Report of Working Group A: Compatibility and Interoperability

1. The International Committee on Global Navigation Satellite Systems (ICG) Working Group A (WG-A) on Compatibility and Interoperability met Wednesday and Thursday, 7-8 September 2011 under the co-chairmanship of Mr. Sergey Revnivykh, Russian Federation, and Mr. David Turner, United States of America.

2. After brief welcoming remarks, and before formally approving the agenda, the Co-chairs began Session 1 focused on system updates. Rather than invite new presentations, they asked if any system providers had additional information for the working group not covered in the Plenary Session presentations or the briefings provided at the inter-session meeting held in June at the UN Offices in Vienna. Ms. Tatiana Mirgorodskaya, Russian Federation, corrected the planned next GLONASS launch date, now scheduled for September rather than August as originally presented. Ms. Jun Lu of the China Satellite Navigation office provided a brief overview of her countries efforts related to compatibility and interoperability, their participation in WG-A, and their specific proposals for consideration at this week's meeting.

3. The co-chairs then returned to the adoption of the meeting agenda, which was divided into the same 6 sessions held at the June inter-session meeting. Two of the six sessions were to be conducted with the participation of working groups B and D. The agenda, which reflected requests for additional presentations received since the opening of ICG-6 on September 4, was adopted without further change.

4. The Co-Chairs then opened the session 2 on compatibility by inviting the co-chairs of the subgroup on compatibility to give a report on their activities (see presentation: "GNSS Compatibility Issues"). Takahiro Mitome of Japan explained that the subcommittee held two meetings since ICG-5, one in February and the second in June 2011, where several possible models of multilateral discussion were considered. Mentioning unfinished deliberations on methods of assessing noise floor increase and the appropriate frequency band to begin investigating, Mitome stated that the subgroup will continue its efforts on this topic.

5. Frederic Bastide, European Commission, then presented Recommendation 2.1 for ICG WG-A decision – *Continuation of WG-A Subgroup in accordance with the ToR*, as drafted at the inter-session meeting (see Recommendation 2.1). Mr. Turner then proposed to adopt the recommendation as presented, explaining that there would always be an opportunity to modify the ToR in the future. The recommendation was then adopted by the working group without change and Mitome thanked the members of the subgroup. The session was then closed with his announcement that the first meeting of the new subgroup would be held that very afternoon.

6. Two presentations were made under session 3 on the agenda, Spectrum Protection – Interference, Detection and Mitigation (IDM). Mr. Weimin ZHEN from China began the session with a presentation on IDM for GNSS Open Service in China. The presentation

noted three instances of interference in China. It was also noted that a group has been established to look more closely at IDM in China, with tasks that include investigation, vulnerability analysis, and investigating interference on other systems. They are also researching the development of an interference monitoring detection capability. China recommends establishing an IDM joint laboratory to conduct research and exchange information on interference monitoring. However the joint laboratory's effort according to China, should be more focused on technical rather than legal or political aspects of IDM. In response to a question from participants, it was noted that there are currently no legal regulations on the production and marketing of jammers in China.

7. Mr. Jeffrey Auerbach from the U.S., provided a presentation on a joint Japan-U.S. Proposal for a Spectrum Protection/Interference Detection and Mitigation Workshop. This Proposal was previously presented at the inter-session meeting, which resulted in Recommendation 3.1. Some questions were raised by China about the content of the Workshop agenda being too ambitious. Also, the EU suggested that a discussion on the regulatory aspects of interference be included. Mr. Turner commented that ICG recommendations are not binding on any nation's regulations and laws. An observer from the ITU also indicated that they are ready and willing to support the Workshop. The U.S. noted the comments from China and the EU, and agreed to modify the proposal.

8. Recommendation 3.2 from the inter-session meeting - *proposed joint lab on GNSS IDM*, was reviewed. The co-chair, Mr. Turner, asked the Working Group whether this recommendation should be combined with Recommendation 3.1. After some discussion, the Working Group modified the U.S.-Japan IDM Workshop proposal and agreed to combine the two recommendations into Recommendation 3.1. This recommendation was approved by the Working Group. Mr. Turner also pointed out that there was a suggestion to consider having this Workshop in Croatia (21-24 May 2012) in conjunction with the Vulnerabilities and Solutions Conference, but a potential ITU meeting conflict was noted by Japan. No decision was agreed upon for the venue and time for this workshop.

