INTERAGENCY OPERATIONS ADVISORY GROUP

IOAG-22e Meeting Minutes

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Prepared by: Madeleine Bronstein

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IOAG-22e Meeting Minutes
Teleconference
31 January 2019

Attendance:
Chair: Michael Schmidt
Secretariat: Madeleine Bronstein

Members:
ASI: Fabio D'Amico
CNES: Jean-Marc Soula
CNSA: Gan Yong
CSA: Francois Alain
DLR: Martin Pilgram, Rolf Kozlowski
ESA: Gian Paolo Calzolari, Marco Lanucara
JAXA: Hirokazu Hoshino
NASA: Bernie Edwards, Cathy Barclay, Dan Smith, Dave Israel, Jim Schier, Les Deutsch, Phil Liebrecht, Philip Baldwin, Wallace Tai, Wendy Evans

Observers:
KARI: Sangil Ahn
UAESA: Adnan Alrais
UKSA: Matthew Cosby

Liaisons:
CCSDS: Margherita di Giulio
ICG: JJ Miller

Presentations are available at: www.IOAG.org.

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Introduction: Michael Schmidt

The Chairman thanked the participants for their attendance and provided an overview of the IOAG-22e agenda.

Review of Open Actions

Prior to reviewing the open action items, the Chairman asked delegates if Ms. di Giulio could serve as the temporary CCSDS liaison. Mr. Liebrecht concurred with this temporary appointment until the delegates approve another CCSDS liaison. Ms. di Giulio noted that there is a CCSDS teleconference on February 14 for which the draft agenda has already been distributed. She asked the delegates if she should proceed on schedule for this telecon. Mr. Liebrecht responded that NASA may propose another CCSDS delegate before then, but if not, he asked her to continue with the telecon. Subsequent to this teleconference, Dr. Stephen Townes was confirmed by the CCSDS Management Council (CMC) as NASA's new Principal Delegate to CCSDS, the new Chair of the CMC, and liaison to the IOAG.

The Chairman then reviewed the following open actions:

AI 4-04: JAXA to make proposal on holding Leadership Forum in conjunction with major space conferences for more regular occurrence of meetings.

Mr. Hoshino presented JAXA's proposal for more frequent interaction between IOP delegates. At the IOP-4, Mr. Tachi suggested reviewing recommendations to determine if they're practical within the timeframe between IOP meetings. He recognized that it is not clear whether any progress is made and adequately shared and evaluated between IOP meetings. Therefore, he suggested developing a mechanism for reviewing the practicability of recommendations by delegates to maintain continuity with the previous IOP meeting. A primary objective of the suggested interim IOP meeting is to give feedback to the recommendations and evaluate whether any acceleration, addition, suspension, or any other change to the recommendations are needed. Some recommendations may need less than five years to meet their goals and may have become obsolete by the next IOP.

It is ideal, but may be difficult for executives to participate in IOP meetings for the full two- to three-day schedule. If one day is sufficient for an interim IOP meeting, the first half of the agenda can be used for reviewing a progress summary on the recommendations. The second half could be used for an open discussion on IOAG activities. The Leadership Forum does not have to be held

at a major space conference as proposed earlier, as long as it is anticipated that the majority of IOP delegates attend. A face-to-face meeting is desired, but video conference would also be acceptable. JAXA proposes the following two options:

1. To meet during the IAC or hold a mini-IOAG during SpaceOps. Mr. Hoshino noted that the JAXA IOP delegates do not always attend this type of conference, but their participation may be possible. However, JAXA assumes that setting up a side meeting at major space conferences may be difficult; or
2. To convene IOP delegates at a mid-term IOP-4a at an expanded version of the IOAG on the last days of IOAG-25.

