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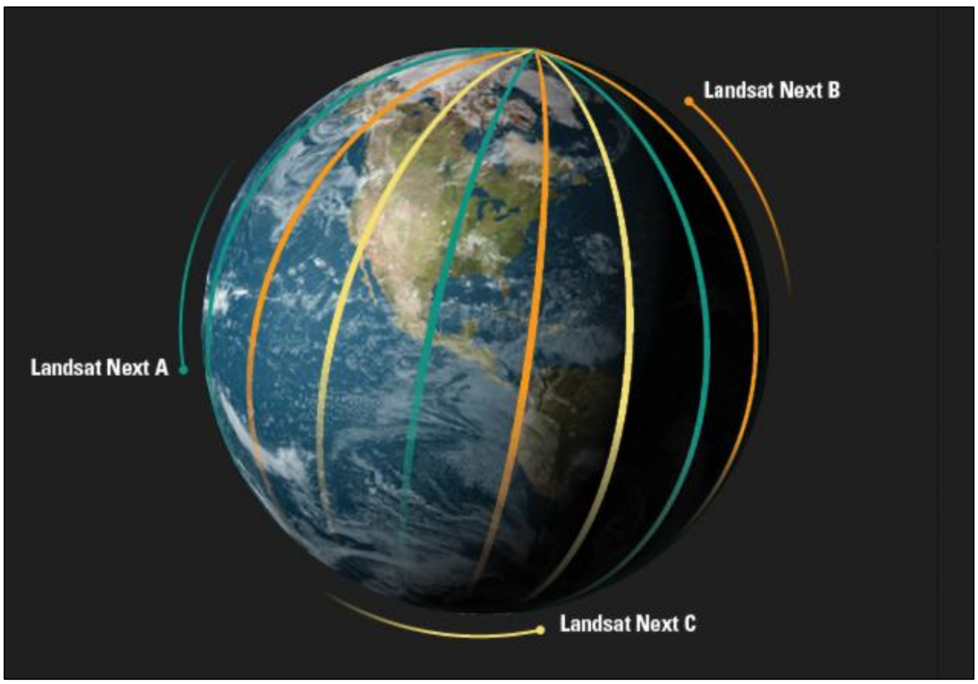
INSIGHT

Landsat Next on the Horizon

Updated June 28, 2024

In December 2022, the National Aeronautics and Space Administration (NASA) and the U.S. Geological Survey (USGS) presented initial details about Landsat Next, the next proposed launch in the Landsat series of Earth-observing satellite missions that began in 1972. Landsat Next is to be a constellation of three satellites sent into orbit on the same launch vehicle in 2030 (**Figure 1**). Landsat Next is expected to collect about 15 times more data than its predecessor mission, Landsat 9.

Figure 1. Schematic of Landsat Next Constellation



Source: U.S. Geological Survey, "Landsat Next," https://www.usgs.gov/landsat-missions/landsat-next.

Notes: The green, orange, and yellow paths are taken by Landsat Next satellites A, B, and C, respectively.

Landsat sensors detect and digitally record visible, shortwave-infrared, and thermal-infrared energy. They transmit images to ground stations where they are processed and stored in a data archive. Landsat images are intended to be consistent with archived images to enable long-term comparisons of changes in Earth's land features. In 2008, the USGS began making all Landsat data publicly available for free, unrestricted download. In 2020, the USGS began releasing Landsat data, still for free, via the commercial cloud.

Sustainable Land Imaging Program

In 2016, NASA and the Department of the Interior (DOI), which includes the USGS, entered into an interagency agreement to redefine their long-term Landsat collaboration through the Sustainable Land Imaging Program (SLIP) and outline their respective responsibilities for future Landsat missions. Under SLIP, the agencies are to develop a multi-decadal, spaceborne system to provide high-quality global land-imaging measurements compatible with the existing Landsat record. In practice, NASA develops Landsat satellites and instruments, launches the spacecraft, and checks initial mission performance. The USGS then takes over satellite operations and manages the collected image data at the Earth Resources Observation and Science Center. SLIP's memorandum of understanding also calls for jointly developing program strategy and architecture, identifying user needs, and defining mission requirements.

