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**Committee on the Peaceful
Uses of Outer Space
Scientific and Technical Subcommittee
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Vienna, 11–22 February 2019
Item 10 of the provisional agenda*
Space Weather**

Progress report on the work of the Expert Group on Space Weather at the 56th session of the Subcommittee

**Submitted by the Rapporteur of the Expert Group on Space
Weather**

I. Introduction

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.

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. The Expert Group continues to enjoy the active participation of Member States, and continues to make solid progress consistent with its mandate.

In particular, we reiterate the strategic importance of the Committee on the Peaceful Uses of Outer Space 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. The Committee 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 Expert Group held four meetings on the margins of the 56th session of the Subcommittee on Tuesday and Wednesday 12-13th February, 2019. Members of the Expert Group also organized and actively participated in the COSPAR Symposium on “*Space Weather and Small Satellites*” held in plenary on the afternoon of Monday 11 February, 2019.

In its meetings the Expert Group continued to expand upon the Recommendations contained in its report on Thematic Priority 4: International Framework for Space Weather Services for UNISPACE+50 ([A/AC.105/1171](#)), which were further

* [A/AC.105/C.1/L.373](#).



elucidated in the Expert Group's report communicated to the subcommittee at its 55th meeting in 2018 (Conference Room Paper 14 (A/AC.105/C.1/2018/CRP.14)). These focus on an international effort to address the "*Why, When, What and How*" of space weather.

The Expert Group also took note of the guidance provided in the report of the 61st session of the Committee on the Peaceful Uses of Outer Space from June 2018 (A/73/20 – section III.C.7, para. 178) that "*Some delegations expressed the view that in relation to a priority activity of the Expert Group on Space Weather on the establishment of an international coordination group for space weather, in close collaboration with COSPAR, ICAO, WMO and the International Space Environment Service, the structure and the working mechanism of such a group could be elaborated only in the course of the implementation of specific joint projects by the participating entities.*" In its deliberations, the Expert Group reiterated its commitment to achieving concrete outcomes in relation to achieving the goal of improved international space weather services by facilitating improved coordination between the relevant international space weather stakeholders.

The Expert Group agrees that such coordination must focus on achieving the efficient implementation of such space weather services by the participating entities. Indeed, identifying avenues where the Expert Group can facilitate this development, consistent with the roadmaps and strategies of the participating entities, was the major focus of the Expert Groups attention during this session.

The Expert Group noted the proposed *Method of work of the Working Group on the "Space2030" Agenda of the Committee on the Peaceful uses of Outer Space under new agenda item "'Space2030' agenda"* (A/AC.105/C.1/2019/CRP.4). The Expert Group notes that its report on Thematic Priority 4: International Framework for Space Weather Services for UNISPACE+50 (A/AC.105/1171) provides input into work of the Working Group on the Space2030 agenda, and further notes in particular section II.9 of the proposed method of work (A/AC.105/C.1/2019/CRP.4) which highlights that the Chair of the Expert Group can provide input to the Bureau of the Working Group on the Space2030 agenda: "*The Bureau of the Working Group will liaise with the Chairs of relevant working and expert groups of the two Subcommittees in a transparent manner, with a view to creating synergies and avoiding duplication of efforts, and with the overall objective of developing a "Space2030" agenda and implementation plan and inform the Working Group accordingly*".

Finally, in relation to the Working Group on the Space 2030 agenda, the Expert Group 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. However, as proposed in the document "The "Space2030" agenda and the global governance of outer space activities, a note by the Secretariat" (A/AC.105/1166), if these pillars are used as the future basis for defining a Space 2030 agenda, the topic of Space Weather could perhaps be most naturally included and highlighted within the context of the space society pillar.

II. Summary of progress in work

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.

Building upon the work by the Expert Group in the developing the report on Thematic Priority 4: International Framework for Space Weather Services for UNISPACE+50 (A/AC.105/1171), the Expert Group focused on assessing the priorities, roadmaps and work plans of the relevant international space weather entities. The goal of the Expert Group was to assess how it can assist these entities to reach their goals. In particular, the Expert Group deliberations focused on possible actions through which it could

promote improved communications, and facilitate enhanced collaboration, between these entities towards the goal of the development of an international framework for space weather services.

The Expert Group continues to highlight the value of the implementation of the approved Guidelines for the Long-Term Sustainability of Outer Space Activities (A/71/20) as a foundational approach to mitigating the adverse impacts of space weather. The text of the relevant voluntary Guidelines B.16 and B.17 are provided for reference in the Appendix. The Expert Group highlights the value of actively promoting and encouraging the widespread international implementation of the Guidelines.

