

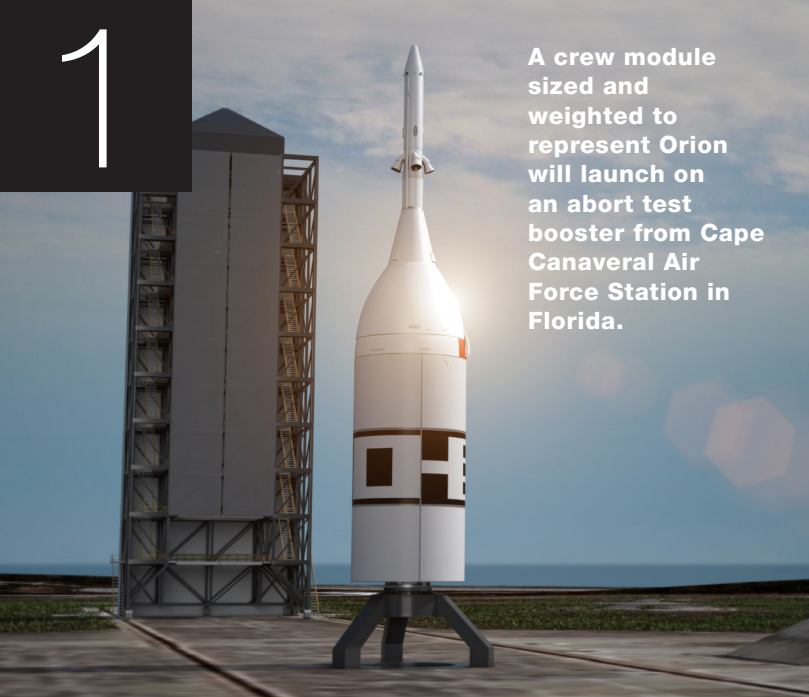


ASCENT ABORT-2 FLIGHT TEST

The safest spacecraft ever built, NASA's Orion will carry the first woman and next man to land on the Moon by 2024, and enable sustained presence on and around the Moon by 2028. An integral part of ensuring safe spaceflight is Orion's Launch Abort System, or LAS. This state-of-the-art crew escape system is attached to the top of the spacecraft and can propel the crew module away from the rocket within milliseconds should a life-threatening event arise during launch.

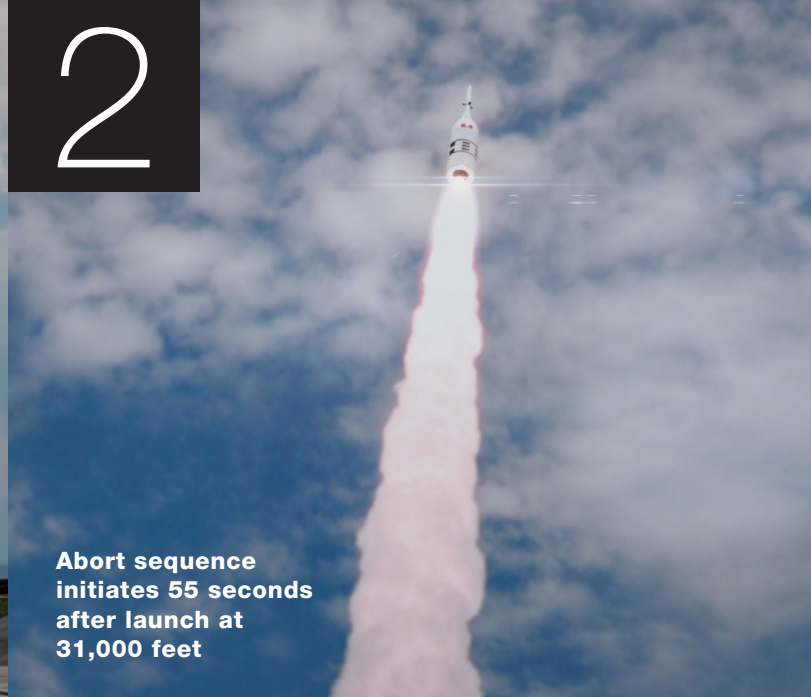


1



A crew module sized and weighted to represent Orion will launch on an abort test booster from Cape Canaveral Air Force Station in Florida.