Current Landsat Observations

Landsat 9 was the first Landsat satellite launched under SLIP. Currently, Landsat 8 and 9 add nearly 1,500 new images a day to the Landsat archive. The satellites each carry two sensors: an operational land imager (OLI), which observes many of the same spectral bands of radiation as Landsat 7, but with improvements, and a thermal infrared sensor (TIRS), which can measure land surface temperature. Both instruments have a 5-year mission design life, although the satellites were launched with more than 10 years of fuel. For more information, see CRS Report R46560, *Landsat 9 and the Future of the Sustainable Land Imaging Program*.

Other countries have remote sensing satellite systems compatible with Landsat in certain capabilities but not in others. For example, the European Space Agency's Copernicus program has deployed its Sentinel-2A and Sentinel-2B satellites with many of the technical characteristics of Landsat 8 and 9, though they have additional capabilities (e.g., red-edge and water vapor spectral bands) and lack thermal infrared capability. Collectively, these satellites and others represent a system of systems, as called for by the National Academy of Sciences in the 2018 decadal strategy for Earth observation from space.

Resolution Improvements Projected for Landsat Next

Under SLIP, a Joint Agency Sustainable Land Imaging Architecture Study Team evaluated an acquisition strategy for a follow-on mission to Landsat 9 that would best satisfy user needs, mission architecture, and mission requirements. NASA and the USGS state that the result, the planned Landsat Next constellation, will improve temporal, spatial, and spectral resolutions by two to three times (**Table 1**), while maintaining radiometric resolution (e.g., how much information is perceived by a satellite's sensor). The sensors on Landsat Next are to have 26 spectral bands (**Figure 2**), including refined versions of the 11 Landsat "heritage" bands, 5 bands with similar characteristics to Sentinel-2 bands, and 10 new bands to support emerging applications.

Table 1. Resolution Differences Between Landsat 8 and 9, Sentinel-2 A and B, and Landsat Next

