

CEOS AD HOC TEAMS AND THEIR LIFECYCLE

DISCUSSION PAPER FOR SIT TW SEP 2018

Version 1.2, 31 August 2018

Introduction

This paper has been prepared in support of a discussion planned for SIT Technical Workshop in September 2018 in relation to the lifecycle of the CEOS Ad Hoc Teams and ensuring, as appropriate, consistency in operation of different types of group across the CEOS structure. It builds upon the discussion started at SIT-33 in April and seeks to address the resulting action on the SIT Chair:

SIT-33-11: Include CEOS Ad hoc Team lifecycle and processes as an agenda item on 2018 SIT Technical Workshop. (Rationale: SIT Chair has proposed that CEOS address inconsistencies in the operation of different types of groups across the structure.)

Ad Hoc Teams have provided an important vehicle through which CEOS can more flexibly designate and manage resources and progress on topics of importance that emerge. Some, such as the SDCG for GFOI, are now in their 7th year of operation. SIT-33 provided the opportunity for the CEOS Ad Hoc Teams to:

- reflect and report on their group trajectory and lifecycle in relation to the thematic initiatives that they support; presenting a clear understanding for SIT as to the outlook and evolution of those initiatives and the requirement and objectives for CEOS participation;
- consider the geometry and capacity required to sustain their efforts into the future, and options for doing so as CEOS reflects on whether and how to achieve continuity of progress in areas beyond ad hoc arrangements;
- explore opportunities for synergies and efficiencies across the CEOS structure and our various processes and meetings, seeking consistency wherever possible.

Action 33-11 aims to progress the discussion in these areas at SIT TW and to aim to reach conclusions by the time of CEOS Plenary as to the operation and sustainment of current and future Ad Hoc Teams within the CEOS structure.

Current Ad Hoc Teams and their Operation

The *CEOS Governance and Processes* document notes that CEOS has two permanent working-level mechanisms (Working Groups and Virtual Constellations). And that...

In the event that the permanent mechanisms described in the preceding paragraphs are judged to be insufficient for CEOS to undertake a particular activity, the capability exists for the Plenary to create Ad Hoc Teams. The Plenary assigns short-term objectives to each Ad Hoc Team and defines the team lifetime when the team is created. The primary reporting path for an Ad Hoc Team is either to the CEOS Chair or to the SIT Chair, as designated by the Plenary according to the purpose and function of the Ad Hoc Team. Annually, the Plenary reviews all Ad Hoc Teams for continuation, termination, or transition to a permanent mechanism.

This need has resulted in the following CEOS Ad Hoc Teams as of July 2018:

- the CEOS Ad Hoc Space Data Coordination Group (SDCG) for GFOI – formed at the 2011 CEOS Plenary (pre-dating the current CEOS Governance and Processes documentation); reports to CEOS Chair;
- the CEOS Ad Hoc WG on GEOGLAM – formed in 2012 (pre-dating the current CEOS Governance and Processes documentation); reports to CEOS Chair;
- the CEOS Ad Hoc team on Future Data Architectures – formed in 2015; reports to CEOS Chair;

- the CEOS Ad Hoc Team on the Sustainable Development Goals – formed in 2016; reports to SIT Chair.

Consistency in Procedures

The table below summarizes differences in the procedures for the establishment, reporting and operation of the CEOS WGs, VCs and AHTs.

Entity	Establishment	Responsible	Reporting	CEOS WP	Term
WGs (5)	CEOS Plenary decision	CEOS Chair (SIT Chair secondary if agreed)	- Monthly to CEOS SEC telecons - Annually to CEOS Plenary - Recently added to SIT Chair tag-ups and VC-WG day	48 active targets	Permanent
VCs (7)	CEOS SIT decision, following the VC Process Paper. Rigorous leadership and resourcing criteria	SIT Chair (CEOS Chair secondary if agreed)	- SIT Chair tag-ups & VC-WG day - SIT and SIT TW meetings - Typically covered at Plenary - Not included in CEOS SEC telecons	17 active targets	Permanent
AHTs (4)	CEOS Plenary decision. Light on specifics and on leadership and resourcing.	CEOS Chair <u>or</u> SIT Chair.	- Routine reporting dropped from CEOS SEC telecons in 2018 - Added to SIT Chair tag-ups in 2018 - Added to VC/WG day agenda in 2018 - As agenda dictates at SIT and Plenary meetings	9 active targets	Defined when created with annual renewal at Plenary

The processes for establishment and operation of the VCs are by far the most detailed thanks to the existence of the VC Process Paper. The AHTs are the least directed of the three groups because of the nature of the purpose of the AHTs.

