CEOS Land Surface Imaging Constellation
Study Team Meeting

Hosted by National Remote Sensing Center of China

Rendezvous Hotel
Sanya, China
February 24-25, 2008

Meeting Summary

The CEOS Land Surface Imaging (LSI) Constellation Study Team held its second meeting (LSI-2) in Sanya, China on February 24 & 25, 2008 in conjunction with the joint meetings of the CEOS Working Group on Calibration and Validation (WGCV) and CEOS Working Group on Information Systems and Services (WGISS). The meeting was graciously hosted by National Remote Sensing Center of China (NRSCC).

The following LSI Constellation Study Team Members (or their representative) participated in the meeting, which was co-chaired by G. Bryan Bailey (USGS) and by Michael Berger (ESA) in the absence of Co-Chair, V. Jayaraman (ISRO):

Bryan Bailey (USGS)
Michael Berger (ESA)
Yonghong Zhang (NRSCC)
Leila Fonseca (INPE, for Joao Vianei Soares)
Keiji Imaoka (JAXA, for Takeo Tadono)
Changyong Cao (NOAA, for Kevin Gallo)
Chris Blackerby (NASA)
S.P. Karthikeyan (ISRO, for V. Jayaraman)
Satish Srivastava (CSA, for Daniel DeLisle)
Greg Stensaas (CEOS WGCV)
Stephen Ungar (CEOS WGCV)
Jean Pierre Antikidis (CEOS WGISS)
John Townshend (U. Maryland).

Also participating in the meeting were:

Martha Maiden (CEOS WGISS Chair)
DeWayne Cecil (CEOS SEO)
Gyanesh Chander (CEOS WGCV)
Jiahong Li (NRSCC)
Xiaohua Yi (CRESDA)
Paul Davis (U. Maryland).

Bryan Bailey welcomed Study Team members and other participants to the meeting and thanked everyone not only for their participation in the meeting, but also for their support of LSI Constellation Study Team activities. Yonghong Zhang, on behalf of our meeting host NRSCC, also welcomed participants to the meeting and to China.

Bryan Bailey then proposed the meeting objectives as follows:

- **Review and Reflect On 2007 Activities.** *What are the Lessons Learned from 2007 that can make us more effective in 2008? What still needs to be completed from our 2007 Work Plan?*
- **Look Strategically at LSI Constellation Activities**. *What is the scope of our overall task? What defines success? What defines completion? How do we better organize ourselves to accomplish the work? How do we best utilize WGCV, WGISS, SEO, etc.?*
- **Define a strong, but largely achievable 2008 Work Plan.**

There was brief discussion of these objectives, and they were accepted by the Study Team as appropriate objectives for the meeting.

Following a review of the meeting agenda (Attachment 1), meeting participants introduced themselves and shared some general information about their interests and expertise as relate to remote sensing in general, and the LSI Constellation, in particular.

Next, Bryan Bailey led a review and discussion of LSI Constellation activities conducted in 2007 by presenting the report he made to the CEOS Plenary held last November in Hawaii. That presentation stated the **fundamental mission** of the CEOS Land Surface Imaging Constellation is 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. That is, the fundamental mission is to *expand and enhance the beneficial use of space-acquired image data of the global land surface.* To help accomplish this mission, the LSI Constellation Study Team identified two primary objectives. The first addresses the primary emphasis of the original CEOS Constellation Concept Paper ***to define standards for the development of future LSI systems***. And the second reflects the early guidance from the CEOS SIT to also ***meaningfully address current and near-term problems and issues*.**

Consequently, 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 optical 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.

Bailey pointed out that 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:

- 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.

- 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.
- User information requirements upon which to base the definition of preliminary standards for future mid-resolution LSI systems were compiled.
- A rather high-level list of such preliminary standards was developed.
- 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.

The 2007 LSI Constellation Plenary Report also noted the participation by the CEOS agencies that contributed to 2007 LSI Constellation activities, and it outlined initial activities planned in 2008 and key challenges likely to be faced by the LSI Constellation Study Team. Notable among such challenges is securing sufficient resources to accomplish the important work the Constellation hopes to achieve. Finally, the report included a request to CEOS space agencies for their support of LSI Constellation activities, in general, and specifically the report requests each space agency to contribute 20% of one person's time to work on LSI Constellation activities and funds to support their participation at two LSI Constellation Study Team meeting each year.
Study Team members discussed 2007 activities in the context of lessons learned last year and what needs to change in 2008, as well as how greater staff resources can be brought to bear on 2008 activities. Study Team members generally agreed that important accomplishments resulted from 2007 activities, both in terms of meeting 2007 goals and objectives and in terms of publicizing LSI Constellation intentions and efforts. However, some members felt that more frequent dialog among the Study Team, more realistic objectives, designation of task leaders for specific tasks, and setting and enforcing due dates could help make 2008 activities more effective.

