ATLAS V OA-7 MISSION

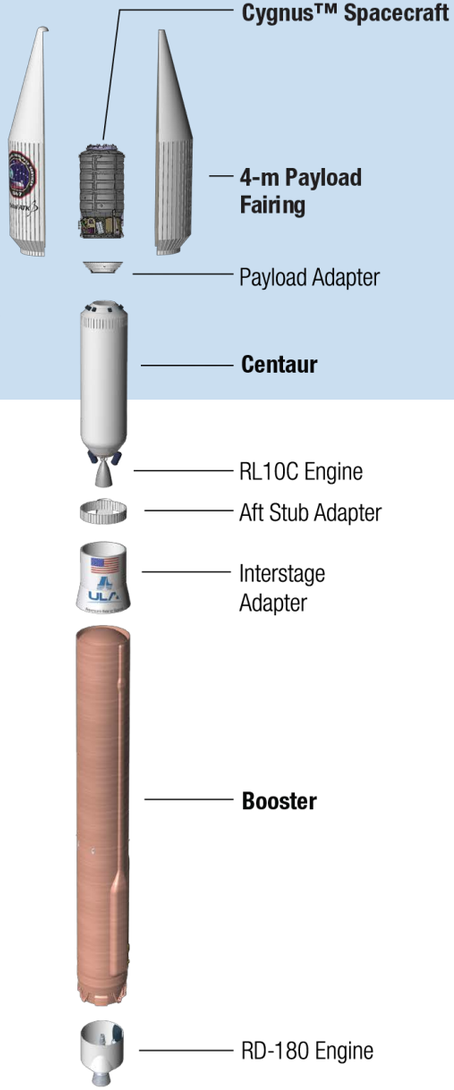
A United Launch Alliance (ULA) Atlas V 401 rocket will launch the Cygnus™ spacecraft on the initial leg of its cargo resupply mission to the International Space Station (ISS). Liftoff will occur from Space Launch Complex-41 at Cape Canaveral Air Force Station, FL.

Orbital ATK developed the Cygnus advanced maneuvering spacecraft to perform ISS cargo delivery missions under the Commercial Resupply Service (CRS) contract with NASA. At a total weight of approximately 7,225 kg (15,928 lb), OA-7 will include approximately 3,380 kg (7,452 lb) of internal cargo and an 83 kg (183 lb) external deployer carrying CubeSats.


Image Courtesy Orbital ATK

Cygnus is a low-risk design incorporating elements drawn from Orbital ATK and its partners' existing, flight-proven spacecraft technologies. Cygnus consists of a common Service Module (SM) and a Pressurized Cargo Module (PCM). The SM is assembled and tested at Orbital ATK's Dulles, VA, satellite manufacturing facility and incorporates systems from Orbital ATK's flight-proven LEOStar™ and GEOStar™ satellite product lines. The PCM is based on the Multi-Purpose Logistics Module, developed and built by Thales Alenia Space of Italy.

The OA-7 mission is the seventh Cygnus flight, and third Cygnus flight onboard an Atlas V rocket, following the extremely successful OA-4 and OA-6 launches in December 2015 and March 2016, respectively. The Cygnus spacecraft for the OA-7 mission will fly the Saffire-III experiment, developed and built by NASA's Glenn Research Center, that tests properties of combustion in microgravity, as well as an external deployer carrying CubeSats that will be deployed after separation from the ISS. It is the fourth flight of Orbital ATK's enhanced Cygnus featuring a larger PCM with increased cargo capacity and an optimized SM design including Orbital ATK's lightweight UltraFlex™ solar arrays.



Payload Fairing (PLF)

The Cygnus spacecraft is encapsulated in the 4-m (14-ft) 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.

Centaur

The Centaur second 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 RL10C engine producing 22,900 lbf 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.

Booster

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.

ATLAS V 401

The Atlas V 401 rocket has become the workhorse of the Atlas V fleet, delivering about half of all Atlas V missions to date. In its more than 14 years of service, the 401 has launched a diverse set of missions including national security, science and exploration, commercial as well as International Space Station resupply.

