

# Department of the Interior's Role in Earth Observation

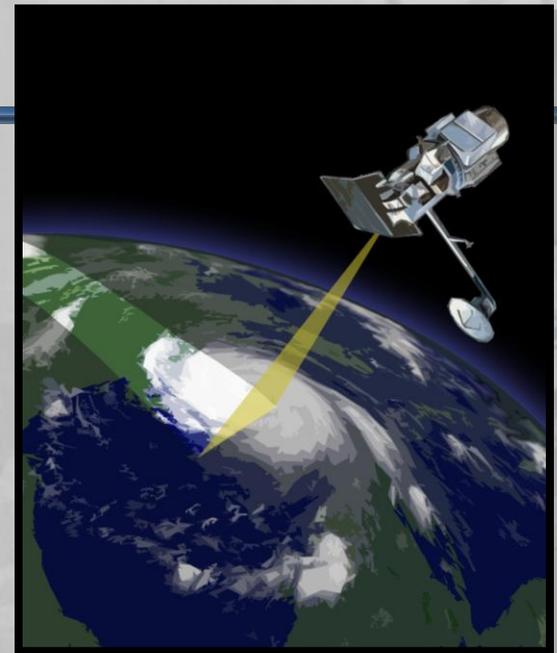
presented by

**Deanna Archuleta**

**Deputy Assistant Secretary for Water and Science**

**JACIE Civil Commercial Imagery Evaluation Workshop**

**March 16, 2010**



# Origin of Landsat

*“... the time is now right and urgent to apply space technology towards the solution of many pressing natural resource problems being compounded by population and industrial growth.”*

Secretary of the Interior Stewart L. Udall, 1966

## **Bolivia Deforestation**

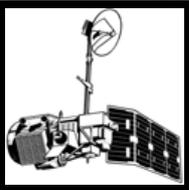
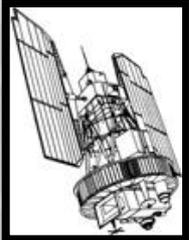
These images show the progression of deforestation in Bolivia from 1975 to 2003. This area lies northeast of Santa Cruz de la Sierra, Bolivia, in an area of tropical dry forest. Since the mid-1980s, the resettlement of people from the Altiplano (the Andean high plains) and a large agricultural development effort (the Tierras Baja project) has led to this area's deforestation.



