

MISSION

A United Launch Alliance (ULA) Atlas V 401 rocket will deliver NASA's Landsat 9 spacecraft to a near-polar, sun-synchronous orbit. Lift off will occur from Space Launch Complex-3 at Vandenberg Space Force Base, California.

For nearly 50 years, Landsat satellites have provided the longest continuous global record of Earth's changing landscapes. With Landsat 9, the mission will continue collecting essential science-quality data on Earth's forests, farms, cities and freshwater regions. Landsat 9 will join Landsat 8 in orbit, and the two satellites together will collect images of our planet's landscapes and coastal regions every eight days. Landsat is the only U.S. satellite system designed and operated to repeatedly observe the global land surface at a moderate scale to show both natural and human-induced change.

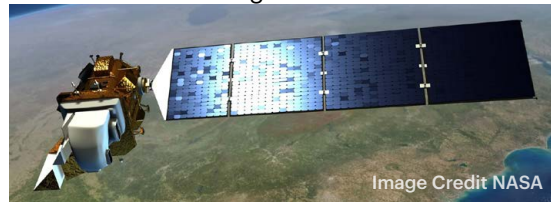


Image Credit NASA

LAUNCH VEHICLE

Payload Fairing (PLF)

The spacecraft is encapsulated in the 14-ft (4-m) diameter extra extended payload fairing (XEPF). The XEPF is a bisector (two-piece shell) fairing consisting of aluminum skin/stringer construction with vertical split-line longerons. The vehicle's height with the PLF is approximately 194 ft (59.1 m).

Centaur

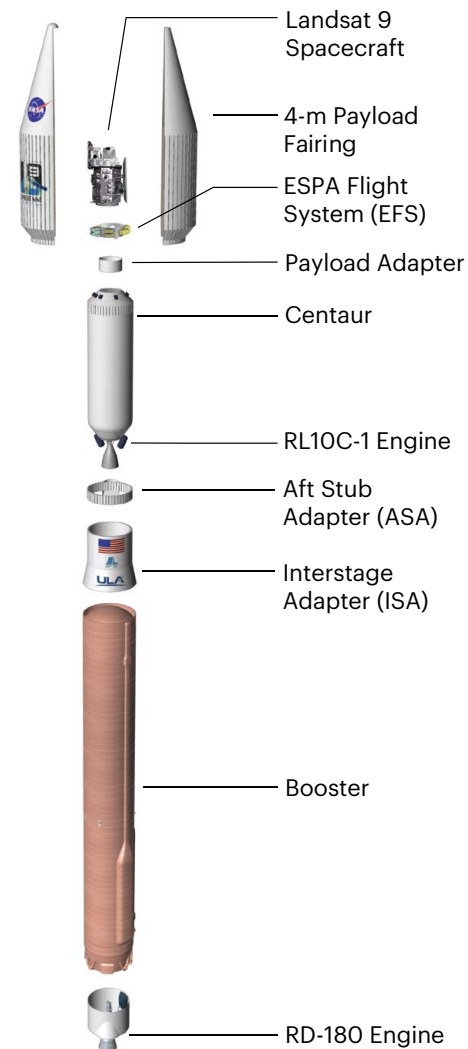
The Centaur second stage is 10 ft (3 m) in diameter and 41.5 ft (12.6 m) in length. Its propellant tanks are pressure-stabilized and constructed of corrosion-resistant stainless steel. Centaur is a cryogenic vehicle, fueled with liquid hydrogen and liquid oxygen, powered by an RL10C-1 engine producing 22,900 lbs (101.8 kilo-Newtons) 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 structural and electrical interfaces with the spacecraft.

Booster

The booster is 12.5 ft (3.8 m) in diameter and 106.5 ft (32.5 m) 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 lbs (3.83 mega-Newtons) of thrust at sea level. The Centaur avionics system, provides guidance, flight control and vehicle sequencing functions during the booster and Centaur phases of flight.

Landsat 9 is a joint mission of NASA and the U.S. Geological Survey (USGS). NASA's Goddard Spaceflight Center manages the mission through launch and post launch checkout and the Launch Services Program based at Kennedy Space Center manages the launch service. USGS operates the satellite and the mission data archive.

In addition to Landsat 9, this mission includes the Landsat 9 ESPA Flight System (EFS) which will deploy multiple CubeSats after Landsat 9 separation. The EFS is a U.S. Space Force activity to demonstrate the capability of integrating and delivering secondary payloads to orbit on an adapter ring. There are four multi-manifest satellites sponsored by the Defense Innovation Unit, Air Force Research Laboratory, Missile Defense Agency and NASA. The NASA CubeSats include the Colorado Ultraviolet Transit Experiment (CUTE) from the University of Colorado at Boulder which will measure how near-ultraviolet light from a host star changes when an exoplanet passes in front of it and through a planet's atmosphere. The Cusp Plasma Imaging Detector (CuPID) from Boston University will measure X-rays emitted when solar wind plasma collides with neutral atoms in Earth's atmosphere.



