MISSION OVERVIEW | SLC-3 VAFB, CA

United Launch Alliance

ATLAS

The United Launch Alliance (ULA) team is proud to be the launch provider for the Landsat Data Continuity Mission (LDCM).

The Landsat series of satellites, developed and operated by the U.S. Geological Service (USGS), has collected a continuous set of global multi-spectral land data for more than four decades.

Once in orbit, the LDCM satellite will become Landsat 8, and will take over for the venerable, but aging Landsat 7 which has been in service seven years beyond its design life. Landsat 8 will scan the entire globe on an annual basis, with a complete U.S. territory data set collected every 16 days.

LDCM incorporates sensing and data capture capability improvements and will continue and expand Landsat's vital legacy of Earth image collection. The data from Landsat is freely available and provides critical information to people who work in agriculture, geology, forestry, regional planning, education, mapping, and global change research.

The ULA team is focused on attaining Perfect Product Delivery for the LDCM mission, which includes a relentless focus on mission success (the perfect product) and also excellence and continuous improvement in meeting all of the needs of our customers (the perfect delivery).

The LDCM mission marks the first Atlas V launch from the West Coast with our partners the National Aeronautics and Space Administration (NASA). My thanks to the entire team for its dedication in bringing LDCM to launch and to NASA for trusting ULA to deliver this critical capability to orbit.

Jim Sponnick
Vice President, Mission Operations

LDCM SATELLITE | Overview

The Landsat Data Continuity Mission is NASA's eighth satellite in the Landsat series and continues the Landsat program's critical role in monitoring, understanding and managing the resources needed for human sustainment such as food, water and forests. As our population surpasses seven billion people, the impact of human society on the planet will increase, and Landsat monitors those impacts as well as environmental changes.

Since 1972, NASA's Landsat fleet has provided the longest continuous record of the Earth's surface as seen from space, providing the world with unprecedented information on land cover changes. The knowledge gained from 40 years of continuous data contributes to research on climate, carbon cycle, ecosystems, water cycle, biogeochemistry and changes to Earth's surface, as well as our understanding of visible human effects on land surfaces. Data collected by Landsat has, over time, led to the improvement of human and biodiversity health, energy and water management, urban planning, disaster recovery and agriculture monitoring, all resulting in incalculable benefits to the U.S. and world economy. Landsat data have been used to monitor water quality, glacier recession, sea ice movement, invasive species encroachment, coral reef health, land use change, deforestation rates and population growth. Landsat has also helped to assess damage from natural disasters such as fires, floods, and tsunamis, and subsequently, plan disaster relief and flood control programs.

Weighing in at approximately 6,100-lb, fully fueled, the satellite bus is built by Orbital Sciences Corporation, and supports the Operational Land Imager (OLI) and Terrestrial Infrared System (TIRS) as the primary instruments. With each pass, OLI will collect Earth views in the visible, near infrared and short wave infrared portions of the light spectrum with up to 49 ft resolution along a 115-mile wide swath. TIRS will measure land surface temperature in two thermal infrared bands with a new technology that applies quantum physics to detect heat. LDCM will be positioned in a nearly-polar, sun-synchronous orbit which allows a view of the entire Earth once every 16 days and will measure the Earth's surfaces in four distinct frequency bands.

