

**Sub-task Number:** AR-09-02a

**Sub-task Title:** Virtual Constellations

**Overarching Task:** Interoperable Systems for GEOSS

**Area:** ARCHITECTURE

**Relevant Committee:** ADC

**Related Targets:** (to be included in 2009)

**Sub-task Definition** (as given in the 2009-2011 Work Plan):

Advocate rapid development of the “CEOS Constellations Concept”. Observations from a Virtual Constellation would provide better temporal, spatial, and spectral resolution and related data management and dissemination. A series of Virtual Constellations are in definition by space agencies, in consultation with user communities within the CEOS framework, each addressing key GEOSS observation gaps in the process. Prototype Constellations address:

- Precipitation, which aims to strengthen international cooperation on space-based observations of precipitation, including realization of the Global Precipitation Monitoring (GPM) mission and providing guidance to new;
- Land Surface Imaging, designed to ensure the relevant synergy with High Resolution Multispectral Imager Continuity;
- Ocean Surface Topography, designed to ensure continuity of Sea Level measurement in accordance with GCOS requirements;
- Atmospheric Composition, which will address many of the needs for atmospheric observations of the climate community;
- Ocean Colour Radiometry which will provide scientific data products related to marine ecosystems and ocean biogeochemistry for near-surface global ocean and coastal waters;
- Ocean Surface Vector Wind to collect observations of ocean surface vector winds over the global ice-free ocean that will be used for operational analyses and forecasts, as well as retrospective research.

Other cases, for instance constellations of SAR systems or micro-satellites for a range of Earth observation applications, will be considered along the line.

**Leads** (GEO Member or PO, Entity carrying out the work, Contact: e-mail):

CEOS (NOAA) Point of Contact: Mary Kicza, Strategic Implementation Team (SIT) Chair and NOAA Assistant Administrator for Satellite and Information Service; Mary.kicza@noaa.gov

GTOS (GOFC-GOLD)

**Motivation/Background**

CEOS has established the concept of Virtual Constellations for GEO, whereby a number of both existing and already approved satellites or instruments and their observations, when coordinated in their operation and exploitation, can merge or integrate data and derived information to contribute to a (quantitative) analysis/measurement goal. The value of the Constellations concept is its guidance (requirements) for design and development of future systems to meet the broad spectrum of Earth observation requirements. GEO and GEOSS will benefit from this effort because Constellations can help agencies avoid duplication and overlap in Earth observation efforts, close information gaps for all GEO Societal Benefit Areas, and establish and sustain a global Earth observation network.

CEOS Constellation outputs, when joined with *in situ* observations, can contribute to the tailoring of specific services that support end-user customers in relevant SBAs, marking our opportunity as space agencies to contribute to a “value chain” end-to-end system.

**Outputs** (e.g. products and services which result from the activities of the Task/sub-task; outlined in the form of deliverables with timelines)

Planned:

- Assessment of existing and planned systems and gap analysis

- Establishment of user needs and defining product requirements for operational observations through communication with key user groups
- Documentation of opportunities for cooperation in future mission planning
- Demonstration of the value of the projected Constellations for GEO Societal Benefit Areas (SBAs)
- Identification of contributions to comprehensive, sustained observing systems
- Establishment of CEOS Constellation standards across the GEO SBAs

Produced:

- November 2008: Endorsement of the *CEOS Constellations for GEO Process Paper*
- November 2008: Land Surface Imaging Data Portal

*Activities (operations or work processes through which resources are mobilized to produce specific outputs; outlined in the form of milestones including timelines)*

Planned:

The goals of the Constellations, as detailed in the *CEOS Constellations for GEO Process Paper* include:

Move space agencies' coordination efforts from the generic to the specific – *i.e.*, adopting a problem-focused approach to achieve significant results in terms of actual implementation and physical outputs (such as new products or contribution to Fundamental Climate Data Records) within a relatively short time;

Improve considerably the extent to which the combined outputs of the various agency programs are relevant to specific applications, such as climate and other GEO SBAs, and respond to the requirements for space-based observations expressed in, *e.g.*, Integrated Global Observing Strategy (IGOS) Theme reports and the Global Climate Observing System (GCOS) Implementation Plan;

Facilitate the participation of smaller contributors;

Recognize that existing assets could be used more effectively in support of the ongoing GEOSS 10-Year Implementation Plan;

Realize the overall potential benefits at global scale that would result from reduced redundancy and improved continuity and overlap among missions;

Create the conditions, through the adoption of a series of requirements and guidelines which satisfy key GEOSS requirements, whereby all agencies – large and small – as well as other contributors, are able and indeed encouraged to make their contributions to the common objective of developing the space segment of GEOSS; and,

Use an accreditation/recognition process, based on an agreed set of metrics, to ensure that proposed contributions to a Constellation will help to satisfy the relevant community needs.

