

Committee on Earth Observation Satellites (CEOS)
Land Surface Imaging Virtual Constellation (LSI-VC)
Terms of Reference

3 July 2024

Remotely sensed observations acquired from satellites are fundamental to understanding the effects of natural and human-induced changes on the Earth system. They provide frequent and comprehensive observations across large terrestrial areas which contribute to notably improve observation capacity and thereby Earth science and monitoring programs, and the policies and practices of governments and people across the globe.

Land surface imaging satellites have been in operation since 1972. Numerous such instruments are now in operation across space agencies, many of which are represented in CEOS. Data volumes are large with an ever-increasing depth of time series, but they are also cross-cutting amongst various societal benefit domains.

Used in a coordinated manner, these instruments from multiple agencies can form a ‘Virtual Constellation’, with the coordinated effort achieving far more than the sum of the individual parts. This presents great opportunities, along with enormous challenges, to use these assets to serve many different domains. These include:

- Optimizing the use of these assets to maximize global coverage and minimize important data gaps;
- Making it easier for users to interact with such vast amounts and diversity of collected data, challenged by the ever-increasing depth of satellite imagery collections over time;
- Supporting downstream users to better enable them to seamlessly utilize the data generated from these various systems.

Mission Statement and Objectives

The Land Surface Imaging Virtual Constellation (LSI-VC) exists to maximize the value derived from CEOS Agency land surface imaging assets and activities by providing an overarching coordination role.

The responsibility of the LSI-VC is to facilitate coordinated and optimized land surface imaging contributions from CEOS Agencies to enable access to fundamental measurement products in support of confirmed/validated requirements linked to adopted CEOS priorities. These priorities are typically derived from scientific users and key stakeholders, such as UN agencies/programs and GEO.

The LSI-VC aims to optimize the use of existing and future land surface imaging assets and data to better meet user needs by:

- Promoting sustained and systematic collection of satellite-derived land surface imaging observations, by sharing information on future mission development.

- Bringing together validated requirements identified by downstream user communities in order to identify:
 - opportunities to better optimize, and increase resilience within land surface imaging programs;
 - current and potential data gaps encompassing geographic and temporal coverage, as well as in the context of land monitoring requirements.
- Coordinating the production and distribution of, and the ability to analyze, fundamental measurements derived from land surface imaging observations (e.g., surface reflectance, land surface temperature, calibrated radar measurements).
- Facilitating maximum utilization of land surface imaging observations through the development and promotion of common standards such as CEOS Analysis Ready Data (CEOS-ARD); making land surface image products more easily discovered and ready for analysis (i.e., findable, accessible, interoperable and reusable (FAIR)), including by non-expert users.

Characterization of the Space Segment and Measurements Concerned

All space-based remote sensing instruments operated by CEOS Agencies, capable of characterizing the land surface, its changes over time, and its organic and inorganic material, fall within scope. This includes space-based remote sensing instruments operating in the optical and microwave portions of the electromagnetic spectrum. The term ‘imaging’ is not intended to be limiting; current and emerging land surface measurements that do not form a continuous or comprehensive ‘image’ may also be in scope.

Scope of Activities

The LSI-VC applies a CEOS multi-agency perspective to the following activities:

- Assessing land surface imaging data requirements, identifying the fundamental measurements necessary from land surface imaging assets to meet them, and undertaking gap analyses.
- Facilitating the coordination of mission development to ensure the overall set of space assets is optimized, considering the capabilities and limitations of supplying organizations, to support the overall package of validated data requirements.
- Harmonizing, based on inputs received, periodic acquisition planning to optimize asset utilization; helping to resolve competing requirements; and promoting resilience and redundancy within the Virtual Constellation.
- Supporting the coordination of the retrieval and reprocessing of historical products as needed to fill gaps in archives, ensuring support for validated time series analysis requirements.
- Supporting the coordination and implementation of consistent calibration and pre-processing approaches to ensure that observations are used to produce

comparable fundamental measurement products for user benefit.

- Assist the implementation of CEOS land surface imaging data processing, distribution, and analysis capabilities including those being developed by the CEOS Systems Engineering Office (SEO) and the Working Group on Information Systems and Services (WGISS), which enable the broadest user access to fundamental measurements for generating derived products.

Outcomes

The activities of the LSI-VC are undertaken with a view to:

- The harmonization of future and existing mission acquisition plans across major international land surface imaging programs based on a reliable understanding of domain-specific requirements, and;
- The efficient use of very large land surface imaging datasets, enabled by suitable data architectures and non-domain specific land surface measurements that are ‘analysis-ready’ and interoperable.

Sub-Groups

In order to focus on specific areas of interest, sub-groups have been created under LSI-VC. These sub-groups are focused on a specific thematic area and will maintain their relationships with their respective stakeholders and user communities, particularly in support of GEO Flagships. They will focus on data acquisition and user requirements associated strategies for their thematic areas, which will feed into the overall requirements considered by LSI-VC. The current LSI-VC sub-groups are:

- **GEOGLAM:** focused on space data coordination (toward promoting acquisition, access, and use) for the GEO Global Agricultural Monitoring initiative (GEOGLAM).
- **Forests & Biomass:** focused on relevant applications, including space data coordination for the Global Forest Observations Initiative (GFOI).

The approval of sub-groups will be made by the CEOS SIT Chair through recommendation of the LSI-VC co-leads and the prospective sub-group leadership. Sub-group work plans, chair selection and rotation, and all other governance issues will follow the processes defined in their individual governing documents.

Meetings

The LSI-VC will primarily utilize email exchanges, teleconferences/video conferencing sessions, and workshops as needed to fulfill its objectives. There will be two face-to-face meetings planned per year, typically around the annual SIT and SIT Technical Workshop meetings for travel efficiency. Co-Leads are expected to each attend at least one of the face-to-face meetings each year, preferably both.

Participation and Membership

LSI-VC’s official membership consists of representatives of CEOS Agencies and their delegates.

Participation is open to all CEOS Agencies and other organizations (at the discretion of the Co-Leads) that are willing to support and contribute to the priorities of LSI-VC and other activities that are in scope for LSI-VC.

Leadership

To ensure smooth operation, the LSI-VC operates with a team of Co-Leads selected from CEOS Agencies that participate in the LSI-VC. To promote leadership diversity, the LSI-VC aims to distribute Co-Lead responsibilities across all of the major geographic regions (the Americas, Europe/Africa, Asia/Pacific).

In the case where a Co-Lead, for any reason, cannot continue to serve in a leadership position, their agency will have the first option to fill the position with an alternate. If the agency chooses not to nominate an alternate, the LSI-VC will seek nominees from other CEOS Agencies that are active in the LSI-VC.