MISSION

A United Launch Alliance (ULA) Delta II 7420-10 rocket will deliver the Ice, Cloud and land Elevation Satellite-2 (ICESat-2) spacecraft to a 250 nmi (463 km), near-circular polar orbit. Liftoff will occur from Space Launch Complex-2 at Vandenberg Air Force Base, California.

ICESat-2, with its single instrument, the Advanced Topographic Laser Altimeter System (ATLAS), will provide scientists with height measurements to create a global portrait of Earth's third dimension, gathering data that can precisely track changes of terrain including glaciers, sea ice, forests and more. ATLAS is a photon-counting laser altimeter that advances technology from the first ICESat mission launched on a Delta II in 2003 and operated until 2009. Our planet's frozen and icy areas, called the cryosphere, are a key focus of NASA's Earth science research. ICESat-2 will help scientists investigate why, and how much, our cryosphere is changing in a warming climate, while also measuring heights across Earth's temperate and tropical regions and take stock of the vegetation in forests worldwide. The ICESat-2 mission is implemented by NASA's Goddard Space Flight Center (GSFC). Northrop Grumman built the spacecraft. NASA's Launch Services Program at Kennedy Space Center is responsible for launch management.

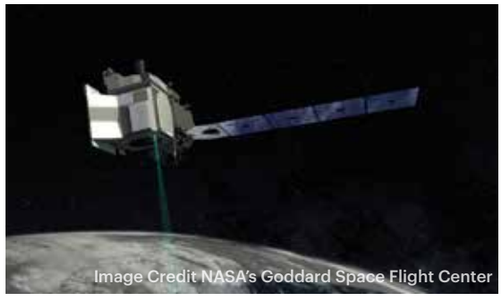


Image Credit NASA's Goddard Space Flight Center

In addition to ICESat-2, this mission includes four CubeSats which will launch from dispensers mounted to the Delta II second stage. The CubeSats were designed and built by UCLA, University of Central Florida, and Cal Poly. The miniaturized satellites will conduct research in space weather, changing electric potential and resulting discharge events on spacecraft and damping behavior of tungsten powder in a zero-gravity environment.

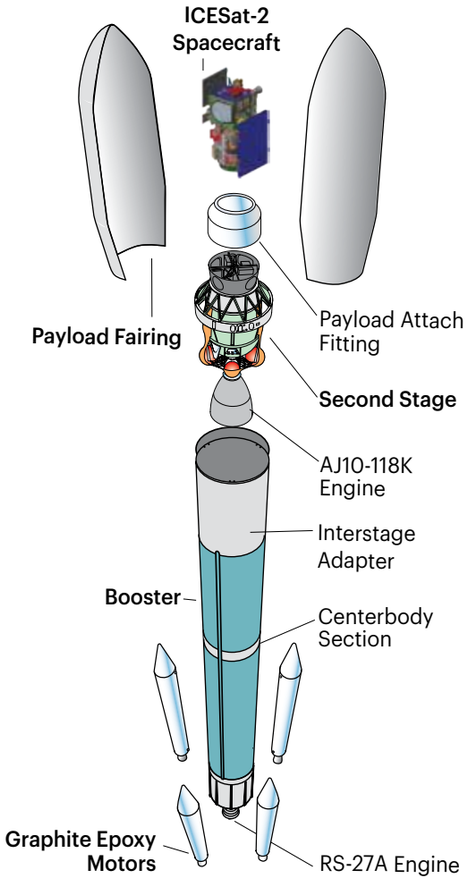
LAUNCH VEHICLE

Payload Fairing (PLF)
The PLF is a composite bisector (two-piece shell) 10-ft diameter fairing. The PLF encapsulates the spacecraft to protect it from the launch environment on ascent. The vehicle's height with the 10-ft PLF is approximately 132 ft.

Second Stage
The Delta II second stage is a hypergolic-(Aerozine 50 and Nitrogen Tetroxide) fueled vehicle with propellant tanks constructed of corrosion-resistant stainless steel. It uses a single AJ10-118K engine producing 9,850 lb of thrust. The second stage's guidance section provides the structural support for the propellant tanks, the PLF, mountings for vehicle electronics and the structural and electronic interfaces with the spacecraft.

Booster
The Delta II booster is 8-ft in diameter and approximately 87-ft in length. The booster's fuel and oxidizer tanks are structurally rigid and constructed of stiffened isogrid aluminum barrels and spun-formed aluminum domes. The booster is completed by the centerbody, which joins the fuel and oxidizer tanks and the LO2 skirt. Propulsion is provided by the RS-27A engine which burns RP-1 (Rocket Propellant-1 or highly purified kerosene) and liquid oxygen, and delivers 200,000 lb thrust at sea level. The booster is controlled by the second-stage avionics system which provides guidance and flight control during flight.

