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Space Situational Awareness: Guiding the Transition to a Civil Capability

Chairman Beyer and distinguished Members of the Subcommittee, thank you for the opportunity to appear before you on this important topic for the United States and for people worldwide.

Space systems are now undeniably essential to our way of life – providing key communications infrastructure, actionable warnings of natural disasters to safeguard human lives, imagery and other remote sensing data to inform decisionmakers and the public at large of critical environmental and geopolitical developments. Due largely to U.S. commercial innovations the inherently international and dynamic space environment has never been so accessible or exciting. For example, NASA is successfully using U.S. commercial capabilities to deliver crew and cargo efficiently and effectively to the International Space Station. Interest is accelerating – applications for more than 100,000 new spacecraft have been filed through 2029, and 32 percent of all payloads since 1957 have been launched within the past 4 years.

However, collisions in Earth's orbit can create additional, exceptionally long-lived, hazardous space debris which can degrade or even render infeasible the use of critical orbits for satellites and human spaceflight. Responsible space users must avoid collisions with existing space debris or other satellites. Article VI of the Outer Space Treaty provides that subscribing Nations must provide "authorization and continuing supervision" for non-governmental space operators. In doing so, States including the United States of America bear the ultimate risk of their commercial space operations. Appropriate space situational awareness capabilities are foundational to effectively managing that risk for government and industry alike.

In 2009, facing increasing space congestion, collision of the U.S. Iridium satellite with the Russian Cosmos 2251 satellite, a growing recognition of the benefits of coordinating their space flight operations, and the lack of adequate SSA support from any U.S. or foreign government agency, competing commercial satellite operators jointly established the Space Data Association – the SDA. The SDA is an open, commercial, non-profit risk management entity

dedicated to safety of flight and space sustainability.<sup>1</sup> SDA's stakeholder participants are commercial, civil, and even some military satellite operators who have invested tens of billions of dollars in satellites on orbit and have come together to reduce the risk of satellite operations.

The SDA has been fully operational for almost twelve years now and was developed without any government funds. The SDA's Space Data Center (SDC), operated by a U.S. commercial company, COMSPOC, has demonstrated reliability of more than 99.99% over those twelve years. The SDA's "crowd-sourcing" model addresses proprietary and intellectual property issues, serving as a nexus for data from the U.S. government and a rich set of operator data. The SDC pioneered many traits that are now widely accepted as a baseline for a modern SSA system, including computationally and legally secure frameworks, firewalled processing to protect data, machine-to-machine interfaces, verified data normalization and conversion, operator phonebooks, data exchange and sharing, and extensive processes to maintain quality control and identify discrepancies in operator or government SSA data.

Since 2011 the SDA has combined U.S. space catalog data with measured satellite location and planned maneuver information from SDA's participants to offer the world's first private, cooperative space traffic coordination (STC) service. The SDA currently has 30 spacecraft operator members operating 769 spacecraft that span all orbital regimes, with over fifty percent of the GEO active spacecraft represented and 423 LEO and MEO spacecraft participating. These operators deliver some of the most critical communications and remote sensing capabilities today and, when not collaborating with the SDA, routinely compete as rivals. Satellite operator-contributed data allows the SDC to generate actionable, forward-looking collision warnings, deconflict planned maneuvers, and securely share selected space situational awareness data between participants.

Because SDA's products augment and improve upon existing DoD collision warning products and systems – which are generally unable to incorporate planned maneuvers into actionable predictions – NOAA and NASA quickly became early and continuing satellite operator subscribers to SDA's services.<sup>2</sup> SDA is proud to voluntarily aggregate, normalize, and contribute SDA member data to the U.S. Space Force and the 18<sup>th</sup> Space Defense Squadron at the Combined Space Operations Center (CSpOC) on a no-fee basis, increasing our nation's Space Domain Awareness and improving the DoD's space catalog, including notifications of discrepancies and high-risk threats. SDA has established a great partnership with the DoD.

However, as many U.S. government leaders have noted, DoD's primary space mission is not space flight safety, nor were its government systems being used to generate conjunction

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<sup>1</sup> For SDA, "safety of flight" means the condition where satellites are positioned and operated in a manner that preserves their long-term operational viability, the long-term operational viability of any other satellites, and the preservation of the orbital regime(s) involved.

