# Land Surface Imaging Constellation

## GEO Strategy for Global Agricultural Monitoring Workshop

**FAO Headquarters**
**Rome, Italy**
**July 16-18, 2007**

Mike Rast, GEO Secretariat

# Presentation Overview

- Introduction & Background
- LSI Constellation Objectives
- Planned Outcomes for 2007
- Participation and Resources
- 2007 Progress
  - 1st Half Accomplishments
  - 2nd Half Plans
  - Obstacles and Issues Requiring Resolution
- Linkages to GEO and AG-07-03
- Closing Comments

# Approach to define a Virtual Constellation

**Challenges to be overcome through GEO:**

- **Technical interoperability, data quality, -formats, -merging, -timely availability and compatibility, -access and dissemination, -storage**
- **The implementation of a GEO sharing principles resulting in principle in worldwide open access (i.e. Data sets could be available only to certain SBA's and/or to certain User).**

**Virtual Constellation – development approach**

**The approach to define the type and number of virtual constellations should enable the implementation of GEOSS requirements in the most flexible and effective way.**

**Virtual constellations may therefore address :**

1. **Themes and associated Communities, like the CEOS proposed Ocean Surface Topography, Precipitation and Atmospheric Chemistry, Land Imaging**
2. **"Intermediate and final products", e.g. the Global Land Cover and DEMs, as proposed in the GEO Work Plan,**
3. **Specific SBA, like what is proposed in the GEO Work Plan for Risk Management, Weather, Climate, ….. etc.**

# The 4 Prototype CEOS Constellations

- **Land Surface Imaging**
  - **Lead: Bryan Bailey (USGS)**
- **Ocean Surface Topography**
  - **Lead: Stan Wilson (NOAA) & Francois Parisot (EUMETSAT)**
- **Atmospheric Composition**
  - **Lead: Ernie Hilsenrath (NASA)**
- **Precipitation**
  - **Lead: Riko Oki (JAXA) & Steve Neeck (NASA)**

