Atlas V Launches WGS-2
Mission Overview

Atlas V 421
Cape Canaveral Air Force Station, FL
Space Launch Complex-41
United Launch Alliance is proud to be a part of the WGS-2 mission with the U.S. Air Force Space Command's Space and Missile Systems Center (USAF/SMC). The WGS-2 mission marks the fifteenth Atlas V launch and the third launch of an Atlas V 421 configuration.

The WGS-2 mission is the second installment of the Wideband Global SATCOM (WGS) system. The WGS satellites are an important element of a new high-capacity satellite communications system; providing enhanced communications capabilities to our troops in the field for the next decade and beyond. WGS enables more robust and flexible execution of Command and Control, Communications Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR), as well as battle management and combat support information functions. WGS-2 augments the existing service available through the UHF F/O and WGS SV-1 satellites by providing additional information broadcast capabilities.

My thanks to the entire Atlas team for its dedication in bringing WGS-2 to launch, and to the USAF/SMC for selecting Atlas for this important mission.

Go Atlas, Go Centaur!

Mark Wilkins
Vice President, Atlas Product Line
## Atlas V Launch History

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<thead>
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<th>Flight</th>
<th>Config.</th>
<th>Mission</th>
<th>Mission Date</th>
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<tr>
<td>AV-001</td>
<td>401</td>
<td>Eutelsat Hotbird 6</td>
<td>21 Aug 2002</td>
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<td>AV-002</td>
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<td>521</td>
<td>Rainbow 1</td>
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<td>Inmarsat 4-F1</td>
<td>11 Mar 2005</td>
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<td>AV-007</td>
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<td>Mars Reconnaissance Orbiter</td>
<td>12 Aug 2005</td>
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<td>AV-010</td>
<td>551</td>
<td>Pluto New Horizons</td>
<td>19 Jan 2006</td>
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<td>AV-008</td>
<td>411</td>
<td>Astra 1KR</td>
<td>20 Apr 2006</td>
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<td>AV-013</td>
<td>401</td>
<td>STP-1</td>
<td>08 Mar 2007</td>
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<td>AV-009</td>
<td>401</td>
<td>NROL-30</td>
<td>15 Jun 2007</td>
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<td>AV-011</td>
<td>421</td>
<td>WGS SV-1</td>
<td>10 Oct 2007</td>
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<td>AV-015</td>
<td>401</td>
<td>NROL-24</td>
<td>10 Dec 2007</td>
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<td>AV-006</td>
<td>411</td>
<td>NROL-28</td>
<td>13 Mar 2008</td>
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<tr>
<td>AV-014</td>
<td>421</td>
<td>ICO G1</td>
<td>14 Apr 2008</td>
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</table>

### Flight/Configuration Key

- **AV - ###**
  - **Atlas V**
  - **3-Digit Tail Number**
  - **Number of Solid Rocket Boosters**
  - **Payload Fairing Size (meters)**
  - **Number of Centaur Engines**
The Atlas V 421 consists of a single Atlas V booster stage, the Centaur upper stage, and two solid rocket boosters (SRB). The Atlas V booster and Centaur are connected by conical and short interstage adapters. The SRBs are connected to the booster by a thrust pin and structural thrusters.

The SRBs are 61.28 in. in diameter, 67 ft long, and are constructed of a graphite-epoxy composite. Their throttle profile is designed into the propellant grain. The SRBs burn for 90 seconds and are then jettisoned.

The Atlas V booster is 12.5 ft in diameter and 106.5 ft long. 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, which is 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 booster and Centaur phases of flight. The boost phase of flight ends 6 seconds after BECO, when the separation charge attached to the forward interstage adapter (ISA) is fired and eight retrorockets push the spent Atlas booster stage away from the Centaur upper stage.

The Centaur upper stage is 10 ft in diameter and 41.5 ft long. The propellant tanks are constructed of pressure-stabilized corrosion-resistant stainless steel. Centaur is a cryogenic liquid hydrogen/liquid oxygen-fueled vehicle. It uses a single RL10A-4-2 engine that produces 22,300 lb of thrust. The cryogenic tanks are insulated with a combination of helium-purged insulation blankets, radiation shields, and closed-cell polyvinyl chloride (PVC) insulation. The Centaur forward adapter (CFA) provides the structural mountings for vehicle electronics and the structural and electronic interfaces with the spacecraft (SC). The WGS SV-2 mission uses the 4-m (14-ft) diameter extended payload fairing (EPF). The payload fairing (PLF) is a bisector (two-piece shell) fairing consisting of aluminum skin/stringer construction with vertical split-line longerons. The vehicle’s height with the EPF is 192 ft.
The WGS-2 spacecraft (SC) is an approximately 13,200-lb communications satellite. The SC is mated to the Centaur upper stage by the space vehicle contractor (SVC)-provided spacecraft launch vehicle adapter (SCLVA), separation system, and electrical harness, and a ULA-provided, mission-unique C22 launch vehicle adapter (LVA).

