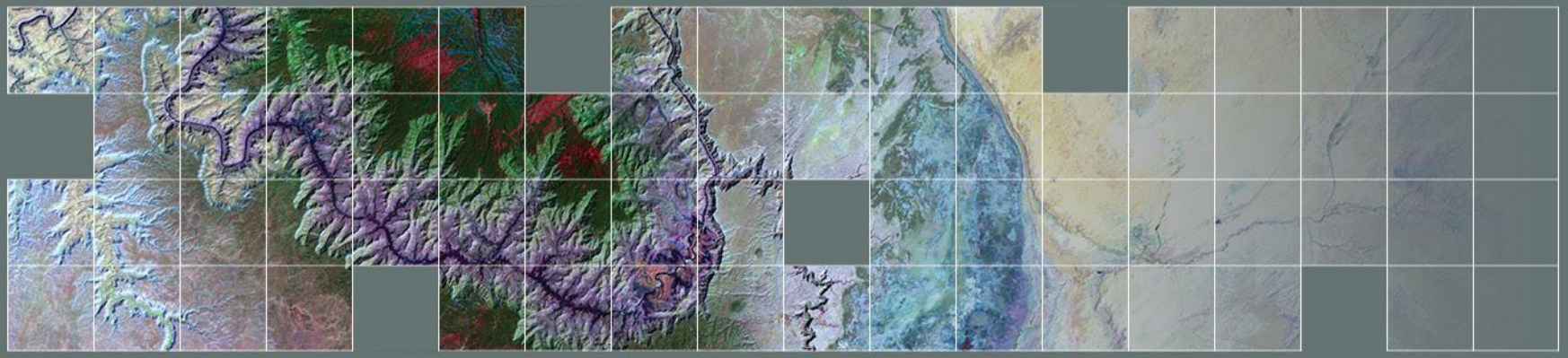
USGS
science for a changing world

Climate and Land Use Change
Earth Resources Observation and Science (EROS) Center

EROS – The Next 40 Years



Frank P Kelly PhD.
National Space Policy Advisor
Director, EROS Center

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

So I Traded This……

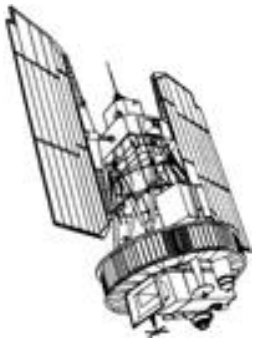

For This……
…..and I’m Excited!

Why Am I Excited?

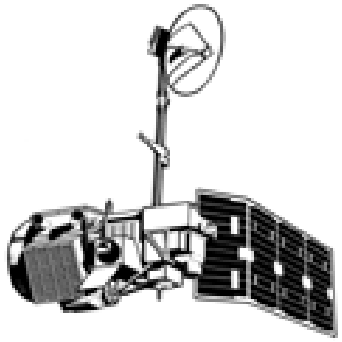
- **Coming into an Excellent History**

1966 - Initiated Earth Resources Observation Systems Program

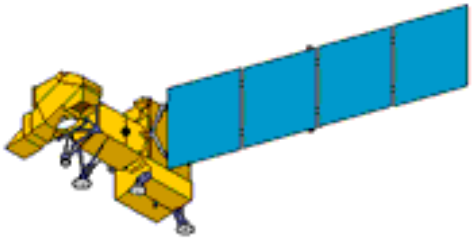
> ***"…the time is now right and urgent to apply space technology towards the solution of many pressing natural resource problems being compounded by population and industrial growth."***
>
> **Secretary of the Interior Stewart L. Udall, 1966**



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

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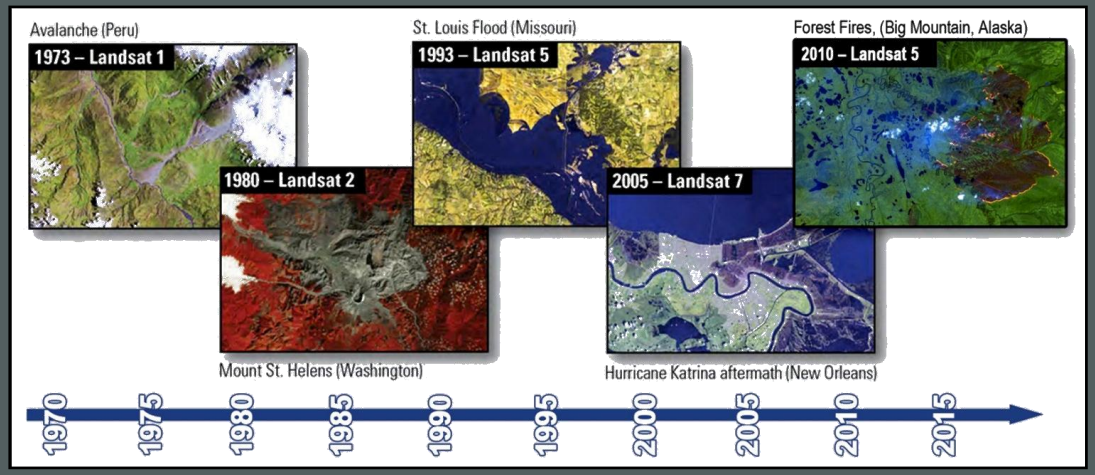
Landsat Status

