



ORION

Launch Abort System (LAS)



NASAfacts

Ensuring Astronaut Safety

NASA is developing technologies that will enable humans to explore new destinations in the solar system. America will use the Orion spacecraft, launched atop the Space Launch System rocket, to send a new generation of astronauts beyond low-Earth orbit. To keep astronauts safe during launch in such difficult, yet exciting, missions, NASA and Lockheed Martin collaborated to design and build the Launch Abort System.

Launch Abort System Configuration

The Launch Abort System, or LAS, is positioned atop the Orion crew module. It is designed to protect astronauts if a problem arises during launch by pulling the spacecraft away from a failing rocket. Weighing approximately 16,000 pounds, the LAS can activate within milliseconds to pull the vehicle to safety and position the module for a safe landing. The LAS is comprised of three solid propellant rocket motors: the abort motor, an attitude control motor, and a jettison motor.

JETTISON MOTOR - The jettison motor will pull the LAS away from the crew module, allowing Orion's parachutes to deploy and the spacecraft to safely land in the Ocean.

ATTITUDE CONTROL MOTOR - The attitude control motor consists of a solid propellant gas generator with eight proportional valves equally spaced around the outside of the three-foot diameter motor. The motor can exert up to 7,000 pounds of steering force to the vehicle in any direction upon command from the Orion crew module.

ABORT MOTOR - The abort motor is capable of producing about 400,000 pounds of thrust to quickly pull the crew module away from danger if problems develop on the launch pad or during the ascent.

FAIRING ASSEMBLY - The fairing assembly is a lightweight composite structure that protects the capsule from the environment around it - whether it's heat, wind or acoustics.

FUN FACTS

- On an abort from the launch pad, the Launch Abort System can activate within milliseconds to carry the crew to a peak height of approximately one mile at about 1.5 times the top speed of a drag race car.
- The Launch Abort System's abort motor generates enough thrust to lift 26 elephants off the ground.
- The Launch Abort System's abort motor produces the same power as five and a half F-22 Raptors combined.
- The Ascent Abort 2 flight test occurred at about Mach 1.2 and at speeds about three times the speed of the fastest sports car.
- The jettison motor can safely pull the Launch Abort System away from the crew module to a height of 240 Empire State Buildings stacked on top of each other.

First Launch Abort System Test: Pad Abort-1

NASA's Pad Abort-1 flight test was the first fully integrated test of the LAS, which successfully launched May 6, 2010, at the U.S. Army's White Sands Missile Range near Las Cruces, New Mexico. The flight was the first in a series of in-flight demonstrations of the three solid rocket motors and parachute landing system. The test was part of an ongoing mission to develop safer vehicles for human spaceflight applications.



Orion's First Flight: Exploration Flight Test-1



In 2014, NASA launched the Orion spacecraft for the first time on Exploration Flight Test-1 (EFT-1) – a mission that took Orion farther into space than any spacecraft built for humans has gone in more than 40 years. Because EFT-1 was uncrewed, only the jettison motor was active on the LAS, but the successful jettison of the system was critical to the mission's success. The flight test provided information on the abort system's performance during the spacecraft's trip to space.

Final Launch Abort System Test: Ascent Abort-2

The Ascent Abort-2 test launched an Orion mock-up from Space Launch Complex 46 in Cape Canaveral, Florida in 2019. During the test, the spacecraft was integrated with an ascent test booster — a first stage booster from a Peace-keeper missile modified by Orbital ATK. Ascent Abort-2 tested the LAS and its three motors. Reaching speeds up to 600 mph, the LAS demonstrated a successful abort under the highest aerodynamic loads it will experience in flight. Aerodynamic forces built as the booster accelerated through the atmosphere, reaching a maximum when the vehicle reached speeds up to Mach 1. Then the LAS abort motor ignited, pulling the crew module away from the ascent test booster. All three motors were active, proving the LAS's readiness for human flight. This test also assessed the capabilities of numerous flight vehicle components, including Orion's avionics, communications, and reaction control system.

First Integrated Test: Artemis I

Artemis I will be the first test of the world's most powerful rocket, the Space Launch System (SLS). During this test, SLS will launch an un-crewed Orion spacecraft to demonstrate the integrated system performance of the rocket and spacecraft before a crewed flight. It will venture 40,000 miles beyond the moon before returning to Earth. The jettison motor will be the only active motor on the LAS.

Why Explore?

Exploration is critical to human prosperity and progress.

Human space exploration helps to address fundamental questions about our place in the universe and the history of our solar system. Through addressing the challenges related to human space exploration we expand technology, create new industries and help foster a peaceful connection with other nations. Curiosity and exploration are vital to the human spirit and accepting the challenge of going deeper into space will invite the citizens of the world today and the generations of tomorrow to join NASA on this exciting journey.

First Crewed Flight Test: Artemis II

Artemis II will use SLS to launch the first humans aboard Orion to deep space. All three motors will be active on the LAS in the unlikely event of an emergency.



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