Mission: NASA TDRS-L

Launch Vehicle: Atlas 5-401

Launch Date: January 23, 2014

Launch Window: 9:05-9:45 p.m.

SPACEFLIGHT NOW

www.spaceflightnow.com

Text by: Justin Ray
Justin@spaceflightnow.com
Design by: Walter Scriptunas II
wscriptunas@gmail.com

Fact SHEET

The Atlas 5-401 will be used to launch the TDRS L communications satellite for NASA. The United Launch Alliance vehicle stands 191 feet tall, weighs 737,000 pounds at launch and produces 860,000 pounds of sea-level thrust. The spacecraft is encapsulated in a 14-foot, diameter, 42-foot-tall aluminum payload fairing.

Atlas 5 represents the culmination of evolution stretching back several decades to America's first intercontinental ballistic missile. At the dawn of the space age, boosters named Atlas launched men into orbit during Project Mercury and became a frequent vehicle of choice to haul civil, military and commercial spacecraft to orbit.

Image Credit: United Launch Alliance

The rocket launching TDRS L was born of the Air Force's competition to develop next-generation Evolved Expendable Launch Vehicles. It has flown 42 times since debuting in 2002, carrying out 15 flights dedicated to the Defense Department, 10 missions for NASA, nine flights with commercial payloads, and seven with spy satellites for the National Reconnaissance Office.

Atlas 5 was built to be more robust and reliable over earlier Atlas and Titan heavy-lift vehicles, and streamlined production has resulted in fewer opportunities for human error.

The new launcher builds upon the success of its predecessors, using the Russian-made RD-180 main engine, a stretched Centaur upper stage and its RL10 engine that were proven during the Atlas 3 program.

The key piece that sets Atlas 5 apart, however, was the rigid body Common Core Booster serving as the rocket's first stage. The CCB replaced the "balloon" pressure-stabilized stage used by previous Atlas vehicles.

As the CCB's name suggests, the stage is common and is used in all the various configurations of the Atlas 5 family. The booster stage is 106.6 feet long and 12.5 feet diameter.

Powering the Atlas 5 during the first four minutes of flight is the RD-180 liquid-fueled engine. The liquid oxygen/kerosene powerplant is a two-thrust chamber, two-nozzle engine made by NPO Energomash of Khimky, Russia. It was developed from the RD-170 engine used by Russia's Energia-Buran space shuttle, the Energia-M and Ukrainian Zenit rockets.

Featuring hypergolic ignition, the engine produces 860,000 pounds of thrust and is throttled up and down to ease the stresses the rocket experiences throughout the launch. And its dual nozzles provides superior steering control during the climb out.

The American propulsion firm Pratt & Whitney financed the development of the RD-180 for the Atlas program. Pratt and NPO Energomash are equal partners of RD AMROSS, the joint venture formed to market, sell and distribute the RD-180 engines.

The workhorse Centaur upper stage has flown in various configurations for decades. For this launch, the stage will use one Pratt & Whitney-built RL10A-4-2 liquid oxygen/liquid hydrogen engine that develops a thrust of about 22,300 pounds.

The Centaur will fire three times during ascent, initially boosting itself and attached satellite into a parking orbit around Earth after separation from the first stage. A second burn then propels the payload into a highly elliptical geosynchronous transfer orbit, followed by a long coast phase before a final push is delivered to raise the orbit's low point and reduce inclination relative to the equator.

The stage is 41.5 feet in length and 10 feet it diameter. It also houses the navigation unit that serves as the rocket's guidance brain.

Atlas-Centaur rockets have been used since the 1960s to dispatch ground-breaking missions for NASA, including the Surveyors to the Moon, Mariner flights to Mars, Venus and Mercury, and the Pioneers that were the first to visit Jupiter and beyond.

In its newest era, the Atlas 5 rocket sent the Mars Reconnaissance Orbiter to the red planet in 2005, propelled the New Horizons probe toward Pluto and the solar system's outer fringes in 2006, doubled up with the dual Lunar Reconnaissance Orbiter and LCROSS impactor to the Moon in 2009, hurled Juno to Jupiter last August and dispatched the car-sized Curiosity rover on the Mars Science Lab mission in November 2012 and the Mars-bound MAVEN orbiter this past November.

