

MISSION

United Launch Alliance (ULA) will launch an Atlas V 541 rocket to deliver NASA's Mars 2020 Perseverance rover to a hyperbolic escape orbit where it will begin a 7-month journey to Mars. Liftoff will occur from Space Launch Complex-41 at Cape Canaveral Air Force Station, Florida.

The Mars 2020 mission with its Perseverance rover is part of NASA's Mars Exploration Program, a long-term effort of robotic exploration of the red planet. A team from the Jet Propulsion Laboratory (JPL) built the spacecraft. The Perseverance rover will seek signs of ancient life and collect rock and soil samples for possible return to Earth.



Image Courtesy of NASA

LAUNCH VEHICLE

Payload Fairing (PLF)

The spacecraft is encapsulated in a 5-m (17-ft) diameter short payload fairing. The 5-m PLF is a sandwich composite structure made with a vented aluminum-honeycomb core and graphite-epoxy face sheets. The bisector (two-piece shell) PLF encapsulates both the Centaur and the satellite. The vehicle's height with the 5-m short PLF is approximately 60 m (197 ft).

Centaur

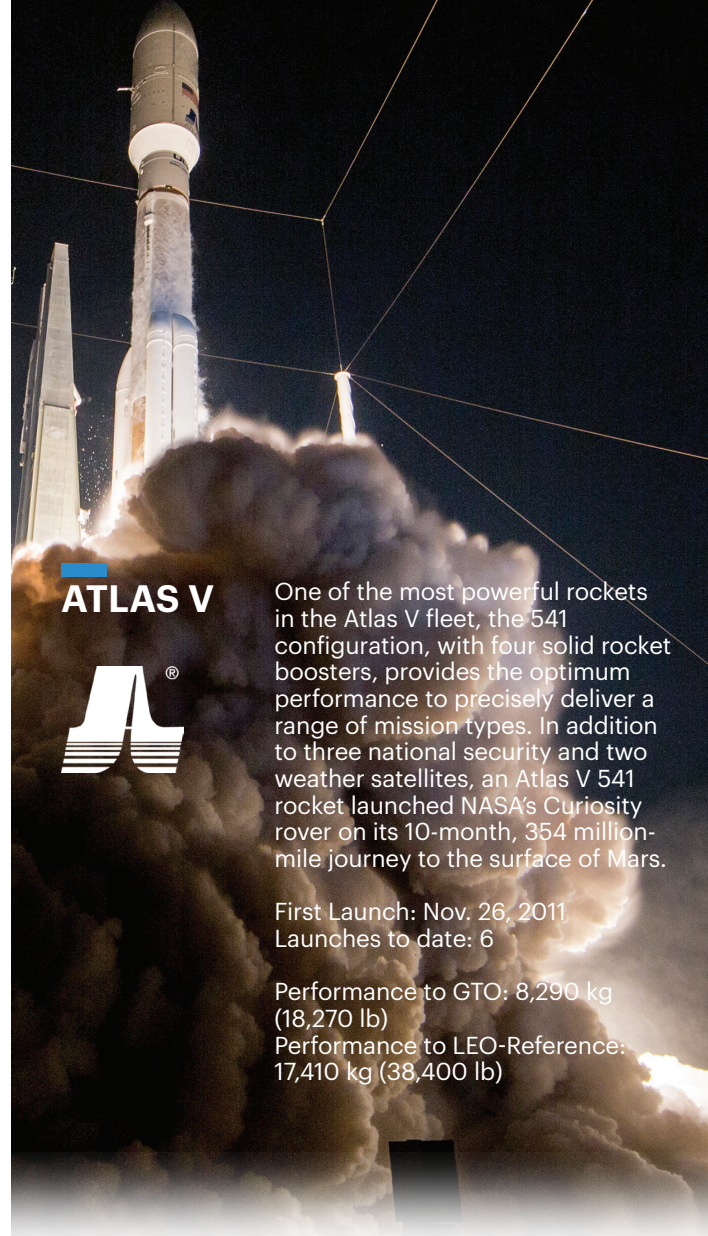
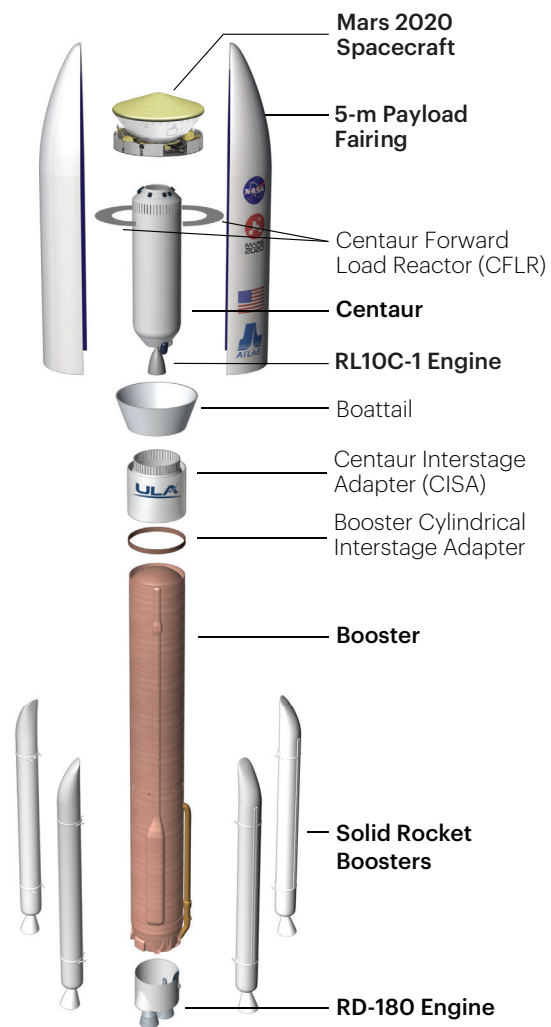
The Centaur second stage is 3 m (10 ft) in diameter and 12.6 m (41.5 ft) in length. Its propellant tanks are pressure-stabilized and constructed of corrosion-resistant stainless steel. Centaur is a cryogenic vehicle, fueled with liquid hydrogen and liquid oxygen, powered by an RL10C-1 engine producing 101.9 kilo-Newtons (22,900 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 structural and electrical interfaces with the spacecraft.

