

National Aeronautics and
Space Administration



Ascent Abort-2 Flight Test

PRESS KIT/July 2019



Ascent Abort-2

Flight Test



Overview

The [Orion](#) spacecraft is part of NASA's backbone for deep space exploration that will land the first woman and next man on the [Moon by 2024](#), along with Space Launch System rocket and the lunar [Gateway](#). Through the [Artemis](#) program, the next American Moon walkers will depart Earth aboard Orion and begin a new era of exploration.

The Ascent Abort-2 (AA-2) flight test will evaluate Orion's [Launch Abort System](#), a rocket-powered tower on top of the crew module built to very quickly get astronauts safely away from their launch vehicle if there is a problem during ascent to space. The test is helping make sure Orion is safe [for human missions to deep space](#) and can reliably carry astronauts to the Moon and beyond.

During AA-2, a booster will launch from Space Launch Complex 46 (SLC-46) at Cape Canaveral Air Force Station in Florida, carrying a fully functional Launch Abort System (LAS) and a 22,000-pound Orion test vehicle to an altitude of 31,000 feet at Mach 1.15 (over 1,000 mph). At that point, the abort system's powerful abort motor will fire 400,000 pounds of thrust, propelling the Orion test vehicle to a safe distance away from the rocket. The launch abort system initiates approximately six miles in altitude at a test condition close to the maximum aerodynamic pressure Orion will face on ascent. The system's three motors will work together to pull the crew module away from its booster and orient it for splashdown in the Atlantic Ocean.



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Flight Test Timeline

The abort test booster (ATB) will launch the Orion test capsule and launch abort system.

Fifty-five seconds later when the vehicle is at 31,000 feet in altitude, the abort sequence is initiated.

The abort motor will fire, pulling the crew module away from the booster. It will gain more than 2 miles in altitude in 15 seconds.

At 43,000 feet, the attitude control motor will activate to orient and flip the capsule to safely separate the crew module.

At 44,000 feet, the jettison motor fires to pull the launch abort system tower from the crew module, releasing the capsule to descend toward the ocean.

During the capsule's descent, a series of 12 [data recorders](#) will be jettisoned from the capsule that will be recovered for analysis.

Because the test is designed to evaluate Orion's launch abort capabilities, the crew module used for AA-2 will not deploy parachutes after the abort system is jettisoned, nor will it have a reaction control system with thrusters needed to help orient the capsule for a parachute-assisted descent and splashdown after the LAS is jettisoned. Those systems have been [rigorously evaluated](#) as part of other testing. NASA was able to accelerate the test schedule to better inform the Artemis 2 flight and lower costs by simplifying the test article and eliminating parachutes and related systems, and not recovering the capsule from the ocean.

A total of 890 developmental flight instrumentation measurements will be monitored and recorded during AA-2 on the booster, separation ring, crew module and LAS. During descent, data from the test will be downlinked as well as recorded on board by 12 data recorders that will be ejected from the crew module starting 20 seconds after LAS jettison. Those data recorders will be recovered post-test.





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Launch to Abort Sequence Timeline

L-hh:mm:sec	Event	
	Abort Test Booster	Flight Test Article
6:00:00	Call to Stations	Call to Stations
2:00:00	Conduct Weather Briefing	
1:30:00	LC Poll Go for ATB Power Up	Power down all SSRs
0:18:00		Final FTA Poll Go/No-Go for Launch
0:16:00	Final ATB Poll Go/No-Go - Launch	
0:06:30	Final Launch Authorization Poll	
L+00:00:00		Liftoff
		10,000 ft
		20,000 ft
		"Mach 1.1"
0:00:55		Abort Initiation – 31,000 feet
Abort+00:00:15		Re-orientation – 43,000 feet
0:00:27		LAS Jettison – 44,000 feet

