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Live coverage: Atlas 5 rocket launches from Vandenberg Space Force Base

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Live coverage of the countdown and launch of an Atlas 5 rocket with the Landsat 9 Earth observation satellite for NASA and the U.S. Geological Survey. Text updates will appear automatically below. Follow us on [Twitter](#).



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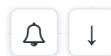


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Launch of the Landsat 9 Earth-Observing Sa...



Last Updated: 09/27/2021 16:43



09/27/2021 16:43

 Stephen Clark



NASA and United Launch Alliance deployed a new Landsat satellite in orbit Monday after liftoff on an Atlas 5 rocket from Vandenberg Space Force Base in California, marking the 2,000th launch from the West Coast spaceport since 1958 and extending a series of Earth observations used by farmers, urban planners, and climate scientists.

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SpaceX flight sets record for most orbital launches from Space Coast in a year

09/27/2021 13:44



Stephen Clark

🕒 December 21, 2021

ULA says four CubeSats have deployed from carriers on the Centaur upper stage.

There are two NASA-sponsored CubeSats: The Cusp Plasma Imaging Detector, or CuPID, which will study the boundaries of Earth's magnetic field, to see how energy from the sun can break through our planet's magnetic shield. The Colorado Ultraviolet Transit Experiment, or CUTE, will train its telescope on planets outside our solar system to study how quickly their atmospheres are escaping. There are also two military-sponsored CubeSats to test advanced communication technology.

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A NASA spokesperson confirms the solar array on the Landsat 9 Earth observation satellite has fully deployed, allowing the spacecraft to start generating its own electricity.

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ULA and NASA say the Atlas 5 rocket's Centaur upper stage has completed two more firings -- each lasting about 10 seconds -- to maneuver into a lower orbit for deployment of four CubeSats.

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NASA confirms ground teams have acquired the first signals from Landsat 9 after separating from the Atlas 5 rocket's Centaur upper stage.

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The 5,975-pound (2,710-kilogram) Landsat 9 spacecraft has separated from the Atlas 5 rocket, beginning its mission to



monitor changes on Earth's land surfaces for NASA and the U.S. Geological Survey.

The satellite, built by Northrop Grumman, is beginning a mission expected to last at least five years. The spacecraft has enough on-board propellant to operate more than a decade.

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Separation of the Landsat 9 spacecraft is expected in about seven minutes.

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09/27/2021 11:45



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Here's another view of the Atlas 5 rocket climbing off the SLC-3E launch pad at foggy Vandenberg Space Force Base to begin the Landsat 9 mission. The Atlas 5's RD-180 engine generated 860,000 pounds of thrust at full throttle. Photo credit: Brian Sandoval / Spaceflight Now



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09/27/2021 11:37




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Here's a quick replay of the Atlas 5 launch.

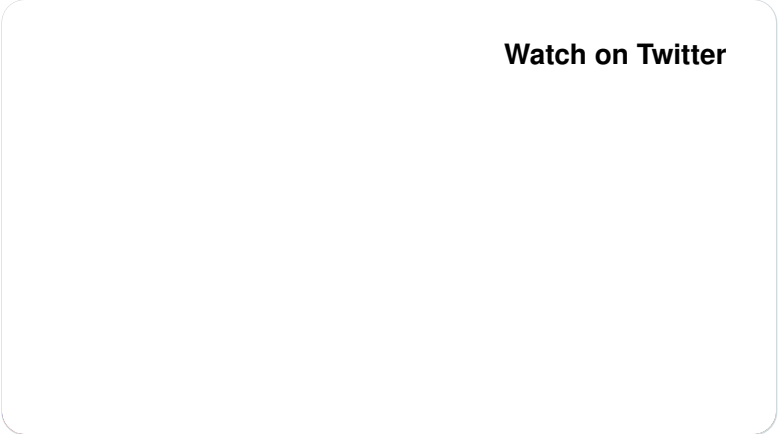








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Liftoff of United Launch Alliance's Atlas 5 rocket with Landsat 9, extending a five-decade legacy of environmental monitoring from orbit. spaceflightnow.com/2021/09/27/atl...

