ATLAS V MUOS-5 MISSION

The U.S. Navy's fifth Mobile User Objective System (MUOS-5) satellite completes the initial configuration of an advanced network of orbiting satellites and relay ground stations that is revolutionizing secure, tactical UHF communications for mobile military forces. Users with MUOS terminals can seamlessly connect around the globe with new smart phone-like capabilities, including simultaneous crystal-clear voice, video and mission data on a high-speed Internet Protocol-based system.

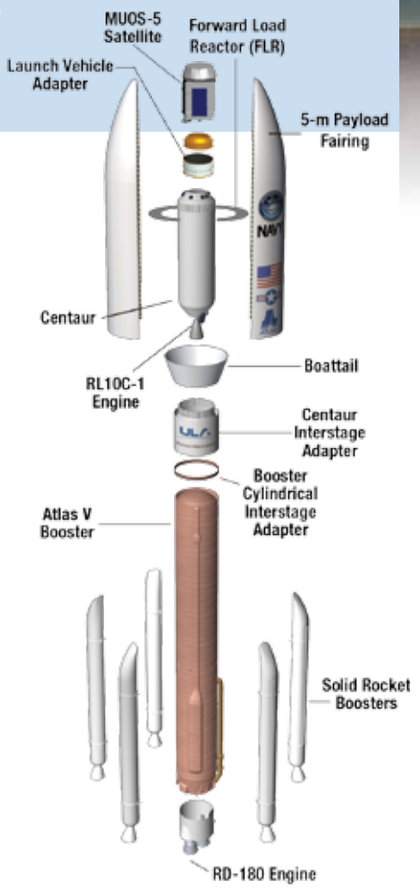

Image courtesy of Lockheed Martin Corporation

Delivering the next generation of narrowband communications, each MUOS satellite has two payloads supporting both new, advanced Wideband Code Division Multiple Access (WCDMA) waveform capabilities and the legacy UHF satellite system. Once fully operational, MUOS will provide users with 10 times more communications capacity than the legacy system.

Once on-orbit, the MUOS-5 satellite, with its 14-meter diameter reflecting mesh antenna, will augment the constellation as an on-orbit spare for the WCDMA capabilities while actively supporting the legacy system. The current MUOS network of four satellites and associated ground stations provides near global coverage. Lockheed Martin is the MUOS prime contractor and system integrator.

Some new MUOS features include:

- MUOS network users will be able to talk direct to, text, and transfer mission data amongst any other beyond line-of-sight MUOS users around the world. Legacy systems users can only communicate with each other by voice as long as they were under the coverage footprint of the same satellite.
- The MUOS WCDMA advanced waveform allows improved connectivity in stressed environments, including naturally scintillated, double canopy forested, mountainous and multi-path urban environments.
- Once MUOS is declared operational, the number of MUOS users is expected to grow rapidly. Already, more than 55,000 currently fielded radio terminals can be upgraded to be MUOS-compatible, with many of them requiring just a software upgrade.



Payload Fairing (PLF)

The MUOS-5 satellite is encapsulated in a 5-m (17-ft) diameter medium 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 medium PLF is approximately 206 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 cryogenic vehicle, fueled with liquid hydrogen and liquid oxygen. It uses a single RL10C-1 engine producing 22,900 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.

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. Five solid rocket boosters (SRB) generate the additional power required at liftoff, with each SRB providing 348,500 lb of thrust. 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 551

Producing more than two and a half million pounds of thrust at liftoff, the Atlas V 551 rocket is the most powerful in the Atlas V fleet. In its 10 years of service, the 551 rocket has launched groundbreaking missions for our nation—from the critically important MUOS constellation to historic science missions including New Horizons, the first mission to Pluto and the Juno mission to Jupiter. MUOS is changing the way we support our troops in the field while New Horizons returned the first images of Pluto in 2015 and later this summer Juno will begin its quest to understand the origin of Jupiter.

