INTERAGENCY OPERATIONS ADVISORY GROUP

IOAG-18 Meeting

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Prepared by: Stephanie Wan, IOAG Secretariat

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IOAG-18 Meeting Minutes
Teleconference
10 February 2014 – Day 1
13:00 – 17:00 CET

Attendance:
Chair: Michael Schmidt
Secretariat: Stephanie Wan

<u>Members</u>:
ASI: Giovanni Valentini
CNES: Jean-Marc Soula
CSA: Jean-Pierre, Ken Lord
DLR: Martin Pilgram, Rolf Kozlowski
ESA: Nestor Peccia, Gian-Paolo Calzolari
NASA: Phil Liebrecht, Madeline Butler, Les Deutsch, Bernie Edwards, Mike Kearney, Wallace Tai
JAXA: Tsutomu Shigeta,
RFSA: Mikhail Vasilyev, Vladimir Shuchev

<u>Observers</u>:
KARI: Sang-Il Ahn
UKSA: Peter Allan

1) Opening/ Introduction of IOAG participants:

Ms. Barbara Negri from the ASI Scientific Department welcomed the Interagency Operations Advisory Group (IOAG) delegates. She noted it was a great pleasure that ASI is hosting the 18th meeting of IOAG and that the issue of interoperability is of great interest for the future of space missions to ASI. Big projects and future space missions are dependent on various agency contributions. Therefore it is important to discuss the issues related to interoperability. She believed that the coming week's discussions will be a good way to prepare the agencies in the field. The IOAG delegates thank Ms. Negri.

The IOAG Chair (ESA) welcomed everyone to Rome and introduced himself. He noted that the IOAG was waiting for a few colleagues, as the JAXA delegation is currently delayed by a snow storm.

The ASI head of delegation, Mr. Giovanni Valentini introduced himself. He joined the IOAG last year and met the IOAG delegates at the IOAG-17 meeting in the UK. He presented a few slides on meeting logistics for the week.

He then informed the delegates about an organization change within ASI, and provided an organization chart to highlight where he and Ms. Negri are located within the ASI organizational structure.

The IOAG delegates introduced themselves and their affiliation.

2) Review of Agenda
The Chair provided an overview of the agenda. The agenda was approved by the IOAG delegates.

3) Chairman's Report
The Chair provided a brief overview on the status of IOAG documentation, noting that he wants to distribute them soon. He then reported about the status of interactions with other organizations, such as the International Committee on GNSS (ICG) and the International Space Exploration Coordination Group (ISECG). He also commented on the status of working groups, noting there was a new working group on Emergency Support for discussion later in the week. He highlighted the ongoing relationship with with the Consultative Committee for Space Data Systems (CCSDS), and that there needs to be a clarification of the ICG relationship.

The Chair then commented the participation of the IOAG member agencies and noted that most of them were very active. He emphasized that there was a new member, the Canadian Space Agency (CSA). He was furthermore very pleased that RFSA is present at the meeting after a long hiatus. Mr. Gan Yong from the China National Space Administration (CNSA) unfortunately could not attend IOAG-18. The Chair then commented that he received no feedback from the Indian Space Research Organization (ISRO) despite contacting the representative in Paris multiple times.

4) Secretariat's Report
The Secretariat provided a brief overview of the current documentations that require approval. The IOAG-17c and IOAG-17d minutes were approved. The 2013 Annual Report also was approved. The Terms of Reference was approved. As for the Procedures Manual document, DLR commented that the 'automatic e-vote approval' is a concern especially if the issue is raised too quickly without the appropriate duration for consideration, then it would automatically be approved. It was proposed by DLR to add a statement in the procedure to ensure that an interval of at least 3 weeks is available for an e-vote and thus allow for sufficient deliberation time. NASA requested adding a statement that agencies can also request for more deliberation time if needed.

The IOAG delegates commented that the 2014 Work Plan does not reflect the new Emergency Cross Support Working Group. The Chair responded that it will be added as one of the Work Plan core items after the approval during the course of this meeting. The IOAG delegates agreed that the 2014 Work Plan and the Procedures Manual will be updated by the Chair to reflect the

discussions. The Chair is to provide a revised wording by Wednesday afternoon for the delegates to review and approve.

The Secretariat then noted that all the IOAG action items were up to date, or were on the agenda for discussion. She displayed the IOAG member agency attendance, noting that it was a pleasure to have CSA listed, and that RFSA was able to participate at IOAG-18. A slide was shown to highlight the reference table status, and that most agencies have contributed to updating their top priorities, communication assets, and cross-support mission models prior to the meeting.

5) CSA Request for Full Members Status
The Chair noted that there would be an open voting for the CSA full member status request.

The CSA head of delegation, Mr. Pierre Jean, provided the CSA presentation. He noted that IOP-3 was the first participation of CSA in the IOAG activities. Upon IOAG's invitation, CSA decided that the issues discussed by the IOAG are important and that CSA can make a contribution. He provided an overview of the CSA organization and the three major areas of expertise and also highlighted that he and Mr. Ken Lord are in Space Exploration and Operations department. He then provided a brief overview of the CSA contributions and assets to International Space Station (ISS) program. Mr. Jean also listed the CSA supported satellite missions and other activities the organization contributes to.

An IOAG delegate asked about CSA's employees. Mr. Jean responded that there is currently a deficit reduction, however approximately 650-700 employees actively work at CSA.

All the IOAG members voted and approved CSA's full member status, and the Chair welcomed CSA as a full participating IOAG member.

6) Agency Reports
ASI, CNES, DLR, ESA, JAXA, KARI, NASA and UKSA provided agency reports to the IOAG.

Mr. Giovanni noted that ASI is currently in the middle of an organization change. He highlighted that he is currently in charge of all activities related to services and missions. He noted that there will also be a new S-band ground antenna at San Marco.

Mr. Jean-Marc Soula from CNES noted there was no organization change. In terms of missions, Jason-1 lost telemetry contact and Parasol is decommissioned.

Mr. Martin Pilgram from DLR highlighted there were some small organizational changes, as there are 2 new areas in optical sensors and complex plasmas. On the 1 of January Rolf Kozlowski became responsible for communications and ground stations within GSOC. He also will take over the role of DLR head of delegation when Mr. Pilgram retires in June this year. The Chair commented he was sorry to see him go, and Mr. Pilgram commented that he has only missed 3 IOAG meetings since his participation started. RFSA asked how DLR works with

groups on small satellites, as there are many in Germany and DLR responded that it is facilitated through university contacts with DLR or ESA.