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09/27/2021 11:35

 **Stephen Clark**

Here's a view of the Atlas 5 rocket lifting off from foggy Vandenberg Space Force Base at 11:12 a.m. PDT (2:12 p.m. EDT (1812 GMT). Photo credit: Alex Polimeni / Spaceflight Now





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The orbit achieved after the first Centaur burn is very close to the pre-flight prediction, according to ULA's telemetry commentator.

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The Atlas 5 rocket's Centaur upper stage has shut down its RL10 engine after reaching orbit. The rocket will coast over the South Pole before deploying the Landsat 9 spacecraft at 3:32 p.m. EDT (1932 GMT).

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One minute until cutoff of the Centaur upper stage's RL10 engine. All systems on the rocket look good.

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T+plus 13 minutes. Velocity is now more than 13,000 mph. The Centaur upper stage has switched its telemetry format to broadcast data through NASA's TDRS satellite network.



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T+plus 11 minutes. Velocity of the Centaur stage with Landsat 9 is now 11,600 mph.

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T+plus 10 minutes. The Centaur stage will fire its main engine until T+plus 16 minutes, 30 seconds, to place the Landsat 9 satellite into orbit.

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T+plus 7 minutes. The RL10C-1 engine is performing as expected.

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The first stage is reported to have performed normally during its more than four-minute firing.

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T+plus 5 minutes. The Atlas 5's first stage has shut down and jettisoned, and the Centaur upper stage's RL10 engine has ignited for the first of two firings on today's flight.

And the payload fairing has jettisoned, exposing Landsat 9 to space for the first time.

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The RD-180 engine is throttling down in preparation for cutoff.

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T+plus 3 minutes, 30 seconds. Velocity is now 5,600 mph.

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T+plus 3 minutes. The RD-180 engine is performing well. About one minute remaining until booster engine cutoff.

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T+plus 2 minutes. The Atlas 5 rocket with Landsat 9 is now flying faster than the speed of sound.

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T+plus 60 seconds. All systems are nominal aboard the Atlas 5.

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Liftoff of United Launch Alliance's Atlas 5 rocket with Landsat 9, extending a five-decade legacy of environmental monitoring from orbit.

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"Go Atlas. Go Centaur. Go Landsat 9," the launch team just called out during a final status check.

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T-minus 40 seconds. Centaur's propellant tanks are reported at stable flight pressures, and a final check of the Western Range's readiness came back with a "green" status.

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T-minus 60 seconds. Ignition of the Atlas 5's first stage RD-180 main engine will be commanded at T-minus 2.7 seconds.

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T-minus 1 minute, 30 seconds. The Atlas 5's flight termination system, which would be triggered to destroy the rocket if it flew off course, has been armed for flight.

A few moments ago, topping of cryogenic liquid hydrogen and liquid oxygen in the Centaur upper stage was completed.

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T-minus 2 minutes, 30 seconds. The Atlas 5's first stage RP-1 and liquid oxygen tanks have pressurized. Both are confirmed at proper flight pressures.

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T-minus 3 minutes. The replenishment of liquid oxygen into the Atlas first stage, which kept the tank full as the cryogenic liquid boiled off in the warm California weather, has been ceased. This is a key step before pressurization of the liquid oxygen tank for launch.

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T-minus 3 minutes, 30 seconds. Final pre-launch steps are continuing. Ground pyrotechnics have been enabled as planned.

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T-minus 4 minutes and counting. The final countdown sequence is underway, leading up to liftoff of the Atlas 5 rocket at 11:12 a.m. PDT (2:12 p.m. EDT; 1812 GMT) from Vandenberg Air Force Base, California.

In the next few minutes, the launch pad's ground pyrotechnics will be enabled, and replenishment of the Atlas 5's propellant tanks will end to allow them to be pressurized for flight. The first and second stage will transition from ground power to on-board battery power.

