



CEOS Constellation Scoping Paper

**The CEOS Constellation  
for  
Land Surface Imaging**

**The 19<sup>th</sup> Meeting of the CEOS  
Strategic Implementation Team (SIT-19)**

**La Jolla, CA  
September 19, 2006**

**CEOS Land Surface Imaging Constellation  
Study Team**

# Outline of Comments

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  - Study Team Participation
  - Scope of the LSI Constellation Study
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## Background and Context

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- CEOS Constellations Concept is new and still evolving.
  - LSI Constellation Study Team understanding of the concept is based largely on the March, 2006 *Constellations Concept Paper*.
    - *New planning processes that takes account of international users and their requirements from the outset of satellite projects.*
    - *Intended to address shortcomings in the international planning process for space-based Earth observations without eroding the independence of individual agencies.*
    - *Fundamental concept is to extract clear requirements from target user communities and translate those requirements into “standards,” which can serve as guidance in the development of future systems and against which future proposed Earth observing systems can be assessed.*
  - The LSI Constellation scoping paper was developed accordingly.
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## Mission Statement

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- “The Land Surface Imaging Constellation seeks to promote the efficient, effective, and comprehensive collection, distribution, and application of space-acquired image data of the global land surface, especially to meet societal needs of the global population, such as those addressed by the Group on Earth Observations (GEO) societal benefit areas.”
- This mission statement embodies what the study team sees as the fundamental goal of CEOS LSI Constellation.
  - Emphasis on addressing the needs of society.
  - Accommodates the broad scope of technology and applications inherent in land remote sensing.

# Objectives of the LSI Constellation Study

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- Define a broad range of rather detailed characteristics (*standards*) that describe optimal, end-to-end capabilities (and policies) to acquire, receive, process, archive, and distribute to the global user community space-acquired land surface image data.
  - Extensively engage broad segments of the land remote sensing user community to fully determine the scientific information requirements that must be met by the data acquired.
  - Identify opportunities where near-term gains may be achieved.
    - Early determination of user requirements and development of related standards for urgently needed systems.
    - Applying newly developed policy recommendations to existing systems.
    - Facilitating CEOS efforts to integrate data from multiple systems to fill a potential gap in the continuity of Landsat data.
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## Study Team Participation

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- Responsibility for leading the prototype Land Surface Imaging Constellation study was assigned to the USGS.
- Study team membership currently dominated by members from space agencies with land imaging interests.
  - USGS – G. Bryan Bailey
  - CNES – Herve Jeanjean
  - INPE – Joao Vianei Soares
  - ESA – Michael Berger
  - NASA – DeWayne Cecil
  - NOAA – Kevin Gallo
  - ISRO – V.K. Dadhwal
  - CSA – Daniel DeLisle
  - CONAE – Ana Medico; Ana Hernandez
  - NRSCC – Mengxue Li (Currently)
  - JAXA – Invited (TBD)

## Study Team Participation (cont.)

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- Particularly, as the LSI Constellation study focuses on gathering user requirements, participation on the study team by members representing various segments of the diverse land remote sensing user community will be important.
- Further, as requirements are translated into standards, user validation of proposed standards will be key to securing general acceptance of the LSI constellation defined.
- However, even at this early stage some user participation by the user community was deemed important.
  - EC-JRC – Alan Belward
  - IGOS – John Townshend – Input/Review
  - FAO – Jeff Tschirley – Invited (TBD)

## Scope of the LSI Constellation Study

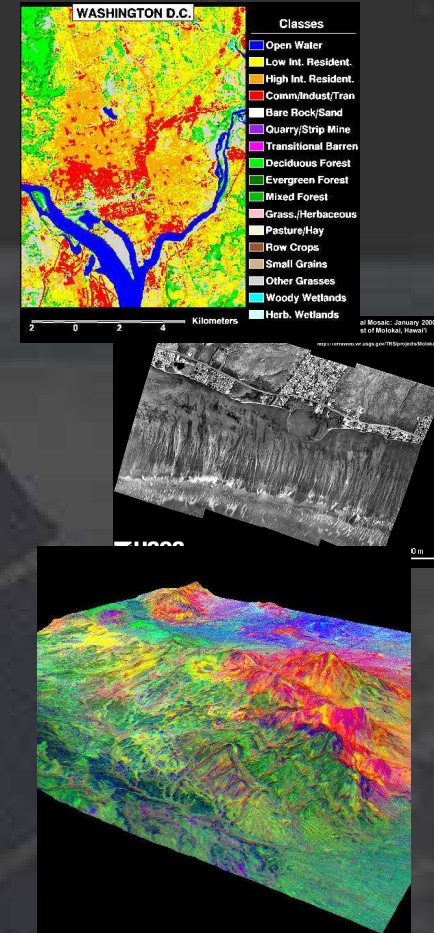
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- Land surface image data acquired by satellites serve a large and diverse user community, and those data span wide ranges in terms of their spectral, spatial, and temporal characteristics.
  - Consequently, the LSI Constellation study must be broad in scope.
  - Yet, it also must be comprehensive and detailed.
    - In identifying multidisciplinary science and practical applications requirements.
    - In its approach to defining the standards that describe LSI Constellation capabilities, characteristics, and policies.
  - The LSI Constellation study will not be a trivial undertaking, but it is one that stands to make enormous contribution to the value of international collaboration in land remote sensing.
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# Examples of Land Surface Imaging Applications

