

Summary of Landsat Science Team Contributions and Impacts

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Looking Back on the Past Five Years

- January 2007 – Sioux Falls, SD
- June 2007 – Corvallis, OR
- January 2008 – Sioux Falls, SD
- July 2008 – Reston, VA
- January 2009 – Fort Collins, CO
- July 2009 – Rochester, NY
- November 2009 (Products Technical Meeting) – Boston, MA
- January 2010 - Mountain View, CA
- July 2010 – Boise, ID
- November 2010 (Products Technical Meeting) – Boston, MA
- March 2011 – Phoenix, AZ
- August 2011 – Sioux Falls, SD

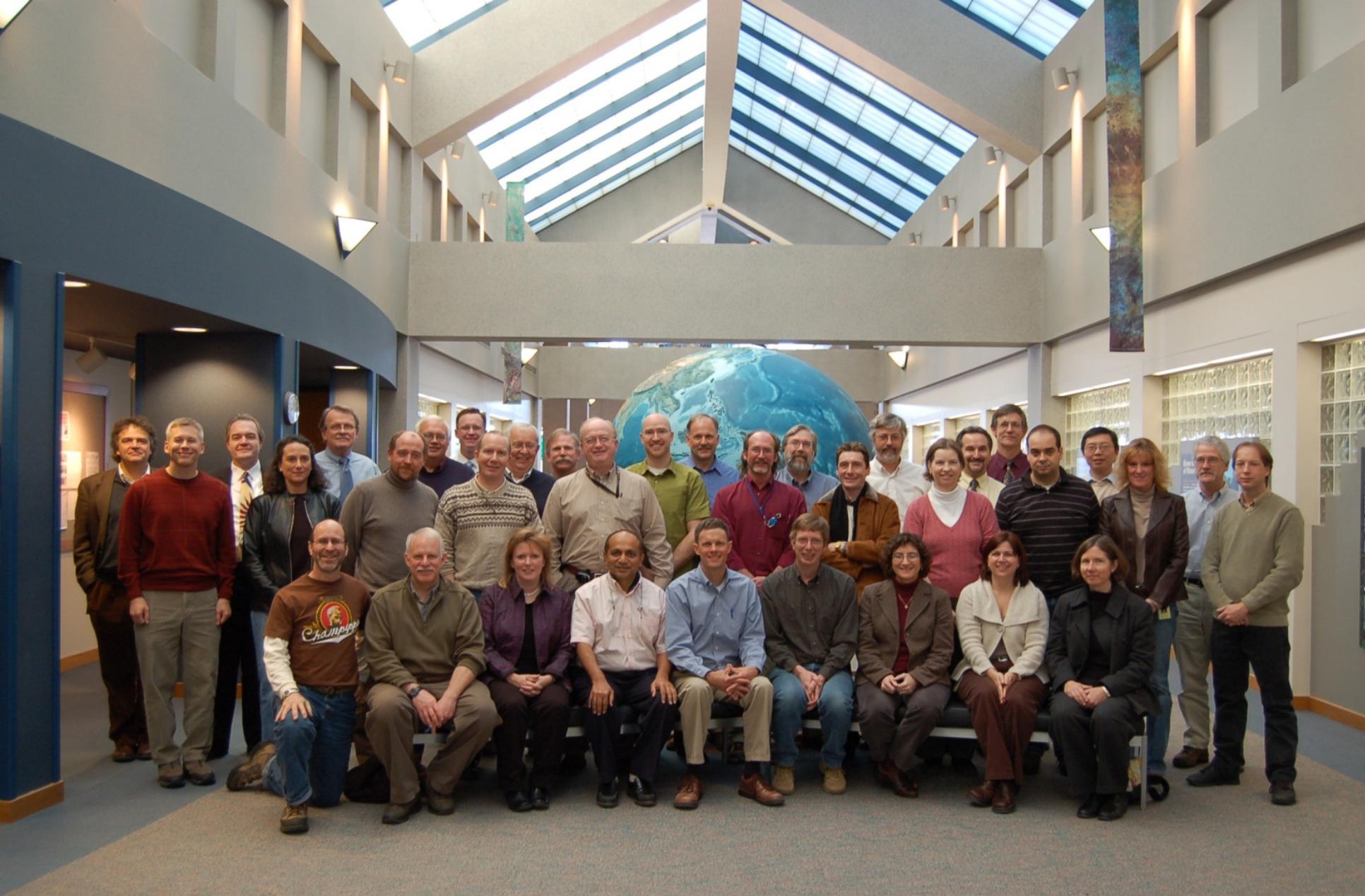
Landsat Science Team January 11, 2007
USGS Center for EROS



First Meeting – January 2007 at EROS



Corvallis, OR – June 2007



EROS – January 2008



Fort Collins, CO – January 2007



Rochester, NY – July 2009



Mountain View, CA – January 2010



Phoenix, AZ – March 2011

Five Major Impacts
(in no particular order)

1. Web-Enabled Landsat Data (aka Free Data)

- The Team contributed to the single most profound Landsat-related event that occurred during their tenure - the decision to distribute Landsat data for free.
 - July 25, 2007 letter to US Secretary of Interior Dirk Kempthorne advocating data accessibility
 - May 28, 2008 letter to the journal Science endorsing free access to Landsat Data.

