Committee on the Peaceful Uses of Outer Space

Fifteenth meeting of the International Committee on Global Navigation Satellite Systems

Note by the Secretariat

I. Introduction

A. Background

1. The International Committee on Global Navigation Satellite Systems (ICG), as an optimal cooperation mechanism, offers the benefit of providing a flexible forum in which global navigation satellite system (GNSS) providers and users come together to discuss all matters regarding the use of multiple GNSS signals. This multilateral coordination mechanism has allowed GNSS technology to evolve over time while still providing the structure necessary to achieve efficient interaction in the field of space applications.

2. With the participation of States Members of the United Nations, intergovernmental bodies and non-governmental organizations, ICG has become an important platform for communication and cooperation in the field of GNSS. The Office for Outer Space Affairs of the Secretariat, as the executive secretariat of ICG, continued to support progress towards achieving compatibility and interoperability among global and regional space-based navigation systems. As new systems emerge, signal compatibility and interoperability among GNSS systems and transparency in the provision of open civil services will be key factors in ensuring that civil users around the world receive the maximum benefit from GNSS and the wide range of its applications. One main challenge is to provide assistance and information for those countries seeking to integrate GNSS into their basic infrastructure, including at governmental, scientific and commercial levels.

3. The four ICG working groups (systems, signals and services; enhancement of GNSS performance, new services and capabilities; information dissemination and capacity-building; and reference frames, timing and applications) address technical issues. Subgroups and task forces support the functions of the working groups by carrying out specific responsibilities and producing defined outcomes.

4. The ICG Providers’ Forum, consisting of those countries that operate global and regional navigation satellite systems or with plans to develop one, provides a venue for coordination and cooperation to improve overall service provision. The meetings of the Providers’ Forum are held in conjunction with the annual meetings of ICG, or more often should the need arise.
ICG held its fifteenth meeting in Vienna, from 27 September to 1 October 2021 in a hybrid format, with three intersessional meetings being held on 19 October 2021, 22 February 2022 and 14 April 2022 in an online format. The Providers’ Forum held its twenty-fourth meeting on 27 September and 1 October 2021 in conjunction with the ICG meeting. The Office for Outer Space Affairs organized the meetings. A list of the States Members of the United Nations, United Nations entities and governmental, intergovernmental and non-governmental organizations participating in ICG is contained in annex I.

B. Structure and programme of the meeting

6. The programme of the fifteenth meeting of ICG consisted of three plenary sessions and a series of meetings of the four working groups. The first plenary session, held on 28 September 2021, provided an opportunity for providers of GNSS, regional systems and augmentation systems to make presentations on their programme and policy updates and on new technologies and research areas, and exchange ideas in the field of GNSS. ICG members, associate members and observers representing GNSS user groups shared their views and perspectives on matters of interest to ICG and its working groups.

7. An expert seminar entitled “Space weather and GNSS” was held on 28 September 2021. The purpose of the seminar was to discuss space weather effects on the signals transmitted by GNSS, including the effect of ionospheric perturbations and solar radio bursts. The peculiarities and the evaluation of different ionosphere models was another focus area of the seminar.

8. The ICG working groups met in four parallel sessions on 29 and 30 September 2021 to discuss activities that had been put forward through the respective working groups workplans and recommendations made at previous meetings.

9. In addition, the working groups held joint sessions to address the following topics: (a) open service information-sharing and service performance monitoring; (b) precise point positioning (PPP) interoperability; and (c) interoperability and service standards. The conclusions and recommendations of the working groups were presented and discussed at the ICG second plenary session, on 30 September 2021.

10. After considering the various items on its agenda, ICG adopted a joint statement (see section III below).

11. In conjunction with the fifteenth meeting of ICG, the Providers’ Forum held its twenty-fourth meeting on 27 September and 1 October 2021 under the co-chairmanship of India and the European Commission (see section IV below).

C. Attendance

12. Representatives of the following States participated in the fifteenth meeting of ICG from 27 September to 1 October 2021: Australia, China, India, Italy, Japan, Malaysia, New Zealand, Nigeria, Russian Federation, United Arab Emirates and United States. The European Union was also represented.

