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**Committee on the Peaceful
Uses of Outer Space
Scientific and Technical Subcommittee
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Draft report

VII. Recent developments in global navigation satellite systems

1. In accordance with General Assembly resolution [75/92](#), the Subcommittee considered agenda item 9, entitled “Recent developments in global navigation satellite systems”, and reviewed matters related to the International Committee on Global Navigation Satellite Systems (ICG), the latest developments in the field of global navigation satellite systems (GNSS) and new GNSS applications.
2. The representatives of China, India, Indonesia, Japan, Kenya, Mexico, the Russian Federation and the United States made statements under agenda item 9. During the general exchange of views, statements relating to the item were made by representatives of other member States.
3. The Subcommittee heard a technical presentation entitled “Development of the BeiDou Navigation Satellite System”, by the representative of China.
4. The Subcommittee had before it the report of the Secretariat on activities carried out in 2020 in the framework of the workplan of the International Committee on Global Navigation Satellite Systems ([A/AC.105/1237](#)).
5. The Subcommittee noted that the Office for Outer Space Affairs continued to play an active role in facilitating cooperation and communication among the providers and users of GNSS.
6. The Subcommittee expressed its appreciation to the Office for its efforts in promoting the use of GNSS through its capacity-building and information dissemination initiatives, in particular in developing countries.
7. The Subcommittee noted with satisfaction that the ICG working groups continued to implement their workplans. The Subcommittee noted the progress made on GNSS compatibility and interoperability and on spectrum protection and interference detection and mitigation. Progress had also been made towards the development of a technical booklet on the importance of GNSS spectrum protection and interference detection and mitigation.
8. The Subcommittee noted that ICG had continued its work aimed at creating an interoperable, multi-GNSS space service volume that would enable improved navigation for future space operations beyond the geostationary orbit or even for lunar missions.



9. The Subcommittee noted that the fifteenth meeting of ICG would be hosted by the Office for Outer Space Affairs in Vienna from 27 September to 1 October 2021.

10. The Subcommittee noted that the United States had continued to upgrade the capability and service of its Global Positioning System (GPS) through the integration of the next generation of satellites, GPS Block III, which were broadcasting the third civil signal, L1C. It was noted that two Block III satellites had been launched in 2020 and that additional satellites would become available in the coming months and years, as the modernization effort moved forward. In addition to those space segment enhancements, the United States continued its effort to upgrade the GPS ground control system to support the new capabilities enabled by the Block III satellites.

11. The Subcommittee noted that the United States intended to continue improving the accuracy and availability of GPS through the enhanced performance of modernized satellites. The United States intended to continue to broadcast GPS signals free of direct user charges and was committed to keeping GPS as a central pillar in an emerging international system of GNSS.

12. The Subcommittee noted that the Global Navigation Satellite System (GLONASS) constellation of the Russian Federation was upgraded on an ongoing basis, with new satellites added each year. In 2020, two satellites had been launched, one of which was the third generation of the GLONASS constellation, namely, the GLONASS-K satellite. That constellation provided users with a broader range of capabilities and a more accurate and informative code division multiple access (CDMA) signal. Further gradual rejuvenation of the GLONASS constellation would ensure ongoing improvement in the quality of navigation services provided.

13. The Subcommittee also noted that the development of the GLONASS constellation remained focused on user requirements, primarily on the provision of high-quality navigation services in difficult terrain. In order to satisfy those needs, the development of the GLONASS high-orbit space complex was planned, and its first satellite would be launched in 2025.

14. The Subcommittee noted that in 2020, the BeiDou Navigation Satellite System (BDS) constellation of China had been successfully completed and currently consisted of 30 operational satellites in the BDS-3 system, providing global coverage. It was noted that, at the global level, BDS-3 had a positioning accuracy within 10 metres, speed measurement accuracy within 0.2 metres per second and timing accuracy within 20 nanoseconds, while at the regional level, those indicators stood at 5 metres, 0.1 metres per second and 10 nanoseconds, respectively.

15. The Subcommittee also noted that BDS provided several types of services to users worldwide, including regional and global short message communication services to the civil community; a satellite-based augmentation service (in test operation) for users with high-integrity requirements in the civil aviation, maritime and railway sectors; a precision point positioning service for users in the precision agriculture, land surveying and autonomous driving sectors; and an international search-and-rescue service.

16. The Subcommittee noted that the European Satellite Navigation System (Galileo) of the European Union provided accurate positioning and timing information and that its data were used for a broad range of applications.

17. The Subcommittee noted that India was pursuing two paths as part of its satellite navigation programme: the GPS-aided Geostationary Augmented Navigation System (GAGAN) and the Indian Regional Navigation Satellite System, also known as "Navigation with Indian Constellation" (NavIC). GAGAN, a satellite-based augmentation system, had been developed by the Indian Space Research Organization (ISRO), together with the Airports Authority of India, to provide the increased positioning accuracy required for civil aviation applications. NavIC had been implemented as an independent regional satellite-based navigation service.