WGS supports communications links in the 500 MHz range of the X-band and 1 GHz range of the Ka-band spectra. WGS can filter and route up to 4.875 GHz of instantaneous bandwidth. Depending on the mix of ground terminals, data rates, and modulation schemes employed, a WGS satellite can support data transmission rates between 2.4 and 3.6 Gbps.

WGS has 19 independent coverage areas that can be positioned throughout its field of view. This includes eight steerable/shapeable X-band beams formed by separate transmit/receive phased arrays; 10 Ka-band beams served by independently steerable diplexed antennas (three with selectable RF polarization); and transmit/receive X-band Earth-coverage beams. WGS can tailor coverage areas and connect X-band and Ka-band users anywhere within its field of view.

Four Army Wideband Satellite Operations Centers (WSOC) provide command and Control of WGS. Each Global SATCOM Configuration and Control Element (GSCCE) has the capability to control up to three satellites at a time, using X-band or Ka-band telemetry and command links. Spacecraft platform control is accomplished by the 3rd Space Operations Squadron (3 SOPS) at Schriever Air Force Base (AFB) in Colorado Springs, CO; using WGS mission-unique software and databases.

Support technologies for WGS include the xenon-ion propulsion system (XIPS), which is 10 times more efficient than conventional bipropellant systems; highly efficient triple-junction gallium arsenide solar cells; and deployable radiators with flexible heat pipes. Four 25-cm XIPS thrusters remove orbit eccentricity during transfer orbit operations. The thrusters are also used to perform orbit maintenance and any required station-change maneuvers during the mission's life. The triple-junction gallium arsenide solar cells provide on-orbit electrical power for the spacecraft. The deployable radiators' flexible heat pipes provide increased radiator area; resulting in a cooler, more stable thermal environment for the spacecraft.
Atlas V Processing Overview

- Denver, CO
  - Booster Fabrication & Final Assembly
  - Centaur Final Assembly
- Cape Canaveral Air Force Station, FL
  - Payload Processing & Encapsulation
  - Launch Vehicle Processing
  - Encapsulated Payload Mating
  - Launch
- Harlingen, TX
  - Payload Fairing/Adapter Fabrication
  - Booster Adapter Fabrication
  - Centaur Adapter Fabrication
- Sacramento, CA
  - Solid Rocket Booster Fabrication
- San Diego, CA
  - Centaur Tank Fabrication

United Launch Alliance
Launch Site Processing Overview

Staging at LC-41 and/or LC-11

- Vertical Integration Facility
- Integration Spacecraft Mate Testing

Solid Rocket Boosters

Atlas Spaceflight Operations Center (ASOC)
- Receiving & Inspection
- Launch Control Center
- Communication Center
- Battery Lab
- Administrative Offices
- Material Stores

- VIP Viewing
- ULA Offices
- Mission Director’s Center
- Spacecraft Control Room
- ITAR Facility
- Conference Center

Mobile Launch Platform

- LC-41 Testing & Launch

- Spacecraft Processing Facility
- Processing Testing Encapsulation

Antonov AN-124
- Booster
- Interstage Adapters

Container Ship (Conical ISA)

Payload Transporter

- 4-m Payload Fairing Halves

Antonov AN-124

4-m Payload Fairing Halves
Launch Site Overview

Space Launch Complex-41
Vertical Integration Facility (VIF)
Spacecraft Processing Facility (SPF)
Ordnance Annex
Atlas Spaceflight Operations Center (ASOC)
Customer Support Center (CSC)
Launch Control Center (LCC)
Mission Profile

- **Launch**
  - Flight Azimuth: 93 deg
- **Orbit at SC Separation**
  - Perigee Altitude: 408.00 km (220.30 nm)
  - 1st SC Apogee Altitude: 66,811 km (36,075 nm)
  - Inclination: 20.93 deg
  - Argument of Perigee: 178.00 deg
  - Delta-V to GSO: 1,532 m/s

