USGS science for a changing world
NASA

Landsat Next

Satellites offer improved data to Earth science

A new chapter in Earth observation is on the horizon. Landsat Next will continue the mission's critical land surface data record —the world's longest at more than 50 years—while transforming Earth system science to further benefit society. Landsat Next, a constellation of three identical satellites, is targeted for launch in the early 2030s and will collect more data more often—with new and improved spectral sampling to support and advance emerging science and public service applications. The mission will fundamentally transform the breadth and depth of actionable information freely available to users. Landsat Next will ensure the continuity and quality of the longest space-based record of the Earth's land surfaces, surface waters, and coastal regions.

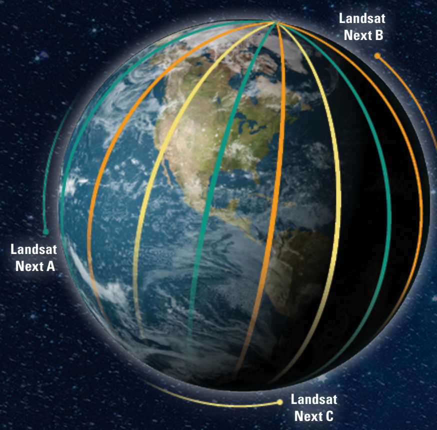


Figure 1. Illustration of the Landsat Next constellation of satellites.

Landsat Next Facts

Mission architecture: Identical triplet observatories
Mission category: 2/Class B
Mission life: 5 years
Observatory orbital separation: 120 degrees
Mean equatorial crossing time: 10:10 a.m. plus or minus 5 minutes
Global grid system: Worldwide Reference System-3
Single observatory repeat interval: 18 days
Triplet constellation repeat interval: 6 days
Sun-synchronous orbit: 653 kilometers (406 miles)
Orbital inclination: 98 degrees
Scene size: 164 kilometers x 168 kilometers

Landsat Next Defined

With three satellites in a Sun-synchronous orbit at an altitude of 653 kilometers (406 miles), the Landsat Next "triplets" will provide higher spatial resolution observations on a new global notation system called the Worldwide Reference System-3. The satellites can acquire frequent observations using this triplet constellation observational concept, which has a 6-day revisit cycle of any location on Earth's land and coastal regions (fig. 1). The frequency of this temporal revisit capability surpasses the 16-day repeat cycle of Landsat 8 or Landsat 9 individually and the combined 8-day repeat cycle of both satellites. Landsat Next's shorter revisit time will allow for more frequent observations enabling an improved understanding of land and water surface dynamics such as vegetation and crop phenology, burn severity, water use and quality, coastal and wetland change, and glacier and ice sheet movements.

Coupled with the increase in the number of imaging revisit times, Landsat Next's improved spatial resolution (fig. 2) will enable the detection of smaller features, making it easier to characterize Earth's land surfaces, water bodies, and coastlines more accurately. Landsat Next will have pixel resolutions ranging from 10 to 60 meters.

