



Landsat Update

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Landsat 9 Mission Status

The Landsat 9 mission continues to meet its milestones, ensuring that the Landsat 9 mission remains on schedule for a launch readiness date of December 2020.

In early March, representatives from NASA and Orbital ATK successfully completed a rigorous **Critical Design Review (CDR)** in Gilbert, AZ demonstrating that the program meets all technical performance measures and requirements. The execution of the design review enables the program to effectively transition into manufacturing and prepare for the assembly, test and launch operations phase of the mission. The Landsat 9 spacecraft will be manufactured and tested at the company's Gilbert, Arizona, facility.

The USGS and NASA held the **Ground System Preliminary Design Review (GPDR)** on March 20-22, 2018 in Sioux Falls, South Dakota. The GPDR, which contains the Data Processing and Archive System (DPAS), Ground Network Element (GNE) and



Landsat Multi-Satellite Operations Center (LMOC) components, demonstrated that the proposed design of each component satisfies the required functional and performance requirements to continue the Landsat 9 development process. USGS and NASA personnel reviewed DPAS technical criteria, the preliminary relationship of the GNE design to the requirements, interface designs, integration and test methods, and LMOC programmatic material. With the GPDR a success, the Ground System can now proceed to the Critical Design Review, which is planned for Fall 2018.

The **Mission Critical Design Review** was held April 17-20, 2018 at NASA's Goddard Space Flight Center, Greenbelt, MD. NASA and USGS scientists and engineers provided the Standing Review Board (SRB) a status on all segments including the spacecraft, instruments, launch vehicle, and ground system to date. The SRB had high praise for the accomplishments and the strengths of the Landsat 9 project team. Highlights noted included the high degree of experience and expertise throughout the project, the close working relationship among agency team members, the project's strong technical maturity, the cost and schedule performance to date, the maturity of plans going forward, and exemplary use of lessons learned. The SRB assigned one request for action (RFA) related to USGS funding reserve levels.

In addition to the successful reviews, NASA's Goddard Space Flight Center (GSFC) received the Thermal Infrared Sensor 2 (TIRS-2) Flight Cryocooler for the Landsat 9 TIRS-2 instrument ahead of schedule. The early delivery from Ball Aerospace will allow GSFC additional time and options during the instrument integration and test phase.

To get a peek of Landsat's OLI-2 instrument during Focal Plane Integration check out NASA's Landsat 9 page: landsat.gsfc.nasa.gov/in-focus-a-peak-at-landsat-9s-oli-2-instrument-during-focal-plane-integration/.

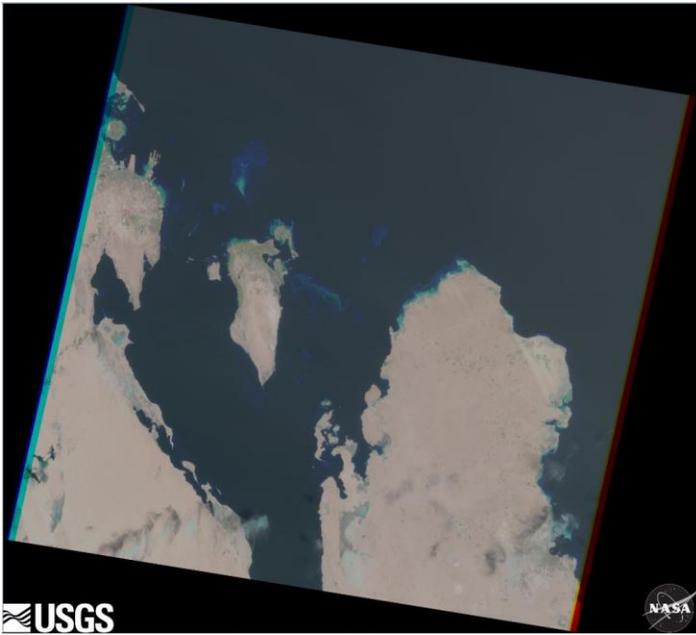
10 Years of Imagery for Everyone

On April 21, 2008, the USGS officially announced the pursuit of an aggressive schedule to provide users with no charge electronic access to any Landsat scene held in the USGS-managed national archive of global scenes dating back to Landsat 1, launched in 1972 (landsat.usgs.gov/sites/default/files/1f031_7f618-pdf-usgs-landsat-imagery-release.pdf). The archive was reprocessed to standard parameters (UTM projection, WGS84 datum, cubic convolution resampling, and in GeoTIFF data format) with all Landsat 7 scenes becoming available for download first on October 1, 2008. All remaining Landsat 1-5 data became available for download in early January 2009.