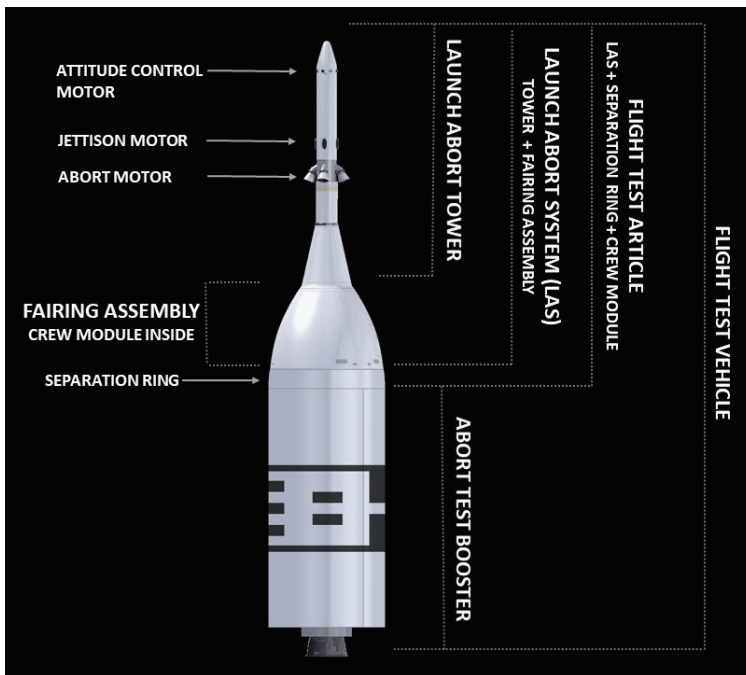


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Vehicle Components

- Flight test vehicle: all components including booster, crew module and separation ring
- Flight test article: launch abort system, separation ring, and crew module
- [Crew module](#), separation ring and [instrumentation](#), built by NASA
- [Launch abort system](#), built by Lockheed Martin



- Fairing assembly: Lightweight composite structure that protects the capsule from the environment around it
- Launch abort tower
 - Abort motor: the primary motor used to pull the crew capsule away from danger if a problem develops on the launch pad or during SLS ascent; manufactured by Northrop Grumman.
 - Attitude control motor: used to stabilize the crew capsule and steer it to any direction and re-orient it for LAS jettison; manufactured by Northrop Grumman.
 - Jettison motor: used to pull the LAS away from Orion after reorienting the capsule during an abort, allowing the parachutes to deploy, and also used to jettison the LAS during a normal SLS launch when it is no longer needed; manufactured by Aerojet Rocketdyne.

- Abort test booster, a refurbished Peacekeeper ICBM first stage SR118 motor manufactured by Northrop Grumman and procured through the U.S. Air Force's Rocket Systems Launch Program.



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Key Components of Abort Test Booster

The booster for this test was procured by the U.S. Air Force Space and Missile Systems Center Rocket Systems Launch Program. It is a SR118 motor from a Peacekeeper missile modified by Northrop Grumman.

Component	Physical Characteristics	Function
Rocket Motor	Length: 334 inches Diameter: 92 inches	Boosts upper stages/payload
Igniter	Length: 27.25 inches Diameter 6.2 inches	Pyrotechnic pellets which ignite the motor propellant
Motor Case	Kevlar filament wound case hardened with epoxy	Forms the pressure vessel container for the solid propellant and also as an attachment point for components
Nozzle	Length: 71.88 inches Throat diameter: 15 inches Expansion Ratio: 16:1	Exhausts propellant gasses and steers the booster through initial phase of flight



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Key Flight Test Objectives

- Demonstrate abort capability at maximum aerodynamic pressure.
- Determine the stability characteristics and reorientation dynamics of the Launch Abort Vehicle while under active control of the attitude control motor.
- Obtain launch abort system structural loads data, assure LAS structural integrity, and obtain interface data for the LAS and crew module.
- Demonstrate, gather data from the crew module/service module separation mechanism.
- Demonstrate and gather data from the crew module and LAS separation mechanism.
- Gather information on the launch abort vehicle external environment—acoustic, aerodynamic, thermal and acceleration.





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By the Numbers

(All approximate)

MASS

- AA-2 flight test vehicle at launch: 310,000 lbs.
- Flight test article: 46,000 lbs.
- Separation ring: 7,000 lbs.
- Crew module: 22,000 lbs.
- Launch abort system: 17,000 lbs.
- Abort test booster: 264,000 lbs.

Flight Test Personnel

Launch Director: Don Reed, NASA

Launch Vehicle Stage Manager: Rob Douglass, U.S. Air Force Rocket Systems Launch Program, Abort Test Booster

Test Director: Jon Olansen, NASA, Flight Test Article

Test Conductor: Jenny Devolites, NASA, Flight Test Article

Launch Conductor: Karl Seelandt, Northrop Grumman Innovation Systems, Abort Test Booster

LAUNCH COMMIT CRITERIA MANAGEMENT:

Assistant Launch Director: Gabe Baca, NASA

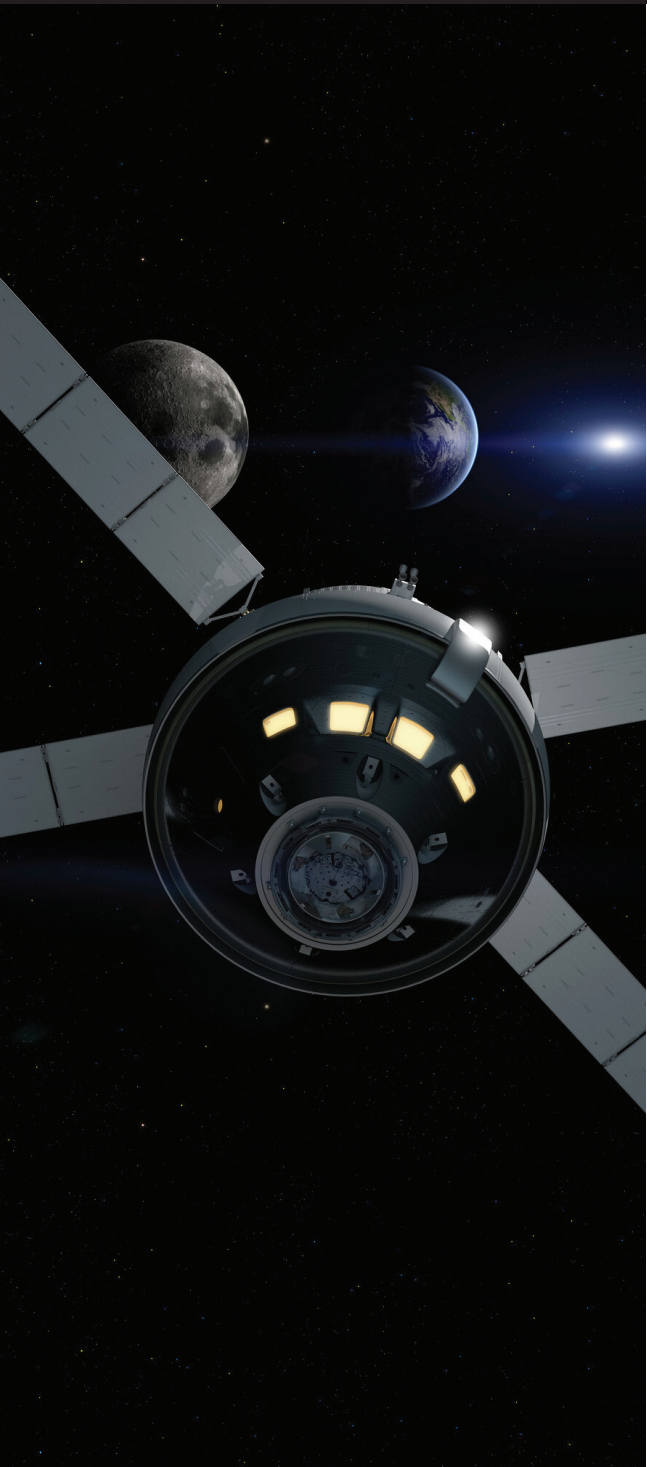
SEIT Lead: Griff Corpening, NASA

Operations Integration Lead: Joe Voor, NASA



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Next Steps for NASA

Charged with returning astronauts to the Moon within five years, NASA's Artemis [lunar exploration plans](#) are based on a two-phase approach: the first is focused on speed – landing astronauts on the Moon by 2024 – while the second will establish a sustained human presence on and around the Moon by 2028. NASA will use what we learn on the Moon to prepare to send astronauts to Mars. Orion is a key piece of NASA's plans and will provide transportation for astronauts on their journey.

The agency and its partners are hard at work building and outfitting the Orion spacecraft for the Artemis 1 and 2 missions. The first in a series of increasingly complex missions, [Artemis 1](#) will be an uncrewed flight that will provide a foundation for human deep space exploration, and demonstrate our commitment and capability to extend human existence to the Moon and beyond. During this flight, the uncrewed Orion spacecraft will launch on the most powerful rocket in the world and travel thousands of miles beyond the Moon, farther than any spacecraft built for humans has ever flown, over the course of about a three-week mission. Artemis 2 will be the first mission with crew in the vicinity of the Moon, and the first Artemis mission with a full active launch abort system. During Artemis 3, astronauts will land on the surface of the Moon for the first time since 1972, enabled by Orion, the [Gateway](#), and a human lunar landing system.



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Orion Multimedia Materials

- [AA-2 Test Video](#)
- [AA-2 Media Resource Reel](#)
- Launch Abort System [Fact Sheet](#)
- Orion [Latest News](#)
- [Orion Images](#)
- Artemis [Latest News](#)



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