Landsat 5

- Launched in 1984 (3-year design life). Operated by USGS since 2001
- November 2011: USGS suspended imaging temporarily to investigate electronic problem

Landsat 7

- Launched in 1999 (5-year design life). Operated by USGS since 2000
- Acquiring over 350 images/day worldwide
- Estimated end of mission, based on fuel supply only: January 2017



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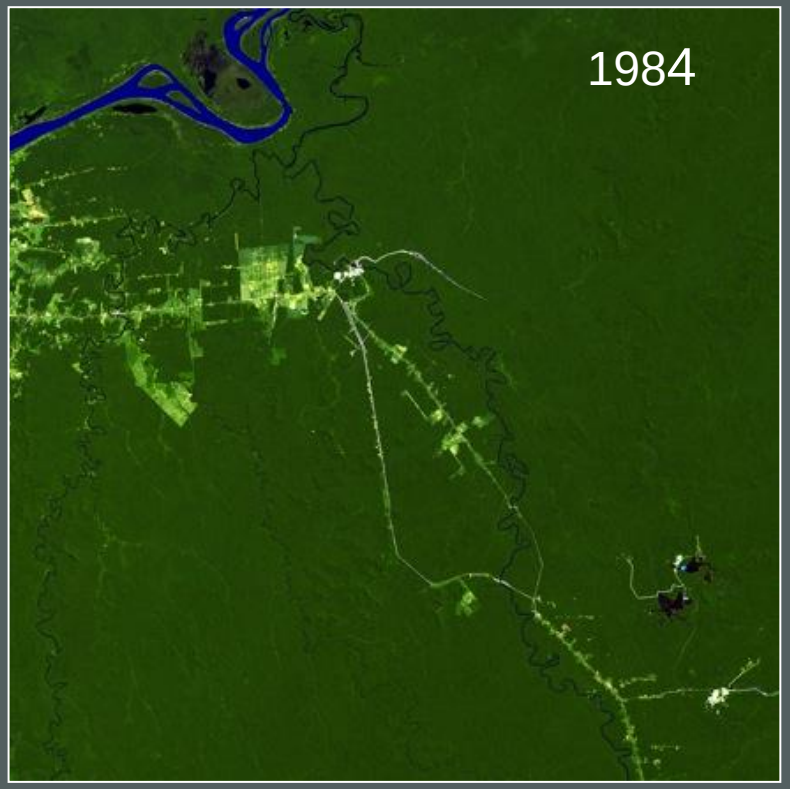
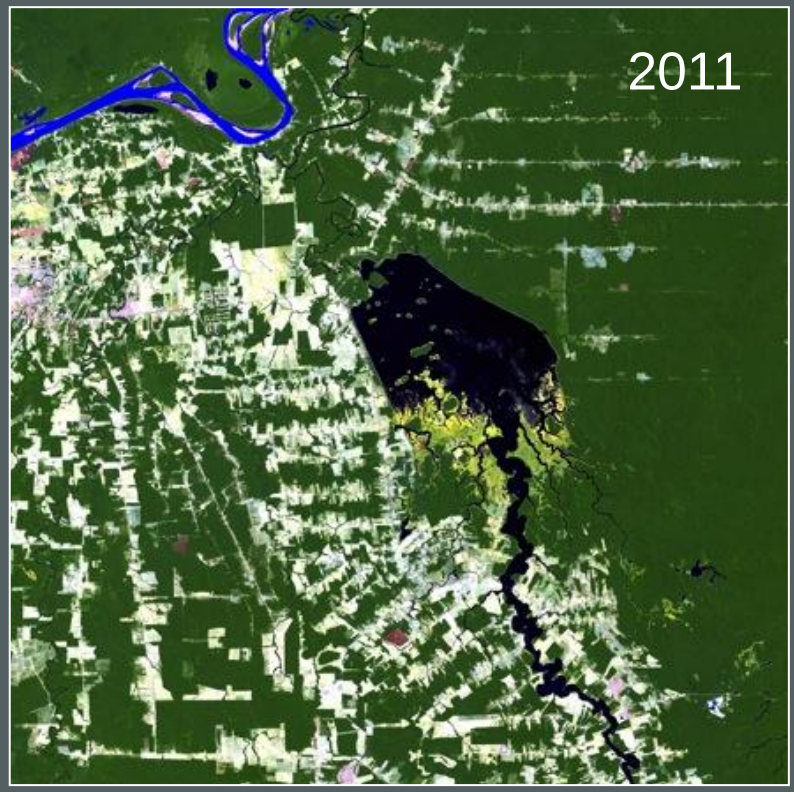
The Landsat Revolution

