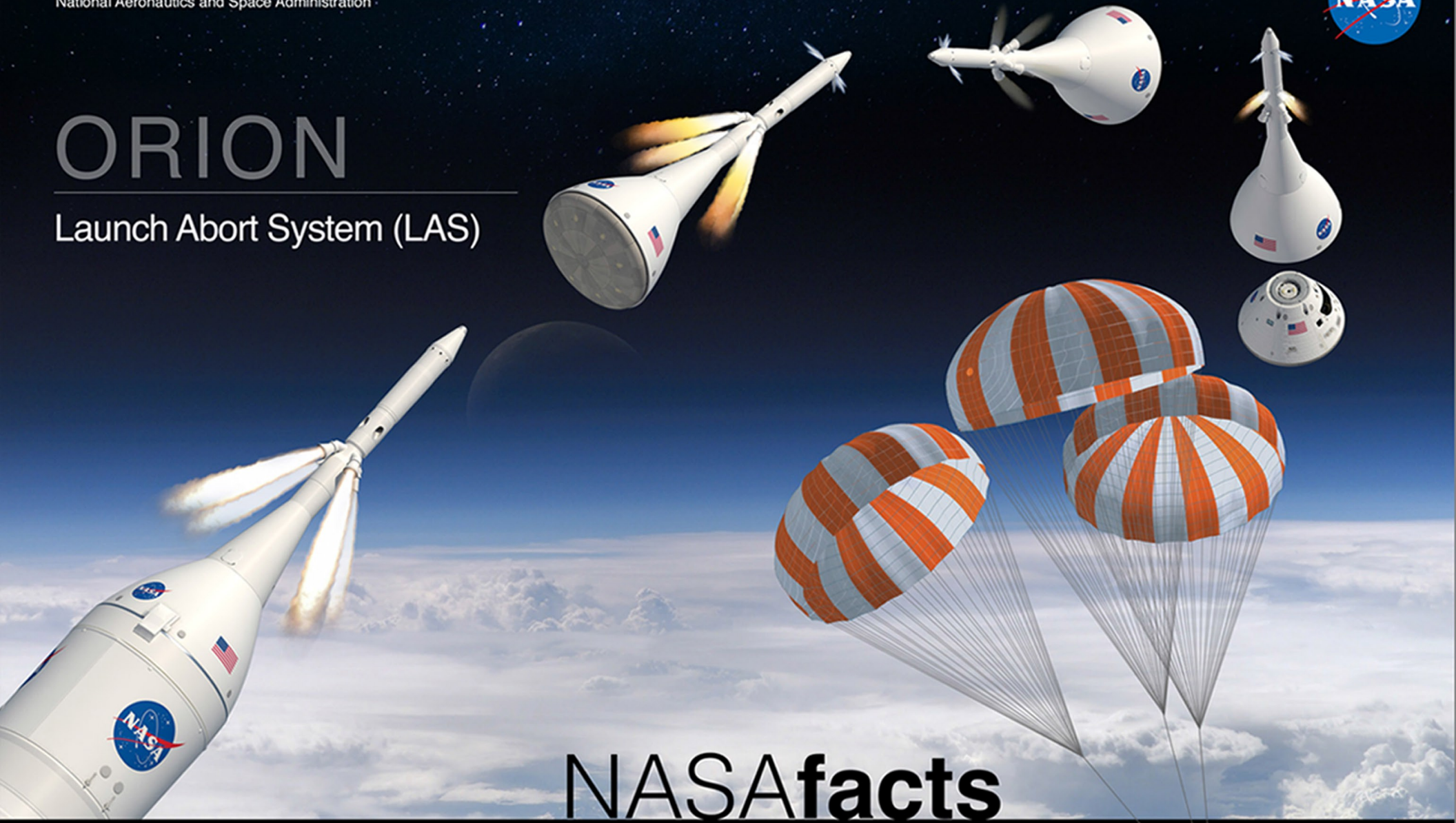
National Aeronautics and Space Administration