18. The Subcommittee further noted that, in 2020, NavIC had been recognized as a component of the Worldwide Radionavigation System by the International Maritime Organization, and that it had been incorporated into the standards of the Third Generation Partnership Project (release 16). A NavIC-based emergency messaging system was also in operation for fishermen to provide alerts on impending disasters.

19. The Subcommittee noted that the Quasi-Zenith Satellite System (QZSS), also known as Michibiki, of Japan had been operated as a four-satellite constellation. QZSS was currently providing three types of services: a service complementing GPS that transmitted ranging signals from satellites; a service that augmented GNSS by providing error corrections through QZSS; and a short messaging service to contribute to disaster risk reduction.

20. The Subcommittee also noted that Japan was currently developing a GNSS augmentation service for high-accuracy applications based on a precise point positioning (PPP) technique called the Multi-GNSS Advanced Demonstration Tool for Orbit and Clock Analysis (MADOCA-PPP), which would go into service by 2023, and that an early warning service for the Asia and Oceania region would be put into operation in 2024.

21. The Subcommittee noted with appreciation that Indonesia, Kenya and Mexico had reported on their projects and activities focused on helping to bring applications of GNSS technology to the widest possible user community.

VIII. Space weather

[The present section of the report relates to item 10, which is addressed in document A/AC.105/C.1/L.386/Add.1. It should be added below paragraph 14 of that document. The two parts will be merged in the final report of the Subcommittee.]

22. At the 946th meeting of the Subcommittee, on 26 April, the Rapporteur of the Expert Group on Space Weather presented the progress made by the Expert Group during the meetings it had held on the margins of the current session of the Subcommittee.

23. The Expert Group noted the growing interest among member States in addressing the challenges associated with mitigating the adverse impacts of space weather and highlighted the important opportunity to improve global preparedness through the implementation of the guidelines relating to space weather in the Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space. The Expert Group also noted the increasing activity in recent years in a number of international organizations to improve global preparedness and increase international collaboration against the threat arising from the adverse impact of space weather.

24. Consistent with the proposal submitted to the Subcommittee at its fifty-seventh session, the Expert Group conducted intersessional surveys among member States on their space weather activities and among international organizations operating in the domain of, or affected by, space weather.

25. Based on the responses to the surveys, the Expert Group presented a set of draft recommendations towards the goal of implementing the guidelines relating to space weather in the Guidelines for the Long-term Sustainability of Outer Space Activities and towards improved international collaboration, in a working paper entitled “Draft report of the Expert Group on Space Weather: survey of the state of member State preparedness, and current and future activities and needs for space weather impact mitigation” (A/AC.105/C.1/2021/CRP.14). The Expert Group invited member States to comment on the draft set of recommendations and requested that the inputs be directed to the Rapporteur of the Expert Group, ideally prior to the sixty-fourth session of the Committee, and with a deadline of 31 August 2021.

26. The Subcommittee took note of the progress report of the Expert Group (A/AC.105/C.1/2021/CRP.23), which included its request to extend its mandate. In view of the report, the Subcommittee agreed to extend the mandate of the Expert Group for a further year. In that connection, the Subcommittee agreed on the following programme of intersessional work for the Expert Group:

(a) Finalize the analysis of the results of the second survey of member States and of the survey of international organizations;

(b) Finalize the set of recommendations, taking account of any further inputs from the Expert Group and from member States, and make the final version of the report on the surveys available to all delegations at the fifty-ninth session of the Subcommittee;

(c) Compile a draft final report of the Expert Group, including draft final recommendations to address and better serve the space weather-related needs of member States in the context of the Committee, through improved international collaboration, and including recommendations directed towards the implementation of the guidelines relating to space weather in the Guidelines for the Long-term Sustainability of Outer Space Activities. That draft final report would be submitted for the consideration of the Subcommittee at its fifty-ninth session.

27. The Subcommittee requested the secretariat to submit the draft final report of the Expert Group in all official languages of the United Nations for consideration by the Subcommittee at its fifty-ninth session, in order to promote the engagement of all member States.

XI. Future role and method of work of the Committee

28. In accordance with General Assembly resolution [75/92](#), the Subcommittee considered agenda item 13, entitled “Future role and method of work of the Committee”.

29. The representatives of Austria, Brazil, Canada, Chile, China, Indonesia and the Russian Federation made statements under agenda item 13. The observer for IAU also made a statement under the agenda item. During the general exchange of views, statements relating to the item were made by representatives of other member States.