In that regard, and consistent with its mandate, the Expert Group considers assessing the voluntary implementation of the space weather related Guidelines for the Long-Term Sustainability of Outer Space Activities (A/71/20) remains an important ongoing task and is one against which progress should be monitored in the global context.

III. Facilitating International Coordination

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. This drives an urgent need to develop an improved basis for international monitoring, forecasting, and warning procedures especially in the form of more coordinated international communication and coordination of warnings of extreme space weather events.

Equally important is then knowing “what” to do, and indeed “how” to do it. This requires understanding 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. This also requires an assessment in each member state of their space weather risks and related socio-economic impacts, as well as defined operating procedures and best practices which should be developed in partnership with critical infrastructure and civil protection administrations.

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 Committee member States.

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).

During this session, the Expert Group engaged in an active review of the priorities, roadmaps, and strategies of a number of space weather entities including, but not limited to, the World Meteorological Organisation (WMO), the European Space

Weather Assessment and Consolidation Working Group of the European Space Sciences Committee, the International Space Environment Service (ISES), the Coordination Group for Meteorological Satellites (CGMS), the International Civil Aviation Organisation (ICAO), and the Committee on Space Research (COSPAR). There were also presentations from NASA in relation to transitioning research to operations, from NOAA in relation to their mission to the first Lagrange point (L1), and from ESA in relation to the proposed ESA Lagrange mission to the fifth Lagrange point (L5).

The Expert Group review of multiple space weather entities and their activities identified a number of strongly coordinated and common themes which are cross-cutting across the goals of these entities. Whilst the Expert Group continues this assessment, consistent with its ongoing mandate, it identified the following as priority examples of concrete and significant outcomes, which, in close collaboration with COSPAR, ICAO, WMO, CGMS, ISES, the Office for Outer Space Affairs and other relevant entities, could be elaborated in the course of the implementation of specific joint projects by the participating entities:

1. Encourage the enhancement and development of an international space weather warning network

This goal of an enhanced global warning network is directly traceable to priorities in ISES, in relation to Action 6, and to goal 4 of the draft of the WMO Four-Year Plan for WMO Activities Related to Space Weather (2020–2023). In the context of the work being developed for space weather services for aviation for the ICAO customer, the Expert Group welcomes the upcoming roll out of these new global services. The Expert Group further recognizes the potential for the possible utilisation of the best practices and lessons learned from the development of the services for ICAO, in particular for example in relation to the protocols for hand-over between multiple operational service centres. The Expert Group further highlights the critical importance of the development of benchmarks at appropriate thresholds for space weather services. It therefore encourages the development of international benchmark standards involving appropriate space weather stakeholders, and drawing on lessons learned from current activities and seeking to define best practices.

2. Promote efficient further development of space weather services in response to user needs

Recognising existing service providers, promoting the collaborative development of new services utilising best practices and facilitate their implementation through collaboration between international space weather stakeholders.

3. Promote recognition of the importance and risks of space weather in Member States

4. Encourage Member States to develop National Space Weather Plans

This is key to national preparedness, and could facilitate the entry of new states into an engagement in space weather activities, based on best practices and recognizing that Member States national needs may differ from region to region.

5. Promote the maintenance and filling of key measurement needs and gaps required for space weather services

This is consistent with the Guidelines for the Long-Term Sustainability of Outer Space Activities (e.g., B.16.5), and traces directly to the priority goals of international entities such as goal 1 of the draft of the WMO Four-Year Plan for WMO Activities Related to Space Weather (2020–2023). Encourage widespread Member State participation in appropriate observational data collection networks, including supporting space weather activities in developing nations for example by joining the International Space Weather Initiative (ISWI).

6. Encourage Member States to complete Space Weather risk and impact assessments

These studies were recommended by the Guidelines for the Long-Term Sustainability of Outer Space Activities (B.17 7). As countries undertake such assessments, it is important to encourage the development of shared best practices and lessons learned.

Benchmarking at appropriate level is also critical for accurate risk and related assessments. The results from risk assessments should serve to inform disaster management agencies for the development of appropriate risk mitigation protocols in those administrations.