ORION

Launch Abort System (LAS)



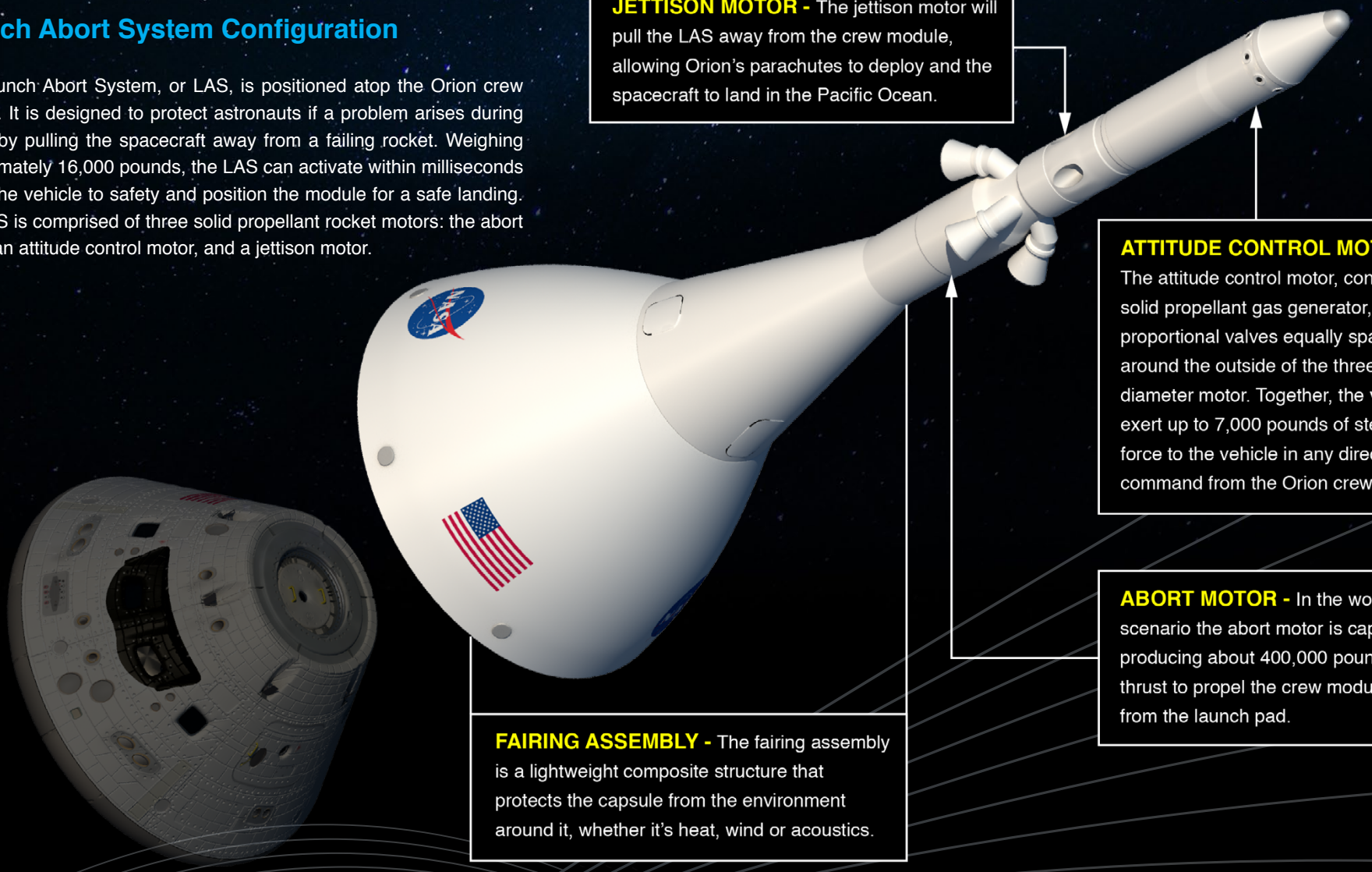
NASAfacts

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 places like an asteroid and eventually Mars. In order to keep astronauts safe 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 land in the Pacific 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. Together, the valves 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 - In the worst-case scenario the abort motor is capable of producing about 400,000 pounds of thrust to propel the crew module away from the launch pad.

