MISSION

A United Launch Alliance (ULA) Atlas V rocket will deliver Boeing's CST-100 Starliner spacecraft to a 98-nautical mile (nmi) sub-orbital trajectory on its Orbital Flight Test (OFT) to the International Space Station (ISS). Following separation from Atlas V, Starliner engines will burn taking it the rest of the way to orbit and on to the ISS. Liftoff will occur from Space Launch Complex-41 at Cape Canaveral Air Force Station, Florida.

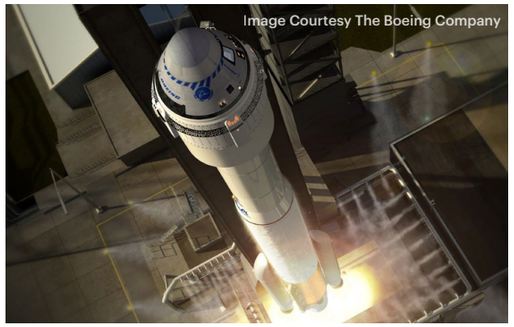


Image Courtesy The Boeing Company

Part of NASA's Commercial Crew Program (CCP), the uncrewed OFT is the first launch of the CST-100 Starliner. The goals of the OFT mission are to demonstrate on-orbit operation of all systems; demonstrate the performance of the Guidance, Navigation and Control systems of the Atlas V and Starliner through ascent, on-orbit and reentry; verify acoustic and vibration levels as well as loads across Starliner's exterior and interior throughout the mission; monitor launch abort triggers; demonstrate end-to-end operational performance and procedures; and demonstrate reentry and landing. Starliner will land at one of five designated sites in the western United States.

All human launch systems, going back to the Mercury Atlas, traditionally conduct uncrewed test flights prior to crewed flights. The uncrewed flight will allow the team to thoroughly evaluate all flight data against pre-flight predictions and make any necessary adjustments prior to flying astronauts.

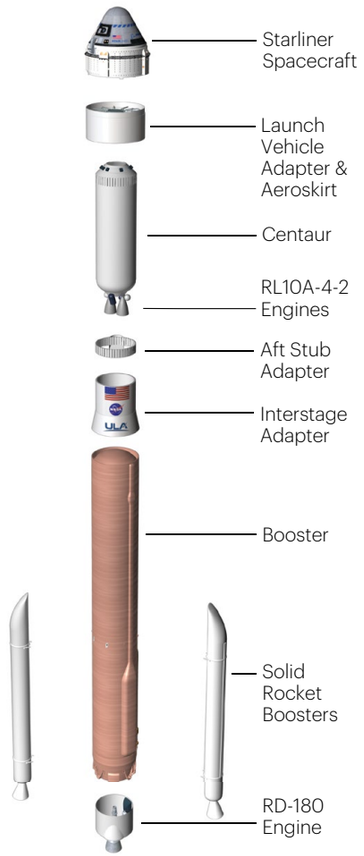
LAUNCH VEHICLE

Spacecraft
Modified specifically for the Boeing CST-100 Starliner spacecraft, the Atlas V Starliner configuration does not include a payload fairing. Instead, the Starliner's own protective surfaces take the place of the fairing to protect the uncrewed spacecraft during ascent. The vehicle's height with the Boeing CST-100 Starliner is approximately 52.4 m (172 ft).

The CST-100 Starliner is attached to the Atlas V using a launch vehicle adapter (LVA) which also includes an aeroskirt to reduce the aerodynamic loads on the vehicle. The aeroskirt is jettisoned for improved performance following booster stage separation.

Centaur
The Centaur second stage is 10 ft in diameter and 41.5 ft in length. Its propellant tanks are pressure-stabilized and constructed of corrosion-resistant stainless steel. Centaur is a cryogenic vehicle, fueled with liquid hydrogen and liquid oxygen. The Atlas V configuration for this mission is powered by dual RL10A-4-2 engines, each producing 22,600 lb of thrust. The cryogenic tanks are insulated with a combination of helium-purged blankets, radiation shields and spray-on foam insulation (SOFI). The Centaur forward adapter (CFA) provides structural mountings for the fault-tolerant avionics system and electrical interfaces with the spacecraft. The Centaur also includes an Emergency Detection System (EDS) that monitors for critical hazards to detect an imminent or occurring failure. The EDS also provides critical in-flight data which supports jettison of the ascent cover and initiates CST-100 spacecraft separation.

Booster
The booster is 12.5 ft in diameter and 106.5 ft in length. The booster's tanks are structurally rigid and constructed of isogrid aluminum barrels, spun-formed aluminum domes and intertank skirts. Booster propulsion is provided by the RD-180 engine system (a single engine with two thrust chambers). The RD-180 burns RP-1 (Rocket Propellant-1 or highly purified kerosene) and liquid oxygen and delivers 860,200 lb of thrust at sea level. Two solid rocket boosters (SRBs) generate the additional power required at liftoff, with each SRB providing 348,500 lb of thrust. The Centaur avionics system provides guidance, flight control and vehicle sequencing functions during the booster and Centaur phases of flight.



