



INTERAGENCY OPERATIONS ADVISORY GROUP

CMC-IOAG Joint Meeting & IOAG-16 Minutes

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Prepared by: Nick Tongson, CCSDS Secretariat (CMC-IOAG Joint Meeting);

Barbara Adde, IOAG Secretariat (IOAG-16)

Date: January 25, 2013

**CMC-IOAG Joint Meeting
12 December, 2012**

Participants:

Barbara Adde (NASA) [joint CMC-IOAG meeting]
James Afarin (NASA)
Sangil Ahn (KARI) [Tuesday-Wednesday]
Peter Allan (UK Space Agency)
Erik Barkley (NASA) [via telecon/WebEx]
Eduardo Bergamini (INPE)
Madeline Butler (NASA) [joint CMC-IOAG meeting]
Gian-Paolo Calzolari (ESA) [via telecon/WebEx]
Les Deutsch (NASA) [joint CMC-IOAG meeting]
Bernie Edwards (NASA) [joint CMC-IOAG meeting]
Tom Gannett (Secretariat) [via telecon/WebEx]
Leo Hartman (CSA) [via telecon/WebEx]
Adrian Hooke (NASA) [via telecon/WebEx]
Mike Kearney (NASA)
Yuta Kimura (JAXA)
Rolf Kozlowski (DLR) [joint CMC-IOAG meeting]
Phil Liebrecht (NASA) [joint CMC-IOAG meeting]
Juan Miro (ESA)
Brian Oliver (Secretariat) [via telecon/WebEx]
Durk-Jong Park (KARI) [Tuesday-Wednesday]
Nestor Peccia (ESA)
Martin Pilgram (DLR)
John Rush (NASA) [joint CMC-IOAG meeting]
Michael Schmidt (ESA) [joint CMC-IOAG meeting]
Peter Shames (NASA) [via telecon/WebEx]
Tsutomu Shigeta (JAXA)
Jean-Marc Soula (CNES)
Huixian Sun (CNSA)
Wallace Tai (NASA) [joint CMC-IOAG meeting]
Nick Tongson (Secretariat)
Giovanni Valentini (ASI) [joint CMC-IOAG meeting; via telecon/WebEx]
Pete Vrotsos (NASA) [joint CMC-IOAG meeting; part time]
Stephanie Wan (NASA) [joint CMC-IOAG meeting]
Atsushi Yamada (JAXA)
Badri Younes (NASA) [joint CMC-IOAG meeting; part time]
Rusheng Zhang (CNSA)

Agenda:

The agenda can be found as Appendix A and on the IOAG public website (www.ioag.org).

1. Welcome, Opening Remarks, Introduction of Delegates

The IOAG Chairman and CCSDS Chairman both welcomed the delegates to the joint session of the IOAG and CCSDS. As the host, Mr. Liebrecht also welcomed everyone to the Kennedy Space Center.

NASA's Deputy Associate Administrator for Space Communications and Navigation, Mr. Younes, gave remarks about the importance of the CCSDS, IOAG, and SFCG continuing to work together to achieve interoperability amongst all the agencies' networks, especially in these times of budgetary hardship. Our ability to meet the aspirations of the scientists and missions we support will depend on the kinds of capabilities we have, he said. "We are available wherever you need us," he offered. NASA is proceeding with its evolution, representing a quantum leap into the future to support the kinds of technologies we need and the standards we will need. "Your activity will lead us back into the future. We support it fully," Mr. Younes said. "Clear standards will be critical for the future. I wish you success. You can always depend on NASA's commitment to your mission and success." He also introduced Mr. Vrotsos, NASA's Network Services Director. Mr. Kearney stated that the IOAG and CCSDS concurred with his statements and proceeded with the introduction of the delegates.

2. Agenda Review

Mr. Soula reviewed the agenda for the joint session, which was approved.

3. Liaison Report: CCSDS and ICPA Review

Mr. Peccia provided the ICPA review presentation. He requested a counterpart in IOAG to liaise with CCSDS and the IOAG assigned Mr. Calzolari and Mr. Soula as the IOAG liaisons to CCSDS for the ICPA. The CCSDS Secretariat was instructed to provide Mr. Soula with access to the data systems of the ICPA.

Mr. Kearney provided a brief introduction to the ICPA and who has access to edit the various fields. He requested that the comments from Mr. Calzolari should be submitted directly to the CCSDS liaisons (Mr. Peccia and Mr. Hooke) and CCSDS Secretariat. Mr. Soula suggested that the IOAG review the priorities and due dates in the ICPA so that they can report the results of the review to CCSDS prior to the Spring 2013 technical meetings.

Mr. Peccia provided the CMC-CESG report to the IOAG presentation. Mr. Kearney, Mr. Peccia, and Mr. Hooke all noted how much work was completed in spite of the limited resources. Mr. Liebrecht agreed with this assessment and also commented that the ICPA is a good tool to help CCSDS and the IOAG move forward in an organized way.

4. Overall IOP-3 Preparation

Mr. Soula provided background information and the draft agenda for IOP-3 presentation. He informed the group that the IOP-3 meeting will be hosted by CNES in Toulouse at the end of June 2013 for 2.5 days. Mr. Soula noted that CCSDS and the IOAG will have meetings prior to IOP-3 so that both organizations can coordinate their responses and presentations for IOP-3. He also added that there is a possibility of shortening the meeting to benefit the agency directors by having the agency reports be more focused on pertinent topics and also lessening the time for topics towards the end of the agenda. Mr. Soula reviewed the draft agenda:

- Liaison reports: CCSDS will have the opportunity to provide a presentation focused on items of interest for this session of the IOP, but this does not preclude the introduction of other CCSDS areas of interest not listed here, but any additions need to be in balance.