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.

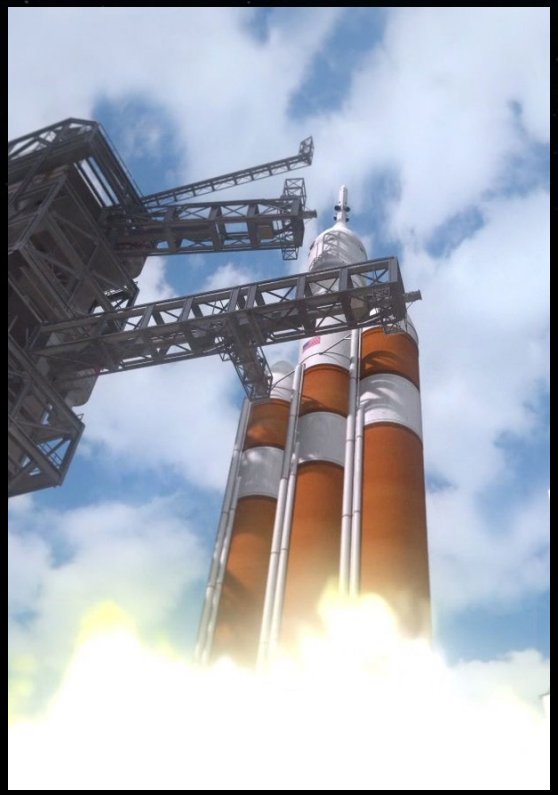
FUN FACTS

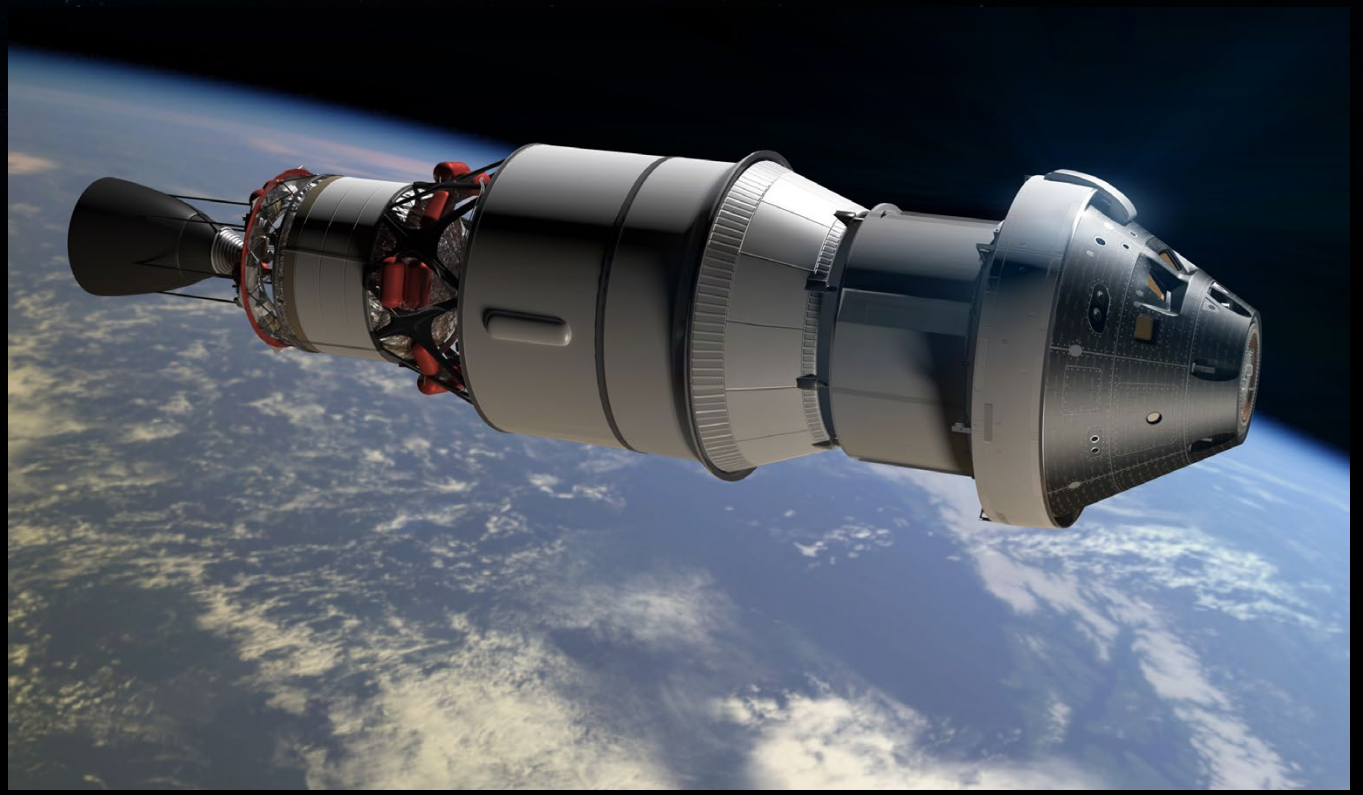
- The Launch Abort System can activate within milliseconds to carry the crew to a peak height of approximately one mile at 42 times the speed of a drag race car.
- The Launch Abort System's abort motor generates enough thrust to lift 26 elephants off the ground.
- The Launch Abort System's abort motor produces the same power as five and a half F-22 Raptors combined.
- The Launch Abort System can move at transonic speeds that are nearly three times faster than the top speed of a fast 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 will launch the Orion spacecraft for the first time on Exploration Flight Test-1 (EFT-1) – a mission that will see Orion travel farther into space than any human spacecraft has gone in more than 40 years. Because EFT-1 is uncrewed, only the jettison motor will be active on the LAS, but the successful jettison of the LAS is critical to the mission's success. This flight test will provide information on the abort system's performance during the vehicle's trip to space.

First Integrated Test: Exploration Mission-1

Exploration Mission-1 will be the first test of the world's most powerful rocket, the Space Launch System (SLS). During this test, SLS will launch an uncrewed Orion spacecraft to demonstrate the integrated system performance of the rocket and spacecraft before a crewed flight. The jettison motor will be the only active motor on the LAS.