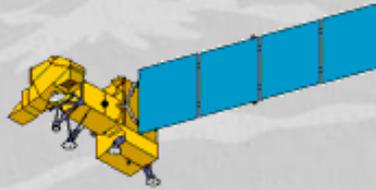
# Landsat Program

## The World's Most Sophisticated Optical Observatories of the Earth

**Landsat 1 - 3**  
 Multi-Spectral Scanner (MSS) 79 meter  
 Return Beam Vidicon (RBV) 80/40 meter



**Landsat 4 - 5**  
 Multi-Spectral Scanner (MSS) 79 meter  
 Thematic Mapper (TM) 30 meter

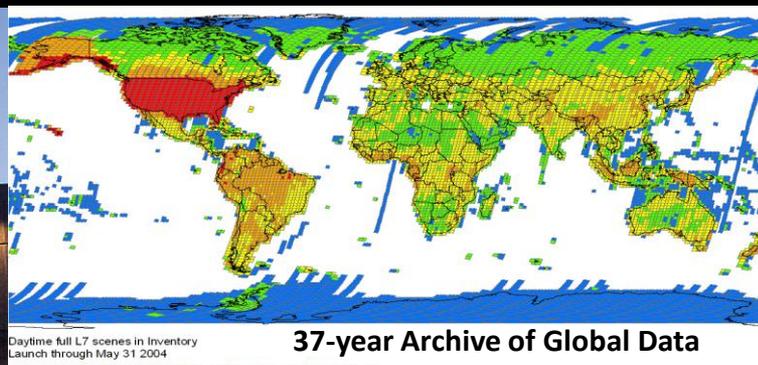
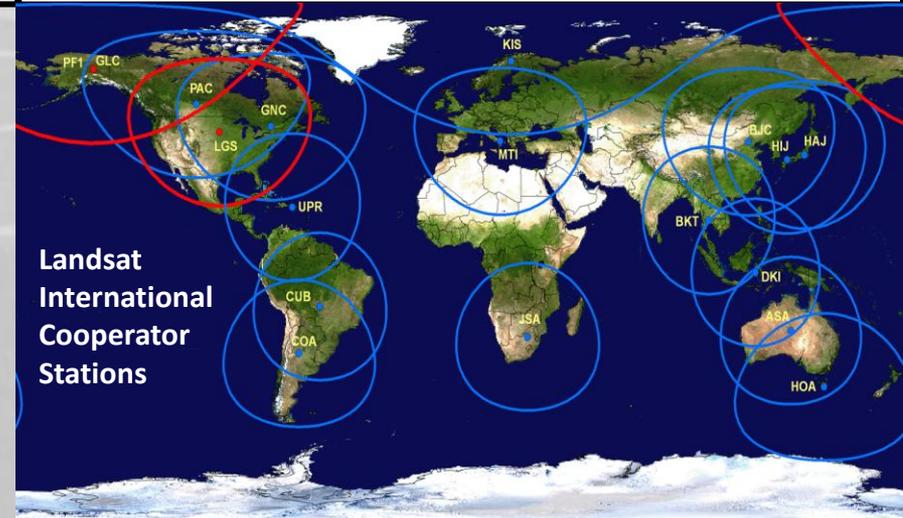


**Landsat 7**  
 Enhanced Thematic Mapper  
 Plus (ETM+) 30/15 meter



**Landsat 8**

## The World's Model for International Collaboration in Earth Observation



# Applications of Landsat Imagery

<b>Agriculture &amp; Forestry</b>	<b>Crop and Timber Inventories, Crop Forecasting Crop, Irrigation, &amp; Forest Management</b>
<b>Wildlife &amp; Public Lands</b>	<b>Vegetation, Species, Habitat &amp; Wetlands Inventories &amp; Management Refuge Management &amp; Planning Natural Resource, Mineral Wealth, Rangeland Management</b>
<b>Commerce &amp; Industry</b>	<b>Land &amp; Property Valuation Real Estate Property Management Mines, Mineral Resources, &amp; Energy Exploration &amp; Management Power Plant &amp; Pipeline Management Transportation Planning &amp; Management Inland Waterway, Open Sea, Sea Ice, &amp; Port Navigation</b>
<b>Regional, State, and Local Government</b>	<b>Land Surveys, Soils &amp; Geologic Mapping Water Resource Planning, Reservoir &amp; Water Quality Management Land Use Planning Real Property &amp; Government Property Management Spring Flooding Prediction &amp; Analysis, Flood Plain Assessment Erosion Control</b>
<b>Disaster Management</b> -- Hazard Analysis -- Disaster Mitigation & Planning -- Damage Assessment -- Recovery & Relief	<b>Hurricanes &amp; Severe Storms Floods &amp; Landslides Wildfires &amp; Forest Fires Earthquakes &amp; Volcanoes</b>
<b>International Economic Development</b>	<b>USAID In-Country Applications</b>
<b>National Security / Homeland Security</b>	<b>Global Coastal Mapping &amp; Monitoring, Emergency Response, Theater Mapping, Illicit Crop Detection</b>
<b>Global Change Policy &amp; Research</b>	<b>Land Cover Change, Deforestation, Desertification, Salinization Land Surface Processes, Hydrology, Snow cover &amp; Glaciation Ecosystem Analysis, Urban and Rural Geography</b>

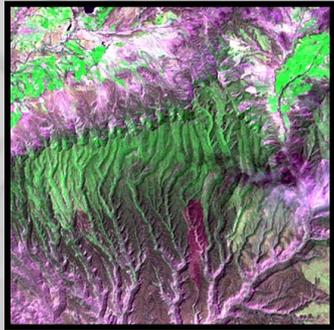
# Monitoring Land Management Practices

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**Boundary between Targhee National Forest (left) and Yellowstone National Park**