An automated launch sequencer will take control of the countdown at T-minus 1 minute, 55 seconds. Shortly after, the Atlas 5's destruct system will be armed.

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ULA launch conductor Scott Barney just completed his poll of the Atlas launch team. All stations confirmed their readiness to proceed with the countdown.

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ULA launch conductor Scott Barney just briefed the Atlas 5 team ahead of the pre-launch status poll.





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09/27/2021 11:02



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The Landsat 9 spacecraft is switching to internal power in preparation for liftoff.

The newest Landsat satellite, built by Northrop Grumman, will fly around Earth in a polar orbit 438 miles (705 kilometers) above the planet, surveying the globe every 16 days in image swaths 115 miles (185 kilometers) wide.

Each pixel in the images captured by Landsat 9's Operational Land Imager 2, or OLI 2, instrument will be about 100 feet (30 meters) across, about the size of a baseball diamond. Landsat 9's other instrument — the Thermal Infrared Sensor 2, or TIRS 2 — can resolve features about 330 feet (100 meters) in size, roughly the length of a football field.

The nearly \$750 million Landsat 9 mission is based on the Landsat 8 satellite, which launched in 2013. The Obama administration directed NASA and the USGS to develop Landsat 9 in 2015, using new copies for the OLI and TIRS instruments on Landsat 8.

The Landsat 8 satellite, designed for a five-year lifetime, remains operational. Landsat 8 and 9, working in tandem, will cover all of Earth's land masses every eight days, according to Jeff Masek, NASA's project scientist for the Landsat 9 mission.

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09/27/2021 11:01



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The final readiness poll of the Atlas 5 launch team is expected to begin in a couple of minutes. Each member of the team will be



asked for their "go" or "no go" status before the countdown resumes at T-minus 4 minutes.

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The countdown loops are mostly quiet at this time, and there is no indication of any problems that could prevent liftoff of the Atlas 5 from Cape Canaveral at 11:12 a.m. PDT (2:12 p.m. EDT; 1812 GMT).

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On this page, you can toggle between our "SFN Live" feed with minimal commentary and live audio of the ULA launch team, and the NASA TV launch broadcast with public affairs commentary and video features on the Landsat 9 mission.

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Stephen Clark

The flight trajectory profile for today's launch has been loaded into the Atlas 5's guidance computer, known as the Inertial Navigation Control Assembly, or INCA. This trajectory data takes into account the upper level wind conditions measured by weather balloons over Vandenberg.

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T-minus 4 minutes and holding. This is the final built-in hold in today's Atlas 5 countdown. During this 30-minute pause, the



launch team and ULA management will be polled to ensure all consoles are ready for the terminal countdown.

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T-minus 8 minutes and counting. The Atlas 5 countdown is ticking down to a 15-minute built-in hold at T-minus 4 minutes.

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In the last few minutes, ULA launch control reported completion of flight control system checkouts. This involved a steering, or slew, check to test out the thrust vector controls on the Atlas 5's engines.

Updated: 09/27/2021 10:30

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09/27/2021 10:28



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The RD-180 engine's fuel fill sequence is beginning at this time.

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09/27/2021 10:27



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45 minutes until liftoff of United Launch Alliance's Atlas 5 rocket from Vandenberg Space Force Base with the Landsat 9 satellite. The 194-foot-tall (59-meter) Atlas 5 rocket is fully loaded with propellants, weighing in at 749,479 pounds (339,958 kilograms).

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09/27/2021 10:25



Stephen Clark

T-minus 17 minutes. The 194-foot-tall (59-meter) Atlas 5 rocket is fully loaded with liquid propellants. The launcher weighs 749,479 pounds (339,958 kilograms) with its tanks full.