- Subgroup reports:
 - SISG: This section begins the focus on decisions to be taken by IOP-3. IOP-2 tasked IOAG to develop concept of operations (CONOPS) for Solar System Internetworking (SSI) and elaborate a draft architecture for SSI. The SISG needs to analyze the situation and present it for a decision.
 - Mission Ops: The main decision is determining if the IOAG Terms of Reference should be modified to include Mission Operations, and if so, to provide a timeline for a roadmap.
 - Optical Links Study Group (OLSG): There is evidence for interoperability and the need for standardization, although this doesn't mean many new standards are needed. It suggests an opportunity for the user community to put in place assets that are truly interoperable. OLSG should provide an analysis of its studies.
 - 26GHzSG: The 26GHz Study Group should report on progress made on Ka-band activities.

Mr. Schmidt asked if there would be another opportunity to coordinate with CCSDS prior to IOP-3 in order to discuss a possible coordinated approach to resource requirements within the agencies. Mr. Soula invited the CCSDS liaison to participate in IOAG-17, as well as the related teleconferences. He also noted that as Chairman, he would provide an introduction to explain the objectives of IOP-3 and decisions that are expected.

Mr. Schmidt also noted that he had spoken with ESA's IOP-3 delegate, Thomas Reiter, who would find a three day meeting difficult to fit into his schedule, and requested consideration of a shortened agenda. Other agencies confirmed this situation and the Chairman agreed to remove the agency reports and would attempt to condense the schedule to accommodate this request. Mr. Hartman recommended consideration of online discussion groups on either CCSDS, IOAG or IOP website so that preliminary discussion can enable real time decision making at the IOP. He also suggested providing an executive summary with the main issues to be highlighted in the web content so that the main points can be familiar and dealt with offline before meeting.

5. MOSCG Revival, Prep for IOP-3

Mr. Kearney provided background information and the decision timelines, including the range of outcomes presentation. Mr. Liebrecht commented that increasingly more missions are international so this topic would be an ideal one for IOP-3 to take on, especially with more interest from the Science Mission Directorate of NASA.

There was a discussion on the divergence of NASA and ESA on the involvement of human spaceflight exploration. NASA would like to include human spaceflight; Mr. Liebrecht reinforced what Mr. Kearney commented on in his report by emphasizing the need for strategy architecture planning and the standards needed to build the foundation for cross support for future human exploration missions. Both Mr. Liebrecht and Mr. Kearney noted the lessons learned/missed opportunities from the International Space Station experience.

Mr. Pilgram provided the DLR feedback by advocating that any solution derived by the MOSCG should also be applicable for simple missions. He also added that the focus should be on the interfaces; Mr. Kearney agreed with this feedback. Mr. Soula added that CNES has implemented some of the CCSDS mission operations standards but advocated to be pragmatic and possibly start with simple missions first and build up to more complex missions. Mr. Schmidt reminded the group that this is outside the scope of the IOAG.

Mr. Liebrecht suggested that the IOAG lay out a strategic plan on a way forward indicating when human spaceflight exploration would be included in the scope of work of the MOSCG when this is presented at IOP-3. Mr. Peccia and Mr. Kearney both agreed that the core functionalities and interfaces between agencies (pertaining to mission operations) are very similar between human missions and robotic missions.

To further the MOSCG study, M. Kearney presented the draft letter for programs and missions that included a survey. The survey covers both mission operations systems and mission operations practices. The results of the survey would provide external verification of the benefits, priorities, etc. that will be discussed in the MOSCG. The IOAG proposed that the letter should come from the individual IOAG agencies instead of from the IOAG or MOSCG as an organization. The IOAG chair recommended that after the draft letter is revised, each member should circulate the letter within their agency to the appropriate individual. M. Kearney reiterated that the goal is to get feedback from program managers with international or multi-agency mission operations experience. The IOAG agreed to give the responsibility of obtaining the data from the survey to the MOSCG but instructed them that individual agencies should contact their appropriate program or mission personnel directly. It was noted that the survey should be completed prior to the IOP-3 meeting but there was also the question of time criticality. The IOAG agreed to turn on the MOSCG but to discuss the details of the next steps forward later in the week.

6. SISG Revival, Prep for IOP-3

SISG Co-chair Mr. Rush provided the SISG Objectives and Plan of Work presentation, reporting that SISG revival would start 25 January and end 15 May. Mr. Soula asked about the status of the Green Book regarding this topic and Mr. Peccia responded that a CESG poll will be initiated in January so that it can be published around the February/March timeframe. Mr. Peccia added that the Green Book will describe all the possible architectures from physical to network layer in different scenarios for multi-agency cross-support. Mr. Hooke also described the network architecture work being done. Mr. Rush envisioned that the bulk of the work of the SISG will be to draft the resolution in preparation for IOP-3.

Mr. Liebrecht mentioned that the missions driving SISG for the 2020 timeframe are the human exploration missions in NASA targeted for around 2017-2018 and another one in the 2022 timeframe. Mr. Hooke added that the NASA MPCV and space launch systems are the duo of missions that are nominally moving towards the DTN architecture. He also mentioned the SSI protocol suite being developed by a group headed by Mr. Rush that will be ready by around 2016 that will underpin the space internetworking system. Both Mr. Hooke and Mr. Rush noted the high interest in the space internetworking system by human exploration missions, including the International Space Station, and emphasized that it is a long term proposition because of the long development lead time for human exploration missions. Mr. Pilgram said that DLR does not currently see the need to advance this issue, and Mr. Rush responded that the robotics scenario seems to be very advantageous. He stated that part of what the SISG needs to do to prepare a draft IOP-3 resolution is to explore any changes in what we have learned over the past several years of ISS experimentation since the SISG completed its work. Mr. Shigeta said that JAXA's plan to install a new deep space antenna to replace an aging one is still under study, and it might provide a good platform to install DTN capabilities. Mr. Soula suggested that the resolution for IOP-3 should take into account the incremental stages and the various projects and plans of all agencies. The IOAG approved the revival of the SISG after IOAG-16.

