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English only

Committee on the Peaceful Uses of Outer Space
Scientific and Technical Subcommittee
Sixtieth session
Vienna, 6-17 February 2022
Item 17 of the provisional agenda*
General exchange of views on dark and quiet skies for science and society

Conference Room Paper on the Protection of Dark and Quiet Skies for science and society

Presented by Chile, Spain, Slovakia, Bulgaria, Dominican Republic, Peru, South Africa, International Astronomical Union, European Organization for Astronomical Research in the Southern Hemisphere and Square Kilometre Array Observatory

I. Introduction

1. The deployment of communication satellites constellations in Low Earth Orbit may represent a valuable step forward in improving world connectivity. However, their large number, their sun-reflected luminosity and their radio-frequency emissions have a serious impact on astronomical observations as well as on the pristine appearance of the night sky.

2. The issue has been raised to the attention of the Subcommittee since its 57th Session with the Technical Presentation “The impact of mega- constellations of communication satellites on Astronomy”, presented by the International Astronomical Union. The discussion continued at the 58th Session of the Subcommittee with the Conference Room Paper AC.105/C.1/2021/CRP.17 “Recommendations to Keep Dark and Quiet Skies for Science and Society” presented by Chile, Ethiopia, Jordan, Slovakia, Spain and the International Astronomical Union which was positively commented by 18 Delegations.

3. At the 59th Session of the Subcommittee the dedicated single-issue Agenda Item “18. General exchange of views on dark and quiet skies for science and society” was added under which the Working Paper “Protection of the dark and quiet sky” (A/AC.105/C.1/L.396) was prepared by Austria, Chile, the Dominican Republic, Slovakia, Spain, International Astronomical Union (IAU), European Organization for Astronomical Research in the Southern Hemisphere (ESO) and the Square Kilometre Array Observatory (SKAO).

* A/AC.105/C.1/L.405.

4. Up to 25 Delegations, either under Agenda Item 18 or 4 (“General exchange of views”) expressed their view on the issue which can be summarized as follows:

(a) Astronomical observations for both optical and radio astronomy are an essential aspect of space activities and should be protected from interference. (A/AC.105/1258, para. 267);

(b) The ever-increasing number of stakeholders, including private entities, that are launching spacecraft into orbit, raises serious concerns about their degrading interference on astronomical observations. (A/AC.105/1258, para. 266);

(c) There is a need for trade-offs between the requirements of the astronomical community and those of the orbital operators. (A/AC.105/1258, para. 271);

(d) The collaboration between the astronomical community and the satellite industries and operators aimed at studying and implementing mitigating measures has produced positive results and should be encouraged. This collaboration includes Coordination Agreements where companies have made commitments to abide by ITU international standards, modifications of orbital altitudes, voluntary changes to satellite designs, provision of telemetry information for observational follow-up and modification of satellite orientation in orbit raising and lowering procedures used to minimized reflected light. (A/AC.105/1258, para. 272);

(e) Because of the rapid evolution in launches of satellite constellations, the ongoing exchange of views on dark and quiet skies should continue to take place in the Subcommittee, with a single-issue agenda item on dark and quiet skies for science and society to be included in future sessions of the Subcommittee. (A/AC.105/1258, para. 276).

II. The impact of the constellations on astronomy: an update

5. In April 2022, the new IAU Centre for the Protection of Dark and Quiet Sky from Satellite Constellations Interference (CPS) began its operation. Considerable progress has been made in the analysis and initial implementation of mitigating measures. In particular:

(a) More than 200 external members (either individuals or institutional) have offered their collaboration to the CPS;

(b) A network of observers (mostly professional or amateur astronomers), coordinated by the CPS, started collecting data of the apparent luminosity of the different satellites along their orbit. These data are instrumental to understand the reflection behaviour of the satellites and to calibrate the predictive model of the expected luminosity by future constellations. Some of these data have been explicitly requested by some constellations’ operators;

(c) Technological studies on different materials have been initiated by some companies in the attempt to reduce the bi-directional reflectivity of the satellites. The result of these studies are made publicly available to the world space industry;

(d) Contacts have been established by the CPS with private companies that can provide accurate positional predictions of the satellites. These data could then be used to schedule the astronomical observations in such a way that the satellite’s trails are avoided;

(e) Discussions with operators are ongoing to implement mitigation measures to protect radio astronomy sites, especially radio quiet zones;

(f) The lessons so far learned and the best practices to be proposed to future constellation companies are being collected and made publicly available.

III. The path forward: a proposal

6. Considering the rapid evolution of the LEO constellations, it is considered necessary that the Subcommittee is kept informed about their impact on the visibility of the night sky, and on their impact on the science of astronomy.

7. It should be noted that not all aspects of coordination between satellite constellations and astronomy are appropriate for the Subcommittee: for example, global regulatory considerations relevant to radio frequency allocations are the responsibility of the ITU-R, as it was correctly remarked in the past by some Delegations. This new scenario where optical, infrared and radio emission effects share the same source, calls for a coordinated effort by the entities that oversee the peaceful use of space, regulate the use of the radio spectrum, are involved in the development and operations of large satellite constellations and the astronomical community. The IAU CPS may serve as a key coordinating body for the various stakeholders involved and member States are encouraged to participate in the appropriate forum.

8. For this purpose, two proposals are submitted to the attention of the Delegations to the Subcommittee:

(a) The maintenance of the single-issue Agenda Item “General Exchange of views on Dark and Quiet Sky” for the next three sessions of the Subcommittee;

(b) The creation of an Expert Group with the task of promoting awareness, providing guidance, and enabling communication and cooperation between member States and stakeholders regarding the impact of the satellite constellations on astronomy, formulating recommendations in agreement with all stakeholders. This Expert Group should regularly report to the Subcommittee on the matter and leverage the work and structure of the IAU CPS. The duration of the work plan of the Expert Group is proposed to be of three years.

9. The obvious purpose of 8.a is to offer the possibility to any Delegation to freely express their position and report on actions on the matter without having to confine it under a more generic Agenda Item.

10. A tentative Terms of Reference for the proposed 8.b Expert Group could include the following, but should be revised and finalized by the Expert Group upon its formation:

(a) Promoting awareness of the impact on optical/infrared and radio astronomy by the launched and planned satellite constellations;

(b) Conducting a structured consultation process with industry and space operators to take account of best practices and mitigation guidelines;

(c) Analysing the overall implications of the adoption of the various mitigating measures that are being proposed in close coordination with the satellite constellations companies;

(d) Defining a coordinated approach to addressing both optical reflectivity and radio-frequency emissions, with special consideration of the boundaries and interfaces between the Subcommittee and the ITU-R;

(e) Supporting the development of recommendations and possible guidelines for mitigating measures and approaches to be voluntarily considered by member States and the constellation operators;

(f) The Expert Group will elect its Bureau and will define its method of work;

(g) Reporting regularly to the Subcommittee about its findings.

11. It is advisable that the Expert Group would be open to the participation of all interested stakeholders. Therefore, member States and Permanent Observers are encouraged to consider including representatives of the academic and private sectors

in their delegations so as to allow for their participation in the work of the Expert Group.

12. The Expert Group should not duplicate the efforts of the IAU CPS, but can work to bring the results of the IAU CPS structure to the Subcommittee.

IV. Concluding remarks

13. The Delegations to the Subcommittee are respectfully asked to consider the proposals under 8.a and 8.b for which the presenters aim at obtaining the consensus of the Subcommittee.