Atlas 5 Launch Vehicle

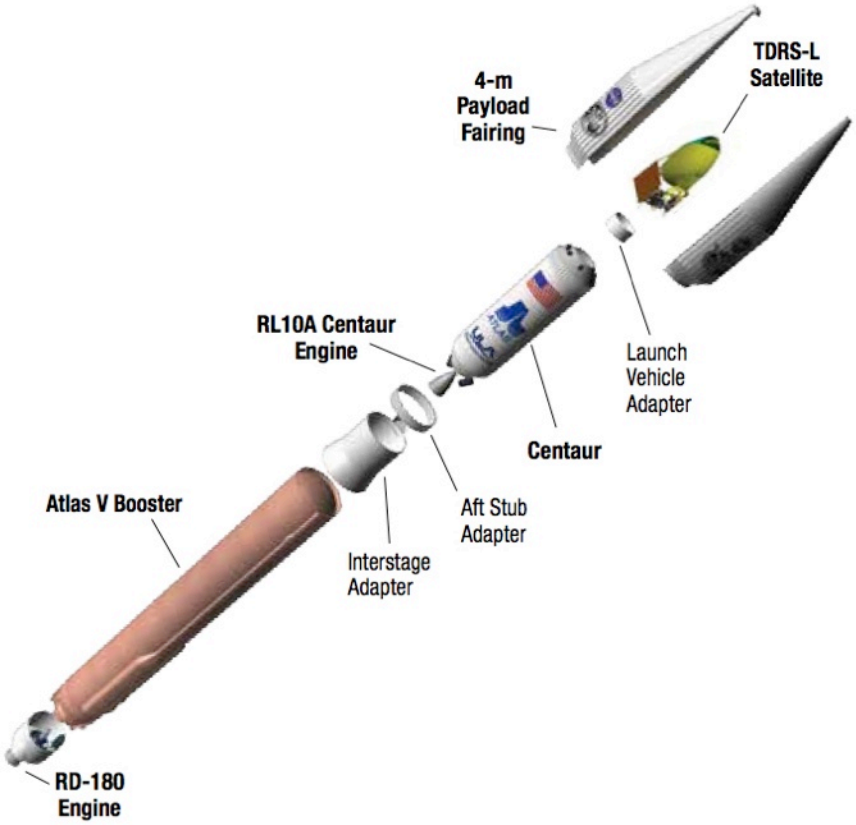

Image Credit: United Launch Alliance

Atlas V Facts

-The 625th launch for Atlas program since 1957
-The 334th Atlas to occur from Cape Canaveral
-The 214th mission for the Centaur upper stage
-The 191st use of Centaur by an Atlas rocket
-The 443rd production RL10 engine to be launched
-The 49th flight of the RD-180 main engine
-The 43rd launch of an Atlas 5 since 2002
-The 67th Evolved Expendable Launch Vehicle flight
-The 11th Atlas 5 launch for NASA
-The 36th Atlas 5 to occur from the Cape
-The 8th nighttime Atlas 5 launch from the Cape
-The 78th United Launch Alliance flight overall
-The 67th Evolved Expendable Launch Vehicle flight
-The 35th Atlas 5 under United Launch Alliance
-The 28th 400-series flight of the Atlas 5
-The 20th Atlas 5 to fly in the 401 configuration
-The 12th Tracking and Data Relay Satellite launch
-The 5th TDRS built by Boeing
-The 5th TDRS launched on an Atlas vehicle
-The 2nd Atlas 5 launch for TDRS
-The first Atlas launch of 2014

Image Credit: Walter Scriptunas II

Here's a timeline of the countdown's key events:

HR:MM..Eastern...Event
T-6:20...1:55pm...Countdown begins with rocket power up
T-5:30...2:45pm...Weather briefing
T-4:55...3:20pm...Start clearing assembly building area
T-4:20...3:55pm...C-band tracking beacon testing
T-3:40...4:35pm...S-band telemetry link checks
T-2:55...5:20pm...Establish blast danger area roadblocks
T-2:20...5:55pm...Weather briefing
T-2:15...6:00pm...Clear the pad
T-2:00...6:15pm...T-120 minutes and holding (for 30min)
T-2:00...6:40pm...Launch conductor briefing to team
T-2:00...6:43pm...Readiness poll for fueling
T-2:00...6:45pm...Resume countdown
T-1:50...6:55pm...Centaur LOX transfer line chilldown
T-1:43...7:02pm...Begin Centaur liquid oxygen loading
T-1:30...7:15pm...Begin Atlas first stage LOX loading
T-1:25...7:20pm...Centaur LH2 transfer line chilldown
T-1:10...7:35pm...Centaur RL10 engine chilldown
T-1:02...7:43pm...Begin Centaur liquid hydrogen loading
T-0:40...8:05pm...FLight termination system final test
T-0:16...8:29pm...RD-180 engine fuel fill sequence
T-0:10...8:35pm...Weather briefing
T-0:04...8:41pm...T-4 minutes and holding (for 20min)
T-0:04...8:58pm...Readiness poll for launch
T-0:04...9:01pm...Resume countdown
T-0:00...9:05pm...LAUNCH