7. Discussion of ISECG Coordination

Mr. Soula presented the text that had been coordinated with the ISECG for inclusion in their Roadmap Version 2. Mr. Hartman and Ms. Adde informed the delegates that the Global Exploration Roadmap Version 2 is expected to be released in the second quarter of 2013. ISECG is still investigating the wider architecture approach and will rely on the IOAG, CCSDS, and SFCG to develop their communication architecture.

Mr. Kearney mentioned that a CMC action item that instructed the CESG chairs to draft a message regarding DEM vs PUS will be submitted to ISECG through the IOAG. He suggested that the CESG chairs should confer with Mr. Hartman regarding this CMC action item. The IOAG agreed to submit this message to ISECG on behalf of CCSDS after reviewing the draft from CESG chairs and Mr. Hartman. Mr. Soula reminded the group that IOAG will continue its coordination with ISECG to prevent any future overlaps in the scope of work.

8. Adjournment

The CMC met separately and discussed the resolutions and action items agreed to at this December 2012 meeting (file).

There being no other business to discuss, the meeting was adjourned at 17:35 on Wednesday, 12 December 2012.

IOAG-16
13 December, 2012

Chairman:

Jean-Marc Soula, CNES

Secretariat:

Barbara Adde, NASA

Stephanie Wan, NASA

Members:

ASI: Giovanni Valentini (teleconference)

CNES: Jean-Marc Soula

DLR: Martin Pilgram, Rolf Kozlowski

ESA: Michael Schmidt, Manfred Warhaut, Klaus-Juergen Schulz, Gian-Paolo Calzolari (teleconference)

JAXA: Tsutomu Shigeta, Atsushi Yamada, Yuta Kimura

NASA: Philip Liebrecht, John Rush, Madeline Butler, Les Deutsch, Wallace Tai, Bill Horne, Mike Kearney, Bernie Edwards, Badri Younes, Pete Vrotsos

Observers:

KARI: Sangil Ahn, Durk-Jong Park

UK-SA: Peter Allan

Liaison:

CCSDS: Nestor Peccia (ESA), Mike Kearney (NASA), James Afarin (NASA), Adrian Hooke (NASA; teleconference)

SFCG: Enrico Vassallo (ESA; teleconference)

ICG: James Miller (NASA; teleconference)

7. Meeting Introduction

Following a tour of the Kennedy Space Center, the Chairman called the meeting to order. He reviewed the agenda which was approved by all delegates, with changes to the OLSG presentation to 14 December.

8. Chairman's Report

The Chairman reported on the status of the IOAG 2012 Work Plan, the third for the IOAG, as well as the third Annual Report. He will prepare the 2013 documents and distribute to the heads of delegation for review and comment. Mr. Soula provided the status of the core tasks and the IOAG reference tables. He stated that these tables must be updated and provided on the public website before the IOP-3. He also noted the improvements to the website this past year and an attempt to improve the interface with the users; suggestions and comments are still welcome.

Mr. Warhaut encouraged the IOAG to take a fresh look to find 1-3 common goals we can all stand behind, a collective goal. Mr. Soula agreed, noting that the SSI was one such issue for IOP2; Mission Ops is another new topic for IOP-3.

9. Secretariat Report

With a voice vote, the IOAG approved the IOAG-15d draft minutes. The Secretariat reviewed the e-votes during the past year, noting that a quorum can be difficult to achieve. The Chairman stated that with ASI's recent participation, this may change.

The IOAG agreed that while ESA abstained from voting for its own member for the new Chairman, the vote had passed and Mr. Schmidt will serve as the IOAG Chair commencing immediately following IOP-3.

The Secretariat reviewed open action items. The following action item was modified:

AI 15a-01: Mr. Kearney to request information from ISS Program Office.

Mr. Kearney stated that he will work through the CMC to list ISS Assets in IOAG documentation.

The Secretariat provided a summary of member attendance to IOAG meetings. Discussion followed regarding the two member agencies that have not been regularly participating, ISRO and RFSA, and observer agency, CNSA. He stated that although many efforts were made to reach out to them, none were successful in achieving their participation. In response to his query regarding their participation in IOP-3, Mr. Warhaut recommended that the Chairman present to the IOP what had been attempted to reach out to them. In turn, these member agencies may be modified to observers.

10. IOAG Reference Tables

The Chairman presented the IOAG reference tables, both available on the public and the private websites. He noted that the commercial assets table is on the private website. He also reiterated that the tables should not show old or inaccurate information; the purpose is to show activities and make visible to external communities, such as the ISECG, the progress that has been made. They also serve as a reference for members regarding infusion of standards.

Mr. Soula also referred to the letter prepared for the IOP delegates, which will include the levels of priorities that had been approved by the IOAG. These priorities will also be used as input to the IOAG-CCSDS Product Agreement (ICPA) database, which is due now. He stated that an annual process needs to be established for updating the ICPA. The ICPA is available at:

<http://cwe.ccsds.org/fm/Lists/Projects/IOAG.aspx>

The following Action Items were generated:

AI 16-01: IOAG members to verify completeness and matching the lists of standards in the ICPA vs. the SC#s and the IOP requirements (SSI docs). [Assigned to: All Agencies; Due Date: 25 January, 2013]

AI 16-02: IOAG Chairman to aggregate priorities and target dates according to the most recent inputs received from the Member Agencies in their reference tables. Chairman to analyze the discrepancies between requirements and status in the ICPA so as to initiate discussions with CCSDS. [Assigned to: Chairman; Due Date: 26 January, 2013]

11. Agency Reports

CNES: Mr. Soula provided a new organization chart, pointing out the new director of Operations, Joel Barre, who is responsible for the coordination of all field centers. He also reported on the launch of Pleiades 1A and 4xElisa on 16 December, 2011. Other highlights include the launch of ATV3, Edoardo Amaldi, on 23 March, 2012, and a new Payload Operation Center, the French Instruments Mars Operation Center (FIMOC), which manages the French contributions to instruments onboard NASA's Mars Science Laboratory, Curiosity. Mr. Soula also announced the commissioning of two S+X bands ground stations at Kiruna and Inuvik, which will be serviced by the Swedish Space Corporation and remotely monitored and controlled from Toulouse. Finally, Pleiades 1B was launched on 2 December, 2012 on a Soyuz rocket from French Guiana.