As of March 31, 2018, more than 75 million Landsat scenes have been downloaded from the USGS-managed archive! The **Landsat Media Library** web page (landsat.usgs.gov/media-library) showcases how making the Landsat archive available to everyone has helped us understand our changing Earth.

The Department of Interior and the U.S. Geological Survey have recently requested a Federal Advisory Committee to review the free and open policy for Landsat data. More information about the review can be found on the USGS Page: <https://www.usgs.gov/center-news/landsat-advisory-group-undertakes-a-landsat-cost-recovery-study>.

Landsat Global Archive Consolidation Milestone Reached



The 5 millionth scene received in support of the Landsat Global Archive Consolidation (LGAC) effort has been added into the USGS Landsat archive. The goal of LGAC is to 'bring home' all unique data originally stored only at international ground stations. To date, over 46 percent of the Landsat archive are from data acquired through the LGAC, further helping us understand past changes on the earth.

The Landsat 5 Thematic Mapper (TM) scene to the left (Path 169 Row 42) was acquired on April 16, 1989, and downlinked to the International Cooperator in Saudi Arabia (KACST) Riyadh ground station (RSA). The scene was ingested into the Landsat inventory at USGS EROS on March 14, 2018.

More information on LGAC can be found at landsat.usgs.gov/landsat-global-archive-consolidation-lgac.

Landsat Collection 1 Level-1 Processing Status

Landsat 1-5 Multispectral Scanner (MSS) Collection 1 Level-1 data are now available to download from the USGS Landsat archive. The addition of these data into the collection ensures a consistent archive to support time-series analyses from 1972-present.

On-demand ordering of MSS Pre-Collection Level-1 data has been discontinued from EarthExplorer, but the scenes available for download will remain downloadable until O.

Users are strongly encouraged to use Landsat Collection 1 Level-1 data products for science applications (landsat.usgs.gov/landsat-collections).

U.S. Landsat Analysis Ready Data (ARD)

The USGS temporarily suspended the production of U.S. Landsat Analysis Ready Data (ARD) tiles on March 19, 2018, for the integration of two new Landsat Science Products, Surface Temperature, and Dynamic Surface Water Extent. The planned April 30 production re-start was delayed unexpectedly and is rescheduled for August 2018.

U.S. Landsat ARD tiles processed through March 18, 2018, remain available for download.

More information on Landsat ARD can be found on landsat.usgs.gov/ard.

U.S. Landsat ARD Special Issue Call for Manuscripts

Remote Sensing is seeking manuscripts for a special issue on the Science of Landsat Analysis Ready Data (ARD) that aims to explore the new generation of Landsat science data products that were released by the USGS in October 2017. Manuscript submissions are **due July 31, 2018**. The topics this journal issue is addressing include:

- Tools and algorithms for visualizing and analyzing U.S. Landsat ARD.
- Suitability of U.S. Landsat ARD for mapping and monitoring land and water dynamics.
- Current status and planned/operational U.S. Landsat ARD products.
- Specifications and characteristics of U.S. Landsat ARD, including geometric and radiometric consistency.
- Combined use of U.S. Landsat ARD and other sensor data (e.g., Sentinel-2, LIDAR, microwaves, thermal scanners) and fusion approaches.

For more information, visit www.mdpi.com/journal/remotesensing/special_issues/landsat_ard.

Upcoming Landsat Science Products

In 2018, the USGS will release four new U.S. Landsat Science Products to support land surface change studies: Surface Temperature (ST), Dynamic Surface Water Extent (DSWE), Burned Area (BA), and fractional Snow Covered Area (fSCA). These products are derived from U.S. Landsat Analysis Ready Data (ARD).

- The ST Level-2 product contains raster data that represent the temperature of the Earth's land surface in Kelvin.
- The DSWE Level-3 product contains raster data about the existence and condition of surface water.
- The BA Level-3 product produces raster data that represent burned probability and burn classification.
- The FSCA Level-3 product contains raster data indicating the percentage of the pixel covered by snow.



Examples of Landsat Surface Reflectance (left) and Burned Area (right) images. The images were derived from Landsat 5 ARD Tile H006V010, July 07, 2003.

Release plans for these data will be announced on the Landsat Missions Web Site and social media outlets later in the year.