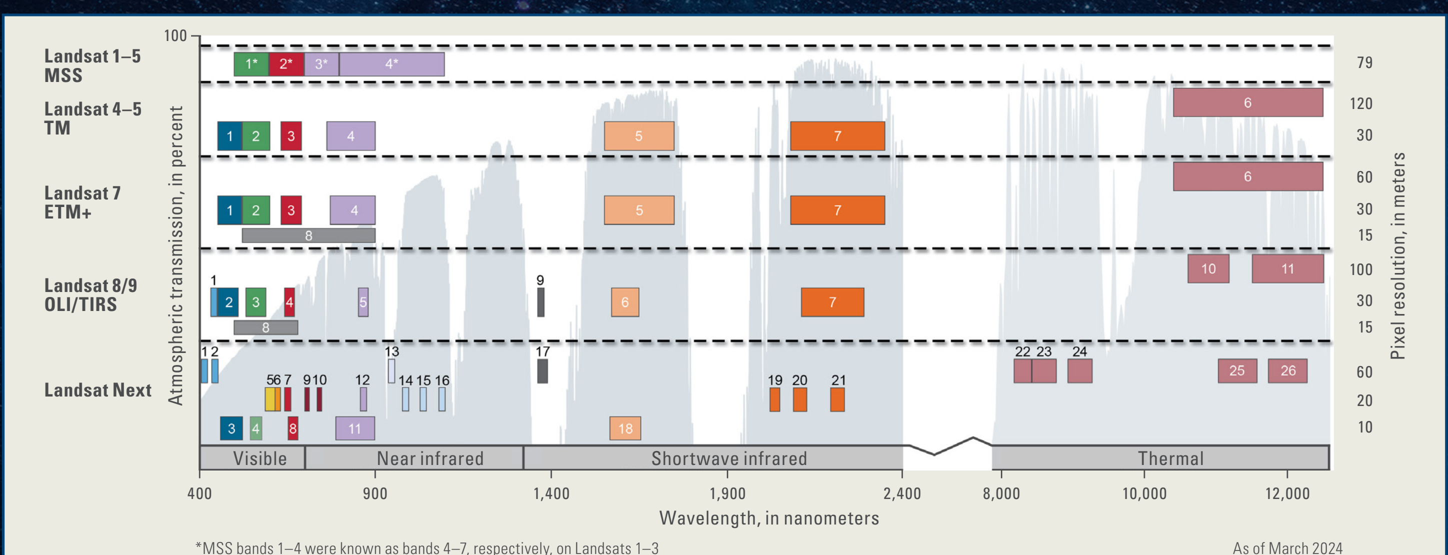


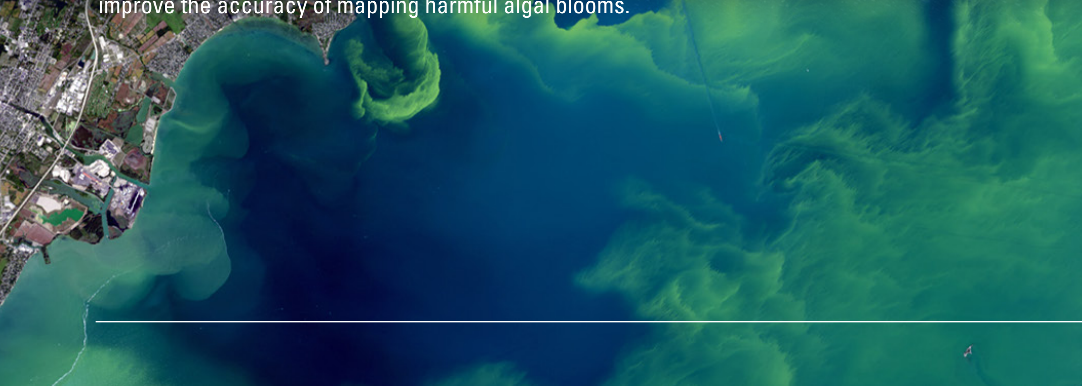
Figure 2. The estimated spectral bandpasses and pixel resolution (right axis) for the sensors on all Landsat satellites. [MSS, Multispectral Scanner; TM, Thematic Mapper; ETM+, Enhanced Thematic Mapper Plus; OLI, Operational Land Imager; TIRS, Thermal Infrared Sensor]

Table 1. Landsat Next spectral band numbers and names, pixel resolution, wavelength range, and observational rationale.

[*, denotes Landsat heritage band; +, denotes Sentinel-2 synergy; m, meter; nm, nanometer; NIR, near infrared; NDVI, normalized difference vegetation index; SWIR, shortwave infrared; TIR, thermal infrared]