Mr. Soula also reported on CNES' future plans, including the Cormoran Project to replace existing antennas and improve the ground network facilities. He provided inputs on areas of IOAG interest in technology efforts, subgroups and liaison with other international groups. Finally, he noted that CNES will be hosting both the SFCG and the IOP in June 2013.

DLR: Mr. Pilgram reported there are no changes in DLR's organization; however, they will be opening a new office in Japan in early 2013. This past year, DLR launched TET and will launch BIROS in 2013. Future missions include the European Data Relay Satellite (EDRS) and Small GEO Hispasat Advanced Generation (HAG1). In 2012, DLR opened a mobile optical ground station and started operations of a new full motion 13-meter Ka-band antenna; new dedicated ground stations (Ka-band) will be built for EDRS and Alphasat. Mr. Pilgram also reported on DLR's areas of IOAG interest, study groups, and other international groups, focusing on optical communication, and noting that DLR supports OLSG's report and the intensive additional research.

ESA: Mr. Schmidt provided new organization charts for ESA, reflecting Thomas Reiter as the Director of Human Spaceflight and Operations, and a new organization for Galileo Operations Procurement Service within the Mission Operations Department. Mr. Warhaut will be retiring as the head of that Department in January 2013; his replacement has not yet been named. He reported on many operations achievements for the past year, including ATV-3 launch and docking to the ISS in March, MSG-3 launch in July, MetOp-B launch in September, Galileo IOV-2 launch as well as the Meteron and DTN demonstration in October. Mr. Schmidt also congratulated NASA on the successful landing of Curiosity on Mars in August, which ESA supported.

Upcoming events include the inauguration of DS3 at Malargue the week following the IOAG-16 meeting, and launches in March 2013 of Proba-V and Swarm. In April, ESOC zone 5 will be available and ATV-4 will be launched. Galileo IOC 1st and 2nd launches are expected in the 3rd and 4th quarters. Sentinel 1A and Gaia are due to launch in October.

Mr. Schmidt reported related outcomes from the Ministerial Conference, including a 10 billion euro budget for ESA space activities and programming for the upcoming years. They also approved Europe providing the service module for NASA's Orion Multipurpose Crew Vehicle (MPCV). The EDRS, which will launch in 2014 and 2016, has approval from its first customer, the Global Monitoring for Environment and Security Initiative (GMES).

JAXA: Mr. Shigeta said that Dr. Iwata sends his regrets and hopes to attend the next IOAG meeting as the JAXA delegate. He provided JAXA's organization chart and announced a new 11-meter station, "Miyabaru," which is equipped with S-band TX/RX and UHF RX, and Earth observation receiving stations in Katsuura (11-meter) and Tsukuba (6-meter). The antenna in Perth will be moved to Dongara before 2015. All of these stations are remote-controlled from Tsukuba. JAXA is undergoing installing new S/X station in Katsuura and studies on future stations. During the past year, JAXA has launched GCOM-W1, SDS-4, and HTV-3. Future missions include ALOS-2, ASTRO-H, and Hayabusa-2. Mr. Shigeta also provided JAXA's input on areas of IOAG interest in technology efforts, subgroups and liaison with other international groups, with particular focus on Disruption Tolerant Networking (DTN)

KARI: Dr. Ahn reported on KARI's organizational structure and the launch of H-2A at Tanegashima, Japan on May 17. There are no changes in communications assets. He provided a list of KARI's ongoing missions – KOMPSAT-2, COMS, and KOMPSAT-3 -- and future missions, KOMPSAT-5 and KOMPSAT-3A. He mentioned a target for compatibility to SLE as of 2015.

NASA: Mr. Liebrecht reported that the reorganization of the Human Spaceflight Program has been officially approved and presented the Human Exploration and Operations Mission Directorate organization chart. The Associate Administrator, Bill Gerstenmaier, will serve as NASA's representative to the IOP-3. Mr. Liebrecht reported on the successful landing of Curiosity on Mars, on August 6, the launch onboard JAXA's HTV-3 of the SCaN Testbed on July 20; the Testbed is currently in use onboard the ISS now. He also discussed the commercial cargo and crew activities in support of ISS, with the next launch expected in January. The Radiation Belt Storm Probe (RBSP) was launched on August 30 and will study the radiation belts surrounding the Earth. NuSTAR, the Nuclear Spectroscopic Telescope Array, which launched on June 13, will observe high energy x-rays for two years. He also noted that the Tracking and Data Relay Satellite System (TDRS)-K that had been scheduled for launch that day but had been delayed due to issues with the launch vehicle was now scheduled to launch on 29 January from the Kennedy Space Center.