First Launch: Aug. 21, 2002
Launches to date: 35

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

ATLAS®

ULA™

America's Ride to Space

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 115 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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Image Courtesy NASA

MISSION OVERVIEW

– 3rd ULA Mission Supporting ISS Cargo Resupply

– 71st Atlas V Launch

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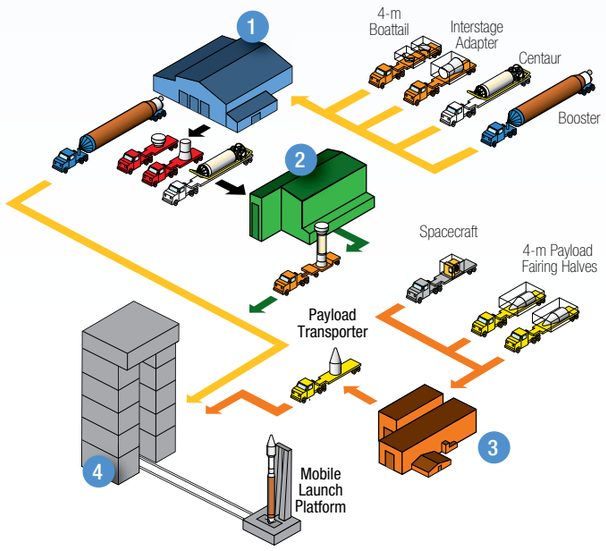
America's Ride to Space