*Values Approximate*
The WGS-2 mission will be flown from Space Launch Complex 41-(SLC-41) at Cape Canaveral Air Force Station, FL on an Atlas V 421 vehicle (tail number AV-016) with two solid rocket boosters (SRB) and a single engine Centaur. The payload will be encapsulated in a 4-meter diameter extended payload fairing (EPF) and integrated to the Centaur upper stage using a modified C22 payload adapter (PLA) and a space vehicle contractor (SVC)-provided spacecraft launch vehicle adapter (SCLVA), separation system, and electrical harness.

The WGS-2 payload consists of a single communications satellite. The two-burn, minimum-residual-shutdown mission will fly an easterly trajectory from SLC-41 with an approximately 93° flight azimuth. The separation event will release the WGS-2 spacecraft into a supersynchronous transfer orbit with a 220.3-nmi perigee, an apogee radius no greater than 39,687 nmi, and an approximately 20.93° inclination.

Launch begins with RD-180 engine ignition approximately 2.7 seconds before liftoff (T-2.7 seconds). SRB ignition takes place at T+0.8 seconds; after telemetry indication of healthy RD-180 startup.

Liftoff occurs at T+1.1 seconds. Shortly after the vehicle clears the pad, it performs its pitch/yaw/roll program. Maximum dynamic pressure occurs 66 seconds into flight.
The SRBs burn out at T+90 seconds, and are jettisoned at T+140 seconds. Booster engine cutoff (BECO) occurs at approximately 255 seconds. Telemetry data are gathered by TEL-4, Jonathan Dickinson Missile Tracking Annex (JDMTA), Antigua, Diego Garcia, and Guam Tracking Stations. The Tracking and Data Relay Satellite System (TDRSS) will also participate in gathering telemetry during the WGS-2 mission.

Centaur separation is 6 seconds after BECO. Centaur main engine start (MES1) occurs 10 seconds after the separation event. Payload fairing jettison takes place at 8 seconds after MES1. At approximately 15 minutes into the mission, main engine cutoff 1 (MECO1) occurs and Centaur has achieved its parking orbit.

After a 9-minute coast phase, Centaur reorients itself for MES2. MES2 begins approximately 24 minutes into the mission and lasts about 4.5 minutes. After MECO2, Centaur re-orient its attitude for the separation event.

The WGS-2 spacecraft separates about 31.5 minutes after launch. The turn to Centaur Collision and Contamination Avoidance Maneuver (CCAM) attitude begins about three minutes after the separation event. Centaur’s mission ends 1.5 hours after launch after blowdown of the propellant tanks and burn off of residual N₂H₄.
Mission Ground Trace

Subvehicle Point, East Longitude (degrees)

 MES1
 MECO1
 MECO2
 MES2
 SC First Apogee
 WGS-2 Separation
## Countdown Timeline

### F-1 Day - MLP TRANSPORT TO PAD

<table>
<thead>
<tr>
<th>Time</th>
<th>MLP</th>
<th>GC3 &amp; RF / FTS</th>
<th>Flight Control</th>
<th>Atlas/ Centaur Pneu, Prop</th>
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<tr>
<td>T-11:30</td>
<td>MLP Transport Preps</td>
<td>Start Count</td>
<td>Weather Brief + Status Check</td>
<td>Transport Preps</td>
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<tr>
<td>T-11:00</td>
<td>MLP Roll</td>
<td>MLP Hard Down</td>
<td>MLP Connect</td>
<td>Pad Connections</td>
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<tr>
<td>T-10:00</td>
<td>MLP Connect</td>
<td>Flight Control Preps</td>
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<tr>
<td>T-9:00</td>
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<td>T-8:00</td>
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<td>T-7:00</td>
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<td>T-6:00</td>
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<td>T-5:00</td>
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<tr>
<td>T-4:00</td>
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<tr>
<td>T-3:00</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

- **MLP**: MLP Transport Preps, MLP Roll, MLP Connect
- **GC3 & RF / FTS**: Transport Preps, Pad Connections
- **Flight Control**: Weather Brief + Status Check
- **Atlas/ Centaur Pneu, Prop**: Transport Preps, Pneumatic System Preps