The Chairman suggested setting up a meeting at the IAC since most agencies will be represented there at a high level, or at the next SpaceOps meeting. Mr. Liebrecht agreed that IAC is likely the best option, but he has not had the opportunity to speak to Mr. Gerstenmaier about his plans to attend the IAC. He recommended asking the IOP delegates about their opinion on this approach and what they think are the best conferences to consider. The Chairman responded that he could send the proposal to the IOP delegates to determine if the IAC would be a convenient meeting place in addition to holding a telecon at IOAG-25. Mr. Soula noted that the Director of CNES would not attend the IAC and proposed following the IOAG-23 with a teleconference during which the IOP delegates could discuss the results of the Industry Day. The Chairman agreed with Mr. Soula's proposal to organize a telecon as a part of the IOAG-23 and if delegates would like to meet at the IAC as well, that could possibly be arranged. Mr. Hoshino agreed with this approach.

Associated Document:
https://www.ioag.org/_layouts/15/WopiFrame.aspx?sourcedoc=/Lists/Actions/Attachments/618/AI_IOP-4-04_review%20rec_JAXA.pdf&action=default

AI 4-03: All agencies to consult experts regarding ongoing space traffic management efforts to avoid duplication of efforts. / AI 22d-09: Jean-Marc Soula to make recommendation on space traffic management forward work.

Mr. Soula presented his response to AI 22d-09. He reminded the delegates that at the IOP-4, the Chairman noted that the terminology for space traffic management and its relevance for the IOAG aren't clear. It was proposed that the IOAG could potentially act as a body for exchanging information, but this topic would have to be discussed in further detail in the future. Mr. Soula noted that space operations sustainability is a valid topic for the IOAG, because the IOAG Terms of Reference states that the IOAG provides a forum for identifying common needs across multiple agencies for coordinating operations topics in the domain of space communications, navigation, and mission operations. The proposal at the IOP Leadership Forum was to address space operations sustainability and Mr. Soula emphasized that long term space operations sustainability should be a major concern of the IOAG. It was also confirmed that the IOAG is not a regulatory body, but could contribute to other regulatory bodies.

The IOAG could: (1) identify what is changing in space activities, (2) establish what the new or increasing threats to space operations are, (3) understand what needs to be better addressed to cope with these threats, and (4) elaborate on recommendations that may be used by other organizations and regulatory bodies regarding what coordination is required and what needs to be improved. The approach by the IOAG should be based on a technical analysis of the threats and the mitigation measures, as well as on considerations for the required operational coordination. The recommendations should be useful for space agencies and government bodies of every state to bring their attention to this problem. Mr. Soula presented ideas for the starting point of the work, which may be found in further detail in the associated document. He noted that the ideas presented are a starting point and is not an exhaustive list.

The proposed forward work on STM is to: (1) amend the presentation based on the outcomes of the discussion, (2) to serve as a support document for the experts of the agencies to evaluate the possible added value of an IOAG contribution (technical/operations) in the frame of the AI 4-03, (3) to discuss the topic based on the feedback of the experts and decide if a WG should be established, and (4) if so, charter the WG and define membership.

Mr. Liebrecht noted that the presentation was thought provoking and an interesting proposal. He suggested that the delegates review the details of the presentation and provide feedback to Mr. Soula. There were many issues touched on and the IOAG should prioritize them and form a strategy for how to work through them. The scope is so broad that prioritization may help in getting work done.

The Chairman also noted that he has contacted the ESA space debris expert and is working with groups that have identified some tasks where there is interest for the IOAG to take over. He will put the expert in contact with Mr. Soula to elaborate on the proposal while waiting on input from the other delegates. Mr. Soula responded that he will work with the expert and can also work with other experts across agencies to discuss the ideas. He also reemphasized that STM has to address a lot of issues and those related to operations have to be identified.

The Chairman proposed amending AI 4-03 for delegates to provide a response and input to the presentation from Mr. Soula.

Associated Document:
https://www.ioag.org/_layouts/15/WopiFrame.aspx?sourcedoc=/Lists/Actions/Attachments/627/SOS%20at%20IOAG.pptx&action=default

AI 4-02: All agencies to discuss extension of IOAG charter to assess new services and technologies. / AI 22d-10: Delegates to provide input on new technologies for the IOAG to address.