Final Launch Abort System Test: Ascent Abort-2

The Ascent Abort-2 test will launch an Orion mock-up from Space Launch Complex 46 in Cape Canaveral, Florida. During the test, the spacecraft will be integrated with an ascent test booster – a first stage booster from a Peacekeeper missile modified by Orbital Sciences Corporation in Arizona. The Ascent Abort-2 test will be the last test the LAS and its three motors will perform before a human mission. Reaching speeds up to 600 miles per hour, the LAS will demonstrate a successful abort under the highest aerodynamic loads it will experience in flight. Aerodynamic forces build as the booster accelerates through the atmosphere, reaching a maximum when the vehicle reaches speeds up to Mach 1. Then the LAS will ignite, pulling the crew module away from the ascent test booster. All three motors will be active, proving the LAS's readiness for human flight. This test also will assess the capabilities of numerous flight vehicle components, including Orion's avionics, communications, reaction control system and parachutes.

Why Explore?

Exploration is critical to prosperity and human 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 to 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: Exploration Mission-2

Exploration Mission-2 will use SLS to launch the first humans aboard Orion. All three motors will be active on the LAS in the unlikely event of an emergency.

National Aeronautics and Space Administration

Langley Research Center
100 NASA Road
Hampton, VA 23681-2199

www.nasa.gov

FS-2014-06-220-LaRC