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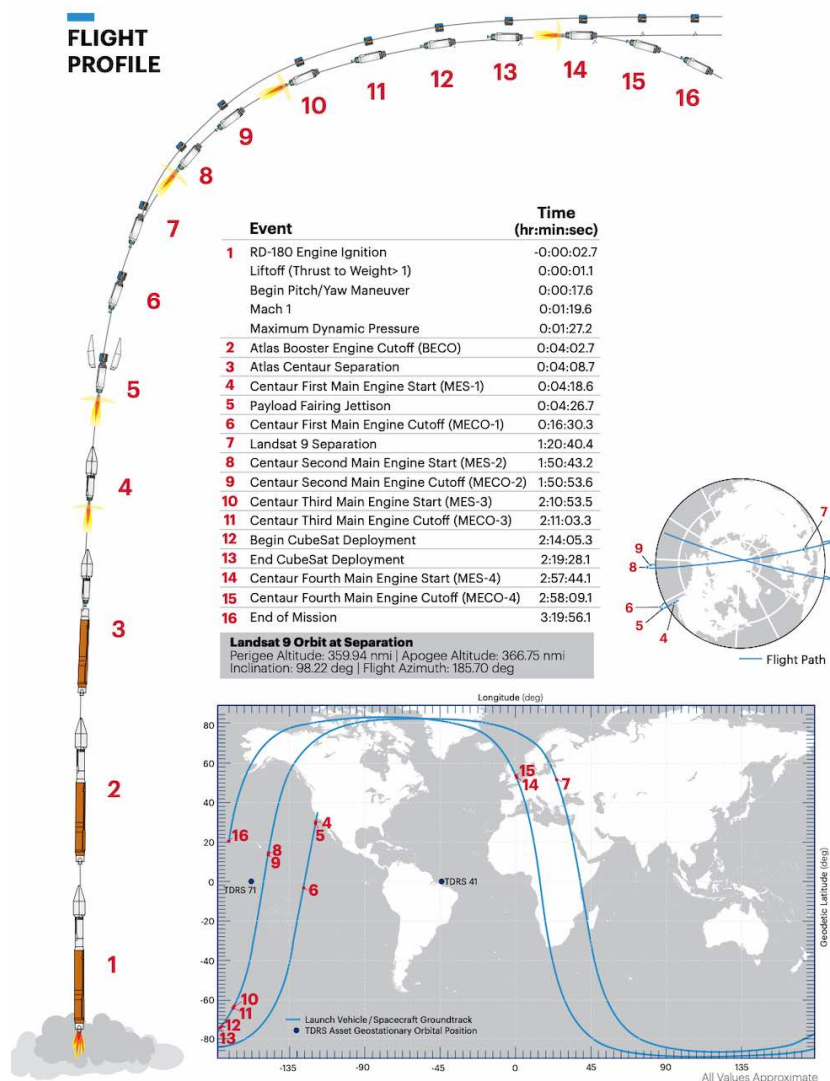
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Stephen Clark



Check out a timeline of today's Atlas 5 launch with the Landsat 9 satellite. It will take approximately 80 minutes to deploy the spacecraft in orbit.



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The Atlas first stage liquid oxygen tank is now in topping mode after the completion of fast-fill.

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60 minutes until launch. Here are some statistics on today's mission:

- 670th launch for Atlas program since 1957



- 300th Atlas launch from Vandenberg Space Force Base
- 2,000th overall launch from Vandenberg Space Force Base
- 259th mission of a Centaur upper stage
- 236th use of Centaur by an Atlas rocket
- 505th production RL10 engine to be launched
- 35th RL10C-1 engine launched
- 94th flight of an RD-180 main engine
- 88th launch of an Atlas 5 since 2002
- 20th NASA use of an Atlas 5
- 2nd Landsat to launch on an Atlas 5
- 9th Landsat satellite overall
- 16th launch of an Atlas 5 from Vandenberg Space Force Base
- 2nd Atlas 5 launch of 2021
- 130th Evolved Expendable Launch Vehicle flight
- 145th United Launch Alliance flight overall
- 80th Atlas 5 under United Launch Alliance
- 41st United Launch Alliance flight from Vandenberg Space Force Base
- 56th 400-series flight of the Atlas 5
- 39th Atlas 5 to fly in the 401 configuration
- 49th Atlas to use Space Launch Complex 3
- 5th orbital launch overall based out of Vandenberg in 2021

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09/27/2021 10:05



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ULA says the Atlas first stage is now 80 percent full of liquid oxygen. ULA's CEO, Tory Bruno, reported on Twitter moments ago that the liquid oxygen flow control valve issue noted earlier in the countdown has been resolved.

