Progress report on the work of the Expert Group on Space Weather at the 57th session of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space

Submitted by the Rapporteur of the Expert Group on Space Weather, Dr. Ian R. Mann (Canada)

I. Introduction

1. The present document contains information for delegations on the progress of work of the Expert Group on Space Weather, as will be presented to the Subcommittee by the Rapporteur of the Expert Group, Ian Mann of Canada.

2. The Expert Group notes the growing interest in addressing the challenges associated with mitigation of the adverse impacts of space weather in COPUOS Member States. The Expert Group reiterates the growing appreciation of the importance of space weather and the growing and pressing need to address the global space weather threat with a global response.

3. The Expert Group further highlights the importance of improved communication between Member States and their national and international organisations in the context of further space weather research, in developing improved understanding of space weather phenomena, and in the development of improved space weather services and approaches to mitigate the adverse impacts of space weather.

4. The Expert Group notes the draft report from the *Working Group on the "Space2030" Agenda of the Committee on the Peaceful uses of Outer Space"* (A/AC.105/C.1/L.382), and in particular that space weather forms a core part of *Overarching Objective 3: Improve access to space for all and ensure that all countries can benefit socioeconomically from space science and technology applications and space-based data, information and products, thereby supporting the achievement of the Sustainable Development Goals*. The Expert Group further notes that Space Weather is an important element of all of the four pillars, namely space economy, space society, space accessibility, space diplomacy, already identified by the Committee and the General Assembly resolution 73/6. The Expert Group further notes the likely focus on implementation of the approved LTS Guidelines, including B.6 and B.7, in the new Working Group on the Long-Term Sustainability of Outer Space Activities ("LTS 2.0").

5. In this context, we reiterate the strategic importance of COPUOS for continuing to promote the significance of the threat from space weather, and to encourage Member States to take concrete steps to respond by not only taking the necessary steps to protect their own infrastructure but also to participate in a coordinated global effort aimed at global resilience. COPUOS has a key role to play in facilitating the level of international collaboration needed to meet the challenges of understanding and mitigating the impacts of severe space weather, for the benefit of all mankind. The COPUOS Expert Group on space weather may also be valuable in providing a more specific interpretation of the space weather guidelines B.6 and B.7 in support of their implementation in Member States.

6. The Expert Group held four meetings on the margins of the 57th session of the Subcommittee on Tuesday, Wednesday and Thursday 4-6th February, 2020. Members of the Expert Group also organised and actively participated in an intersessional Space Weather Expert Group Workshop which was hosted at the Headquarters of the Canadian Space Agency on 10-11th July 2019, on the margins of the 27th Assembly of the International Union of Geodesy and Geophysics (IUGG) and which was held in Montreal, Canada from 8-18th July 2019.

II. Facilitating International Coordination

7. As expressed in previous Expert Group reports to the Subcommittee, and consistent with its mandate, the Expert Group continues to emphasise that international coordination is essential in order to deliver a global response to the questions of the "*Why, When, What and How*" of space weather. Understanding that there could potentially be severe global impacts of adverse space weather is "why" we need a global response. Member States need clear and actionable information to be able to know "when" to act, for example to be able to respond to impending severe space weather, and "what" to do and "how" to do it. This drives an urgent need to develop improved knowledge through research and in parallel develop improved international monitoring, forecasting, and warning procedures especially in the form of more coordinated international communication and coordination of warnings of extreme space weather events.

8. The Expert Group emphasises that future coordination in the context of COPUOS must focus on achieving the efficient implementation of such space weather services by the participating entities.

9. Assessing the unique space weather vulnerabilities in each Member State, and having a defined set of best practices, operating procedures, and actions which can be taken during such extreme space weather, are also key.

10. In the report on Thematic Priority 4: International Framework for Space Weather Services for UNISPACE+50 (A/AC.105/1171), the Expert Group identified six priority areas in the "Roadmap for international coordination and information exchange on space weather events" in section III of the report:

a. Product and service selection
b. Information communication protocol
c. Response procedures
d. Product sustainment and improvement and risk assessments
e. Improved understanding of fundamental physical processes which cause extreme space weather
f. Promote capacity building for space weather in COPUOS Member States

11. As demonstrated in the Thematic Priority 4 report, all of these six priorities are directly traceable to the voluntary Guidelines for the Long-Term Sustainability of Outer Space Activities (A/71/20) B.6 and B.7 which relate to space weather. The Expert continues to recommend that Member States and their national and international agencies focus on the implementation of these space weather Guidelines. As part of this approach, progress against implementation within Member States could be assessed in the context of the LTS 2.0 Working Group.

III. Recent Progress

10. The Expert Group continues to work in accordance with its mandate, not least in relation to the promotion of increased and expanded member State involvement in providing space weather monitoring, from the ground and in space, and in developing, advancing, and sharing and delivering space weather services.

11. The Expert Group on Space Weather noted with pleasure the progress achieved through international cooperation towards operational space weather services with the designation by International Civil Aviation Organization (ICAO) of global space weather information providers for international air navigation, which became operational on 7 November 2019, and which will be augmented by regional space weather information providers no later than November 2022.

12. The Expert Group on Space Weather recognized that space weather services are underpinned by science and innovation, and in this context the Expert Group commended the contribution being made by the COSPAR Panel on Space Weather (PSW) in its efforts to develop International Space Weather Actions Teams (ISWAT) to improve the scientific models that support transitional efforts for research to operations to enable future improved space weather operational services. The Expert Group approved the nomination of the Chairman and Rapporteur of the Expert Group on Space Weather as its formal representative on the COSPAR PSW.