Proposed plans of the Current Ad Hoc Teams

The discussion at SIT TW will seek to improve processes generally but also aim to ensure that there is a clear and appropriate path forward for each of the existing AHTs. The summaries below represent the outcomes of recent consultation with the leadership and stakeholder agencies for each of the four current teams, their proposed plans, and any issues for CEOS attention.

1. SDCG for GFOI

Lead agencies: JAXA (Osamu Ochiai), ESA (Frank-Martin Seifert), UKSA (Joanne Nightingale)

Other active agencies: NASA, DLR, CSA, ASI (and USGS until recently)

2018 status and context: GFOI has entered its second Phase with a refreshed structure and stronger focus on user countries. The logic of the GFOI Methods and Guidance and IPCC-compliant methods appears to be extremely appealing to the major forest donor countries and institutions with UK, Norway and Germany all declaring intention to utilize GFOI processes to direct and coordinate their respective activities and funding. World Bank has also joined as a lead and declared itself willing to

co-lead the new Data Component alongside CEOS. The recent Data Component planning meeting in Tokyo provided a common sense of purpose among GFOI Partners in moving into GFOI Phase 2 and understanding the role of space data, along with a greater emphasis on the tools and services to help countries access and apply the data.

Overall, the future for GFOI looks extremely vibrant as it attracts donor activity and the central role of CEOS in ensuring the global annual baseline coverage is broadly recognized. CEOS puts the 'O' in GFOI.

SDCG Secretariat (SDCG SEC) has long maintained a 3-year Work Plan for CEOS GFOI activities in order to communicate its activities within both GFOI and CEOS. This has recently been updated (currently draft) to reflect the directions and emphasis apparent in Phase 2 of GFOI and the needs and opportunities for space data. The main threads of the new Work Plan being:

- continuation of the global baseline coverage, but with expansion to include the new generation of biomass instruments, seeking to accelerate the policy-relevance of these data-streams including through early provider-user dialogue;
- greater emphasis on tools and services for discovery, access and application of the data – within the GFOI framework to develop shortlists of recommended data and tools;
- technical exchange opportunities among GFOI countries on issues such as CEOS Data Cube for forest monitoring;
- support to the new GFOI Early Warning activity, which will be critically dependent on space data supply;
- establishment of a GFOI reference community for feedback and engagement in CEOS Analysis ready Data standards and pilots;
- coordination with the GFOI R&D Component on a new R&D program to address technical obstacles to space data application.

SDCG sees significant benefits for CEOS and space agencies with an active interest in forest monitoring through our active participation in GFOI, as it develops a critical mass in Phase 2. This includes close engagement with IFIs such as World Bank for sustainment of country capabilities, as well as the logical links through to IPCC and UNFCCC thanks to the GFOI Methods and Guidance.

AHT Plans: A poll of stakeholder agencies as recent as last year concluded that SDCG would best remain as a stand-alone group in service of CEOS engagement with GFOI. This remains the view of SDCG EXEC. It must be determined however whether we have the critical mass of membership and participation to do so.

Issues for CEOS attention: Whilst the CEOS lead for GFOI (JAXA) and the SDCG Co-Chairs (ESA and UKSA) are all committed to the SDCG cause, none of these three agencies is able to bring significant capacity in service of the proposed Work Plan outcomes. SDCG and CEOS had the luxury of significant funding from the government of Australia for SDCG EXEC through to 2017 that essentially provided the operating capacity. With the loss of that funding and of the USGS Co-Chair and representative in 2017, SDCG capacity has been somewhat hollowed out and the group has been operating on a much-reduced basis in 2018.

The opportunity of commencement of Phase 2 of GFOI provides a milestone for CEOS to undertake a senior-level review of the wishes and commitment of space agencies for support for GFOI and to design and contribute to structures and processes to realize it. The expanded scope to include biomass data streams might also dictate consideration of how to import the necessary expertise and agency contacts into the SDCG activities as and when required. It is proposed to start this discussion at SIT TW, with a view to conclusion at CEOS Plenary.

To clarify and simplify the discussion, the current SDCG SEC has signaled its plan to step down from the roles of SEC and Component Manager at CEOS Plenary.