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The Atlas booster is now 60 percent full of liquid oxygen.

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The chilldown sequence to thermally condition the Centaur stage's Aerojet Rocketdyne RL10C-1 engine has started.

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The liquid hydrogen tank on the Centaur upper stage is now at 96 percent. The tank is now being topped off to reach flight level.

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Stephen Clark

T-minus 55 minutes. The countdown is heading toward a 30-minute built-in hold at T-minus 4 minutes.

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Stephen Clark

The Centaur upper stage's liquid hydrogen tank is now 40 percent full. And ULA confirmed a short time ago that the Centaur liquid oxygen tank is at flight level.

The cryogenic tanks will be gradually replenished until the final minutes fo the countdown to replace the propellant that naturally boils off.

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Stephen Clark

The Atlas first stage booster liquid oxygen tank is now 20 percent full.

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Stephen Clark

After initially pumping liquid oxygen into the Atlas 5's first stage in a slow-fill mode, the cryogenic oxidizer is now being pumped into the rocket in the fast-fill mode. But this flow rate is being slowed by the transfer flow control valve issue.

The Atlas 5's first stage is also known as the Common Core



Booster, and it holds 48,800 gallons of liquid oxygen, which will be consumed by the RD-180 main engine in a mixture with RP-1 kerosene, which was previously loaded on-board the rocket.

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Stephen Clark

ULA's launch team is discussing an anomaly with a transfer flow control valve that is reducing the rate liquid oxygen is flowing into the Atlas first stage.

At this point, tanking of the Atlas 5 rocket is continuing for launch of the Landsat 9 satellite.

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09/27/2021 09:11



Stephen Clark

Landsat 9 is the next in a series of land imaging missions launched since 1972, tracking nearly 50 years of city growth, climate change, and trends in use of lands for agriculture and infrastructure.

"We are days away from launching our ninth Landsat mission," said Karen St. Germain, director of NASA's Earth science division, in a recent press conference. "The Landsat program spans nearly 50 years and is a cornerstone of our understanding of Earth's surface.

"Each satellite in the Landsat program has captured increasingly sophisticated data and imagery documenting Earth's changing landscapes, and increasing our understanding of the planet on regional, national and global scales," St. Germain said.

"Landsat data informs a wide range of decisions related to managing crop health and water resources," she said. "These are critical decisions to mitigate global issues like regional famine or food scarcity in an era of accelerating climate change.

"This data is essential to global aid agencies, first responders here in the United States, policymakers at every level, major agricultural producers, and individual people, from farmers and ranchers to urban planners," St. Germain said.

The Landsat program is a joint effort between NASA and the U.S. Geological Survey, with NASA responsible for spacecraft development and launch services. The USGS is in charge of ground systems and the Landsat data archive, and will operate the Landsat 9 mission after launch.



The Landsat 9 satellite is the next in a series of land imaging missions launched since 1972, collecting views from space of urban sprawl, tropical deforestation, retreating glaciers, and changes in coral reefs, crops, and tectonic faults.



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50 percent of the Centaur's liquid oxygen capacity has been loaded.

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09/27/2021 09:03



Stephen Clark



ULA says today's launch window has been adjusted to a length of 26 minutes -- from 11:12 a.m. to 11:38 a.m. PDT -- to account for three collision avoidance, or COLA, cutouts. These cutouts help ensure the rocket avoids getting too close to any objects already in orbit.