- Landsat 7 ETM+ Data
  - Land Cover Classification
  - Vegetation Flow Resistance Mapping
  - Groundwater Discharge Modeling
  - Geologic Mapping
- Aerial Photography
  - Cooperative Vegetation Mapping Program
  - Monitoring Coral Reef Degradation
- Interferometric Radar
  - Earthquake-Related Ground Deformation
  - Volcanic Inflation Detection
- AVIRIS Data
  - Mineral Mapping
  - Crop Identification
- ASTER Data Geologic Studies



## Scope of the LSI Constellation Study (cont.)

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- User Requirements will be the foundation of the LSI Constellation Study.
- As possible, requirements gathering results of other reputable studies will be used.
  - GCOS
  - FLI Interagency Working Group
  - IGOS Land Theme
  - LDCM
  - GMES
- Building on known requirements, processes will be implemented to define and compile comprehensive sets of user requirements.
- Particular emphasis will be placed on fully identifying user requirements associated with the 9 SBAs of GEO.

## Scope of the LSI Constellation Study (cont.)

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- Studies leading to the definition of standards for a land surface imaging constellation, must examine three fundamental areas.
    - Space Segments
    - Ground Segments
    - Policies and Plans
  - Space Segments
    - Standards will focus on sensor system characteristics, especially spectral coverage & resolution, spatial resolution, geographic coverage, and temporal characteristics.
    - Additional sensor system characteristics, such as radiometric accuracy and precision, dynamic range, polarization sensitivity, pointing and geolocation accuracy, and others, also will be addressed.
    - On-board recording capabilities, platform characteristics, and telemetry systems are examples of other space segment components to examine.
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## Scope of the LSI Constellation Study (cont.)

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- Ground Segments
    - Standards will focus on characteristics of data reception, data processing, data archiving, and data distribution systems needed to best satisfy user requirements.
    - Characteristics of satellite command-and-control systems and functions, availability and qualifications of user support staff, and characteristics of associated data and information systems also will be examined.
  - Policies and Plans
    - Optimal sensor and ground systems are of little value to users if data policies and plans inhibit rather than promote data access and use.
    - Consequently, factors such as data acquisition strategies and data distribution policies will be fully considered by the study.
    - Policy standards will be developed that encourage easy access to global land surface data and promote beneficial application of the data by users around the world.
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## Study Approach

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- The LSI Constellation study will be conducted by the study team as generally outlined in this presentation and within guidelines provided by CEOS SIT, as well as the yet-to-be-completed CEOS Constellations Process Paper.
  - Various details of the overall approach must yet be defined, pending refinement of expectations and desired outcomes.
    - Engineering-based targets vs. process-based targets
    - Short-term vs. longer-term objectives
    - Targeting the “doable” vs. the “impossible”
  - The prototype constellations are not all directly comparable. The LSI Constellation study approach may need to embrace the concept of a “constellation of constellations” to effectively accomplish all of its land surface imaging goals.
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## Study Approach (cont.)

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- The LSI Constellation Study may best be carried out in a phased approach based on determined priorities.
    - Objectives outlined by CEOS in its recent response to the GCOS Implementation Plan.
    - Urgencies associated with current situations, such as a potential gap in the continuity of Landsat data.
    - Desire to be responsive to elements of the GEO 2007-2009 Work Plan.
  - Opportunities may exist to implement parts of a Land Surface Imaging Constellation in the near-term.
    - Once standards are defined for certain policy or ground system elements, they could be applied to existing systems.
      - Data acquisition strategies
      - Data access and distribution
      - Data cost
    - Provide a good early test of constellation viability and benefit users.
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## In Summation

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- The CEOS LSI Constellation Study Team intends to undertake a comprehensive study that will define, based on identified user requirements and in terms of specific standards, characteristics of optimal land surface imaging systems.
  - Standards defined by the study can serve as benchmarks, which space agencies will aspire to emulate in the design and operation of their future land surface imaging space missions, as well as criteria against which future proposed systems can be assessed.
  - The study will seek opportunities for early gains by addressing high priority issues and by implementing aspects of the defined LSI Constellation in the near-term, thereby enhancing beneficial use of existing land surface imaging data by the global land remote sensing user community.
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## Issues and Discussion

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- The study team is “wrestling” with the issue of scope.
  - We recognize the opportunities and potential benefits of framing a study that is sufficiently broad in scope to embrace the needs and interests of virtually all users and providers of land surface imaging data.
  - Yet, we recognize potential risks in “aiming too high,” and we recognize the need to address certain high-priority topics, as well as the CEOS desire to achieve some “early wins.”
  - A majority of the study team seem comfortable with a phased-approach that embraces a broad scope and focuses the longer-term future, but is prepared to address priority near-term needs.
- The term “standards” needs further discussion and clarification in terms of how, exactly, we will define constellation components.
  - Hard technical specifications vs. guidelines or characteristics (thresholds?)
  - Engineering-based targets vs. process-based targets



## Issues and Discussion (cont.)

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- Presentation Checklist for Discussion

- What is the added value? The major outcomes?

Credible, requirements-based system and policy guidelines, which if embraced by space agencies providing land surface image data will markedly enhance and expand the beneficial use of land remotely sensed data for society.

- Is there a clear and common statement of requirements validated by the recognized user community?

The land remote sensing user community is large and diverse, so there is no single statement of requirements. Segments of the user community, such as the global climate change community, have stated their requirements.

- Who needs to be involved to insure success?

Both users and providers of land surface imaging data. Also, key to success will be management “buy-in” to the constellation concept and their willingness seriously to consider newly developed standards in their planning processes.

- SIT Questions, Comments, and Guidance

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