



INTERAGENCY OPERATIONS ADVISORY GROUP

2017 Annual Report

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Overview

This 2017 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 2017 Work Plan. It is intended to keep all stakeholders and partners informed of the ongoing and planned IOAG work and achievements in the domain of space communications, in line with the mandate given by the second Interoperability Plenary (IOP-2) held in Geneva at the end of 2008 and the third Interoperability Plenary (IOP-3) held in Toulouse in June 2013.

Considering the outcome of the IOP-3, the IOAG widened a bit its scope by including also Mission Operations aspects. Therefore, the IOAG deals now with a broad spectrum of issues, such as:

- Radiofrequency (RF) Modulation and Coding,
- Spacecraft (S/C) Emergency Cross Support,
- Evolution of the 26 GHz band,
- Follow utilization of frequency bands¹ including optical links,
- Mission Operations Interoperability,
- Service Catalogues,
- Space Internetworking concept promotion,
- Communications Scenarios for the upcoming Global Exploration Roadmap.

These are also the drivers of the IOAG activities, which comprise basically the following items:

- The basic task of providing a discussion forum regarding interoperability aspects for the participating agencies including the maintenance of the mission models and databases of communications assets.
- The coordination with various international working groups / organisations, which are 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].
- The guidance of various working groups (WG) that were kicked off in the context of the IOAG. The most recent WG that was put in place in 2017 concerns the communication scenarios of the upcoming Global Exploration Roadmap, which has the objective to define a reference communications architecture for the Lunar scenario.

As the identification / definition of required standards is one of the core activities of the IOAG, some emphasis was as usual put on the interaction with CCSDS. This concerned not only the maintenance of the IOAG-CCSDS Product Agreement (ICPA) but also the progress regarding the update of the Service Catalogues. A small WG is following these topics and keeps a close contact with the CCSDS. Apart from the update of the Service Catalogues 1&2,

¹ Apart from the 26 GHz band, the 32 and 37 GHz bands became also of interest recently.

work has started in the context of the Mission Operations Services Strategy Group regarding a Service Catalogue 3 that deals with Mission Operations Services.

There was some fluctuation regarding the involvement of space agencies in the IOAG. As requested by the IOP-3, some activities were undertaken to involve more space agencies and organizations. New contacts have been established to the United Arab Emirates Space Agency (UAESA) and the South African National Space Agency (SANSA), which show an interest in the IOAG and have nominated representatives. However, their involvement in the activities is limited for the time being. The UAESA participated in the meetings in 2017. In addition, a contact with the China National Space Administration (CNSA) is maintained but their involvement in the activities is also not (yet) regular. ROSCOSMOS has confirmed their interest to participate again in the IOAG activities and nominated a representative. They were present during the IOAG meetings and telecons. Unfortunately, it was not possible to re-establish the links to the Indian Space Research Organisation (ISRO). Therefore, the IOAG consists currently of the following formal member agencies: Italian Space Agency (ASI), 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), and the following observer space agencies: CNSA, ISRO², Korean Aerospace Research Institute (KARI), RFSA / ROSCOSMOS, SANSA, UAESA and United Kingdom-Space Agency (UK-SA).

Some of the participating space agencies have provided their agency reports for the annual face-to-face meeting, which are available for information via the IOAG website (ioag.org). The website can also be used to access further information. The information concerning the mission models and the list of communication assets have been stored in a SANA database. This data base is used as reference also by CCSDS and SFCG.

The IOAG held its annual face-to-face meeting in Darmstadt in November, hosted by ESA. One day was devoted to a combined meeting with the CCSDS – CMC in order to enhance the critical cooperation between the two organisations. In addition, several teleconferences and a reduced IOAG meeting in Marseille were held during the course of the year to exchange information on the progress of the work in the working groups and regarding the interaction with the liaison organisations. There were also meetings/telecons of the individual working groups. The information, provided in the context of the meetings and the teleconferences, is available through the IOAG website.

Interface to International Groups

The IOAG maintains a close relationship with the **CCSDS**. The CCSDS liaison participated regularly in the IOAG meeting and teleconferences and provided the CCSDS reports. The main point of contact on the IOAG side is the **Service Catalogue WG (SCWG)**. The “IOAG-CCSDS Product Agreement” (ICPA) was maintained by both sides. This ICPA identifies the priorities and the required target dates of the various space agencies regarding the future cross support standards. This ICPA together with the two Service Catalogues that were produced in the past years shall provide guidance to the CCSDS considering the evolution of the various standards. The Service Catalogues are being refined to keep them up-to-date. A third Service Catalogue considering the Mission Operations Services is currently in preparation and should be available in Spring 2018.

² During the IOAG-21 meeting it has been agreed to remove ISRO from the list of participating agencies.