The Chairman recommended noting which technologies have to be addressed and then discussing how to deal with these new technologies. This topic can be addressed at IOAG-22f. Mr. Liebrecht

added that the Leadership Forum discussed specific technologies, some of which are addressed in CCSDS, and the IOAG should figure out if/how these new technologies can contribute to facilitating operations. If so, what role should the IOAG take? For example, the IOAG set up a strategy group to determine if space internetworking could help operations and then come up with recommendations. This topic was heavily influenced by technologists and CCSDS, but the IOAG addressed specifically how it could help operations. Mr. Soula agreed to make this topic an agenda item for the next IOAG telecon, because it requires discussion. Mr. Alain noted that some of the technologies discussed at the Leadership Forum included: encryption technology, automation, artificial intelligence, technologies on proximity operations, and docking & rendezvous. The Chairman responded that this is the correct level of topics to discuss.

AI 4-01: Contact ISRO to reengage them in the IOAG and IOP.

Mr. Liebrecht noted that he has contacted NASA's external relations team and asked them how to proceed with this. He will provide an update on the action at the next telecon.

AI 22d-08: UKSA to make proposal for commercial engagement at IOAG-23 (interaction with Chairman first, then submit proposal to IOAG for discussion).

Mr. Cosby presented the UKSA proposal for an Industry Day during the IOAG-23 meeting in Goonhilly in September 2019. It was proposed that the day is focused around the harmonization of industrial and institutional communications technologies and infrastructure. In other words, is there a role for both industry and agencies, to work alongside each other, to increase communication capability to the benefit of both parties? To explore this, industry is invited to present how the agencies can help with this type of harmonization. If there is industry interest, then the role for the IOAG regarding harmonization is to be clarified. Mr. Cosby emphasized that this should be a collaborative discussion without one group dictating to the other and that the process for participation should be fair.

For the purpose of the proposal, industry was split into the following areas: (1) supply chain, (2) communication services, and (3) users of lunar/deep space communications services. The full list of companies provided as an example can be found in the associated document. Mr. Cosby noted that as the day is an exploratory exercise, characterization of industry is not necessarily required to address the topic of harmonization. Therefore, the day can be structured so that the IOAG can present its capacity and the delegates can gain input through industry presentation and face-to-face discussions.

Presentations would be held in the morning to allow the IOAG to take inputs for the discussion in the afternoon. The presentations will comprise of a selection of industry (if more than 10 volunteer for presentations) presenting their position on harmonization. Before the day is concluded, there will be an opportunity for interaction between IOAG delegates and industry as an area will be made available for individual companies to exhibit or just be there for discussion. This area is proposed to be a large area containing tables and not exhibition stands. In addition, there will be

tables containing specific agency / industry topics, such as future K/Ka-band and optical support that can attract both agency and industry in an open discussion. Mr. Cosby noted that the presentations shall be in terms of the topics to be addressed and industry's specific interests, within harmonization, and should not be a marketing exercise. Presenting of this type of material can be done at the tables in the afternoon. He also included a more detailed proposed agenda, which can be found in the associated document.

It was also proposed that each agency invite industry participants through accepted portals. For example, ESA (including the European space agencies) would advertise this event through EMITS. To further allow inclusion from industry, it is proposed to stream the event and allow interaction from registered users during the discussion in the afternoon (this give opportunities for Asian and American industry representatives to join if they cannot be physically present). He also noted that UKSA can support approximately 130 attendees.

Mr. Cosby recommended that an action be given to the agencies to talk to their industry and clarified that if this process is successful, then additional resources will be required from the IOAG agencies. Agreement on the Industry Day should be by the February/March timeframe with further discussion at IOAG-22f in April and invites released by May.

The Chairman noted that an ESA industry day was held a few weeks ago and there was interest from industry in activities. The concern was raised that the scope shouldn't be too broad and it was recommended that a specific topic be identified (e.g. evolution of Ka-band, evolution of optical ground station, etc.). Mr. Cosby, reviewing the proposed topic areas, noted that from the UK perspective industry has the most potential for growth within the lunar and deep space communications services area. The examples of the evolution of Ka-band and optical ground stations could be addressed under this topic area.