ATLAS V



The Atlas V 401 rocket is the workhorse of the Atlas V fleet. In its nearly 20 years of service, the 401 has launched a diverse set of missions including national security, science and exploration, commercial and International Space Station resupply.

First Launch: Aug. 21, 2002
Launches to Date: 38

Performance to GTO:
10,470 lb (4,750 kg)
Performance to LEO-Reference: 21,600 lb (9,800 kg)

MISSION SUCCESS

With more than a century of combined heritage, ULA is the nation's most experienced and reliable launch service provider. ULA has successfully delivered more than 140 missions to orbit that aid meteorologists in tracking severe weather, unlock the mysteries of our solar system, provide critical capabilities for troops in the field, deliver cutting-edge commercial services and enable GPS navigation.



ulalaunch.com



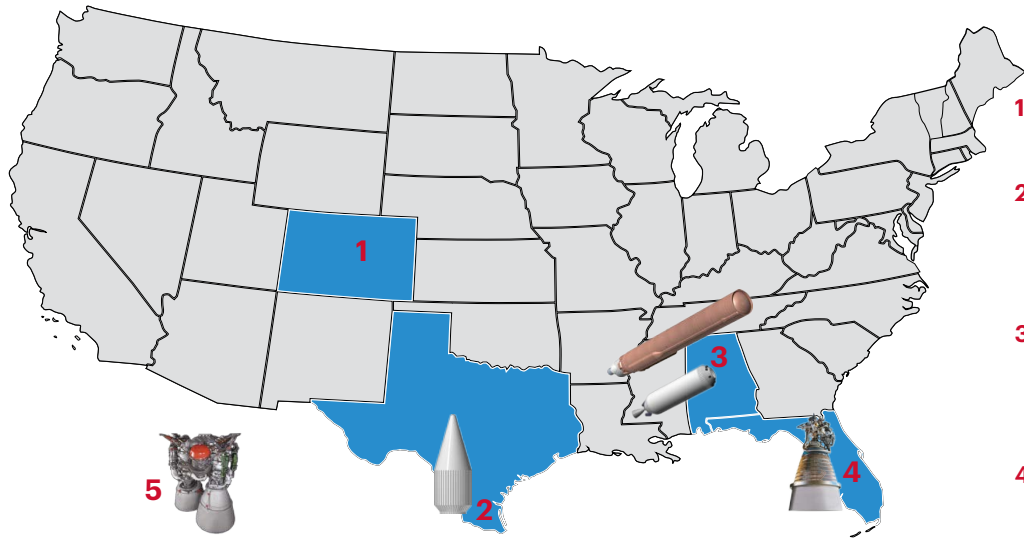
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MISSION OVERVIEW