Booster

The booster is 3.8 m (12.5 ft) in diameter and 32.4 m (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 3.83 mega-Newtons (860,200 lb) of thrust at sea level. Four solid rocket boosters (SRBs) generate the additional power required at liftoff, each providing 1.55 mega-Newtons (348,500 lbs) of thrust. The Centaur avionics system, provides guidance, flight control and vehicle sequencing functions during the booster and Centaur phases of flight.

More specifically, Perseverance will study Mars' habitability, seek signs of past microbial life, collect and store samples of selected rock and soil, and prepare for future human missions. Perseverance rover will carry seven primary instruments: MASTCAM-Z, Mars Environmental Dynamics Analyzer (MEDA), Mars Oxygen ISRU Experiment (MOXIE), Planetary Instrument for X-ray Lithochemistry (PIXL), Radar Imager for Mars' Subsurface Experiment (RIMFAX), Scanning Habitable Environments with Raman & Luminescence for Organics & Chemicals (SHERLOC), and SuperCam. Also, the Mars helicopter, Ingenuity, will ride to Mars attached to the belly of the rover. The helicopter is a technology demonstration to test the first powered flight on Mars.

Mars 2020 and the Perseverance rover are scheduled to arrive at Mars in February 2021. The mission duration is at least one Mars year (about 687 Earth days). ULA and its heritage vehicles have launched every U.S. led mission to Mars. Mars 2020 will continue the legacy started by earlier missions to provide NASA and JPL with crucial knowledge and understanding of the red planet.



ATLAS V



One of the most powerful rockets in the Atlas V fleet, the 541 configuration, with four solid rocket boosters, provides the optimum performance to precisely deliver a range of mission types. In addition to three national security and two weather satellites, an Atlas V 541 rocket launched NASA's Curiosity rover on its 10-month, 354 million-mile journey to the surface of Mars.

First Launch: Nov. 26, 2011
Launches to date: 6

Performance to GTO: 8,290 kg (18,270 lb)
Performance to LEO-Reference: 17,410 kg (38,400 lb)

