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## Committee on the Peaceful

### Uses of Outer Space

#### Legal Subcommittee

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Item 6 of the provisional agenda\*

#### Status and application of the five United Nations treaties on outer space

## Registration of large constellations and megaconstellations

### Background paper by the Secretariat

#### I. Introduction

1. At the sixtieth session of the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, held in 2021, the Working Group on the Status and Application of the Five United Nations Treaties on Outer Space agreed that the Secretariat should prepare, for submission to the Subcommittee at its sixty-first session, a document containing statistics and information on practices of States relating to the registration of large constellations and megaconstellations ([A/AC.105/1243](#), annex I, para. 14).

2. The present document, prepared by the Secretariat in response to that request, is a summary of practices of States in registering space objects of large constellations and megaconstellations with the Secretary-General in accordance with the Convention on Registration of Objects Launched into Outer Space or General Assembly resolution 1721 B (XVI).

3. As the registration practices of States have evolved over time, including through the implementation of General Assembly resolution [62/101](#), entitled “Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects”, the Secretariat has limited its analysis of States’ practices to registrations submitted since 2015.

#### II. Registration practices

##### A. Satellite constellations

4. While the term “megaconstellation” is relatively new, satellite constellations have been an integral part of space activities for nearly six decades. Constellations

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\* [A/AC.105/C.2/L.319](#).



for communications, disaster prevention and management, Earth observation, meteorology, national security, navigation, science and technology development are ubiquitous and are among the foundations of modern-day civilization.

5. Since 2015, constellations comprising tens of thousands or hundreds of thousands of operational satellites have been authorized by national regulators. According to advance publication information submitted to the International Telecommunication Union (ITU) and information provided to national regulators and the media, the number of satellites in a constellation now ranges from several to more than 300,000. At present, more than 50 satellite constellations with an operational satellite population exceeding 100 have been announced. Almost all of those constellations are operated by non-governmental entities and provide commercial communications or Earth observation services.

6. Consequently, the roles and responsibilities of States concerning the activities of non-governmental entities in outer space that result in the registration of space objects operated by such entities has taken on increased importance.

## **B. Activities of non-governmental entities in outer space**

7. In article VI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, it is stated that:

States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization.

8. In accordance with article VI of the Outer Space Treaty, States parties are therefore responsible for authorizing and continually supervising the outer space activities of their non-governmental entities, which currently include academic institutions, non-profit organizations and private corporations. The importance of this requirement has been emphasized by the Committee, most notably in guideline A.3 of the Guidelines for the Long-term Sustainability of Outer Space Activities adopted by the Committee in 2019 ([A/74/20](#), para. 163 and annex II).

9. Such oversight is generally accomplished through the development of national legal mechanisms enacted by States. A common practice among States has been to link such mechanisms to their space object registration obligations.

10. However, the implementation of those treaty requirements by States covers a wide spectrum: some States have robust regulatory mechanisms in place that require detailed information to be obtained from non-governmental entities, while other States do not have any such regulatory mechanisms in place. Some States may have national legislation that applies only to space objects that are partially or fully funded by the Government. As a result, a State may have differing regulatory mechanisms for governmental and non-governmental space activities.

11. In addition, some States have such national regulatory mechanisms in place but may nevertheless assert, for some of their non-governmental entities' activities, that while the State bears international responsibility under article VI and also has jurisdiction and control in accordance with article VIII of the Outer Space Treaty, it is in fact neither the "launching State", nor the "State of registry" or the "launching

authority” for the purposes of the Convention on International Liability for Damage Caused by Space Objects, the Registration Convention or the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space. In such cases, while information on space objects operated by non-governmental entities may be provided to the Secretary-General under article XI of the Outer Space Treaty, the space objects in question remain unregistered under the Registration Convention or General Assembly resolution 1721 B (XVI).

12. Other States, however, take the opposite approach and note that, while they may be launching States because they provided launch services, they are not the States of operation. Such States may register each of the space objects that they launch for other procuring States in the spirit of contributing to the practical effectiveness of the treaties.

13. Given the multinational nature of academic and/or commercial space activities, it is also possible that a State may not be aware of the space activities of a non-governmental entity within its jurisdiction. In some cases, non-governmental entities may cite the high expense incurred or the long wait times involved in obtaining authorization from their States as reasons why they choose to “register” their space objects with another State through a subsidiary. However, instances can arise in which the State of the subsidiary has no actual knowledge of its non-governmental entities’ space activities and subsequently neither authorizes nor supervises those activities.