Mr. Liebrecht noted that it is likely that most of industry is unaware of what the IOAG, SFCG, and CCSDS are. The IOAG should set the stage for what the scope is as well as the history of the groups. For additional context it was suggested to distribute several papers on the IOAG and CCSDS to participants of Industry Day. The Chairman agreed with this and suggested that this information be included in the information package with points of contact for further information on Industry Day.

Mr. Liebrecht added that NASA currently has several procurement actions regarding interaction with industry. The first point is that he needs to make sure the Industry Day doesn't cause problems with the procurements, otherwise NASA won't be able to participate. The other point is that industry will be closely watching what is coming out from NASA and other agencies – NASA has a Broad Agency Announcement (BAA) out already. Mr. Schier added that the BAA was released in September, which announced a study request for proposals. The U.S. government shutdown, however, delayed the proposal evaluation one month. NASA is currently getting ready to announce 3 to 5 awards for 5-month studies to industry, specifically looking at creating commercial

opportunities for space communications in the future. After awards are made, NASA could talk to the awardees and see if they have an interest in participating in Industry Day. Mr. Liebrecht noted that NASA has supported these types of events in the past and intends to in the future.

Mr. Liebrecht mentioned that most commercial space users are in LEO (e.g. space tourism, servicing, private labs, etc.) and this was left out of Mr. Cosby's proposal. Mr. Cosby responded that he hadn't considered those examples, so he can add that topic into the proposal, but he noted that the delegates need to be mindful that the topic should be narrow enough to fit in the span of one day. Mr. Liebrecht suggested for the delegates to review the proposal and provide input on the priorities to focus on with industry. Mr. Yong noted that there is interest from commercial companies, especially in the supply chain area. The Chairman asked the delegates to take an action to provide input to Mr. Cosby on their priorities for topics to address at Industry Day by February 22. He asked JAXA, KARI, and CNSA to provide proposals on what topics are of relevance specifically to their agencies as well as the process for their agencies engaging with industry, since he is unfamiliar with what the process is in Asia. Mr. Hoshino asked if it would be okay to contact companies about Industry Day prior to the formal release of invitations in the May timeframe. The Chairman responded that this would be okay and contact with industry is up to the discretion of the agencies. Mr. Soula noted that the IOAG needs to reach an agreement on which aspect to focus on soon and asked if there is a telecon to discuss the proposals in February. The Chairman responded that there next telecon is planned for mid-April, but the delegates can decide if a telecon is needed for February or early March.

Mr. Cosby reminded the delegates that the current proposal for Industry Day is to hold it on the Tuesday of the week of the IOAG-23. The IOAG would meet for a half-day meeting on Monday, and continue the rest of the IOAG Wednesday through Friday. The configuration of the room will be in a lecture-type configuration Monday and Tuesday, and a boardroom-type configuration Wednesday through Friday.

Associated Document:
https://www.ioag.org/_layouts/15/WopiFrame.aspx?sourcedoc=/Lists/Actions/Attachments/626/UKSA%20Industry%20Day%20Proposal%20v1.0.docx&action=default

AI 22d-07: UAESA to make proposal for engaging with emerging space agencies and academia.

Mr. Alrais presented the UAESA's proposed plan for engaging emerging space agencies and academia. He noted that the IOAG should identify linkages and synergies with other associations, conferences, and organizations. It should also coordinate, integrate, and leverage activities with other organizations as appropriate. The IOAG should promote its activities to other organizations and conferences through reaching out and engaging existing member agencies to promote the IOAG through its existing local network, such as space centers, universities, and industry. In addition, he recommended the IOAG define topics of interest relevant to academia and emerging

space agencies. Lastly, more accessible and relevant content should be available online and the IOAG communique, annual reports, and working group outcomes with non-members agencies should be distributed.

Mr. Alrais proposed promoting the IOAG at the:

- IAF Global Conference on Space for Emerging Countries (GLEC) (Marrakech, Morocco in 2019);
- IAF 70th International Astronautical Congress (IAC) (Washington, D.C. in 2019);
- SpaceOps 2020 conference (Cape Town, South Africa in 2020);
- IEEE 2019 Aerospace Conference (Big Sky, Montana in 2019);
- IEEE Young Professional in Space (Dubai, UAE in 2019); and/or
- SFCG Annual Meeting (Berlin, Germany in 2019).

