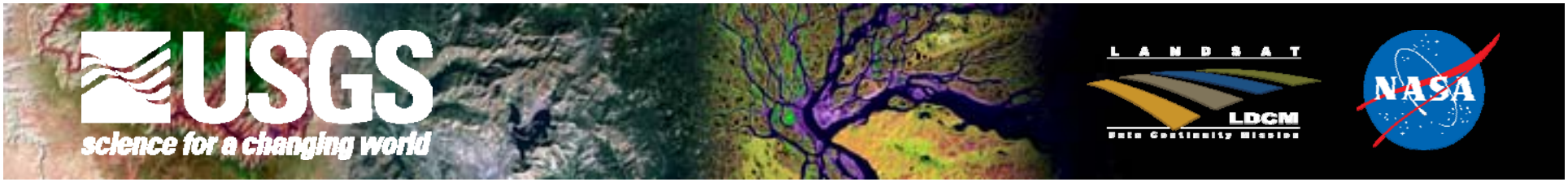

Review of Selected Landsat Science Drivers

July 17, 2008

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

Thursday Schedule

8:00	USGS Outreach activities – Ron Beck, USGS
8:15	Planning for Landsat 9 – Tim Newman, USGS
8:45	Review of selected Landsat science drivers – Tom Loveland (USGS)
9:00	Discussion on Landsat 9 science requirements and priorities – Landsat Science Team
11:15	Technical discussion on gap filling approaches – Curtis Woodcock (Boston University)
12:00	Lunch
1:00	Landsat end-of-mission criteria discussion – Tom Loveland and Kristi Kline (USGS)
1:45	Discussion on science drivers for National Land Imaging – Landsat Science Team
3:00	Meeting Summary, planning for winter 2009 Landsat Science Team Meeting
3:30	Wrap-up discussion

USGS

LANDSAT LDCM Data Continuity Mission

NASA

Future of Land Imaging Interagency Working Group, 2007. A Plan for a U.S. National Land Imaging Program.

- Continuous global record of moderate resolution land imaging for:
  - Management of US lands and territorial possessions
  - Domestic agriculture and natural resources
  - Monitoring global change
  - National security
  - General US economic welfare
- Documented requirements in 13 Federal agencies (Departments of Agriculture, Commerce, Defense, Energy, Homeland Security, Interior, Justice, State, Transportation, EPA, NASA, NGA, NSF)
- "Land imaging is not only relevant to basic science or to the application of basic research in preserving the natural state of the Earth or studying the effect of natural systems on the human population, but also of great significance as a tool for civil government and economies."

USGS

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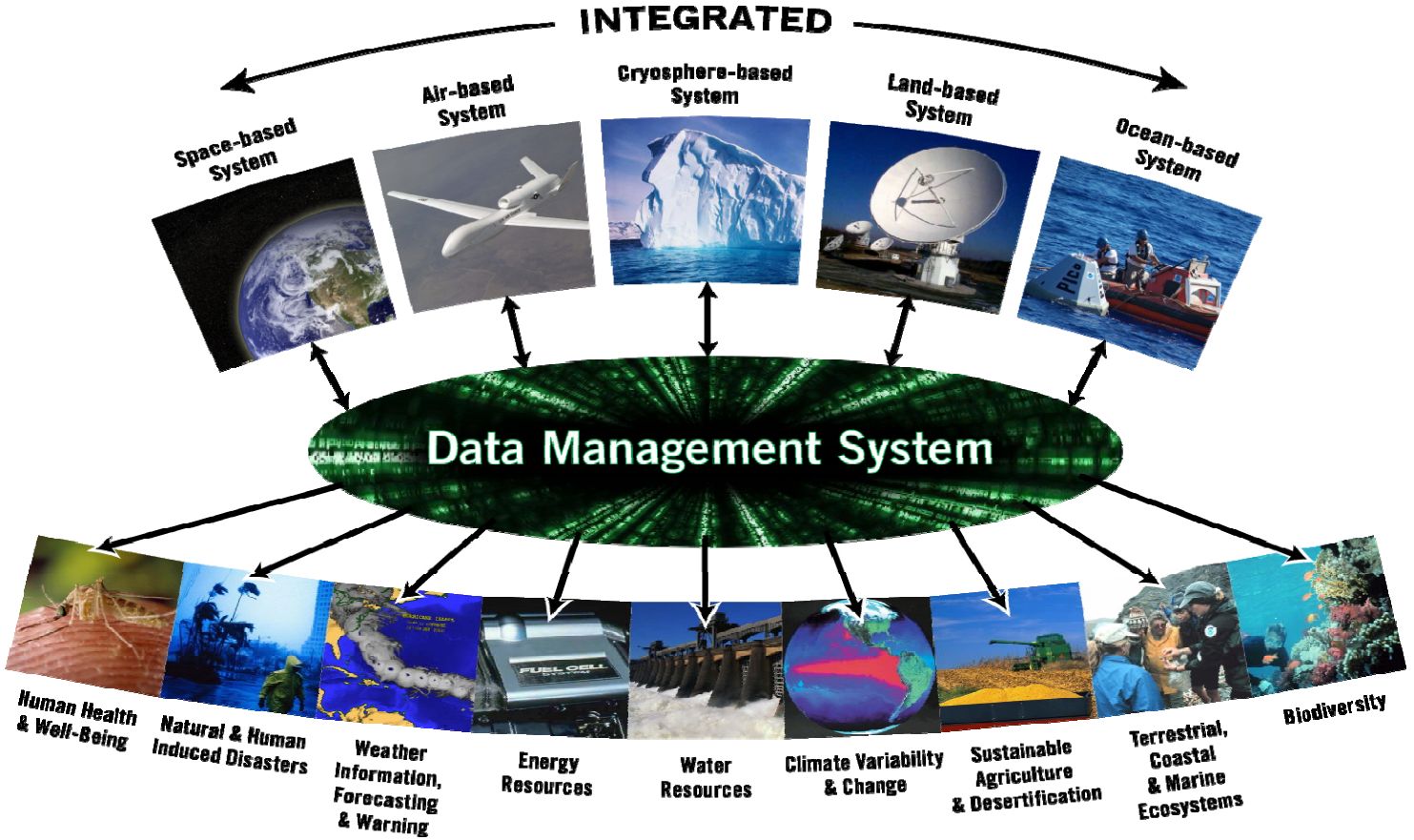
NASA