Following lunch, the LSI Constellation Study Team began its more detailed review and discussion about the status of specific 2007 activities and plans for completing unfinished tasks in 2008. Members briefly reviewed the compilation of recommendations from LSI data users about the types of specific cooperation that agencies that currently operate mid-resolution optical LSI systems could engage in to improve the value of the date they provide.

The recommendations received from the user community (noted above) formed the basis for three separate agreements, or annexes to the Declaration of Intent signed by seven agencies, that define specific activities for mid-resolution agencies to cooperate together in completing. These agreements describe user-endorsed activities in the area of ***enhanced user access to data***, ***acquisition of data***, and ***ground segment operations***.

The three previously drafted agreements were reviewed by Study Team members, who concluded that all three agreements were appropriate as drafted. Bryan Bailey reported that none of the seven agencies that were provided copies of the agreements late last year had provided any feedback on their contents. It was decided that the agreements should be re-sent to the seven agencies that signed the Declaration of Intent, and they each should be asked to provide suggestions for revision (or endorse the current contents) by a specified date. Following that date, the three agreements will be finalized based on input received from the agencies, and efforts will be made to secure signatures from agencies interested and willing to cooperate in the activities described in the three agreements.

ACTION: Re-send the agreements to the seven agencies that signed the Declaration of Intent and ask for their suggestions for revision by May 15, 2008.

Study Team members also reviewed the status of efforts to develop preliminary standards for future mid-resolution LSI systems by examining the process that Noblis (under contract to and direction of the USGS) employed to compile user requirements and translate those requirements first into system requirements and then into preliminary standards for mid-resolution systems. They also reviewed the preliminary standards developed via the Noblis effort. In general, Study Team members concurred with and were complimentary about the suite of standards proposed by Noblis. However, some exception was taken with some of the standards proposed, particularly as relate to metadata and formatting standards and product delivery methods. Consequently, it was decided that the table of preliminary standards should be reviewed by selected members of the CEOS WGCV and WGISS, as well as by selected members of the land remote sensing user community, and input from those reviews should forwarded to Noblis and used to make appropriate revisions to the proposed standards.
ACTION: Initiate a review, by selected users and by selected WGCV & WGISS members, of preliminary standards for future mid-resolution LSI systems proposed by Noblis. Input from these reviews will be provided to Noblis for appropriate revision of the proposed standards.

The LSI Constellation Study Team also discussed the question of defining mid-resolution LSI standards for additional mid-resolution system parameters, particularly more detailed parameters many of which might be considered sub-categories of the major categories for which preliminary standards were defined. It was decided that input regarding what additional categories, or sub-categories, of system parameters should be included for standard definition also would be solicited from of individuals being asked to review the preliminary set of standards already developed.

In addition, the Study Team briefly discussed the list of more detailed parameters proposed by Noblis as examples of the types of sub-categories for which additional LSI Constellation standards for mid-resolution optical systems could be developed. There was general concurrence that the list was pretty good in terms of the next level of detail that needs to be covered by the standards. If anything, Study Team members thought there may be some of the more detailed categories proposed by Noblis that were, perhaps, too detailed for inclusion in a suite of mid-resolution optical system standards.
ACTION: Input about additional categories or sub-categories for standards definition to be requested from the individuals asked to provide input in the previous Action.

The Study Team reviewed the history and status of efforts to provide mid-resolution data needed by the U.N. FAO Forest Resource Assessment 2010 (FRA2010) to fill holes in its base data set, which is comprised dominantly of Landsat data. Until recently, the FRA2010 Project had been unable to provide the LSI Constellation Study Team with detailed information about where gaps existed in that base dataset. Consequently, the Study Team had been prepared a draft agreement, which described the nature of the FRA2010 data contribution effort and asked the mid-resolution space agencies to commit to providing up to 400 20km-by-20km image chips to the FRA2010 project. However, the Study Team has recently been provided with location information that begins to identify exact data requirements. The Study Team decided to abandon the general agreement previously drafted in favor of working with the FRA2010 Project to fully define exact data requirements and base applicable agreements on those detailed requirements.

The last item of business on the first day the LSI Constellation Study Team meeting was a *tour de table* with Study Team members and representatives from the space agencies talking about their agency's plans and activities in the area of land remote sensing, in general, and as relate particularly to supporting the CEOS LSI Constellation. Numerous interesting activities and plans were described, but this summary makes no attempt to capture the details of comments made during the *tour de table*.

The first day of the meeting adjourned shortly past 5:00 p.m.

Day 2 of the LSI Constellation Study Team meeting began with a rather detailed review of discussions and actions from the first day of the meeting, primarily for the benefit of several members and representatives of members who had not been able to attend the meeting's first day.