Mr. Michael Schmidt from ESA provided an overview of the new missions and mentioned the kickoff of the OPS-SAT Project that will allow testing functions relevant to spacecraft operations. He also noted that here is a ministerial conference coming up by the end of the year. On the European Space Operations Centre (ESOC) side, a new office building is under construction that will be open in the May/June timeframe this year.

Mr. Tsutomu Shigeta from JAXA noted there was no organization change. However, within the Consolidated Space Tracking and Data Acquisition Department (CSTDA), there is a new Flight Dynamics Division Manager, Shigeru Usuki. Some recent events include the Episilon Launch Vehicle, SPRINT-A, HTV-4, and Manned flight on the ISS Expedition 38/39. Some upcoming missions planned for 2014 include the GPM/DPR, ALOS-2, Hayabusa 2, and PROCYON.

Mr. Phil Liebrecht from NASA noted there are a few organizational changes, as the Deputy Administrator, Lori Garver, left in September. Also, John Rush will be retiring in April and he welcomed IOAG members to join the retirement party or to send a few words that can be read during the event. Mr. Liebrecht then highlighted some of the recent TDRS-L launch and cross support missions the agency has been participating in.

Dr. Sang Il Ahn from KARI noted there will be a new KARI president in June. He also highlighted 2 recent launches, KOMPSAT-5 and STSAT-3, and the new space policy focus towards a lunar program.

Mr. Peter Allan from UKSA highlighted the agency's expansion from 33 to 58 employees, as well as expansion of their facilities. Some activities include the UKube-1 cubesat (UK's first cubesat), as well as the participation in several international missions.

7) Summary of the Day
The Chair thanked the IOAG delegates for a successful first day of IOAG-18 meetings, and noted tomorrow the agenda will be full with a sharp cut off time to accommodate for the no-host dinner.

IOAG-18 Meeting Minutes
Teleconference
11 February 2014 – Day 2
9:00 – 17:00 CET

Attendance:
Chair: Michael Schmidt
Secretariat: Stephanie Wan

<u>Members:</u>
ASI: Giovanni Valentini
CNES: Jean-Marc Soula
CSA: Jean-Pierre, Ken Lord
DLR: Martin Pilgram, Rolf Kozlowski
ESA: Nestor Peccia, Gian-Paolo Calzolari, Enrico Vassallo
NASA: Phil Liebrecht, Madeline Butler, Les Deutsch, Bernie Edwards, Mike Kearney, Wallace Tai
JAXA: Takanori Iwata, Tsutomu Shigeta, Yoshikazu Miyaki (PM only)
RFSA: Mikhail Vasilyev, Vladimir Shuchev

<u>Observers:</u>
KARI: Sang-Il Ahn
UKSA: Peter Allan

<u>On Teleconference:</u>
NASA: Bill Horne

8) Opening/ Review:
The Chair opened the meeting by welcoming Mr. Enrico Vassallo (SFCG) and Mr. Takanori Iwata (JAXA), who had not been able to join the first day. He requested delegates to look at the two changes made to accommodate the previous day's discussions on the Procedures and 2014 Work Plan document. After displaying the two changes, the IOAG delegates approved the new text in both documents.

Afterwards, the Chair noted that the no-host dinner time was changed to start at 7:30PM to allow for transportation time between the meeting location and downtown Rome.

9) CCSDS Report

Then CCSDS Liaison, Mr. Nestor Peccia introduced himself. He provided the progress on what has been produced since the last meeting in 2013. He noted that 3 green books, 7 blue books, and 4 magenta books have been published. He noted there were some proposed changes in preparation concerning the organization and processes of CCSDS. However, it will require more time to reach an agreement within the CMC for the changes. Currently CCSDS has 132 standards that are currently active and applicable, and there are106 new projects underway.

Mr. Peccia then noted that certain projects are not making progress due to limited resources, in particular some prototype projects; however those issues are not show stoppers.

It was also noted that the CCSDS Management Council secretary sent a response to the IOAG Secretariat to the IOP-3 communique.

Since IOP-3, CCSDS has introduced some new in the system of 26 GHz. A project for related modulation (2015) is ongoing. Variable Coding and Modulation (VCM) is planned for 2015, and Adaptive Coding and Modulation (ACM) for 2017. The Optical Communications working group has been created with 4 projects included in the program of work. JAXA and NASA noted that NICT is also contributing, even though it is only a CCSDS an observer agency..

As for ICPA, Mr. Peccia noted that there are 3 areas where the priority 1's items have no approved CCSDS projects: CSTS File transfer service, CSTS Offline Radiometric Service, and Bundle Security Protocol for CCSDS (BSP). UKSA asked a question about the IOAG requested 2015 date, confirming whether it was the IOAG need-by date. Mr. Peccia noted it was the next item on the IOAG-18 agenda. Mr. Peccia remarked that agencies giving priorities need to also support the project with adequate resources otherwise projects are affected. Mr. Peccia also noted that Optical Communications is effectively consuming the resources of other projects and causing delays in those projects.

JAXA noted that the optical comm WG seems to still have a lingering issue on the wavelength. Several IOAG delegates that were aware of the situation responded that the issue is difficult to decide, so the working group is proceeding to standardize other parameter items and keeping the wavelength issue open. Mr. Peccia responded that this will be solved at the working group level. Mr. Bernie Edwards (NASA) noted that there is currently no plan to standardize the wavelength in the working group. Mr. Peccia commented that what is important is that due dates that CCSDS has estimated should correspond to IOAG needs. In terms of resources and schedule, he noted that the Conjunction data message was finished in record time (2 ½ years for CCSDS publication) because it was supplied with the necessary resources. If there are issues in resources, then these goals and priorities will be difficult to achieve by the requested IOAG need. Technical issues, which might also cause delays, have also to be taken into account. Furthermore, the prototyping and other issues are not familiar for some people in the working group, causing

things to slow down. He commented that polls in the working group are also causing delays.

10) Top 10 Priorities/ ICPA

Top Priorities
Mr. Soula noted that Top Priorities in IOAG will be presented by him (slides 1 to 17), and Mr. Calzolari will present the second part that includes the ICPA (slides 18 to 25), as a result of a delegation by the IOAG chair to prepare proposals on these subjects.
Mr. Soula said that the first goal was to establish the highest priority given by the IOAG for the definition of common practices and the development of new standards.

He briefly mentioned that the history of the Top Priorities was started in March 2011. There were actually 7 Top Priorities selected in 2011, out of which 4 items are now available. At IOAG-17, there was a request to re-visit the list also considering that some items should be removed now that these standards have been developed by CCSDS. For the Top Priorities process, NASA emphasized that there should be a clean mapping with priorities and ICPA. CCSDS noted that the Top Priorities items correspond to more items in IPA. There was a question whether this Top Priorities process is necessary. Mr. Soula responded that there should be a list of high level priorities first, not all of them having flow down to the ICPA, and some possibly not related to CCSDS nor to standards. Mr. Wallace Tai (NASA) asked if there was any reason why IOAG could not reach a consensus so that they could establish up to date Top Priorities. He hoped the Chair could help them reach consensus at the end of the process. The Chair responded that they should not pre-empt the discussion that is planned in the context of this meeting.