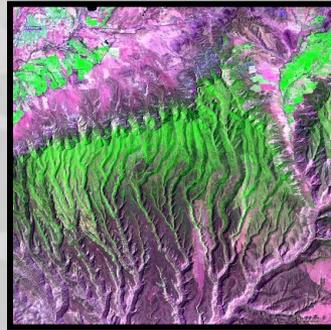
# Wildfires - Monitoring Three Decades of Change



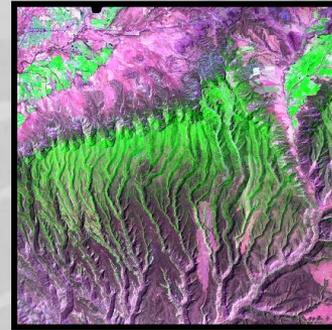
1973



1978



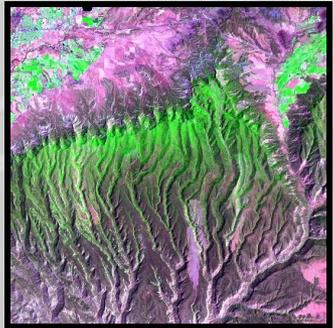
1984



1989



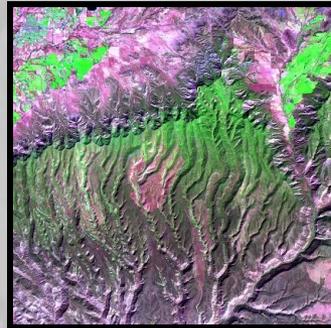
1990



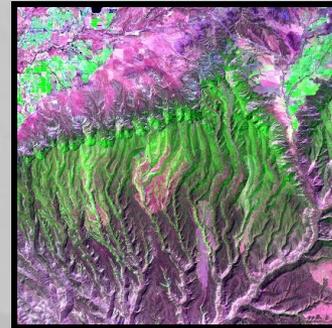
1996



1997



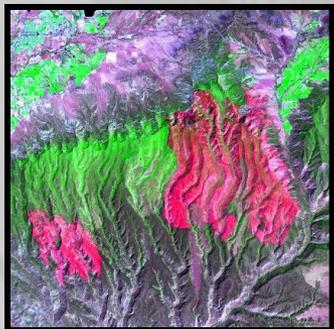
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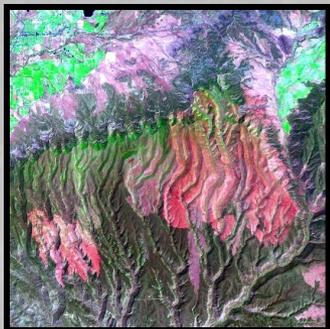
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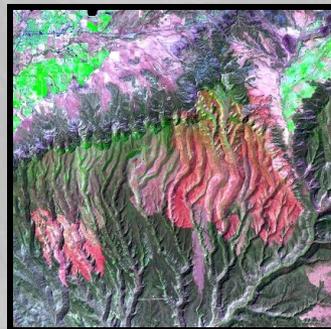
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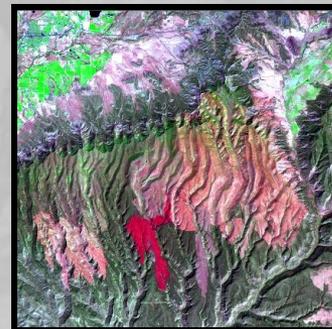
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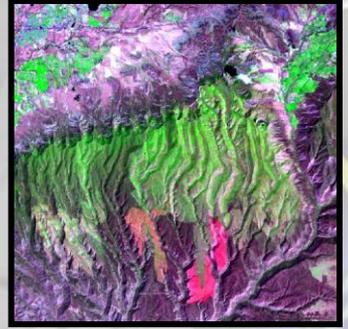
2002