Progress (current status): ...

**Resources** (*indication of resources – e.g. financial, human – contributed by GEO Members or Participating Organizations to produce outputs*)

Each Virtual Constellation has at least two identified Co-Leads and a number of other CEOS agencies that participate as Virtual Constellation members.

Atmospheric Composition Constellation Co-Leads: Ernest Hilsenrath, NASA and Claus Zehner, ESA

Land Surface Imagining Constellation Co-Leads: Bryan Bailey, USGS and VS Hegde, ISRO

Ocean Surface Topography Constellation Co-Leads: Stan Wilson, NOAA and François Parisot, EUMETSAT

Precipitation Constellation Co-Leads: Steven Neeck, NASA and Riko Oki, JAXA

Ocean Colour Radiometry Constellation Co-Leads: Hiroshi Murakami, JAXA and Nicolas Hoepffner, EC-JRC

Ocean Surface Vector Wind Constellation Co-Leads: Hans Bonekamp, EUMETSAT, BS Gohil, ISRO, and Stan Wilson, NOAA

**Architecture and Data Component**

1) Please briefly describe any task-related Earth observation resources (data set, system, website/portal) and any related Web Service interfaces that are contributed to GEOSS. State whether these items are or will be registered with the GEOSS Component and Service Registry for access via the GEO Web Portals, and whether any associated standards or other interoperability arrangements will be registered in the Standards and Interoperability Registry.

2) Please also describe what data and information your activity/system needs that you would request to be accessible through the GEOSS Common Infrastructure.

**Capacity Building Component**

(capacity building is defined to include the development of capacity related to: (i) Infrastructure and technology transfer (Hardware, Software and other technology required to develop, access and use EO); (ii) Individuals (education and training of individuals to be aware of, access, use and develop EO) and (iii) Institutions – building policies, programs & organizational structures to enhance the value of EO data and products).

1) In accordance with the above definition does this Task have a capacity-building component? If so, please provide a short description of this component including a description of end users.

This Sub-task does have a capacity-building component, especially with respect to the Land Surface Imaging Constellation and data dissemination through the Data Portal, first exhibited at GEO-V Plenary.

2) Have any additional CB needs for this Task been identified? Please provide a short description.

**User Engagement Component**

(please briefly describe to what extent end users are engaged in this Task and influence the nature of the outputs produced)

**Science and Technology (S&T) Component**

1) Please briefly describe the elements of scientific research or technological development contained in this Task.

2) In relation to the S&T component(s) of this task, please describe gaps, priorities, continuity needs, barriers, scientific expertise and additional resource needs (this information will be used for developing a gaps and needs assessment in Task ST-09-01)

**Members and POs' Contributions to Outputs and Activities above:**

(Input is optional. This section gives the chance to Members and POs to provide more details (3-5 lines) on their individual activities, making a clear connection with the Outputs and Activities outlined above).

**Germany**

Deutscher Wetterdienst (DWD)/GPCC: Activities in the framework of the Global Precipitation Climatology Center (GPCC).

**Japan**

JAXA POC to the all constellations.

- 1) LAND: To participate in the CEOS LSI constellation by contributing the available ALOS resources.
- 2) Precipitation: To develop the GPM constellation and the GPM ground system design.
- 3) Atmospheric Chemistry: To develop the Atmospheric Chemistry constellation in cooperation with NASA/OCO project.

NICT: Contribute to GPM Mission.

**USA**

NOAA-NASA: Co-Lead of the Ocean Surface Topography Constellation and Co-Lead of the Ocean Surface Vector Wind Constellation.

**CEOS**

ESA: Zehner co-lead of CEOS ACC; other ESA members contributing to other constellations.

NASA: Improve PC radiometer intercalibration through new methodologies developed by the Precipitation Measurement Missions (PMM) Science Team intercalibration working group in coordination with the CGMS/GSICS.

NASA-CNES: Extend the capability of altimetry to denser observational coverage through the development of swath altimetry

**GCOS**

Provide guidance to development of the Constellations in adhering to the GCOS Climate Monitoring Principles and in meeting needs for climate observations.

*Participation (Table to be filled in 2009):*

Type	Member or PO	Representing	Contact Name	Email Address
Lead(PoC)	CEOS	NOAA	Mary Kicza	Mary.kicza@noaa.gov
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