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To: Dr. Michael Griffin, NASA Administrator
Dr. Mark Myers, Director of the USGS

The Landsat Science Team strongly and unanimously recommends that the thermal imager option for the Landsat Data Continuity Mission (LDCM) be fully funded and implemented.

The Landsat Science Team was established to provide science-based assessments of the requirements and plans for the Landsat program and the LDCM. In our evaluation of mission plans, it is clear that the absence of a thermal imaging capability compromises many important applications, particularly water resources management.

Land-surface temperature is a fundamental quantity in Earth science and measuring it is critical to the management and operation of water resources systems of the U.S[1]. Through time, water resources continue to become increasingly scarce and valuable. As a result, the need for thermal data in support of agriculture and many other sectors of the economy is increasing both in the U.S. and internationally. Maintaining the heritage of thermal imaging in the Landsat Program is more important than ever and the needs in the future will only increase.

Furthermore, the Land Remote Sensing Policy Act of 1992 (P.L. 102-555) mandates continuity in Landsat data collection, maintaining consistency with earlier Landsat systems in terms of spectral and spatial coverage. Landsat satellites have collected thermal data since 1978. Elimination of a thermal imaging capability in future Landsat missions represents a departure from the continuity mandate.

[1] 2006. Rounds, M.M and Freudenthat, D. Letter from Western Governors' Association to J.H Marburger, Director of the President's Office of Science and Technology Policy; http://www.idwr.idaho.gov/gisdata/ET/thermal_band_issues/wga-landsat-letter-2.pdf

Thermal remote sensing is an essential and proven tool for management of scarce water resources. As expressed by the National Research Council in their recent 2007 report[2], "Remote sensing of land radiometric surface temperature is critical to all current schemes to estimate evapotranspiration remotely." Water management agencies in the Western U.S. rely on high-resolution Landsat thermal data to monitor evapotranspiration at spatial scales that permit cost-effective assessment of compliance with water rights and irrigation diversion strategies[3]. Similar monitoring techniques are being adopted in foreign countries under World Bank, United Nations and International Water Management Institute programs where water shortages are increasingly acute[4]. Understanding evapotranspiration and water cycling are key components of the study of climate change and impact. In addition, the thermal band effectively monitors drought and crop stress[5] and only at Landsat resolution do thermal data have the potential for significantly improving global yield forecasts. Thermal data at the necessary spatial scales for water cycle monitoring are not available on a routine basis from any other satellite system.

Despite the demonstrated utility of thermal data, the current budget for NASA does not include funding for the thermal imaging option on LDCM. We are convinced that the return on investment in the thermal instrument will greatly exceed the cost, and economic analyses by western water management agencies support this conclusion[6]. In the Survey on the Future of Land Imaging[7], the thermal band was the fourth highest priority attribute for Landsat data. The implementation of a thermal imager aboard LDCM was recognized as the number one priority action item by the Landsat Science Team in January 2007. The recent NRC Decadal Survey Report[2] recommended to "Implement an effective Landsat-7 follow-on program *including* a slightly enhanced reflective channel selection and *effective thermal band selection*."

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[2] 2007. *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond.* Space Studies Board, National Research Council. The National Academies Press p.165, 356.

[3] 2005. Allen, R.G., Morse, A., Tasumi, M, Kramber, W.J., Bastiaanssen, W. Computing and Mapping of Evapotranspiration. Chapter 5 in *Advances in Water Science Methodologies*; U. Aswathanarayana, Ed.; A.A. Belkema Publishers, Leiden, The Netherlands.

[4] 2002. Droogers, P. and Bastiaanssen, W.; Irrigation Performance using Hydrological and Remote Sensing Modeling; American Society Civil Engineers *J. Irrigation and Drainage Engineering*., Vol. 128(1):11-18

2006. World Bank, Investment Note 3.6 - Using Satellites to Assess and Monitor Irrigation and Drainage Investments; in Chapter 3: Investing in the Improvement and Modernization of Irrigation Systems; in Sourcebook: *Shaping the Future of Water for Agriculture.* http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTARD/EXTAGWSOU/0,,contentMDK:20948791~pagePK:64168445~piPK:64168309~theSitePK:2502682,00.html

2003. *Unlocking the Water Potential of Agriculture.* U.N. Food and Agriculture Organization, Rome, Italy. http://www.fao.org/docrep/006/y4525e/y4525e00.htm#Contents

[5] 1995. Moran, M.S., S.J. Maas and P.J. Pinter, Jr., Combining remote sensing and modeling for estimating surface evaporation and biomass production, *Rem. Sens. Reviews* 12:335-353.

[6] 2006. Western Governors' Association; Water Needs and Strategies for a Sustainable Future.

[7] Report to the White House Office of Science and Technology Policy Future Land Imaging Working Group on the American Society for Photogrammetry and Remote Sensing Survey on the Future of Land Imaging by Kass Green, Jim Plasker, Gerald Nelson and Don Lauer, *Photogrammetric Engineering and Remote Sensing*, Jan. 2007 p.5-9.

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.

Thank you for your help and consideration of this important matter. Please let me know if I can be of any further assistance.

Sincerely,

Dr. Curtis Woodcock, Landsat Science Team Leader
on behalf of the Landsat Science Team

cc
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