**RP-1 Tanking (If Required)**
Countdown Timeline (concl’d)

F-0 Day - LAUNCH

- **T-6:20**: Start Count
- **T-6:00**: Power Application, System Preps, Flight Control/Guidance Tests, & Countdown Preps
- **T-5:00**: Open/Closed Loop Tests
- **T-4:00**: ECS GN2 Preps
- **T-3:00**: Centaur LH2/LO2 Preps Atlas Propulsion/Hydraulic Preps Storage Area Chilldown
- **T-2:00**: Pressurize Chilldown & Tanking
- **T-1:00**: Flight Control Final Preps
- **T-0:04H**: LAUNCH
### Plus Count Key Events

<table>
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<tr>
<th>MET (sec)</th>
<th>MET* (hr:min:sec)</th>
<th>Action</th>
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<tbody>
<tr>
<td>0</td>
<td>+00:00:00.</td>
<td>T=0 (Engine Ready)</td>
</tr>
<tr>
<td>49</td>
<td>+00:00:49</td>
<td>JDMTA AOS (1.5 deg)</td>
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<tr>
<td>90</td>
<td>+00:01:30</td>
<td>(Mark Event 1) SRB Burn Out</td>
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<tr>
<td>139</td>
<td>+00:02:19</td>
<td>(Mark Event 2) SRB Jettison</td>
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<tr>
<td>255</td>
<td>+00:04:15</td>
<td>(Mark Event 3) Atlas Booster Engine Cutoff</td>
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<tr>
<td>261</td>
<td>+00:04:21</td>
<td>(Mark Event 4) Atlas/Centaur Separation</td>
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<td>271</td>
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<td>(Mark Event 5) Centaur First Main Engine Start (MES1)</td>
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<td>279</td>
<td>+00:04:39</td>
<td>(Mark Event 6) Payload Fairing Jettison</td>
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<tr>
<td>384</td>
<td>+00:06:24</td>
<td>Antigua AOS (1.5 deg)</td>
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<td>411</td>
<td>+00:06:51</td>
<td>Switch Date Rate from 512k to 256k (MES1+140 sec)</td>
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<td>420</td>
<td>+00:07:00</td>
<td>TDRS 041 AOS</td>
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<td>469</td>
<td>+00:07:49</td>
<td>TEL-4 LOS (1.5 deg)</td>
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<td>482</td>
<td>+00:08:02</td>
<td>JDMTA LOS (1.5 deg)</td>
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<tr>
<td>759</td>
<td>+00:12:39</td>
<td>Antigua LOS (1.5 deg)</td>
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<td>760</td>
<td>+00:12:40</td>
<td>Switch from OMNI to Antenna Select (MES1+489 sec)</td>
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<td>914</td>
<td>+00:15:14</td>
<td>(Mark Event 7) Centaur First Main Engine Cutoff (MECO1)</td>
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<td>1460</td>
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<td>(Mark Event 8) Centaur Second Main Engine Start (MES2)</td>
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<td>(Mark Event 9) Centaur Second Main Engine Cutoff (MECO2)</td>
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<td>(Mark Event 10) SV Separation</td>
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<td>1924</td>
<td>+00:32:04</td>
<td>Begin CCAM</td>
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<td>2069</td>
<td>+00:34:29</td>
<td>DGS (REEF) AOS (0.7 deg)</td>
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<td>3399</td>
<td>+00:56:39</td>
<td>Begin Blowdown</td>
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<td>3738</td>
<td>+01:02:18</td>
<td>GTS (GUAM) AOS (0.7 deg)</td>
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<tr>
<td>3800</td>
<td>+01:03:20</td>
<td>DGS (REEF) LOS (0.7 deg)</td>
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<td>4843</td>
<td>+01:20:48</td>
<td>Expected N2H4 Depletion</td>
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<td>5685</td>
<td>+01:34:45</td>
<td>GTS (GUAM) LOS (0.7 deg)</td>
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<td>5699</td>
<td>+01:34:59</td>
<td>End of Mission (Arm Uplink Interrupt)</td>
</tr>
<tr>
<td>6299</td>
<td>+01:44:59</td>
<td>End TDRS 041 Coverage (EOM+10 Minutes)</td>
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*Values Approximate*
Timeline not to scale; Times approximate