The Chairman asked if there are any representatives from the IOAG attending GLEC. Mr. Alrais responded that he will be participating in the conference and can coordinate with the organizing team. The Chairman also asked if there is any chance of any IOAG representatives presenting at the IAC. Mr. Alrais noted that it would be possible to have a session at the IAC and invite academia. The IAC has a section focused on emerging countries as well, so this presents a good opportunity for approaching academia as well as emerging countries. The Chairman asked Mr. Alrais to take an action to suggest a session at the IAC. Mr. Alrais accepted the action.

The Chairman asked if there are any suggestions for which topics to discuss with universities and academia. Mr. Alrais recommended finding a way for students and universities to contribute to the working groups and the research/studies within those groups. The IOAG could see if there is interest in this and whether they are able to contribute to the activities of the working groups. Mr. Liebrecht agreed that the key thing the IOAG wants is to try and engage these communities so that they will contribute to helping plan the global way forward in space operations. He noted that the IOAG does, however, need to be mindful about the results of the IOAG studies and some other topics that are shared between the members and those who contribute. There is a balance between demonstrating to the larger community that there is value added from their participation and working better together as a space community, and taking benefits of membership away by making things available to groups that don't actively contribute. The more people that use consistent approaches and compatible standards, the better, so the CCSDS has an approach that many entities contribute, but people around the world use their standards, even groups that don't contribute. Mr. Schier suggested identifying hard topics that require research and development, which would provide opportunities for universities to offer students research opportunities. Space agencies can offer points of contact for coordination. The Chairman asked Mr. Alrais to collect proposals for specific topics for and types of collaboration with universities.

Mr. Soula commented that there are very different objectives for engagement with emerging agencies and academia and recommended not to address both at the same time. The IOAG should

involve academia with what research is being done, but agency engagement is more about adding new participants in future plans. The Chairman responded that the scope of the interface is different, but he doesn't see a problem with doing them both at the same time. The IOAG should see what feedback is from engagement at the conferences.

AI 22d-06: MOSSG to follow up on AI 22-03 (agency interest in a Mission Operations Interoperability demonstrations).

Mr. Smith noted that because of the U.S. government shutdown, the MOSSG had missed its last 2 meetings. The group does have inputs from agencies on their interest in a demonstration and will meet next week to discuss the action.

AI 22d-05: Secretariat to upload MOSSG reports to the IOAG webpage. Delegates to conduct informal review and provide comments to the MOSSG. Following integration of comments, Secretariat to initiate eVote.

Mr. Smith noted that all updates were made prior to the IOP-4, and would like agencies to review them in detail and provide feedback.

AI 22d-04: C&MWG to give an introduction on forward work at IOAG-22e.

Mr. Calzolari presented expectations and recommendations for the C&MWG on behalf of himself and Dr. Deutsch. The C&MWG is currently expected to: (1) periodically review the CCSDS list of coding and modulation standards, (2) reviewing the C&MWG report when appropriate, (3) adding new membership to reflect actual IOAG participation and changes, and (4) update (when required) the list of preferred standards. Approximately a 5-year cycle is expected for the updates. This interval represents the reasonable timeframe for refreshing or confirming documents (similar to the CCSDS cycle for standards), but the documents can also be refreshed when necessary. The "Recommendations on Preferred Coding and Modulation Schemes" were approved at IOAG-19d in April 2016, and consequently, a revision should be carried out by mid-2021 unless conditions for an earlier revision rise. In such a case, the C&MWG should be resurrected at the beginning of 2020.

Today, the C&MWG can envisage checking CCSDS updates for new codes, new modulations, and new scenarios. In addition, it can check the maturity of those items that were marked as "Possibly Preferred in Future." Regarding the work status of the group, considering the ongoing activities in CCSDS and elsewhere (e.g. LOP-G selection of standards), a C&MWG resurrection in the first or even second quarter of 2020 looks like a reasonable target.