Graphite Epoxy Motors (GEMs)
The Delta II 7420-10 launch vehicle uses four GEMs, approximately 40 in. in diameter and 42-ft in length. The GEMs are constructed of a graphite-epoxy composite and are jettisoned by structural thrusters.



DELTA II

For nearly 30 years, the reliable Delta II rocket has been an industry workhorse, launching critical capabilities for NASA, the Air Force and customers around the world. From its origin as the launch vehicle for the first Global Positioning System (GPS) satellites to science and interplanetary satellites, including Mars rovers Spirit and Opportunity, to vital commercial communication and imaging satellites, the Delta II rocket has truly earned its place in space history.

First Launch: February 14, 1989
Launches to date: 154

MISSION SUCCESS

With more than a century of combined heritage, United Launch Alliance is the nation's most experienced and reliable launch service provider. ULA has successfully delivered more than 125 satellites to orbit that provide critical capabilities for troops in the field, aid meteorologists in tracking severe weather, enable personal device-based GPS navigation and unlock the mysteries of our solar system.

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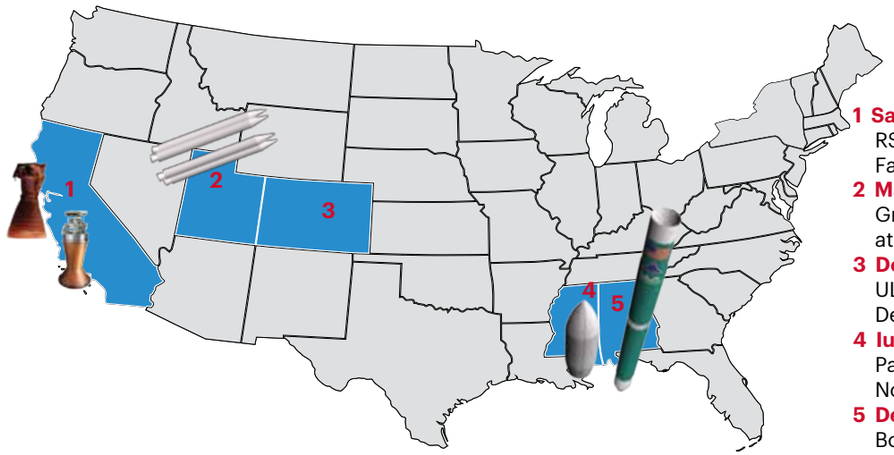
MISSION OVERVIEW

PRODUCTION



1 Sacramento, CA
RS-27A and AJ10-118K Engine Fabrication at Aerojet Rocketdyne

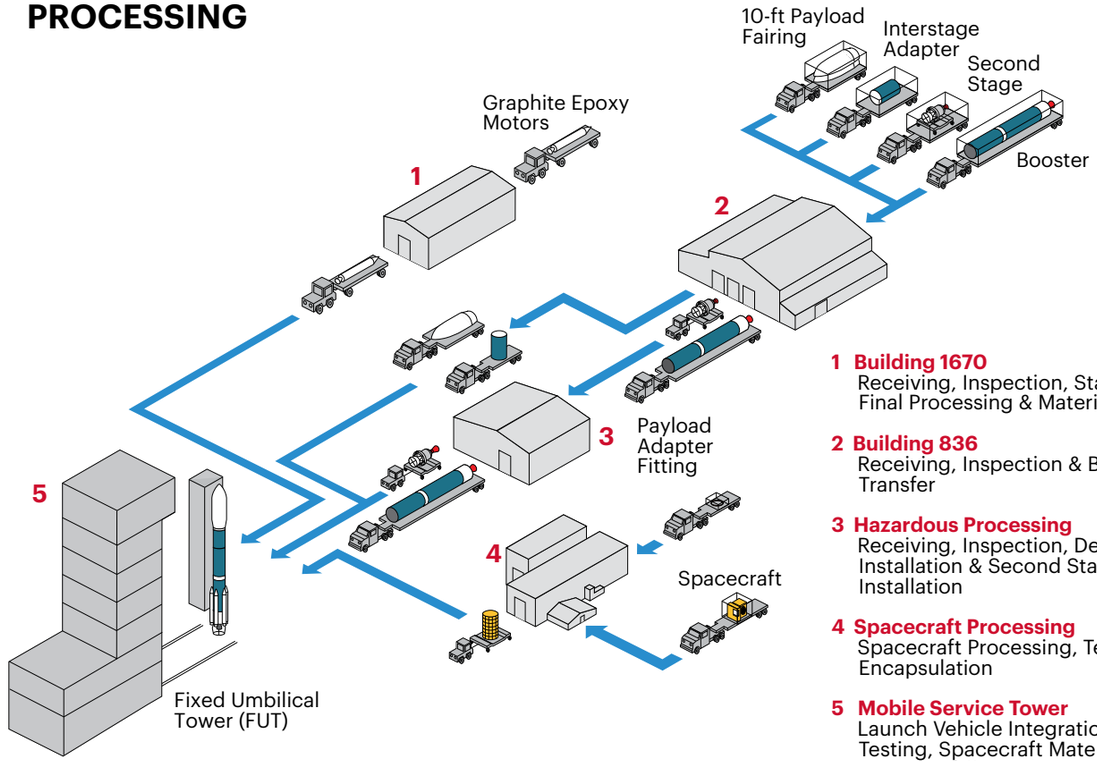
2 Magna, UT
Graphite Epoxy Motor Fabrication at Northrop Grumman