2. GEOGLAM

Lead agencies: NASA (Brad Doorn), CNES (Philippe Maisongrande)

Other active agencies: NASA, CNES, CSA, JAXA, ESA, CONAE, CSIRO, ISRO, SANSa

2018 status and context: In planning for the next phase of GEOGLAM, our community has recognized an expanded range of policy drivers. While our primary focus remains related to the G20 Action Plan on Food Price Volatility & Agriculture's mandate for providing information to support markets, we also recognize the need to support the UN Sustainable Development Goals (UN-SDG), Sendai Framework for Disaster Risk Reduction, and efforts to counter climate change (Paris Climate Accord). An underlying requirement from all these drivers is the need to move towards more quantitative metrics. Fortunately, the GEOGLAM priorities are largely shared with CEOS and the space agencies.

GEOGLAM recognizes the effective relationship we have had to date with respect to data acquisition, as well as opportunities to enhance interaction toward common goals. Although there is an advantage of having data products generated by different agencies from different satellite missions, the user community expressed a clear need to better understand the product characteristics, accuracies and how best to integrate them for seamless analysis.

AHT Plans: GEOGLAM and CEOS are well positioned to work together to develop a coordinated approach to data and services, which will enhance user adoption. However, some of these interactions are beyond the current scope of the Ad Hoc Working Group and could be addressed by the CEOS SEO or other CEOS Working Groups and Virtual Constellations.

The GEOGLAM AHWG recommends that it remain a stand-alone group for the next year. During this time, GEOGLAM will establish options for ongoing global agriculture support from CEOS. Initial concepts have already been discussed for future support. For instance, GEOGLAM has identified the need to evolve our relationship with CEOS in order to leverage the efforts of CEOS to support analysis ready data (ARD), and beyond that, develop application ready data (ARD+) with a focus on "Essential Agricultural Variables" that are consistently validated and interoperable. Also, GEOGLAM data users at end users have identified the need for a coordinated approach for leveraging the proliferation of Information and Communication Technology (ICT) platforms and data services to support the public sector agricultural monitoring system of systems, and believes there is value in coordinating the curation of this proliferation of data, processors, tools, and services to best fit end user needs.

The GEOGLAM AHWG will review organizational options at SIT-34 (April 2019), and plan to present preferred options at the 2019 TW (September 2019) with a recommendation for discussion and decision at CEOS Plenary 2019 (October 2019).

Issues for CEOS attention: In 2015 the GEOGLAM AHWG delivered the "CEOS Strategic Response to GEOGLAM Requirements" which included a transition to a post-Ad Hoc status.

Post-Ad Hoc Working Group CEOS support to GEOGLAM will need to be defined by the Group before it is disbanded. The vision will be to account for the functions of the Group in existing CEOS entities such as the Land Surface Imaging Virtual Constellation (LSI-VC), the CEOS Systems Engineering Office (SEO), and others. Specific roles and responsibilities will need to be developed by the Group in cooperation and consultation with these other entities, but could include:

- *evaluation of new EO requirements and missions, communicate availability of new EO datasets, and facilitate access to datasets by the LSI-VC; and*

- *maintaining open source tools to support data management including the provision for Data Cubes, and support systems analyses by the CEOS SEO.*

As of CEOS Plenary 2015, the nominal timeframe foreseen for such a transition is 2-3 years, with many details remaining to be coordinated.

At that time, LSI-VC was in its initial stages of re-establishment and it was quickly determined that this schedule was too disruptive to LSI-VC activities. GEOGLAM will continue to work more closely with LSI-VC on the CARD4L initiative to define ARD and ARD+ requirements, with an emphasis on developing the fundamental metrics that will support the UN-SDGs. In particular, we would suggest starting with a focus on crop area and crop type mapping (current state and interannual change). To support this, standard accuracy assessment protocols would also be required, and the CEOS WGCV LPV group could also be engaged by GEOGLAM thematic experts. The analytical methods for optical and SAR applications are mature and largely in the operational domain. Therefore, there is an opportunity to capitalize on our progress with a little incremental effort. In those areas where there is demand for these methodologies but utilization is not yet realized, coordination with the WGCapD on comprehensive technology transfer and capacity development also represents an incremental investment with large potential benefit. We believe that this would have a positive impact on GEOGLAM's ability to deliver to our policy and programs community, while providing a showcase for CEOS coordination and space agency assets.