14. ICG invited the observers for Pakistan, the Republic of Korea and the United Kingdom of Great Britain and Northern Ireland and for the Abdus Salam International Centre for Theoretical Physics (ICTP), Boston College, the Centre for Space Science and Technology Education in Asia and the Pacific, the Goddard Space Flight Centre, the Inter-Agency Space Debris Coordination Commission, L3Harris Technologies, the Plasma Physics Laboratory of Sorbonne University, Qascom, the Radio Technical Commission for Maritime Services, the Regional Centre for Space Science and Technology Education for Latin America and the Caribbean, the Regional Centre for Space Science and Technology Education for Western Asia, the Royal Observatory of Belgium, the Space Generation Advisory Council and the University of Rijeka, at their request, to attend the fifteenth meeting and to address it, as appropriate, on the understanding that it would be without prejudice to further requests of that nature and that doing so would not involve any decision of ICG concerning their status.

15. Representatives of the following Member States participated in three intersessional meetings held on 19 October 2021, 22 February 2022 and 14 April 2022: Australia, China, India, Italy, Japan, Malaysia, New Zealand, Nigeria, Russian Federation, United Arab Emirates and United States. The European Union was also represented. Representatives of Pakistan and the Republic of Korea also attended the meeting as invited observers.

D. Expert seminar

16. An expert seminar entitled “Space weather and GNSS” was held on 28 September 2021. The recent research activities in Pakistan and Nepal using GNSS and magnetometer data was presented by the representative of France. Developments and applications of the NeQuick ionosphere electron density model were presented by the representative of ICTP. Presentations on monitoring space weather with space-based GNSS receivers and on the solar origin of severe space weather were made by representatives of the United States.

17. Presentations on the application of GNSS technology in space weather research and the future perspective of GNSS radio occultation and reflectometry on the Fengyun-3 GNSS occultation sounder mission were made by representatives of China. Presentations on the study results of degradation of tomographic estimations of the ionosphere during geomagnetic storms were by the representatives of India. An overview of space weather studies using the Indian Regional Navigation Satellite System (NavIC) was also provided.

E. Documentation

18. A list of the documents before ICG at its fifteenth meeting is contained in annex II. Those documents and further information on the agenda of the fifteenth meeting, background materials and presentations are available on the ICG information portal on the website of the Office for Outer Space Affairs (www.unoosa.org).

19. A description of the activities undertaken or supported by the Office for Outer Space Affairs in 2021 in the framework of the workplan of ICG, and the main results achieved, can be found in document A/AC.105/1249.

II. Observations, recommendations and decisions

20. After considering the various items before it at its fifteenth meeting, ICG made the observations, recommendations and decisions set out below.
21. ICG took note with appreciation of the reports of its working groups and its Providers’ Forum, which contained the results of their deliberations conducted in accordance with their respective workplans.

22. ICG endorsed the decisions and recommendations of the working groups with regard to the implementation of the actions set forth in their workplans.

23. ICG took note of the schedule of the intersessional meetings and workshops of the working groups for 2022, which would be held in conjunction with space-related international conferences and symposiums.

24. ICG welcomed with appreciation the publication of *The Interoperable Global Navigation Satellite Systems Space Service Volume* (ST/SPACE/75/Rev.1) by the Office for Outer Space Affairs (available on the website of the Office). ICG noted the individual efforts led by participants in the working group on enhancement of GNSS performance, new services and capabilities included the following: documenting and publishing space service volume (SSV) performance metrics for each individual constellation; developing standard assumptions and definitions to perform multi-GNSS SSV performance analyses; encouraging the design and manufacture of GNSS receivers that could operate in SSV; characterizing GNSS antenna performance to more accurately predict SSV mission performance; providing a reliable reference for space mission analysts; and working towards the formal specification of SSV performance by each GNSS provider.

25. The chair of the meeting informed participants that requests for membership in ICG were received from the following two States Members of the United Nations: Republic of Korea (letter dated 30 December 2019) and Pakistan (note verbale dated 4 January 2021).

26. ICG heard a presentation by the representative of the Republic of Korea entitled “Korea Positioning System and Korea Augmentation Satellite System”. It was noted that the Republic of Korea was developing an advanced satellite-based augmentation system named the Korea Augmentation Satellite System, which would be completed by the end of 2022 and would begin providing safety-of-life services in 2023. It was also noted that a regional satellite navigation system, the Korea Positioning System, would be built and deployed over the Korean Peninsula with a view to improving position, navigation and timing (PNT) performance.