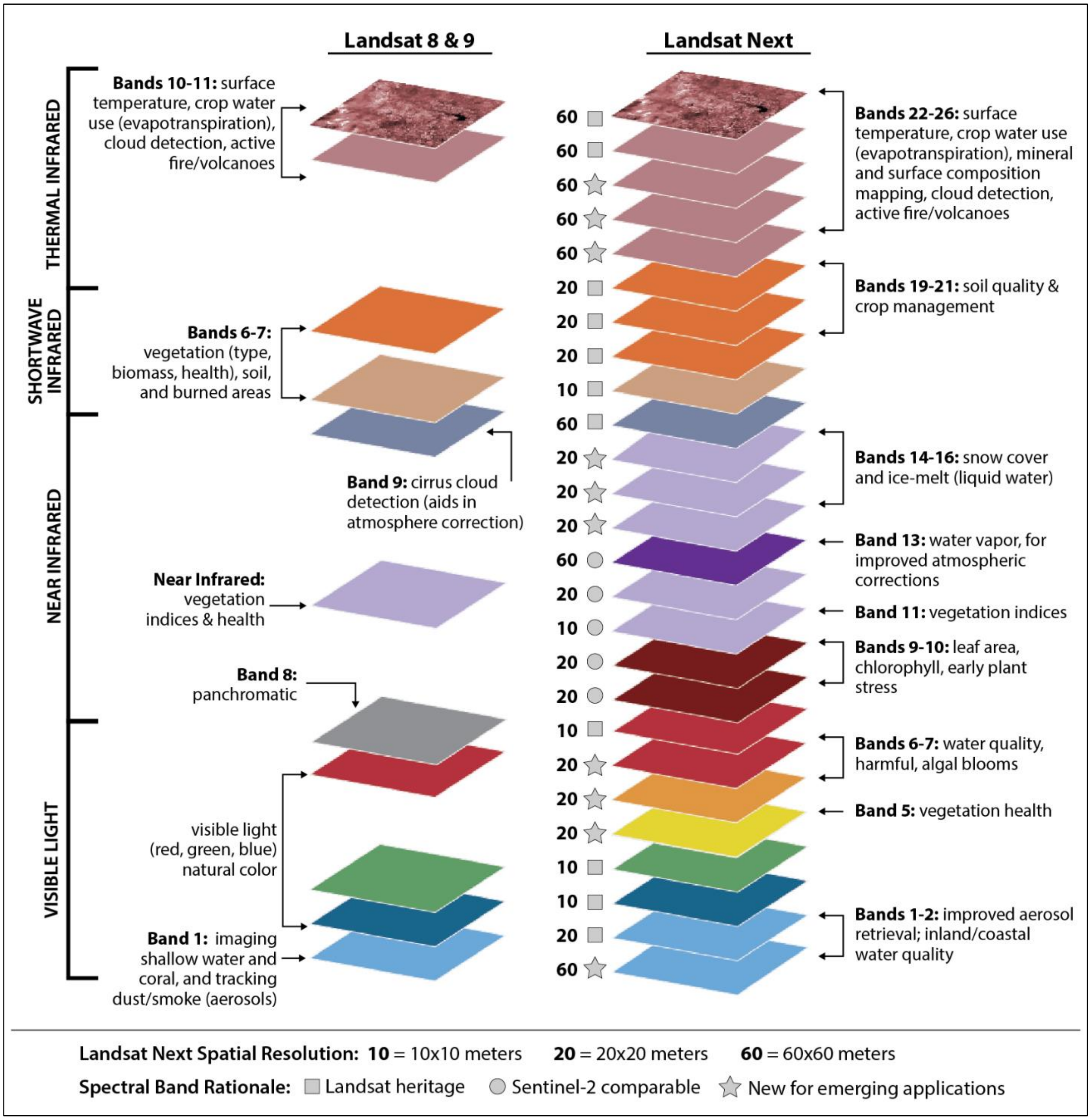
Resolution	Definition	Landsat 8 and 9	Sentinel-2 A and B	Landsat Next
Temporal[a]	Amount of time between visits of a sensor to a specific observation area (i.e., the time between satellite orbits over the same location)	16 days per satellite or 8 days in tandem (swath width of 185 kilometers)	10 days per satellite or 5 days in tandem (swath width of 290 kilometers)	16 days per satellite or 6 days collectively (swath width of 165 kilometers)
Spatial	Size of the area on Earth's surface represented by each pixel (finer resolution allows greater detail within the targeted area)	30x30 meters for 9 OLI bands; 100x100 meters for 2 TIRS bands	10x10 meters for 3 bands; 20x20 meters for 6 bands; 60x60 meters for 4 bands	10x10 meters for 5 bands; 20x20 meters for 13 bands; 60x60 meters for 8 bands
Spectral	Ability of a sensor to discern different wavelengths of electromagnetic radiation (more wavelength bands provide finer resolution)	11 bands (including 2 thermal bands)	13 bands (no thermal bands)	26 bands (including 5 thermal bands)

Source: CRS using National Aeronautics and Space Administration, U.S. Geological Survey, and European Space Agency websites.

Notes: OLI = operational land imager; TIRS = thermal infrared sensor.

a. Clouds can obscure imagery of the Earth at any given time, affecting temporal resolution.

Figure 2. Spectral Comparison of Landsat 8 and 9 and Landsat Next



Source: CRS using U.S. Geological Survey, "Landsat Next," https://www.usgs.gov/landsat-missions/landsat-next.

Moving Landsat Next Forward

Landsat Next's life cycle progress, including mission formulation, design, construction, launch, and operations, is contingent on multiple years of federal appropriations. In 2022, the mission entered Formulation Phase A to complete concept and technology development. After requesting funds to initiate Landsat Next in FY2024, NASA requested $150.0 million for FY2025. In FY2025, the USGS requested an increase of $8.9 million over FY2024 funding of $94.5 million for Landsat Next ground system development. On June 13, 2024, NASA selected the Raytheon Company to provide three instruments, with an option for one additional instrument, and related services for the mission. Congress may debate the amount and timing of Landsat Next funding and may provide oversight of mission administration and progress.

Author Information

Anna E. Normand
Specialist in Natural Resources Policy

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