Tenth Meeting of the
International Committee on Global Navigation Satellite Systems (ICG)

1 – 6 November 2015
Boulder, Colorado, United States

Joint Statement

The Tenth Meeting of the International Committee on Global Navigation Satellite Systems (ICG) was held in Boulder, Colorado, the United States from 1 to 6 November 2015, to continue reviewing and discussing developments in global navigation satellite systems (GNSS) and to allow ICG members, associate members, and observers to address recent developments in their organizations and associations with regard to GNSS services and applications. ICG also addressed relevant challenging issues associated with observing earth processes using GNSS. Representatives from industry, academia and Governments shared their views on GNSS today and vision for the future.

The President of the University Corporation for Atmospheric Research (UCAR), Aerospace and Defense Industry Champion of the Colorado Office of Economic Development and International Trade, Major General of the United States Air Force Space Command, and the Deputy Assistant Secretary of the United States Department of Homeland Security delivered opening speeches on behalf of the United States. The Director of the Office for Outer Space Affairs of the United Nations Secretariat also addressed the Meeting.

The meeting was hosted by the Government of the United States and organized by UCAR. The Meeting was attended by representatives of China, India, Italy, Japan, Malaysia, the Russian Federation, the United Arab Emirates, the United States of America and the European Union, as well as the following intergovernmental and non-governmental organizations: Arab Institute of Navigation (AIN), Asia-Pacific Space Cooperation Organization (APSCO), Civil Global Positioning System Service Interface Committee (CGSIC), European Space Agency (ESA), International Aeronautical Federation (FAI), International Association of Geodesy (IAG) and IAG Reference Frame Sub-Commission for Europe (EUREF), International Association of Institutes of Navigation (IAIN), International Bureau of Weights and Measures (BIPM), International Federation of Surveyors (FIG) and International GNSS Service (IGS). Representatives of the Office for Outer Space Affairs of the United Nations Secretariat also participated. Australia and Canada were invited to attend as observers. The representatives of the regional centres for space science and technology education, affiliated to the United Nations, located in China, Mexico and Morocco, and the Space Generation Advisory Council attended the meeting.

The ICG recalled that the United Nations General Assembly, in its resolution 69/85 of 16 December 2014, had noted with satisfaction the continuous progress made by the ICG towards achieving compatibility and interoperability among global and regional space-based positioning, navigation and timing systems and in the promotion of the use of GNSS and their integration into national infrastructure, particularly in developing countries. The United Nations General Assembly noted with appreciation that the ICG held its ninth meeting in Prague, Czech Republic, from 10 to 14 November 2014.

The ICG noted that the working groups focused on the following issues: compatibility and interoperability; enhancement of the performance of GNSS services; information dissemination and capacity building; and reference frames, timing and applications.

The Working Group on Compatibility and Interoperability addressed all areas of its current workplan in 2015 through multiple meetings of its sub-group and task forces, two intersessional meetings (Vienna, Austria in June 2015 and Gold Coast, Australia in July 2015), and during the Tenth Meeting of the ICG. The compatibility and performance standard subgroup decided to continue addressing the need for worldwide GNSS spectrum protection through a recommendation to providers and user community member states to promote the implementation of protection measures for GNSS operations in their nations and/or regions as well as other parts of the world. The interference detection and mitigation (IDM) task force organized and completed the fourth ICG IDM workshop in Vienna, Austria in June 2015. That event and the subsequent deliberations with the working group led to a recommendation to the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) to establish a multi-year agenda item focused on National Efforts to protect the Radio Navigation Satellite Services (RNSS) Spectrum, and pursue GNSS IDM in member states.

The international GNSS monitoring and assessment (IGMA) Task Force conducted several meetings in 2015 and the second IGMA Workshop, hosted by China in Xi'an. The Task Force intends to initiate a joint trial project with IGS that will demonstrate a global GNSS Monitoring and Assessment capability after the completion of several preliminary items. Finally, the interoperability task force reported several conclusions based on all five workshops held by providers in 2014 and 2015. This task force, under a restructuring and revised workplan completed by the group, will become the Interoperability and Service Standards Subgroup, with the IGMA Task Force continuing under its auspices, as well as the on-going work on open service performance standards. The existing Compatibility and Performance Standards subgroup has been renamed the Compatibility and Spectrum Subgroup, which will also have responsibility for the IDM Task Force. The approved new workplan includes a new area of possible work focused on system-of-systems operations, pending tasking from the Providers Forum. This architecture compromises the newly named **Systems, Signals, and Services Working Group of the ICG**.