In Canberra, Australia, NASA is building a new 34- antenna as part of its Deep Space Network. Mr. Kearney noted that yesterday a major milestone had been achieved with the spectacularly

successful operation of Spheres onboard the ISS controlled from the ground via the DTN. Mr. Liebrecht also pointed out that the Lunar Laser Communication Demo (LLCD) has shipped and will be integrated soon onboard the LADEE spacecraft, which is expected to launch August 12. He also said that in replacing the Space Network ground system, NASA will be up to date with CCSDS standards. Around 2018, NASA expects to upgrade the other two networks so that all are compatible. He closed by providing NASA's future goals and challenges, including forming an integrated network from three pre-existing individual networks during a period of resource constraints and with the goal of achieving interoperability with US and international spacecraft and networks.

UKSA: Dr. Allan reported that a new Chief Executive for United Kingdom Space Agency will be named by late December. He announced UK's future plans include a 6.1-meter antenna being installed at Chilbolton currently and a 6-meter antenna planned for EDRS at the Rutherford Appleton Laboratory.

12. IOAG Priorities

The Chairman asked the heads of delegation to verify there is no major evolution in priorities and proposes sending his drafted letter to the IOP-3 delegates.

AI 16-03: To verify no big evolution in priorities and to send letter to IOP delegates. [Assigned to: Chairman and Secretariat; Due Date: 11 January, 2013]

AI 16-04: To review ESA priorities. [Assigned to: M. Schmidt; Due Date: 11 January, 2013]

He noted that while not all agencies have indicated who will represent them at the IOP-3, the letter will be sent to those who have been identified. Dr. Allan reported that he will be serving as the IOP-3 representative for the UKSA. Dr. Ahn reported that KARI is still under consideration.

AI 16-05: KARI to provide IOP representative. [Assigned to: S. Ahn; Due Date: 15 February, 2013]

13. Liaison Report: ISECG

The Chairman asked the participants how ISECG should be represented at the IOP-3. Mr. Schmidt recommended that the IOAG prepare charts for ISECG's approval for the IOAG Chairman to present at the IOP-3. It was also noted that the ISECG's Senior Agency Manager meeting will be held in April; the Global Exploration Roadmap version 2 is expected to be released in May.

AI 16-06: Make a proposal and get ISECG approval on presentation for IOP regarding the ISECG liaison relationship. [Assigned to: IOAG Chairman, M. Schmidt; Due Date: 26 April, 2013]

14. Liaison Report: ICG

Mr. Miller reported on the November 2012 annual meeting of the International Committee on Global Navigation Satellite Systems (ICG), ICG-7, which was held in Beijing, China. He stated that all ICG member agencies agree on fully interoperable Positioning, Navigation and Timing (PNT) systems for the users' benefit. He was pleased to report that ESA provided its report on Space Service Volume, joining with the one he had made to the ICG the previous year, showing excellent opportunities for cooperation in this area. Mr. Miller recommended that the IOAG members meet with their agency's PNT counterparts in order to see out other areas of potential collaboration. Templates for providing information have been provided and are on the IOAG website. He also encouraged IOAG members to participate in upcoming ICG meetings, including a possible preparatory meeting in Vienna in June 2013 and ICG-8 in Dubai on November 10-15, noting that the first 2-3 days would be the most important. DLR, CNES and JAXA reported their agency has no official link to ICG but will try to contact their National counterparts in this organization.

Mr. Schmidt stated that he has made contact with ESA's Mr. Stefan Wallner, who attended ICG-7 and Mr. Werner Enderle, who is in the Flight Dynamics Group. Mr. Schmidt has reviewed Mr. Wallner's ICG presentation and can provide it for the IOAG website. Mr. Warhaut noted that while Galileo does not yet have a constellation, he concurs with the liaison role to ICG; it is useful although not IOAG's primary business. Mr. Soula said the goal is to improve coordination and the navigation mission model.

15. IOP-3 Planning

In discussing plans for the IOP-3, it was again reiterated that it should be held in two days at the most, due to the pressing schedules of the senior management participants. It was agreed that in order to leave more time for discussion on key topics and decisions, the agency reports would be provided in a briefing package to each IOP representative by their IOAG delegate. This briefing package will include all issues on which decisions will be taken. Mr. Warhaut recommended a 20-minute presentation on ICG, ISECG and SFCG, and a 30-minute presentation on CCSDS. The draft agenda also includes a summary of past accomplishments by the Chairman and a status on actions given at IOP-2, and blocks of time for subjects requiring guidance on: 1) committing agency resources, 2) priorities, 3) long-term vision and 4) resolution.

AI 16-07: Update the IOP draft agenda based on discussions in IOAG-16 and match 2 day format. [Assigned to: Chairman; Due Date: 15 February, 2013]

It was agreed that Mr. Soula will report on past accomplishments and Mr. Schmidt will report on future plans as Mr. Soula's second term ends at IOP-3.

The Chairman adjourned the meeting for the day.

FRIDAY, DEC 14, 2012

16. Liaison Report: SFCG

Mr. Vassallo reviewed examples of two tables that he can begin providing to the IOAG annually. Mr. Warhaut expressed strong interest in a summary table. Mr. Liebrecht suggested that the IOAG use the SFCG's table, rather than replicate the same information. Mr. Warhaut suggested that an action be taken to import differences in the SFCG table into the IOAG database.

AI 16-08: Secretariat to evaluate the possibility of an automated comparison of the 2 mission model tables (SFCG and IOAG) to point out discrepancies. Identify the differences so that we can discuss in joint meetings with SFCG with liaison. [Assigned to: Secretariat; Due Date: 26 April, 2013]

Mr. Vassallo said that the SFCG meets once a year and can provide input to the IOAG for the annual meeting.

The Chairman pointed to the open action to all delegates regarding preparation for the World Radiocommunications Conference, for each agency to coordinate with its Frequency Manager and report to IOAG, for which there have been responses.

