



INTERAGENCY OPERATIONS ADVISORY GROUP

2021 Annual Report

Issue Date: February 24, 2022

Document Number: IOAG.A.AR.2021.001



IOAG 2021 Annual Report

Overview

This 2021 Annual Report of the Interagency Operations Advisory Group (IOAG) provides an overview of the activities conducted over the past year, with reference to the objectives defined in the IOAG 2021 Work Plan (reference IOAG.A.WP.2021.001). It is intended to keep all stakeholders and partners informed of the ongoing and planned IOAG work and achievements, in line with the ToR and the mandate given by the fourth Interoperability Plenary (IOP-4) held at Kloster Andechs in December 2018.

Considering the outcome of the IOP-4, the IOAG continued to pursue new initiatives that were requested by the IOP delegates. Therefore, the IOAG dealt with a broad spectrum of issues, such as:

- Communications Scenarios concerning Moon missions,
- Communication Scenarios concerning Mars missions,
- Utilization and evolution of frequency bands, including optical links,
- Service Catalogues,
- Sustainability of Operations in Space,
- Spacecraft (S/C) Emergency Cross Support,
- Mission Operations Interoperability (not active work in the reporting period),
- Radiofrequency (RF) Modulation and Coding (not active work in the reporting period),
- Space Internetworking promotion (put into dormant state at the 2019 IOAG annual meeting).

The above list of issues reflects also the drivers of the IOAG activities, which comprise the following main items:

- Providing a discussion forum regarding interoperability aspects for the participating Agencies including the maintenance of the mission models and databases of communications assets.
- Coordinate with relevant international working groups / organisations, in particular the Consultative Committee for Space Data Systems [CCSDS], the International Space Exploration Coordination Group [ISECG], the Space Frequency Coordination Group [SFCG] and the International Committee on Global Navigation Satellite Systems (GNSS) [ICG].
- Provide guidance to specific working groups (WGs) initiated in the context of the IOAG.

The focus of the activities in 2021 was on the following topics:

- The Service Catalogue: a revision to the Service Catalogues was performed and SC-1 and -2 released;
- Lunar Communications Architecture: a detailed review of the Lunar Communication architecture was performed and the related report updated. Interaction with the ISECG and the ARTEMIS / Gateway Projects were further consolidated, and an initial assessment of Lunar Communication relays elements conducted;
- Mars and Beyond Communication Architecture: a detailed review of the Mars Communication architecture was performed and the related report updated, taking into account among others the interaction with the ISECG;
- Spacecraft Emergency Cross Support: the potential involvement of Industry / Service Providers was further explored;
- Sustainability of Operations: significant progress was made leading to the release of a first draft report for internal review.

The identification / definition of required standards is one of the core activities of the IOAG. During the course of the year, emphasis was placed on maintaining close interaction with the CCSDS. This concerned not only the maintenance of the IOAG-CCSDS Product Agreement (ICPA) but also the infusion of the services defined in the various Service Catalogues that have been produced and are maintained by the IOAG. The Service Catalogue WG (SCWG) is following these topics and maintains a close coordination with the CCSDS.

One of the goals that were defined by the IOP-3 and enforced by the IOP-4 was to involve more Space Agencies and Organizations in the activities of the IOAG. In line with this objective, the Australian Space Agency (ASA) and the ISRO (Indian Space Research Organisation) have joined as observers and made a very positive contribution to the IOAG activities over the course of the reporting period. Hence, the IOAG comprises at the moment the following formal Member Agencies: Italian Space Agency (ASI), French Center for National Space Studies (CNES), Canadian Space Agency (CSA), German Aerospace Center (DLR), European Space Agency (ESA), Japan Aerospace Exploration Agency (JAXA), National Aeronautics and Space Administration (NASA), United Kingdom Space Agency (UKSA), and the following Observer Agencies: Australian Space Agency (ASA), China National Space Administration (CNSA), Korean Aerospace Research Institute (KARI), Indian Space Research Organisation (ISRO), Russian Federal Space Agency (RFSA / ROSCOSMOS), South African National Space Agency (SANSA), United Arab Emirates Space Agency (UAESA). Most of the Agencies participated in the regular meetings that were held in form of telecons due to the Corona-crisis.

The mission models and the Global Navigation Satellite System (GNSS) database that contains information about relevant payloads have been maintained based on the inputs provided by the Agencies.

An extensive update of the IOAG website was performed under the lead of the IOAG Secretariat. This included an upgrade of the underlying Web technology, as well as a restructuring of the Portal to facilitate access to information and documentation. The Portal can be accessed at ioag.org

No face-to-face meeting could be organised due to the travel restrictions imposed by the COVID-19 crisis. Instead regular telecons were held that were well supported by the Agencies. Frequent meetings/telecons were conducted by the individual working groups, allowing to make major progress in the generation and release of related reports. The information, provided in the context of the meetings and the teleconferences, is available through the IOAG website.

A new IOAG Chairman was elected in June 2021, by the unanimous consensus from all IOAG Agencies members.