9. Session 4, Open Service Information Sharing and Service Monitoring, began with a presentation from Mr. Xurong DONG from China, on the International GNSS Monitoring and Assessment Service (iGMAS). Mr. Xurong noted that this was proposed in June 2011 to complement the IGS and MGM-net projects, as well as to ensure interoperability among the systems. China is recommending that a technical working group (TWG) be established and meet by December 2011, and to establish an international BeiDou/GNSS demonstration system. Mr. Xurong was asked a question about when the COMPAS/BeiDou ICD will be released. He indicated that China plans to release the document in both Chinese and English in October 2011.

10. Mr. Satoshi Kogure from Japan provided an update on the Multi-GNSS Asia (MGA) Demonstration Campaign. Mr. Kogure, noted that JAXA is preparing to deploy 60 3G receivers that are capable of tracking GPS, GLONASS, GALILEO and QZSS satellites. The first 20 will be deployed by the end of March, 2012, and the remaining 40 will be deployed by the end of March 2013. JAXA will be asking the IGS to host some of the networks. Mr.

Kogure, as co-chair of the MGA, noted that they welcome China as a participant promoting multi-GNSS applications jointly in the Asia-Pacific region.

11. Mr. Seregy Revnivykh provided an update on the GNSS Performance Monitoring System in Russia. Russia has analyzed the performance of both GLONASS and GPS. Mr. Revnivykh further commented that Russia's recommendation is that each provider should contribute data to an international system, and agreement should be reached on a set of parameters to be monitored with a common understanding of how they are calculated.

12. An update on the International GNSS Service (IGS) Multi-GNSS Activities and Plans was presented by Mr. Chris Rizos. One of the key points made by Mr. Rizos was that this is an excellent opportunity to combine the multi-GNSS activities, and the IGS is well suited to be a key player. The IGS is a federation of networks, and not monolithic. So products do not come from one country. The IGS not only consists of "private" systems but also includes some "government operated" receivers, and also takes advantage of commercial off-the-shelf receivers.

13. Mr. Turner presented Recommendation 4.2 from the inter-session meeting, for ICG WG-A decision - *International GNSS Monitoring and Assessment.* Mr. Matt Higgins suggested that the wording be modified to allow interested members of ICG to participate rather than limit it to WG-A members. There was general agreement on this suggestion, but the working group agreed to further discuss this at the meeting the next day.

14. Recommendation 4.1 from the inter-session meeting was presented for WG-A discussion – *Consensus on Open Service GNSS performance parameters, including Definitions and Calculation Methods.* The working group agreed to continue the discussion on this at the meeting the next day.

15. Session 5, GNSS Interoperability, began with a presentation from Ms. Xiachun LU from China, on the relationship between the number of visible satellites and receiver noise floor. This led to a discussion on the noise floor. The EU requested that there be a review of the power levels. Ms. LU recommended that a subgroup be established to evaluate interoperability under WG-A, B, and C. One idea would be to standardize a list of parameters to be broadcast by each system. Mr. Revnivykh suggested that many other parameters should be included in the subgroup discussion, including messages and other factors. The working group agreed to delay a decision on the recommendation and continue discussing at the WG-A meeting the next day.

16. Session 6, Conclusion, was held on 08 September 2012. The co-chairs noted that there was no further unfinished business, and continued on with a final review of the recommendations. Mr. Turner noted that the objective was to review the recommendations so they could be presented at the Plenary Meeting. Recommendations 2.1 and 3.1 were approved by WG-A on the previous day.

17. Recommendation 4.2, formation of a team to optimize international GNSS monitoring and assessment was reviewed again. After some discussion, consensus was reached on

modifying the recommendation to allow for participation by members from WG-B and WG-D. The revised language was approved by WG-A and it was noted that there was considerable interest on the part of China, Japan, and Russia to lead this activity.

18. Recommendation 4.1, consensus on Open Service GNSS performance parameters, was discussed. The EU suggested that it may be necessary to maintain different definitions for different providers. The U.S. suggested that this task be assigned to the compatibility subgroup. The subgroup co-chairs agreed to take on this task, and the modified recommendation was approved by WG-A.