Expected Telemetry Coverage

**Mandatory Coverage**
- **TEL-4**
  - 0:00 – 0:19:14
  - 0 – 1,154 sec
- **JDMTA**
  - 0:49 – 0:08:02 sec
  - 49 – 482 sec
  - 1.5 deg
- **Antigua**
  - 06:24 – 0:12:39 sec
  - 384 – 759 sec
  - 1.5 deg
- **TDRSS 41 (F10)**
  - 7:00 – 01:44:59
  - 420 – 6,299 sec

**Timeline Events**
- **BECO**
  - 0:04:15
  - 255 sec
- **A/C Sep**
  - 0:04:21
  - 261 sec
- **MES1**
  - 0:04:31
  - 279 sec
- **PLF Jettison**
  - 0:04:39
  - 279 sec
- **SW1**
  - 256k
  - 0:06:51
  - (411 sec)
- **SW2**
  - Omni to Ant Sel
  - 0:12:39
  - (759 sec)
- **MECO1**
  - 0:15:14
  - (914 sec nom)
- **SW1**
  - MECO1
  - 0:15:14
  - (914 sec nom)
- **T + 0:20:00**
- **TDRSS 41 (F10)**
  - 7:00 – 01:44:59
  - 420 – 6,299 sec

**Timeline not to scale; Times approximate**
Expected Telemetry Coverage (concl’d)

Mandatory Coverage
22:45 - 31:54
(1,365 - 1,914 sec)

T + 20:00

MES2
24:20
(1,460 sec)

MECO2
28:50
(1,730 sec)

Spacecraft Sep
31:39
(1,899 sec)

CCAM
32:04
(1,924 sec)

Begin Blowdown
56:39
(3,399 sec)

TDRSS 041 (F10)
7:00 – 01:44:59 (EOM+10 min)
420 – 6,299 sec

REEF
34:29 – 01:03:20
2,069 – 3,800 sec
AOS at 0.7 deg
REEF will be released after GUAM AOS

GUAM
01:02:18 – 01:44:59
3,738 – 6,299 sec
0.7 deg

EOM
01:34:59
(5,699 sec)
I-Channel Telemetry Flow

- **ULA Denver**
- **AGO STARS**
- **Cape STARS**
- **TEL-4**
- **ASOC**
- **TSF**
- **EVCF**
- **MOC (ROCC)**
- **Hangar AE**
- **LC-41**
- **CCAFS**
- **NOPS, SAFB**
- **White Sands, NM**
- **GSFC, MD**

