

# ORION



MARCH 2019



## Liftoff to Splashdown: Orion is Safe

Two key tests in March helped ensure NASA's Orion spacecraft is safe from liftoff to splashdown for missions to the Moon.

# LIFTOFF TO SPLASHDOWN: ORION IS SAFE



Engineers completed two key tests the week of March 18 to help ensure NASA's Orion spacecraft is ready from liftoff to splashdown for missions to the Moon. Teams successfully tested one of the motors on Orion's Launch Abort System responsible for taking the crew to safety in an emergency during launch, and completed testing at sea for the qualification of the system used to upright Orion after it lands in the ocean.

At its facility in Elkton, Maryland, Northrop Grumman hot fired a motor for Orion's launch abort system. The attitude control motor is responsible for orienting the crew module for landing in the event that Orion's ride to space experiences a failure during launch or ascent. The motor is essential because it helps stabilize Orion and control its trajectory as it moves away from the rocket. During the 30-second test, the motor produced more than 7,000

pounds of thrust from eight valves. This test was the first in a series of evaluations aimed at qualifying the attitude control motor for crewed missions.

Orion's launch abort system is positioned on top of the crew module and is designed to protect astronauts during their trip to space. It can activate within milliseconds to pull the crew module to safety if needed. It consists of three solid rocket motors: the abort motor that pulls the crew module away from a rocket, the attitude control motor that can steer Orion in any direction upon command, and the jettison motor that ignites to separate the launch abort system from the spacecraft so that Orion is free to deploy its parachutes to assist with landing.

Ensuring crew safety continues throughout the mission, including systems used to assist with returning astronauts

to land. Off the coast of Atlantic Beach, North Carolina, engineers tested the crew module uprighting system (CMUS) to ensure the capsule can be oriented right-side up once it returns from its deep space missions.

When Orion splashes down in the ocean, it can settle in one of two positions. In the most ideal scenario, the capsule is oriented with the heat shield in the water and its windows and hatches out of the water. The crew module also could land with the top submerged in the water, and the heat shield facing the sky. The CMUS deploys a series of five, bright orange airbags to flip the capsule right side up in the event the Orion lands upside down. It takes less than four minutes for the system to upright the capsule to help protect the astronauts inside that are returning home from future deep space missions.

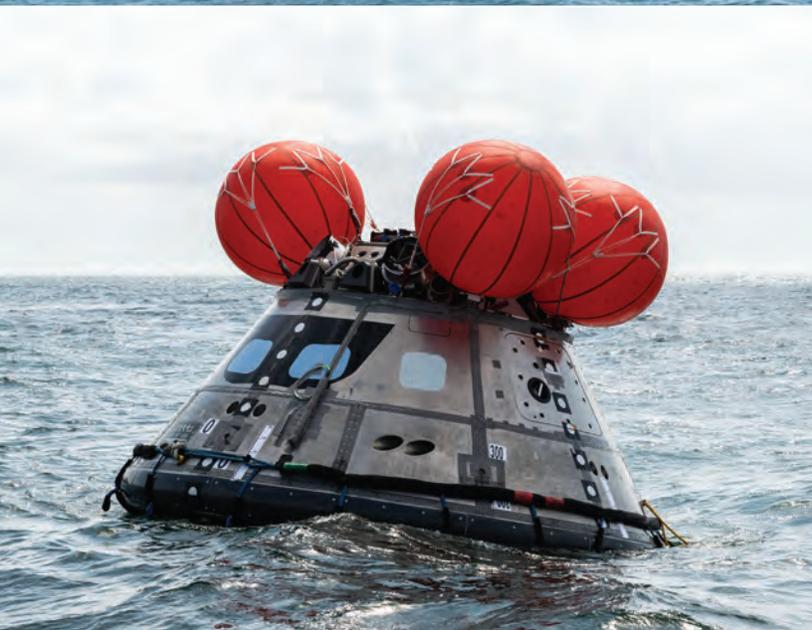
In a perfect post-mission landing situation, all five of Orion's airbags will deploy to reorient the capsule, and while this is the most likely scenario for capsule recovery, NASA aims to be ready for any situation. Several tests performed with a mockup of the Orion crew capsule demonstrated that even

if one of the airbags failed to inflate, the CMUS would still be able to perform as intended.