The Chairman agreed with the approach for the group to be dormant until 2020. Mr. Lanucara added that in the context of the lunar communications standard, if anything comes up the group can be reactivated. Mr. Schier noted that the first element of the LOP-G is supposed to be launched in 2022 and the first version of Gateway standards is being finalized. Further work on

communication and navigation standards are expected in the next year. He agreed with Mr. Calzolari on the working group recommendation with the caveat that the C&MWG could reactivate earlier if it would benefit reaching conclusions on the Gateway standards.

Associated Document:
https://www.ioag.org/_layouts/15/WopiFrame.aspx?sourcedoc=/Lists/Actions/Attachments/622/IOAG-22e.CandMwgReport%20v1.0.pptx&action=default

AI 22d-03: Enrico Vassallo to present on WRC-19 results at IOAG-23a.

The action was closed.

AI 22d-02: NASA to debrief with ICG liaison on IOP feedback.

Mr. Liebrecht noted that he had a discussion with Mr. Miller, the ICG liaison. The action was closed.

AI 22d-01: NASA to debrief with ISECG liaison on IOP feedback.

Mr. Liebrecht noted that he would set up a meeting with the ISECG liaison to complete the action. Subsequent to this teleconference the ISECG briefing was schedule for February 28.

AI 22c-02: DLR and Secretariat to collect clearance information from IOP-4 attendees for entrance to GSOC.

This action was closed.

AI 22a-05: Provide a hardcopy IOAG Context chart for delegates at IOP-4.

This action was closed.

AI 22a-01: SCWG to make a recommendation to the IOAG on a path forward based on inputs to the offline RMD eVote. / AI 22-21: SCWG to organize within the SCWG a critical review of the SC's. / AI 22-23: SCWG co-chairs to update SC #2 according to the results of AI 22-26.

Mr. Calzolari noted that these three actions are ongoing.

AI 22-05: All agencies to respond to SFCG liaison recommendations for defense of space communication-related spectrum at WRC-19.

This action was converted into a resolution at IOP-4. The action was closed.

Status of Working Groups

C&MWG

The Chairman noted that the status of this group was already discussed as a part of AI 22d-04.

SISG

Mr. Israel noted that due to the shutdown he hadn't had any further conversation with Mr. Schulz since the IOP. He believes that the group will continue to discuss interoperability demonstrations and other conversations of that nature. Regarding updating documents, the SISG hasn't had any discussion on this and didn't receive any direct actions from the IOP to generate anything.

OLSG

Mr. Edwards responded that he hasn't been in contact with Mr. Schulz due to the government shutdown, but he does expect to continue the work of the group and report on its progress. The Chairman noted that there were no concrete actions for the group at this point, but if the Industry Day addresses optical (implementation of optical ground stations) then there will be some preparatory work. Mr. Edwards agreed with this and noted that the group has been going over the draft LCAWG architecture report to correct certain aspects of it and will work together to come up with a detailed list of items for forward work.

MOSSG

The MOSSG has provided the most recent version of documents and has asked for delegate feedback.

LEO26WG

Mr. Baldwin noted that the group is currently waiting on the results for the seasonal performance at Svalbard, but other than that there is low activity in the group. The group is following ongoing activities and acting mainly as a discussion forum.

SECSWG

Ms. Barclay noted that the SOP is a mature draft and is nearing completion. The WG will go over final comments to it at the next meeting and then distribute it to the IOAG for member agencies to review. Additionally ESA and DLR are working on demonstrations to help validate the procedure. The group also started working on a draft of the policy statement, but needs further clarification on exactly what is intended at this point because of the changes to the resolution at the IOP.

As part of the working group expansion, commercial services may be a good topic for Industry Day (not necessarily the first one). At some point, the group may want to ask commercial ground station providers if they are interested in participating in the SECS process. Ms. Barclay also noted that there has been good participation in the working group and invited other agencies to participate if they're interested.

SCWG

Mr. Soula noted that the working group would continue to update the service catalogs.

