

CEOS Constellation for Land Surface Imaging

2008 Work Plan

I. Introduction

The primary objective of the CEOS Land Surface Imaging (LSI) Constellation is to define a broad range of rather detailed characteristics (or *standards*) that describe optimal, end-to-end capabilities (and policies) to acquire, receive, process, archive, and distribute space-acquired land surface image data to the global user community. These standards will not all be defined by a single study. Rather, multiple studies, each focusing on a spatial-resolution-based and/or spectral-based subset of the full scope of land surface imaging sensor systems will be needed. Complete definition of the CEOS Land Surface Imaging Constellation may be a rather lengthy process, possibly requiring several years to fully complete. Constellation studies and activities also will address current and shorter-term problems and issues facing the land remote sensing community today, such as seeking ways to work more cooperatively in the operation of existing land surface imaging systems and helping to accomplish tangible benefits to society through application of land surface image data.

Consistent with guidance provided by the CEOS Constellations Process Paper and to aid in the accomplishment of LSI Constellation goals and objectives, the LSI Constellation Study Team will prepare an Annual Work Plan to guide its activities for each year. The Work Plan will identify goals for the year and describe the work to be accomplished to achieve those goals, including the objectives, approach, and personnel resources needed. The Work Plan also will identify deliverables expected from the work, and it will present a timeline with milestones for the year's activities. This *2008 Work Plan* is the second Annual Work Plan prepared by the LSI Imaging Constellation Study Team.

II. 2008 LSI Constellation Goals

In 2007, the LSI Constellation Study Team defined three primary goals, all of which addressed the mid-resolution optical sensor category of the LSI Constellation. None of the three 2007 goals were completely accomplished last year, but important progress was made toward achieving all three. At its meeting held in Sanya, China on February 24-25, 2008, the LSI Constellation Study Team defined three new goals for 2008. These are:

1. **Complete Unfinished Tasks from 2007**
 - a. Annexes to Declaration of Intent
 - b. Standards for Mid-Resolution Systems
 - c. Data to FRA2020 Project
2. **Initiate a New RADAR Focus Area**
3. **Compile Regional Mid-Resolution Data Sets over Selected (TBD) Areas**

III. Goal 1: Complete Unfinished Tasks from 2007

Background. The LSI Constellation Study Team defined three main goals for 2007, all of which focused on the mid-resolution segment of land surface imaging. They were:

1. Establish agreements among the space agencies that currently operate mid-resolution LSI systems to cooperate more fully in the operation of those systems.

2. Develop preliminary standards for future mid-resolution LSI systems.
3. Contribute needed data to the Forest Resource Assessment 2010 Project.

While not all objectives stated in the 2007 Work Plan were fully accomplished last year, the Study Team did achieve meaningful results. These important results included:

1. Seven of the eight space agencies that currently operate mid-resolution LSI systems signed a **Declaration of Intent** stating their resolve *to realize the benefits of a Land Surface Imaging Constellation* by seeking ways to cooperate more fully in the operation of those systems.
2. Follow-up agreements that propose specific cooperation in the areas of data access, data acquisition, and ground systems operation drafted and distributed to the signing agencies for initial review.
3. User information requirements upon which to base the definition of preliminary standards for future mid-resolution LSI systems were compiled.
4. A rather high-level list of such preliminary standards was developed.
5. A draft agreement to help ensure provision of mid-resolution image data needed by the FRA2010 Project to fill holes in their primary survey data set was prepared and distributed to signing agencies for initial review.

Objectives. As there were three unfinished goals from last year, there necessarily are multiple objectives associated with this 2008 goal. The first is to reformulate the three draft agreements for increased cooperation in the areas of 1) enhanced user access to mid-resolution optical LSI data; 2) acquisition of mid-resolution optical data; and 3) ground systems operation into *Annexes for Cooperative Activities*. These annexes will be developed under the authority of the Letter of Intent for Increased Cooperation signed last year by seven CEOS agencies that operate mid-resolution LSI Systems, and they essentially will be *cooperative project plans* that can be agreed to at a level equal to or lower than required for the Letter of Intent. Indeed, participation by an agency many require no additional signatures. The follow-up and equally key objective here is to implement the three annexes or cooperative projects among the agencies interested in doing so.