The system was previously tested in the Neutral Buoyancy Lab, a giant pool at NASA's Johnson Space Center in Houston, primarily used for astronaut training, as well as off the coast of Galveston, Texas. Engineers also wanted to test the uprighting system in more challenging waves, similar to those where Orion is expected to land, and partnered with the Coast Guard to test the CMUS in the Atlantic Ocean.

Engineers experimented with four different CMUS configurations over several days of testing. These tests verified the system's ability to perform in varying wave conditions, and demonstrated how the CMUS would protect the crew in a wide range of landing scenarios. With the success of both tests, the Orion team is well on its way to verify Orion is ready for missions to the Moon and beyond.

Watch the ACM Hot Fire Facebook Live Here:  
[bit.ly/ACM\\_Mar19Test](https://bit.ly/ACM_Mar19Test)



# FIT TO FLY



Preparing for Orion's crew and service modules leaving Florida for testing in Ohio, NASA's Super Guppy aircraft underwent a fit check of the Orion crew and service module horizontal transport (CHT). At NASA's Kennedy Space Center's Shuttle Landing Facility in Florida, Space Florida operated the test to ensure transportation planning was correctly moving forward. The Super Guppy's payload bay lay open as the CHT was moved inside, secured on the U.S. Air Force aircraft loader. This fit check was performed to confirm the procedure of loading operations, ensure that the CHT fit inside the Super Guppy with adequate space, and to test the needed aircraft interface to aircraft power. The Orion crew and service modules, which will be mated at the time, will be transported to NASA's Plum Brook Station in Sandusky, Ohio, for full thermal vacuum testing. In this unique facility, the crew and service modules will be put through extensive testing to ensure they can survive the rigors of launch, space travel, re-entry and splashdown.

# AA-2, REALIGNED

The Orion team at the NASA Kennedy Space Center Launch Abort System Facility in Florida recently completed the milestones of turning the Ascent Abort-2 (AA-2) launch abort system (LAS) vertical as well as mating the LAS with the AA-2 separation ring and crew module. This moves the AA-2 team another step closer toward the June 12 flight test.

This full-stress test will see the LAS and a 22,000 pound crew module propelled on a booster to an altitude of 31,000 feet at Mach 1.15 (over 1,000 miles an hour). At that point, the LAS will begin its task of propelling the Orion crew module away from the vehicle, simulating an emergency abort of Orion. The test will verify that the LAS can steer astronauts inside the crew module to safety when the spacecraft is under the highest aerodynamics loads it will experience during ascent.



# SUPPLIER SPOTLIGHT

## HONEYBEE ELECTRONICS



Headquartered in New York City, Honeybee Robotics, Ltd. has been working with NASA since 1986. In the past, they have contributed hardware to programs such as their Rock Abrasion Tool for the Mars Exploration Rovers and the Sample Manipulation System on the Curiosity Rover, to mention a few. However, for Orion, they developed something a little different. Honeybee is responsible for building Orion's Side Hatch Gearbox Assembly. This

gearbox is part of the primary mechanism used in the operation of the side hatch, which will allow crew members to manually open and close the hatch in order to enter and egress the vehicle. Working on Orion is the first time Honeybee will contribute their hardware and expertise to a human-rated spacecraft. They are proud to be a part of the mission, as well as to have the opportunity to solve some of the technical challenges associated with space travel.

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)

### HOUSTON WE HAVE A PODCAST: **ENGAGING THRUSTERS**

In episode 84, Steve Barsi, Orion European Service Module Propulsion Subsystem manager, discusses Orion's propulsion system, how it works and why it's suited for deep space travel.

Listen here: <https://go.nasa.gov/2FBOs1W>