MISSION SUCCESS

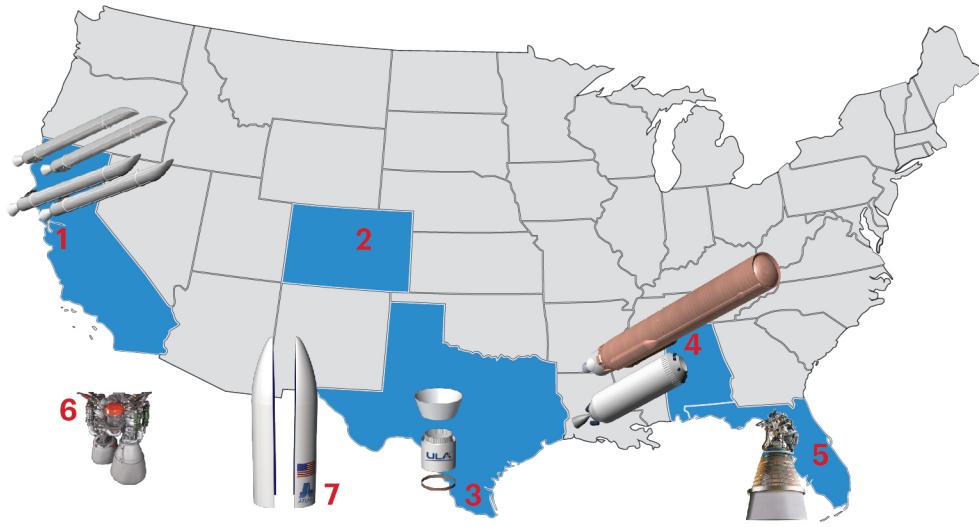
With more than a century of combined heritage, ULA is the world's most experienced and reliable launch service provider. ULA has successfully delivered more than 135 missions to orbit that provide Earth observation capabilities, enable global communications, unlock the mysteries of our solar system and support life-saving technology.

