

USGS NATIONAL LAND IMAGING PROGRAM UPDATE

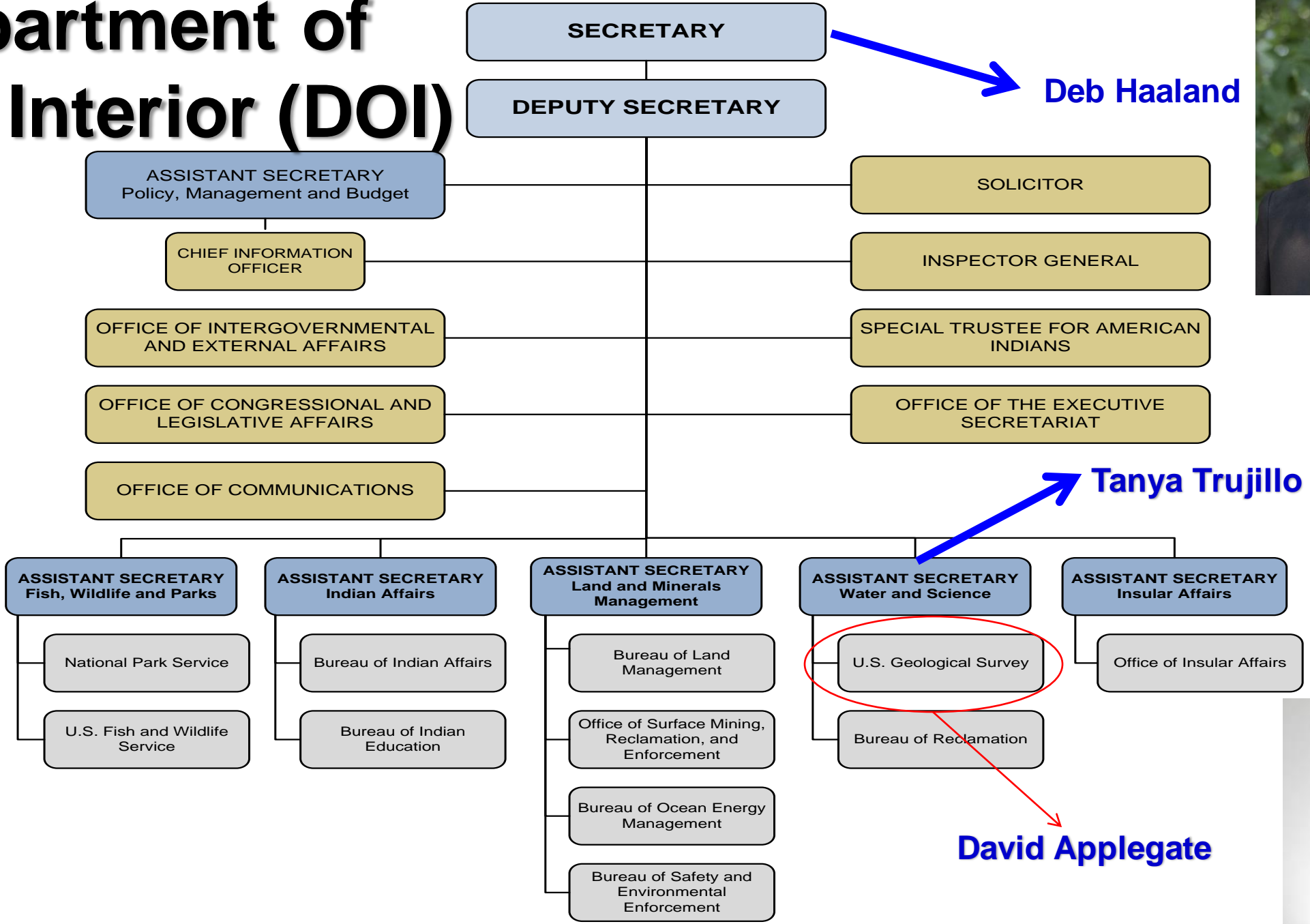
TIMOTHY STRYKER

*CEOS PRINCIPAL AND CHIEF, OUTREACH AND COLLABORATION
BRANCH, NATIONAL LAND IMAGING PROGRAM
U.S. GEOLOGICAL SURVEY (USGS)
U.S. DEPARTMENT OF THE INTERIOR*

*CEOS WGCV/IVOS SUBGROUP MEETING
AUGUST 29, 2022*



Department of the Interior (DOI)



