Landsat 9

Landsat 9 is a partnership between the U.S. Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA) and continues the Landsat program's critical role of repeat global observations for monitoring, understanding, and managing Earth's natural resources since 1972. Landsat data provide a unique resource for those who work in agriculture, geology, forestry, regional planning, education, mapping, and global-change research. Landsat images also prove invaluable to the International Charter: Space and Major Disasters, supporting emergency response and disaster relief to save lives. With the addition of Landsat 9, the Landsat program's record of land imaging extends to more than half a century in 2022.

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LANDSAT NINE

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Quick Facts

Science instruments: OLI; TIRS
OLI built by: Ball Aerospace & Technology Corporation
TIRS built by: NASA Goddard Space Flight Center
Design life: 5 years
Spacecraft provider: Northrop Grumman
Image data: About 750 scenes per day
Launch date: September 27, 2021
Launch vehicle: United Launch Alliance Atlas V 401
Orbit: Near-polar, sun-synchronous at an altitude of 438 miles (705 kilometers)
Orbital inclination: 98.2 degrees
Spacecraft speed: 16,760 miles per hour (26,972 kilometers per hour),
Consumables: 10+ years

Landsat 9 Spacecraft and Launch Components

Landsat 9, like previous missions, was launched from Vandenberg Air Force Base, California, onboard a United Launch Alliance Atlas V 401 rocket on September 27, 2021. Landsat 9 carries the Operational Land Imager (OLI), built by Ball Aerospace & Technologies Corporation, Boulder, Colorado, and the Thermal Infrared Sensor (TIRS), built at the NASA Goddard Space Flight Center, Greenbelt, Maryland. Northrop Grumman designed and fabricated the spacecraft and was responsible for integrating the two instruments.

NASA is responsible for the space segment (instruments and spacecraft/observatory), mission integration, launch, and on-orbit checkout. The USGS is responsible for the ground system, flight operations, data processing, and data product distribution after NASA completes on-orbit checkout.

Landsat 9 moved into the previous orbit of Landsat 7. Landsat 9 images the Earth every 16 days in an 8-day offset with Landsat 8. Landsat 9 collects as many as 750 scenes per day, and with Landsat 8, the two satellites add nearly 1,500 new scenes a day to the USGS Landsat archive. Landsat 9 continues to increase the volume of the USGS archive by imaging all global landmasses and nearshore coastal regions, including islands at solar elevation angles greater than 5 degrees that were not always routinely collected before Landsat 8.

Figure 1. Landsat 9 natural color image (bands 4, 3, 2) of the Bangladesh coastline on the Bay of Bengal acquired on February 8, 2022. The Sundarbans mangrove forest, a protected United Nations Educational, Scientific and Cultural Organization area, appears as dark green on the left side of the image. The right side of the image shows agricultural lands and urban areas as light tan and gray. Between Landsat 8 and Landsat 9, the Landsat program delivers complete coverage of the Earth's surface every 8 days.

Landsat 9 Instruments

The instruments onboard Landsat 9 are improved replicas of those onboard Landsat 8, providing data that are radiometrically and geometrically superior to instruments on previous generation Landsat satellites.

Landsat 9's OLI captures observations of the Earth's surface in visible, near-infrared, and shortwave-infrared bands (table 1; fig. 2) with an improved radiometric precision (14-bit quantization increased from 12 bits for Landsat 8), allowing sensors to detect more subtle differences, especially over darker areas such as water or dense forests. The TIRS measures the thermal infrared radiation, or heat, of the Earth's surface with two bands that have improved performance over Landsat 8's thermal bands (table 1; fig. 2). Both OLI and TIRS have a 5-year mission design life, although the spacecraft has 10+ years of consumables.

Landsat 9 Data Products

Data acquired by Landsat 9 are consistent with currently archived Landsat data in terms of acquisition geometry, calibration, coverage, and spectral characteristics. All Landsat 9 data products are available for download through the USGS Earth Resources Observation and Science (EROS) Center at no charge.

For More Information

For additional information or to learn more about Landsat 9, please visit the USGS or NASA websites at https://usgs.gov/landsat or https://landsat.gsfc.nasa.gov/.

Visit https://www.usgs.gov/ for more information about the USGS and https://www.usgs.gov/programs/national-land-imaging-program for specifics about the National Land Imaging Program.

Questions about Landsat operations, data products, and data access can be directed to:

USGS EROS Customer Service
U.S. Geological Survey
Earth Resources Observation and Science (EROS) Center
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Facebook: https://www.facebook.com/USGSLandsatProgram
Instagram: https://www.instagram.com/USGSLandsat

Table 1. Landsat 9 Operational Land Imager and Thermal Infrared Sensor spectral bands.

Spectral band	Wavelength, in micrometers	Resolution, in meters
Operational Land Imager		
Band 1—Ultra blue (coastal/aerosol)	0.435–0.451	30
Band 2—Blue	0.452–0.512	30
Band 3—Green	0.533–0.590	30
Band 4—Red	0.636–0.673	30
Band 5—Near infrared (NIR)	0.851–0.879	30
Band 6—Shortwave infrared (SWIR) 1	1.566–1.651	30
Band 7—Shortwave infrared (SWIR) 2	2.107–2.294	30
Band 8—Panchromatic	0.503–0.676	15
Band 9—Cirrus	1.363–1.384	30
Thermal Infrared Sensor		
Band 10—Thermal infrared (TIR) 1	10.60–11.19	100[a]
Band 11—Thermal infrared (TIR) 2	11.50–12.51	100[a]

[a]Thermal bands are acquired at 100 meters resolution but are resampled to 30 meters.

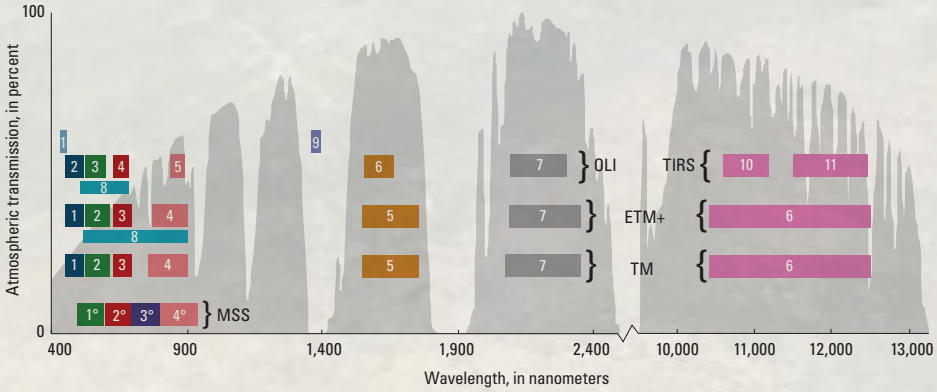

Figure 2. Comparison of Landsat 8–9 spectral band regions with Landsat 1–5 Multispectral Scanner System (MSS), Landsat 4–5 Thematic Mapper (TM), and Landsat 7 Enhanced Thematic Mapper Plus (ETM+). The atmospheric transmission values for this graphic were calculated using the MODerate resolution atmospheric TRANsmission model for a summertime midlatitude hazy atmosphere (circa 5-kilometer visibility). Numbered rectangles indicate the band number for that particular instrument. Image modified from NASA Landsat; used with permission.

Landsat 9 launched from Vandenberg Space Force Base at 1:12 p.m. (central time) on Monday, September 27, 2021, aboard an Atlas V rocket. Photograph by NASA.

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