MISSION OVERVIEW



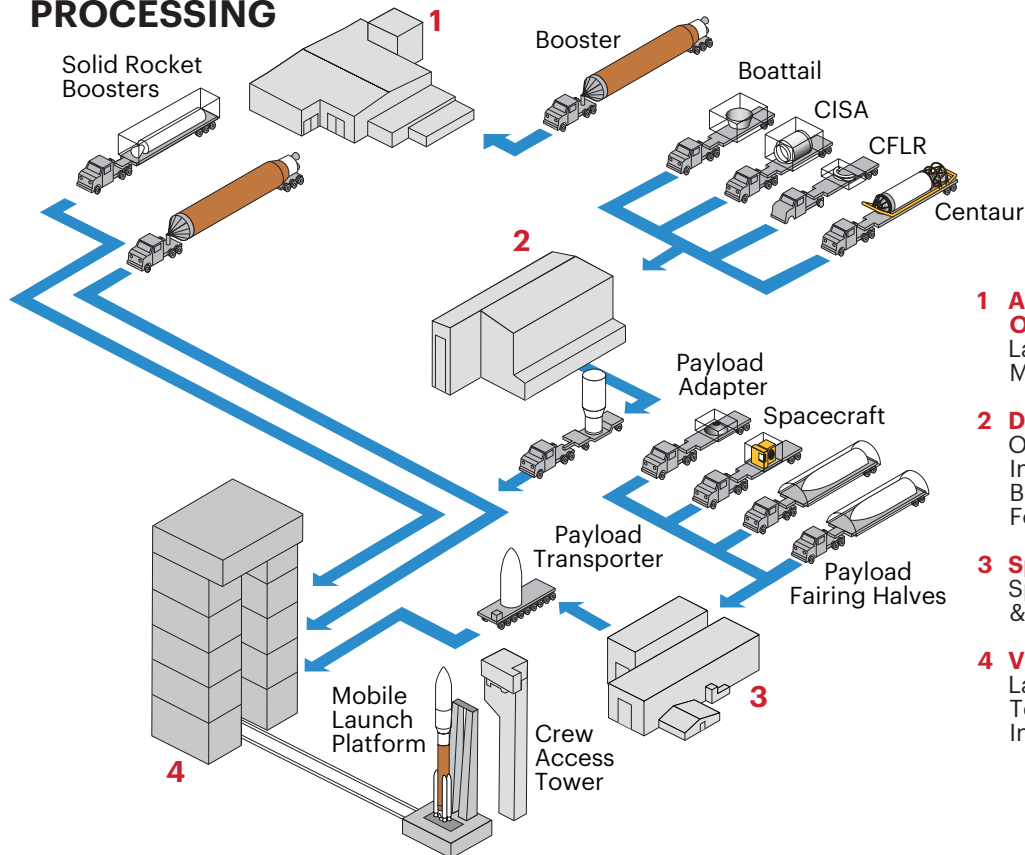
ulalaunch.com

PRODUCTION



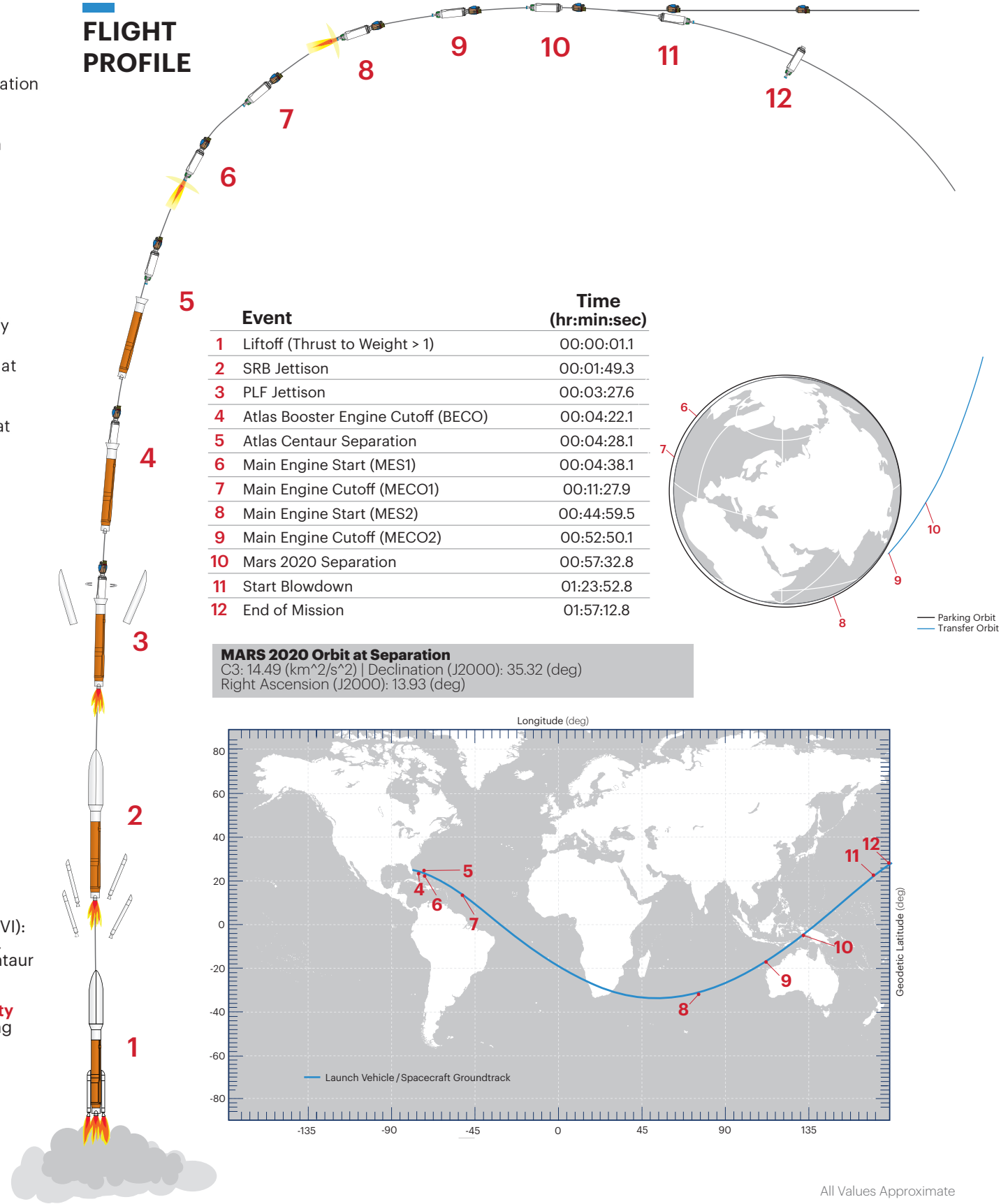
- 1 Sacramento, CA**
Solid Rocket Booster Fabrication at Aerojet Rocketdyne
- 2 Denver, CO**
ULA Headquarters & Design Center Engineering
- 3 Harlingen, TX**
Payload Adapter, Booster Adapter & Centaur Adapter Fabrication
- 4 Decatur, AL**
Booster Fabrication & Final Assembly, Centaur Tank Fabrication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

SPACE LAUNCH COMPLEX-41 PROCESSING



- 1 Atlas Spaceflight Operations Center (ASOC)**
Launch Control Center & Mission Director's Center
- 2 Delta Operations Center**
Offline Vertical Integration (OVI): Interstage Adapters, Centaur, Boattail, Base Module and Centaur Forward Load Reactor Deck
- 3 Spacecraft Processing Facility**
Spacecraft Processing, Testing & Encapsulation
- 4 Vertical Integration Facility**
Launch Vehicle Integration & Testing, Spacecraft Mate & Integrated Operations

FLIGHT PROFILE



MARS 2020 Orbit at Separation
 C3: 14.49 (km²/s²) | Declination (J2000): 35.32 (deg)
 Right Ascension (J2000): 13.93 (deg)

All Values Approximate