

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

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Remotely sensed observations acquired from satellites are fundamental to understanding Earth system functioning and the effects of natural and human-induced changes on the global environment. 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.

Satellites with instruments that image the land surface have been in operation since 1972. Numerous land remote sensing instruments are now in operation across many 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, providing valuable information across many of the Group on Earth Observations (GEO) Societal Benefit Areas. These data are likewise relevant to progressing many of the United Nations 2030 Sustainable Development Goals.

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 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.
- Drawing together validated requirements identified by downstream user communities to:
  - Identify opportunities to better optimize, and increase resilience of, land surface imaging programs;
  - Identify current and potential data gaps (both in terms of geographic and temporal coverage, and in land monitoring requirements).
- Coordinating the production and distribution of, and the ability to analyze, fundamental, non-domain specific, measurements derived from land surface imaging observations (e.g., surface reflectance, land surface temperature, calibrated radar backscatter).
- Facilitating maximum utilization of land surface imaging observations through the promotion of common standards; making land surface image products more easily discovered and ready for analysis.

### **Characterization of the Space Segment and Measurements Concerned**

All CEOS Agency space-based remote sensing instruments that generate data that can characterize the land surface and the organic and inorganic material on it and in it are deemed to be in scope. This includes space-based remote sensing instruments operating in the visible, infrared, and microwave portions of the electromagnetic spectrum. The term ‘imaging’ is indicative of current technologies and is not intended to be limiting; 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 that are required 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, within the supplying organizations’ abilities and constraints, to support the overall package of validated data requirements.
- Harmonizing, based on inputs received, periodic acquisition planning to optimize asset use; helping to resolve competing requirements; and promoting resilience and redundancy of the Virtual Constellation.
- Support the coordination of the retrieval and reprocessing of historical products to fill gaps in archives where required to support validated time series analysis

requirements.

- Support the coordination of the implementation of consistent calibration and pre-processing approaches so that observation data are used to produce comparable fundamental measurement products for user benefit.
- Support the implementation of CEOS land surface imaging data processing, distribution and analysis capabilities (such as 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 dedicated to 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 use requirements associated strategies for their thematic areas, which will feed into the overall requirements worked by LSI-VC. The sub-groups are:

- **LSI – GEOGLAM:** focused on space data coordination (toward promoting acquisition, access, and use) for the GEO Global Agricultural Monitoring initiative (GEOGLAM).
- **LSI – 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. The first meeting will be planned for the February timeframe, and the second (around September) will be held jointly with the GEOGLAM and Forests & Biomass sub-groups. The second meeting will be scheduled in concert

with the CEOS SIT Technical Workshop, when feasible, to help reduce travel costs.

### **Membership and Leadership**

LSI-VC participation is open to all CEOS Agencies, and organizations they sponsor, that are willing to support and contribute to activities that are in scope for LSI-VC.

To promote leadership diversity, the LSI-VC will seek to share the three co-lead responsibilities across major geographic regions (the Americas, Europe/Africa, Asia/Pacific).

The LSI-VC has three co-leads. Each co-lead serves a term of three years. Co-leads will rotate out at alternate 1-year intervals to provide an overlap with the two remaining co-leads, in order to maintain continuity through the co-lead transition. LSI-VC will request CEOS Agencies to nominate a new co-lead at the annual Spring LSI-VC meeting. In the case where there is not a co-lead nominee from another CEOS Agency, the current LSI-VC co-lead whose term is expiring will be asked to continue for another term. The incoming co-lead will begin his/her term at the annual Fall LSI-VC Joint Meeting.

In the case where a co-lead, for any reason, cannot fulfill their term, their agency will have the first option to fill the position with an alternate for the remainder of the existing term. If the agency chooses not to nominate an alternate, the LSI-VC will open the position for nominees from other CEOS Agencies.