Working Group on the enhancement of GNSS service performance made important progress in establishing an interoperable GNSS Space Service Volume (SSV). All service providers recognize the importance of GNSS for space missions. Characteristics to

establish an interoperable GNSS SSV were given by all six providers. ICG appreciates the efforts conducted by all Service Providers to establish these characteristics. Members of the Working Group will continue to develop a booklet on interoperable GNSS space service volume for presentation at the next Providers' Forum and conduct the necessary simulations as a joint effort.

The group reviewed the progress in analysing the benefits of the NeQuick Galileo ionospheric model for single frequency users based on the assessment made by different service providers. Promising results were obtained with this model. Also space-users in Low Earth Orbit (LEO) can benefit from it.

The Working Group members acknowledged the benefits of ranging signals broadcast from Galileo satellites in eccentric, non-nominal Medium Earth Orbit (MEO) orbits for Position, Velocity and Time (PVT) applications and scientific demonstrations. Progress was presented on the use of GLONASS for geodetic applications showing similar performance to other GNSS. It was identified that high precision applications benefit from SBAS GEO ranging if sufficient quality ephemeris data for the GEO satellite is provided. The group confirmed that wide band signals will minimize multipath error and can significantly improve the accuracy for users.

The application subgroup of this Working Group continued its work and presented an Application Catalogue. The findings of the group will be summarized in a report for the eleventh meeting of the ICG (ICG-11). The Working Group reviewed and updated its workplan. The updated workplan continues to address the areas of future integrity solutions, the monitoring of application developer needs and atmospheric correction models. In addition new areas of work related to SSV and Space Weather/Remote Sensing communities were introduced. In order to support the follow-up of the updated Workplan, China was appointed as the 3rd co-chair of the Working Group.

Noting the benefits of increased cooperation and support among Providers' Service Centers and the United Nations-affiliated Regional Centres for Space Science and Technology Education, the **Working Group on information dissemination and capacity-building** proposed to expand knowledge sharing, by engaging in faculty/student exchange programmes and providing textbooks/teaching materials.

Additionally, the Working Group recommended that the ICG members consider the value of National and Regional Positioning, Navigation and Timing (PNT) Advisory Committees and share their findings at future ICG meetings when available. It was also recommended that the Providers and GNSS user information centres continue to develop and adopt a process for referring inquiries to each other, where appropriate.

The Working Group on Reference Frames, Timing and Applications apprised the ICG of the United Nations General Assembly resolution on the Global Geodetic Reference Frame (GGRF) passed in February 2015. The Committee of Experts for the United Nations Global Geospatial Information Management (UN-GGIM) endorsed the establishment of a working group on the GGRF, whose task is to develop a "roadmap"

for the realization of the GGRF. The Co-Chairs of the Working Group are engaged in the GGRF working group.

The Working Group organized a panel of expert speakers at ICG-10. The Working Group also met to discuss progress since ICG-9. The Working Group noted significant progress on the geodetic and timing references for the GNSS currently represented in the ICG with refinement of: (1) the alignments of GNSS associated reference frames to the latest realization of the International Terrestrial Reference Frame (ITRF2008), and (2) on timing references in relation to rapid Coordinated Universal Time (UTCr). The Working Group reported on several developments at the BIPM, including updates on its Circular T, UTCr and the revision of the definition of UTC being discussed at World Radiocommunication Conference 2015 (WRC-15). The Working Group informed the ICG of progress in the computations of the new ITRF2014. ITRF2014 will be a significant improvement over the current ITRF2008.

The Working Group has contributed to the IGMA initiative as one of the co-chairs of the IGMA Task Force. Since ICG-9 the work of the Task Force has focused on the definition of the parameters to be monitored. Considerable progress was made at ICG-10, with the recommendation to launch a joint ICG-IGS Trial Project. The Working Group has undertaken to review their workplan and define new tasks in the run-up to ICG-11, paying particular attention on issues related to precise/scientific applications of GNSS.

The ICG accepted the invitation of the Russian Federation to host the Eleventh Meeting of the ICG in Sochi, from 6 to 11 November 2016. The Office for Outer Space Affairs, in its capacity as the Executive Secretariat of ICG and its Providers' Forum, will assist in the preparations for the meeting and for interim planning meetings and Working Groups activities to be held in 2016. The ICG noted the expressions of interest by Japan to host the Twelfth Meeting of the ICG in 2017, by China to host the Thirteenth Meeting of the ICG in 2018, and by India to host the Fourteenth Meeting of the ICG in 2019.

All the presentations made during the ICG-10 meeting are available at the ICG information portal (www.unoosa.org).