2002



2002



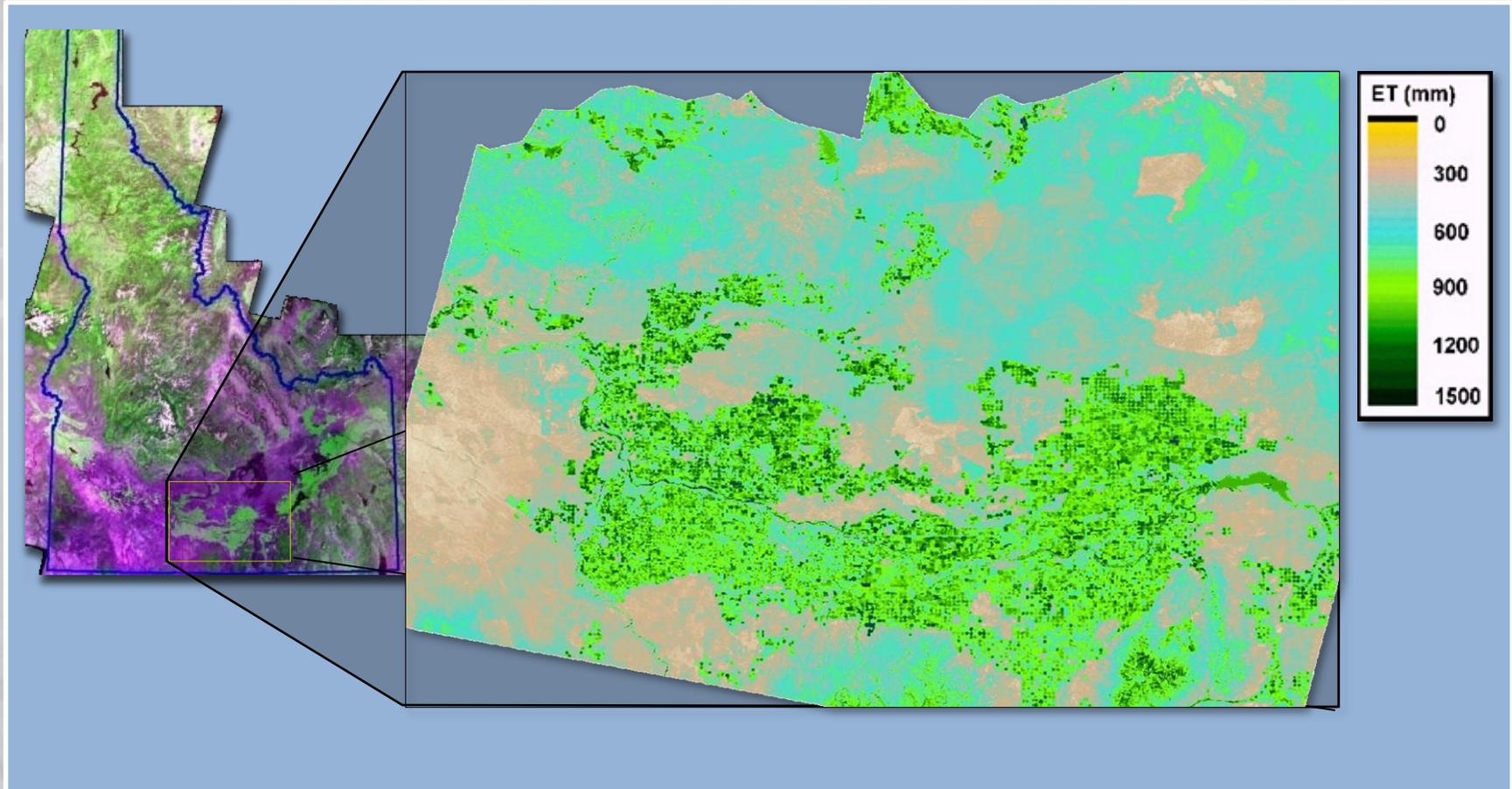
2004

Landsat data of Mesa Verde National Park, Colorado

# Landsat Remote Sensing of Water Resources

## Magic Valley, Idaho – Total Seasonal Water Use -- 2006

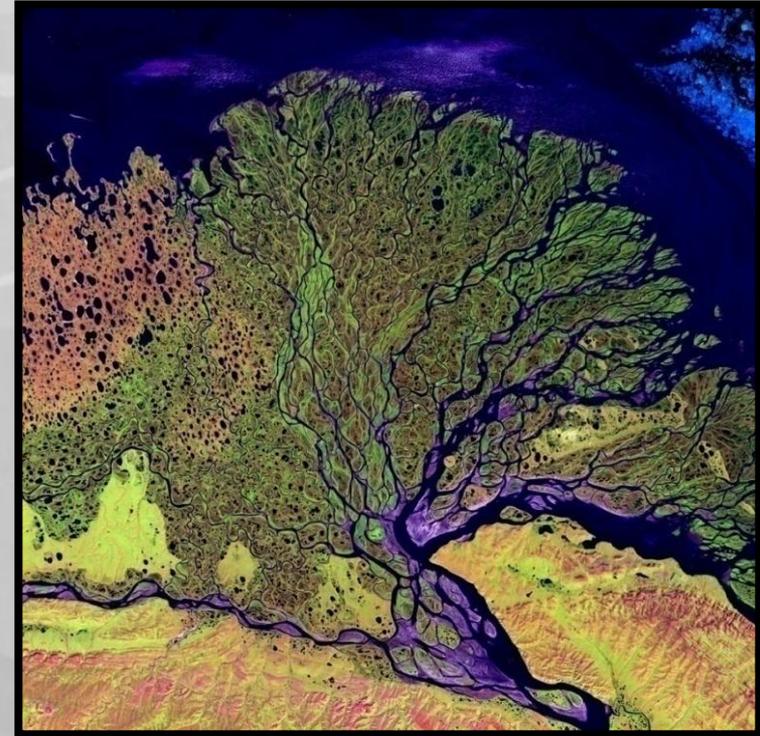
*Idaho Department of Water Resources Assessment based on Landsat Thermal Data using Evapotranspiration*



# Landsat Remote Sensing of Global Change

## *Role in Global Change Research*

- Impacts of land use and land cover change
  - Carbon cycle dynamics
  - Changes in ecosystem services, e.g., deforestation
  - Carbon inventory
  - Carbon credit verification
- Monitoring climate-driven land dynamics
  - Changes in snow and ice extent, e.g., glaciers
  - Changes in fire frequency and severity
  - Drought cycles
- Climate studies
  - Human dimensions of global change
  - Land-atmosphere interactions
  - Land use modifications of weather and climate
- Essential Climate Variables (ECVs) - Terrestrial
  - River discharge, Water use, Ground water, Lake levels, Snow cover, Glaciers and ice caps, Permafrost and seasonally-frozen ground, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (fPAR), Leaf area index (LAI), Biomass, Fire disturbance, Soil moisture