27. ICG heard a presentation by the representative of Pakistan on GNSS-related activities. It was noted that Pakistan was actively pursuing satellite navigation programme and developing infrastructure across the country to provide PNT services.

28. ICG accepted the invitation extended by the United Arab Emirates to host the sixteenth meeting of ICG, in 2022, and noted the offer made by the European Commission to host the seventeenth meeting, in 2023. ICG also noted the interest of New Zealand and Australia in jointly hosting the eighteenth meeting of ICG in New Zealand in 2024.

29. ICG agreed on a tentative schedule for the preparatory meeting for its sixteenth meeting, to be held during the sixty-fifth session of the Committee on the Peaceful Uses of Outer Space, in 2022.

30. At the closing ceremony, participants expressed their appreciation to the Office for Outer Space Affairs for hosting the meeting.

### III. Joint statement

31. ICG adopted by consensus the following joint statement:

1. The fifteenth meeting of the International Committee on Global Navigation Satellite Systems (ICG) was held in Vienna from 27 September to 1 October 2021 to continue reviewing and discussing developments in the field of global navigation satellite systems (GNSS) and to allow ICG
members, associate members and observers to address recent developments in their countries, organizations and associations regarding GNSS services and applications. Intersessional meetings of ICG were held on 19 October 2021, 22 February 2022 and 14 April 2022.

2. On behalf of the United Nations, Simonetta Di Pippo, Director of the Office for Outer Space Affairs, delivered an opening statement. Sharafat Gadimova, on behalf of the executive secretariat of ICG, also addressed the meeting.

3. The meeting was held with in-person and online attendance by representatives of Australia, China, India, Italy, Japan, Malaysia, New Zealand, Nigeria, the Russian Federation, the United Arab Emirates, the United States of America and the European Union, as well as the following United Nations entities and intergovernmental and non-governmental organizations: Asia-Pacific Space Cooperation Organization, Civil Global Positioning System Service Interface Committee, Committee on Space Research, European Position Determination System, European Space Agency (ESA), Interagency Operations Advisory Group (IOAG), International Aeronautical Federation, International Association of Geodesy, International Association of Geodesy Reference Frame Sub-Commission for Europe, International Association of Institutes of Navigation, International Bureau of Weights and Measures (BIPM), International Civil Aviation Organization, International Federation of Surveyors, International Global Navigation Satellite System Service (IGS), International Maritime Organization and International Telecommunication Union (ITU). Representatives of the Office for Outer Space Affairs also participated.

4. Representatives of Pakistan, the Republic of Korea, the United Kingdom of Great Britain and Northern Ireland, the Abdus Salam International Centre for Theoretical Physics, Boston College, the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP, India), the Goddard Space Flight Center, the Inter-Agency Space Debris Coordination Committee (IADC), L3Harris Technologies, the Plasma Physics Laboratory of Sorbonne University, Qascom, the Radio Technical Commission for Maritime Services (RTCM), the Regional Centre for Space Science and Technology Education for Latin America and the Caribbean (CRECTEALC, Mexico), the Regional Centre for Space Science and Technology Education for Western Asia (RCSSTEW, Jordan), the Royal Observatory of Belgium, the Space Generation Advisory Council and the University of Rijeka were invited to attend as observers.

5. Three intersessional meetings, held online on 19 October 2021, 22 February 2022 and 14 April 2022, were attended by representatives of Australia, China, India, Italy, Japan, Malaysia, New Zealand, Nigeria, the Russian Federation, the United Arab Emirates and the United States. The European Union was also represented. Representatives of Pakistan and the Republic of Korea also attended the meeting as invited observers.

6. Consensus was reached on accepting the request for membership of the Republic of Korea received in December 2019.

7. Regarding the membership of Pakistan, ICG received no objections from members. However, one member asked for further time to consider the technical merits of the application. The co-chairs of ICG Working Group S and the co-chairs of its subgroups reviewed the request by the Government of Pakistan for membership in ICG, including the presentation from the June 2021 planning meeting and statements made during the ICG plenary meeting. Based on the characteristics described in the ICG terms of reference for membership, the co-chairs of the Working
Group and the co-chairs of its subgroups concluded that Pakistan satisfied the technical requirements for membership in ICG.