13. The Expert Group on Space Weather noted all COPUOS Members are also Members of the World Meteorological Organization (WMO), and further noted the shared history of cooperation between WMO and COPUOS. During the Eighteenth World Meteorological Congress in June 2019, WMO Members adopted the Four-year Plan for WMO Coordination of Space Weather Activities and called on Members to support implementation in partnership with relevant international organizations and national agencies. Effective 1 January 2020 the WMO Integrated Global Observing System (WIGOS) became operational and together with the WMO Information System (WIS) and the Seamless Global Data Processing and Forecasting System (SGDPFS) will serve a broad range of application areas, including space weather.

14. The Expert Group on Space Weather acknowledged that there are many opportunities available to help implement the LTS Guidelines B.6 and B.7 on space weather, and highlighted the importance for Member States and their national and international agencies to implement these guidelines.

15. The Expert Group on Space Weather further noted that opportunities to help implement the LTS Guidelines B.6 and B.7 include continuing development of the WMO technical and regulatory framework for space weather, the registration of space weather observing stations with the WMO Integrated Global Observing System (WIGOS), the use of the WMO Information System (WIS) and Seamless Global Data Processing and Forecasting System (SGDPFS) for space weather applications and services, and a need for better coordination and collaboration among national and international space weather actors.

16. The Expert Group on Space Weather highlighted the importance of training and capacity building in relation to enabling Member States to implement LTS Guidelines B.6 and B7, which contribute also to the LTS Guideline C.1, C.2 and C.3 with emphasis on the need for capacity building related to Space Weather risk assessments and socio-economic impact studies; as well as the ongoing important capacity building being conducted within the International Space Weather Initiative (ISWI), and the new Variability and Predictability of the Solar-Terrestrial Coupling (PRESTO) program within the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP).

17. The Expert Group will prepare a report with recommendations highlighting opportunities for the efficient coordination of space weather activities at the international level towards implementation of LTS Guidelines B.6 and B.7. The report aims to map the international space weather actors, their mandates and linkages, identify gaps, and recommend actions by Member States and other relevant space weather actors for improving coordination. The Expert Group would submit this paper to the 58th

Session of the Subcommittee, together with a proposition for a way forward, beyond the end of the Expert Group mandate in 2021.

IV. Recommendations

18. In the view of the Expert Group, implementation of the approved voluntary Guidelines for the Long-Term Sustainability of Outer Space Activities (A/71/20) provide foundation for a global approach to the mitigation of the adverse impacts of space weather. The Expert Group therefore reiterates its view that implementation of the voluntary guidelines is of the utmost importance and should be prioritised for appropriate action within Member States and their national and international organisations.

19. Consistent with the Guidelines for the Long-Term Sustainability of Outer Space Activities (A/71/20), and with the Expert Group report Thematic Priority 4: International Framework for Space Weather Services for UNISPACE+50 (A/AC.105/1171), the Expert Group has already identified a number of strongly coordinated and common themes which are cross-cutting across the goals of multiple space weather entities including COSPAR, ICAO, WMO and the International Space Environmental Service and which could be elaborated in the course of the implementation of specific joint projects by the participating entities.

20. To this end, at this 57th meeting of the Subcommittee, the Expert Group recommends that the Member States of the Committee:

a) Take action to ensure coordination of their national space weather activities with respect to relevant international organizations, in particular coordination of these activities with their respective Permanent Representatives to the World Meteorological Organization and the International Civil Aviation Organization.

b) Engage actively with the COSPAR PSW International Space Weather Action Teams initiative, in order to promote the development of improved space weather services.

c) Continue to actively support and participate in capacity building activities for space weather services and research, including those of the International Space Weather Initiative.

d) Provide regular updates to the Committee on their progress toward implementing LTS Guidelines B.6 and B.7.

V. Mandate and Work Plan for the Expert Group

21. The Expert group work plan for the period of its mandate up to 2021 was approved at the 56th session of the STSC as is as follows:

1. The expert group will continue to review the space weather related activities and work plans of the relevant United Nations organizations, including the World Meteorological Organisation (WMO) and International Civil Aviation Authority (ICAO) and others, and those within States members of the Committee and national and international organizations. Identify and assess their role in the global space weather effort, promote coordination and communication between them, and ensure that the efforts of STSC are complementary.

2. Recognizing the impacts of space weather, the group will promote increased and expanded member State involvement in providing space weather monitoring, from the ground and in space, and in developing, advancing, and sharing and delivering space weather services.

3. Consistent with the Thematic Priority 4 report, the Expert Group will continue to examine mechanisms to facilitate improved coordination between the relevant space weather organisations, with a view to developing future recommendations for their possible implementation within COPUOS. The Expert Group re-iterates that facilitating such improved coordination is key for the cost effective development of new international space weather services. However, this must be done with due regard to existing work plans and road maps of the space weather organisations, avoiding duplication of effort.

4. The expert group will report yearly to the STSC on its progress, on important issues which have been identified, and where specific actions are recommended, including those related to a possible future international coordination group for space weather. The expert group will also make a recommendation for its continuing and future work plan.

22. Consistent with its existing mandate, and consistent with the recommendations contained in the UNISPACE+50 Thematic Priority 4 Report, and with the draft report from the Working Group for the Space2030, the Expert Group proposes to complete the work described above.

23. Specifically, the Expert Group will complete intersessional work to compile a report to be submitted to the Subcommittee at its 58th session. The report will assess the activities of the multiple international space weather entities, and will propose a future

way forward for the Expert Group beyond the end of its current mandate in 2021. In the context of the new LTS 2.0 Working Group, any recommendations presented in the report will be guided by an approach which focusses on implementation of the LTS Guidelines, in particular B.6 and B.7.