Landsat 9 Atlas V

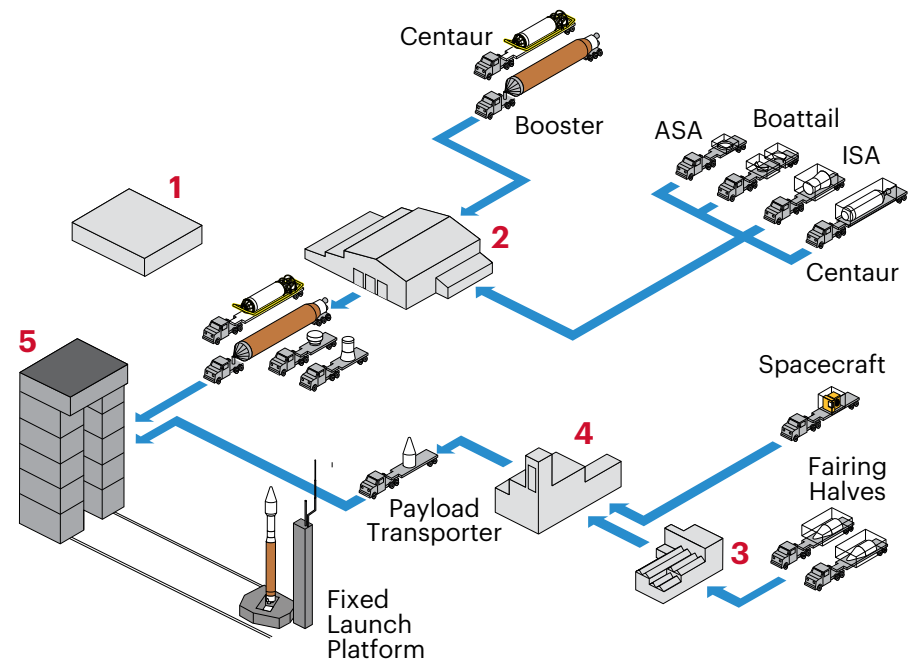


PRODUCTION



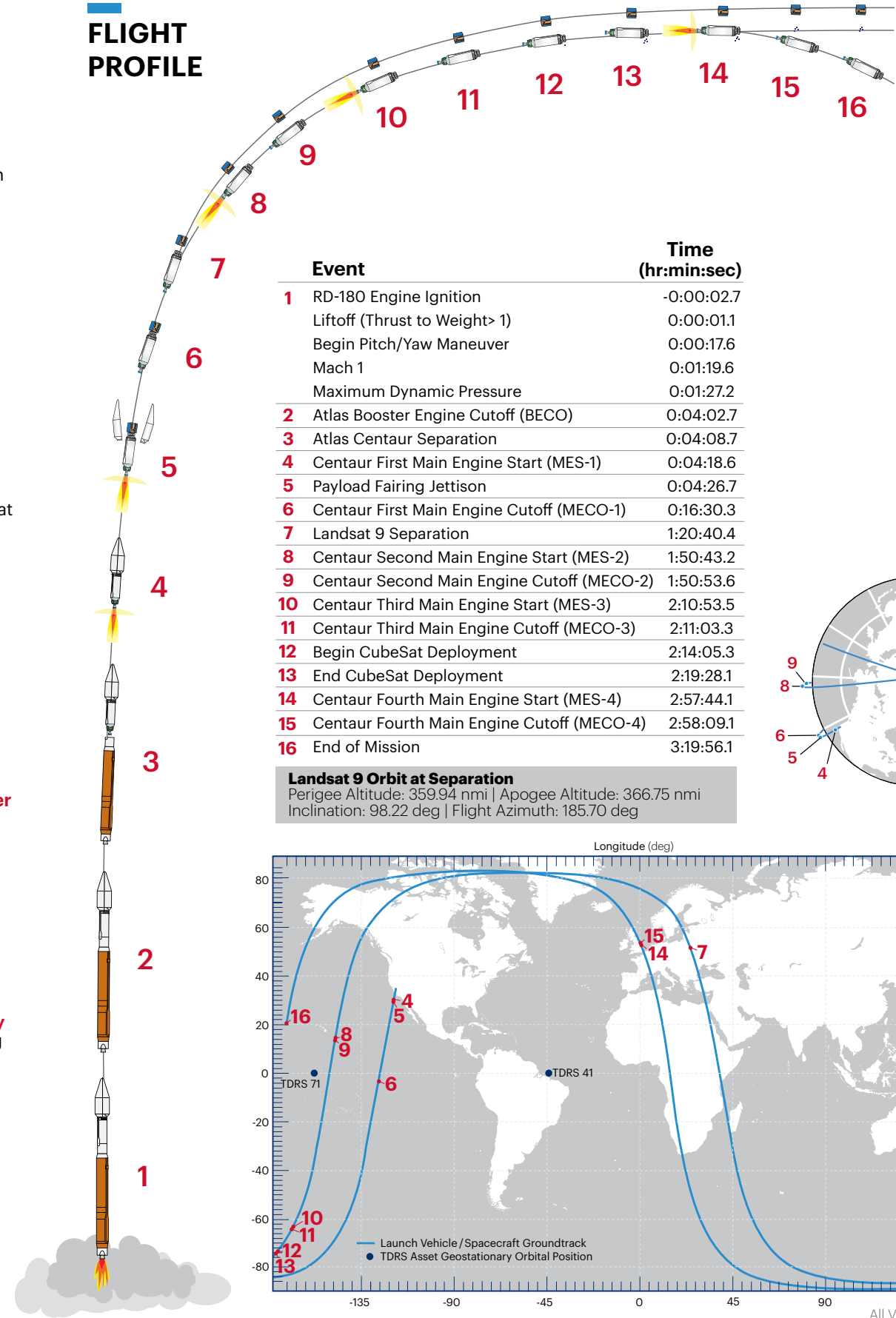
- 1 Denver, CO**
ULA Headquarters & Design
Center Engineering
- 2 Harlingen, TX**
Payload Fairing, Payload
Fairing Adapter, Booster
Adapter & Centaur
Adapter Fabrication
- 3 Decatur, AL**
Booster Fabrication & Final
Assembly, Centaur Tank
Fabrication & Centaur
Final Assembly
- 4 West Palm Beach, FL**
RL10C-1 Engine Fabrication
at Aerojet Rocketdyne
- 5 Khimki, Russia**
RD-180 Engine Fabrication at
NPO Energomash