8. ICG agreed to invite Pakistan to continue its participation as an invited observer in the work of ICG, pending a formal decision on the full membership of Pakistan at the sixteenth meeting of ICG, in 2022.

9. ICG conducted an expert seminar entitled “Space weather and GNSS”. At the seminar, the challenging aspects of space weather phenomena, their impact on GNSS users, the variability of those impacts and the actions that might mitigate their effects were described.

10. ICG noted that the working groups had focused on the following issues: systems, signals and services; enhancement of GNSS performance, new services and capabilities; information dissemination and capacity-building; and reference frames, timing and applications.

11. The Working Group on Systems, Signals and Services (Working Group S), through its subgroups and task forces, made good progress in advancing its workplan during the intersessional period between the fourteenth and fifteenth meetings of ICG. Under the leadership of the subgroup on compatibility and spectrum protection, a ninth GNSS Interference Detection and Mitigation (IDM) workshop was conducted online in August 2021. At the workshop, a number of concepts and ideas were presented on IDM capabilities and methodologies, as well as GNSS resilience. The Working Group continued its campaign to promote adequate protection of the GNSS spectrum by agreeing on a plan for completing a booklet on the importance of spectrum protection and IDM, which was a recommendation from the fourteenth meeting of ICG. The subgroup on compatibility and spectrum protection also maintained awareness of GNSS/radionavigation satellite service (RNSS)-related ITU activities. The Working Group tasked the subgroup with conducting workshops in 2022 focused on utilizing Automatic Dependent Surveillance–Broadcast (ADS-B) and the Automatic Identification System (AIS) for interference detection, and to further investigate national processes for notification of interference testing. The subgroup will also continue to discuss policy and technical measures regarding the resilient use of GNSS.

12. The subgroup on interoperability and service standards held three online meetings during the intersessional period focused on continuing to make progress on recommended activities consistent with its workplan. An updated version 2.0 of the performance standard guidelines document was adopted by the Working Group and will be made available for posting on the ICG information portal. The international GNSS monitoring and assessment (IGMA) task force continued to make progress on calculation methodologies and data formats for the joint ICG-IGS trial project, as well as an update to the project’s terms of reference. The performance standard subgroup and the IGMA task force plan to hold combined workshops in 2022, as well as continuing to hold combined virtual meetings on a monthly basis. During a joint working group session on timing interoperability, a new recommendation for calculating GNSS offsets was presented by BIPM. The working group agreed on the need to hold an in-person workshop in 2022 in conjunction with Working Groups B and D, in order to further discuss techniques to ensure multi-GNSS time interoperability and determine whether consensus can be reached on a recommendation. Finally, the precise point positioning (PPP) interoperability task force held two meetings and established its membership. In addition, the task force began putting together a template for collecting information from service providers on the characteristics of
their PPP services. The task force agreed to hold a workshop later in 2022 to continue this effort.

13. Under the Working Group’s focus on system of system operations, a report was received from IADC in November 2020, following a recommendation from the thirteenth meeting of ICG to study the issue of debris mitigation practices relevant to the medium Earth orbit and inclined geosynchronous satellite orbit orbital regimes used by GNSS. The Working Group intends to complete its review of the report with input from system providers in time to submit feedback to IADC before its planned meeting in June 2022.


15. The Working Group B space users subgroup informed the Working Group on the progress made since the fourteenth meeting of ICG. The space users subgroup was pleased to announce the second edition of the GNSS space service volume (SSV) booklet, which represents a thorough review and update of all content, including the latest constellation data from all providers and adding real-world GNSS space user flight experiences. In addition, the space users subgroup announced the release of the companion SSV video (available on the website of the Office for Outer Space Affairs). Both efforts had been developed to convey the significant improvements afforded by the use of a multi-GNSS SSV and its benefits to science and humanity.

16. All ICG participants were encouraged to broadly disseminate both the booklet and the video within their respective regions and organizations. Furthermore, the space users subgroup was interested in gathering feedback from users of the booklet and the video and taking steps to further promote their use, including the publication of translations and tailored versions.