### **Landsat 7: Lena Delta**

Image taken 7/27/2000 The Lena River, some 2,800 miles (4,400 km) long, is one of the largest rivers in the world. The Lena Delta Reserve is the most extensive protected wilderness area in Russia. It is an important refuge and breeding grounds for many species of Siberian wildlife.

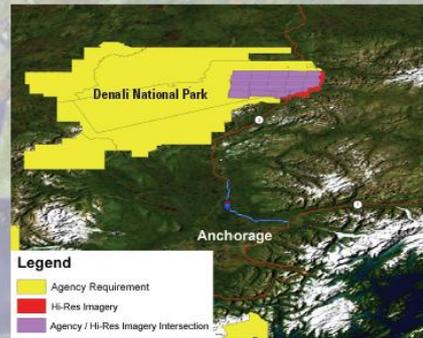
# DOI supports the Commercial Remote Sensing Policy



## Implementing the Commercial Remote Sensing Space Policy (CRSSP) *Helping Federal Users Get the Imagery They Need*

Federal users are informed of how to obtain existing data and/or potential partnerships.

If imagery does not exist, users can procure the data from commercial vendors through contracts such as the USGS Commercial Remote Sensing Data Contracts.



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Federal users needing aerial or satellite imagery enter their requirements into the web-accessed CRSSP Imagery Derived Requirements (CIDR) tool. (<http://cidr.cr.usgs.gov>)

The requirements are then analyzed by USGS staff. The CIDR database is used to find potential agency/interagency partnerships. USGS and NGA commercial imagery holdings (as well as commercial vendors) are searched for existing imagery that may meet the users' requirements.