3. FDA

Lead agencies:

ESA (Nicolaus Hanowski), CSIRO (Alex Held), USGS (Steve Labahn).

Other agencies involved:

EC, NASA, CNES, ISRO, and others with varying participation.

2018 status and context: Since the CEOS 2017 Plenary in which FDA intermediate results were presented further consolidation has been achieved. Fundamentally, five topical themes have crystalized, each of which can be decomposed into a set of ongoing practical implementations as well as activities aimed at harmonizing their conceptual framework and at opening pathways for standardization.

The five themes are:

- Analysis Ready Data (ARD), which have been quickly identified as a key component to facilitate and foster EO data uptake especially by user communities, which are not comprised of EO data specialists.
- Data Cubes of which a large variety have emerged. They have proven to fulfill a wide range of traditional and novel user needs and have increased the impact of EO data for various entities. The "CEOS Data Cube" initiative aims at utilizing CEOS Agency resources, global partnerships, satellite data, and CEOS organizational groups for further improving data access, data preparation, and data analysis for all users of satellite data.
- EO User Platforms, which encompass various concepts of virtual data exploitation environments (providing data, tools, processing options, etc.) based on commercial infrastructures (e.g. cloud resources). This constitutes a broader set of initiatives (e.g. DIAS) with the capacity to integrate ARD and data cube components.
- A User Metrics initiative and EO Resource Inventory: User metrics play an important role in the quantitative and qualitative assessments of the attractiveness and impact of the various CEOS FDA

initiatives. Together with an up-to-date inventory of relevant EO resources available through the CEOS community improved programmatic harmonization and planning can be achieved.

- EO Data Analytics was identified in the FDA process as an increasingly important theme in terms of CEOS coordination. Improved data analysis is also seen as a key driver to increase the usability and use of Earth Observation data, in particular by user communities, which have not been acquainted with EO data so far.

AHT Plans:

An FDA Roadmap detailing the five themes exists and a repository of action items has been defined to make further progress (see Annex here). The Roadmap also suggests that the further curation and development of the five FDA themes can be largely continued within the established CEOS bodies most closely associated with them. These are in particular the WGISS and LSI-VC. For regular general updates and a more integrated view for the broader CEOS community, side meetings (every 6 months) as part of the official CEOS events are proposed. The responsibility for the coordination and organization of these side meetings could become part of the WGISS obligations closely monitored by the respective CEOS Chairmanship.

Issues for CEOS Attention:

The increased significance of being able to assess, foster and employ EO Data Analytics in the EO system chain is a topic that transgresses the boundaries of FDA considerations and any individual FDA theme. Although addressed in several CEOS groups, EO Data Analytics may warrant a more rigorous and focused CEOS initiative.

4. SDGs.

Lead agencies: ESA (Marc Paganini), CSIRO (Alex Held and Flora Kerblat), Americas (TBD)

Other active agencies: NASA and JAXA (through EO4SDG team of GEO)

2018 status and context: The SDG Ad Hoc Team (AHT SDG) was officially formed in Nov 2016 at the CEOS Plenary in Brisbane, to be the main point of contact and coordinator for SDG-activities within CEOS. The Terms of Reference of the CEOS AHT SDG was presented and approved at CEOS SIT 32 in April 2017. The AHT SDG works under the auspices of the CEOS Plenary and following the guidance the AHT receives from SIT Chair. It was agreed that the AHT would be led by co-leads representing three regions – Europe, Asia, and the Americas. The Americas co-chair slot is currently unoccupied.

In practice, only a few CEOS Agencies are active in the AHT (mainly CSIRO, ESA, NASA, NOAA and JAXA). A few CEOS Agencies nominated a point of contact on SDGs. Observers to the AHT SDG are also accepted, in particular for CEOS Agencies who only want to be informed on the progress of the work of the AHT, without taking an active role.

The AHT SDG originally decided to align its engagement on SDGs principally through GEO, and on a case-by-case basis through the existing relationships CEOS Agencies have with UN agencies (custodians of the SDG indicators), individual countries (through their National Statistical Offices and relevant line ministries) and other SDG stakeholders (e.g. GPSDD, Global Partnership for Sustainable Data). The AHT maintains constant and regular coordination with the GEO EO4SDG initiative (co-led by NASA, JAXA and INEGI).