Image Courtesy NASA

ATLAS V 401 LAUNCH VEHICLE | Overview

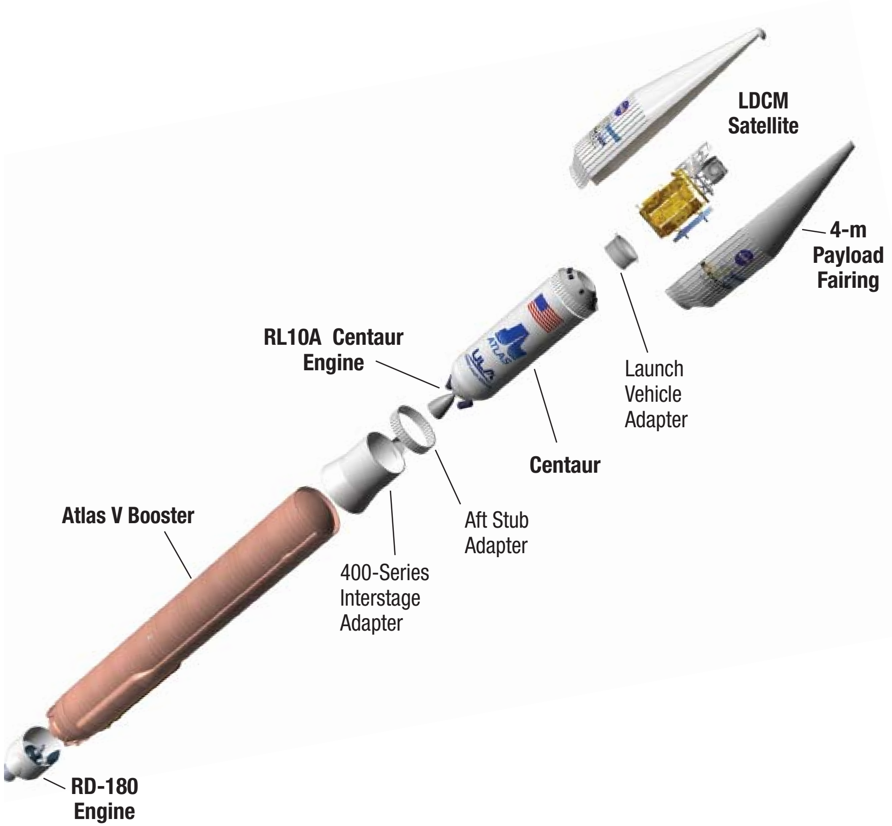
The Atlas V 401 consists of a single Atlas V booster stage, the Centaur upper stage, and a 4-m diameter payload fairing (PLF).

The Atlas V 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. Atlas 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. The Atlas V booster is controlled by the Centaur avionics system, which provides guidance, flight control, and vehicle sequencing functions during the booster and Centaur phases of flight.

The Centaur upper stage is 10 ft in diameter and 41.5 ft in length. Its propellant tanks are constructed of pressure-stabilized, corrosion resistant stainless steel. Centaur is a liquid hydrogen/liquid oxygen- (cryogenic-) fueled vehicle. It uses a single RL10A-4-2 engine producing 22,300 lb of thrust. The cryogenic tanks are insulated with a combination of helium-purged insulation blankets, radiation shields, and spray-on foam insulation (SOFI). The Centaur forward adapter (CFA) provides the structural mountings for the fault-tolerant avionics system and the structural and electrical interfaces with the spacecraft.