2



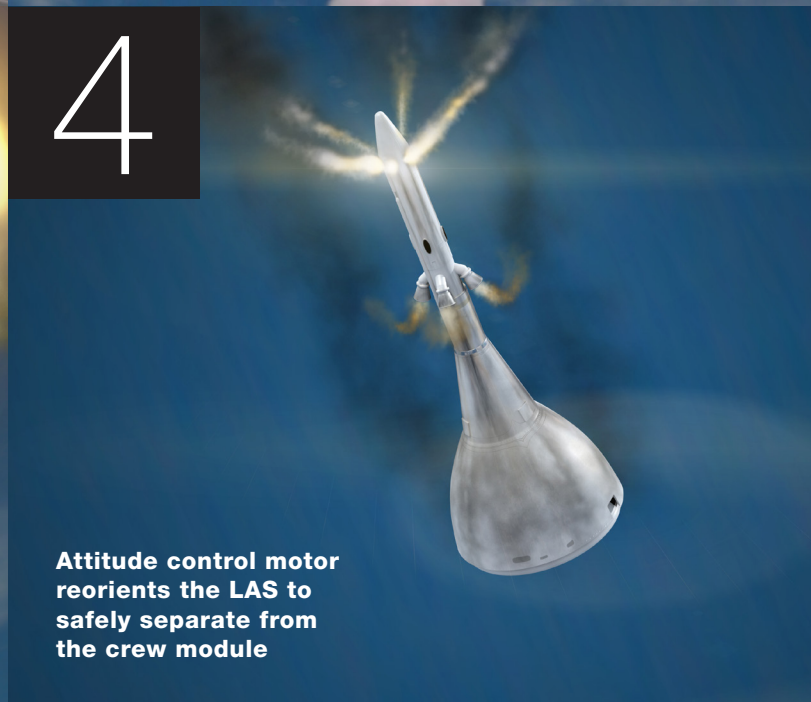
Abort sequence initiates 55 seconds after launch at 31,000 feet

3



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

4



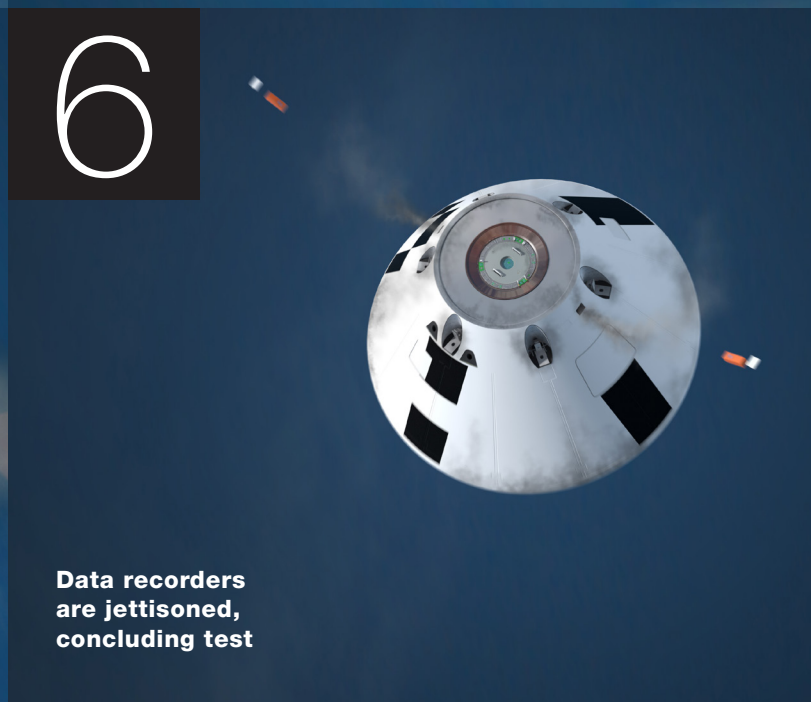
Attitude control motor reorients the LAS to safely separate from the crew module

5



Jettison motor fires, separating the LAS from the crew module

6



Data recorders are jettisoned, concluding test

In 2019, Orion is scheduled to undergo a full-stress test of the LAS, called Ascent Abort Test 2 (AA-2), where a booster provided by Northrop Grumman will launch from Cape Canaveral Air Force Station in Florida, carrying a fully functional LAS and a 22,000-pound Orion test vehicle to an altitude of 31,000 feet at Mach 1.3 (over 1,000 miles an hour). At that point, the LAS' powerful reverse-flow abort motor will fire 400,000 pounds of thrust, propelling the Orion test vehicle to a safe distance away from the rocket. Timing is crucial as the abort events must match the abort timing requirements of the Orion spacecraft to the millisecond in order for the flight test data to be valid.

NASA is accelerating the timeline of the test to provide engineers with critical abort test data to validate computer models of the spacecraft's LAS performance and system functions in advance of the first crewed flight of Orion and the Space Launch System (SLS) rocket. AA-2 provides the only opportunity to test a fully active launch abort system during ascent before flying crew, so verifying that it works as predicted in the event of an emergency is a critical step for deep space exploration.