Mr. Soula provided a summary on slide 6 to 8 of the situation as of IOAG-18. 11 items remain from the 2011 list of candidate Top Priorities and 10 items were added based on proposals from ESA, CNES and NASA.
Mr. Soula then introduced the new proposals for Top Priorities from CNES. NASA commented that some of the items not only just correspond to CCSDS, but also SFCG. It was suggested that supporting longer term projects would be able to harmonize efforts. CCSDS responded that it would be great to have a pilot mission for cross support. CNES noted that it would require time to infuse standards and that common choices and practices are needed to achieve true interoperability; if too many different options are left open, cross support may not be possible, depending on the actual implementations. NASA commented that the IOAG infusion tables are related to Service Catalog 1 & 2, whereas ICPA is for standards development.

A comment was raised about the difference between "common choices" versus "harmonized practices" – if it was to be produced in CCSDS, there may be interoperability but in reality not be in sync.

In providing input to the IOAG Priorities Table, NASA proposed the forward error-correction (FEC) code for forward link as a top-priority item. It was stated that:
1. There is no CCSDS standard for forward error-correction code for uplink (forward link).
2. There is no CCSDS standard for forward error-correction code for high-rate uplink (forward link).

Regarding (1), some participants, however, argued that rate 1/2 and 1/3 convolutional codes had been used by the NASA SN for 30 years, and they were viewed as the "standards." Moreover, the CCSDS has been defining the true, explicit standard for more efficient FEC codes based on binary LDPC codes. The specific code block parameters documented in a Blue Book are forthcoming. Therefore, they questioned the rationales of the NASA priority.

NASA participants responded by pointing out that in the high-rate uplink regime serving human space flight (HSF) missions, e.g. MPCV in 2014, 2017 and beyond, and human Mars exploration using 34 GHz or 40 GHz links, we really need the uplink FEC code with higher coding gain. For MPCV EFT-1, EM-1 and EM-2, NASA will proceed with the LDPC rate 1/2 code (not exactly standardized by the CCSDS) for encoding the AOS frames. That means, longer code blocks for the long AOS frames, optimized as such. The LDPC-based uplink FEC currently being defined by the CCSDS, while an excellent choice, is only intended for the telecommand (TC) frames. Since forward links to human exploration vehicles often have much higher bandwidth for voice channels and additional data channels beyond telecommand, this is insufficient.

The discussion then turned to the HSF relevancy as to how many space agencies have the driving need for high-rate uplink. Clearly, NASA, RFSA, and CNSA all have their independent "in-house" astronaut missions. If we believe there will be an international program for human deep space (eg: Mars) exploration in the future, then the IOAG, as a strategic body for interoperability and cross support, must treat the standard FEC coding for high-rate uplink as a high-priority item.

ESA commented that their 2 proposed Top Priorities on GNSS tables and Emergency Cross support were also on the agenda of IOAG-18.

The priority template was displayed with all agency inputs, and the Chair confirmed consensus on the template, while CSA and RFSA abstained at this stage.

Mr. Soula pointed out two items that do not need discussion and should belong to the new Top Priority list as they result from a consistent evaluation for high priority by all Members (see slide 12); those are:

  – Protection of the S-band for TT&C operations of S/C

- Common choices for RFM and Coding in the IOAG SC's#

Mr. Soula then listed items proposed for inclusion in the Top Priorities list after discussion as they are evaluated with intermediate marks and sometimes with intermediate deviations (not a full consensus), so requiring further inputs from various agencies (see slide 13): Emergency Working Group, SM&C Core Services, Data Link Security Layer, Harmonized practices for 26GHz band cross support utilization, DTN, 26GHz, and the Forward link coding & high-rate forward link.

Agencies being responsible for the deviations to the consensus were asked if they would accept the corresponding item being included in the list of Top Priorities.

- UKSA did not object that the Emergency WG is considered as Top Priority, as agreed by Full Members.
- ASI agreed to the SM&C Core Services and agreed that this item should be maintained as a Top Priority, as was in the 2011 list.
- JAXA agreed to priority 2 for the Space Data Link Security and agreed that this item should be maintained as a Top Priority, as was in the 2011 list.
- ESA and UKSA commented that the list looks fine on the 26GHz band for cross support. Both the development of the standards identified by the LEO26SG and the definition of harmonized practices may then be part of the new Top Priorities.
- As for DTN, CNES noted the even if it has no plans on DTN, it should be added for consistency with the results of SISG. There was no objection from UKSA and KARI.
- Only few agencies had provided their evaluations on the Forward Link. ESA commented that this requires clarification and consideration based upon actions discussed later that day. NASA commented that they would like international standards, as it is already built and will be flying.

Mr. Soula then discussed proposals for items not to be part of the "Published" Top Priority List (see slide 14). The Chair asked if CCSDS will have issues if items reduce their priority as it seems to be the case for Service management. CCSDS responded that engaged work will continue. It was also commented that the items related to Optical Links may be left with Priority 2 as they are not required in the very short term. No other item was then added to the Top Priorities list.

Mr. Soula then provided updated definitions to priorities and the Chair asked if there is a problem to track other priorities outside of 1; he then suggested focusing on priority 1 items, but continuing to maintain a list of other items, for later consideration. It was agreed that sometimes the meaning of a top priority item is not well defined, and it was suggested the Secretariat to maintain a document providing a clear rationale and description for each item, as well as a

description of the process for adding/removing items. Mr. Soula volunteered himself and Mr. Calzolari to help the Secretariat develop such a document.

AI 18-04: CNES/Soula, ESA/Calzolari, and IOAG Secretariat to create documentation for a re-usable priority process.   [Assigned to: CNES/Soula, ESA/Calzolari, IOAG Secretariat; Due Date: 25 March 2014]

ICPA
Mr. Calzolari then presented the IOAG ICPA status. He noted that the ICPA process should provide guidelines on what is followed. The following 3 items required IOAG consideration: Space Data Link Security (SDLS), Solar System Internetwork Architecture Document, CSTS Transfer File Service and CSTS Offline Radio Metric Service.

The Chair noted the SDLS completion date is not an issue. Also the final delivery of the Green Book for the Solar System Internetwork Architecture Document can be delayed and not an issue. The date is not an issue but the question is that the SISG review document was accepted by IOP and the most recent modifications should be checked again by the SISG. As for the CSTS File Transfer Service and CSTS offline Radio Metric Service, CCSDS noted it is necessary IOAG provides revised input. It was agreed that an action item be created for agencies to assess and report on their need of the CSTS services or the existence of alternate solutions.