19. A fifth recommendation from China to establish a subgroup to evaluate interoperability under WG-A, B, and C was discussed. No consensus was established either to have a new sub-group or to assign this topic to an existing sub-group. Mr. Turner noted that there is a need for input from users and user groups on interoperability, but so far there has been limited input.

20. In summary, four recommendations (2.1, 3.1, 4.1 and 4.2) were approved by Working Group A, for presentation at the full Plenary Meeting.

Recommendation 2.1 for Committee Decision

Prepared by: **Working Group A**

Date of Submission: **8 September 2011**

Issue Title: **Continuation of WG-A compatibility subgroup**

Background/Brief Description of the Issue:

In June 2010, a Providers-only workshop on compatibility was conducted and a sub-group was formed to investigate organizational models relevant to multilateral coordination of GNSS compatibility. At ICG-5, the Committee recommended to continue the work of the sub-group on organizational models and procedures for multilateral discussions on GNSS compatibility.

Discussion/Analyses:

Following ICG-5, the subgroup met twice on, 25 February 2011 in Geneva and on 8 June 2011, in Vienna. During its last meeting, the subgroup developed draft terms of reference (see the annex) and presented them at the ICG WG-A meeting on 9 June 2011. WG-A members agreed on the relevance of those ToR and on the usefulness of continuing the work of the subgroup.

Recommendation:

To continue the activities of the WG-A Compatibility subgroup in accordance with the ToR as attached. The subgroup will assess compatibility issues to support the development of Common Signal Characteristics Reference Assumptions, which are recommended by ICG-5 Recommendation 6. The subgroup will also initiate discussions and collaboration on open service GNSS performance parameters, including definitions and calculation methods, as requested by ICG-6 WG-A recommendation 4.1.

Annex

Draft Terms of Reference

OF THE WG-A COMPATIBILITY SUB-GROUP

Noting:

a) the importance of cooperation related to civil satellite-based PNT and value-added services;
b) The unique and irreplaceable role of bilateral coordination under ITU procedures;
c) The increasing importance of multilateral information exchange among GNSS systems;

Considering:

a) that at ICG-5, WG-A recommended the creation of a subgroup to investigate multilateral discussions for GNSS compatibility.
b) that at ICG-6, the committee endorsed a recommendation from WG-A to continue studying the various issues of compatibility that are of concern to all parties;
c) that the terms of reference should be reviewed at least annually to determine if the subgroup should continue to exist, and if so, to maintain current relevance;

Deciding:

a) that English will be the official language for the conduct of its meetings and its documentation;
b) that the two Co-Chairs are appointed by Working Group A [for a period of one year], to organize the work to be conducted during meetings and to guide the discussions during meetings;
c) that the sub group shall only work on the compatibility issues that are agreed to by WG-A;

The WG-A Compatibility Subgroup will*:*

1. work on the compatibility issues as approved by WG-A and define work plans for the corresponding issues;
2. express its agreed results in the form of findings, reports, or whatever form may be appropriate for the case;
3. provide proposals of compatibility issues to WG-A, for discussion and decisions.

Recommendation 3.1 for Committee Decision

Prepared by: **ICG Working Group A**

Date of Submission: **8 September 2011**

Issue Title: **Proposed workshop on GNSS Spectrum Protection and Interference Detection and Mitigation for ICG Providers Forum Member Consideration**

Background/Brief Description of the Issue:

ICG Terms of Reference work plan includes the means to: "establish, as mutually agreed and on an ad hoc basis, working groups to investigate specific areas of interest, cooperation and coordination." Also, the work plan of the Providers Forum contains the provision to consider GNSS Interference detection and mitigation. This proposal sets forth the description of a workshop focused on spectrum protection and interference detection and mitigation for GNSS.

Discussion/Analyses:

As current and emerging GNSS systems become more and more useful for world-wide economic benefit and efficiencies in operations, it is becoming more important for Providers to work together to protect users of these GNSS signals from harmful interference. A Proposed Agenda for the workshop has been developed based on experience and concerns related to GNSS IDM. The issues to be discussed include regulatory, policy, operational and technical aspects. Specifically, the proposed agenda suggests discussion of the following subjects: RNSS Spectrum Protection Overview; Sources of interference; Update from current Providers; Current and future information sharing, dissemination, collaboration and standardization; Case Studies, Workshop views and recommendations. One of the desired outcomes of this workshop will be to address the next steps for collaboration on IDM, especially on possible technical concepts for interference detection and monitoring and the forecast and observation of harmful space weather effects. This may include establishing additional workshops and/or case studies to examine in more detail some additional aspects of IDM, to include: joint GNSS IDM monitoring, communication and exchange of information, possible development of (recommended) standards for interference detection devices, development of a mechanism for interference source monitoring and mitigation within the ICG, and the exchange of information related to space weather forecasting.