Emphasis then shifted to **strategic planning**. Study Team members reaffirmed their support for the LSI Constellation mission statement, which is ***"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 (SBAs)."*** Significantly, this mission addresses not only the building and launching of satellite systems, but also the development and operation of associated ground segments and their ability to get critical data efficiently into the hands of many interdisciplinary science users. To address its mission, the LSI Constellation has defined both longer- and nearer-term goals, as exemplified, respectively, by definition of standards for future LSI systems and by efforts to get space agencies to cooperate more in the operation of existing systems.

Discussions during this strategic planning session suggested that what may be missing from current LSI Constellation activities and plans are some "intermediate" goals and objectives, like those that could be defined to enhance the effectiveness of systems that currently are under development but whose launch is still some years away, such as Sentinel 2 and LDCM. While no specific goals or objectives for this intermediate category of potential activities were suggested, all agreed that further consideration of such intermediate goals and objectives is warranted.

The focus of LSI Constellation activities in 2007 was on mid-resolution optical systems, and the Study Team decided to complete the unfinished tasks from 2007 in 2008. However, there also was general 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. 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. The Study Team spent some time discussing and debating the pros and cons of focusing upon these various systems, but delayed selecting a category to focus on in 2008 until addressing development of the 2008 LSI Constellation Work Plan.

The Study Team also addressed the question of agency membership on this Study Team. For starters, as a new member of CEOS, CRESDA will appoint a member to the LSI Constellation Study Team. This is particularly important as CRESDA likely is the logical agency, because of its responsibilities for CBERS, to sign the Declaration of Intent. **ACTION: CRESDA to appoint a member to the LSI Constellation Study Team**.

Also as relates to membership, the suggestion was made that the German Aerospace Center (DLR), because of their role with radar systems, particularly, should be invited to appoint a member to the LSI Constellation Study Team. **ACTION: Co-Chairs to invite DLR to appoint a member to the Study Team.**

By the time the Study Team expressly addressed itself to the topic of Formulating the 2008 LSI Constellation Work Plan, it already had covered several topics that would influence the selection of 2008 LSI Constellation goals. Specifically, the Study Team had decided to complete **unfinished tasks from 2007** (*agreements for specific cooperation among agencies that currently operate mid-resolution LSI systems; complete standards development for future mid-resolution systems; and provide need data to FRA2010 Project*), and it had decided to move beyond mid-resolution systems and select a new category of LSI systems to focus on in 2008 as its second major goal.

Consequently, discussion related to formulating a work plan for 2008 focused on selecting a relevant activity as the 3rd primary LSI Constellation goal for 2008. There was support for selecting an activity that would have short-term benefits to users. At least two proposals were made that related to providing enhanced user access to global data sets. One proposal was for all agencies that operate mid-resolution LSI systems to contribute a global data set from their system that would be openly available to all users. While such multiple global data sets would be welcomed by the user community, Study Team members agreed that the likelihood of succeeding in such an effort was very low. Another proposal was to compile a global data set from existing systems and centered on 2010. A third suggestion was to focus on compiling one or two regional data sets from existing mid-resolution systems and make these data readily available to all users. The merits of these latter two proposals were discussed by the Study Team at some length. In the end, it was decided to attempt 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, the selection of this 3rd 2008 LSI Constellation Study Team goal was made with Study Team consensus that this effort should be the first step in a longer-term goal to compile a global mid-resolution data set centered on 2010.

Following lunch, the Study Team returned to its rather lengthy discussion about which different category of LSI systems to focus on in 2008. There was general consensus that all had merit, and that eventually all the categories previously mentioned should be appropriately addressed by the LSI Constellation Study Team. In the end, however, there was strong consensus that 2008 focus should be on radar systems. **ACTION: Establish an LSI Constellation working group, chaired by an LSI Constellation Study Team member or representative from a CEOS agency that currently operates LSI radar systems, to define the LSI Constellation strategy and plans for its focus on radar systems. Use, as a starting point, the general approach employed for mid-resolution systems that seeks to both define standards for future systems and address near-term problems and issues.**

Due to time limitations, it was decided to make no attempt to actually draft a 2008 Work Plan. Rather, Bryan Bailey took an **action to prepare and circulate for review (no later than April 15) a draft 2008 LSI Constellation Work Plan.**

Finally, the LSI Constellation Study team talked about what roles the CEOS WGCV and WGISS, as well as the CEOS Systems Engineering Office (SEO) might be able to play in the execution of the

LSI Constellation 2008 Work Plan. The WGISS had previously approached the LSI Constellation about helping implement some of the activities defined in the annexes to the Letter of Intent signed by seven CEOS agencies that operate mid-resolution LSI systems, particularly as relate to enhanced user access to data and ground systems operations. The offer of such help certainly is welcomed and appreciated by the LSI Constellation Study Team, yet it is recognized that key to being able to fully benefit from such assistance will be getting necessary arrangements in place (via the annexes) among at least some of the agencies. It addition and as noted earlier, the Study Team talked about how the WGCV and WGISS might be able to assist in the definition of standards for future mid-resolution LSI systems, as well as in the definition of systems other than mid-resolution when they are addressed by the LSI Constellation Study Team. The WGCV and WGISS meetings scheduled for the coming week will provide opportunities for the Study Team to further explore possible roles for these two working groups in carrying out LSI Constellation activities.