Deb Haaland



Tanya Trujillo

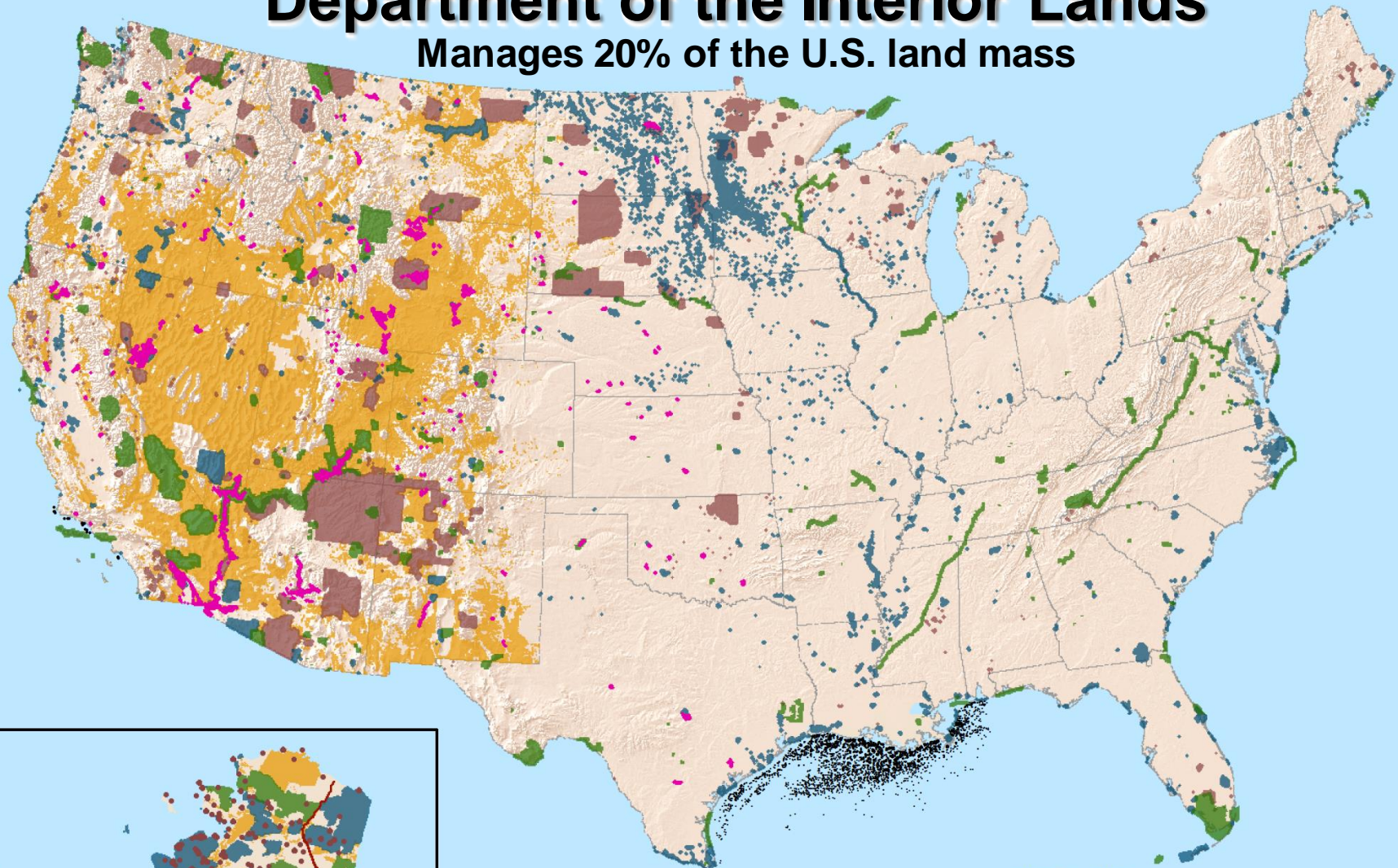


David Applegate



Department of the Interior Lands

Manages 20% of the U.S. land mass



Alaska

- Trans-Alaska Pipeline
- Native Alaskan Village

Hawaii

Puerto Rico & US Virgin Islands

- Oil & Gas Platforms
- Bureau of Land Management
- Bureau of Indian Affairs
- Fish & Wildlife Service
- National Park Service
- Bureau of Reclamation



DOI Bureaus

- National Park Service
- U.S. Fish & Wildlife Service
- Bureau of Indian Affairs
- Bureau of Land Management
- Office of Surface Mining, Reclamation & Enforcement
- Bureau of Ocean Energy Management
- Bureau of Safety and Environmental Enforcement
- U.S. Geological Survey**
- Bureau of Reclamation



USGS Mission Areas

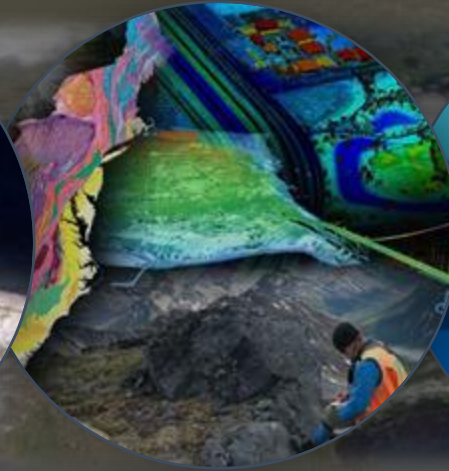
Water Resources



Natural Hazards



Core Science Systems



Ecosystems



Energy and Minerals



Vision


- Lead the Nation in 21st-century integrated research, assessments, and prediction of natural resources and processes to meet society's needs.