In the complex SDG landscape, the AHT SDG must take stock of the UN processes in place for the SDG implementation and of the existing SDG stakeholders. In addition to its support to GEO, the AHT SDG

decided to focus its activities around the unique role that CEOS should play as a coordination body of the Space community efforts, to facilitate mainstreaming satellite observations in the SDG processes and systems, for a full realisation of the 2030 Agenda on sustainable development by all countries.

The AHT implementation plan is organised along 7 key elements that are the cornerstones of the AHT activities:

1. Compile and maintain a compendium of CEOS Agencies' engagement on the SDGs.
2. Define a coherent, flexible and adaptive CEOS engagement plan on SDGs.
3. Coordinate CEOS support to the GEO EO4SDG initiative.
4. Review and assess the contribution of satellite observations to the SDG Targets and Indicators.
5. Demonstrate, showcase and foster the added-value of satellite data in the SDG monitoring and reporting process.
6. Facilitate uptake of satellite data by SDG stakeholders.
7. Conduct impactful Communication & Outreach activities on EO for SDGs.

Whilst the co-leads (CSIRO and ESA) are fully committed to the SDG cause and convinced the ad hoc team is needed within CEOS especially to support one of three priorities of GEO, we acknowledge we still need additional dedicated resources/more capacity in service of the proposed Implementation Plan outcomes.

AHT Plans: The current lead agencies believe it's important for CEOS to keep a solid or "permanent" structure dedicated to the SDGs in order to promote and showcase the importance of satellite observations in the 2030 Agenda on Sustainable Development, for the benefit of all countries, leaving no one behind. Priorities should be assigned to specific activities where space agencies can also bring tangible support, especially in providing continuity with global datasets in a sustainable manner over several years.

It must be determined however whether this permanent structure has the critical mass of membership and resources to do so. The options for the way forward discussed at SIT-33 were as follows:

- **Option 1: Continue as an AHT**, requesting renewal for another year at Plenary, and continue to use Agencies' best efforts to support UN and GEO mainstreaming EO in the SDG processes (new co-leads?);
- **Option 2: Continue as an AHT** to ONLY act as a CEOS point of contact for external users, without undertaking new activities, and forward all specific requests to VC;
- **Option 3: 'Graduate' and become a CEOS Working Group** with a more formal work plan, governance system and reporting mechanisms, and therefore more sustained efforts and support (= commitment) from CEOS and WG members to implement the work plan;
- **Option 4:** Consider what the AHT SDG achieved, and still needs to be done from a CEOS perspective, and **phase out the AHT with transfer of all AHT activities to GEO EO4SDG** (including CEOS Agencies support)
- **Option 5:** Transform the AHT into an "**SDG Strategy**" (given its cross-cutting essence, following the "Carbon Strategy" path), with a solid work plan and coordination body to map SDG activities to existing CEOS resources (VC, WG, etc) and continue being the "SDG space arm" focal point for GEO

Issues for debate at SIT TW and decision at Plenary

The following points and themes are proposed for debate at SIT TW and decision at CEOS Plenary.

1. Taking stock of the intentions of the four AHTs and a strategic and collective consideration of their way forward and the renewal review process at Plenary

In brief, the intentions of the four current AHTs can be summarized as:

- FDA: AHT concluding with WP tasks going to WGISS (mainly) and LSI-VC;
- SDCG/GFOI: subject to stakeholder agency support and capacity for GFOI Phase 2;
- GEOGLAM: keen to continue as a stand-alone entity for at least a year;
- SDGs: subject to stakeholder agency support and capacity.

2. Improvements in procedural consistency to reflect the importance of all three types of CEOS subsidiary group

Including the procedures around establishment, leadership and resourcing; and the lines and instruments of reporting within CEOS. CEOS might also consider strengthening the processes around establishment and annual review of AHTs.

3. Explicit focus on the evolution from ad hoc status to standing and sustained CEOS activities where appropriate

Of the three subsidiary group mechanisms available for organizing work on CEOS (WGs, VCs, and AHTs):

- The VCs are thematically and measurement-type focused and represent a very specific community of practice and their science groups;
- The WGs represent a mix of cross-cutting functions that underpin space agency EO program operation and exploitation (such as information systems, cal-val, and capacity building) and more recently, with a thematic observations focus (currently being climate (since 2010) and disasters (since 2013)).

Of the four current AHTs, we might consider SDCG, GEOGLAM and the SDGs as being thematic in nature and possible candidates for a WG structure equivalent to climate and disasters (albeit noting that the SDGs is exceptionally broad in scope but nevertheless represents a recognized and focused community and observing need). These same three AHTs all interface to and address GEO Flagships or priorities.