Another objective related to completing 2007 tasks is to build upon the preliminary standards for future mid-resolution systems developed by Noblis (under contract to the USGS) and produce a final set of standards for the future mid-resolution systems of the LSI Constellation. The final objective related to completing 2007 goals is to identify the specific mid-resolution LSI data required by the FRA2010 Project to fill holes in their base data set, and develop a plan and schedule for providing the needed data.

Approach. The LSI Constellation Co-Chairs will reformulate the three draft agreements for cooperation related to enhanced user access to data, data acquisition, and ground systems operation into **Annexes for Cooperation** or *cooperative project plans*. These will be sent to the LSI Constellation Study Team members from the seven CEOS agencies that signed the Letter of Intent last year for their review and comment. The annexes will be revised and finalized based on input received. The final Annexes will be sent to the seven agencies with an invitation to participate in the cooperative activities described. Three projects will be implemented according to the project plans that comprise the annexes, and their implementation will benefit from contribution made by the three CEOS Working Groups, particularly WGISS and WGCV, as well by the CEOS SEO.

Noblis will submit its final report on the Development of Standards for Future Mid-Resolution Systems for the LSI Constellation to the USGS in May, 2008. This report will be circulated to the LSI Constellation Study Team for thorough review and detailed comment. Preliminary

standards proposed by Noblis will be revised by a working group of the LSI Constellation comprised of members from agencies with current and planned mid-resolution optical LSI systems. Final Mid-Resolution System Standards defined by the working group will be submitted to the full LSI Constellation Study Team for endorsement and then submitted to CEOS SIT as a LSI Constellation deliverable.

A lesson learned from 2007 was that it is absolutely necessary for the LSI Constellation Study Team to have precise definition of the data required by the FRA2010 Project to fill the holes in its base data set. The Study Team still desires to work with the appropriate CEOS agencies to provide the needed data, however it is incumbent upon the FRA2010 Project to provide the Study Team exact data requirements, including precise location information and any temporal constraints. Once data requirements are fully defined, LSI Constellation Study Team members will work with these agencies to locate and provide the needed data. Because of the uncertainty in knowing when precise data requirements will be provided by the FRA2010 Project, timelines associated with completing these tasks are rather speculative.

Deliverables. There are 2008 deliverables associated with each of the three goals that were not fully achieved in 2007. Three **Annexes for Cooperation**, which essentially will be cooperative project plans that set out cooperative activities wherein participating agencies will work together to enhance user access to data, coordinate data acquisition strategies, and address important issues related to ground system operations. The **cooperative projects** undertaken and the **beneficial results they produce** likewise will be important deliverables. The other two deliverables associated with this goal will be **standards for future mid-resolution LSI systems** and **data provided to the FRA2010 Project**.

Tasks & Timelines.

2008 Work Task	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Create Annexes for Cooperation from three draft agreements				■								
Mid-resolution agency members on LSI Constellation Study Team review and comment on Annexes				■	■							
Final draft of Annexes for Cooperation completed and sent to mid-resolution agencies with invitations to participate in cooperative activities described.					■							
Cooperative projects implemented according to project plans comprising Annexes for Cooperation						■	■	■	■	■		
Noblis submits final Mid-Resolution Standards Report to the USGS					■							
Noblis Report circulated to LSI Constellation Study Team for review and comment.					■	■						
LSI Constellation Study Team working group builds on Noblis work and ST member input to define final mid-resolution standards for future LSI systems						■	■	■				
Final Mid-Resolution Standards endorsed by LSI Constellation Study Team and submitted to SIT									■			
Specific data requirements for filling holes in FRA2010 base data set provided by FRA2010 Project				■	■	■	■					
LSI Constellation Study Team members locate and secure their agency's permission to provide needed data to FRA2010 Project .							■	■	■	■		

IV. Goal 2 - Initiate a New RADAR Focus Area

Background. Although there was general consensus among members and representatives at the Sanya Study Team meeting to complete unfinished 2007 tasks related to mid-resolution optical LSI systems, there also was consensus among Study Team members that the LSI Constellation needs to move beyond mid-resolution optical systems and focus efforts on other categories of LSI systems. At the Sanya meeting, a number of candidate categories were proposed by Study Team members/representatives, including radar, thermal infrared, lidar, coarse-resolution optical systems, high-resolution optical systems, and spaceborne imaging spectroscopy. It was agreed that all have merit, and that eventually all the categories previously mentioned should be appropriately addressed as part of LSI Constellation studies. In the end, however, there was strong consensus that 2008 focus should be on radar systems.