2. Thermal Imaging - TIRS

- The Team provided proactive advocacy for restoration of thermal imaging requirements for LDCM.
 - Rick Allen engaged the aid of the Western States Water Council and other western state water management officials in the deliberations. He was bolstered by Martha Anderson and John Schott as well as the rest of the team.
 - Woodcock's January 23, 2007 letter to USGS Director Mark Meyers and NASA Administrator Michael Griffin recommended TIRS for LDCM.
 - "Failing to continue the 28-year history of Landsat-scale thermal surveillance will have negative consequences in terms of safeguarding the future economy, environment, health, and natural resources of the United States and our ability to address water supply crises abroad."

3. Landsat Global Archive Consolidation

- The Team's initially recommended repatriation and consolidation of international Landsat holdings during the 2007 summer meeting – and since then, has provided constant encouragement.
- Woodcock's July 25, 2007 letter to DOI Secretary Kempthorne said:
 - By the launch of the LDCM in mid-2011, all the existing historical Landsat imagery be consolidated in the US archive and made equally accessible as LDCM imagery.
 - A priority should be to "...bring copies of foreign holdings into the US archive. The sooner work begins on this front the better, as delays will result in more images being lost."

4. Supporting NLI and Future Landsats

- The Team advocated for NLI and an operational Landsat program beginning with Landsat 9 and Landsat 10 throughout their term.
 - Woodcock July 25, 2007 letter to DOI Secretary Kempthorne
 - Woodcock May 15, 2009 letter to U.S. Secretary of Interior Ken Salazar advocating initiation of Landsat 9 planning and a National Land Imaging Program.
 - And the many individual activities of all Team members.

5. Research and Development

- The Team science, applications, and engineering accomplishments have had significant contributions and impacts on Landsat, remote sensing, and environmental science. For example:
 - Establishing the foundation for higher level products.
 - The time and effort of those that supported the two product workshops is acknowledged.
 - Developing methodologies for using large volumes of Landsat data for long-term and/or broad-area studies.
 - Over 400 Landsat-related publications

LDCM-Sentinel 2 Communication

- The Team's encouragement of NASA/USGS collaboration and cooperation with ESA is also a great thing. Inviting ESA/Sentinel 2 representatives to the Team meetings was inspired and the Team's endorsement of collaboration was very helpful. A lot of credit goes to our European, Alan Belward, in this area.

Landsat Issue Assessments

- Level 0R Requirements (2007)
- Landsat Pixel Size (2007)
- Landsat Launch Delay (2008)
- Landsat Free Data Priorities (2008)
- Recovering old MSS Digital Data and TM Film (2009)
- Landsat Watermarking (2009)
- MSS Backlog Strategy (2009)
- TIRS on OCO (2009)
- Landsat 5 TWTA (2010)
- Landsat 9 Trade Studies (2011)

LDCM Level 0R Requirements

- Issue: Should LDCM L0R products be provided?
- Assessment: The Landsat Science Team recognizes that the demand for lower level products will be low but important opportunities are lost if the L1T is the only LDCM standard product.
- Recommendation: Add a lower level LDCM data product (e.g., L0R or L0Rp format) requirement for the LDCM ground system.
- Outcome: Accepted.

Landsat Launch Delays

- Issue: What instrument capabilities or performance requirements can be relaxed to avoid launch delays (from Dr. Freilich, NASA Earth Science Director)?
- Recommendations: Woodcock's Jan. 30, 2008 letter to Freilich stated:
 - The Team's top priority is to maintain the **summer 2011** launch date. If there are launch delays, an operational LDCM capability is required by **March 2012** (northern hemisphere growing season).
 - Current spectral band/radiometric performance requirements should only be relaxed or waived if their full achievement jeopardizes the ability to observe this growing season and that the inability to meet performance requirements do not indicate of a more serious problem that could jeopardize the overall mission.
 - The Team advocates the inclusion of a thermal infrared sensor if it can be achieved in time for March 2012 operations. However, the Team considers a delay of one year, or more, intolerable.
- Outcome: Launch was delayed, capabilities were preserved.