4. Sustainment of the activities covered currently by the AHTs

Regardless of the vehicle through which the AHT activities proceed, the availability of capacity for operation of the entities - for realization of their WP outcomes, and for maintenance of the interfaces and external meeting processes which they handle for CEOS - must be clear (noting that CEOS WG Chairs are responsible for provision of operating capacity during their term).

AHT	Key Lifecycle Events	Leadership	Current resources for operation and WP
SDCG for GFOI	<p>2011: Formed at Plenary 2012: Start CEOS data strategy 2013: GFOI structure formalized; R&D Plan 2014: Country engagement 2015: 3-year Work Plan 2016: End of Australian funding 2017: GFOI donors launch Phase 2; CEOS declares baseline success</p>	<p>CEOS Lead: JAXA SDCG: ESA & UKSA</p>	<p>JAXA resources Lead Team aspects Some capacity pledged for 2019 SDCG operations by SEO (NASA) and SIT Chair (NOAA)</p>

	<p>2018: UKSA co-chair; reduced participation; Data Component formed including World Bank</p>		
GEOGLAM	<p>2012: Formed at Plenary & started Framework for Data Requirements of Global Agriculture</p> <p>2012-15: Delivered Data Requirements to each CEOS Plenary at incremental phases.</p> <p>2013: US and France GEOGLAM support initiated</p> <p>2014: Draft of 2015-2017 Workplan</p> <p>2015: Final CEOS Strategic Response to the GEOGLAM Requirements, including lifecycle recommendations. Established formal connections with LSI-VC</p> <p>2015: Validated a data requirements submission tool and established Data Cube support to GEOGLAM access to space agency data</p> <p>2016: GEOGLAM requirements evolved from Global to National and from cropland to rangeland requirement. Initiated GEOGLAM Data Requirements Refresh/Update</p> <p>2017: Draft of 2018-2020 Workplan. Established End-to-End EO Data Use and Requirements Concept</p> <p>2018: Canada, Germany, and China GEOGLAM support initiated. Deliver Refresh of GEOGLAM Data Requirements</p>	NASA & CNES	SEO (NASA)
FDA	<p>2015: Formed at Plenary</p> <p>2016: Interim Report</p> <p>2017: Final Report</p> <p>2018: Completion</p>	CSIRO, ESA, USGS	-
SDGs	<p>2016: Formed at Plenary</p> <p>2017: Implementation Plan</p> <p>2018: ?</p>	CSIRO, ESA, (USGS)?	CSIRO?

ANNEX: CEOS Future Data Architecture (FDA) Roadmap

Over the last two years the following themes have emerged as the main strands of Future Data Architecture considerations and activities:

1. Analysis Ready Data (ARD):

Analysis Ready Data are a key component to facilitate and foster EO data uptake especially by user communities, which are not comprised of EO data specialists. Progress has been made and activities need to continue in:

- a) Improving the overall ARD development logic (including an unambiguous nomenclature, which is currently best described in the “concentric-layer” model). Concrete ARD development steps and principles continue to emerge from the CEOS LSI-VC WG.
- b) Generating interoperable and harmonized data products. Here continuous improvements are being achieved for the Landsat 8 – Sentinel 2 data products. The results will be presented by the EC, USGS, ESA and NASA in various CEOS and other international events over the second half of 2018. This and other bi-lateral data harmonization initiatives provide crucial insights for further optimized ARD evolution.
- c) Developing ARD on-demand demonstrators in close interaction with all stakeholders. This is done with strong involvement of commercial data providers. One instance of the close interaction between institutional and commercial providers is the “Analysis Ready Data Interoperability” workshop with a focus on Spatio Temporal Asset Catalogs (STAC), which was held in August 2018.
- d) Developing the CEOS ARD 4 Land in which specifications for three product families have been completed and product assessment is ongoing. Still required is an assessment how space agencies data sets are aligned with CARD4L Product Family Specifications (PFS). It is also foreseen to generate and inventory and to publicize all CARD4L aligned products. Additional products for radar (polarimetry, interferometry) are under definition.

The FDA Ad Hoc Team suggests the transfer of the oversight of all four lines of activity to the CEOS LSI-VC WG. In addition, CEOS side meetings should be organized in regular intervals (every 6 months) to update all interested CEOS members on the progress of ARD and about opportunities for cooperation and product utilization in the ARD domain.