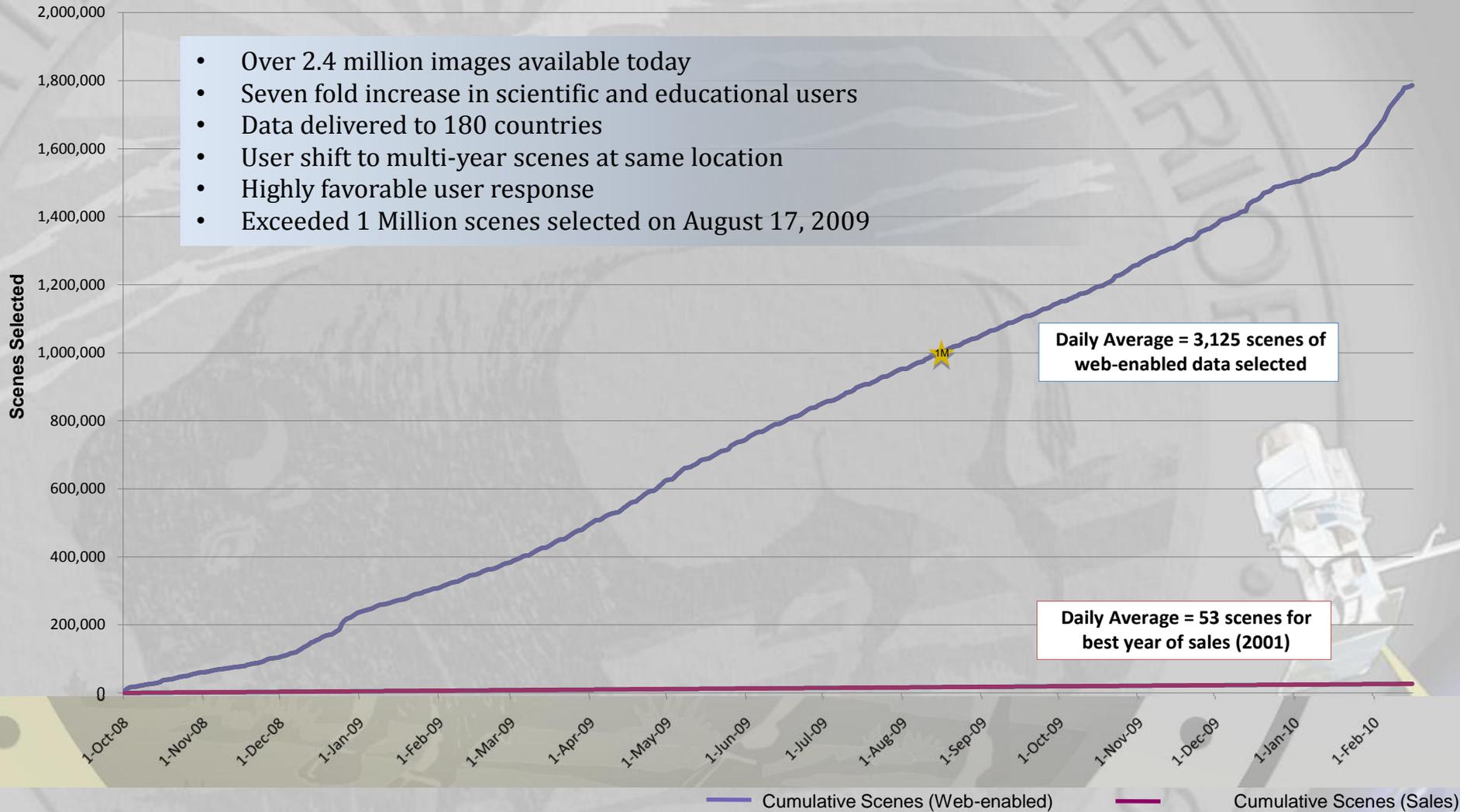
If new imagery is acquired, users are encouraged to share the imagery with other federal agencies by providing a copy to the USGS. (The USGS acts as a clearinghouse for commercial imagery.)