Mission

- Monitor, analyze and predict current and evolving dynamics of complex human and natural Earth system interactions
- Deliver actionable intelligence at scales and timeframes relevant to decision makers.

National Land Imaging Program

As defined by **Public Law** and **National Space Policy**, to carry out the Public Interest of the United States:

- 
- **Operate and maintain a National Land Imaging Archive** to house a Basic Data Set of global data – for historical, scientific, and technical purposes – includes data obtained from U.S. civil, commercial and foreign satellite systems
 - **Operate and maintain the Landsat** flight and ground systems
 - **Collect, process, archive and distribute these data** as Public Domain holdings of the United States
 - **Determine U.S. civil operational requirements** for global land surface data and to conduct a national program of civil-operational land imaging
 - **Conduct research and development in the applications of remote sensing** in order to enhance the ability of the U.S. to manage and utilize its renewable and nonrenewable resources
 - **Develop civil applications and information tools** using known standards and protocols and make them available to the general public; facilitate federal civil agency use of National Security Space system data via the Civil Applications Committee

Fundamental goal: Ensure public availability of a primary data record about the historical condition and current state of the Earth's land surface and to predict its future condition

National Land Imaging Program Components

Satellite Operations

- **Develop and operate systems to acquire, produce, preserve, and deliver products and services to meet civil Earth observation research and operational requirements**
 - Collect, archive, process & disseminate Landsat & Landsat-like data (Landsat 1-8, Sentinel-2)
 - Operate the Landsat 7 and 8 satellites, calibrate and validate the incoming data
 - Complete commissioning of the Landsat 9 ground system & assume ownership and operations in 2022
 - Collect, maintain & analyze user requirements; Develop Landsat Next with NASA for late 2020s launch

Science, Research & Investigations

- **Conduct science, research and technology investigations to improve upon and develop new products and services and to improve understanding of roots, causes and consequences of land use change**
 - Applied science & applications; land cover mapping, monitoring & assessments; ecosystem modeling & decision support; fire applications; risk & vulnerability assessments; drought & global cropland monitoring
 - Remote sensing research and development, including uncrewed aircraft systems
- **Manage National Civil Applications activities**
 - Provide National Security Space system geospatial data supporting USGS applications
 - Facilitate Federal civil agency use of these systems via the interagency Civil Applications Committee

Landsat 9 Launch

Launched from Vandenberg SFB on September 27, 2021

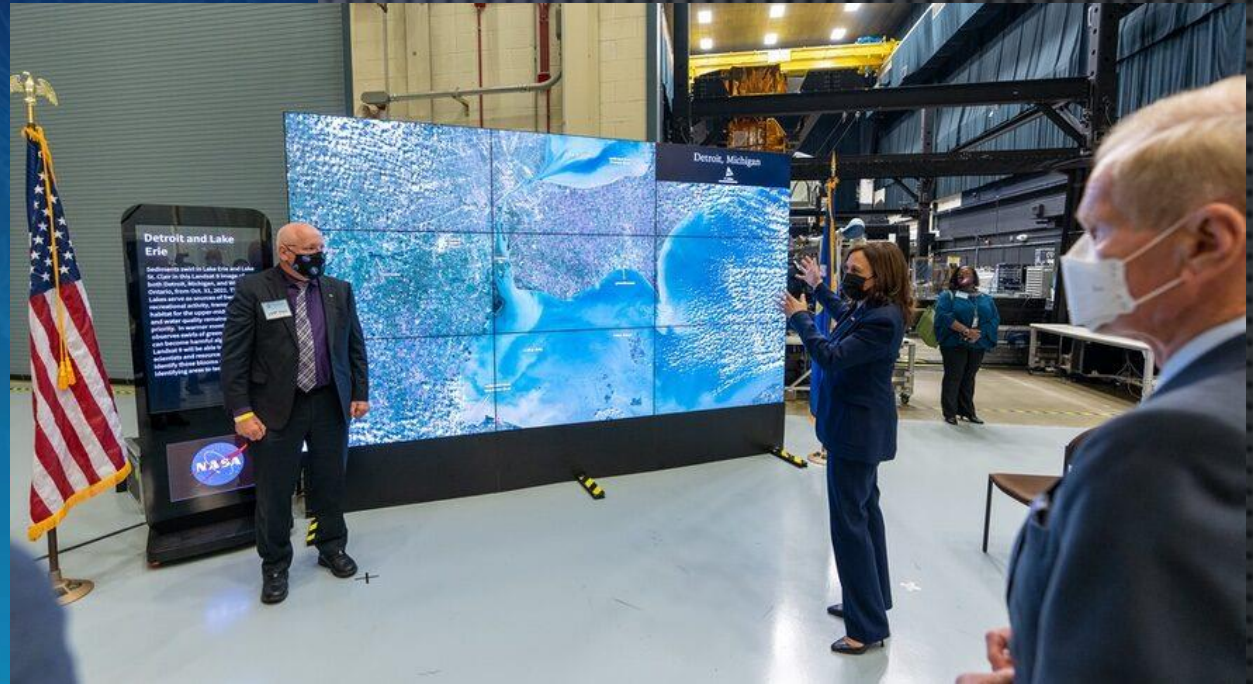


Landsat 9 “First Light” image of an area of Florida near Eglin Air Force Base

Vice President Harris visit to NASA Goddard - 11/5/2021



and to adapt to the impact.