AI 16-09: Chairman to elaborate a synthesis of all replies and comments regarding agency's positions on SFCG's stated positions on ITU WRC-15 Agenda Items and send summary report to SFCG liaison. [Assigned to: Chairman; Due Date: 15 February, 2013]

AI 16-10: NASA to make a proposal on what can be done to exploit SFCG mission model to make IOAG mission model process more efficient. [Assigned to: P. Liebrecht; Due Date: 15 May, 2013]

17. 26 GHz Ka-Band LEO Study Group

Mr. Schulz presented the Study Group's Terms of Reference and discussed the group's teleconference planning. The Chairman noted that EUMETSAT is a study group participant and asked if NOAA is attending. At this time, Mr. Schulz responded, there is not a NOAA nominee. Mr. Liebrecht said he would work with NOAA to find an appropriate participant. It was agreed that the schedule as presented is very aggressive, with the Table of Contents to be finalized by 20 December and the final report available by 26 April for presentation at IOAG-17 and IOP-3. The Chairman suggested that a draft report at the IOAG-17 would be sufficient, with an interim report at the IOP-3. Mr. Warhaut recommended a chapter outlining possible target missions for incorporating this band. Mr. Schulz noted that this is covered in Chapter 3.1. Mr. Warhaut also suggested considering industry participation as an observer, or at the least providing the draft report to industry representatives, and seeking a statement regarding their compatible capabilities in that timeframe, in order to enable credible implementation. It was agreed that this would be an informational presentation at the IOP-3; no decision would be required.

18. Optical Links Study Group (OLSG)

The report was provided in June; today's presentation is on the addendum to the final report. The participating agencies in the very intense efforts of the OLSG are CNES, DLR, ESA, JAXA, KARI, and NASA. Mr. Schulz began the presentation with a review of OLSG's priority set of recommendations.

He stated that there are additional topics beyond standardization that need to be worked further: coordination with ICAO regarding aviation interruption, and eye safety for astronauts.

Mr. Schulz stated that an issue affecting only NASA is a requirement to coordinate all lasing into space from the ground with the Laser Clearing House (LCH). The LCH is the US operational clearinghouse that coordinates lasing so that it won't interfere with satellites passing through the beam. It can be disruptive to a laser uplink operation, and even worse with aircraft interruptions. Mr. Rush said that one of the biggest issues that need to be addressed is clouds over a ground station. The study shows that the best option for addressing these disruptions is having a number of ground stations that are dispersed geographically where statistically there is an anti-correlation for clouds. In order to do that, he said, ground coordination and an exchange of data is required. The Study Group has asked to include uplink as a part of standardization; the utility of modulating data on an uplink and transferring data to a spacecraft would be critical.

Regarding eye safety, Mr. Schulz said, the Study Group identified that the 1550 does have more margin for uplink beams, but the bottom line is there is still an eye safety issue due to the power. The Study Group looked at LEO and GEO links; they can be designed to be eye safe according to calculations. He said the group still has questions with ICAO that need to be worked through. The Study Group provided a list of recommendations, including:

OLSG Priority 1 Recommendation: OLSG and agencies continue a dialogue with ICAO.

This has already begun; they may be willing to review their eye safety formulas. Each country has a representative to ICAO; he encouraged all agencies to talk with their aviation representatives to engage in this dialogue with ICAO. The group is also working with NASA's Johnson Space Center (JSC) medical office, to review their laser considerations, which have been based on Lidar for docking and rendezvous with the International Space Station (ISS). Since this is not a communications application, they agree with new optical communication installations on the ISS over the next few years, they can further discuss this requirement with the IOAG.

OLSG Priority 1 Recommendation: Continue dialogue with JSC and any other agency Human Spaceflight organizations.

Regarding the clouds, Mr. Schulz said, the requirement for geographically dispersed ground stations became a strong indicator for cross support. They developed basic models to create a structure that will coordinate cross support for ground stations by looking ahead and making assignments based on predicted weather a few days in advance. This would require a level of coordination among the agencies for handover process.

OLSG Recommendation: Recommend that CCSDS develop the SM standard and identify areas that should be modified to handle optical communications.

Mr. Rush said that perhaps there are some techniques that could be investigated; CCSDS could look at just how this should work in detail. He believes the guidance for CCSDS is to consider sharing the same standard meteorological data and develop a mechanism. Mr. Tai suggested that the solution doesn't have to come from SM, to which Mr. Schulz and Mr. Rush agreed. Mr. Pilgram noted that the issue is storage on board. Mr. Warhant suggested that with the high data volume expected with optical communication, the focus should be concentrated on the downlink. Mr. Rush noted that an additional operational consideration is aircraft avoidance, stating that protocols can handle any short term break in the beam; DTN might not be needed for that. If deficient, the IOAG could ask CCSDS to develop some additional protocols. He also said that ICAO considers the amount of energy that enters the eye over ten seconds of staring into the beam. Mr. Schulz noted, in response to a comment by Mr. Calzolari, that he recommends using Service Catalogue 1 and Service Catalogue 2; only if these are insufficient would a requirement be made to define additional standards.

Dr. Deutsch asked if the uplink could be from different stations than the downlink. Mr. Schulz answered that this scenario has not been considered, having considered only different terminals at same station for both up and down link.

OLSG Priority 2 Recommendation: CCSDS should develop two sets of standards for modulation and coding for forward links to deal with the low and high photon density domains.

OLSG Priority 1 Recommendation: CCSDS to develop two sets of standards for modulation and coding for return links to deal with the low and high photon density domains.

OLSG Priority 1 Recommendation: CCSDS should standardize the uplink beacons and associated acquisition sequence.

OLSG Priority 2 Recommendation: The space agencies should conduct a rigorous detailed study independent of the CCSDS to determine if there are ways of accomplishing beaconless PAT, as this would also facilitate a solution to the eye safety issues.