First Launch: Jan. 19, 2006
Launches to date: 6

Performance to GTO: 8,900 kg (19,620 lb)
Performance to LEO-Reference: 18,850 kg (41,570 lb)

ATLAS®

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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 100 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

– 63rd Atlas V Launch

– 108th ULA Launch

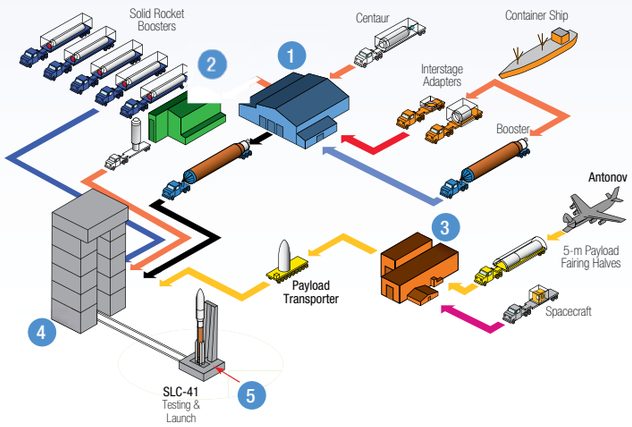
ULA™

America's Ride to Space

ATLAS V PRODUCTION AND LAUNCH

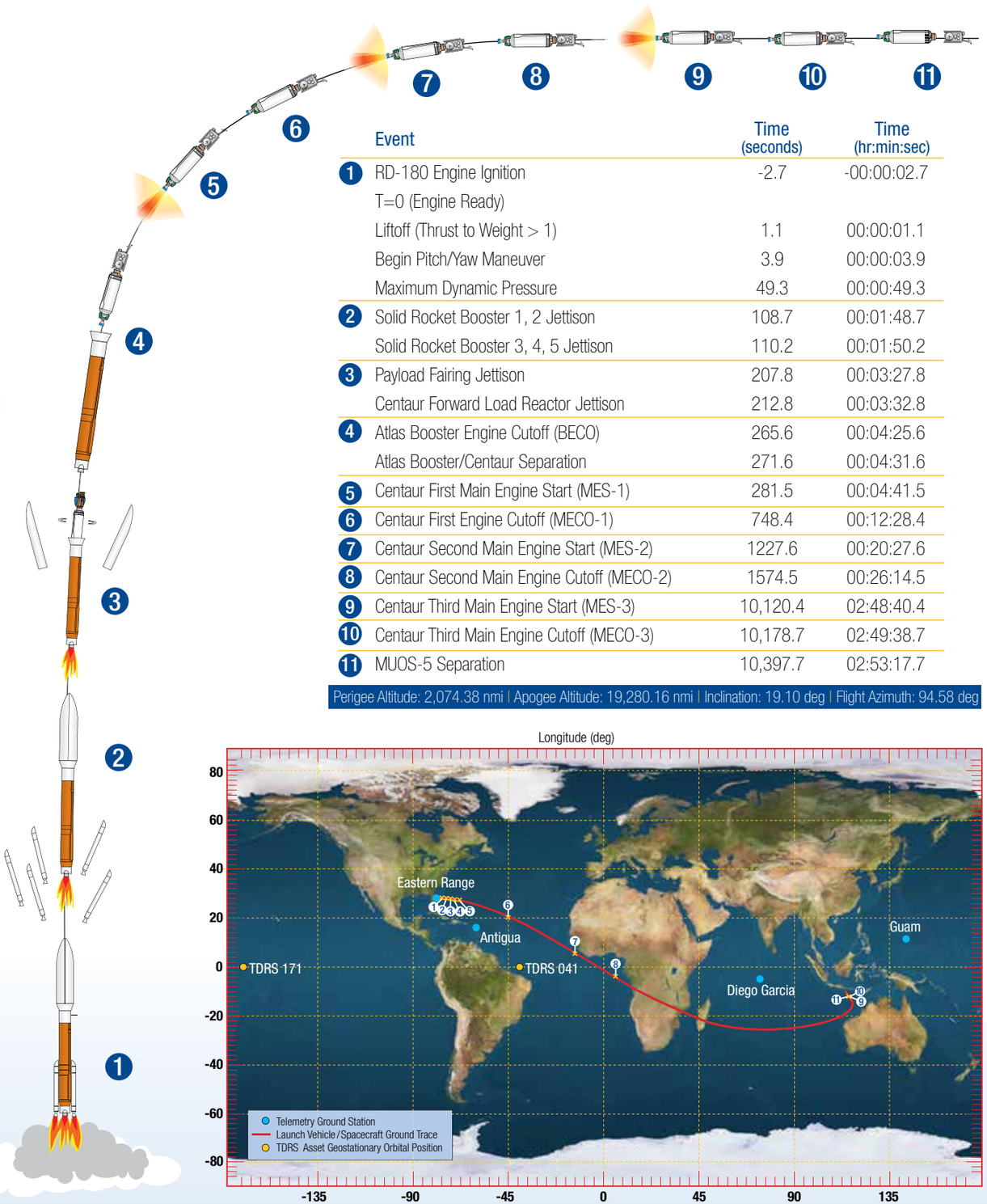
1. **Sacramento, CA**
   - Solid Rocket Booster Fabrication at Aerojet Rocketdyne
2. **Denver, CO**
   - ULA Headquarters & Design Center Engineering
3. **Harlingen, TX**
   - Payload Adapter, Booster Adapter & Centaur Adapter Fabrication
4. **Decatur, AL**
   - Booster & Centaur Fabrication
   - Booster Final Assembly
   - Centaur 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