In October 2008, the USGS made the entire Landsat archive, over 3 million images, available via the Internet at no cost.





Samuel Dam: Jamari River Rondonia, Brazil

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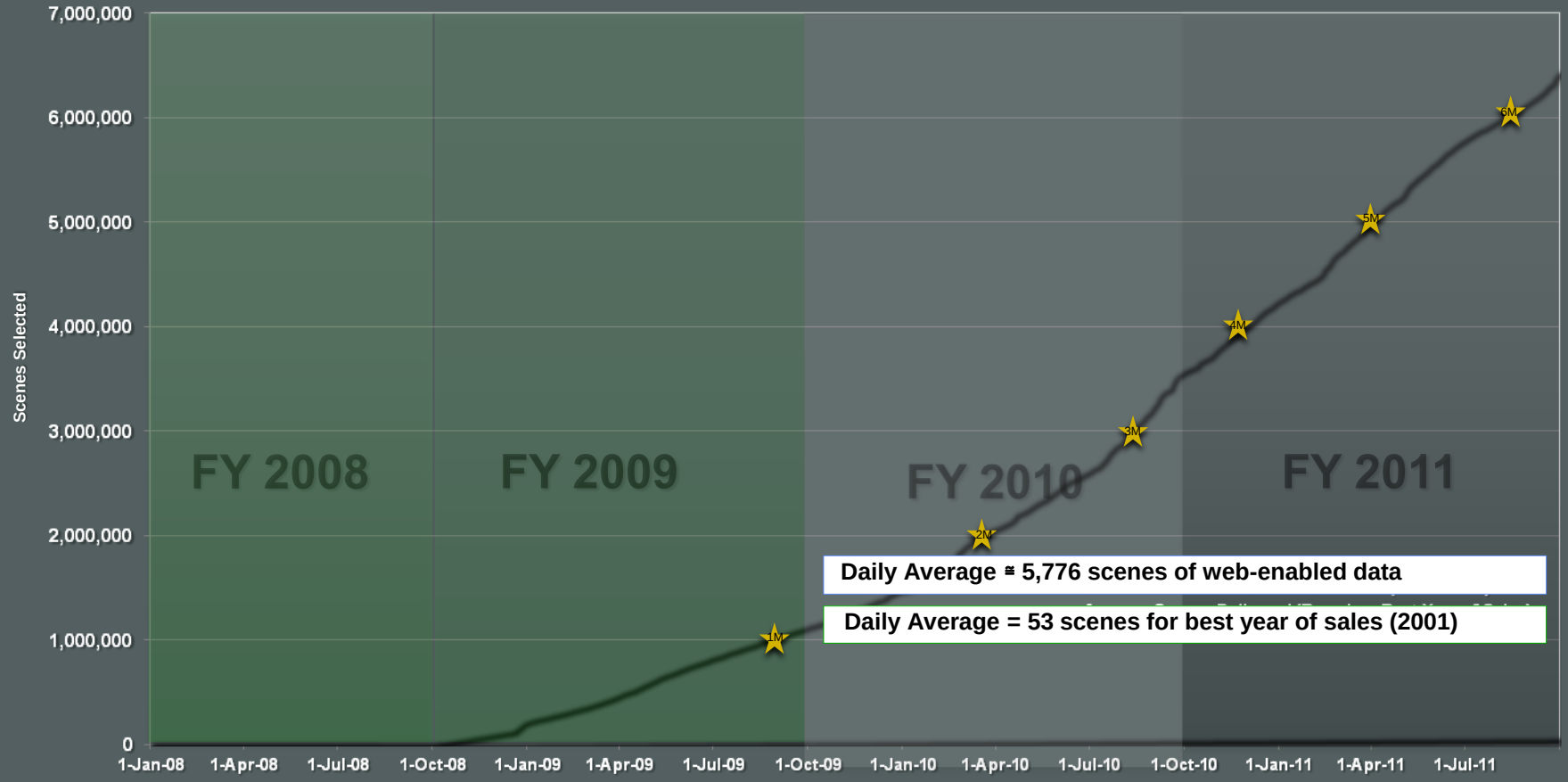
Landsat Internet Data Distribution

39-year archive of global data provided freely on the Internet



Total Landsat Scenes Selected By Users Since January 1, 2008

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Innovative Benefits of Open Availability

- **Studies indicate societal value exceeds data acquisition and distribution costs**

- **Encourages development of research applications leading to innovative commercial endeavors**

"The opening of the Landsat archive to free, web-based access is like giving a library card for the world's best library of Earth conditions to everyone in the world."