NASA Goddard Director Andruczyk discussing first Landsat 9 images with VP Harris (view of SE Michigan, NW Ohio, W Lake Erie, and S Lake St Clair)



VP Harris with USGS Director Applegate Viewing OSAM-1 demonstration with Landsat 7 mockup

National Space Council Meeting – 12/1/21

- Convened by Vice President Harris at U.S. Institute of Peace
- Announced new **Executive Order** renewing the Council; adds Interior, Agriculture, Labor, Education, and the National Climate Advisor
- Released **Space Priorities Framework** synchronizing civil, commercial and national security space communities::



“The United States will advance the development and use of space-based Earth observation capabilities that support action on climate change...”

Note: The US Global Change Research Program identified Landsat as a critical observatory for climate and environmental change research due to the unbroken length of the Landsat record and its ability to monitor remote regions with surface features such as glaciers, rainforests, permafrost, and coral reefs.

Landsat Collection 2

Released in the Commercial Cloud – May 2021



- IMPROVED RADIOMETRY, GEOMETRY, METADATA AND ACCESS
- NEW TOOLS FOR SEARCH AND DISCOVERY
- DIRECT ACCESS TO U.S. ANALYSIS READY DATA TILES
- CONTINUED GROWTH IN LANDSAT DATA ACCESS VIA MORE EFFICIENT PROCESSES



Landsat Operations Status

Landsat 9 (2021 -)

Collecting more than 700 new scenes per day; full mission transition to USGS this week

Landsat 8 (2013 -)

Collecting more than 700 new scenes per day; night and off-nadir imaging of volcano and fire imaging.

Landsat 7 (1999 - 2022)

Recently lowered into storage orbit; awaiting NASA satellite rendezvous and refueling

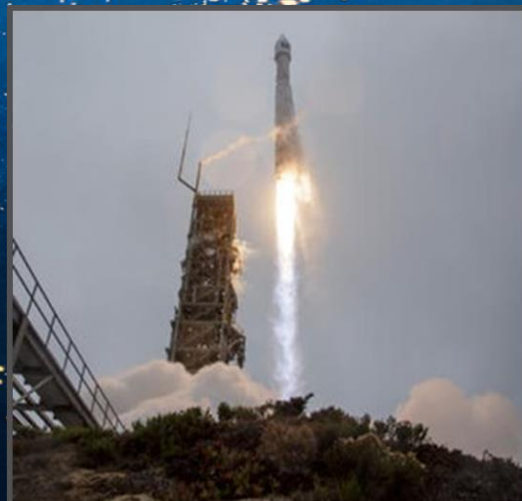


Earth Resources Observation and Science Center (EROS)

Landsat Archive Operations

10 million unique Landsat scenes available in the near 50-year archive, with well over 100 million downloads since Landsat data become freely available in 2008.