Landsat Pixel Size

- Issue: Should Landsat pixel sizes be standardized?
- Assessment:
 - A 28.5 (vs 30m) pixel results in a 0.2% radiometric improvement. So, in a practical sense, the difference between the two approaches is probably very minimal
 - Users find the 14.25/28.5m pixel dimensions cumbersome and typically resample to 15/30m.
- Recommendation: Standardize pixel dimensions for L1T products to 15/30/60/120m.
- Outcome: Accepted

Landsat Free Data Priorities

- Issue: What are the priorities for the provision of web-enabled Landsat Data?
- Recommendations:
 - TM and ETM+ Priorities
 - There is overwhelming support for releasing all Landsat 7 data first and as soon as possible.
 - After that, make newly acquired Landsat 5 TM and the complete archive of Landsat 7 SLC-on scenes available as soon as possible.
 - MSS Conclusions
 - Release MSS data after the conversion from NLAPS is complete so that the scenes have improved geometry and calibration. The importance of improved geometry is a greater concern than is calibration improvements, although the consensus was clear that improved radiometric calibration is essential to the long-term viability of the full Landsat archive.
- Outcome: All data were released in December 2008

MSS Digital Data and TM Film

- Issue: Should some misc. collections of “missing” historical Landsat scenes be added to the Landsat archive
- Recommendations:
 - Recovery of the MSS “orphans” is important
 - Scanning of non-digital TM film is not recommended
- Outcome: 100,000 MSS scenes added



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Landsat Watermarking

- Issue: Deputy USGS Director Doyle called for insertion of USGS logo into each Landsat digital scene.
- Assessment: Woodcock's July 20, 2009 to USGS Acting Director Suzette Kimball stated:
 - The LST strongly opposes Landsat watermarking since it destroys the scientific value of the data as well as the integrity of the USGS as the Landsat steward.
- Recommendation:
 - Watermark full-resolution Landsat browse images.
 - Focus on “better branding of Landsat” and ways to widen the recognition of the value of Landsat and the importance of the role the USGS plays in ensuring high quality data sets.
 - Expand and improve Landsat science products.
- Outcome: Accepted



MSS Backlog Strategy

- Issue: NLAPS MSS orthorectification process was creating major backlog.
- Assessment:
 - The LST considers the conversion to LPGS and an improved MSS orthorectification capability to be a critical step that should be achieved as soon as possible.
- Recommendation:
 - Change to a systematically processed (L1G) product without precision/terrain correction applied to speed up user access to the MSS data, until the MSS processing is transitioned to LPGS, and then (re)process new MSS orders as L1T using the LPGS.
- Outcome: Accepted

TIRS on the Orbiting Carbon Observatory (OCO)

- Issue: NASA HQ considering placing TIRS on a future OCO platform.
- Assessment: Curtis Woodcock June 17, 2009 letter to Dr. Michael Freilich, NASA Director of Earth Science:
 - “My understanding is that the planned delivery date of December 2011 for TIRS provides more than sufficient time for integration of the TIRS instrument onto the LDCM spacecraft. Perhaps more significantly, placing TIRS on an OCO mission that has not been authorized by Congress and will need to be redesigned to accommodate TIRS is likely to mean that there will be a significant gap between the launch of LDCM in December 2012 and the eventual launch of OCO carrying TIRS.”
- Recommendation: Leave TIRS on LDCM.
- Outcome: Accepted

Landsat 5 TWTA

- Issue: Rising TWTA current could end the Landsat 5 mission.
- Recommendation:
 - The priority should be acquiring as much Landsat TM imagery as possible for the remainder of the mission (“run that puppy until she dies”).
 - Additional suggestions included:
 - Using cloud avoidance strategies when scheduling acquisitions.
 - Making growing season coverage a top priority, particularly in the northern hemisphere.
 - Imaging the CONUS (especially western CONUS), and important GLS 2010 targets.
 - Placing top priority on acquisitions that will immediately reside in the EROS archive.
- Outcome: Partially accepted

Landsat 9-10 Trade Studies

- Issue: What are the priority trade studies for Landsat 9 and 10?
- Recommendations:
 - Landsat 9 Spacecraft Improvements - the feasibility for operating Landsat 9 in an “always on” mode in order to increase the amount of global Landsat data.
 - Landsat 9 TIRS Resolution – improve TIRS resolution from 120m to 60m – or even 30m.
 - Landsat 10 Band Replacement – replace the Pan band with 15m resolution Red and NIR bands.
- Outcome: Pending

Finally...

Leadership



- The Team made a wise choice in selecting its leader.
- Professor Woodcock has done a tremendous job setting the tone for the Landsat Science Team meetings, keeping the Team on track during meetings, and expertly capturing and communicating the sense of the Team in the numerous letters he crafted.