1. **Atlas Spaceflight Operations Center (ASOC)** | Receiving & inspection, communication center, spacecraft control room, launch control center, mission director's center, ITAR facility
2. **Delta Operations Center (DOC)** | Offsite Vertical Integration (OVI) in Cell 4
3. **Spacecraft Processing Facility** | Spacecraft processing, testing and encapsulation
4. **Vertical Integration Facility** | Launch vehicle integration and testing, spacecraft mate and integrated operations
5. **Mobile Launch Platform**



1. **Vertical Integration Facility (VIF)**
2. **Launch Vehicle**
3. **Centaur LO_2 Storage**
4. **High Pressure Gas Storage**
5. **Booster LO_2 Storage**
6. **Pad Equipment Building (PEB)**
7. **Pad ECS Shelter**

MISSION PROFILE AND GROUND TRACE



	Event	Time (seconds)	Time (hr:min:sec)
1	RD-180 Engine Ignition	-2.7	-00:00:02.7
	T=0 (Engine Ready)		
	Liftoff (Thrust to Weight > 1)	1.1	00:00:01.1
	Begin Pitch/Yaw Maneuver	3.9	00:00:03.9
	Maximum Dynamic Pressure	49.3	00:00:49.3
2	Solid Rocket Booster 1, 2 Jettison	108.7	00:01:48.7
	Solid Rocket Booster 3, 4, 5 Jettison	110.2	00:01:50.2
3	Payload Fairing Jettison	207.8	00:03:27.8
	Centaur Forward Load Reactor Jettison	212.8	00:03:32.8
4	Atlas Booster Engine Cutoff (BECO)	265.6	00:04:25.6
	Atlas Booster/Centaur Separation	271.6	00:04:31.6
5	Centaur First Main Engine Start (MES-1)	281.5	00:04:41.5
6	Centaur First Engine Cutoff (MECO-1)	748.4	00:12:28.4
7	Centaur Second Main Engine Start (MES-2)	1227.6	00:20:27.6
8	Centaur Second Main Engine Cutoff (MECO-2)	1574.5	00:26:14.5
9	Centaur Third Main Engine Start (MES-3)	10,120.4	02:48:40.4
10	Centaur Third Main Engine Cutoff (MECO-3)	10,178.7	02:49:38.7
11	MUOS-5 Separation	10,397.7	02:53:17.7

Perigee Altitude: 2,074.38 nmi | Apogee Altitude: 19,280.16 nmi | Inclination: 19.10 deg | Flight Azimuth: 94.58 deg

All Values Approximate