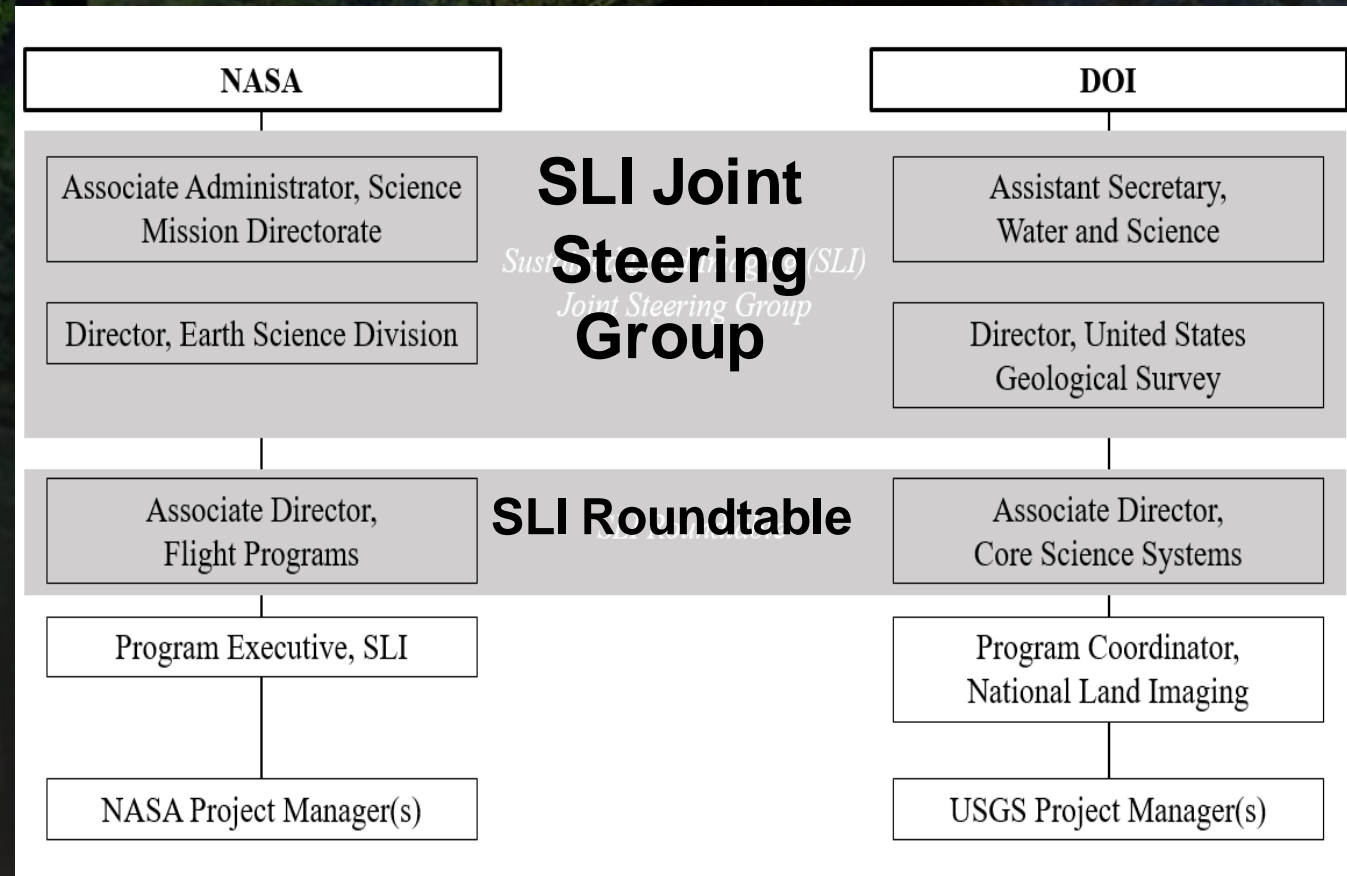
“Collection 2” available on the Amazon Cloud.



Sustainable Land Imaging Governance



- SLI: Joint program by which NASA and DOI/USGS ensure the continuation of the multi-decadal Landsat series of missions
- New ten-year agreement signed in December 2021
- Joint Steering Group: Top-level steering board to integrate SLI program efforts
- Roundtable: Mid-level executive review team to coordinate SLI activities



NASA/DOI Interagency Agreement for Collaboration on SLI Projects (2021)