30. The Subcommittee had before it the following:

(a) Note by the Secretariat on the governance and method of work of the Committee and its subsidiary bodies ([A/AC.105/C.1/L.384](#));

(b) Conference room paper containing a paper submitted by Chile, Ethiopia, Jordan, Slovakia, Spain and IAU entitled “Recommendations to keep dark and quiet skies for science and society” ([A/AC.105/C.1/2021/CRP.17](#));

(c) Conference room paper submitted by the Moon Village Association entitled “Report of the Moon Village Association on the Global Expert Group on Sustainable Lunar Activities” ([A/AC.105/C.1/2021/CRP.20](#));

(d) Conference room paper submitted by Canada, Japan and the United States containing a proposal for a single issue/item for discussion at the fifty-ninth session of the Subcommittee, in 2022, on a general exchange of views regarding satellite system effects upon terrestrial-based astronomy ([A/AC.105/C.1/2021/CRP.24](#)).

31. The Subcommittee recalled that, at its sixty-second session, the Committee had decided to introduce a regular item entitled “Future role and method of work of the Committee” on the agendas of both subcommittees to allow for discussion of cross-cutting issues ([A/74/20](#), para. 321 (h)).

32. The Subcommittee welcomed document [A/AC.105/C.1/L.384](#) as an important basis for further consideration under the multi-year workplan on the governance and method of work of the Committee and its subsidiary bodies. The Subcommittee noted

that proposals made by delegations for future measures were presented in that document in order to assist the Committee and its subcommittees in their considerations.

33. The view was expressed that clearly defined criteria for granting observer status with the Committee to organizations should be developed; that more topics could be prepared and worked through in working groups; that sufficient time was devoted to working groups, and the schedule of working group meetings was adapted according to the schedule of the plenary; and that the two subcommittees should report to each other regularly or hold joint meetings.

34. The view was expressed that the possibility of adopting voting procedures for procedural matters should be investigated; that there should be a limit to the number of technical presentations per delegation, and that presentations should be delivered outside of formal meetings; and that the use of electronic forms for the collection of information in preparation for sessions of the Committee and its subcommittees should be considered.

35. The view was expressed that mandates of working groups should be reviewed every five years; that working groups should be allowed to span both subcommittees on cross-cutting discussions, technical presentations should be held over lunch for no more than one hour, and the last hour of interpretation time each day should be allocated to presentations requiring interpretation; and that the allocation of time slots for technical presentations should be limited.

36. The Subcommittee noted that the Committee and its subcommittees served as unique platform for international cooperation in the peaceful uses of outer space.

37. The view was expressed that the adoption by the General Assembly of resolutions that address issues under the purview of the Committee, such as the long-term sustainability of outer space activities and space debris, without providing the Committee with an opportunity to discuss or provide views on such resolutions, might erode the responsibilities of the Committee, might not meet the requirements of the relevant resolutions of the Assembly and might distort the division of responsibilities, the coordination and cooperation among different entities within the United Nations system.

38. The view was expressed that the discussion of important topics on the space agenda, such as space debris, should be carried out in the framework of the Committee and not transferred to parallel platforms; that it was important to further strengthen the intergovernmental status of the Committee; and that a dialogue with commercial operators, scientific and academic circles should be conducted in such a way as to avoid any form of interference in the work of the Committee.

39. The view was expressed that the role of the Committee should be compliant with global space developments in all areas, including security, and that the resources for the Office for Outer Space Affairs should be adapted to the current rapid increase in space activities and the need for regulations and global coordination.

40. Some delegations expressed the view that the Committee and its subcommittees were the right international forums to address various implications resulting from the deployment of mega-constellations of satellites and their impacts on astronomy.

41. Some delegations expressed the view that there was a need to further examine and identify the most appropriate mechanism and modalities for further discussion of the topic of dark and quiet skies in the Subcommittee.

42. The view was expressed that the topic of dark and quiet skies, addressed in document A/AC.105/C.1/2021/CRP.17, should be included as an item on the agenda of the Subcommittee.

43. The view was expressed that the topic "General exchange of views regarding satellite system effects upon terrestrial-based astronomy" should be included as an

item on the agenda of the Subcommittee, as proposed in document A/AC.105/C.1/2021/CRP.24.

44. Some delegations expressed the view that sustainability issues relating to the topic of dark and quiet skies could be considered within the framework of the new working group under the agenda item on the long-term sustainability of outer space activities.

45. The view was expressed that the topic of dark and quiet skies was a matter for ITU.

46. The view was expressed that some of the issues relating to the topic of dark and quiet skies might be better addressed with the involvement of other bodies, such as ITU, and that future work in that area by IAU, or by industry, could be focused on the development of tools and guidance for satellite operators and regulators for assessing and addressing the reflectivity and brightness of satellites, as well as guidance for astronomers on applying existing space situational awareness data. The delegation expressing that view was also of the view that the Subcommittee could engage in considering the technical aspects of that topic, including in relation to space sustainability.

47. Some delegations expressed the view that there was a need for a more fulsome evaluation of the topic on dark and quiet skies, with the involvement of the scientific community, non-governmental organizations, industry and government, in particular the regulatory community, with a view to determining the best approach for the consideration of the issue.

48. The view was expressed that any possible legal implications in the area of space law relating to the topic of dark and quiet skies could be assessed by the Legal Subcommittee.