2. CEOS Data Cubes (CDC):

A large variety of Data Cubes have emerged. They have proven to fulfill a wide range of traditional and novel user needs and have increased the impact of EO data for various entities. The "CEOS Data Cube" initiative aims at utilizing CEOS Agency resources, global partnerships, satellite data, and CEOS organizational groups for further improving data access, data preparation, and data analysis for all users of satellite data. The following aspects are important from a FDA Ad Hoc Team perspective:

- a) The CEOS Data Cube (CDC) effort is well managed and supported within the CEOS environment. The accumulated knowledge is key for the further evolution of a harmonized data cube domain.
- b) There are a number of data cube activities (e.g. in Europe) that have not yet been integrated into the global data cube scenario.
- c) There are ongoing efforts to instantiate data cube deployments in EO data platform environments and, in particular, to provide an infrastructure (e.g. cloud) substrate. For example, the European DIAS

have been approached to consider the integration of data cubes in their offerings.

The FDA Ad Hoc Team suggests continuing to mandate the oversight of these activities to the CEOS Data Cube (CDC) coordination team led by Brian Killough. In addition, CEOS side meetings should be organized in regular intervals (every 6 months) to update all interested CEOS members on the progress of the data cubes and about opportunities for cooperation and product utilization in the data cube domain.

3. EO User Platform Evolution (e.g. Copernicus DIAS):

The concept of virtual data exploitation environments (providing data, tools, processing options, etc.) based on commercial infrastructures (e.g. cloud resources) constitutes a broader set of initiatives with the capacity to integrate ARD and data cube components. The following aspects are important from a FDA Ad Hoc Team perspective:

- a) Five Copernicus DIAS (Data and Information Access Services) have become operational in June 2018. Four are under EC - ESA control and one is under EC – EUMETSAT – ECMWF - Mercator control.
- b) A demonstrator for a DIAS data cube instantiation service is being implemented and should be operational shortly. This also includes an “ARD on demand” component.
- c) As a key feature of the expanding Copernicus system the DIAS are an important reference for future integration of data, tools, and standards at CEOS level.

The FDA Ad Hoc Team suggest to mandate the EC and ESA to report on the progress in this domain as part of the CEOS side meetings that should be organized in regular intervals (every 6 months). Due to the close relationship of the platforms with the other FDA themes, updates of all interested CEOS members should happen in the context of the updates for the ARD and Data Cube themes.

4. User Metrics and EO Resource Inventory

User metrics play an important role in quantitative and qualitative assessments of the attractiveness and impact of the various CEOS FDA initiatives. Together with an up-to-date inventory of relevant EO resources available through the CEOS community improved harmonization and programmatic planning can be achieved. The following activities have been initiated:

- a) The CEOS WGISS WG has taken ownership of the User Metrics and is preparing the corresponding processes and documentation. ESA, DLR, NASA, USGS have already provided substantial information. High diligence will be required in the maintenance of the User Metrics scheme as it is measuring highly dynamic parameters (e.g. number users, types of products, available processing capacity).
- b) The EO Resource Inventory is closely linked to User Metrics and the CEOS WGISS WG has also taken ownership. This activity should also be harmonized with the Network of Resources activity, which are handled in conjunction with all ESA Member States in the ESA Data Coordination Body.

The FDA Ad Hoc Team suggests the transfer of the oversight of all User Metrics and EO Resource Inventory activities to the CEOS WGISS WG. In addition, CEOS side meetings should be organized in regular intervals (every 6 months) to update all interested CEOS members on the progress of the User Metrics and EO resource Inventory domain with explicit request for updates of the corresponding data bases by the CEOS agencies.

5. Data Analytics

Data Analytics was identified early in the FDA process as a neglected theme in terms of CEOS coordination. Improved data analysis is also seen as a key driver to increase the usability and use of Earth Observation data, in particular by user communities, which have not been acquainted with EO data so far. Two aspects appear to be important:

- a) It is important to get a more complete picture of the range and the state-of-the-art of EO data analytics in the CEOS context. Specific communities, such as the Artificial Intelligence (AI) community are already formulating specific requirements toward EO data and product providers.
- b) It is important to agree on a systematic process and supporting mechanisms to integrate Data Analytics as a highly relevant FDA theme in the CEOS environment. The topic should be closely linked with the four themes that have emerged from the FDA effort.