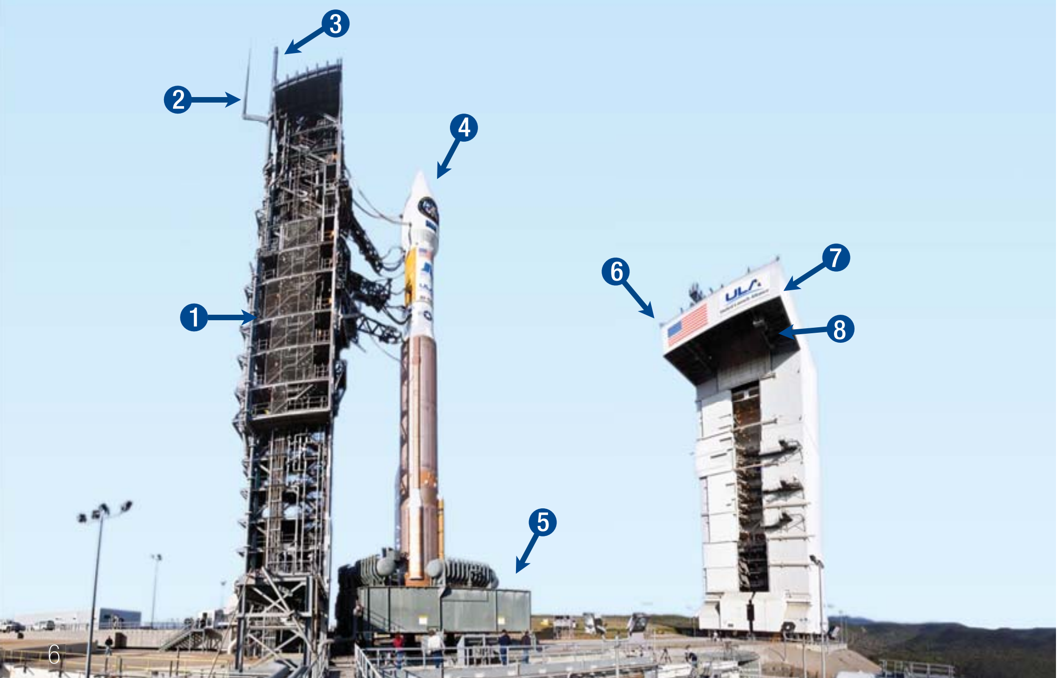
The LDCM mission is encapsulated in the 4-m (14-ft) diameter extended payload fairing (EPF). The EPF is a bisector (two-piece shell) fairing consisting of aluminum skin/stringer construction with vertical split-line longerons. The vehicle's height with the PLF is approximately 192 ft.

ATLAS V 401 LAUNCH VEHICLE | Expanded View



SPACE LAUNCH COMPLEX 3 (SLC-3) | Overview

1 Umbilical Tower
2 Lightning Mast
3 Hydrogen Vent Stack
4 Launch Vehicle
5 Launch Platform
6 Mobile Service Tower (MST)
7 Bridge Crane Hammerhead
8 Bridge Crane



ATLAS V LDCM | Mission Overview

The LDCM mission will be flown on a due-south trajectory from Space Launch Complex 3 (SLC-3) at Vandenberg Air Force Base (VAFB), CA. The satellite will be released in a nearly-polar, sun-synchronous orbit.

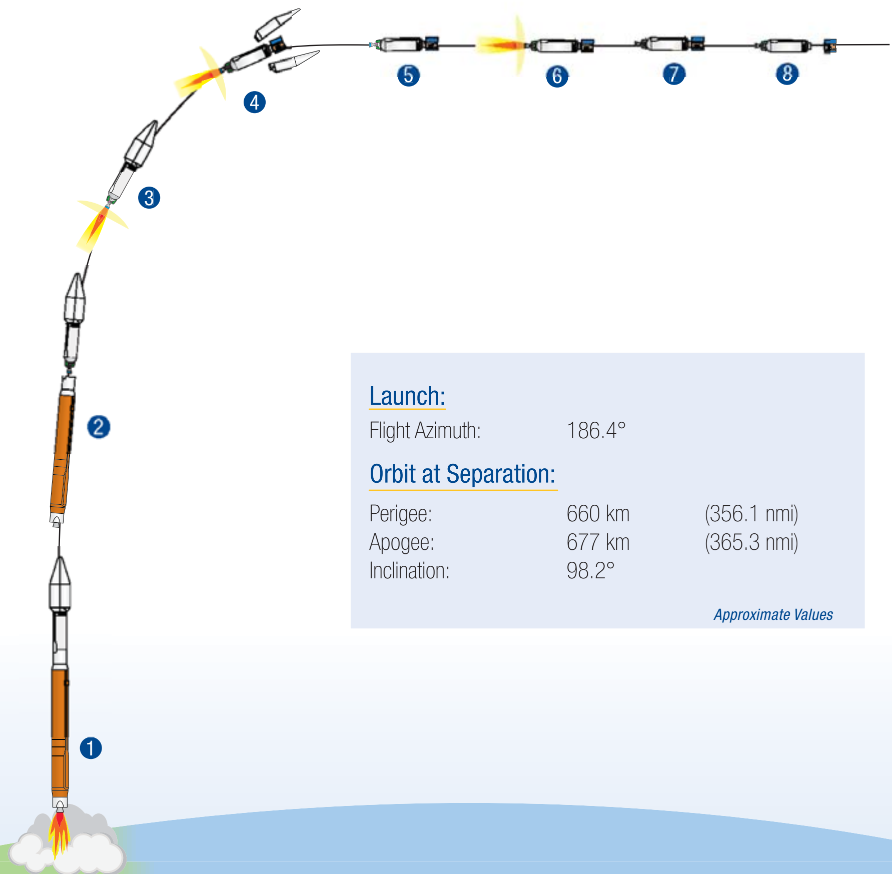
Mission telemetry data will be gathered by the Western Range (VAFB), Hawaii (HULA), RAF Oakhanger (LION), and Thule (POGO) tracking stations. The orbiting Tracking and Data Relay Satellite (TDRS) constellation will also participate in gathering telemetry data during the LDCM mission.