International cooperation to improve Atmospheric Correction Inter-comparison eXercise (ACIX)

The Atmospheric Correction Inter-comparison eXercise (ACIX; calvalportal.ceos.org/projects/acix) project compares the output of atmospheric correction algorithms for Landsat 8, and Sentinel 2A and 2B. An international team of scientists looked at differences between algorithms and the two sensors for Surface Reflectance, Aerosol Optical Thickness, and Water Vapor at select sites with varying land cover and atmospheric conditions. The work will help users understand differences between algorithms, as well as their strengths and weaknesses. It will also lead to improvements in atmospheric correction outputs resulting in better data for users. Future work will include techniques for cloud and cloud-shadow filtering and continued work on atmospheric correction. A description of the project and a summary of results can be found in Remote Sensing at <http://www.mdpi.com/2072-4292/10/2/352>.

Landsat Science Team Update

The inaugural 2018-2023 Landsat Science Team meeting was held February 21-22, 2018 at the USGS EROS Center in Sioux Falls, SD. The meeting objectives were to introduce team members to each other and allow them to present an overview on their work. There were also status updates on the Landsat 7 and Landsat 8 missions, Landsat Analysis Ready Data, Landsat science products, and a briefing on Landsat 9 status and development.

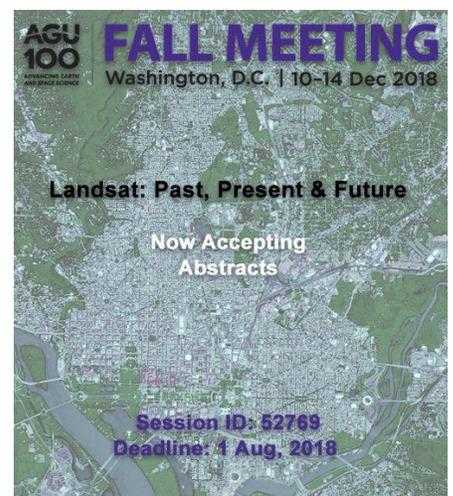
The team also discussed priorities for their 5-year term which included continuing to build synergy with the Sentinel project, time series applications, atmospheric correction, and cloud and cloud shadow screening. They will also be making recommendations for science needs and data product requirements for Landsat 10 and beyond.

The summer meeting will be held at the University of Colorado in Boulder, August 8-10, 2018 where the team will give updates on their work. They will also review the Landsat Data policy, and be briefed on activities from the Calibration and Validation teams. In addition, they will visit Ball Aerospace for OLI-2 development updates. All presentations will be available after the meeting on the USGS Landsat website landsat.usgs.gov/landsat-science-teams.

Meetings of Interest and User Conferences:

AGU Landsat session call

Are you interested in presenting at the 2018 AGU meeting? Landsat will be hosting a session (session ID: 52769) titled: **Landsat: Past, Present, and Future** and will cover a breadth of topics from how the Landsat mission is operated, to how data is collected, archived and distributed, to what archive, products and data access enhancements are planned. To join this session, be sure to submit your abstract by **August 1, 2018** (fallmeeting.agu.org/2018/abstract-submissions/). The session will highlight the following topics:



- Operating the Landsat Mission from data collection, archive, and distribution
- Landsat Collections based studies
- US. Landsat ARD time series analysis studies
- Landsat Science Products
- Integration/harmonized initiatives between Landsat and other sensors
- Tools and algorithms for visualizing and analyzing the Landsat archive

IGARSS

July 23-29, 2018 Valencia, Spain

www.igarss2018.org

Ecological Society of America (ESA)

August 5-10, 2018 New Orleans, LA

esa.org/neworleans/

Landsat Science Team

Aug 8-10, 2018, Boulder, Colorado

landsat.usgs.gov/team-meetings-agendas-and-presentations

SPIE Remote Sensing

September 10-13, 2018 Berlin, Germany

spie.org/conferences-and-exhibitions/remote-sensing/conferences?SSO=1

Geological Society of America (GSA)

Nov 4-7, 2018 Indianapolis

www.geosociety.org/GSA/Events/Annual_Meeting.aspx

American Geophysical Union (AGU)

Dec 10-14, 2018 Washington, DC

fallmeeting.agu.org/2018/

American Association of Geographers (AAG)

April 3-7, 2019 Washington, DC

annualmeeting.aag.org/

ESRI

July 8-12, 2019, San Diego, CA

www.esri.com/en-us/about/events/uc/

Pecora Memorial Remote Sensing Symposium (Pecora21) and International Symposium on Remote Sensing of Environment (ISRSE38)