17. The space users subgroup also announced its new workplan for the period 2021–2022, which outlines five major areas of future work: (a) availability of provider antenna data, (b) GNSS space user mission data, (c) GNSS space user timing requirements, (d) lunar GNSS SSV and (e) GNSS space user standards. The space users subgroup requested and encouraged collaboration with the other ICG working groups in each of these areas. Further coordination with international bodies such as IOAG, the International Space Exploration Coordination Group (ISECG), the Space Frequency Coordination Group (SFCG) and others was planned.

18. The Working Group recognized the efforts made by its application subgroup. Based on the joint statement of the fourteenth meeting of ICG, the application subgroup proposed to start a new initiative entitled “GNSS applications: for present and future”, to survey GNSS applications that identify challenges and facilitates the development of solutions that serve society. These actions were intended to provide assistance, lessons learned and guidance to GNSS users. This initiative would lead to a research report entitled “GNSS applications for sustainable development: case studies”.

19. Further enhancements were identified to create opportunities for greater participation and to attract new contributions to the application subgroup. All members of the working groups were encouraged to take a proactive role in support of this new initiative of the application subgroup.

20. The application subgroup intended to participate in important GNSS conferences and events to promote GNSS application development and to obtain information about trends in GNSS applications in line with the new initiative. The subgroup also intended to support the workshops on the applications of GNSS of the Office for Outer Space Affairs.
21. Working Group appreciated the variety of the contributions received, such as from the Emergency Warning Service (EWS) of the European satellite navigation system (Galileo), the Indian Regional Navigation Satellite System (NavIC) NavCom (an electronic navigation and communication system) and scientific applications, the Beidou Satellite Navigation System (BDS) search and rescue service, and LunaSAR, illustrating the convergence of science, position, navigation and timing and communication systems. The growing importance of the scientific use of GNSS was noted by the Working Group.

22. Working Group recognized the potential impact that the rising solar activities of twenty-fifth solar cycle could have on GNSS services and satellites. Further discussions among experts through workshops should be conducted to understand the possible impact of space weather events and the need for alert systems. This would be subject to further discussion at the Working Group’s intersessional meeting in 2022.

23. The Working Group on Information Dissemination and Capacity-building (Working Group C) addressed all areas of its workplan. Representatives of China, India, Japan, the Russian Federation, the European Union and ESA gave presentations on their GNSS education programmes. The Working Group received an update on the activities undertaken or supported by the Office for Outer Space Affairs during 2021 and the main results achieved.

24. The Working Group noted the work of the United Nations-affiliated regional centres for space science and technology education, also acting as information centres for ICG. The Working Group would continue to collaborate with the regional centres to further develop the GNSS curriculum, including scientific applications, and provide support in carrying out seminars and training courses on space weather and GNSS.

25. Experience from the International Space Weather Initiative (ISWI) instrument network, which was developing space weather science, showed that the instrument network required further enhancement. The Working Group proposed to establish a project team on “space weather monitoring using low-cost GNSS receiver systems” that would develop prototype systems to explore the possibilities of using low-cost receiver systems for space weather monitoring.

26. The Working Group on Reference Frames, Timing and Applications (Working Group D) noted significant progress on the geodetic and timing references by the GNSS providers. Specific progress was noted: (a) the refinement of the alignments of GNSS reference frames to the International Terrestrial Reference Frame (ITRF); and (b) the information on the GNSS timing references and the intercomparisons of GNSS time offsets.

27. The Working Group noted that the templates on geodetic and timing references currently provided on the ICG information portal should be updated by the GNSS providers to contain the most current information. Moreover, the tracking of updates on the web repository should be improved. The Working Group reiterated that satellite physical and geometrical properties related to the shape, mass, optical properties, dimensions and locations of radiating antennas permitted improved orbit modelling, which in turn increased the accuracy of satellite ephemerides and clock correction determination.