A National Land Imaging Program Supports Societal Benefit Areas

Earthquakes ★ Floods ★ Hurricanes ★ Landslides ★ Tsunamis ★ Volcanoes ★ Wildfires



USGS

LANDSAT LDCM Data Continuity Mission

NASA

Future of Land Imaging Interagency Working Group, 2007. A Plan for a U.S. National Land Imaging Program.

- The core technical capabilities of moderate-resolution land imaging that provide specific contributions to societal benefits are:
  - Systematic, repetitive coverage of the global land surface
  - Synoptic observations of broad areas
  - Multispectral observations
  - Moderate spatial resolution (30 meters or better)
  - Accurate radiometry, geolocation, and cartographic registration.
- Each of these characteristics is essential to meeting current U.S. needs for land imaging data and could be improved in the future as new requirements emerge (e.g., a need for hyperspectral or radar data, or data of higher resolution).

USGS

LANDSAT LDCM Data Continuity Mission

NASA

National Research Council, 2007. Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond.

- A near-term issue requiring attention is understanding the changing patterns of land use due to the needs of a growing population, the expansion and contraction of economies, and the intensification of agriculture.
  - It is vital to “continue to document biosphere changes indicated by measurements made with instruments on the Landsat series of spacecraft.”
- Long time series of critical environmental variables need to be maintained, with the highest priority attached to records related to land and ocean primary productivity and high-resolution land cover.
  - These records should be continued whenever possible with improved technology and scientific approaches.

USGS

LANDSAT LDCM Data Continuity Mission

NASA

National Research Council, 2007. Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond.

- For global ecosystem change monitoring:
  - The target resolution should be higher than that of MODIS (less than 250 m), and should balance the need for high temporal resolution and global coverage against spatial resolution.
  - The extremely high spatial resolution missions should be left to the private sector and operational satellites.
  - The longest revisit time acceptable is a month or so.
  - There is a need for pointability that occasionally allows more frequent revisits to critical areas. Operations would need to allocate observing time dynamically between the background program and targeted acquisitions.

USGS

LANDSAT LDCM Data Continuity Mission

NASA

National Research Council, 2008. Earth Observations from Space: The First 50 Years of Scientific Achievements.

- Building a predictive capability relies strongly on the availability of seamlessly inter-calibrated long-term records, which can only be maintained if subsequent generations of satellite sensors overlap with their predecessors.
- The maintenance of long-term observing capacities and to innovation in observing technology is equally important for sustaining the rate of scientific discovery and advances.

USGS

LANDSAT LDCM Data Continuity Mission

NASA

Climate Change Science Program, 2003. Strategic Plan for the Climate Change Science Program.

- Long term observations require a focus on maintenance and replacement to sustain the capability at a sufficient level of accuracy to detect climate change over decades.
  - Provide a uniform global set of surface reference sites of key ocean, land, atmosphere, and hydrology variables.
  - Provide careful calibration and overlapping operation of new and old technology during transitions to maintain quality control of data records.

USGS

LANDSAT LDCM Data Continuity Mission

NASA

Climate Change Science Program, 2003. Strategic Plan for the Climate Change Science Program.

- Future global measurements from satellites will be developed that dramatically improve quality and vertical, spatial, and/or temporal resolution, especially to enhance regional coverage for decision support applications.
- Over land, the great spatial heterogeneity requires extremely detailed measurements and presents a major challenge.
- Instrument calibration, characterization, and stability become paramount considerations.

USGS

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NASA

What are the reoccurring themes for science and applications?

- Necessity for Landsat observation for land change monitoring and assessment
- Data consistency and continuity
- Long-term measurements
- Well-characterized measurements
- Technological evolution and innovation

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Lessons from PI Presentations

- Value of a consistent time series, including access to the full Landsat archive (US and global)
- Access to and integration with other data sets
- Value of SWIR and TIR, and expected value of aerosol blue
- High level of geometric and radiometric consistency
- Increased temporal frequency
- Expand use of Landsat to national-continental-global land surveys
- 30m resolution is appropriate for resource management and land monitoring
- Range of applications is expanding and will accelerate when full access to free data occurs
- Move to more robust product paradigms – “map quality data”
- Improve signal to noise performance and > 8 bit quantization
- Consistent calibration of all bands

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Some steps to consider

- Immediate
  - Landsat 9 authorization advocacy and planning
    - Meetings with key USGS, NASA, and congressional reps
    - Broad audience article on necessity of Landsat
  - Special issue on a new Landsat era
  - Stepped up LST presence at key national science meetings
- Longer-term activities
  - Consider NRC study on operational land earth observation needs
  - Advocacy for NLIP and operational Landsat

USGS

LANDSAT LDCM Data Continuity Mission

NASA

For Landsat 9 and beyond, what needs to evolve and change?

- Spectral capabilities
- Radiometric performance
- Temporal frequency
- Spatial/geographic properties
  - Expanded swaths
  - Improved resolution
  - Geometric quality
- Data processing and data access

USGS

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NASA