Adam Gerrand, Food and Agriculture Organization of the United Nations

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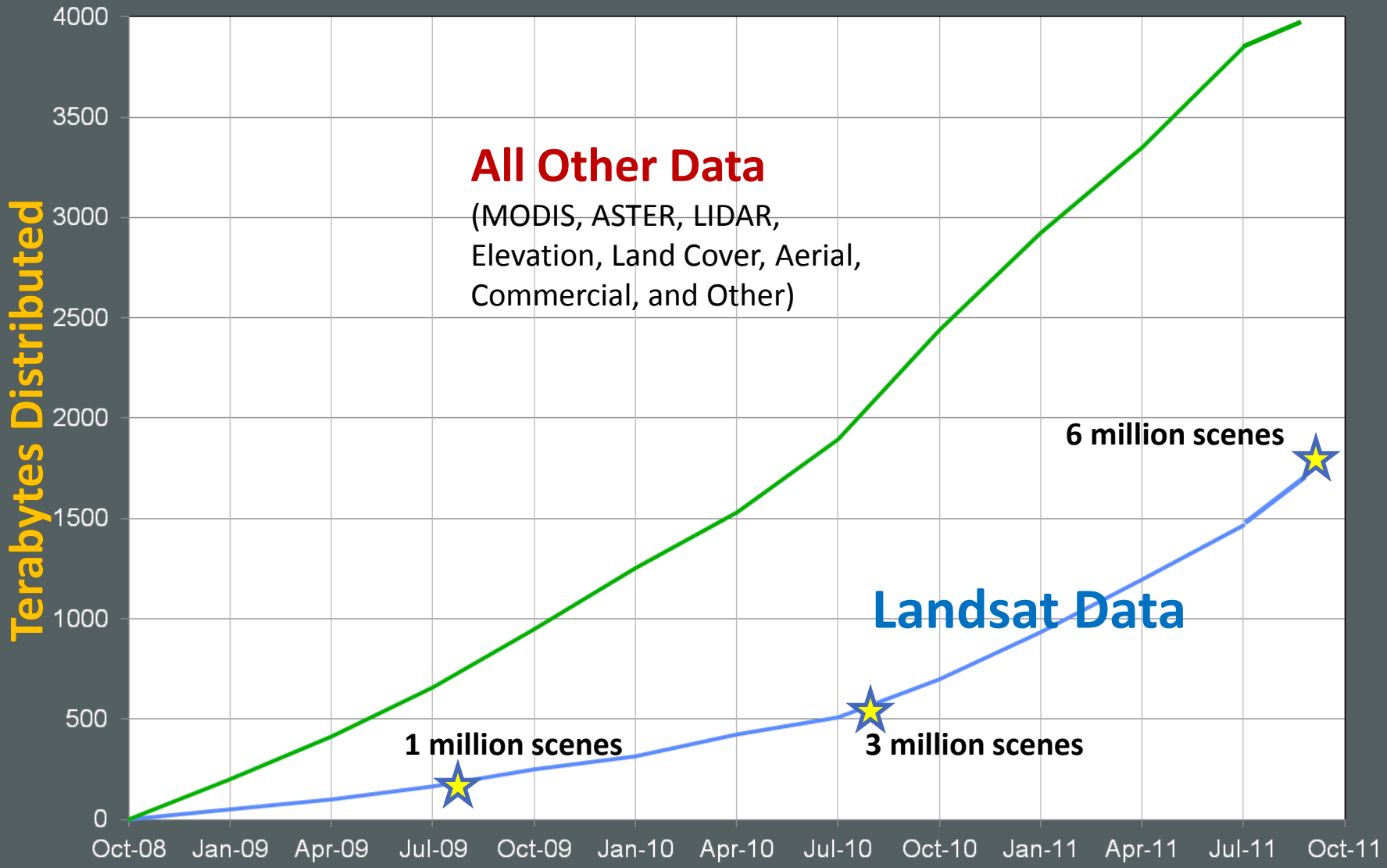
Data Distribution – USGS EROS Center