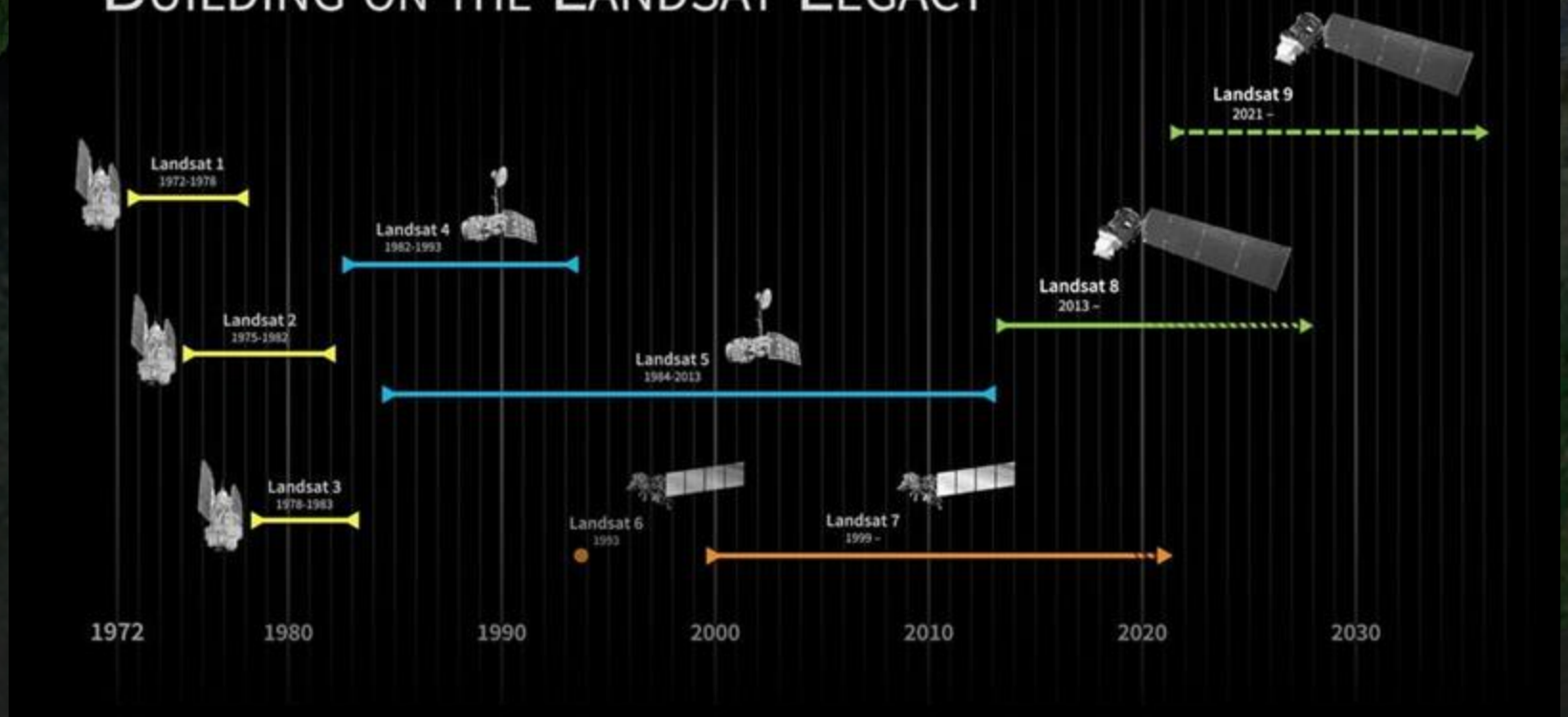
Sustainable Land Imaging



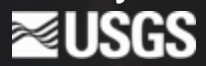
A partnership between DOI/USGS and NASA to ensure sustained access to high-quality, global, land-imaging measurements compatible with the existing 50-year Landsat record for research and operational users

- NASA responsible for developing the space segment, launch and on-orbit check-out
- DOI/USGS responsible for developing the ground segment, flight and ground system operations

BUILDING ON THE LANDSAT LEGACY



- Nearly five-decade record of land cover, land use, and vegetation condition
- Large area coverage for global, continental and regional land cover studies
- Landsat remains the most cited land remote sensing system in the peer-reviewed scientific literature—and the citation rate is increasing



Sustainable Land Imaging into the Future (NASA-DOJ/USGS)

Landsat 7



1999 - present

Landsat 8



2013 - present

Landsat 9



2021 - present

Landsat Next

Late-2020s



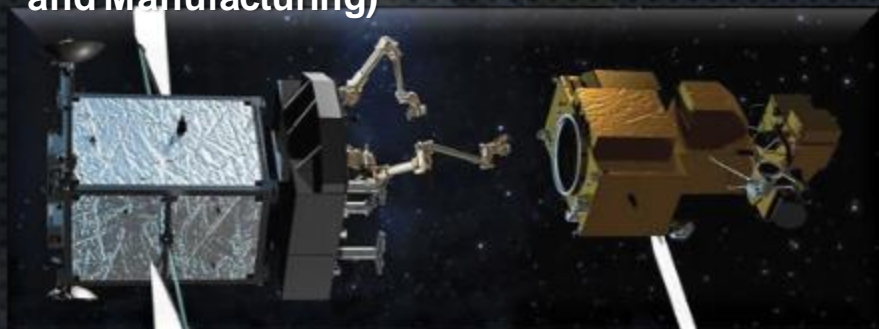
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Technology Infusion

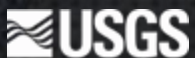
Partnerships for Expanded Interoperability

Commercial/Interagency/
International Data Partnerships

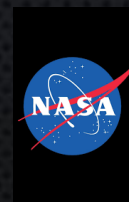
OSAM-1 (On-orbit Servicing, Assembly, and Manufacturing)



Mid-2020s



Sustainable Land Imaging



LANDSAT NEXT

- **Landsat Next:** Under the SLI agreement, the U.S. intends to implement a robust spaceborne, land imaging system to ensure continued collection of data for processing into useful and efficient information products for use by the wide range of interested science communities.
- **Mission Concept:** Collection of “superspectral” land observations featuring both richer spectral information and higher spatial resolution than Landsat 8 and 9 with improved temporal frequency.
- **Requirements:** Reflect the needs of users for:
 - **Improved temporal revisit** for monitoring dynamic land and water surfaces such as vegetation crop phenology, burn severity, water use and quality, coastal and wetland change, glacier and ice sheet dynamics.
 - **Improved spatial resolution** for agricultural monitoring, ecological monitoring, urban studies, water resources management and other applications.
 - **Synergy with European Sentinel-2** bands allowing easier merging of information products.
 - **Improved spectral resolution** to support new and evolving applications, including surface water quality, cryospheric science, geology, and agricultural applications including crop water consumption.
 - **Preservation of heritage performance:** spatial, geometric, radiometric, and Signal-to-Noise Ratio (SNR).

