DeVos made a trip to Texas on June 5 to tour NASA's Johnson Space Center and visit with astronauts, engineers and subject matter experts. DeVos toured the Orion mockup where she learned more about the spacecraft and its purpose to travel to deep space, including the Moon and beyond. She also visited mission control, where she had the opportunity to call directly to the International Space Station and speak with astronauts onboard. At the conclusion of her tour, DeVos met with a group of interns and discussed their tasks for the summer.

U.S. Secretary of Education, Betsy DeVos, stops inside the Orion mockup on her tour.



NEW MOTORS ARRIVE FOR ARTEMIS 1 MISSION



The launch abort motor (pictured here) and jettison motor, two of three motors that are key elements of Orion's launch abort system (LAS), arrived in June at NASA's Kennedy Space Center for final assembly, testing and integration for the Artemis 1 mission to the Moon. Each motor has a specific role in ensuring crew module safety. The goal of the LAS is to safely pull the crew module from the launch vehicle in the event of an emergency during ascent. The system itself can move at transonic speeds that are nearly three times faster than the top speed of a fast sports car.

The abort motor, manufactured by Northrop Grumman, is identical to the motor that initiated the successful Ascent Abort-2 flight test on July 2.

The jettison motor, built by Aerojet Rocketdyne, is located on the tower of the LAS. It will fire to separate the crew

module from the LAS if there is a problem during launch, followed by parachute deployment for a safe landing. During a normal launch, the jettison motor will fire to separate the LAS from the crew module so the spacecraft can continue its mission to deep space.

Both of these new motors will be incorporated into the spacecraft for the Artemis missions. The Artemis 1 mission's uncrewed Orion will launch atop the Space Launch System rocket from Launch Pad 39B at Kennedy. Orion will embark on an approximately three-week mission that will take the spacecraft thousands of miles past the Moon. Orion will return to Earth and splashdown in the Pacific Ocean off the coast of California, where it will be retrieved and returned to Kennedy.

ARTEMIS 2 HEAT SHIELD LANDS AT KENNEDY



The world's largest heat shield structure arrived at NASA's Kennedy Space Center on July 11 for assembly and integration onto the Orion crew module for the Artemis 2 mission. Measuring about 16 feet in diameter, the heat shield provides critical protection for the crew upon re-entry into Earth's atmosphere and during splashdown. Artemis 2 will be NASA's first crewed flight in the series of missions to the Moon and on to Mars, and will verify that the spacecraft's systems operate as designed in the harsh environments of deep space.

The large piece of flight hardware arrived from Lockheed Martin's manufacturing facility near Denver aboard the NASA Super Guppy aircraft and was transported to the Neil Armstrong Operations and Checkout Building high bay at Kennedy. Currently, the heat shield is a base titanium truss structure, or skeleton. Over the next several months, technicians will apply Avcoat, an ablative material that provides thermal protection.

FLIGHT CONTROL 'FEELS THE BURN'

In mission control at NASA's Johnson Space Center in Houston, flight controllers simulated part of Orion's uncrewed flight to the Moon for Artemis 1. The team executed an outbound trajectory correction, a maneuver that will be needed to make sure Orion is on the right path after the Space Launch System performs the trans-lunar injection burn that sends the spacecraft out of Earth orbit and toward the Moon. As Orion travels toward the Moon over the course of several days, flight controllers will command Orion from the ground six times to correct its trajectory to ensure the spacecraft can fly by the Moon at the correct time and place. The flight control team is preparing for Artemis missions by refining and practicing procedures they will use on the ground to command and control Orion on its missions to the Moon.



SUPPLIER SPOTLIGHT

UNLV HOWARD R. HUGHES COLLEGE OF ENGINEERING

Located in Las Vegas, Nevada, the Howard R. Hughes College of Engineering is a minority serving institution that works with many industry partners to develop new and innovative technologies in the areas of renewable energy, water resources and reuse, transportation, national security, big data, and nuclear energy. UNLV's College of Engineering has partnered with Lockheed Martin to give students an opportunity to provide engineering services to the Orion program.

Graduate and undergraduate students have assisted with machining and performing the specimen, bonding and mechanical testing for materials aboard the Orion spacecraft. Students work as part of the Orion Process Coupon Testing, which involves the specimens for Artemis 1 and Artemis 2 missions. The key to all of the Orion projects that UNLV is engaged in is quality assurance for flight crew and spacecraft safety.

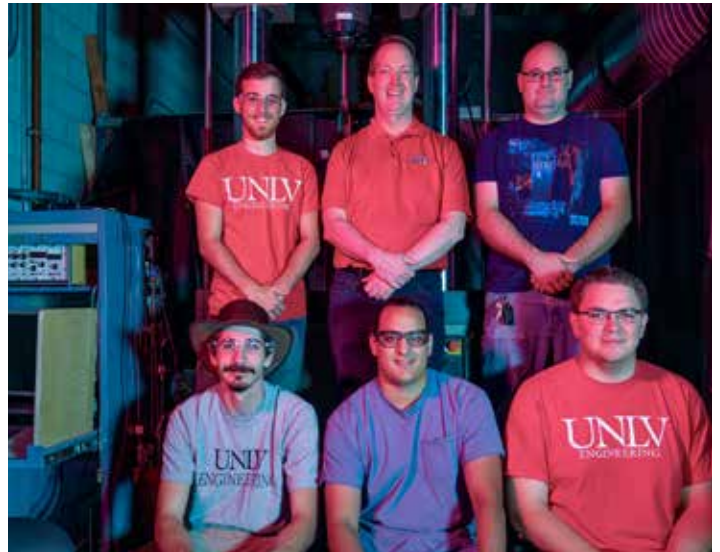
UNLV is supporting Orion in the development of 3D printed assembly tools. Currently, the UNLV team is working to develop an optimized 3D printed alternative to a more traditional machined drill plate to reduce the cost and production time of producing the plates.

For UNLV, working with Lockheed Martin on the Orion program provides unique opportunities for the College's faculty and students to enhance their knowledge as well as research capabilities in exciting new areas. They have an opportunity to accelerate the efforts on research activities across the space program.

UNLV has worked and participated in two previous NASA programs. In 2015, UNLV entered the NASA Mentor-Protégé Program with Teledyne Brown Engineering.

UNLV students participated in developing multimedia training for International Space Station payload ground support personnel and payload developers. The collaboration was recognized by NASA's Office of Small Business Programs and selected as the 2016 Mentor-Protégé Agreement of the Year. Students and professors of the College of Engineering also participated in NASA's Eclipse Balloon Project in 2017.

The UNLV students appreciate engaging in meaningful, hands-on work that is directly applicable to such an important project. The College's student interest has increased in the aerospace industry and the manufacturing and design process-- both of which are addressed through work on the Orion program.



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WHAT IS ARTEMIS?

Learn about Artemis, the namesake for Orion's flights that will push the boundaries of human exploration forward to the Moon.

Read here: <https://go.nasa.gov/2HOMOeG>