SPACE LAUNCH COMPLEX-3 PROCESSING



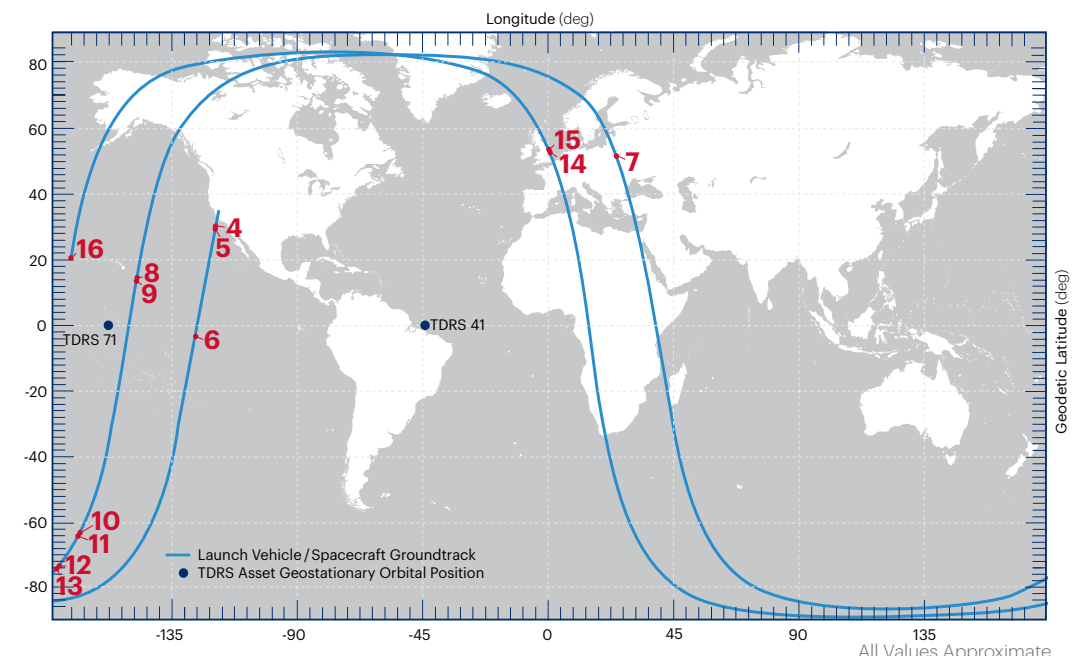
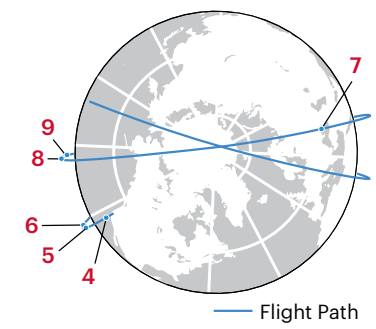
- 1 Remote Launch Control Center (RLCC)**
Launch Control Center & Mission Director's Center
- 2 Operations Center**
Receiving & Inspection
- 3 Building 8337**
PLF/Adapter Receiving & Inspection
- 4 Spacecraft Processing Facility**
Spacecraft Processing, Testing & Encapsulation
- 5 Mobile Service Tower**
Launch Vehicle Integration & Testing, Spacecraft 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	0:00:17.6
Mach 1	0:01:19.6
Maximum Dynamic Pressure	0:01:27.2
2 Atlas Booster Engine Cutoff (BECO)	0:04:02.7
3 Atlas Centaur Separation	0:04:08.7
4 Centaur First Main Engine Start (MES-1)	0:04:18.6
5 Payload Fairing Jettison	0:04:26.7
6 Centaur First Main Engine Cutoff (MECO-1)	0:16:30.3
7 Landsat 9 Separation	1:20:40.4
8 Centaur Second Main Engine Start (MES-2)	1:50:43.2
9 Centaur Second Main Engine Cutoff (MECO-2)	1:50:53.6
10 Centaur Third Main Engine Start (MES-3)	2:10:53.5
11 Centaur Third Main Engine Cutoff (MECO-3)	2:11:03.3
12 Begin CubeSat Deployment	2:14:05.3
13 End CubeSat Deployment	2:19:28.1
14 Centaur Fourth Main Engine Start (MES-4)	2:57:44.1
15 Centaur Fourth Main Engine Cutoff (MECO-4)	2:58:09.1
16 End of Mission	3:19:56.1

Landsat 9 Orbit at Separation
 Perigee Altitude: 359.94 nmi | Apogee Altitude: 366.75 nmi
 Inclination: 98.22 deg | Flight Azimuth: 185.70 deg



All Values Approximate