The mission begins with RD-180 engine ignition at approximately T-2.7 seconds. Liftoff occurs at T+1.1 seconds. Shortly after the vehicle clears the pad, it performs its pitch/yaw/roll maneuver.

Booster engine cutoff (BECO) occurs at approximately 240 seconds into the mission. Centaur separation occurs 6 seconds after BECO followed by Centaur main engine start (MES-1) 16 seconds later. The PLF jettison takes place at approximately 8 seconds after Centaur MES-1. The booster and Centaur fly a fixed ascent trajectory until it clears the Range Safety control region, but then follow a varying ascent profile depending on the time of launch, so all subsequent mission times are variable.

Approximately 14.4 minutes into the mission, the first Centaur main engine cutoff (MECO-1) occurs. At 70 minutes, Centaur reorients itself for its second main engine start (MES-2). The second Centaur engine burn lasts nearly 3 minutes, followed by the second Centaur main engine cutoff (MECO-2). Following MECO-2, Centaur reorients its attitude for separation. LDCM is separated approximately 78 minutes after liftoff.

FLIGHT PROFILE | Liftoff to Separation



Launch:

Flight Azimuth: 186.4°

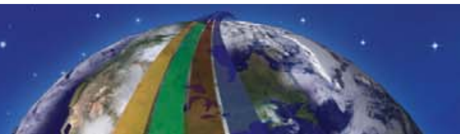
Orbit at Separation:

Perigee: 660 km (356.1 nmi)
Apogee: 677 km (365.3 nmi)
Inclination: 98.2°

Approximate Values

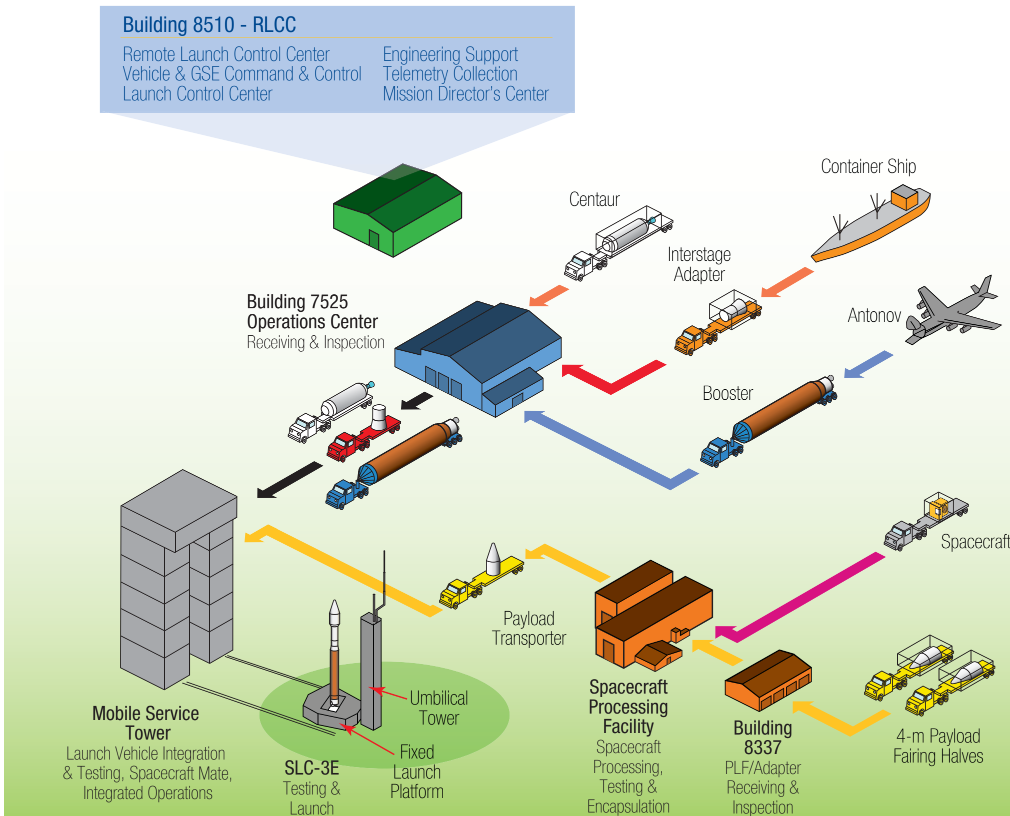
SEQUENCE OF EVENTS | Liftoff to Separation

	Event	Time (seconds)	Time (hr:min:sec)
1	RD-180 Engine Ignition	-2.7	-00:00:02.7
	T=0 (Engine Ready)	0.0	00:00:00.0
	Liftoff (Thrust to Weight >1)	1.1	00:00:01.1
	Begin Pitch/Yaw/Roll Maneuver	17.3	00:00:17.3
	Maximum Dynamic Pressure	87.3	00:01:27.3
2	Atlas Booster Engine Cutoff (BECO)	242.2	00:04:02.2
	Atlas Booster/Centaur Separation	248.2	00:04:08.2
3	Centaur First Main Engine Start (MES-1)	258.2	00:04:18.2
4	Payload Fairing Jettison	266.2	00:04:26.2
5	Centaur First Main Engine Cutoff (MECO-1)	923.7	00:15:23.7
6	Centaur Second Main Engine Start (MES-2)	4,234.2	01:10:34.2
7	Centaur Second Main Engine Cutoff (MECO-2)	4,339.9	01:12:19.9
8	LDCM Separation	4,700.9	01:18:20.9