**Future candidates for Constellations under preparation to address Risk management and an Ocean Colour**

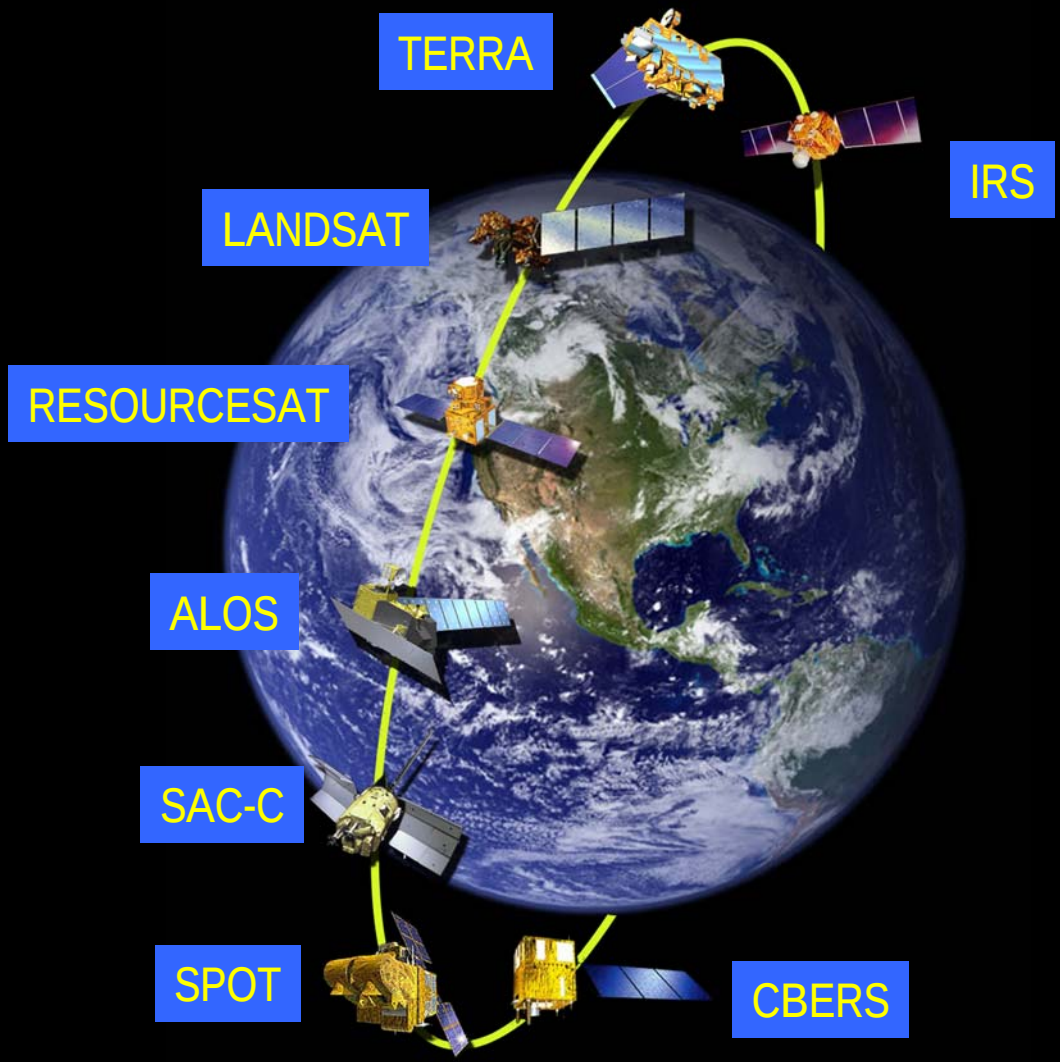
# Introduction & Background

- LSI Constellation Mission
  - Promote the efficient, effective, and comprehensive ***collection, distribution, and application*** of space acquired image data of the global land surface.
  - Do this especially to meet societal needs of the global population, such as those addressed by the societal benefit areas of GEO.
- The primary objective of the LSI Constellation is to define *standards* (or guidelines) that describe optimal future LSI Constellation capabilities, characteristics, and policies.
- It also is an important objective of LSI Constellation studies and activities to address current and shorter-term problems and issues facing the land remote community today.
  - Enhancing effectiveness of current systems to meet societal needs.
  - Addressing real or approaching issues such as data continuity and mitigating potential data gaps.

# LSI Constellation 2007 Objectives

- Establish agreement(s) among space agencies currently operating mid-resolution land surface imaging satellite systems, to cooperate more closely together to operate those assets as a real prototype LSI Constellation.
- Develop preliminary standards for a mid-resolution component of a LSI Constellation.
- Meaningfully contribute to the production of a fundamental climate data record (FCDR).
  - The UN FAO Forest Resource Assessment 2010 (FRA2010) is the FCDR that we selected to contribute to.
  - Our goal is to contribute land surface image **data** that are required to complete this assessment.

# A Potential *Real* Prototype Land Surface Imaging Constellation



# LSI Constellation 2007 Objectives

- Establish agreement(s) among space agencies currently operating mid-resolution land surface imaging satellite systems, to cooperate more closely together to operate those assets as a real prototype LSI Constellation.
- Develop preliminary standards for a mid-resolution component of a LSI Constellation.
- Meaningfully contribute to the production of a fundamental climate data record (FCDR).
  - The UN FAO Forest Resource Assessment 2010 (FRA2010) is the FCDR that we selected to contribute.
  - Our goal is contribute the land surface image **data** that are required to complete this assessment.

# Expanding Virtual Constellation Concept(3)

**The interim constellation** is made of the current operational missions.
The objective will be to define a set of constellation performances meeting users requirements, but compatible with each individual mission plan. Modifications and adaptations of the Ground Segments of each mission may be required and could be implemented.

**The medium term constellation** will be made of the current operational missions + the missions under development.
Modifications could be envisaged for what concerns product standards and formats, as well as observation plans and Ground Segment concept, architecture and data distribution approach, while it would be difficult to change major parameters such as orbit, instrument configuration, observation strategy, … etc. This will certainly increase the response to User Requirements

**The long-term constellation** will have the majority of its components being designed against the full set of User Requirements and implemented in a coordinated way for all technical and operational aspects of the different missions.

# 2007 Planned Outcomes (Deliverables)

- Higher-level agreement (Declaration of Intent) to cooperate.
- Up to three annexes (agreements) that begin to identify how.
  - Data access policy
  - Ground systems operations
  - Data acquisition and data management
- Representative cross-section of user-requirements for mid-resolution LSI data.
- Initial *standards* that describe optimal characteristics for a mid-resolution component of an LSI Constellation.
- Land surface image data requirements for FRA2010.
- Agreement(s) to provide data needed by FRA2010.
- Data provided to FRA2010 to perform global forest assessment.

# Participation and Resources

- The LSI Constellation Study Team was established to perform and/or coordinate the studies and activities required to achieve LSI Constellation goals and objectives.
- Eleven space agencies, two CEOS working groups, and the land remote sensing user community are represented.
- Current membership is well-suited for addressing current LSI Constellation goals and objectives.
- Resources to support LSI Constellation studies are provided mostly in kind by the agencies and organizations represented.
- NASA is funding the Systems Engineering Office (SEO).
- USGS is exploring a potential contract to provide support for performance of selected LSI Constellation work tasks.