AI 18-01: All agencies to assess and report on their need for the CSTS file transfer service and CSTS offline radiometric service. [Assigned to: All agencies; Due Date: 17 April 2014]

Mr. Calzolari then presented the IOAG revisions made to the ICPA and discussed various inputs to be updated on the template. He then noted the very few changes in the definition of ICPA priorities for standards development that were developed back in 2011(see slide 23). Those changes were endorsed and will be reflected in the ICPA before the upcoming Spring meeting of CCSDS.

He noted that some new projects were added by CCSDS after the IOAG evaluations started in December; those require to be evaluated and their need dates be assigned.

AI 18-05: CNES/Soula, ESA/Calzolari to contact agencies and confirm the priority need date (drivers) regarding new standards and services recently added to ICPA by CCSDS. [Assigned to: CNES/Soula, ESA/Calzolari; Due Date: 17 April 2014]

As a result, he requested that the next evaluation deadline be for December 2017, and have to workload be based upon the driving needs. UKSA was concerned that there is at least 1 mission for application and cross support at that time, and it won't be top priority in time as it hasn't been

linked to any documents. NASA expressed the desire to move the standards forward and push for more formalized process. With priorities on the ground and space flight missions, there is a need date. However, they recognize that with uncertain budgets it makes things difficult.

A question arose about whether priority 2 dates would automatically move to priority 1 after a certain timeframe. It was suggested to remove the priority column that would be kept internally in IOAG. The Chair noted his concern of creating another document. CNES suggested adding an additional column for the need date. After discussion, the IOAG agreed to keep only the priorities Need Date column in ICPA.

11) Liaison Report: SFCG

Mr. Enrico Vassallo provided a SFCG liaison report. Concerning mission coordination, the report stated that it has continued as in the past. He commented that ISRO had apparently misinterpreted a 3-party agreement (ISRO, ESA, NASA) thus potentially causing radio frequency interference (RFI) to ESA missions There were some understanding issues with regards to ISRO's use of a frequency set only for emergency purposes. As a result, Mr. Vassallo emphasized the need to strictly follow coordination agreements.

Mr. Vassallo then noted that ESA and CNSA coordinated bi-laterally on the Chang'e 3 mission, thus not requiring operational coordination. However, he wished China participated more in IOAG, as it would be valuable to keep an open line of communication with the organization.

He then provided basic background on the upcoming World Radio Conference (WRC-15) meeting, and noted a potential threat with regards to AI 1.1 "Additional spectrum for International Mobile Telecommunications" targeting (among many others) the bands 2025-2110 MHz and 2200-2290 MHz, while studies have shown High density IMT systems and space services cannot share the band. He wished that China would be more involved in order to receive clarification on the position of their delegation asking to keep the study open. He mentioned that Sweden's administration is still in favor of this band for IMT. The Chair suggested that he could send a note on behalf of IOAG to both the Swedish Space Corporation and China's space ageny.

Mr. Vassallo then highlighted AI 1.9.1 "Possible new allocations to fixed-satellite service" which targets the bands 7145-7235 MHz and 8400-8500 MHz; the issue is that FSS downlinks at 7 GHz may cause RFI to DS and Lagrange missions in near earth phases (LEOP, transfer, fly-by). Furthermore protection of 8 GHz SRS receive stations from FSS uplinks require very large coordination areas. Mr. Vassallo then requested that all member agencies to talk with their administration as to make the views of space agencies known.

As for AI 1.9.2 "Possible new allocation to maritime-mobile satellite service" that targets the band 8025-8400 MHz, protection of 8 GHz EESS receive stations require very large exclusion

zones around coastal areas (which is difficult to enforce). Furthermore, out-of-band RFI at 8400-8500 MHz could be caused to deep space stations located not too far from coastal areas. He commented that the Russian Federation seems to be still considering the allocation as feasible with constraints. Mr. Vasyilev noted he would be able to look into this issue.

In conclusion, Mr. Vassallo requested that to improve the chances of a successful WRC-15 result for IOAG, the IOAG members shall:

- actively contribute to the work of the ITU and its regional preparatory meetings in accordance with the SFCG strategic goals;
- express the concerns of space agencies to the relevant national Administrations so that a balanced national position can be taken.

CNES noted they have no position on those agenda items, but will check with their agency. Mr. Vassallo requested that the Secretariat send out a note to IOAG members on the importance of ITU WRC-15 (slide 12).

AI 18-02: IOAG Chair to draft letter to Sweden (SSC/Universal Space Network) and China (Gan Yong) with regards to SFCG report on "Additional spectrum for International Mobile Telecommunications" targets (among many others) the bands 2025-2110 MHz and 2200-2290 MHz". [Assigned to: IOAG Chair, NASA/Liebrecht; Due Date: 21 February 2014]

AI 18-03: IOAG Secretariat to send out note to IOAG members on the importance of ITU WRC-15 (SFCG liaison report- slide 12). [Assigned to: IOAG Secretariat; Due Date: 21 February 2014]

12) Liaison Report: ISECG
The Chair commented that he spoke with Kathy Laurini from ISECG. He noted that nothing was on-going that requires updates and direct interaction at this point. Mr. Liebrecht agreed. He highlighted that the IOAG inputs to the current version of the ISECG roadmap have been constructive. DLR commented that the document only addresses manned space flight and robotic missions. He suggested that it should cover other missions as well. It was mentioned that the annual report and work plan do not have anything on the liaison relationship term.

A question was asked about the next meetings of ISECG. The Secretariat will look at the dates and share with the IOAG delegates.

13) Working Group on Coding and Modulation
Mr. Les Deutsch (NASA) made a presentation on a proposed IOAG study of coding and modulation, with a goal of making recommendations on managing the growth of the number of standards in this area. Mr. Calzolari pointed out that there is a difference with Europe and the

US in the use of standards and perhaps there is no reason to reduce the number of available standards.

NASA proposed that member agencies come together to look at the number of standards that exist. It does not need formal working group, but will need representation from a number of agencies to discuss and report back. Mr. Liebrecht recommended the group provide recommendations on coding and modulations for cross support. Ideally it would be a small, short-term, manageable group that is committed to providing a review and solution.

Mr. Calzoari then provided his presentation, proposing that each agency should submit the coding and modulation schemes that its stations support. Afterwards a small team can provide the necessary template to accomplish the task. The aggregated table could then be used to decide if it makes sense to further explore a reduction of the coding and modulation schemes. DLR commented on Mr. Calzolari's proposal that there needs to be an inventory of what is available. Then it can be decided whether a new scheme is needed when a new mission is created. ESA has for example no missions which to use certain items. Mr. Vassallo added that, if IOAG makes a table listing the items, SFCG can see which ones they support.

