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## **TOWARD COOPERATIVE SPACE SAFETY BRIDGING DATA, INFRASTRUCTURE, AND TRUST**

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### **ABSTRACT**

The rapid increase in the number of active satellites and space debris is transforming near-Earth space into a highly dynamic and congested environment, where ensuring safe and sustainable operations requires unprecedented levels of coordination. While space situational awareness (SSA) capabilities continue to improve globally, the effectiveness of space safety mechanisms is constrained not only by the availability of data, but also by fragmentation across technical systems, institutional frameworks, and political domains.

This situation—where SSA data sharing, and consequently space traffic coordination, remain highly siloed—also affects emerging space actors. Countries developing national space capabilities may face structural barriers to participation in global SSA ecosystems, including limited access to high-quality data and insufficient institutional integration.

In this context, the presentation explores the growing gap between expanding SSA capabilities and the lack of inclusive and trusted data-sharing and coordination mechanisms. It highlights the need to move beyond purely technical solutions toward integrated approaches that combine federated data-sharing architectures, governance models, and incentive structures. Three interconnected challenges are addressed: technical interoperability between heterogeneous observation systems, institutional fragmentation and asymmetries in data access, and broader issues of trust in an environment shaped by dual-use technologies and geopolitical competition.

In response, a framework for cooperative space safety is outlined, emphasizing distributed and interoperable data-sharing approaches that lower

barriers to entry and enable broader participation in SSA systems, flexible participation models, and the role of neutral or internationally governed platforms in facilitating coordination. An additional layer based on possibility-theory-driven approaches to data sharing and data fusion is considered to support integration of heterogeneous and partially accessible data sources under uncertainty.

Particular attention is given to how countries with emerging space capabilities can contribute to broader SSA efforts through participation in observation networks, data-sharing frameworks, and integration into international coordination mechanisms.

Drawing on practical experience from distributed international observation networks and ongoing policy dialogues, the presentation highlights pathways for gradually evolving from fragmented systems toward more resilient, inclusive, and cooperative approaches to space safety, based on incremental, trust-building solutions that reflect current geopolitical realities and enable broader and operationally meaningful participation in ensuring long-term sustainability of space activities.