**Centaur Telemetry (512 KBPS or 256 KBPS)**

*TRS & Hangar AE have fixed antennas with near-pad coverage only*

**From**
- DGS (REEF) & GTS (Guam)
- TDRSS

**To**
- AGO STARS
- Hangar AE*

**From**
- NOPS, SAFB
- TDRSS

**Antigua**

*TEL-4, JDMTA, TRS (VWSN)*

**From**
- NOPS, SAFB
- To AGO STARS
- From TDRSS

**To**
- AGO STARS
- Hangar AE*

**From**
- Hanger AE*
- CD & SC, KSC
- From TDRSS

**To**
- GSFC, MD

**From**
- NOPS TEL-4
- JDMTA
- TRS (VWSN)*

**To**
- AGO STARS
- LC-41

**From**
- ULA Denver
- AGO STARS
- Cape STARS
### Abbreviations & Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>3 SOPS</td>
<td>3rd Space Operations Squadron</td>
</tr>
<tr>
<td>A/C</td>
<td>Atlas Centaur</td>
</tr>
<tr>
<td>AFSCN</td>
<td>Air Force Satellite Control Network</td>
</tr>
<tr>
<td>AGO</td>
<td>Aerospace Group Offices</td>
</tr>
<tr>
<td>AOS</td>
<td>Acquisition of Signal</td>
</tr>
<tr>
<td>ASOC</td>
<td>Atlas Spaceflight Operations Center</td>
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<tr>
<td>BECO</td>
<td>Booster Engine Cut Off</td>
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<tr>
<td>BPSK</td>
<td>Binary Phase Shift Key</td>
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<tr>
<td>C4ISR</td>
<td>Command and Control, Communications, Computers; Intelligence, Surveillance, and Reconnaissance</td>
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<tr>
<td>CCAFS</td>
<td>Cape Canaveral Air Force Station</td>
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<tr>
<td>CCAM</td>
<td>Collision and Contamination Avoidance Maneuver</td>
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<tr>
<td>CCLS</td>
<td>Computer Controlled Launch System</td>
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<tr>
<td>Ch</td>
<td>Channel</td>
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<tr>
<td>DGS</td>
<td>Diego Garcia Station</td>
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<tr>
<td>ECB</td>
<td>Entry Control Building</td>
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<tr>
<td>ECS</td>
<td>Environmental Control System</td>
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<tr>
<td>EDT</td>
<td>Eastern Daylight Time</td>
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<td>EELV</td>
<td>Evolved Expendable Launch Vehicle</td>
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<td>EOM</td>
<td>End of Mission</td>
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<td>EPF</td>
<td>Extended Payload Fairing</td>
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<td>ER</td>
<td>Eastern Range</td>
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<td>EVCF</td>
<td>Eastern Vehicle Checkout Facility</td>
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<tr>
<td>F/O</td>
<td>Follow On</td>
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<tr>
<td>FTS</td>
<td>Flight Termination System</td>
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<tr>
<td>Gbps</td>
<td>Gigabits per second (billions of bits per second)</td>
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<tr>
<td>GC3</td>
<td>Ground Command Control and Communications</td>
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<td>GMT</td>
<td>Greenwich Mean Time</td>
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<td>GN2</td>
<td>Gaseous Nitrogen</td>
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<td>GSCCE</td>
<td>Gapfiller Satellite Configuration and Control Element</td>
</tr>
<tr>
<td>GSO</td>
<td>Geosynchronous Orbit</td>
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<td>GSFC</td>
<td>Goddard Space Flight Center</td>
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<tr>
<td>GTS</td>
<td>Guam Transmitter Station</td>
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<tr>
<td>INU</td>
<td>Inertial Navigation Unit</td>
</tr>
<tr>
<td>ISA</td>
<td>Interstage Adapter</td>
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<tr>
<td>Isp</td>
<td>Specific Impulse</td>
</tr>
<tr>
<td>JDMTA</td>
<td>Jonathan Dickinson Missile Tracking Annex</td>
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<tr>
<td>Jett</td>
<td>Jettison</td>
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<tr>
<td>Kbps</td>
<td>Kilo Bits Per Second</td>
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<tr>
<td>LC</td>
<td>Launch Complex</td>
</tr>
<tr>
<td>LH2</td>
<td>Liquid Hydrogen</td>
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<tr>
<td>LO2</td>
<td>Liquid Oxygen</td>
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<tr>
<td>LOS</td>
<td>Loss Of Signal</td>
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<td>LVA</td>
<td>Launch Vehicle Adapter</td>
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<tr>
<td>Max Q</td>
<td>Maximum Dynamic Pressure</td>
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<tr>
<td>MBPS</td>
<td>Mega Bits Per Second</td>
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<td>MECO</td>
<td>Main Engine Cut Off</td>
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<tr>
<td>MES</td>
<td>Main Engine Start</td>
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</table>
MD Maryland
MD Mission Director (USAF)
MLP Mobile Launch Platform
MOC Morrell Operations Center
N₂H₄ Hydrazine
NHS New Hampshire Tracking Station AFSCN
(N Call Sign - BOSS)
NM New Mexico
nmi Nautical Mile
NOPS NRO Operations Squadron
NRO National Reconnaissance Office
PEB Pad Equipment Building
PLA Payload Adapter
PLF Payload Fairing
Pneu Pneumatics
Prop Propulsion
PTC Passive Thermal Control
QPSK Quadrature Phase Shift Key
REEF Diego Garcia Tracking Station
ROCC Range Operations Control Center
RF Radio Frequency
RP-1 Rocket Propellant – 1 (Kerosene)
SAFB Schriever Air Force Base
SATCOM Satellite Communications
SC Spacecraft
SCLVA Spacecraft Launch Vehicle Adapter
Sep Separation
SMC Space and Missiles Systems Center
SRB Solid Rocket Booster
STARS Space Launch Operations (SLO) Telemetry Acquisition and Reporting System
SVC Space Vehicle Contractor
SW Switch
TDRSS Tracking & Data Relay Satellite System
TLM Telemetry
TRS Telemetry Receiving Site
TSF Technical Support Facility
UHF Ultra High Frequency
ULA United Launch Alliance
USAF United States Air Force
Vac Vacuum
VIF Vertical/Vehicle Integration Facility
VWSN Visual Warning Site, North
XIPS Xenon Ion Propulsion System
WANIU Wide Area Network Interface Unit
WGS Wideband Global SATCOM
WSOC Wideband Satellite Operations Centers