NASA noted both proposals are correct, but DLR is asking for a strategic view to start transitioning so that 5-8 years from now, IOAG ends up with a limited set of standards. CNES proposed that the first step is to submit what stations can do today. The Chair suggested making a table and moving forward on the task from there. ESA and NASA agreed as it is a two-step approach to utilize what Mr. Calzolari and Mr. Vassallo put together and then move forward. NASA commented that the group needs to consider and provide a short list of what can be done. Mr. Tai noted that the action item does not include what is implemented at various stations and may require going one step further. The Chair requested this to be completed offline and NASA suggested Mr. Deutsch and Mr. Calzolari form a group to work this action offline.

AI 18-06: All agencies to provide names and point of contact to further discussions on the coding and modulation. [Assigned to: All agencies; Due Date: 28 February 2014]

14) Working Group Updates
MOSSG Update
Mr. Kearney provided a presentation on MOSSG and highlighted the study group's background on how it was created, as well as expected products based upon the terms of reference developed. The Chair noted that elements of the mission operations group can be relevant to the emergency working group. Mr. Kearney agreed. Chair asked whether RFSA would be interested in participating and RFSA said they need to look into this further.

A question was raised who is part of the MOSSG group, besides the ESA and NASA co-chairs. Mr. Kearny listed JAXA/Mr. Yoshikazu Miyano, CSA/Mr. Ken Lord, CNES/Mr. Mark Duhaze, ASI/Mr. Gabriele Mascetti and DLR/Mr. Martin Gnat. Mr. Kearney also mentioned his co-chair,

ESA/Mr. Francois Allard. While there are 6-7 people in the group, it is nothing to the size of SISG and therefore is attempting to accomplish a similar task with much less support/resources.

SISG Update
The IOAG noted that there is no need to activate the group completely. However there is a need to check up on the architecture and see if there will be a replacement for Mr. John Rush after retirement. It was agreed that the group will be activated as required.

OLSG Update
Mr. Bernie Edwards noted that OLSG is on hold and it will just interface with ICAO. There haven't been new discussions since IOAG-17 but there has been some activity going on in CCSDS.

On the Russian side, they will also work on optional communication in the future. The Chair requested an update from RFSA in that regard in the future.

26GHz Update
The group is currently on hold. The IOAG noted that there are various ground elements related to this subject. Both DLR and NASA have Ka-Band antenna(s) and CSA will also have some ground elements . The Chair asked whether there are any lessons learned from the demonstrators. This will be a subject of a future meeting.

AI 18-07: Each working group lead (both dormant and active) to provide follow-up status update their respective topic at the next IOAG meeting. [Assigned to: SISG, OLSG, 26ghz, SECSWG; MOSSG ; Due Date: 1 May 2014]

15) Proposal to Improve the Mission Model Tables and Communication Assets Tables
Mr. Bill Horne (NASA) first addressed the Mission Model tables, providing the background as to why he is looking at the Mission Model topic. He noted that there was a very small number of activity/downloads of the current online Mission Model spreadsheet. He stated concern that it was not clear what the intended use of the mission model was, and as a result it was difficult to improve the process for an uncertain goal. Mr. Liebrecht noted that each IOAG delegate is very busy, and rather than expend time on an unneeded capability, the IOAG should consider whether this database is needed as the maintenance requires some work.

 The Chair noted the Mission Model database provides more background information than just, as the Communications Assets table provides. Definitely a Communication Assets table should be maintained as a standard IOAG activity. The mission model tables are mainly background information; hence it is under discussion as to the utility of such a database.

Addressing the pros and cons of the processes, Mr. Kearney expressed concern that sharing spreadsheets may make it difficult to maintain the accuracy of the tables. CNES mentioned that it was be a heavy workload to develop, as well to update the database. It has to reflect the benefits of what we're doing. IOAG has tried to put in place the communication assets table and that has not been well maintained by all participating agencies.

UKSA requested a bit more clarification on what needs to be developed. The Chair asked if all agencies could investigate their use and value of the mission models and to provide suggestions on whether to update or abandon the Mission Model databases. Mr. Vassallo noted that he uses the SFCG database for mission and cross support mission models. Mr. Horne noted that the discussion was talked about adequately and the survey of agencies' needs for the Mission Model would be a good approach.

Communication Assets Improvement

Mike Kearney requested to bring up a similar topic on improving the Communication Assets table. He provided some background information based upon his visit to Taiwan.

Mr. Kearney stated that similarly to the Mission Model discussion, the same questions applied to the Communications Assets database/spreadsheet that was being maintained by the IOAG. He advocated changing the process from manually updated spreadsheets that were available for download to an online capability similar to the SFCG capability. Mr. Kearney had previously asked the CCSDS Secretariat to prototype such an online capability, and Mr. Kearney demonstrated it live during this IOAG meeting. While this was a prototype, he said that a final implementation would have the capability for each agency to independently update their own communications assets. He stated that there were several options for how to implement this:

(1) On the CCSDS website, since the prototype was already established.
(2) On the SANA registry, since the function is more "operational" and the SANA website is the operational arm of such registries for spaceflight
(3) On the IOAG website, pending verification that there were such capabilities on that SharePoint site
(4) Jointly maintained with the SFCG database, depending on the capabilities to do so, and the interest of the organization that maintains the SFCG database.

Mr. Kearney pointed out that with the approach of an online database accessible by agency representatives,, each agency can update the assets on their own; theoretically rather than once a year, they can update it as their mission model changes. Then there would be a more up to date model, always accessible. SFCG noted that is how they do it in SFCG. NASA suggested there may be some synergies with the SFCG, and the Chair agreed that this can be a possibility. Mr. Kearney noted that there will be resources issues, as the tool and its maintenance would not be free. Plus, there should security layers not included in the demo.

The Chair asked if anyone else had further opinions. UKSA noted that it would appear to make sense in saving time, but it is necessary to look at the cost. It was agreed that Mr. Kearney would investigate the costs.

AI 18-08: All agencies to investigate the use and value of the mission models and to provide suggestions on improvement or whether to abandon the model. [Assigned to: All Agencies; Due Date: 17 April 2014]

AI 18-09: NASA/Mike Kearney to investigate the costs of creating an automated online database for the IOAG communication assets. [Assigned to: NASA/Mike Kearney; Due Date: 17 April 2014]

16) SpaceOps Paper
Mr. Liebrecht provided an overview of the SpaceOps 2014 outline that has been developed with Mr. Soula, Mr. Pilgram, and Mr. Schmidt. He welcomed all IOAG members to join the discussions and planning on Thursday. He noted that there is still a question on who would be presenting the conference paper.