The IOAG also maintained a close relationship with the **SFCG**, whose liaison participated in the meeting and teleconferences. The main issue, which is currently of relevance in this context, is the protection of certain frequency bands for satellite operations because the IOAG and the SFCG have common goals regarding this topic. This concerns among others the protection of the 26, 32 and 37 GHz bands from the fifth generation (5G) mobile phone, and of the 26 GHz band from high altitude platforms (HAPS).

The interaction with the **ISECG** increased significantly in 2017. Apart from the presentation provided by IOAG, regarding its activities relevant to the Moon / Mars missions, the IOAG got involved in the discussions regarding the relevant communications architecture for the future Exploration missions. The IOAG has established a WG to define a reference communications architecture mainly concerning the upcoming Lunar missions. This WG will closely work together with the corresponding group of ISECG. The output of this WG will be provided to ISECG. Apart from this IOAG is following the progress of the Technology Working Group (TWG) of ISECG to provide support regarding communications aspects if 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 applicable. 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 and is currently being used by the ICG.

Status of the IOAG Working Groups

The bulk of the work of the IOAG is done in working groups. Various WGs are in a semi-dormant state after providing their report to the IOP in 2013. They are mainly used as a kind of discussion forum and are consulted if required, e.g., in the preparation of the IOP-4.

The **Optical Link Strategy Group (OLSG)** has stopped the active work because it achieved the defined objectives when providing the report to the IOP. However, the experts of the WG are following the activities regarding optical communications in the various organisations. The CCSDS liaison reported this year that an agreement has been reached within the CCSDS WG how to proceed with the books related to all the Optical link related standards.

The **LEO 26 GHZ Study Group (LEO26SG)** has been reactivated in order to have a forum to discuss the harmonization of the various 26 GHz systems that are currently in place or in planning by several space agencies. It has provided an updated report to the IOAG face-to-face meeting, which reflects the evolution in this field.

The Mission Operations Systems Strategy Group (MOSSG) progressed by responding to many conflicting comments to the draft Service Catalog #3. The team also experienced a change in personnel and received redirection and clarification from the IOAG regarding the scope and approach to achieving the group's goals. The group reconsolidated its objectives and established a goal to finish its work for the IOP-4. The group worked on a report and on a Service Catalogue #3 that should be available in Spring 2018.

The **Spacecraft (S/C) Emergency Cross Support Working Group (SECSWG)** is supported by several agencies. It provided a report during the IOAG meeting. The group selected the chairs and has identified the terms of reference for the 2nd phase of the activities, which consist mainly in verifying the guidelines defined in the first phase using a test case. The group selected the GAIA mission of ESA and potentially the HAYABUSA-2 mission of JAXA to verify the guidelines. The relevant activities are planned for early Summer 2018.

The **Lunar and Mars Mission WG (LMWG)**, which has been implemented by request of the CCSDS to assess the future standardization needs of the Lunar and Mars mission programs, provided a report to the ISECG. The groups also provided some recommendations regarding the frequency bands to be used. Considering the relevance of this subject for the future Exploration Program it was agreed to put in place another WG, **Lunar Communications Architecture WG (LCAWG)**, that defines a reference communications architecture for the future Exploration missions in close cooperation with other international groups such as the ISECG.

Future Work

The IOAG Chairman will further consolidate the cooperation with RFSA / ROSCOSMOS and CNSA to determine the relevant level of involvement. In addition, the interaction with the SANSA and the UAESA will be intensified.

It is planned that the following WGs will be active in 2018:

- SECSWG: to execute the second phase of the verification of the guidelines using a few test missions;
- MOSSG: to finalise the work by completing the report and providing a draft Service Catalogue 3;
- LEO26: to follow the evolution of the 26 GHz band;
- LCAWG: to define a reference communications architecture and to provide a corresponding concept.
- SCWG: to maintain the interface to CCSDS and to maintain the Service Catalogues 1&2.

The other working groups will be largely in a dormant status, but will be activated as necessary to prepare for the IOP-4.

The work regarding the interface to CCSDS, i.e., to maintain the ICPA and to update the Service Catalogues as required, will continue. This will be done in the context of the SCWG.

The next face-to-face meeting will be held in the June 2018 time frame in order to allow a proper preparation of the IOP-4. The location is not yet fixed. Several telecons are planned in 2018, mainly to prepare the IOP-4.

It is envisaged to hold the IOP-4 in the Fall 2018 timeframe. The event will be hosted by DLR but the location is not yet fixed. The purpose is to provide a report about the results of IOAG activities, in particular the ones that were triggered during the IOP-3. This IOP-4 will also be used to confirm the mandate of the IOAG in particular with respect to the Global Exploration Roadmap. The IOP shall endorse the role of the IOAG as the forum to consolidate the communications aspects that are needed for the projects that require a wider cross-support. Another topic that could be of relevance concerns the interaction with Industry / Service Providers and the role that the IOAG could play.

For any further information, please consult the IOAG web site (www.IOAG.org) or contact the IOAG Secretariat (Barbara.Adde@nasa.gov) or the IOAG Chairman (Michael.Schmidt@esa.int).