Landsat Next Requirements Meet Emerging Needs

Multi-spectral → Super-spectral

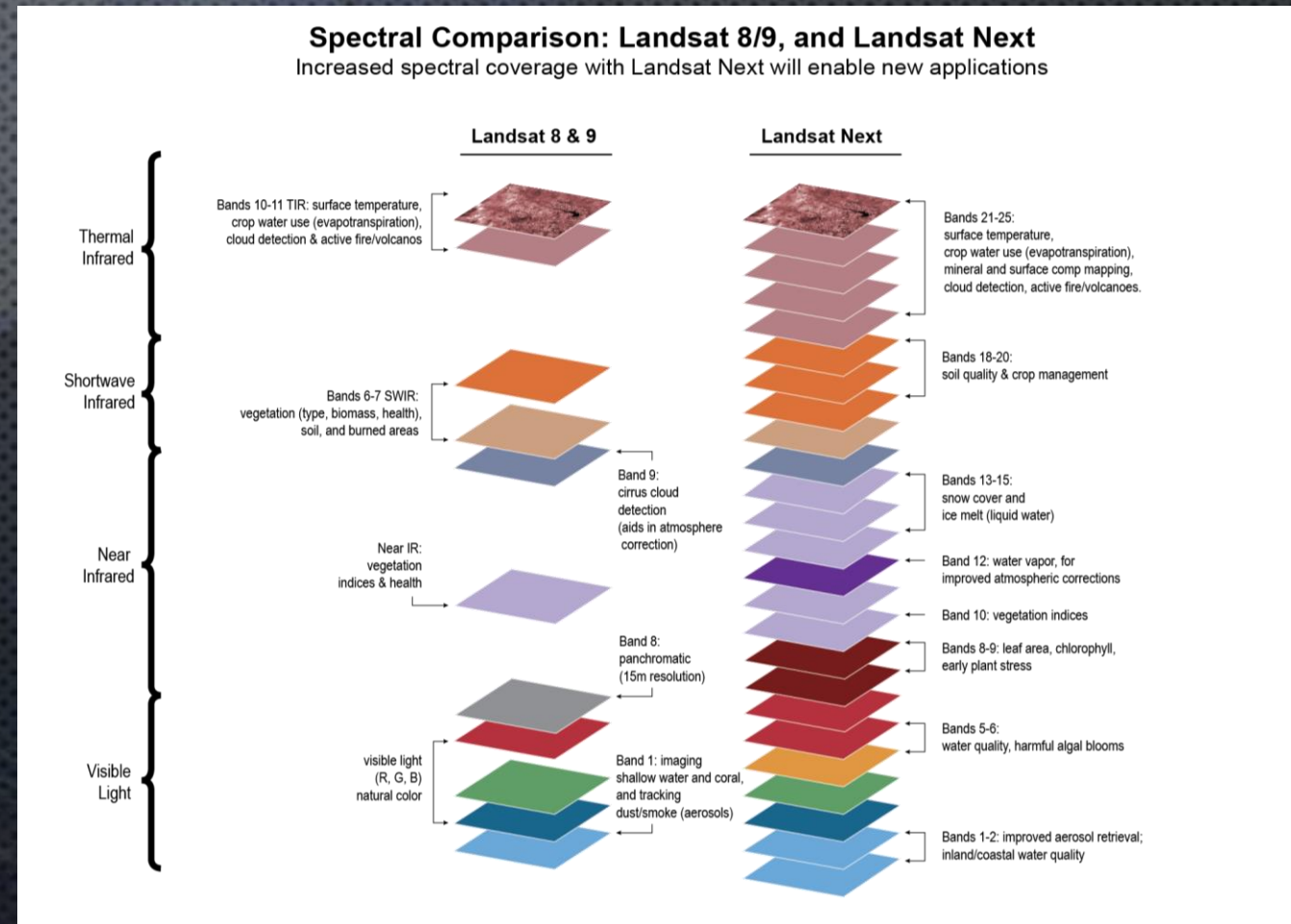
User need surveys provided a clear set of priorities for Landsat Next requirements to meet emerging needs at breakthrough effectiveness:

Improved Revisit Frequency. Dynamic phenomena (crop health & productivity, water quality, snow/ice state, wildfire) which require ~weekly clear views.

Higher Spatial Resolution. Experience with Sentinel-2 has underscored importance of 10-meter data for monitoring small agricultural fields, forest disturbance, urbanization, and other applications.

Additional spectral bands to support emerging applications in water quality, snow hydrology, soil mapping, and other areas.