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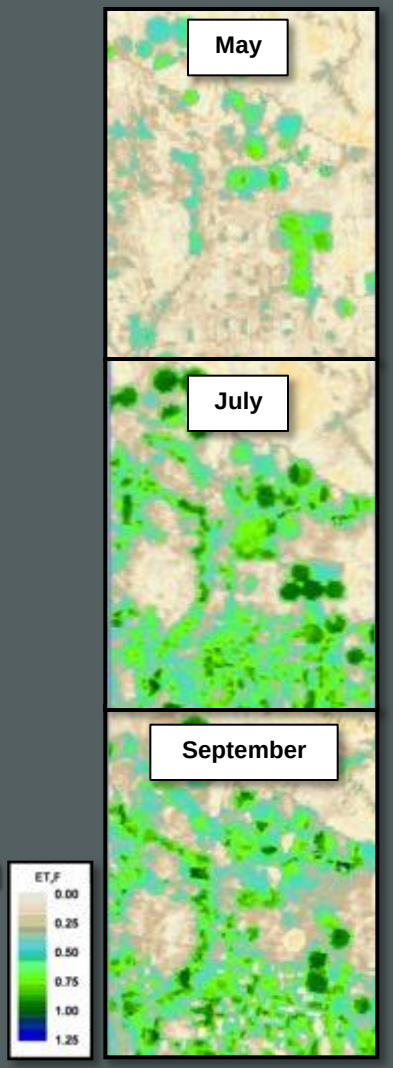
Economic Advantages of Open Availability

Commercial data use has increased under free distribution policy

- Google Earth/TerraMetrics
- ESRI "Change Matters" product.

Economic cost savings for environmental management

- Landsat imagery data gap loss would be $935M per year
- Water managers will save an estimated $1 billion over the next decade



Progression of Evapotranspiration overtime – Nebraska, *Landsat 5 1997*

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Why are Earth observations important for civil society?

Continuous Earth imaging from space ensures that events are registered and cannot be concealed, even if the traces of the event have been removed on-site (for example, oil spills).

O. Gershenzon, RussiaTransparent World Partnership, 2011.

Landsat is akin to the Earth's free press. With its global perspective, we have objective and indisputable evidence of the condition of the planet.

Curtis Woodcock, Boston University, 2011.

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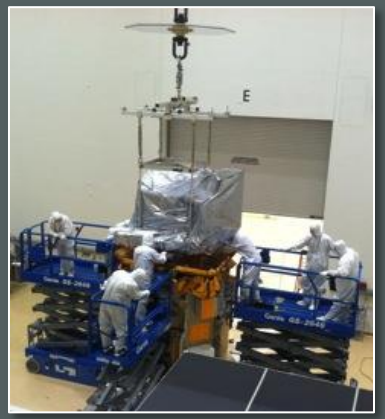
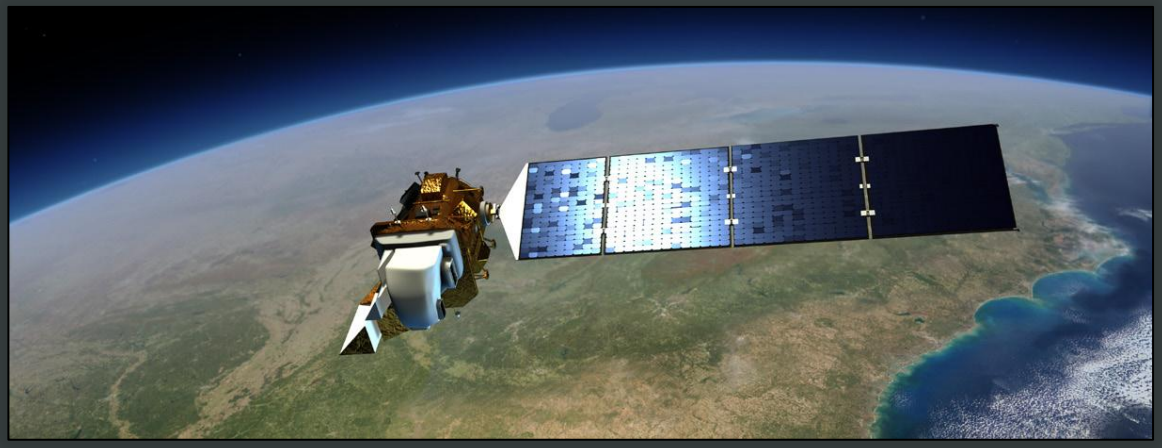
LDCM Status

Landsat Data Continuity Mission (LDCM or Landsat 8)