17) Drafting Committee
The Chair adjourned the meeting for the day, requesting volunteers from the IOAG delegations to support the drafting committee. Mr. Soula and Mr. Liebrecht joined to support the Secretariat and Chair in the drafting committee.

IOAG-18 Meeting Minutes
Teleconference
12 February 2014 – Day 3
9:00 – 17:00 CET

Attendance:
Chair: Michael Schmidt
Secretariat: Stephanie Wan

Members:
ASI: Giovanni Valentini
CNES: Jean-Marc Soula
CSA: Jean-Pierre, Ken Lord
DLR: Martin Pilgram, Rolf Kozlowski
ESA: Nestor Peccia, Gian-Paolo Calzolari
NASA: Phil Liebrecht, Madeline Butler, Les Deutsch, Bernie Edwards, Mike Kearney, Wallace Tai
JAXA: Tsutomu Shigeta, Yoshikazu Miyano
RFSA: Mikhail Vasilyev, Vladimir Shuchev

Observers:
KARI: Sang-Il Ahn
UKSA: Peter Allan

On Teleconference:
ESA: Erik Soerensen
NASA: JJ Miller, Frank Bauer, AJ Oria

18) Opening/Review

The Chair opened the meeting by thanking ASI for organizing the no-host dinner. He then reviewed the agenda and noted time constraints due to a fixed schedule for the ASI tour.

CCSDS noted that they had sent a letter in response to IOP-3, and was looking to receive a response from IOAG. The Secretariat commented that there will also be a congratulatory retirement letter to John Rush that also requires IOAG review. The Chair noted that it will be an item tabled for discussion before lunch.

19) Working Group on Spacecraft Emergency Cross-Support
The Chair noted originally that the topic of discussion was raised originally by JAXA. Mr. Erik Soerensen/ESA joined on telecon for the topic. Chair reviewed the working group charter drafted by NASA and noted that Erik Soerensen (from the ESA ground station department) will be the ESA representative in working group. The Emergency Cross Support concept has 3 elements: spacecraft, ground tracking assets, and ground control center.

He mentioned that if agencies have the pre-validated ground support standard systems in place, it can help save time during an emergency because systems can be configured more easy.

Mr. Tai commented that he had read a white paper on the concept and highlighted NASA's interest in the issue IOAG wants to solve. Interagency cross support in emergency has been going on for long time with success. Mr. Soerensen stated that ESA and NASA have a long history working together and the relevant infrastructure is basically in place. Mr. Tai noted that there might be some areas concerning operational policy and process that deserved some improvement.

Mr. Kearney referred to the 2012 CCSDS Darmstadt meeting when Mr. Wolfgang Hell addressed the failed Phobos-Grunt mission. He mentioned the successful support to the XMM-Newtown, which was only possible because a standardized configuration for the INTEGRAL mission was in place. Mr. Tai noted that the SLE capability for relevant stations is important – it has been in place and it is nothing new, however in providing this capability with high priority when an emergency event occurs, it may require a governing policy so that agencies can be accountable to provide timely support.

Mr. Peccia noted that a tested system is needed beforehand, otherwise the support is difficult. Mr. Tai emphasized that it is a policy about how we treat emergency spaceflight mode. Mr. Peccia responded it is also a political issue. Mr. Soula questioned if this is a common policy or common IOAG agreement issue. This kind of support has already been done on a bi-lateral basis for many years. However, it should be checked whether there is enough drive to move forward on a multilateral level.

NASA noted that a policy by national government is needed. The Chair asked Mr. Tai if it is a formal policy at agency level, or rules/agreement by IOAG members. Mr. Tai responded that whatever is appropriate should be implemented. ESA noted that it requires committing resources and the management of the concerned agencies should be contacted to reach an agreement. Mr. Tai noted during emergency mode, it is the policy that everything else is low priority so long as there is a bi-lateral agreement; if there are multiple emergencies, then there needs to be a good understanding of the policy level. NASA noted that such a policy does not apply to spacecraft within a bi-lateral agreement. History shows that agencies can deal with emergency incidences easily and work well in the end, but it would be good to have a common set of policy/guideline on what IOAG should do. CNES asked if we should target a global agreement to provide cross

support to each other, or apply on bi-lateral basis. NASA noted it is not that 'easy, it might also depend on the individual mission.

The Chair asked for clarification and suggested to define the technical basis. CNES mentioned that this aspect is not covered by the current charter. NASA noted that IOAG can set up a standard framework on how to operate, as they hoped the working group can investigate the minimal amount of interface for this to happen. CNES responded this was already in place, and questioned whether there needs to be a common database or a common agreement.

NASA highlighted that the working group can investigate the technical aspects, but there is still the issue of political/governmental coordination. The Chair was concerned about pre-loading the working group with that topic, and suggested the investigation of Emergency Cross Support political/governmental policy coordination become an action item worked by each agency.

UKSA raised the issue that there may be a financial component, and the Chair responded that it differs from agency to agency. NASA hopes for a consistent framework, and each agency needs to think about the right political approval. DLR asked at which level IOAG sees this become implemented effectively. Chair responded there are two areas to coordinate: the policy level worked on by the head of each delegation, and the technical level by the working group. NASA agreed that the political and legal aspect needs to be discussed within each agency internally.

The Chair asked Mr. Tai if the policy issues were investigated prior to the IOAG meeting. Mr. Tai responded that they had noted the need to identify the policy related issues, though in the past it was resolved on an ad hoc basis.

Mr. Soerensen agreed and noted that while the working group can identify policy issues, they cannot resolve political issues. The group should instead focus on technical issues. The Chair proposed to define a draft work plan.

The Chair went around room to see if agencies have any additional opinions. ASI referred to the organization change and would need to ask internally and wait for the new President to come up with the resources to support the group. CSA said they will take back the subject to discuss with their SatOps area to see if it would be something they want to be active in. CNES noted they are interested and will provide a representative. JAXA noted that it will participate , noting that the network and satellite project people will need to coordinate this concept within JAXA. DLR agreed supporting the effort and would be happy to contribute, although they need to identify who will support the activity. KARI noted they are interested to follow the progress of the IOAG working group's activities, but need to assess how far they can be involved. RFSA said they are interested, but an agreement at agency level is needed. RFSA took an action item to check back within the agency and to respond at the next meeting. NASA noted they believe there is value to the working group as this will facilitate the process. Madeline Butler will be the NASA representative in this working group. UKSA said they need to discuss this with their agency;

they currently do not own ground assets, and it is STSC who owns it. ESA noted they are interested and Mr. Erik Soerensen will be the representative.