3 Denver, CO
ULA Headquarters & Design Center Engineering

4 Iuka, MS
Payload Fairing Fabrication at Northrop Grumman

5 Decatur, AL
Booster, Payload Fairing & Second Stage Fabrication

SPACE LAUNCH COMPLEX-2 PROCESSING



1 Building 1670
Receiving, Inspection, Staging, Final Processing & Material Stores

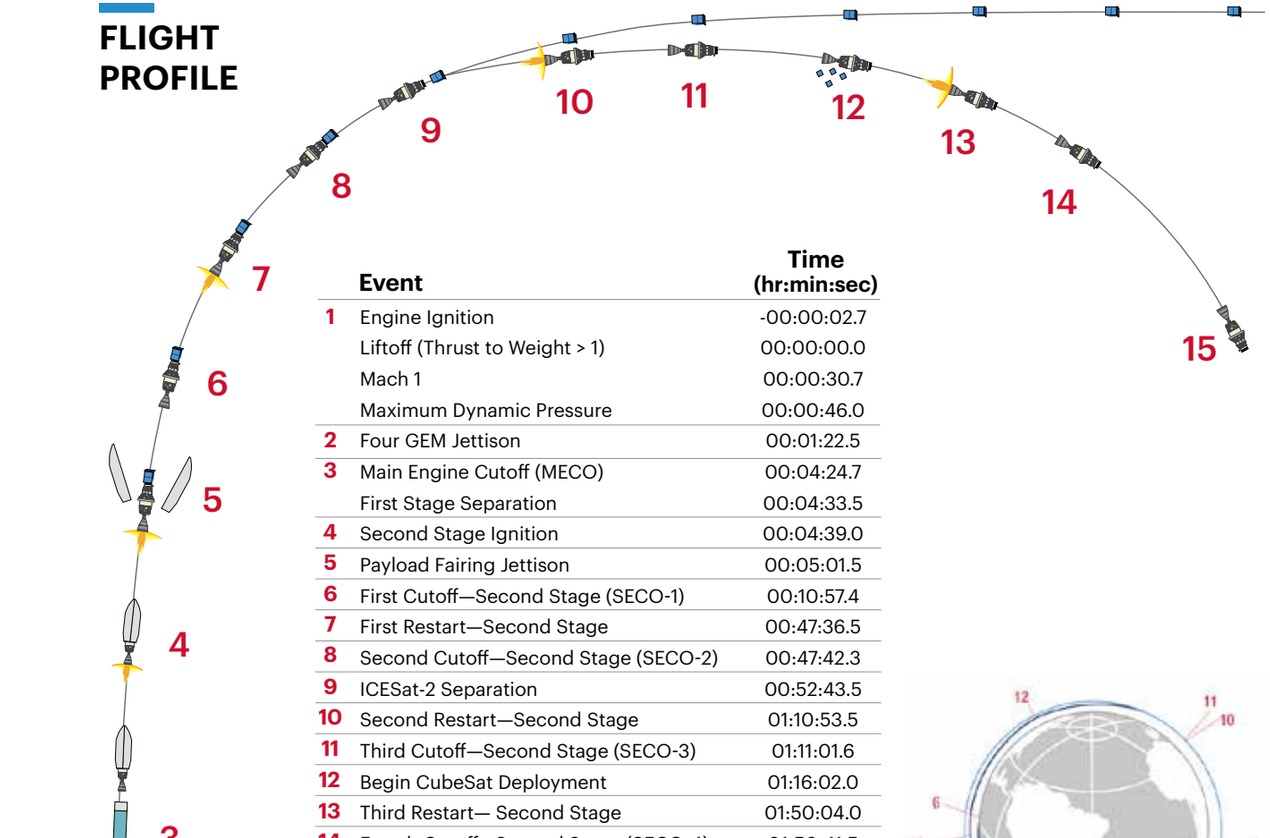
2 Building 836
Receiving, Inspection & Booster Transfer