U.S. Department of the Interior  
U.S. Geological Survey

For more information:  
USGS Commercial Remote Sensing Space Policy Implementation: <http://crssp.usgs.gov>  
Email: [crssp@usgs.gov](mailto:crssp@usgs.gov)  
Phone: 800-252-6547

# Landsat Web-Enabled Imagery Distribution

*Total Landsat Scenes Selected By Users Since October 1, 2008*



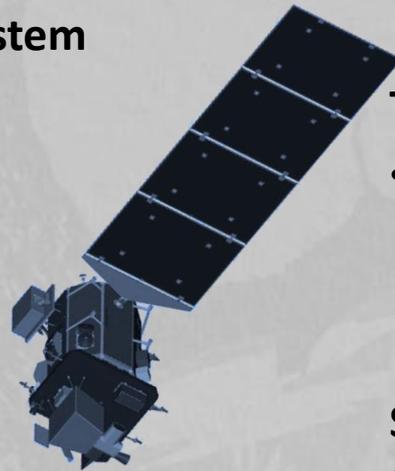
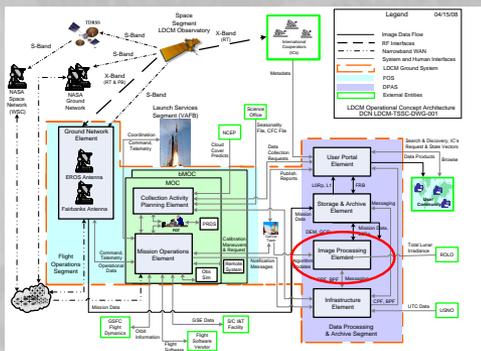
# Beginning of a new era - Landsat Data Continuity Mission (LDCM) or Landsat 8

## Mission Characteristics

- Orbit: Polar, 705km circular, sun-synchronous (WRS2), 98.2° inclined, mid-morning, 16-day repeat
- **Launch Date: Dec. 2012; Launch Vehicle: Atlas V**
- Mission Life: 5 Years (with consumables 10 years)
- Mission Project Management: NASA/USGS

## DOI USGS developed Ground System

- 4 design elements
- **Critical Design Review this week!**



## Operational Land Imager (OLI)

- 9 spectral bands (including new deep blue and cirrus bands)
- 30m resolution for VIS/NIR/SWIR, 15m for PAN
- 185km swath width
- Collect 400 WRS-2 scenes/day; 265Mbps

## Thermal Infrared Sensor (TIRS)

- TIRS in initial design at NASA; proposed in American Recovery and Investment Act of 2009 Approximately 100m resolution in 2 bands; 185km swath

## Spacecraft

- Observatory mass of 3085kg
- Maximum power of 2130W
- 3Tb Solid State Recorder
- 384Mbps X-band downlink

# Landsat 9 and Beyond

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- **DOI/USGS has served as the Landsat data steward since program's inception in 1966**
  - experienced several changes in program leadership, including two unsuccessful attempts to commercialize the satellites
- **DOI/USGS Joined NASA in 2000 as full partner in program management**
  - Presidential Decision Directive NSTC-3 (5/94, revised 10/00)
- **NASA and DOI/USGS funded for Landsat 8 development; funding projected for USGS operations through 2017**
- **No agency yet has responsibility or funding for Landsat 9 or beyond**
  - 8 Federal agencies recommend that DOI/USGS manage the Landsat program and NASA build and launch Landsat 9 and beyond (see *A Plan for a U.S. National Land Imaging Program*, National Science and Technology Council, 2007)
- **Definition of Landsat 9 needs to start in FY12 to support a launch in FY17**
- **DOI recognizes the need for a civil operational land remote sensing program and is starting to plan for Landsat 9**

# Summary

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- Remote sensing is a powerful tool for monitoring the Earth's environment
- Remote sensing data are critical for compilation and maintenance of several U.S. government programs (drought monitoring, natural resource assessment, habitat studies, etc.)
- DOI science and numerous land management practices could not happen without remote sensing data and technology
- DOI is committed to the acquisition, calibration/validation, preservation, distribution, and application of remote sensing data and technology
- Commercial and international cooperative partnerships are critical to success
- **DOI/USGS is a charter sponsor of JACIE and recognizes its importance to the remote sensing community**