Objectives. The primary objective of this 2008 goal is to define the LSI Constellation strategy and plans for its focus on radar systems. It also is an objective to begin initial implementation of the activities developed during the planning phase of the LSI Constellation’s focus on radar topics and issues.

Approach. LSI Constellation Study Team members whose agency currently operates a land surface imaging radar system, or that has plans to launch a radar system in the near-term, will be asked to serve on (or recruit an agency colleague to serve on) the LSI Constellation Study Team’s Working Group on Radar (WGR). Radar user community representatives also will be recruited to serve on the WGR. The WGR will prepare the LSI Constellation strategy and initial work plan for developing standards for future LSI Constellation radar systems, as well as for addressing important current and near-term issues facing the LSI radar community, particularly users of radar data. Based on the strategy developed, the WGR will identify and begin work to accomplish initial radar tasks in 2008.

Deliverables. Two primary deliverables are planned for this goal in 2008: 1) a LSI Constellation **strategy paper** for developing standards for future radar LSI systems and for addressing important current and near-term problems and issues facing the LSI radar community; and 2) an **initial radar work plan** that identifies one or more tasks that the WGR can begin working on in 2008.

Tasks & Timelines.

2008 Work Task	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Establish the LSI Constellation Working Group on Radar (WGR)				—								
WGR to develop LSI Constellation strategy for radar and prepare Strategy Paper					—	—						
Based on Radar Strategy Paper, WGR to prepare an initial LSI Constellation Radar Work Plan							—	—				
Under direction of the LSI Constellation WGR, being work on task(s) defined in radar work plan.								—	—	—		

V. Goal 3 - Compile One or More Regional, Mid-Resolution Optical LSI Data Sets for Use by the General Land Remote Sensing User Community.

Background. In recent years, the high value of regional and global datasets, particularly those compiled from mid-resolution optical sensors, to many segments of the land remote sensing user community has been demonstrated by the great popularity of the *Global Land Survey* (GLS)

datasets. GLS data sets have been produced (or are in production) using primarily Landsat data for the circa 1985, 1990, 2000 and 2005 time periods. These datasets are sources of free, terrain-corrected, orthorectified global imagery of the land surface, and the data have been used by thousands of agencies and scientists in virtually all countries of the world. These datasets have revolutionized the use of mid-resolution imagery for studying large areas. Their value to the science community, in general, and the earth observation community, in particular, has been immense.

The GEO Task on Land Cover (DA-07-02) includes a task to “collect and make openly available mid-resolution image data for the following time periods: 1990, 1995, 2000, 2004-06, 2009-2011.” Except for the 2009-2011 period, these data sets are either complete or currently being produced. The production of the 2009-2011 period data set largely from Landsat data is problematic because of the age of Landsat 5, the scan-line corrector problem on Landsat 7, and near certainty that the Landsat Data Continuity Mission (LDCM) will not launch before late 2011, at the earliest. The LSI Constellation Study Team has been approached by DA-07-02 participants to coordinate the collection and compilation of a global data set acquired by mid-resolution LSI systems operated by CEOS member agencies.

At its recent meeting in Sanya, the LSI Constellation Study Team considered various options for selecting, as its third goal for 2008, a data compilation task that would benefit the global land remote sensing user community. While there is great support for compiling a global mid-resolution data set centered on 2010, the Study Team opted not to claim that as its third goal for 2008. Rather, it decided to compile one or two regional data sets (regions yet TBD) from data collected by mid-resolution optical systems currently operated by CEOS agencies. However, it also was explicitly noted that such an exercise should be considered as the first step in a longer-term goal to compile a global mid-resolution optical LSI data set centered on 2010.

Objective. The objective of this goal is to compile one or two regional data sets (regions yet TBD) from data collected by mid-resolution optical LSI systems currently operated by CEOS member agencies that will be openly available for use by the international earth observation user community.

