

ORION LAUNCH ABORT SYSTEM

Pad Abort 1
PA-1
Flight Test

White Sands
Missile Range

Thursday, May 6 2010



LOCKHEED MARTIN



Orbital

Honeywell

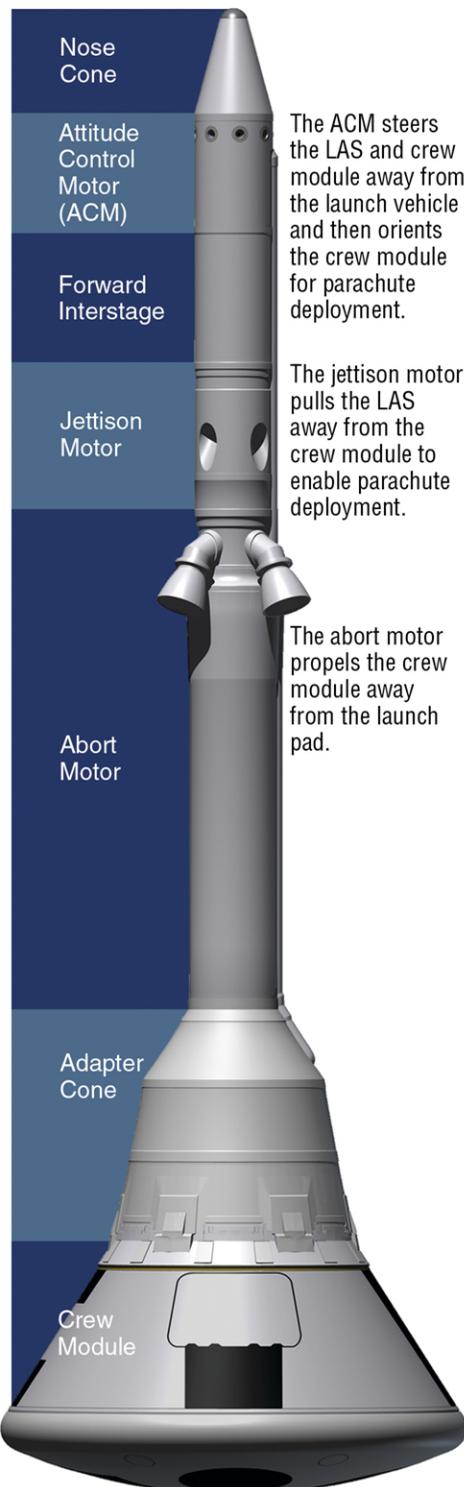
ATK

AEROJET

ORION LAUNCH ABORT SYSTEM

Lockheed Martin, the prime contractor to NASA for the Orion crew exploration vehicle, led the industry team development effort for the launch abort system (LAS). This new system is the highest thrust and acceleration escape system ever created and significantly improves flight crew safety as compared to current human space flight systems.

With contributions from Aerojet, Alliant Techsystems (ATK), Honeywell, and Orbital Sciences Corporation, the Lockheed Martin Orion team combined innovative technical expertise in solid rocket motors, separation mechanisms, avionics, spacecraft adapter structures, ordnance systems, electrical systems, harnesses, and design integration to ensure the LAS provides optimal escape capability for the Orion crew from pad operations through ascent.



The ACM steers the LAS and crew module away from the launch vehicle and then orients the crew module for parachute deployment.

The jettison motor pulls the LAS away from the crew module to enable parachute deployment.

The abort motor propels the crew module away from the launch pad.

Technology firsts incorporated into the LAS design include a new reverse-flow, high-thrust, human-rated rocket motor and the largest and only human-rated controllable solid rocket motor.

Risk reduction testing, such as the Pad Abort 1 flight test, is an ongoing effort throughout Orion's development phase to maximize mission success and crew safety. The Orion spacecraft is currently on schedule for an early demonstration flight in 2013.

Team Contributions

Aerojet: jettison motor, the only motor activated on all nominal missions to separate the spacecraft from the LAS assembly

ATK: abort motor, activates within milliseconds to pull the crew module off the launch vehicle; and attitude control motor, provides steering and orientation capability

Honeywell: avionics for onboard control of abort sequencing and inertial navigation

Lockheed Martin: overall system design, development, integration, and testing

Orbital: system design, development, and build support

Test Objectives

1. Demonstrate full-scale LAS pad abort performance
2. Verify in-flight loads and environments
3. Demonstrate escape capability of the LAS
4. Demonstrate abort event sequencing

LAS Predicted Performance

LAS Operations Duration:	97 sec
Separation Rate:	500 ft in 3 sec
At Liftoff:	4,000 lb of propellant burned in 3 sec
Max Velocity:	600 mph
Mach:	0.74
Altitude:	5,000 ft (approximately 1 mile)
Down Range:	1 mile
Max Acceleration:	15 g's
Max Angle of Attack:	10 deg
Abort Motor Thrust:	500,000 lbf
Jettison Motor Thrust:	38,000 lbf
Control Motor Thrust:	7,000 lbf in any direction

PA-1 Countdown

- T-4 hr:
Launch countdown begins
- T-1 hr 50 min:
Launch vehicle systems power up
- T-1 hr 25 min:
Telemetry and ACM power up and built-in test begins
- T-17 min:
Pyro event controller enabled and safe and arm commanded to arm
- T-5 min:
Go for launch confirmed
- T-1 min, 50 sec:
Abort enable command issued
- T-0:
Abort execute command issued
- L+6 sec:
Abort motor burn complete
- L+10 sec:
ACM orients vehicle for LAS jettison and parachute deployment
- L+21 sec:
Jettison motor separates LAS from crew module
- L+22 sec:
Forward bay cover separates from crew module and two small parachutes deploy
- L+25 sec:
Crew module drogue parachutes deploy
- L+31 sec:
Drogue parachutes cut away and three pilot parachutes deploy
- L+50 sec:
Pilot parachutes fully open
- L+53 sec:
Crew module reaches descent on parachutes
- L+1 min, 37 sec:
Crew module touches down