ATLAS V

The Atlas V Starliner configuration will launch The Boeing Company's CST-100 Starliner vehicle as part of NASA's Commercial Crew Program. This is the inaugural flight of this configuration.

First flown in 2002, the Atlas V launch vehicle has a record of 100 percent mission success over more than 80 launches.

MISSION SUCCESS

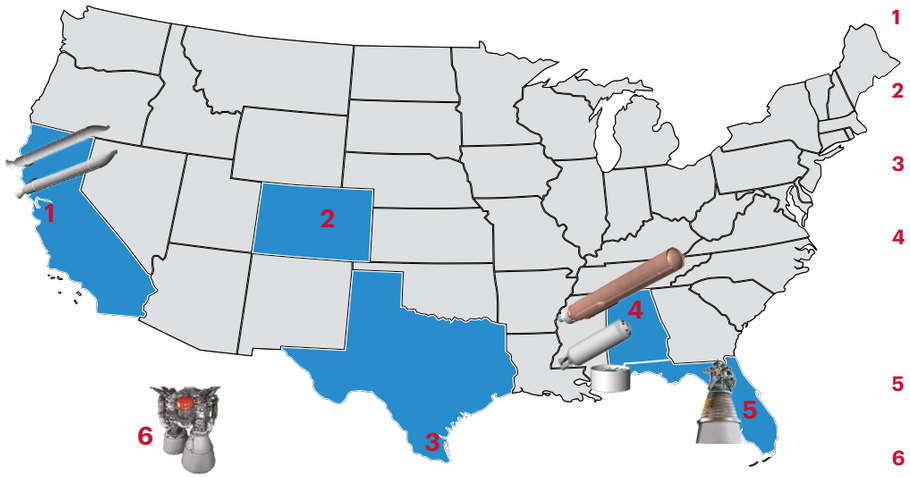
With more than a century of combined heritage, ULA is the world's most experienced and reliable launch service provider. ULA has successfully delivered more than 130 missions to orbit that provide Earth observation capabilities, enable global communications, unlock the mysteries of our solar system and support life-saving technology.

ulalaunch.com

MISSION OVERVIEW

ATLAS V STARLINER
ORBITAL FLIGHT TEST
OFT

PRODUCTION



1 Sacramento, CA
Solid Rocket Booster Fabrication at Aerojet Rocketdyne

2 Denver, CO
ULA Headquarters & Design Center Engineering

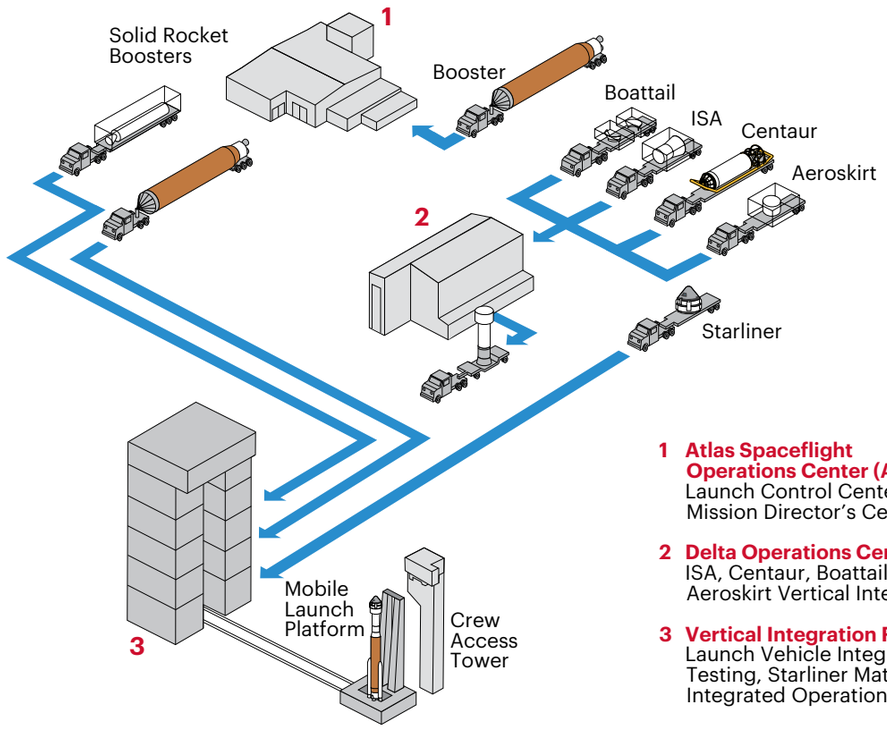
3 Harlingen, TX
Booster Adapter & Centaur Adapter Fabrication

4 Decatur, AL
Booster Fabrication & Final Assembly, Centaur Tank Fabrication & Centaur Final Assembly, Aeroskirt Fabrication