Approach. The implementation of this goal will be the responsibility a LSI Constellation Working Group on Regional Data Set Compilation (WGRDSC), which will be comprised of members from CEOS agencies that currently operate mid-resolution LSI systems, as well as members from the land remote sensing user community. The Study Team Co-Chairs will be responsible for creation of the WGRDSC. The WGRDSC will select one or more regions (sub-continental) for which mid-resolution optical LSI data sets will be compiled from existing data acquired in 2008, or from data yet to be acquired, by CEOS member agency satellite systems. The WGRDSC also will develop an implementation plan for accomplishing this goal. The plan will detail the strategy for determining what systems appropriately can contribute to the selected regional compilation(s), outline a plan for determining what existing data can contribute to the compiled data sets, and propose a strategy for acquiring data needed to complete the regional compilation(s). The WGRDSC also will be involved in developing the arrangements that will be needed with CEOS agencies to 1) provide existing data and 2) acquire needed data to complete the regional compilation(s), however responsibility for such arrangements will lie with the full LSI Constellation Study Team.

Deliverables. The most important deliverable from this goal will be the **data** provided to the regional data set compilations that are the focus of this goal. However, an important interim deliverable will be **the implementation plan** for this goal to be developed by the WGRDSC. Likewise, **arrangements with CEOS agencies**, which operate mid-resolution optical LSI

systems, to provide and acquire data needed for the regional data set compilations also will be an important deliverable.

Tasks & Timelines.

2008 Work Task	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Establish the LSI Constellation Working Group on Regional Data Set Compilation (WGRDSC)				■								
WGRDSC select one or more sub-continental size regions for compilation of mid-resolution data set(s)				■	■							
WGRDSC develop implementation plan for completion of regional data set compilation goal					■	■	■					
Carry out tasks defined in implementation plan								■	■	■	■	■
LSI Constellation Study Team to work with appropriate CEOS agencies to develop arrangements for providing and acquiring data needed for regional data set compilations								■	■	■	■	■

VI. Summary of 2008 Tasks and Timelines

2008 Work Task	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Complete 2007 Tasks												
Create Annexes for Cooperation from three draft agreements.				■								
Mid-resolution agency members on LSI Constellation Study Team review and comment on Annexes.				■	■							
Final draft of Annexes for Cooperation completed and sent to mid-resolution agencies with invitations to participate in cooperative activities described.					■							
Cooperative projects implemented according to project plans comprising Annexes for Cooperation.						■	■	■	■			
Noblis submits final Mid-Resolution Standards Report to the USGS.					■							
Noblis Report circulated to LSI Constellation Study Team for review and comment.					■	■						
LSI Constellation Study Team working group builds on Noblis work and ST member input to define final mid-resolution standards for future LSI systems.						■	■	■				
Final Mid-Resolution Standards endorsed by LSI Constellation Study Team and submitted to SIT.									■			
Specific data requirements for filling holes in FRA 2010 base data set provided by FRA2010 Project.					■	■	■	■				
LSI Constellation Study Team members locate and secure their agency's permission to provide needed data to FRA2010 Project.								■	■	■	■	
Initial New LSI Constellation Radar Focus Area												
Establish the LSI Constellation Working Group on Radar (WGR).				■								
WGR to develop LSI Constellation strategy for radar and prepare Strategy Paper.					■	■	■					
Based on Radar Strategy Paper, WGR to prepare an initial LSI Constellation Radar Work Plan.							■	■				
Under direction of the LSI Constellation WGR, being work on task(s) defined in radar work plan.									■	■	■	■
Regional Data Set Compilation												
Establish the LSI Constellation Working Group on Regional Data Set Compilation (WGRDSC).				■								
WGRDSC select one or more sub-continental size regions for compilation of mid-resolution data set(s).				■	■							

Regional Data Set Compilation (cont.)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
WGRDSC develop implementation plan for completion of regional data set compilation goal.						—	—					
Carry out tasks defined in implementation plan.								—	—	—	—	—
LSI Constellation Study Team work with appropriate CEOS agencies to develop arrangements for providing and acquiring data needed for regional data set compilations.								—	—	—	—	—
Prepare 2008 LSI Constellation Study Report for Presentation at 22 nd CEOS Plenary.									—	—	▲	▲

VII. Summary of 2008 Deliverables

1. Three **Annexes for Cooperation** and the resulting **cooperative projects**, carried out by CEOS agencies that currently operate mid-resolution optical LSI systems, to enhance user access to data, coordinate data acquisition strategies, and address important issues related to ground system operations.
2. **Standards** for future mid-resolution LSI systems.
3. **Data** provided to the FRA2010 Project.
4. **Radar strategy paper**.
5. Initial **radar work plan**.
6. **Implementation plan** for regional data set compilation.
7. **Arrangements with CEOS agencies** for providing and acquiring mid-resolution, optical LSI data.
8. **Data** provided for regional data set compilation.