- Same mission characteristics as previous Landsats
- Five year design life, with 10 years of fuel
- Two instruments
  - Operational Land Imager (OLI) - 9 spectral bands
  - Thermal Infrared Sensor (TIRS) – 2 thermal bands
- All data freely available over the Internet
- Projected launch date: January 2013





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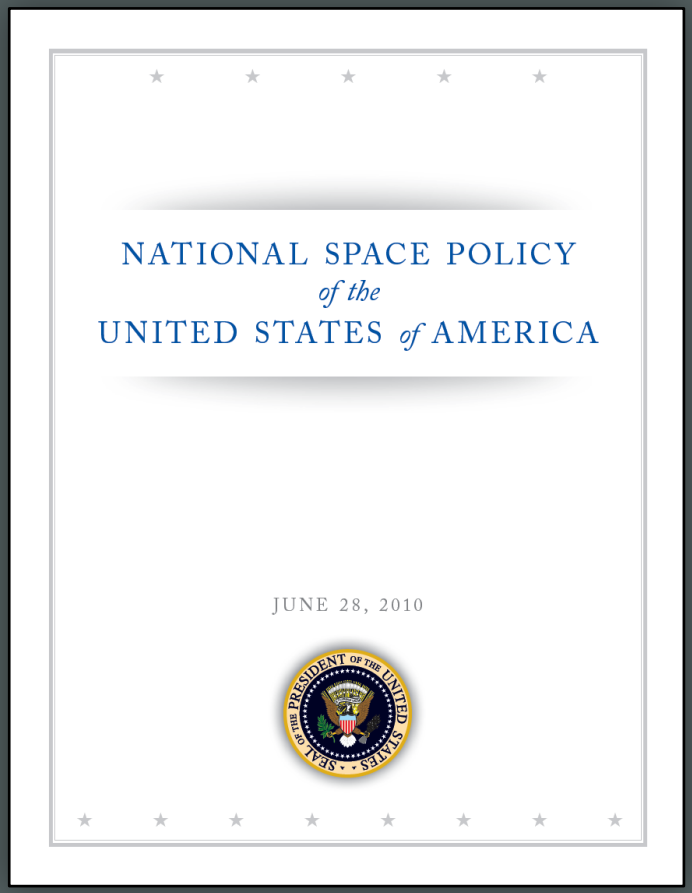
A Turning Point

- **National Space Policy** (June 28, 2010) calls for the DOI Secretary to:
  - Determine the operational requirements for collection, processing, archiving, and distribution of land data to the US Gov't and others
  - Work through the Director of the USGS and the NASA Administrator to maintain a program for operational land remote sensing observations
- **USGS and NASA HQ's** are currently developing:
  - Joint Agency Memorandum of Understanding (MOU)
  - Program Plan
  - Level-1 Requirements