Maintaining radiometric quality established by Landsat 8/9



Landsat Next will provide more than twice as many spectral bands, with resolution improved by a factor of 2, and with the repeat coverage of Landsats 8 and 9, combined

50 YEARS OF LANDSAT SUCCESS BORNE FROM INT'L PARTNERSHIPS

Year-Long Activities

- Landsat and Social Media Products branded with 50th Anniversary Graphic
- Completion of all Landsat State Fact Sheets and State Mosaics

May

- LGSOWG South Africa – first announcement on IC Network's 50th anniversary

July

- Esri User Conference: July 11–15, 2022 – San Diego, CA – Map Gallery Exhibit
- July Photogrammetric Engineering & Remote Sensing Journal Cover story on Landsat's 50th Anniversary
- **Landsat 50th Anniversary Events on Capitol Hill – July 21**
- **Resolution of Congress honoring Landsat released by the Senate**
- **Landsat 9 Transition Turnover Event – August 10-11 – EROS-Sioux Falls, SD (slides in backup)**
 - Full 2-day schedule of events including tours and special communications products
- Planning exhibits in the National Air & Space Museum and Natural History Museum
- Many 50th Anniversary articles for media and publications
- 50th Anniversary Video and Poster

October

- Pecora-22: October 23 – 28, 2022 – Denver, CO (Theme 50th Anniversary Celebration)



PECORA 22

Opening the
Aperture to Innovation:
Expanding Our Collective
Understanding of a
Changing Earth

October 23-28, 2022
Denver, CO • Hilton City Center

Celebrating

50
YEARS
of Landsat
1972-2022



Pecora-22: October 23-28, 2022

Denver, Colorado



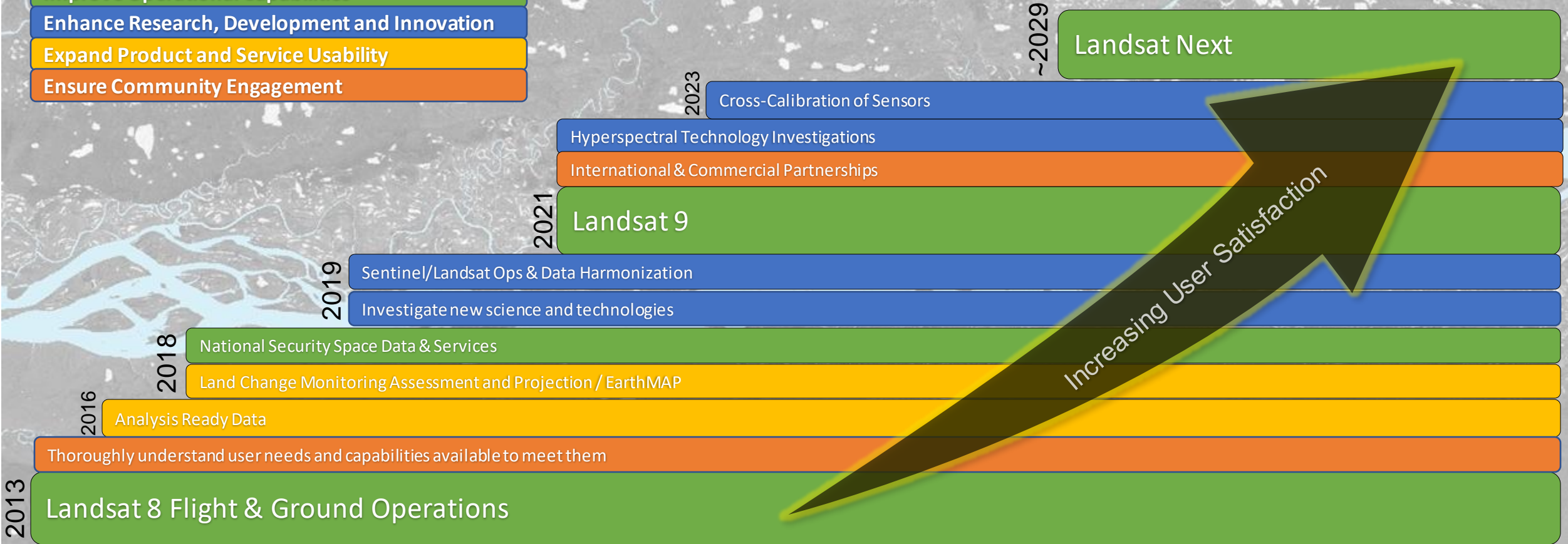
- Flagship land-imaging satellite applications conference; longstanding USGS-NASA partnership
- Highlights Landsat's 50th anniversary
- Features Landsat 9, Landsat Next and the many innovative developments in government and commercial land-imaging programs
- Inviting Secretary Haaland and NASA Administrator Nelson for Plenary & Evening Celebration on the 26th
- **Monday workshop on the Future of International Collaboration**
- **Website: pecora22.org**

National Land Imaging (NLI) Program Future Directions

Leveraging the diversity of Earth Observations to meet the Diverse Needs of Science & Operational Users

NLI Program Goals

- Improve Operational Capabilities
- Enhance Research, Development and Innovation
- Expand Product and Service Usability
- Ensure Community Engagement





THANK YOU!