14. Based on discussions with national focal points on space object registration, it appears that the general practice of States is to depend on non-governmental entities to inform the respective Governments that the activities of those entities require authorization and supervision, including filing with ITU for frequency allocation and coordination. In some cases, a State may file a satellite network with ITU but may not be the State of registry for the satellites in the network.

15. In addition, the discussions between launching States required under article II, paragraph 2, of the Registration Convention in order to jointly determine the State of registry for a space object may not, in fact, be held. Varied reasons for that situation may exist, including a State not being aware that a national entity is procuring the launch of a space object, one State choosing not to raise the issue with the other State or the non-governmental entity indicating that another State will take responsibility without that State’s knowledge or consent. While not a uniform practice, some launch service providers have begun to require non-governmental entities procuring a launch to provide documentation demonstrating that the State having jurisdiction over that entity will register the space object once placed in orbit at the conclusion of launch services.

### **C. Registration of objects operated by non-governmental entities**

16. As noted in paragraph 7 above, in article VI of the Outer Space Treaty, no distinction is made between responsibility for space activities conducted by governmental or non-governmental entities. Similarly, in the Rescue Agreement, the Liability Convention and the Registration Convention, no distinction is made between space objects operated by governmental and non-governmental entities.

17. However, as indicated in paragraphs 11 to 15 above, national regulatory mechanisms may or may not accommodate the inclusion of a non-governmental entities’ space objects in the national registry established pursuant to article II, paragraph 1, of the Registration Convention, from which information is transmitted to the Secretary-General in accordance with article IV of that Convention.

18. In cases where a space object of a non-governmental entity is registered in a State’s national registry, the practice of distinguishing such an object from the State’s governmental space objects can vary. In General Assembly resolution [62/101](#), States were invited to incorporate into their registration practices information relating to the

change of supervision of a space object, including the identification of the new owner or operator, which would also be transmitted to the Secretary-General. In that resolution, the Assembly also recommended that, following a change in supervision of a space object in orbit, if there was no State of registry, the appropriate State according to article VI of the Outer Space Treaty could furnish the information to the Secretary-General. Thus, the State having jurisdiction over the non-governmental entity taking ownership of a space object on orbit could register that space object even if it has not been previously registered.

19. As requested in paragraph 5 (a) of General Assembly resolution 62/101, the Office for Outer Space Affairs developed a model registration form reflecting the recommended information to be provided by States. In addition to the information recommended under resolution 62/101, the form also allows States to voluntarily provide other information, including the identity of the space object's owner and operator.

20. As at 31 December 2021, of the approximately 4,980 satellites launched into Earth orbit since 1 January 2015, 83.7 per cent were owned or operated by non-governmental entities. Of those satellites, 91.5 per cent (nearly 3,300 satellites) were commercial, while 8.5 per cent were from academic institutions, non-profit organizations and other non-commercial entities.

21. At present, of the 59 States that have registered space objects since 2015, 64 per cent have provided names of non-governmental entities as owners and/or operators. Some States have specified that the owner and the operator are two different entities within a single State, and a few States have provided both the owner and operator when they are separate entities from different States (e.g. the registration of Nusat satellites by Uruguay). In one case, as the coordinating entity of a scientific project, a State assumed responsibility for the registration of multiple space objects operated by academic institutions in other States (i.e. the registrations by Belgium under the QB50 project).

22. Several States have also noted in a space object's general function that it is intended for commercial purposes (e.g. "Commercial geostationary telecommunications satellite") or part of an academic programme (e.g. "University research and academic amateur-radio nanosatellite").

#### **D. Registration practices for large constellations and megaconstellations**

23. When registering relevant space objects, States of registry often do not indicate that an object is part of a large constellation or megaconstellation.

24. However, there have been instances in which States have indicated that a space object is part of a small constellation operated by a single operator within that State (e.g. the registration of Glonass satellites by the Russian Federation). States have also noted in their registrations that objects are part of small multinational constellations (e.g. the registration of NigeriaSat-2 by Nigeria, indicating that it was part of the Disaster Monitoring Constellation).

25. Consequently, on the basis of information submitted under the Registration Convention or General Assembly resolution 1721 B (XVI), it is not possible to identify whether a space object is part of a large constellation or megaconstellation. The Office is therefore required to use "unofficial" information<sup>1</sup> to make such determinations.