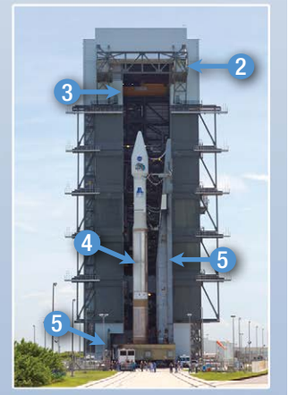
ATLAS V PRODUCTION AND LAUNCH

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

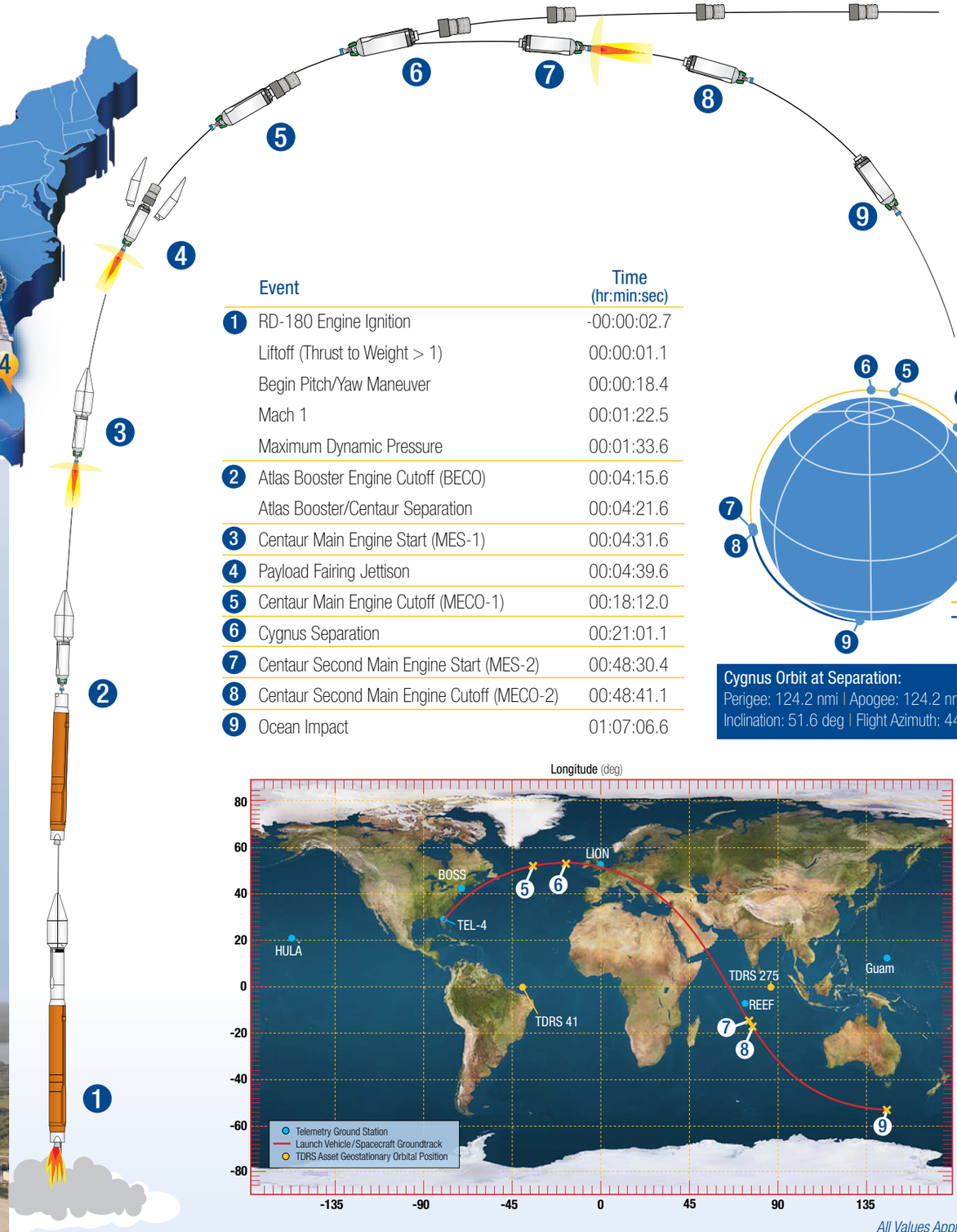
1. **Atlas Spaceflight Operations Center (ASOC)** | Launch Control Center and Mission Director's Center
2. **Delta Operations Center** | ISA, Centaur, Boattail Vertical Integration
3. **Spacecraft Processing Facility** | Spacecraft processing, testing and encapsulation
4. **Vertical Integration Facility** | Launch vehicle integration and testing, spacecraft mate and integrated operations



1. **Vertical Integration Facility** (VIF) (See inset)
2. **Bridge Crane Hammerhead**
3. **Bridge Crane**
4. **Launch Vehicle**
5. **Mobile Launch Platform** (MLP)
6. **Centaur LO_2 Storage**
7. **High Pressure Gas Storage**
8. **Booster LO_2 Storage**
9. **Pad Equipment Building** (PEB)
10. **Pad ECS Shelter**



MISSION PROFILE AND GROUND TRACE



	Event	Time (hr:min:sec)
1	RD-180 Engine Ignition	-00:00:02.7
	Liftoff (Thrust to Weight > 1)	00:00:01.1
	Begin Pitch/Yaw Maneuver	00:00:18.4
	Mach 1	00:01:22.5
	Maximum Dynamic Pressure	00:01:33.6
2	Atlas Booster Engine Cutoff (BECO)	00:04:15.6
	Atlas Booster/Centaur Separation	00:04:21.6
3	Centaur Main Engine Start (MES-1)	00:04:31.6
4	Payload Fairing Jettison	00:04:39.6
5	Centaur Main Engine Cutoff (MECO-1)	00:18:12.0
6	Cygnus Separation	00:21:01.1
7	Centaur Second Main Engine Start (MES-2)	00:48:30.4
8	Centaur Second Main Engine Cutoff (MECO-2)	00:48:41.1
9	Ocean Impact	01:07:06.6

Cygnus Orbit at Separation:
Perigee: 124.2 nmi | Apogee: 124.2 nmi
Inclination: 51.6 deg | Flight Azimuth: 44.4 deg

All Values Approximate