The test will verify the LAS can steer the crew module and astronauts inside to safety in the event of an issue with the SLS rocket when the spacecraft is under the highest aerodynamic loads it will experience during a rapid climb into space.

Engineers at several NASA centers already are building the Orion test article that has many of the design features and the same mass as the capsule that will carry crew. This test is designed to focus on Orion's launch abort capabilities, and all required data will be captured by the data recorders, so the crew module used for AA-2 will not deploy parachutes after the abort system is jettisoned or fire thrusters to orient the capsule for splashdown. A separate test series is focused on certifying the parachute system in various conditions.

The AA-2 test development and execution is a partnership between the Orion Program and the Advanced Exploration Systems Division, the technology advancement organization in the Human Exploration and Operations Mission Directorate at NASA Headquarters in Washington.

NASA's Johnson Space Center oversees production of the fully assembled and integrated crew module and separation ring, including development of unique avionics, power, software and data collection subsystems and several elements of ground support equipment.

The agency's Langley Research Center in Hampton, Virginia, is building the primary structure of the crew module test article and a separation ring that connects the test capsule to the booster and provides space and volume for separation mechanisms and instrumentation.

Critical sensors and instruments used to gather data during the test will be provided by NASA's Armstrong Flight Research Center in Edwards, California. The integrated test article will be delivered to NASA's Kennedy Space Center in Florida, where it will be processed before launch.

NASA's prime contractor, Lockheed Martin, is providing the fully functional Orion LAS, and the crew module to service module umbilical and flight design retention and release mechanisms.

The abort and attitude control motors are built by Northrop Grumman. The jettison motor, manufactured by Aerojet Rocketdyne, is the only LAS motor that will be activated on every mission.

LAUNCH ABORT SYSTEM

LAUNCH ABORT TOWER

ATTITUDE CONTROL MOTOR

JETTISON MOTOR

ABORT MOTOR

FAIRING ASSEMBLY

CREW MODULE
Inside fairing assembly

LAUNCH VEHICLE

The LAS is divided into two parts: the fairing assembly, which is a shell composed of a lightweight composite material that protects the capsule from the heat, wind and acoustics of the launch, ascent, and abort environments; and the launch abort tower, which includes the system's three motors. In an emergency, those three motors – the launch abort, attitude control and jettison motors – work together to propel Orion away from a problem on the launch pad or during SLS' first stage ascent, steering and re-orienting for LAS jettison, and pulling the LAS away from the crew module. During a normal launch, only the LAS jettison motor will fire, once Orion and the Space Launch System clear most of the atmosphere, to separate the LAS from Orion and allow the spacecraft to continue with its mission.

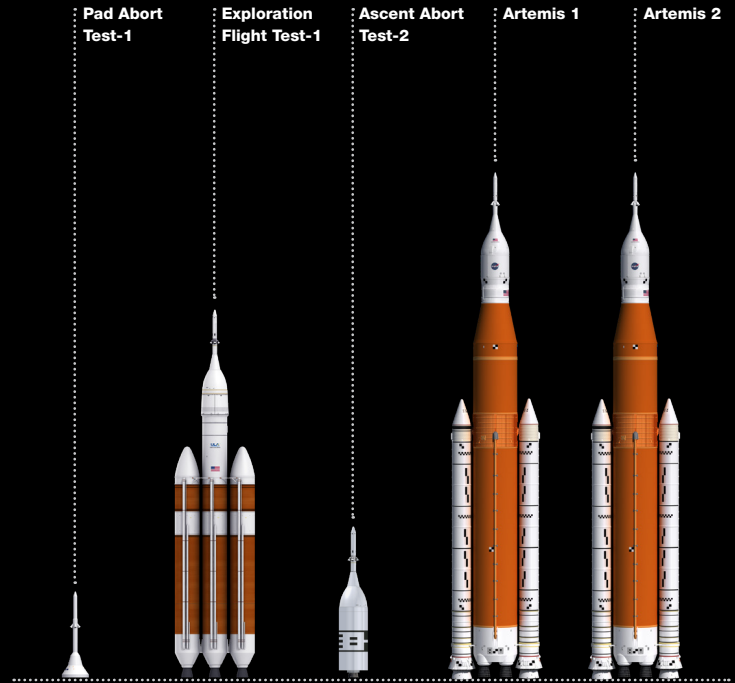
Pad Abort Test-1

Exploration Flight Test-1

Ascent Abort Test-2

Artemis 1

Artemis 2



In 2010, an earlier version of Orion's LAS was successfully tested to evaluate the performance of the system from the launch pad during Pad Abort Test-1 at White Sands Missile Range in New Mexico. For Artemis 1 – NASA's first integrated flight test of Orion atop the powerful SLS – the abort system will not be fully active since astronauts will not be inside the spacecraft.