28. The Working Group noted that there had been some progress made in the provision of satellite properties by the GNSS providers based on ICG recommendation No. 23 in accordance with the whitepaper entitled “Satellite and operations information for generation of precise GNSS orbit and clock products” released by IGS. IGS collects and makes available
GNSS satellite properties to the user community. Access to satellite metadata was essential for enabling scientific applications and for high-accuracy precise positioning. The Working Group also noted that the provision of GNSS satellite phase centre offsets significantly contributed to the determination of the scale of the GNSS/IGS reference frame and allowed intercomparing with satellite laser ranging and very-long-baseline interferometry scales used to determine the ITRF scale. The Working Group recognized the significant progress made in the release of additional satellite metadata by the Quasi-Zenith Satellite System (QZSS), Galileo and BeiDou-2.

29. The Working Group noted that there had been little progress on ICG recommendation No. 12. Some providers were providing GNSS data from their tracking stations to IGS. The Working Group would continue to monitor progress (in conjunction with IGMA) and continue to demonstrate the benefits of consolidated monitoring system products, and encouraged all GNSS providers to contribute to that end. The Working Group continued to contribute to the IGMA initiative, in particular through involvement in the IGMA-IGS joint trial project.

30. The Working Group noted the progress made by BIPM towards implementation of IGS recommendation No. 20 through the publication by BIPM of the clock data [UTC–GNSS time] and [UTC–UTC(k)_GNSS]. Details on the procedure leading to the publication for all four GNSS systems had been presented. The Working Group noted the great progress in the development of the NavIC infrastructure by India and encouraged experimentation on the NavIC system time, also in collaboration with other metrological laboratories. The Working Group also noted proposal by India for NavIC to be included in the BIPM publication of the clock data [UTC–GNSS time] and [UTC–Brdc.UTC GNSS], as first mentioned at the fourteenth meeting of ICG.

31. Working Group recognized that the extension of the BIPM publication to regional and national systems was not foreseen at the moment and had to be discussed by BIPM international committees based on the needs of international users. So, updating recommendation No. 20 in this direction was not mature at the present stage. The Working Group examined developments relating to recommendation No. 21-B (On the monitoring of offsets of GNSS times). It noted the work carried out by the Consultative Committee for Time and Frequency (CCTF) and its working groups and task groups, emphasizing that the current broadcast predictions of [UTC–GNSS time] provide a ready-to-use and robust method to determine GNSS-to-GNSS timing offsets (GGTO). The Working Group discussed a recommendation of CCTF of 2021 (On the use of existing time scales to generate GNSS inter-system information). That recommendation solicits GNSS providers to evaluate the possible use of the broadcast predictions of [UTC–GNSS time] for interoperability and to continue improvement of these predictions in collaboration with time laboratories. The recommendation also invites receiver manufacturers to consider this possibility for interoperability. Working Group D concluded that through collaboration with Working Groups S and B, it would continue to further assess the user needs in view of considering support of the recommendation of CCTF of 2021, at the sixteenth meeting of ICG.

32. The co-chairs of Working Groups C and D recognized the synergies between the activities of the two working groups in GNSS, geodesy and reference frames. Working Group D would continue to work together with Working Group C to contribute to capacity-building on GNSS and the utilization of GNSS in geodesy and reference frames.
33. The Working Group noted the recent efforts of the United Nations Committee of Experts on Global Geospatial Information Management and its Subcommittee on Geodesy, namely, the ongoing work of building and maintaining a global geodetic reference frame, as well as the plans for establishment of a United Nations global geodetic centre of excellence in early 2022 at the United Nations campus in Bonn, Germany.

34. Working Group D, together with Working Groups B and S, highlighted the importance of harmonizing key aspects of system-provided PPP services, which led to the successful establishment of the task force under the Working Group S subgroup on interoperability and service standards.

IV. Providers’ Forum

32. The twenty-fourth meeting of the Providers’ Forum, co-chaired by the European Union and India, was held in conjunction with the fifteenth meeting of ICG, on 27 September and 1 October 2021, in a hybrid format with both in-person participation in Vienna and online participation. China, India, Japan, the Russian Federation, the United States and the European Union were represented at the meeting.

33. After considering the items on its agenda, the Providers’ Forum adopted the report on its twenty-fourth meeting, containing the discussions and recommendations set out below.

A. Summary of discussions and recommendations

1. Open service information dissemination

34. Presentations were made on the following topics.

(a) International GNSS monitoring and assessment system update

35. China presented an update on its international GNSS monitoring and assessment system (iGMAS), including the enhancement of iGMAS by providing more types of BDS-3 precise orbit and clock products, implementing new receivers to track all GNSS open signals and releasing five national standards to specify the quality requirements and file format for observation data and products. The assessment results for BDS, GPS, GLONASS and Galileo from the past year were also introduced. The results showed that BDS-3 had a much better performance than BDS-2.