# LSI Constellation Study Team Members

- G. Bryan Bailey, USGS (Co-Chair)
- V. Jayaraman, ISRO (Co-Chair)
- Herve Jeanjean, CNES
- João Vianei Soares, INPE
- Michael Berger, ESA
- DeWayne Cecil, NASA
- Kevin Gallo, NOAA
- Chu Ishida, JAXA
- Yonghong Zhang, NRSCC
- Daniel DeLisle, CSA
- Ana, Medico; Ana Hernandez, CONAE

Space Agency Members

- Stephen Ungar, NASA (CEOS WGCV)
- Jean-Pierre Antikidis, CNES (CEOS WGISS)

CEO WG Members

- Alan Belward, JRC
- Brad Reed, USGS
- Stuart Marsh, BGS
- Mike Abrams, NASA/JPL; Yasushi Yamaguchi; Nagoya Univ. (ASTER)
- Richard Fernandes (NRCan) & John Latham (FAO) - Invited

User Community Members

# 2007 Progress

- 1st Half Accomplishments
  - Prepared formal LSI Constellation Proposal in response to SIT guidance.
  - Developed 2007 Work Plan.
    - Outlines tasks designed to accomplish 2007 objectives.
    - Proposes timelines for accomplishing tasks.
  - Higher-level agreement to cooperate more fully in operation of current mid-resolution LSI systems was drafted, reviewed, and iterated prior to its discussion and ***approval*** at the recent Study Team meeting.
  - Initial work on development of a multilateral agreement for enhancing cooperation in the area of data access policy has been accomplished and was presented and discussed at the Study Team meeting.
  - Substantial progress has been made toward definition of the precise land surface imaging data requirements for FRA2010.

# 2007 Progress (cont.)

- 2nd Half Plans
  - Submit higher-level agreement to agencies for signature.
  - Subgroups will develop draft agreements for review and signature (ideally) by agencies with current mid-resolution systems.
    - data access policy
    - ground systems operations
    - data acquisition/data management strategies
  - Compile representative cross-section of user information and technical requirements for mid-resolution LSI data.
  - Subgroups will define initial standards for mid-resolution LSI systems.
    - space segments
    - ground systems
    - data and operations policy

# 2007 Progress (cont.)

- 2nd Half Plans (cont.)
  - Complete data requirements definition for FRA2010.
  - Establish necessary agreements to provide data to FRA 2010.
  - Begin providing the data.
- Obstacles and Issues Requiring Resolution
  - Securing the resources necessary to accomplish the tasks and meet the objectives defined in the 2007 Work Plan has been the biggest issue facing the LSI Constellation Study Team.
  - Although important progress was made during the first half of 2007, a substantially greater effort will be required in the months ahead to accomplish 2007 goals and objectives.
  - Based on discussions held and commitments the recent Study Team meeting, the Study Team feels confident that most of the goals and objectives defined for 2007 will be accomplished.

# Linkages to GEO and AG-07-03

- Beyond the obvious linkage to GEO Task DA-07-03 (Virtual Constellations), the CEOS LSI Constellation will acquire and provide data that will directly benefit endeavors undertaken in each of GEO's nine SBAs, including AG-07-03.
- This applies for both near-term and longer-term LSI Constellation goals and objectives.
- In the near-term, the LSI Constellation will facilitate cooperation among space agencies with mid-resolution LSI systems that will enable more efficient and effect global agricultural monitoring.
- Standards defined for LSI systems of the future will help ensure that those systems provide optimal data under optimal conditions to meet global agricultural monitoring needs of the future.
- Input is sought from AG-07-03 team in defining requirements.

# Summary and Conclusions

- The CEOS LSI Constellation Study Team has made substantial progress in accomplishing its 2007 Work Plan.
  - ***Declaration of Intent*** to cooperate in operating existing mid-resolution LSI systems was approved by the Study Team.
  - Preliminary draft for a common data policy for mid-resolution LSI systems has been prepared and reviewed by the Study Team. This draft will be used in developing future data policy agreements and standards.
  - Good progress has been made in defining FRA2010 data requirements.
- Actions taken at the recent Study Team meeting should enable successful completion of most 2007 goals and objectives.
  - Space agency members of the Study Team will seek approval from their agency of the ***Declaration of Intent*** to cooperate in operating existing mid-resolution LSI Systems (by August 31).

# Summary and Conclusions (cont.)

- Actions taken at recent Study Team (cont.)
  - Three Topic Area Subgroups were established and accepted the action of completing the work required to provide respective deliverables associated with 1) increased cooperation among space agencies with current mid-resolution LSI systems and 2) definition of preliminary standards for mid-resolution LSI systems (by October 1).
    - Space Segment
    - Ground Systems
    - Data and Operations Policy
  - Co-Chairs to work with FRA2010 team to finalize data requirements and with Data and Operations Policy subgroup to establish necessary agreements for providing requested data to FRA2010.
  - Both near-term and long-term objectives of the LSI Constellation will substantially benefit global agricultural monitoring when accomplished.