Interface to International Groups

The IOAG continued to maintain a close relationship with the **CCSDS**. The CCSDS liaison participated regularly in the IOAG teleconferences and provided the CCSDS reports. The “IOAG-CCSDS Product Agreement” (ICPA), which was maintained by both sides, identifies the priorities and the required target dates of the various space agencies regarding the future cross support standards. It provides guidance to the CCSDS considering the needs of new standards.

The IOAG also maintained a close relationship with the **SFCG**, whose liaison participated in the teleconferences. The main topic relevant to this interaction concerns the protection of certain frequency bands necessary for spacecraft operations. The iterations were also aimed at ensuring coherency between the latest SFCG rules and guidelines and the Communication Architectures being defined by IOAG.

The interaction with the **ISECG** was also pursued. The Lunar and Mars communications architectures are being maintained by IOAG based on the feedback from the ISECG and the corresponding WGs. Furthermore, IOAG is following the progress of the Technology Working Group (TWG) and the In-Situ Resource Utilization (ISRU) WG of ISECG to provide support regarding communications aspects as required.

The interface to the **ICG** has been maintained. This allows the IOAG to inform member agencies who are not involved in the ICG about the progress within the ICG, e.g., regarding the Space Service Volume, and to forward requirements to the ICG, if relevant. The IOAG is maintaining a database which contains data on missions of the IOAG member agencies that have a GNSS-related payload on-board. This database has been made available to the ICG.

Status of the IOAG Working Groups

The **Service Catalogue WG (SCWG)** has maintained the catalogues as required and is currently mainly following the infusion of the corresponding standards by the Agencies.

The **Spacecraft (S/C) Emergency Cross Support Working Group (SECSWG)** was active supported by several Agencies. It followed the evolution of the Standard Operations Procedures (SOP), and pursued further interaction with Industrial providers and operators.

The **Lunar Communications Architecture WG (LCAWG)** revised the reference communications architecture for the future Exploration missions in close cooperation with other international groups such as the ISECG and the ISS interoperable standards group.

The **Mars Communications Architecture WG (MCAWG)** revised the reference Mars communications architecture for the future Exploration missions in close cooperation with other international groups such as the ISECG and the ISS interoperable standards group. The future communications for the Mars and beyond missions are assessed by the MBCAWG that was established in 2020.

The **Sustainability of Operations in Space WG (SOSWG)** that was proposed at the IOP-4 continued its activities and provided the first detailed results and recommendations via a draft WG report.

The **Space Internetworking Strategy Group (SISG)** is currently dormant.

The **Coding & Modulation WG (CMWG)** is currently dormant. It is envisaged to reconvene the CMWG every 3 to 4 years to perform an update of the list of relevant Coding & Modulation schemes, as required. This approach has been approved by the IOP-4.

The **Optical Link Strategy Group (OLSG)** is currently dormant. The experts of the WG are following the activities regarding optical communications in the various organizations and follow the work of the relevant CCSDS WG to proceed with the books related to all the Optical Communications related standards.

The **Mission Operations Systems Strategy Group (MOSSG)** activities continued in the course of the year, with lower frequency meetings. The WG continued to monitor the infusion plans of the agencies and related priorities for development of the missing standards to support the services in the catalog. Since the mission operations aspect is considered relevant to the GATEWAY / ARTEMIS Project the WG chair is to interact with these Projects when considered appropriate.

The **LEO 26 GHZ Study Group (LEO26WG)** activities have been completed and the WG is closed.

Future Work

It is planned that the following WGs will be active in 2022:

- SCWG: to maintain the interface to CCSDS and to maintain the Service Catalogues 1-2.
- SECSWG: to continue the work to implement the procedures and the set-up needed for S/C emergency cross-support;
- MBCAWG: This WG will continue to work on the definition of the Mars and Beyond communications architecture
- SOSWG: This WG will continue its work according to the plan

- LCAWG: The WG is currently planned to be placed in dormant state, but the chair will continue to follow the evolution of the Lunar Communication implementation in the context of on-going initiatives such as e.g. Moonlight, LunaNet and others.
- MOSSG: The WG will continue to be active, with a reduced frequency of meetings. In order to follow the evolution of the Service Catalogue #3 and to produce the corresponding Infusion Plan.

The other current working groups will be largely in a dormant status, but the WG chairs (involving experts of the WG as required) will interact to follow the evolution of the various topics. This concerns in particular the OLSG.

Proposals to create new Working Group(s) have been put forward by some IOAG participating Agencies and are currently being assessed for a potential implementation. This relates in particular to the topics of IoT communication to LEO satellites, Lunar Navigation services and secure communications architecture.

The work regarding the interface to other organisations (CCSDS, ISECG, SFCG and ICG) will continue.

The location and date of the next face-to-face have not yet been fixed. It is envisaged to assess the evolution of the travel restrictions imposed by the global Coronavirus pandemic. Regular telecons are planned in 2022 to follow the work of the WGs.

For any further information, please consult the IOAG web site (www.IOAG.org) or contact the IOAG Secretariat (barbara.adde@nasa.gov) or IOAG Chairman (Pier.Bargellini@esa.int)