LCAWG

Mr. Tai noted that the draft study report should be available in early March. In addition, CNES has proposed a new frequency band to be used for the relay, but this can be deferred to the SFCG.

Mr. Calzolari noted that the group may be down-selecting too much and they will have to discuss some of the comments together. Mr. Cosby responded that the WG will have a discussion about comments.

Mr. Soula asked if there had been a decision on the future of the group from the IOP. Mr. Cosby responded that the LCAWG would conclude with just the lunar architecture and the IOAG delegates would decide if Mars architecture should be addressed by the group.

The Chairman thanked the delegates for their input and noted that he would update the IOAG work plan accordingly.

Final Remarks & Conclusion of Meeting

The Chairman recapped the topics mentioned in the meeting. He asked NASA if they would like more time to review the communique as a result of the government shutdown. Mr. Liebrecht responded that he would like a week to look at the communique.

The Chairman asked for any further comments regarding the IOP. Mr. Liebrecht noted that he was pleased with the amount of engagement in the Leadership Forum and it was very constructive. The Chairman added that the IOP delegates were happy with the Leadership Forum, but felt it was too restrictive and in the future they would like more time to interact and elaborate on certain topics. Mr. Liebrecht suggested polling the IOP for certain topics to address in the future. Mr. Kozlowski noted that from the DLR side, they were pleased that everything ran smoothly. He agreed that the Leadership Forum was too short and the delegates should discuss a way to optimize it in the future, as well as find a way to include all the delegates more into the IOAG's work.

There were no further comments. The Chairman thanked the delegates for their contributions and concluded the meeting.

Appendix A: Actions

AI 22e-01: Provide a list of technologies to address at next telecon in response to AI 4-02. [Assigned to: All Agencies. Due date: 5 April 2019]

AI 22e-02: Provide input to Mr. Cosby on priorities for topics to address at Industry Day. [Assigned to: All Agencies. Due date: 22 February 2019]

AI 22e-03: Discuss the possibility of an IOAG session at the 70th IAC with the organizing team. [Assigned to: UAESA. Due date: 5 April 2019]

AI 22e-04: Provide input on topics to discuss and types of collaboration to have with academia. [Assigned to: UAESA. Due date: 5 April 2019]

Appendix B: Acronyms

AI	Action Item
ASI	Italian Space Agency
BAA	Broad Agency Announcement
C&MWG	Coding & Modulation Working Group
CCSDS	Consultative Committee for Space Data Systems
CNES	Centre National d'Etudes Spatiales
CNSA	China National Space Administration
CSA	Canadian Space Agency
DLR	German Space Agency
ESA	European Space Agency
GLEC	Global Conference on Space for Emerging Countries
GSOC	German Space Operations Center
IAC	International Astronautical Congress
IAF	International Astronautical Federation
ICG	International Committee on GNSS
IEEE	Institute of Electrical and Electronics Engineers

IOAG	Interagency Operations Advisory Group
IOP	Interoperability Plenary
ISECG	International Space Exploration Coordination Group
ISRO	Indian Space Research Organization
JAXA	Japan Aerospace Exploration Agency
KARI	Korean Aerospace Research Institute
LCAWG	Lunar Communication Architecture Working Group
LEO	Low Earth Orbit
LEO26WG	Low Earth Orbit 26 GHz Working Group
LOP-G	Lunar Orbital Platform Gateway
MOSSG	Mission Operations Systems Strategy Group
NASA	National Aeronautics and Space Administration
OLSG	Optical Link Study Group
RMD	Radio Metric Delivery
SC	Service Catalog
SCWG	Service Catalogs Working Group
SECS	Spacecraft Emergency Cross Support
SECSWG	Spacecraft Emergency Cross Support Working Group
SFCG	Space Frequency Coordination Group
SISG	Space Internetworking Strategy Group
SOP	Standard Operating Procedure
STM	Space Traffic Management
UAESA	United Arab Emirates Space Agency
UKSA	United Kingdom Space Agency
WG	Working Group

WRC   World Radiocommunication Conference