The Chair counted 6 agencies confirming their interest in joining. There were no objections and an agreement for setting up the working group was established. ESA noted Mr. Erik Soerensen offered to be a co-chair. NASA volunteered Madeline Butler as the other co-chair.

JAXA asked about the frequency this group will convene. The Chair responded that he hoped the first progress report would be ready by the next face to face meeting. The frequency of meetings can be decided by the working group. JAXA noted that it is also required to define which satellites can be supported; and the Chair agreed. NASA noted that may be another item to identify is the spectrum licenses. The Chair proposed that this is also addressed by the working group. This was agreed by Mr. Soerensen. The Chair thanked Mr. Soerensen for his participation and suggested further coordination with Ms. Butler.

AI 18-11: All interested agencies to investigate their respective political/governmental aspect of spacecraft emergency cross support impact and what is further needed to move forward in developing a potential framework/guideline. [Assigned to: All Agencies; Due Date: 17 April 2014]

AI 18-13: All Agencies to provide names for SECSWG participation. [Assigned to: All Agencies; Due Date: 28 February 2014]

AI 18-14: ESA/Soerensen and NASA/Butler will discuss/Set up SECSWG on plan forward and schedule and involve relevant people. [Assigned to: ESA/ Sorenson, NASA/Butler; Due Date: 1 May 2014]

AI 18-15: Chair will update IOAG 2014 Workplan chapter on SECSWG work item and issue work plan by next week. [Assigned to: IOAG Chair; Due Date: 21 February 2014]

20) IOAG Membership
The Chair presented the latest IOAG organization chart. He emphasized that ISRO has not participated in any meetings nor has responded to multiple correspondences sent from himself and the former Chair. This affects the voting process due to not having a quorum. IOAG members agreed that a lot of effort has been put forward from the organization to reach out multiple times to try and engage with ISRO to attend both IOAG meetings and IOP-3 with no response. It was noted that ISRO supported the RFSG meeting that was running in parallel to the IOP meeting in the same city. The Chair proposed a vote to officially move ISRO from Full Member to Observer member status.

The IOAG members voted (2 Abstains; 6 Approvals) to move ISRO's IOAG membership to become an observer status. The Chair was tasked to draft a letter to ISRO informing them of this decision

CNES noted that while UKSA and KARI are observers, they have been full participants and thanked the two agencies for their continued active participation. He highlighted that the letter to ISRO should note they are still welcome to attend meetings and participate actively. NASA noted that ISRO may be observers, but noted if they become active, they can request to return as a Full Member

DLR asked if the South African National Space Agency (SANSA) has been contacted because on becoming an IOAG member. It was agreed that Mr. Kozlawski can ask SANSA on their interest in IOAG. The Chair and CNES noted that, as newcomers to the IOAG, it would be more appropriate for SANSA to initially be an Observer. . NASA was unsure of SANSA's missions, but it would be appropriate for them to participate if they are a government entity. CCSDS noted that some commercial operators are also prepared to provide cross support.

The Chair mentioned a meeting that he had with the Turkish Space Agency and they may also be interested in IOAG activities in the future when the set-up has been consolidated.

AI 18-16: Chair to draft a letter to ISRO stating the IOAG procedures and has voted to move them to Observer status. [Assigned to: IOAG Chair; Due Date: 21 February 2014]

21) Next Meetings

The Chair asked who would attend SpaceOps 2014, as it would provide an opportunity for a mini-meeting (IOAG-18a) on agenda topics, such as an update for the SECSWG, ICPA, and proposal of top priorities with a poll). ASI, DLR, NASA, UKSA, ESA, CNES, CCSDS, JAXA noted they would be attending, with KARI as a tentative participant. CSA commented they would not join in person. RFSA noted they currently do not know whether they can commit to working groups and provide inputs at the following meetings and will need to consult internally within their organization and notify IOAG. The Chair and Secretariat agreed to check the time and availability of rooms in SpaceOps 2014 for a possible IOAG-18a meeting.

It was agreed that the following telecon (IOAG-18b) would then be held on September 16, which would be before the CCSDS meeting.

Then IOAG-18c telecon is planned for 27 January 2015. KARI offered to host IOAG-19 in the Spring 2015 and look into the feasibility and dates, with JAXA as the backup host.

AI 18-12: RFSA to check with agency about IOAG participation and report back about representation availability. [Assigned to: RFSA; Due Date: 17 April 2014]

AI 18-17: Chair and Secretariat to check time/availability of room for IOAG-18a meeting at SpaceOps. [Assigned to: IOAG Chair & IOAG Secretariat; Due Date: 28 February 2014]

<u>AI 18-10</u>: KARI to look into the dates and ability to host IOAG-19. [Assigned to: KARI; Due Date: 1 May 2014]

22) Other Items for Discussion

CCSDS Letter Response:
The IOAG members reviewed the CCSDS Response to the IOP. The Chair asked if the dates of the LEO26SG are reasonable. CNES noted they are compatible with ICPA.

For MOSSG, the IOAG said it believed that CCSDS's response is appropriate. The Chair's response to the letter will be a 'thank you'. NASA then asked if the MOSSG would be able to complete the priorities by the end of 2014. Mr. Kearney responded this would not be an issue..

For OLSG, the Chair noted that based upon what he learned from Mr. Klaus-Juergen Schulz, the section looks fine. NASA noted that the need dates are accurate, while somewhat optimistic.

The Chair added that he thanks the work of CCSDS and will prepare a letter from IOAG.

23) ASI Tour
The IOAG delegates were led through an ASI Tour of the ASDC and Concurrent Engineering Facility.

24) Liaison Report: ICG
The Chair introduced the ICG and asked that members identify how far IOAG should interface with ICG and which work should be done on behalf of some agencies. Mr. JJ Miller (NASA) introduced himself and Mr. Frank Bauer.

Mr. Miller then provided an overview of 8th ICG meeting in Dubai, United Arab Emirates, and highlighted the benefits of the IOAG Chair attending the meeting. IOAG presence enforced the collaboration between the two organizations. He then commented that due to agency resource constraints, he could not attend the Vienna, Austria ICG preparatory meeting. Mr. Miller then recommended that the IOAG participates at ICG-9 meeting to be held in November 2014 in Prague, Czech Republic.

Mr. Miller then provided an overview of the ICG Working Group B activities, highlighting IOAG's involvement in developing the Global Navigation Satellite System (GNSS) Space Service Volume for providing navigation services to space users between 3000 km altitude up through geosynchronous altitude (36,000 km).. He noted the general organization structure of ICG, its four working groups, and the outcomes of ICG-8 meeting. He thanked the IOAG members for providing inputs to the GNSS Mission Model reference table. He commented that some parts of the GNSS Mission Model tables need further inputs and requested that agencies continue to provide, and update the information in these tables.