OLSG Priority 2 Recommendation: A common best practice optical interface should be defined that would allow one agency's back-end equipment to be connected to another agency's optical front-end.

Mr. Soula stated that CNES is not in complete agreement with this, and would like a preferred signal for this. Mr. Warhant suggested that CNES optimize on the wavelength that is their prime customer and other customers have to accept suboptimal. He stated that the report was very comprehensive and the IOAG now has to consider where to focus its efforts. It was agreed that a common vision for the future was desired.

Mr. Schulz next addressed adaptive optics, which he said can only work in a high photon density environment, and in general is not suited for deep space. Therefore, the OLSG has no recommendation in any direction of standardization in this area.

He concluded his presentation with charts reviewing standardization guidance, technical guidance, and optical communications cross support methodology guidance. A discussion followed regarding possible CCSDS resource requirements; the co-chairs agreed that the intention is to utilize existing standards rather than developing new ones.

The Chairman asked them about the amount of work required before IOP-3, to develop the mission model? Mr. Schulz referred to the optical communications cross support methodology guidance (chart 19) and planning and engineering best practice guidance (page 20). The final charts provided a summary of all recommendations. Mr. Warhaut suggested focusing on establishing the priorities for the next 2-3 years. Mr. Calzolari stated that a specific timeframe should be made clear so that CCSDS can reply to the recommendations.

Additional recommendations for the IOAG specific to the OLSG (chart 23) include:

Recommendation: OLSG to develop briefing for IOP-3.

- Encouragement of 2013 demonstrations of cross-support scenarios that will demonstrate the value of cross support in the optical communication domain and confirm the findings of the OLSG. Enhance mutual understanding of pros and cons of the various technical solutions being proposed and reduce the options as much as possible for each of the scenarios, with the objective of easier cross support implementations.

Recommendation: ESA/NASA to jointly pursue LLCD, ESA/DLR to share results of Alphasat and EDRS/Sentinel, JAXA/NICT to share results of SOTA.

- That the CCSDS Optical Communication Special Interest Group (OCM-SIG) is asked to prepare a concept paper and charter for standardization, taking into account guidance from the Interagency Operations Panel (IOP-3), leading to the formation of a CCSDS Working Groups on Optical Communications by Spring 2014.

Recommendation: OLSG to prepare first CCSDS WG concept paper, draft charter, and effort estimate, as key engineers in OLSG will also be in the CCSDS OCM-SIG

Mr. Schulz noted that the timeframe is through 2020, with the development of a CCSDS working group in 2014. The first priorities are for 3-4 years, with a flight demonstration in 2013. It is NASA's longer term goal to fly the first deep space terminal by the end of the decade. Mr. Warhaut stated that experience is needed before a 2014 start to understand standards requirements. Mr. Schulz responded that by 2014, the results of most demos will be available. The CCSDS Birds of a Feather (BoF) is on standby, pending IOP-3 guidance. Mr. Warhaut stated that he would like to get an appraisal of the user dimension. Mr. Soula said that he would

like to see this on Ka-band; Ka-band standardization is much further along. Mr. Schulz responded that he won't have insight into ESA's missions in the 2020-2030 timeframe. Mr. Liebrecht replied that each agency can suggest candidate missions to give an idea of what missions could use optical communications, and suggested that the agencies begin talking with their science mission managers about the benefits and potential types of missions in order to develop a business case, to which Mr. Warhaut agreed. He proposed the IOAG take stock again in 2014-15 when first results are available. Mr. Schulz suggested one modulation scheme and one coding scheme, to which Mr. Warhaut agreed. Mr. Liebrecht recommended a team assessment on existing techniques that the agencies can agree on, beginning with the "low hanging fruit."

Everyone agreed that the IOAG should validate this report and actions still to be conducted by OLSG as proposed. They will continue to prepare for IOP-3. The Chairman requested that the final diagram in the presentation needs to be adapted regarding the strategy. He suggested that it is time for the IOAG and CCSDS work together on this subject.

Mr. Schulz stated that after two years of investigation in this subject, the OLSG members believe that the potential is there. These things are realizable, he said; the question is cross support and standardization to prevent divergence. Mr. Rush said that the next step is to get IOP endorsement to move forward with a consolidated roadmap. Mr. Schulz recommended having an estimate at first effort on priority 1 recommendations; Mr. Warhaut recommended getting user community feedback included. He said the vision is 26 GHz "tomorrow" and optical communications "the day after tomorrow" as IOAG prepares the steps of future communication.

Mr. Soula stated that CNES is not going to use Ka-band; optical link may deploy at the same time. CNES may delay a little bit, he said, but not too much because industry may go before us. He agrees on the need to prepare for clear guidance with a clear proposal to IOP. He recommended starting standardizations with priorities coming from IOAG based on mission model.

Mr. Schulz noted that the downlink has three modulation standards, one of them concerned with a patent; IOP3 should ask the IPR owner to make this open, which would solve this issue.

19. MOSCG Revival: Preparation for IOP-3

Mr. Kearney stated that the Mission Operations Study Coordination Group (MOSCG) is looking for IOAG guidance on being revived in order to prepare for IOP-3. He had provided a draft letter earlier in the day for review. The goal would be to have each delegation contact his agency's projects and collect the required information.

A lengthy discussion followed regarding the best path to pursue in collecting this data from each agency and if there is interest within each agency to pursue this activity. Mr. Warhaut recommended finding a synergy of the three approaches – CNES, NASA, and ESA (as presented by Mr. Merri at IOAG-14 in 2010). Mr. Soula noted that CNES has not decided to utilize mission operations protocols onboard its satellites; Mr. Schmidt acknowledged this was the same for ESA.