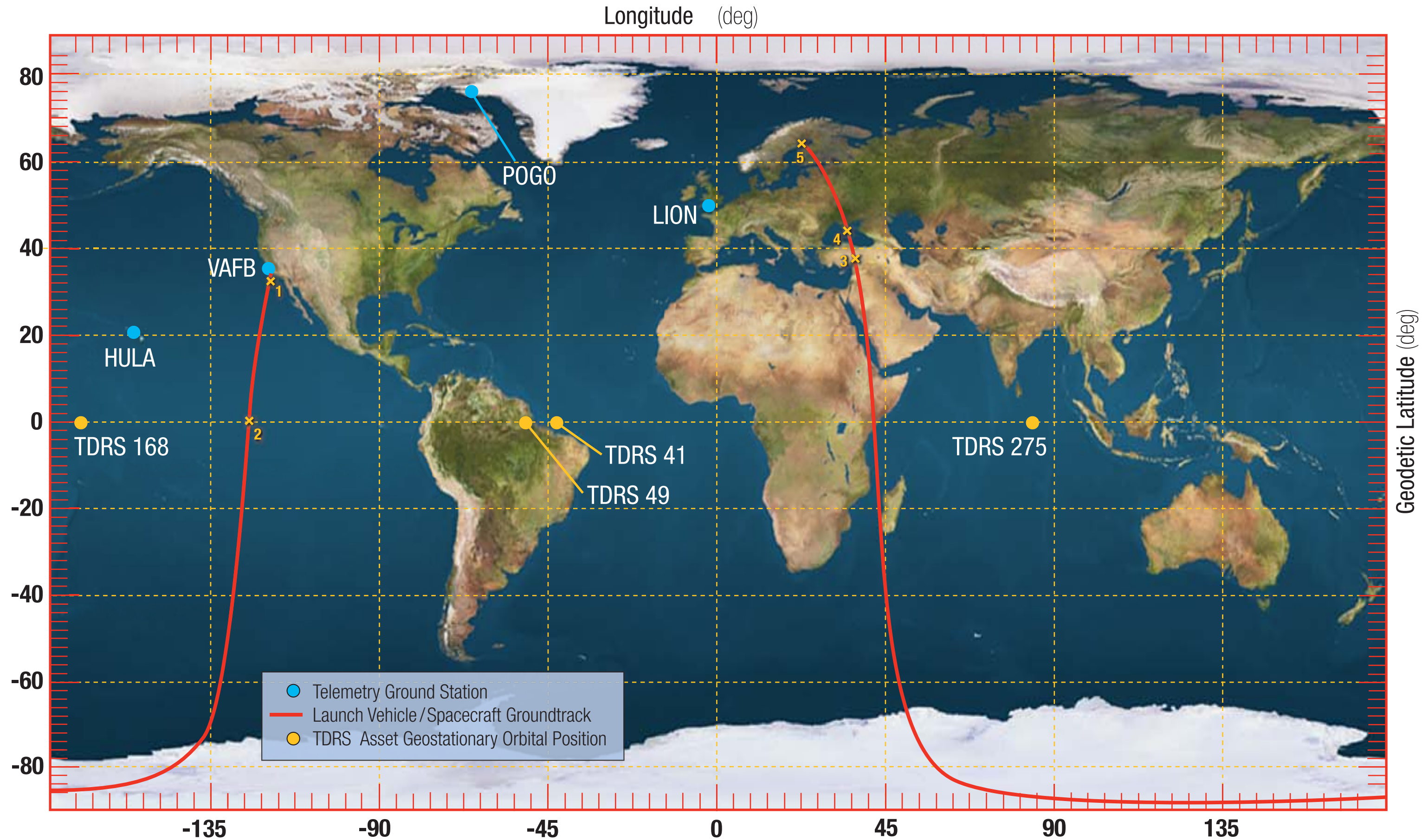


ATLAS V PRODUCTION & LAUNCH | Overview

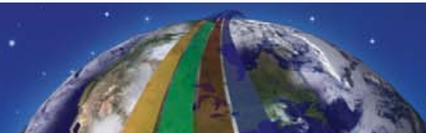
ATLAS V PROCESSING | Vandenberg

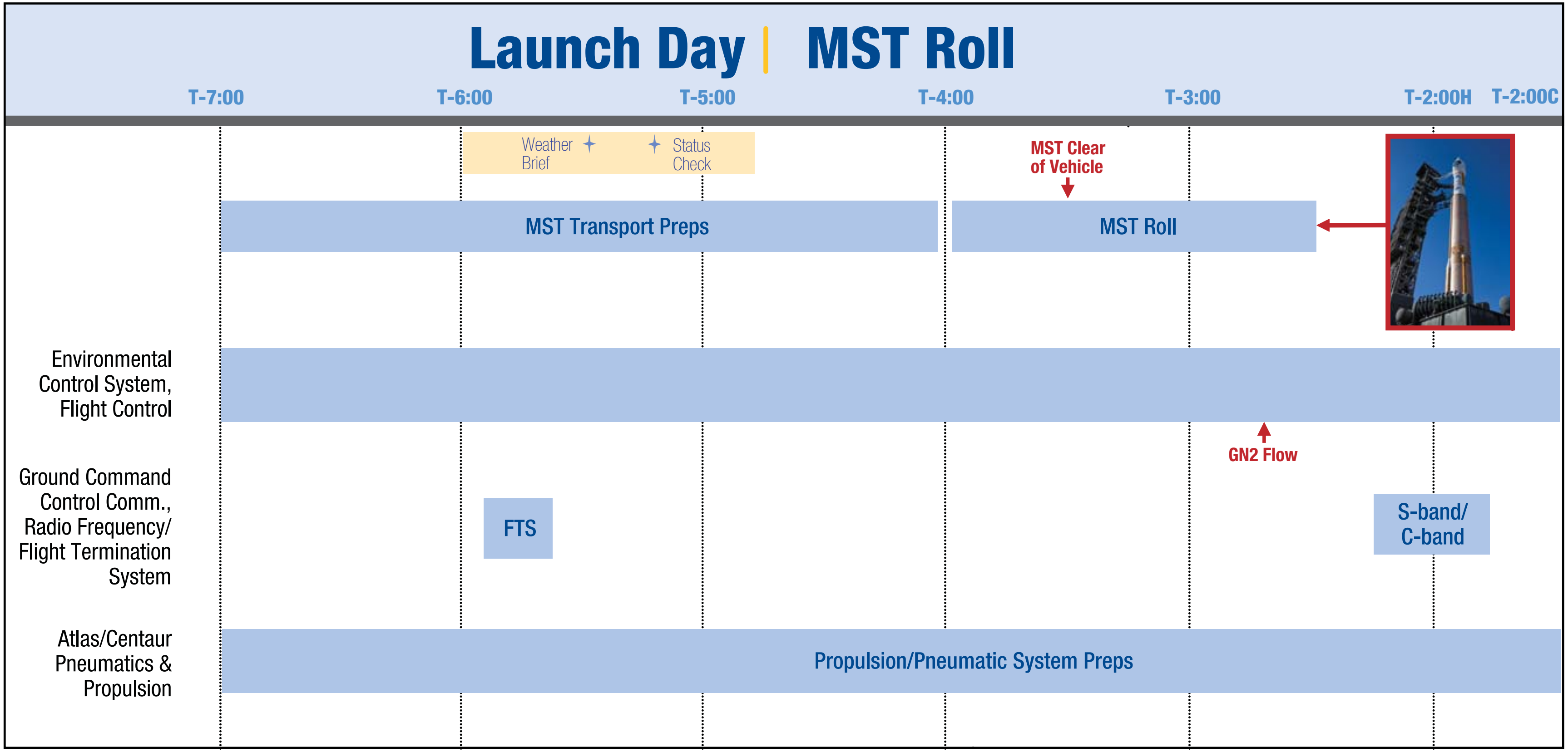


GROUND TRACE | Liftoff to Separation

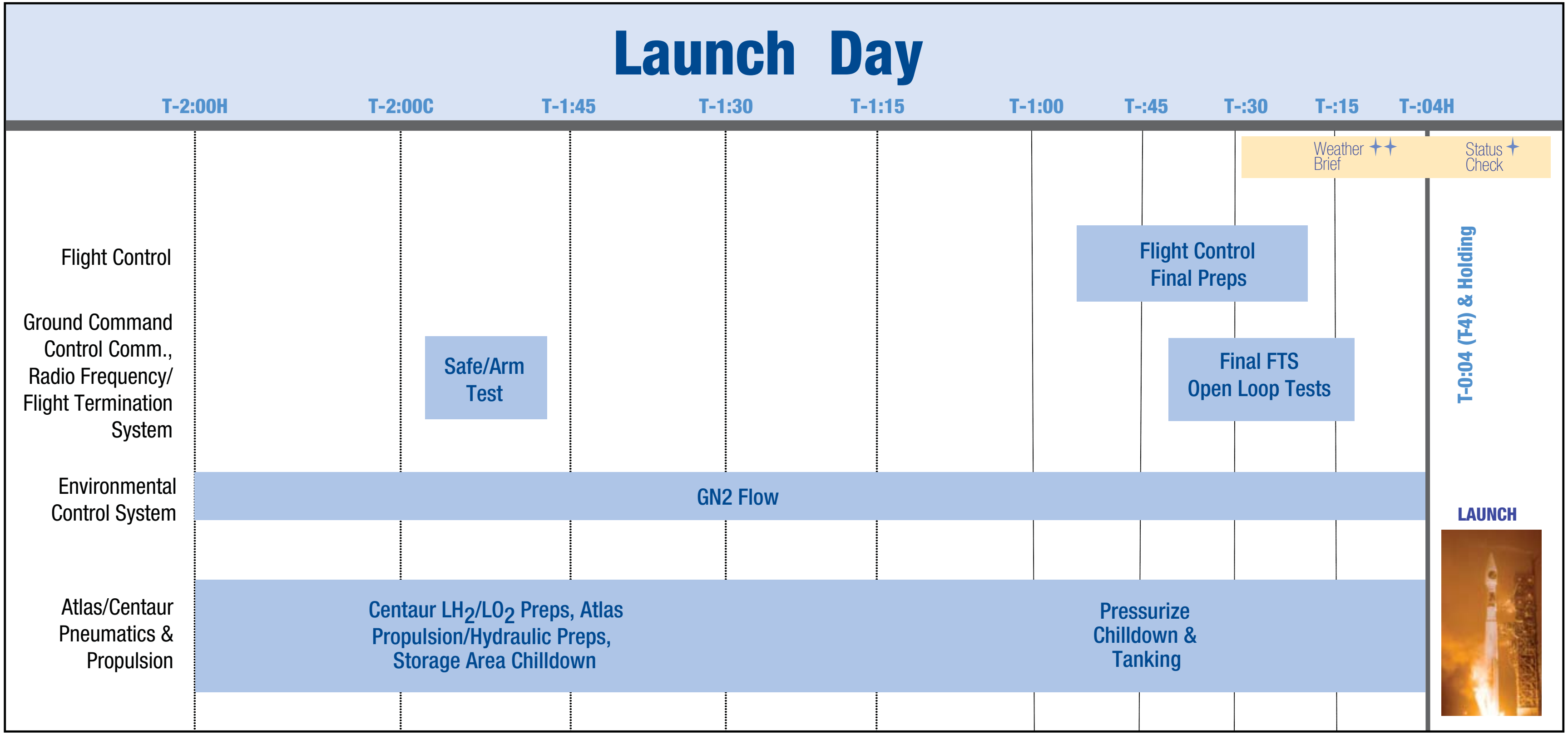


1 = MES-1 (0:04:18.2) | **2 =** MECO-1 (0:15:23.7) | **3 =** MES-2 (1:10:34.2)
4 = MECO-2 (1:12:19.9) | **5 =** LDCM Separation (01:18:20.9)





Launch Day | MST Roll
T-7:00
T-6:00
T-5:00
T-4:00
T-3:00
T-2:00H
T-2:00C
Weather Brief
Status Check
MST Clear of Vehicle
MST Transport Preps
MST Roll
Environmental Control System, Flight Control
GN2 Flow
Ground Command Control Comm., Radio Frequency/ Flight Termination System
FTS
S-band/ C-band
Atlas/Centaur Pneumatics & Propulsion
Propulsion/Pneumatic System Preps


Launch Day
T-2:00H
T-2:00C
T-1:45
T-1:30
T-1:15
T-1:00
T-:45
T-:30
T-:15
T-:04H
Weather Brief
Status Check
Flight Control
Ground Command Control Comm., Radio Frequency/ Flight Termination System
Environmental Control System
Atlas/Centaur Pneumatics & Propulsion
Flight Control Final Preps
Safe/Arm Test
Final FTS Open Loop Tests
GN2 Flow
Centaur LH2/LO2 Preps, Atlas Propulsion/Hydraulic Preps, Storage Area Chilldown
Pressurize Chilldown & Tanking
T-0:04 (T4) & Holding
LAUNCH

United Launch Alliance | P.O. Box 3788 Centennial, CO 80155 | www.ulalaunch.com