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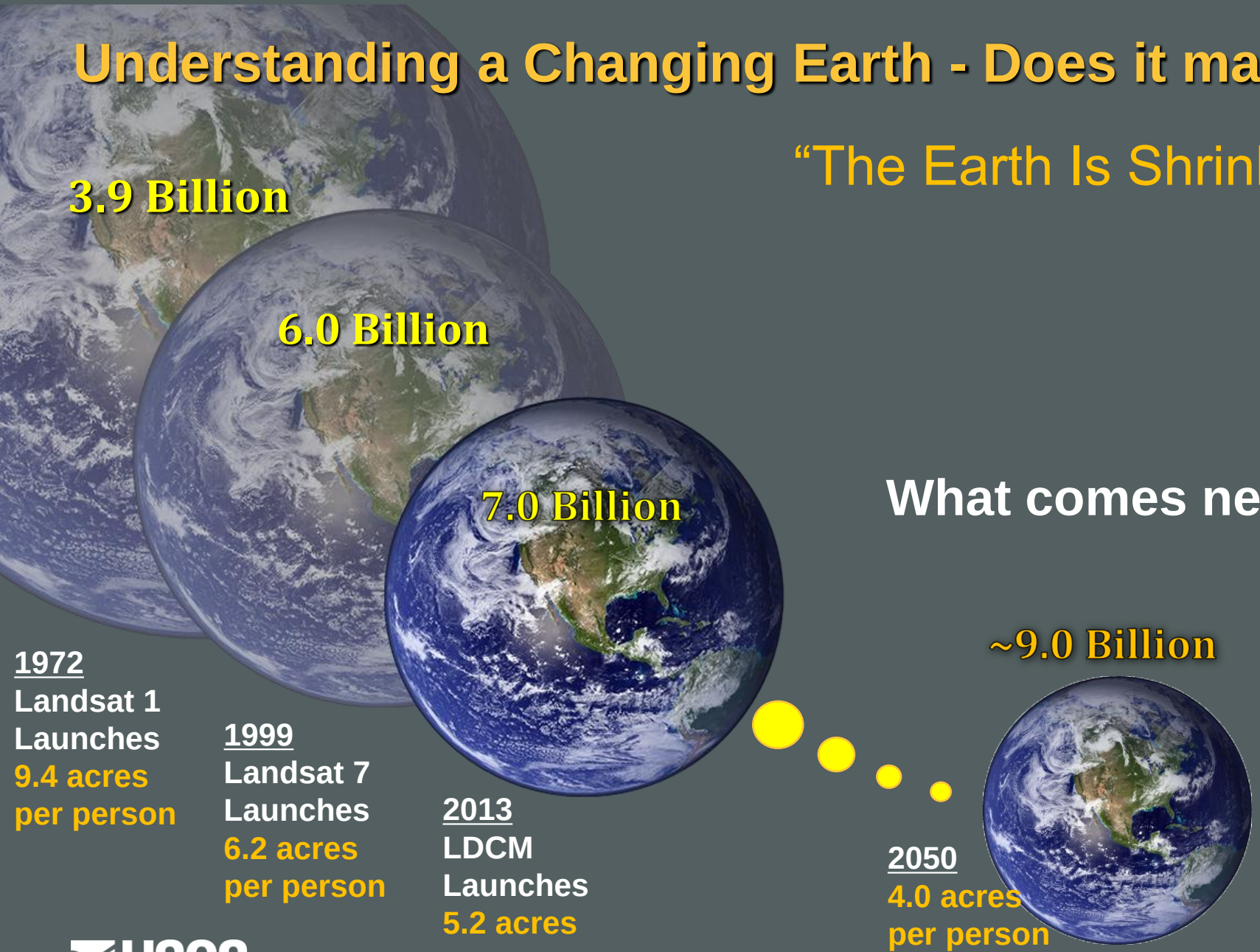
Understanding a Changing Earth - Does it matter?

"The Earth Is Shrinking"



What comes next?

1972
Landsat 1
Launches
9.4 acres
per person

1999
Landsat 7
Launches
6.2 acres
per person

2013
LDCM
Launches
5.2 acres
per person

2050
4.0 acres
per person

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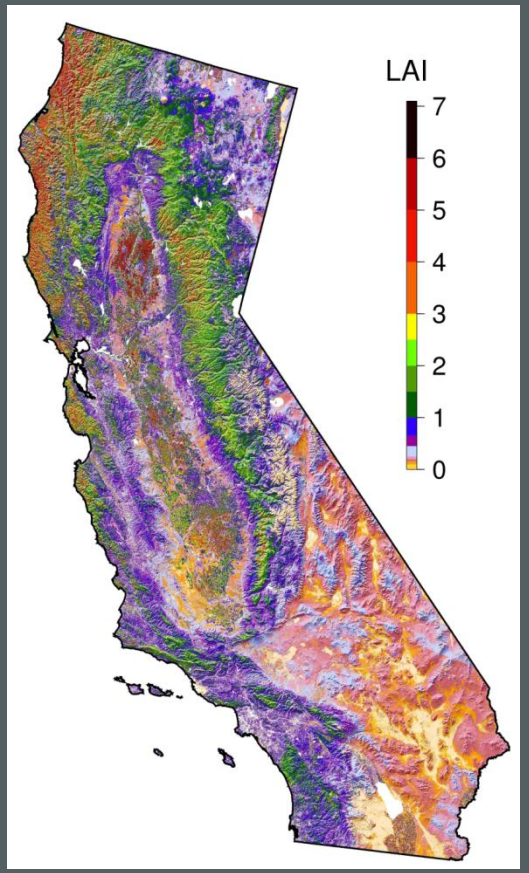
Moving from Data to Information

L1T At-sensor Radiance (FCDR)

Surface Reflectance (TCDR)

Leaf Area Index (ECV)



Courtesy Rama Nemani, NASA Ames Research Center

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The Next 40 Years: Setting the Course

- **Landsat: No longer the only game in town**
  - At least twenty other countries either will or have launched earth-observing satellites
  - Over a half-dozen *private* EO satellites up there!
- **Technology is Changing Everything!**
  - In Space and especially on the Ground
  - Remote Sensing data are becoming ubiquitous (GIS tools, Bing Maps, Google Earth, etc.)
  - Information processing allows us to do what was formerly impossible
- **Where will we be in 40 years?**

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The Next 40 Years: Setting the Course

- What problems do we face?
- What roles are best for government?
- What partnerships make the best sense?
- What is the wisest use of taxpayer money?

