

The Outer Space Institute 6224 Agricultural Rd Vancouver, BC V6T 1Z1

Agenda Item 15 – Outer Space Institute Statement on the Earth-Space System and its relation to Dark and Quiet Skies

Madam Chairperson, distinguished delegates,

The Outer Space Institute greatly appreciates the opportunity to comment on Dark and Quiet Skies in relation to the Earth-Space System.

Madam Chairperson, the peaceful use and exploration of outer space has long brought many benefits to society. As expressed by previous speakers, humanity's rapidly increasing use of outer space promises to further these benefits, as well as create opportunities for transformative global innovation. However, these benefits and opportunities come with risks that, if not recognized and addressed, could severely limit humanity's use of outer space, undermine the long-term sustainability of outer space activities, and compromise efforts to utilize outer space to meet the United Nations' Sustainable Development Goals.

Concerning Dark and Quiet Skies, ground-based astronomical observations are a principal way that humanity explores the cosmos, and light and radiofrequency pollution diminishes that ability. We agree with and support many of the points that have already been raised by the International Astronomical Union in this and prior STSC Sessions, as well as the Group of Friends conference room paper on Dark and Quiet Skies. The main additional point that we wish to make is that, in our view, Earth and Space cannot be treated as disconnected domains, especially when working toward the long-term sustainability of outer space activities. Rather, Earth and Space are a system, and as such, effects in one part of the system can lead to undesirable effects in other parts, including between domains.

As one example, space debris is widely recognized as a major safety and operational hazard for activities conducted in outer space. Space debris also contributes to increasing the night sky brightness, producing night-sky variability, and could contribute to radio spectrum pollution through reflections. In this case, controlling space debris is complementary to addressing Dark and Quiet Skies.

Another example is the prospective use of innovative space technologies that aim to enable rapid post-mission disposal of satellites, such as drag sails or electrodynamic tethers. The implementation of such potentially important technologies could come with substantial light or radiofrequency pollution if not carefully designed with those risks in mind. In this instance, addressing space debris through deorbiting technologies could, depending on their implementation, conflict with efforts to protect Dark and Quiet Skies.

Madam Chairperson, in our final example, recent studies indicate that rocket launches and space object re-entries are altering Earth's upper atmosphere. Such alterations have been anticipated by the scientific community for several years, and, recently, the unmistakable chemical fingerprints of spacecraft and rocket materials have been measured in Earth's stratospheric aerosols. Here,



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multiple factors are at play. The proliferation of satellite systems without controlled re-entry capabilities is necessitating the use of design-for-demise in mission planning to minimize casualty risks from re-entering space objects. However, in doing so, space systems are being designed to ablate entirely into fine particulates in the upper atmosphere where they may collect. This pollution could have potentially significant destabilizing effects for the Earth's ozone layer and climate system as the number of re-entering objects continues to dramatically increase. There is also the possibility of changing metal layers in the upper atmosphere, with implications for background sky glow and Dark and Quiet Skies. At this time, we do not know the full extent of these changes and their resulting effects. We do know, however, that atmospheric changes are happening – and that further research is urgently needed. In this example, multiple areas of the Earth-Space system are closely interwoven through post-mission disposal.

We urge that discussions in the STSC and other fora recognize that preserving Dark and Quiet Skies is a sustainability challenge for the Earth-Space system – that Earth and Space are a coupled system and events in one domain can cause undesirable effects in the other. The changes to that system are occurring at a rapid pace, and there is an immediate need for cross-disciplinary research into which of those changes are problematic, and which ones are not. There is also reason to exercise caution in changing the Earth-Space system at such a rapid pace, so as not to compromise the long-term sustainability both of outer space activities and of critical terrestrial systems and infrastructure.

To conclude, the OSI wishes to affirm its support for the Chair and the work of the Subcommittee. We look forward to the discussions on Dark and Quiet Skies and other important matters. Thank you for your attention.