DeWayne Cecil, who represented the CEOS SEO at the WGISS and WGCV meetings, also stopped by the LSI Constellation Study Team meeting and made an ad hoc presentation on a study that the SEO had conducted to compare the characteristics and capabilities of Landsat 7 ETM+, Sentinel 2, and Rapid Eye, particularly as relates to global revisit capabilities. The presentation was interesting and resulted in discussion among the Study Team members and representatives about how the LSI Constellation might better use the SEO in the future. Key to doing that will be to define tasks where LSI Constellation requirements match well with the experience, expertise, and capabilities of the SEO. In fact, the same can be said about our effort to best utilize the WGCV and WGISS in the execution of LSI Constellation activities.

In context with the revisit study part of the SEO study, Michael Berger described the SaVoir software, which ESA has developed and would make available to future LSI Constellation studies of this type.

The next meeting of the LSI Constellation Study Team was not explicitly scheduled, but it was agreed that such a meeting should be held in the late summer or early fall.

Actions taken during the meeting were summarized as follows:

- **ACTION: Re-send the three annexes to the seven agencies that signed the Declaration of Intent and ask for their suggestions for revision by May 15, 2008.**

- **ACTION: Initiate a review, by selected users and by selected WGCV & WGISS members, of preliminary standards for future mid-resolution LSI systems proposed by Noblis. Input from these reviews will be provided to Noblis for appropriate revision of the proposed standards. (March 7, 2008)**

- **ACTION: Request input about additional categories or sub-categories for standards definition from the individuals asked to provide input in the previous Action. (March 7, 2008)**

- **ACTION: CRESDA to appoint a member to the LSI Constellation Study Team. (March 1, 2008)**

- **ACTION: Co-Chairs to invite DLR to appoint a member to a member to the Study Team. (April 15, 2008)**

- **ACTION: Establish an LSI Constellation working group, chaired by an LSI Constellation Study Team member or representative from a CEOS agency that currently operates LSI radar systems, to define the LSI Constellation strategy and plans for its focus on radar systems. Use, as a starting point, the general approach employed for mid-resolution systems that seeks to both define standards for future systems and address near-term problems and issues. (May 15, 2008)**

- **Prepare, and circulate, for review a draft 2008 LSI Constellation Work Plan. (April 15, 2008)**

The LSI Constellation Study Team meeting adjourned shortly before 5:00 p.m.

ATTACHMENT 1

CEOS Land Surface Imaging Constellation Study Team Meeting

Rendezvous Hotel – Ballroom 1
Sanya, Hainan **Island, China**
February 24-25, 2008
Hosted by National Remote Sensing Centre of China

Agenda

Sunday, February 24

8:30	Registration	Room TBD
9:00	Welcome	Co-Chairs & NRSCC
9:30	Meeting Objectives & Review Agenda	Co-Chairs
9:45	Introductions	All
10:00	LSI Constellation 2007 Activities Review & Discussion	Co-Chairs/Study Team
	• Review of 2007 Plenary Report	Co-Chairs
	• Discussion of Accomplishments and Shortcomings	All
	• Lessons Learned – What Needs to Change in 2008?	All

12:00 Lunch

1:30 LSI Constellation 2007 Activities Review & Discussion (cont.) — Co-Chairs/Study Team
- Status of 2007 Activities & Plans for Completion — All
  - Agreements for Cooperation in the Operation of Existing Mid-Resolution LSI Systems
  - Definition of Standards for Future Mid-Resolution LSI Systems
  - Providing Data to the FRA2010

4:00 Agency Activities and Plans in Support of the LSI Constellation — Agency Members/Delegates
- Agency Reports
- Discussion

5:30 Adjourn

* Short morning and afternoon breaks to be taken as convenient.

Monday, February 25

8:30 Strategic Planning Session — Study Team
- Long-Term LSI Constellation Goals/Objectives
- Focus Areas for Future Years
- Study Team Membership Requirements in Future Years
- Addressing Resource Issues

10:30 Formulating the 2008 LSI Constellation Work Plan — Study Team

12:00 Lunch

1:30 Formulating the 2008 LSI Constellation Work Plan (cont.) — Study Team

3:30 Roles for CEOS WGCV, WGISS, and SEO in 2008 LSI Constellation — Study Team

5:00 Next Meeting

5:15 Adjourn

* Short morning and afternoon breaks to be taken as convenient.