The FDA Ad Hoc Team suggests a discussion and decision as part of the next CEOS plenary to decide on the best perimeter and mechanisms to be applied to the Data Analytics theme.

Additional Considerations:

The Roadmap above suggests that the further curation of the five FDA themes is largely to be continued within the CEOS Working Groups most closely associated with them. For regular general updates and a more integrated view for the broader CEOS community side meetings (every 6 months) as part of the official CEOS events are proposed. The responsibility for the coordination and organization of these side meetings could become part of the WGISS WG obligation closely monitored by the respective CEOS SIT chairmanship.

ANNEX: SDG Ad Hoc Team Information

Achievements to-Date:

- A section with relevant information under CEOS website and contribution to the GEO "[Earth Observations in Support of the 2030 Agenda for Sustainable Development](#)" report.
- One of the most tangible AHT SDG outcomes so far is the production of the CEOS EO handbook on SDG to showcase the contribution of satellite observations to the realization of the 2030 Agenda on sustainable development. The CEOS Handbook was sponsored by ESA and supported by other agencies like CSIRO, NASA and others, in close cooperation with the GEO initiative on SDGs and with the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM) which chairs co-signed the preface of the Handbook. The document was published and printed in March 2018 for the 49th session of the UN Statistical Commission, and is also available online. It has been very well received by the community and being used as a valuable resource. Since the 2030 Agenda context is always evolving, there is yet a need to keep the information updated over the next few years and keep track of changes to better address them.
- ESA initiated in April 2018 a 400,000 EUR project on "EO for the Sustainable Development Goals" to support CEOS and GEO in the full realization of EO in the SDGs. The first activity of the project is to review the EO contribution to the SDG targets and indicators and identify areas of better uptake of EO (Action Line 4 of the AHT implementation Team).
- Following the request from the UNCCD secretariat to GEO and CEOS to assist the UNCCD with the SDG 15.3.1 implementation (*Proportion of land that is degraded over total land area*), GEO has initiated a new GEO initiative on Land Degradation Neutrality (LDN). CEOS has agreed to support this new GEO initiative on LDN with a LDN task team created as part of the CEOS Ad Hoc Team on SDGs. CSIRO and ESA have committed staff (Neil Sims and Marc Paganini, respectively) in support of the GEO response to the UNCCD call for support on the LDN front.
- As Member of the Working Group on Geospatial Information (WGGI) of the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs), CEOS (through ESA, NASA and JAXA) contributes to the program of work of WGGI and in particular to the WGGI Task Stream on Analysis and Production Ready EO data for SDG indicators.
- The CEOS AHT SDG participated in various SDG related events: 4th plenary of UN GGIM Europe (Brussels, June 2017), 7th session of UN GGIM (NYC, July 2017), SDG side meetings at the GEO XIV Plenary (Washington DC, Oct 2017), 5th High Level Forum on UN Geospatial Information (Mexico city, Nov 2017), 49th session of UN Statistical Commission (NYC, March 2018), UNISPACE+50 High Level Panel on EO solutions for the SDGs (Vienna, June 2018), GEOGLAM RAPP/SDG/African Regional Data Cube combined workshop (Nairobi, May 2018), High Level Political Forum on SDGs (NYC, July 2018), IGARSS (Valencia, July 2018).

Additional Activities/Discussions underway:

- Direct support to the Australian delegation in coordination a side meeting on Earth Observation at the UN High Level Political Forum on SDG's (NYC, July 2018)
- Work with CEOS SEO to showcase the production of selected SDG-related products through the CEOS Open Data Cube (ODC) platform.
- Support the new GEO LDN (Land Degradation Neutrality) Initiative by contributing to the formulation of the Terms of Reference and the preparation of the implementation plan.

- Maintain a Database of SDG-related activities from CEOS agencies,
- Seek close collaboration with WGCapD on Capacity Building activities
- Identify exactly and precisely targets and indicators where EO satellite data can provide relevant information, and approach the relevant custodian agencies to include EO satellite data in methods when adequate;
- Initiate a CEOS-level assessment/mapping of VCs/WGs/AHTs to address each of the EO-relevant SDG indicators, and the sustainability of their efforts (graphics to be shown to external stakeholders)
- Opportunities to map SDG activities/focus to existing VCs/WGs/AHTs in CEOS (e.g. WGCapD on capacity building, AHT GEOGLAM on Food security issues (SDG 2 on Zero Hunger), SEO with Data Cube projects)