There was a recommendation that perhaps these tables also private sector missions using GNSS. Mr. Bauer noted that a request for information was sent out back in October 2013, but the data collection was impacted by the U.S. government shutdown. He stated that it would be beneficial to understand the IOAG position concerning a public database of such missions. A questionnaire was provided to show the information being requested. The Chair asked whether some members wished to keep the data as confidential and how the database would be used. Mr. Bauer said responders only needed to provide as much information as they were comfortable in a public setting.

Concerns were expressed on how this information would be used since NASA, and the United Nations, may have different interests.

Mr. Bauer presented the type of information being requested which, for example, includes knowing the various types of available GNSS space receivers as well as the development status of GNSS receivers for different space missions. The evolution of the GNSS receivers is of big interest to all GNSS service providers, as it provides a better understanding of what needs to happen in the future and which technology developments may be needed. The Chair confirmed the advantages of this information but also cautioned about sensitive commercial interests.

Mr. Miller continued addressing the benefits of further ICG involvement. The IOAG delegation at the ICG would be able to listen in on the technical discussions. Furthermore, he recommended that interested IOAG members get on the ICG distribution list to receive information that could be of mutual interest, and that both he and the Chair continue to stay engaged in ICG to ensure the space community interests are adequately represented. The Chair asked whether the role of the IOAG in relation to the ICG should be modified. Mr. Miller stated that the current liaison relationship is adequate. The Chair informed the IOAG members that it had been asked to collect and forward their requirements to ICG and continue developing a table of missions using GNSS receivers. Some of this information, such as the GNSS Missions tables, had already been made available to the ICG. The Chair asked the IOAG members whether there is an interest to collect user requirements and information regarding space missions using GNSS. Mr. Miller emphasized that ICG organization is entirely voluntary and intended to provide a useful forum for space user groups.

NASA noted that the GNSS-based positioning, navigation, and timing in space has expanded the capabilities available to space users, and there are already many depending on GNSS signals. Therefore, it would be useful to have advocates from the space user community at a forum such as ICG for the use of GNSS signals. The Chair commented that he realized this after participating at the ICG-8 meeting. .

The question presented to the IOAG is how much it should engage with ICG, as it depends on the opportunities and cost. The Chair suggested sharing updates to the Aggregate GNSS Missions table when requested. It was also proposed that agencies check the level of interest

within their organizations. ASI asked about the estimated resources required for such work. The Chair believed it should not take a lot resources. NASA suggested that if technical work is required the CCSDS can be involved. Mr. Kearney highlighted that there is already a navigation working group in place in CCSDS. The IOAG agreed to update and verify their GNSS mission models. Mr. Miller will collect the data and the Secretariat will provide the tables to the ICG in time for the June 2014 preparatory meeting in Vienna, Austria. The Chair thanked Mr. Miller and Mr. Bauer for their contributions.

The discussion continued on whether someone from IOAG should either attend future ICG meetings, or only those with an item of particular interest to the group. IOAG members did not volunteer. Mr. Liebrecht noted his interest, but may have constraints. CNES noted not all agencies require the additional channels to relay their requirements. Furthermore, it may be difficult to find the right person to discuss and work on this subject, so CNES was not sure of the best option. NASA compared SFCG's role in the ITU and noted that the IOAG may be able to offer the same. The Chair volunteered to attend ICG-9, and investigate further consideration and interest so that IOAG members can make a decision IOAG-19. All agencies agreed to the Chair's proposal.

AI 18-18: All agencies to go back and check if there is interest to follow up on the GNSS interface with ICG. [Assigned to: All IOAG delegates; Due Date: 17 April 2014]

AI 18-19: Secretariat to share latest GNSS mission model with IOAG delegates to verify inputs. [Assigned to: IOAG Secretariat; Due Date: 28 February 2014]

AI 18-20: All agencies to update and verify their GNSS mission model tables to be prepared for sharing at ICG-9. [Assigned to: All IOAG delegates; Due Date: 17 April 2014]

25) Drafting Committee Report
The Secretariat provided a report on the list of action items proposed during the IOAG-18 meeting. The IOAG members reviewed the list and agreed on the actions.

26) Adjourn
The Chair thanked the IOAG host and the IOAG delegates for having a fruitful meeting and wished everyone a safe travel back home.

ACTION ITEMS

AI 18-01: All agencies to assess and report on their need for the CSTS file transfer service and CSTS offline radiometric service. [Assigned to: All agencies; Due Date: 17 April 2014]

AI 18-02: IOAG Chair to draft letter to Sweden (SSC/Universal Space Network) and China (Gan Yong) with regards to SFCG request for clarification on "Additional spectrum for International Mobile Telecommunications" targets (among many others) the bands 2025-2110 MHz and 2200-2290 MHz". [Assigned to: IOAG Chair, NASA/Liebrecht; Due Date: 21 February 2014]

AI 18-03: IOAG Secretariat to send out note to IOAG members on the importance of ITU WRC-15 (SFCG liaison report- slide 12). [Assigned to: IOAG Secretariat; Due Date: 21 February 2014]

AI 18-04: CNES/Soula, ESA/Calzolari, and IOAG Secretariat to create documentation for a re-usable priority process.   [Assigned to: CNES/Soula, ESA/Calzolari, IOAG Secretariat; Due Date: 25 March 2014]

AI 18-05: CNES/Soula, ESA/Calzolari to contact agencies and confirm the priority need date (drivers) regarding new proposed standards and services. [Assigned to: CNES/Soula, ESA/Calzolari; Due Date: 17 April 2014]

AI 18-06: All agencies to provide names and point of contact to further discussions on the coding and modulation. [Assigned to: All agencies; Due Date: 28 February 2014]

AI 18-07: Each working group lead (both dormant and active) to provide follow-up status update their respective topic at the next IOAG meeting. [Assigned to: SISG, OLSG, 26ghz, SECSWG; MOSSG ; Due Date: 1 May 2014]

AI 18-08: All agencies to investigate the use and value of the mission models and to provide suggestions on improvement or whether to abandon the model. [Assigned to: All Agencies; Due Date: 17 April 2014]

AI 18-09: NASA/Mike Kearney to investigate the costs of creating an automated online database for the IOAG communication assets. [Assigned to: NASA/Mike Kearney; Due Date: 17 April 2014]

AI 18-10: KARI to look into the dates and ability to host IOAG-19. [Assigned to: KARI; Due Date: 1 May 2014]

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developing a potential framework/guideline. [Assigned to: All Agencies; Due Date: 17 April 2014]

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