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09/27/2021 09:00



Stephen Clark

Chilldown conditioning of the systems for the first stage liquid oxygen tank have been accomplished. The launch team just gave a "go" to begin loading super-cold liquid oxygen into the Atlas 5's first stage.

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Stephen Clark

The Centaur liquid oxygen tank is now 20 percent full.

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09/27/2021 08:52



Stephen Clark

Liquid oxygen is now flowing into the Atlas 5's Centaur upper stage at Vandenberg's SLC-3E launch pad. About 4,150 gallons of the cryogenic propellant, chilled to minus 298 degrees Fahrenheit, will be burned by the Centaur's single Aerojet Rocketdyne RL10 engine along with the liquid hydrogen to be loaded aboard later in the countdown.

Four burns by the Centaur's RL10 engine are planned over a roughly three-four launch sequence to place the Landsat 9 satellite into orbit, change altitude for deployment of four CubeSat rideshare payloads, and then deorbit the spent upper stage.

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Updated: 09/27/2021 08:58

09/27/2021 08:43



Stephen Clark

T-minus 2 hours and counting. The countdown clock is ticking again, as the ULA launch team marches toward liftoff of an Atlas 5 rocket at 11:12 a.m. PDT (2:12 p.m. EDT; 1812 GMT) with the Landsat 9 satellite for NASA and the U.S. Geological Survey.



There is one more built-in hold in today's countdown, expected at T-minus 4 minutes.

A thermal conditioning procedure known as chilldown will begin shortly to prepare the plumbing on the Atlas 5's mobile launch platform for the transfer of super-cold cryogenic propellants into the rocket.

Once cryogenic tanking begins, nearly 66,000 gallons of liquid hydrogen and liquid oxygen will be loaded into the two-stage Atlas 5 rocket.

RP-1 kerosene fuel, kept at room temperature, was loaded into the Atlas first stage during an earlier countdown rehearsal.

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Members of the Atlas 5 launch team have reported they are ready to proceed with cryogenic tanking during a pre-fueling readiness poll.

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Stephen Clark

The ULA launch conductor has briefed his team on countdown procedures as the Atlas 5 countdown is about to enter the final two hours before liftoff.

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The pad team has evacuated Space Launch Complex 3-East in preparation for fueling the Atlas 5 rocket with cryogenic propellants.

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09/27/2021 08:12



Stephen Clark

T-minus 2 hours and holding. This is a pre-programmed hold expected to last 30 minutes.

Over the last few hours, the Atlas 5 was powered up and Centaur propellant system preparations have been completed,



along with Atlas booster hydraulic and propulsion preps. The rocket's GPS metric tracking system has also been tested.

During this 15-minute hold, the ULA launch team at Vandenberg Space Force Base will be polled for their readiness to pick up the countdown and begin cryogenic tanking of the Atlas booster and Centaur upper stage.

The countdown's final pre-planned pause is scheduled for T-minus 4 minutes.

Personnel are now departing the Atlas 5 launch pad as the countdown proceeds toward the start of cryogenic tanking.

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This is the 88th flight of an Atlas 5 rocket, and the 16th Atlas 5 mission from Vandenberg. All other Atlas 5s have launched from pad 41 at Cape Canaveral Space Force Station.

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09/27/2021 07:07



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The mobile service gantry has moved into launch position a short distance from the Atlas 5 rocket. Workers will now complete their final tasks before evacuating to a fallback position ahead of the start of cryogenic tanking.

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09/27/2021 06:31



Stephen Clark

The 260-foot-tall Mobile Service Tower is moving away from the Atlas 5 rocket at the SLC-3E launch pad.





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09/27/2021 06:17



Stephen Clark

Teams are preparing to retract a moving gantry to reveal the Atlas 5 rocket for liftoff with the Landsat 9 satellite.

The Atlas 5 countdown is on track for launch at 11:12 a.m. PDT (2:12 p.m. EDT; 1812 GMT). The launcher's avionics systems have been powered up over the last couple of hours, and the next step in the countdown is the rollback of the mobile service tower.