Ground track map

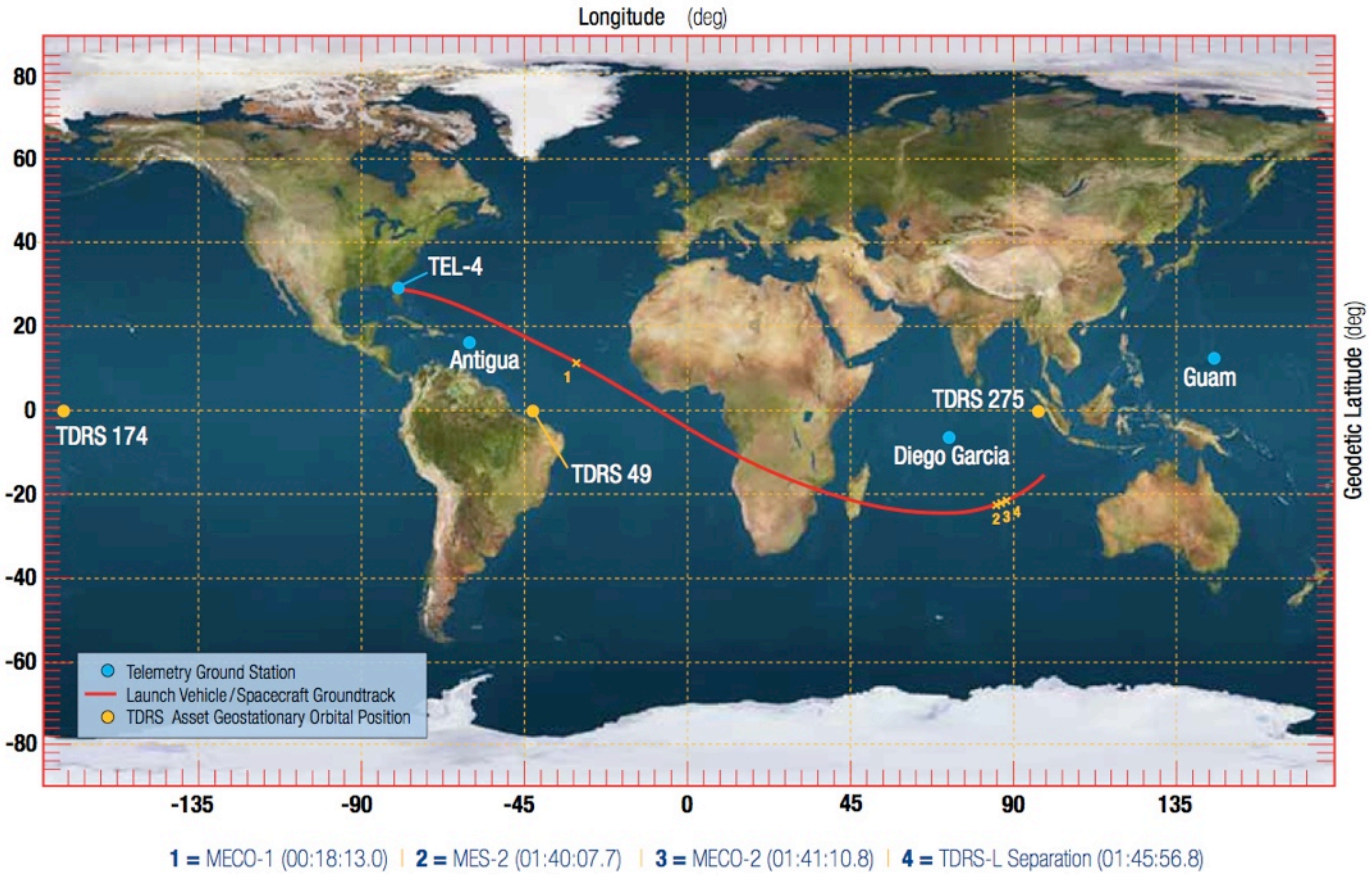

Image Credit: United Launch Alliance

The Atlas 5 will use a two-burn mission to deliver the TDRS L spacecraft into a high-perigee geosynchronous transfer orbit. The targeted orbit is:

4,839 km (3,007 statute miles)
x
35,788 km (22,238 statute miles)

at an inclination of 25.5 degrees.

T+0:00:02.7...RD-180 Engine Ignition
T+0:00:01.1...LIFTOFF
T+0:00:17.5...Begin Pitch/Yaw/Roll Maneuver
T+0:01:31.3...Maximum Dynamic Pressure
T+0:04:01.9...Atlas Booster Engine Cutoff (BECO)
T+0:04:07.9...Atlas Booster/Centaur Separation
T+0:04:17.9...Centaur First Main Engine Start (MES-1)
T+0:04:25.9...Payload Fairing Jettison
T+0:18:13.0...Centaur First Main Engine Cutoff (MECO-1)

At MECO-1, the vehicle will setting into a parking orbit of approximately 15,450 statute miles at apogee, 115 statute miles at perigee and inclination of 26.5 degrees.