26. As at 31 December 2021, of the approximately 4,980 satellites launched into Earth orbit since 1 January 2015, 66.0 per cent were associated with large constellations

<sup>1</sup> Primary sources of "unofficial" information are the Space-Track website maintained by the United States Space Force, governmental space activity/telecommunications regulatory bodies, the International Telecommunication Union, media articles and space enthusiasts' websites.

and megaconstellations. Of those satellites, 71.2 per cent (nearly 2,350) were for constellations comprising more than 1,000 satellites. Of the approximately 950 satellites associated with constellations comprising between 100 and 1,000 satellites, 93 per cent have been registered.<sup>2</sup>

27. Of the approximately 2,350 satellites associated with constellations comprising more than 1,000 satellites, 94 per cent have been registered.

28. On the basis of the information above, the Office notes that there is no discernible difference between the registration practices of States for single-satellite missions and those for constellations with fewer than 1,000 satellites. The Office notes that a State of registry may overhaul its general registration practices to accommodate the larger number of space object registrations.

29. When registering space objects, most States currently use Coordinated Universal Time in their submissions under article IV, paragraphs 1 and 3, of the Registration Convention, as recommended in General Assembly resolution [62/101](#). Similarly, most States also provide basic orbital characteristics in minutes and metric units as recommended in the resolution.

30. While article IV, paragraph 1, of the Registration Convention states what information should be submitted to the Secretary-General, paragraph 2 of the Convention allows States to determine what additional information they may wish to furnish. At present, most States provide information on a space object's owner and/or operator, although that practice can vary on a case-by-case basis. The operator's website address and even contact details for the owner/operator are sometimes provided.

31. Some States that provide commercial launch services include information on space objects launched for foreign clients. While some States provide information comparable to that in their registrations, others may provide only basic information on when the launch took place and what space objects were launched. Those States note that the information provided on foreign space objects does not constitute registration of those objects.

32. The Office notes that some space objects identified as part of large constellations have not been registered, even though the State in which the non-governmental entity is incorporated (or the State that is the ITU administration for the satellite network) is a party to the Registration Convention. Some States have not yet registered any space objects despite being parties to the Convention. In other cases, the State of registry continues to register space objects except for those associated with large constellations.

33. An important technical distinction between large constellations and megaconstellations is that, at present, large constellations are typically "assembled" incrementally, that is, a few satellites are launched at a time, whereas megaconstellation launches are dedicated to the constellation and comprise large batches of 30 to 60 mass-produced satellites. This difference in tempo and numbers is likely to directly influence whether a State modifies its registration practices.

34. At present, although a number of non-governmental entities have begun launching satellites for constellations consisting of more than 1,000 satellites, only two States have launched satellites in significant numbers: the OneWeb constellation of the United Kingdom of Great Britain and Northern Ireland, with 394 satellites, and the SpaceX Starlink constellation of the United States of America, with 1,944 satellites.

35. In both cases, the States increased the frequency of their submissions and implemented the use of a spreadsheet format to submit registration information.

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<sup>2</sup> This figure does not include a constellation of approximately 100 "sprites" that were deployed from a CubeSat in 2019. As they were too small to be tracked in Earth orbit and remained in orbit for only a short duration, they do not appear in any reference data sources and, subsequently, were not registered.

Additional information, such as the operator's website address, the date when the satellites will achieve their intended orbit or the date when the object re-enters the Earth's atmosphere, is also provided.

36. As noted in paragraph 33 above, some States have revised their general registration practices to accommodate the increased number of registrations, and the Office has not identified a discernible difference in registration practices between their registrations of single satellites, large constellations and megaconstellations. The Office does note that, owing to issues in matching a tracked object with a particular satellite when multiple satellites are launched together, a minor delay in submission (days or weeks) may occur while international designations are assigned to satellites. The Office also notes in this context that registrations by other States may take months or years after launch.

### **III. Summary**

37. Generally, the registration practices of States do not change when they register single satellites or multiple satellites that form large constellations and megaconstellations. Some States have taken steps to accommodate the increased number of registrations, such as increasing the frequency of submission, using a tabular/spreadsheet format and other measures.

38. Some States parties to the Convention have not registered their space objects with the Secretary-General.

39. States that have already launched hundreds of satellites belonging to megaconstellations have pre-emptively revised their registration practices, both in the frequency of their registrations and the manner in which the information is provided. Those States have consulted with the Secretariat on how best to provide the information and are actively engaged in refining those practices.

40. Some States whose non-governmental entities intend to operate large constellations or megaconstellations do not appear to have in place appropriate national legislation that demonstrates compliance with article VI of the Outer Space Treaty.

41. In addition, it is also apparent to the Office that there are some instances in which multiple States are involved in a single constellation project that results in inadvertent non-compliance with article II of the Registration Convention.

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