3 Hazardous Processing
Receiving, Inspection, Destruct Installation & Second Stage Nozzle Installation

4 Spacecraft Processing
Spacecraft Processing, Testing & Encapsulation

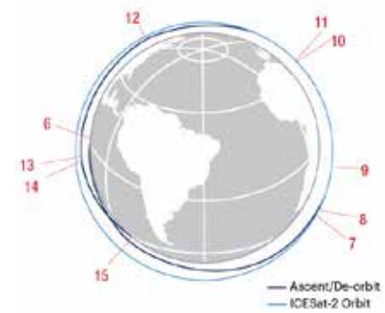
5 Mobile Service Tower
Launch Vehicle Integration & Testing, Spacecraft Mate & Integrated Operations

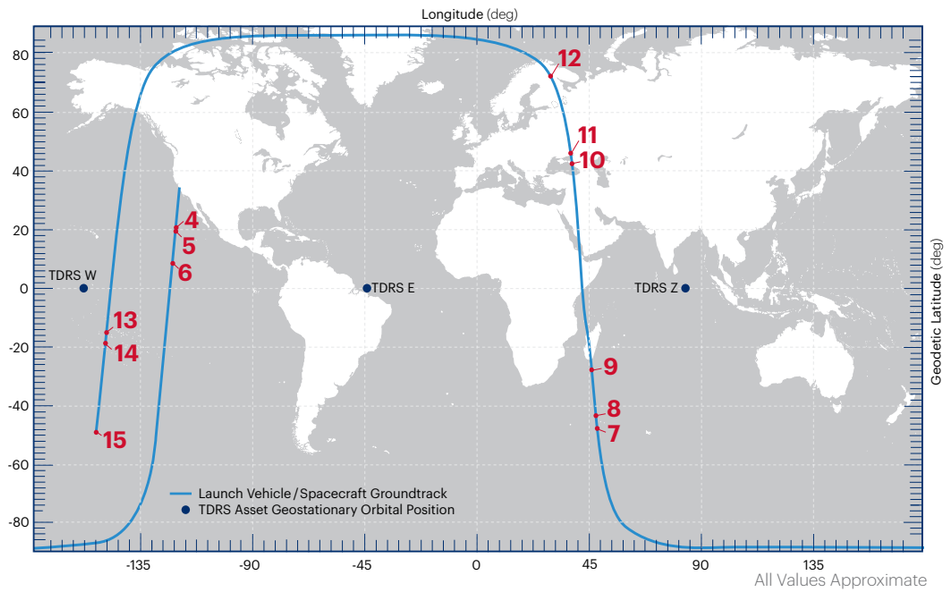
FLIGHT PROFILE



	Event	Time (hr:min:sec)
1	Engine Ignition	-00:00:02.7
	Liftoff (Thrust to Weight > 1)	00:00:00.0
	Mach 1	00:00:30.7
	Maximum Dynamic Pressure	00:00:46.0
2	Four GEM Jettison	00:01:22.5
3	Main Engine Cutoff (MECO)	00:04:24.7
	First Stage Separation	00:04:33.5
4	Second Stage Ignition	00:04:39.0
5	Payload Fairing Jettison	00:05:01.5
6	First Cutoff—Second Stage (SECO-1)	00:10:57.4
7	First Restart—Second Stage	00:47:36.5
8	Second Cutoff—Second Stage (SECO-2)	00:47:42.3
9	ICESat-2 Separation	00:52:43.5
10	Second Restart—Second Stage	01:10:53.5
11	Third Cutoff—Second Stage (SECO-3)	01:11:01.6
12	Begin CubeSat Deployment	01:16:02.0
13	Third Restart— Second Stage	01:50:04.0
14	Fourth Cutoff—Second Stage (SECO-4)	01:50:41.5
15	Impact	02:10:46.9

ICESat-2 Orbit at Separation
Semi-major Axis: 3,696.38 nmi | Eccentricity: 0.001 deg
Inclination: 92.0 deg | Argument of Perigee: 108.95 deg





All Values Approximate