A lengthy coast is initiated to reach the proper conditions for restarting the Centaur and inject the spacecraft into the proper transfer orbit.

T+1:40:07.7...Centaur Second Main Engine Start (MES-2)
T+1:41:10.8...Centaur Second Main Engine Cutoff (MECO-2)
T+1:45:56.8...TDRS-L Separation

TDRS-L Satellite

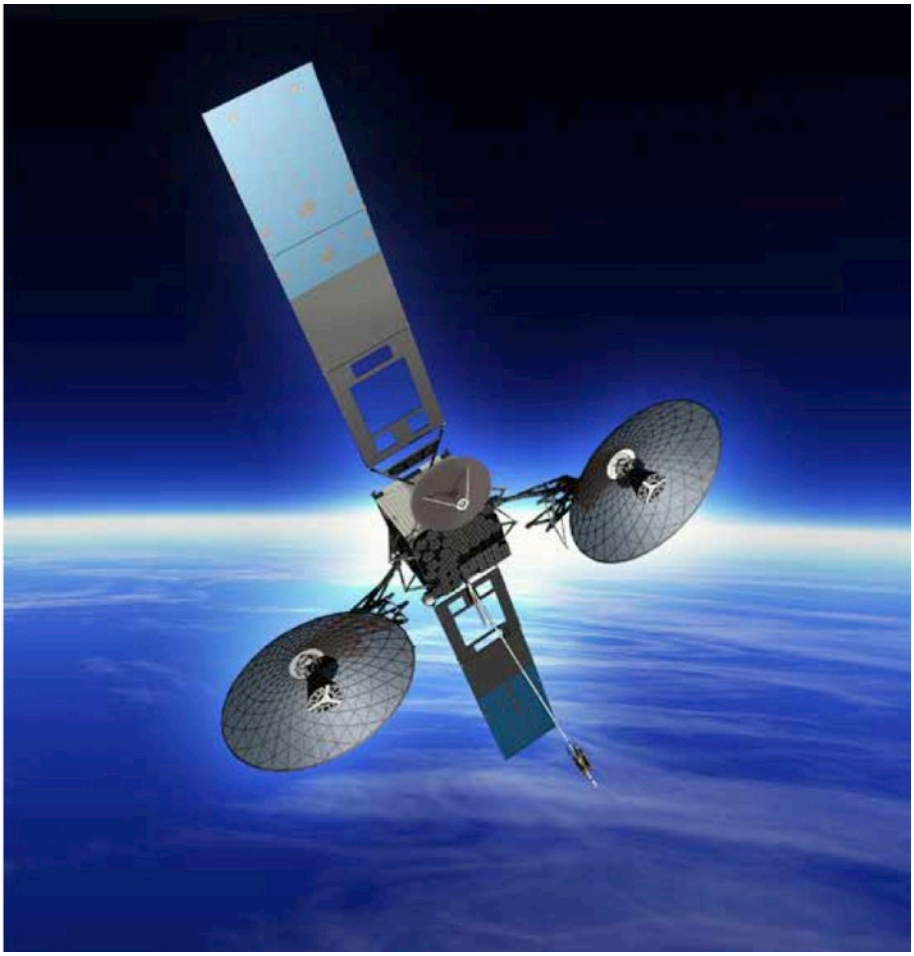

Image Courtesy: NASA Goddard Spaceflight Center

The satellite stands 26 feet tall and weighs over 7,600 pounds at launch, including 3,700 pounds of maneuvering fuel loaded inside the craft. Once fully deployed in space, TDRS L's solar wings will stretch 69 feet tip-to-tip to generate 3,220 watts of power and charge internal nickel-hydrogen batteries.

The primary physical feature of the satellite is two 15-foot-diameter flexible graphite mesh antenna dishes that were folded like taco shells for launch, then springing into shape once released in orbit.

The antennas offer gimbal tracking of targeted spacecraft flying beneath the satellite, providing high-gain communications to the station, Hubble and other craft for vital contacts and data dumps.

After finishing the orbit-raising activities two weeks following the launch, the spacecraft's full appendages will be deployed, starting with one solar array, then the booms holding the Single Access antennas fold out, the other solar wing extends, the forward Omni swings into place and the space-to-ground antenna is positioned.

The spacecraft will undergo testing at 150 degrees West, then drift eastward to its operational location that is to be determined.