Oct 6-11, 2019, Baltimore, MD

www.asprs.org/event/pecora21-isrse38

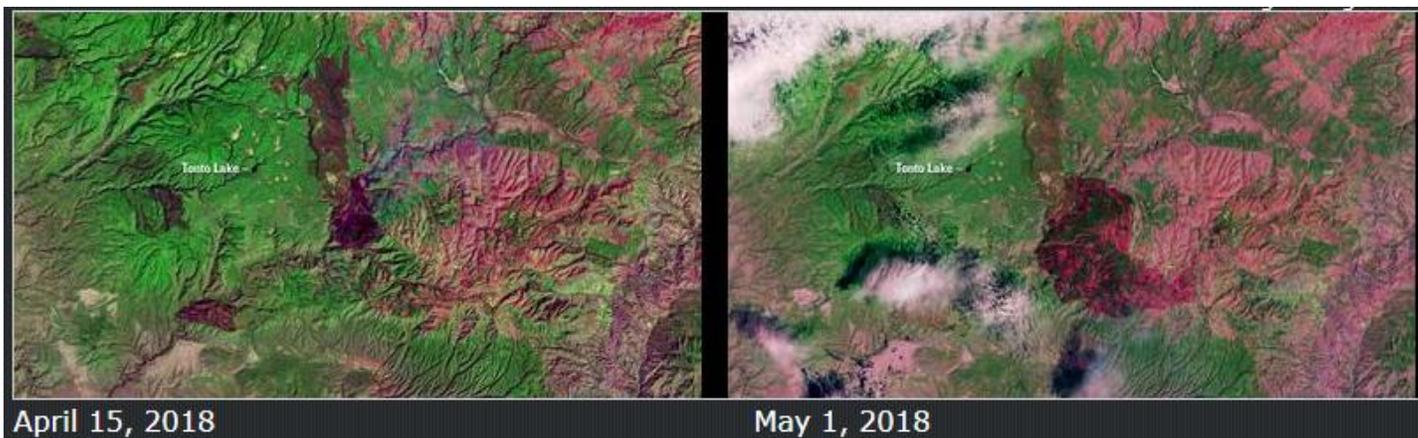
Recently Promoted Landsat Images

Solai Dam Tragedy in Kenya

On May 9, a private dam burst near the Rift Valley town of Solai in Kenya. The dam collapse sent millions of gallons of water rushing through the fields of a 3,000-acre commercial coffee farm and into the homes downstream and killed more than 45 people. Images using Landsat 8's shortwave infrared (SWIR) and near-infrared (NIR) bands highlight the water's destructive path remotesensing.usgs.gov/gallery/gallery.php?cat=2#746

Rattlesnake Fire, Arizona

The Rattlesnake Fire ignited on April 11 and has scorched over 26,000 acres on the Fort Apache Indian Reservation, San Carlos Indian Reservation, and the Apache-Sitgreaves National Forests in eastern Arizona. The Landsat 8 image acquired on April 15 shows the fire emerging from the White Mountains. By May 1, when Landsat 8 acquired data over the area again, the fire was mostly contained remotesensing.usgs.gov/gallery/gallery.php?cat=2#744.



Volcán de Fuego, Guatemala

Volcán de Fuego in Guatemala erupted on January 31, 2018, and Landsat 8 acquired an image of the eruption a day later (remotesensing.usgs.gov/gallery/gallery.php?cat=3#739). A plume of ash rises from the mountain's peak to an altitude of 6,500 meters (21,300 feet). Wind carried the ash 40 kilometers (25 miles) to the west and southwest.

The Salar de Atacama salt flat

The Salar de Atacama salt flat has the planet's largest deposit of economically recoverable lithium, a key ingredient in rechargeable batteries. Landsat imagery shows the expansion of the lithium mining operations from 1991 to 2018 (remotesensing.usgs.gov/gallery/gallery.php?cat=7#740).



These and other interesting images of our changing Earth can be found in the Land Remote Sensing Image Collections Gallery: remotesensing.usgs.gov/gallery/.

Connect/Interact/Contact!

Landsat Missions Website: landsat.usgs.gov

2018 Landsat Headlines: landsat.usgs.gov/2018

Landsat Updates: landsat.usgs.gov/landsat-updates



USGS Landsat: twitter.com/USGSLandsat

NASA Landsat: twitter.com/NASA_Landsat



USGS: www.facebook.com/USGeologicalSurvey

NASA Landsat: www.facebook.com/NASA.Landsat



USGS: www.instagram.com/usgs/

NASA: www.instagram.com/nasa/

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