Mr. Tai noted that in its agency report, JAXA pointed out the JEM support it received from NASA for an emergency event, so this is relevant and of value to users. The Chairman recommended that the MOSCG present at IOP-3 and identify missions or categories of missions that would benefit from this, including human spaceflight missions.

20. SISG Revival: Preparation for IOP-3

The Space Internetworking Strategy Group also needs guidance to begin preparing for IOP-3. Mr. Schulz presented the group's objectives, plan of work, and draft resolution for consideration at IOP-3. The conclusions of the discussions at the joint meeting with CCSDS, on December 12, were confirmed.

21. Service Management

A follow-up discussion was initiated by the Chairman, after the NASA agency report of the previous day; NASA had indicated their intent to start implementation of the SM, which might lead to compatibility issues with other agencies in the long term, depending which standard is taken as reference for this development. Therefore, NASA was asked if its implementation will be based on Blue Book#1 and/or new Framework. It is not clear the level of compatibility between the two versions.

AI 16-11: NASA to report on the analysis and the decision regarding the development of service management in their networks at IOAG-16a. [Assigned to: P. Liebrecht; Due Date: 28 February, 2013]

22. IOAG Membership

The delegates again discussed methods of reaching out to the missing member agencies. Mr. Tai noted that ISRO has contacted NASA, seeking space communication support for their Mars mission next year. The Chairman stated that initial responses have been received from both ISRO and RFSA, they still do not attend meetings; however, IOAG will continue to invite them. He also noted that the Canadian Space Agency (CSA) has said they have budget restrictions; he has invited them to attend IOP as an observer. The Italian Space Agency (ASI) has recently provided a new IOAG representative, Mr. Giovanni Valentini, who participated in Wednesday's joint meeting by teleconference.

Statements on Membership should be prepared at IOAG-17 to be submitted to the IOP for decisions.

22. Planning for next meetings

The Chairman presented the calendar for consideration. Mr. Allan reported that the location of IOAG-17 will be the Rutherford Appleton Laboratory, which is in northwest England, near Abingdon/Oxford, and is part of the Harwell Science and Innovation Campus. Travelers should fly into Heathrow International Airport; a list of places to stay would be provided. The Chairman recommended that the delegates take time required to agree on draft resolutions and review draft presentations. The meeting would start Tuesday, 14 May and end Friday noon, 17 May (note: this was changed right after the meeting and advanced by one day).

Mr. Schmidt, Mr. Soula, and Mr. Liebrecht were nominated to coordinate with the subgroups to elaborate draft recommendations for distribution to all delegates in advance of IOAG-17.

The Chairman stated that it was unknown if an IOAG-18 would be needed in 2014; it could be decided after IOP-3.

The Secretariat will finalize the date for IOAG-16a teleconference, for either 5, 12 or 19 March.

23. Closing Remarks/Adjourn

The Secretariat was tasked to draft the letter of invitation for the IOP delegates, with the 2012 Annual Report attached. The eleven actions assigned during IOAG-16 were reviewed. (See Attachment).

Mr. Warhaut thanked NASA for hosting the meeting, and thanked the Secretariat and Chairman, wishing the IOAG good luck at his final IOAG meeting.

The Chairman thanked NASA for hosting and for the unique opportunity to visit the Kennedy Space Center, which is different than what the IOAG usually has access to. He also thanked the Secretariat, including Dr. Oria, for the effort involved in accurately aggregating the tables and providing the mission model on the IOAG website. The Chairman also expressed his hope that the IOAG has provided sufficient guidance to the subgroups that will help as they prepare for IOP-3.

The Chairman adjourned the 16th meeting of IOAG.

IOAG-16 ACTION ITEMS

AI 16-01: IOAG members to verify completeness and matching the lists of standards in the ICPA vs. the SC#s and the IOP requirements (SSI docs). [Assigned to: All Agencies; Due Date: 25 January, 2013]

AI 16-02: IOAG Chairman to aggregate priorities and target dates according to the most recent inputs received from the Member Agencies in their reference tables. Chairman to analyze the discrepancies between requirements and status in the ICPA so as to initiate discussions with CCSDS. [Assigned to: Chairman; Due Date: 26 January, 2013]

AI 16-03: To verify no big evolution in priorities and to send letter to IOP delegates. [Assigned to: Chairman and Secretariat; Due Date: 11 January, 2013]

AI 16-04: To review ESA priorities. [Assigned to: M. Schmidt; Due Date: 11 January, 2013]

AI 16-05: KARI to provide IOP representative. [Assigned to: S. Ahn; Due Date: 15 February, 2013]

AI 16-06: Make a proposal and get ISECG approval on presentation for IOP regarding the ISECG liaison relationship. [Assigned to: IOAG Chairman, M. Schmidt; Due Date: 26 April, 2013]

AI 16-07: Update the IOP draft agenda based on discussions in IOAG-16 and match 2 day format. [Assigned to: Chairman; Due Date: 15 February, 2013]

AI 16-08: Secretariat to evaluate the possibility of an automated comparison of the 2 mission model tables (SFCG and IOAG) to point out discrepancies. Identify the differences so that we can discuss in joint meetings with SFCG with liaison. [Assigned to: Secretariat; Due Date: 26 April, 2013]

AI 16-09: Chairman to elaborate a synthesis of all replies and comments regarding agency's positions on SFCG's stated positions on ITU WRC-15 Agenda Items and send summary report to SFCG liaison. [Assigned to: Chairman; Due Date: 15 February, 2013]

AI 16-10: NASA to make a proposal on what can be done to exploit SFCG mission model to make IOAG mission model process more efficient. [Assigned to: P. Liebrecht; Due Date: 15 May, 2013]

AI 16-11: NASA to report on the analysis and the decision regarding the development of service management in their networks at IOAG-16a. [Assigned to: P. Liebrecht; Due Date: 28 February, 2013]