Recommendation:

It is recommended that ICG conduct a two day workshop, with another half-day to finalize recommendations, focusing on GNSS Spectrum Protection, Interference Detection and Mitigation, and international cooperation. The location of the proposed workshop, to be conducted no earlier than March 2012, is to be determined. It is also recommended that follow-up meetings, workshops, and/or case studies, and potential establishment of a platform for international technical cooperation, may be discussed and agreed upon as a result of this initial workshop.

Recommendation 4.1 for Committee Decision

Prepared by: **Working Group A**

Date of Submission: **8 September 2011**

Issue Title: **Consensus on Open Service GNSS performance parameters, including Definitions and Calculation Methods**

Background/Brief Description of the Issue:

According to the current work plan, the working group will develop a template that individual GNSS providers may consider using in their publication of signal and system information, the policies of provision, and the minimum levels of performance offered for open services. Before a template for open service performance can be developed, the goal is to reach consensus on a minimum set of parameters common to all GNSS open services.

Moreover, each system has its own definitions and calculation methods for the performance parameters, which may be different from each other. It is recommended that the definitions and calculation methods of the performance parameters be clarified and discussed in order to facilitate the subsequent work on the template.

Discussion/Analyses:

- Parameters of each Performance Document (PD) will address the Open Service (OS) provided by each provider.

- The definitions and calculation methods of open service GNSS performance parameters should be provided by each system provider and discussed by all interested participants in order to achieve a common understanding The OS PD values may change over time – as determined by the GNSS provider.

- Providers may choose to define additional parameters for their respective open services or for additional services they intend to provide.

Recommendation:

The Compatibility sub-group of WG-A, with participation from all interested system providers will initiate the necessary discussions and collaboration, including the issue of definitions and calculation methods of the performance parameters. Names of participants should be provided to the WG-A sub-group Chairs as soon as possible.

Recommendation 4.2 for Committee Decision

Prepared by: **Working Group A**

Date of Submission: **8 September 2011**

Issue Title: **International GNSS Monitoring and Assessment**

Background/Brief Description of the Issue:

The Providers Forum has agreed to consider the development and discussion of proposals to widely monitor the performance of their open signals and provide timely updates to users regarding critical performance characteristics such as timing accuracy, positioning accuracy and service availability. As stated in its work plan, Working Group A will support this activity by focusing on potential cooperation in the development of the necessary ground infrastructure to monitor signal and service performance for open services.

To ensure the service quality, consistent with common open service performance parameters, and realize the ultimate goal of interoperable GNSS open services signals, it is desirable to carry out monitoring and assessment on GNSS open services. An important approach is to determine if international GNSS Monitoring and Assessment requires a single new system, an architecture created by several national systems or through the use of an existing global network such as the one utilized by the International GNSS Service (IGS).

Discussion/Analyses:

Several multi-GNSS monitoring network activities are underway. For example, Preliminary experience includes BeiDou monitoring and assessment, the long-term successful operation of IGS, and the achievements in GNSS signal monitoring and assessment made by Stanford University, DLR, Information Analysis Center of Roscosmos, and others.

China is developing the International GNSS Monitoring and Assessment System (iGMAS).

Japan has also initiated a project known as Multi-GNSS Demonstration Campaign, which is actively seeking proposals for monitoring sites to host GPS/GLONASS/Galileo/QZSS receivers that have already been procured by JAXA.

Future plans for IGS network upgrades to include multi-GNSS receivers should also be investigated, and the support and participation of all GNSS providers will be very beneficial for global monitoring and assessment

Recommendation:
To monitor and assess GNSS open services worldwide, a subgroup of WG-A, with participation from WG-B and WG-D should be formed to develop a proposal to optimize existing and planned capabilities, and identify additional activities necessary for international GNSS Monitoring and Assessment.