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09/27/2021 05:40



Stephen Clark

Early countdown activities are commenced on time this morning. The initial tasks include power-up of the Atlas 5 rocket's systems at Space Launch Complex-3 East, followed by retraction of the launch pad's mobile gantry to reveal the Atlas 5 at around 6:42 a.m. PDT (9:42 a.m. EDT; 1342 GMT).

Once workers finish up closeout tasks, they will clear the launch pad in preparation for fueling of the Atlas 5 rocket. The launcher's Centaur upper stage will be filled with super-cold liquid oxygen first, followed by liquid oxygen on the Atlas first stage, then concluding with cryogenic liquid hydrogen fueling into the Centaur stage.

Two build-in holds are planned in the countdown, first at T-minus 2 hours to allow the launch team to give the "go" for cryogenic tanking, then at T-minus 4 minutes for final polling of the United Launch Alliance team before liftoff.

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09/26/2021 20:39



Stephen Clark

The eight-hour countdown is set to commence shortly after 3 a.m. PDT (6 a.m. EDT; 1000 GMT) Monday.

In the early stages of the countdown, ULA's launch team will power up the Atlas 5 rocket and run the vehicle through electrical checkouts.

There is a built-in hold planned at T-minus 2 hours. During the hold, the launch team will be polled for approval to start loading cryogenic propellants into the Atlas 5 rocket.

Liquid oxygen will be pumped into both stages of the launcher, and liquid hydrogen fuel will flow into the Centaur upper stage. RP-1 kerosene, the fuel for the first stage, was loaded into the Atlas 5 earlier this month during a countdown dress rehearsal.

Another built-in hold at T-minus 4 minutes will allow time for ULA's launch conductor to poll the team for approval for liftoff, timed for 11:12 a.m. PDT (2:12 p.m. EDT; 1812 GMT).

The launch time was adjusted by one minute over the weekend for safety reasons. A collision avoidance notice suggested the rocket and its Landsat 9 payload might get too close to a NASA satellite already in orbit, according to Tim Dunn, NASA's launch director for the mission.

There is a 30-minute launch window available Monday.

Weather forecasters at the Space Force's Space Launch Delta 30 at Vandenberg predict a better than 90% chance of acceptable conditions for liftoff Monday. The only slight concern is with the possibility that ground winds might exceed the Atlas 5's launch constraints.

But forecasters expect conditions to be foggy, with a low marine layer cloud deck blanketing Vandenberg. The fog and low cloud ceiling is not a concern for launch.

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09/26/2021 20:30



Stephen Clark





The launch of a Landsat environmental monitoring satellite Monday from California's Central Coast will be the first liftoff of a United Launch Alliance Atlas 5 rocket since the company confirmed there will be 29 more Atlas 5 flights before the Atlas family's retirement.

ULA is retiring its Atlas and Delta rocket lines with the debut of the company's new Vulcan Centaur rocket, which is scheduled to blast off for the first time next year.

An Atlas 5 rocket standing on a launch pad at Vandenberg Space Force Base, set for liftoff Monday with the Landsat 9 Earth observation satellite, is one of 29 Atlas 5s remaining in ULA's inventory. Jessica Rye, a ULA spokesperson, confirmed last month that all 29 Atlas 5s have been sold to customers for future launches.

ULA received its final shipment of RD-180 engines from Russia earlier this year. A dual-nozzle RD-180 engine, made in Russia by NPO Energomash, powers the first stage of each Atlas 5 rocket, generating around 860,000 pounds of thrust at full throttle while guzzling kerosene and liquid oxygen propellants.

The new Vulcan Centaur will be driven by twin U.S.-made BE-4 main engines from Blue Origin, the space company founded by billionaire Jeff Bezos. ULA says the Vulcan Centaur will have more lift capability, additional mission flexibility, and will be cheaper to operate than the existing Atlas 5 and Delta 4 rocket families.

There are three Delta 4 rockets left to fly on ULA's schedule.

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09/26/2021 20:29

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