Spectral band number/name	Pixel resolution (m)	Wavelength range (nm)	Observational rationale
1—Violet	60	402–422	Aerosol retrieval, atmospheric correction, detection of colored dissolved organic matter.
2—Coastal/ Aerosol* +	20	433–453	Vegetation health and plant vigor assessments.
3—Blue* +	10	457.5–522.5	Bathymetry, soil/vegetation mapping, detection of snow impurities.
4—Green* +	10	542.5–577.5	Vegetation health and plant vigor assessments.
5—Yellow	20	585–615	Detection of leaf chlorosis and vegetation stress, aquatic health and water quality assessments.
6—Orange	20	610–630	Phycocyanin (cyanobacteria) detection.
7—Red 1*	20	640–660	Phycocyanin fluorescence (cyanobacteria) detection, chlorophyll content mapping.
8—Red 2* +	10	650–680	Chlorophyll content and vegetation mapping, vegetation differentiation.
9—Red Edge 1+	20	697.5–712.5	Leaf area index mapping, chlorophyll content and plant stress mapping.
10—Red Edge 2+	20	732.5–747.5	Leaf area index mapping, chlorophyll content and plant stress mapping.
11—NIR Broad+	10	784.5–899.5	10-meter NDVI, biomass content and shoreline detection.
12—NIR 1* +	20	855–875	Biomass content and shoreline detection.
13—Water Vapor +	60	935–955	Atmospheric correction for land surface temperature, surface reflectance.
14—Liquid Water	20	975–995	Liquid water and water surface state detection, vegetation water content mapping.
15—Snow/Ice1	20	1,025–1,045	Snow grain size mapping.
16—Snow/Ice 2	20	1,080–1,100	Ice absorption, snow grain size mapping.
17—Cirrus* +	60	1,360–1,390	Detection of cirrus (high-altitude) clouds.
18—SWIR 1* +	10	1,565–1,655	Detection of nonphotosynthetic vegetation, fuel moisture mapping.
19—SWIR 2a	20	2,025.5–2,050.5	Cellulose/crop residue mapping.
20—SWIR 2b*	20	2,088–2,128	Cellulose/crop residue and soil moisture content mapping, fire scar detection.
21—SWIR 2c*	20	2,191–2,231	Cellulose/crop residue and soil moisture content mapping, fire scar detection.
22—TIR 1	60	8,175–8,425	Mineral and surface composition mapping.
23—TIR 2	60	8,425–8,775	Emissivity separation, volcano/sulfur dioxide emissions mapping.
24—TIR 3	60	8,925–9,275	Mineral and surface composition mapping.
25—TIR 4*	60	11,025–11,575	Surface temperature retrieval, carbonate mineral mapping.
26—TIR 5*	60	11,725–12,275	Surface temperature retrieval, snow grain size and moisture content mapping.

The image below was acquired by Landsat 8 on September 26, 2017, and shows western Lake Erie during a large phytoplankton bloom. Landsat Next's additional spectral bands will improve the accuracy of mapping harmful algal blooms.



Observational Continuity

Each Landsat Next observatory will image the Earth across 26 spectral bands. These spectral bands will include Landsat 8 and Landsat 9 heritage bands, 5 bands with similar spatial and spectral characteristics to Europe's Copernicus Sentinel-2 satellites to allow easier joint use of data products, and 10 new spectral bands to support emerging Earth surface change applications such as algal bloom detection, snow and ice sheet hydrology, crop soil conservation, and surface emissivity estimation (table 1; fig. 2).

Emerging Applications

The sharpened spatial resolution, new spectral bands, and increased observational frequency of Landsat Next will transform the ability to monitor and forecast landscape change. New and improved sensor technologies have the capability to enable research and public services for fire monitoring and recovery, water resources management, agriculture development and evapotranspiration, ecosystem health, public health, and urban sprawl. Landsat Next will greatly augment the joint U.S. Geological Survey/National Aeronautics and Space Administration Landsat program's more than five-decade data record, which has proven valuable for resource management, environmental sustainability, and climate resiliency.

For additional information on Landsat Next, visit the U.S. Geological Survey and National Aeronautics and Space Administration websites at https://www.usgs.gov/landsat-missions/landsat-next and https://landsat.gsfc.nasa.gov/satellites/landsat-next/.

Visit https://www.usgs.gov/nli for specifics about the U.S. Geological Survey National Land Imaging Program.

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

Customer Service, USGS Earth Resources Observation and Science Center
47914 252nd Street
Sioux Falls, SD 57198
Phone: 605–594–6151 or 1–800–252–4547
Email: landsat@usgs.gov
X: https://www.twitter.com/USGSLandsat
Facebook: https://www.facebook.com/USGSLandsatProgram
Instagram: https://www.instagram.com/USGSLandsat

ISSN 2327-6916 (print)
ISSN 2327-6932 (online)
https://doi.org/10.3133/fs20243005