7. Support and encourage advancement of understanding from new research and transition to improved operational services

Member states should share best practices; Encourage focus on transitioning space weather science knowledge to operational user communities; Recognize that transitioning science to operations requires resources within the member States' programs; Understand that transitioning science is an iterative process, and that the science and user communities should work in close collaboration, driven by user needs and augmented by evolving science understanding.

IV. Intersessional Work

Consistent with the proposed Work Plan presented to the Subcommittee at its 55th meeting in 2018 in Conference Room Paper 14 (A/AC.105/C.1/2018/CRP.14), the Expert Group held intersessional meetings and outreach at:

- (a) U. S. Space Weather Workshop, Westminster, CO, April 16–20, 2018;
- (b) AOSWA workshop, Bandon, Indonesia, September 19–21, 2018;
- (c) European Space Weather Week, November 5–9, 2018.

The Expert Group noted that following the conclusion of the 55th meeting of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space in 2018, the Fiftieth anniversary of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE+50; A/AC.105/1137*), and the 61st session of the Committee on the Peaceful Uses of Outer Space in June 2018 (A/73/20), a proposal for a Working Group on the Space2030 Agenda was approved. Intersessional work on 8–12 October, 2018, further defined a proposed Method of Work for the Working Group on the Space2030 agenda.

Given these developments, the Expert Group temporarily postponed its plan to *“Establish a drafting committee to develop a proposal for the membership, terms of reference, and mandate for an international coordination group for space weather”* which was reported to the Scientific and Technical Subcommittee at its 55th meeting in 2018 in Conference Room Paper 14 (A/AC.105/C.1/2018/CRP.14).

As described earlier, the Expert Group remains of the opinion that improved international coordination is essential to address the global threat of space weather. Therefore, consistent with its mandate and noting the parallel work to be completed in the Working Group for the Space2030 Agenda, the Expert Group proposes ongoing considerations and a continuing examination of the options for potential implementation mechanisms, which might be used to achieve this important goal in the Committee on the Peaceful Uses of Outer Space context.

V. Recommendations

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.

Consistent with section II above, 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 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. As a result, the Expert Group therefore identified the following as cross-cutting themes which could be elaborated in the course of the implementation of specific joint projects by the participating entities:

1. Encourage the enhancement and development of an international space weather warning network.
2. Promote efficient further development of space weather services in response to user needs.
3. Promote recognition of the importance and risks of space weather in Member States.
4. Encourage Member States to develop National Space Weather Plans.
5. Promote the maintenance and filling of key measurement needs and gaps required for space weather services.
6. Encourage Member States to complete Space Weather risk and impact assessments.
7. Support and encourage advancement of understanding from new research and transition to improved operational services.

In its prior work, in the report on Thematic Priority 4: International Framework for Space Weather Services for UNISPACE+50 (A/AC.105/1171) the Expert Group recommended that the terms of reference for a possible international coordination group for space weather (ICSW) be developed in the period from 2019–20. With the advent of the Working Group on the Space2030 agenda, whose mandate spans until 2020, the Expert proposes to continue to assess potential mechanisms which can be used to facilitate improved international communication and coordination between relevant space weather entities.

To make progress on assessing mechanisms for improved coordination, and the implementation of specific joint projects by active participating entities such as COSPAR, ICAO, WMO, CGMS, and the ISES, the Expert Group agreed to hold an intersessional Expert Group Meeting/Workshop with a focus on “A framework for improved space weather services”. This intersessional meeting will be held on 10–11th July 2019. It will be hosted by the Canadian Space Agency at the Headquarters in St. Hubert, QC, Canada (close to Montreal), on the margins of the IUGG General Assembly in Montreal, Canada, being scheduled immediately before the IAGA sessions at IUGG. The Expert Group intends to extend a formal invitation to all Member States, and encourage the participation of relevant national space weather service providers, and international space weather organisations, to encourage broad participation of experts and service providers from all Member States at the workshop.

VI. Update to the Work Plan for the Expert Group on Space Weather

The Expert group presents the following updated work plan for the period of its mandate up to 2021, consistent with its existing mandate and consistent with the

recommendations contained in the UNISPACE+50 Thematic Priority 4 Report and with the method of work for the Working Group for the Space2030 agenda:

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 Scientific and Technical Subcommittee 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 organizations, with a view to developing future recommendations for their possible implementation within Committee on the Peaceful Uses of Outer Space. The Expert Group reiterates 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 organizations, avoiding duplication of effort.*
4. *The expert group will report yearly to the Scientific and Technical Subcommittee 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.*