5 West Palm Beach, FL
RL10A-4-2 Engine Fabrication at Aerojet Rocketdyne

6 Khimki, Russia
RD-180 Engine Fabrication at NPO Energomash

SPACE LAUNCH COMPLEX-41 PROCESSING

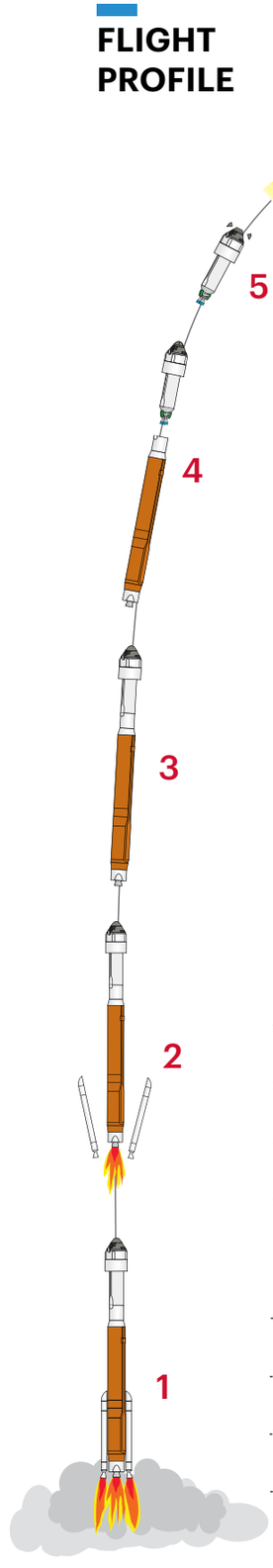


1 Atlas Spaceflight Operations Center (ASOC)
Launch Control Center & Mission Director's Center

2 Delta Operations Center
ISA, Centaur, Boattail & Aeroskirt Vertical Integration

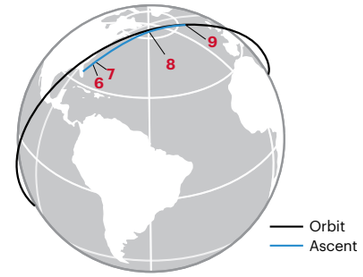
3 Vertical Integration Facility
Launch Vehicle Integration & Testing, Starliner Mate & Integrated Operations

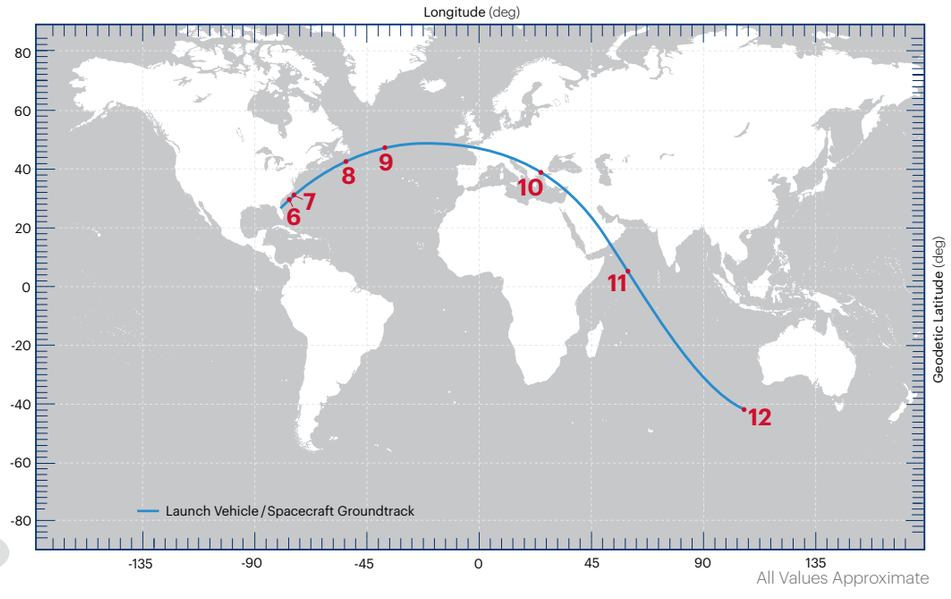
FLIGHT PROFILE



	Event	Time (hr:min:sec)
1	RD-180 Engine Ignition	-0:00:02.7
	Liftoff (Thrust to Weight> 1)	0:00:01.1
	Begin Pitch/Yaw Maneuver	0:00:06.1
	Maximum Dynamic Pressure	0:00:41.8
	Mach 1	0:01:05.8
2	SRB Jettison	0:02:22.0
3	Atlas Booster Engine Cutoff (BECO)	0:04:29.0
4	Atlas Centaur Separation	0:04:35.0
5	Ascent Cover Jettison	0:04:41.0
6	Centaur First Main Engine Start (MES-1)	0:04:45.0
7	Aeroskirt Jettison	0:05:05.0
8	Centaur First Main Engine Cutoff (MECO-1)	0:11:54.5
9	Starliner Separation	0:14:54.5
10	Start Blowdown	0:26:07.5
11	End of Atlas V Mission	0:38:03.5
12	Centaur Ocean Impact	0:57:45.2

Starliner Orbit at Separation
Perigee: 39.30 nmi | Apogee: 98.00 nmi
Inclination: 51.61 deg | Azimuth: 50.40 deg





All Values Approximate