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The Next 40 Years - Summary

- **For 40 years USGS EROS has been the leading source for *Data* for our Changing Planet**

- **In the Next 40 Years:**
  - **We will Expand our Sources of Data**
  - **Move from not only supplying *Data*, but also *Information***
  - **Ultimately, supplying knowledge**

- **In 40 years, USGS EROS will be the Leading Source of *Information* for "Understanding Our Changing Planet"**

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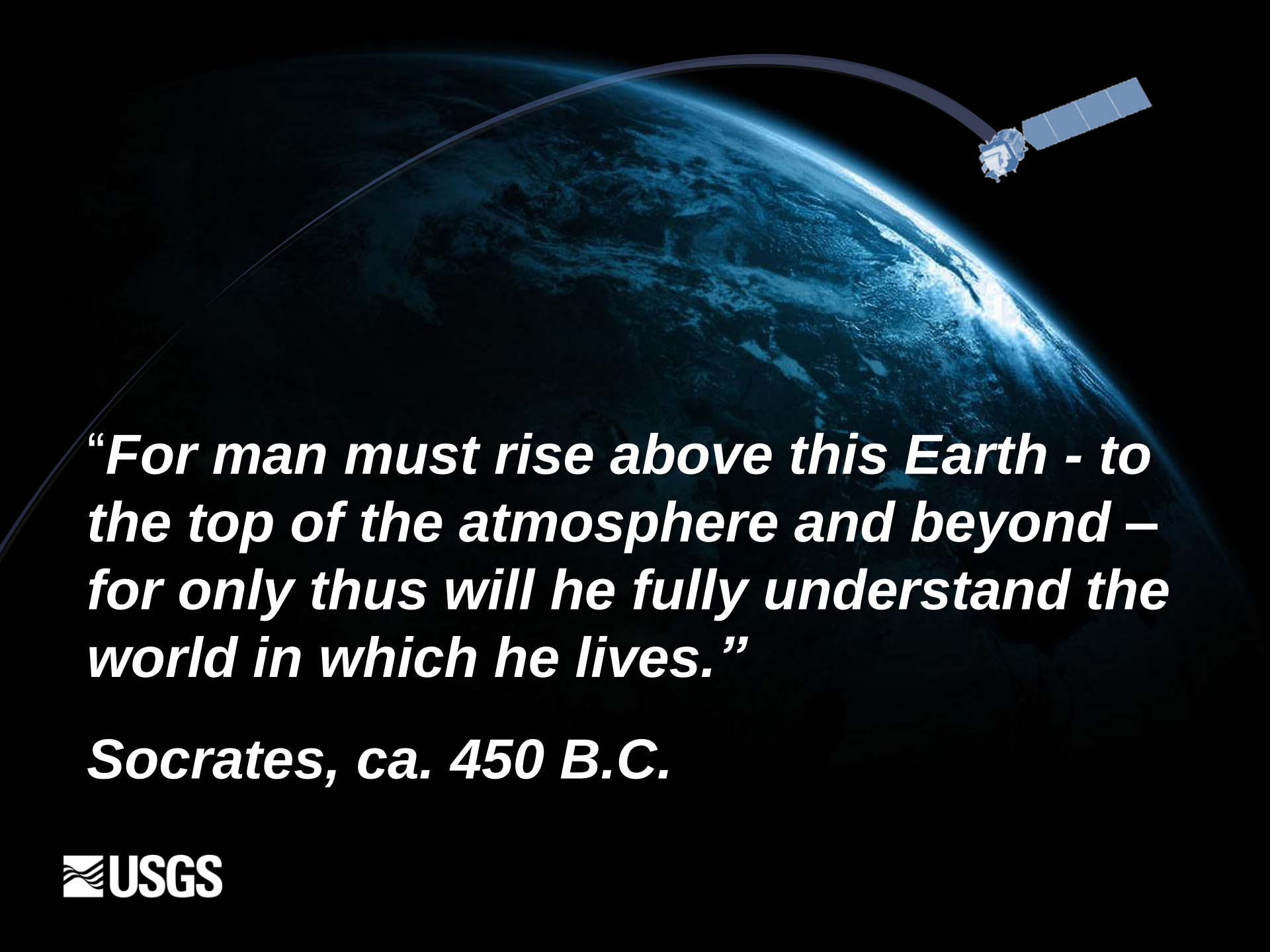
40th Anniversary Open House



“For man must rise above this Earth - to the top of the atmosphere and beyond – for only thus will he fully understand the world in which he lives.”

Socrates, ca. 450 B.C.

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