(b) Spectrum protection and interference detection and mitigation

36. The providers discussed spectrum protection for S-band signals and agreed to recommend to ICG that further discussion on this topic should take place in the Working Group on Systems, Signals and Services under the subgroup on compatibility and spectrum protection.

2. Multi-GNSS demonstration project in the Asia-Oceania region

37. Japan provided an update on Multi-GNSS Asia (MGA), which promotes multi-GNSS in the Asia-Oceania region. Since the annual conference of MGA in 2020 was postponed due to the coronavirus disease (COVID-19) situation, MGA activities for the promotion of and capacity-building in GNSS applications were conducted online. In the Rapid Prototype Development (RPD) Challenge, participants gained the experience of not only the competition of ideas but also of designing, building and demonstrating their proposals/concepts on disaster mitigation and prevention by utilizing precise GNSS positioning as well as the emergency warning service function. The RPD Challenge will continue in 2022 as RPD Challenge 2022, which
was to be launched on 2 October 2021. The annual MGA conference is planned to be held in March 2022 in collaboration with the Geo-Informatics and Space Technology Development Agency.


38. A representative of the executive secretariat of ICG informed the Providers’ Forum that the nine-month postgraduate courses on GNSS would be held at the regional centres for space science and technology education, affiliated to the United Nations, in the academic year 2021/22. The Regional Centre for Space Science and Technology—in French Language, in Rabat, would also host a workshop on space weather and GNSS in 2022. That workshop would be co-organized by the Office for Outer Space Affairs, Boston College and the Abdus Salam International Centre for Theoretical Physics. The representative of the executive secretariat also noted that the second edition of *The Interoperable Global Navigation Satellite Systems Space Service Volume*, launched at the fifteenth meeting of ICG, would be distributed to all regional centres for space science and technology education, for educational purposes.

**B. Other matters**

1. **Requests by Pakistan and the Republic of Korea to become members of the International Committee on Global Navigation Satellite Systems**

39. The providers discussed the request from Pakistan dated 4 January 2021 for membership status in ICG.

40. The providers also discussed the request from the Republic of Korea dated 30 December 2019 for membership status in ICG.

41. The Providers took note of the interest of the Radio Technical Commission for Maritime Services in collaborating with ICG.

2. **Review of the terms of reference of the Providers’ Forum**

42. The Providers’ Forum reviewed and agreed on further changes to be made in paragraph 7 of section D (Procedures of work, structure and organization) of the latest version of the terms of reference (ICG/PF/TOR/2021).
Annex I

List of States Members of the United Nations, United Nations entities and governmental, intergovernmental and non-governmental organizations participating in the International Committee on Global Navigation Satellite Systems

Australia
China
India
Italy
Japan
Malaysia
New Zealand
Nigeria
Republic of Korea
Russian Federation
United Arab Emirates
United States of America
European Union
Arab Institute of Navigation
Asia-Pacific Space Cooperation Organization
Civil Global Positioning System Service Interface Committee
Committee on Space Research
European Space Agency
European Space Policy Institute
Interagency Operations Advisory Group
International Aeronautical Federation
International Association of Geodesy
International Association of Geodesy Reference Frame Sub-Commission for Europe
International Association of Institutes of Navigation
International Bureau of Weights and Measures
International Cartographic Association
International Earth Rotation and Reference Systems Service
International Federation of Surveyors
International Global Navigation Satellite System Service
International Society for Photogrammetry and Remote Sensing
International Steering Committee of the European Position Determination System
International Telecommunication Union
International Union of Radio Science
Office for Outer Space Affairs of the Secretariat
Annex II

Documents before the fifteenth meeting of the International Committee on Global Navigation Satellite Systems

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<td>Recommendation of the Working Group on Information Dissemination and Capacity-building</td>
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<td>ICG/TOR/2021</td>
<td>Terms of reference of the International Committee on Global Navigation Satellite Systems (as amended)</td>
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<td>ICG/PF/TOR/2021</td>
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