<sup>2</sup> The SDC scrutinizes all operator and 18 SDS data, conjunction data messages (CDMs) and SP ephemerides to find and report irregularities, assessing their veracity, accuracy, timeliness, and completeness.

warnings designed or optimized for this use – particularly given the continuing non-transparency required to protect our national security equities.

Critically, U.S. commercial entities and technologies have always undergirded and enabled SDA’s technical capabilities – including cloud-hosted compute platforms, cybersecurity, and most importantly the foundational space situational awareness analytics engine that fuses and transforms disparate data into usable knowledge for satellite operator use. That’s great news for the efforts planned by the Department of Commerce (DoC), but we don’t have a moment to lose. DoC needs to qualitatively improve on the legacy DoD products for SSA and conjunction assessment to enhance safety of flight.

New space operational paradigms including proliferated LEO constellations, electric propulsion with its constant low-thrust maneuvers, on-orbit servicing, space tourism, and autonomous flight operations challenge legacy flight safety capabilities. The SDA has mined its conjunction data to determine that close approaches are occurring five times more often than just five years ago. This dramatic change is due to the ever-increasing presence of orbital debris, our improving knowledge of the hazardous debris already present in orbit, and a more than doubling of the active spacecraft population over these five years. While these increases in themselves don’t suggest that the sky is falling, the increasing workload on spacecraft operators, the need for substantially increased accuracy of space object positional knowledge, and the continued degradation of the space operations environment demonstrate the need to take prompt action.

Beyond DoD’s longstanding efforts, the United States has been a leader in promoting space flight safety, most recently through actions including adopting the National Space Policy, publishing Space Policy Directive 3 (SPD-3), authorizing investments for the DoC, and committing to soft law approaches to establishing norms of behavior to avoid creation of additional space debris. Following publication of SPD-3 the SDA, including some of its operators, routinely engaged with the DoC leaders to provide inputs on the real-world pain points and actual needs of our satellite operator members.

SDA is fully supportive of a DoC partnership with commercial SSA service providers going forward. The SDA’s founding members were unanimous in offering to support a rapid standup of a commercial SSA-based system operated by DoC to provide a basic set of SSA data and services and looked forward to the opportunity to engage with DoC to help develop a set of well-informed system requirements and capabilities to meet the needs of the spacecraft operator community.

The SDA helped conceive and conduct a data fusion exercise for Space Traffic Coordination and Management (STCM) in September 2020. NOAA, in its role as a weather satellite operator, participated in this exercise. Implemented and conducted in just four weeks, this STCM data fusion campaign demonstrated how commercial innovation and capabilities, in partnership with government data and participation, were able to achieve dramatic improvements in SSA

knowledge. For example, accuracy improvements of between ten and fifty percent in Low Earth Orbit, tenfold accuracy improvements in GEO, and as much as one thousand times improvements in the Launch and Early Orbit Phase of LEO missions were achieved. This study was unique in taking a requirements-based approach by assessing what positional accuracy requirements must be met to allow SSA data to meet the needs of operators and the way they conduct flight safety. The results of this rapid demonstration led us to conclude that such a government/industry partnership is not only effective, but imperative if we are to effectively address and facilitate enduring space sustainability.

SDA is disappointed that work achieved by the Office of Space Commerce, informed by the strategic plan which was endorsed by the National Academy of Public Administration and Congress in 2020, appears to have been shelved. This perpetuates avoidable risks and introduces substantial delays in delivering an effective capability to civil and commercial satellite operators.

The picture is confusing, but since 2021 DoC has apparently pursued an alternate approach – electing not to obtain, deploy, and manage existing U.S. commercial space traffic coordination capabilities and services to enable the basic U.S. government-derived SSA data and space traffic management services contemplated in SPD-3 and funded by Congress. They have not conducted industry days with satellite operators to survey their needs, nor discussed how or whether they intend to incorporate satellite operator data (such as ephemerides or maneuver plan) into any solutions.

From our perspective, the DoC has turned inward, taking a government system development approach, and conducted minimal outreach to the operator community. While the intentions have not been clearly signaled, the focus appears to be on developing a new start U.S. government information system, akin to a DoD program of record, to ingest “data” which may be obtained from various sources. SDA believes this “new build” approach is suboptimal, compared to the prior vision of partnering with commercial industry to address specific needs driven by commercial and civil satellite operations for timely and actionable SSA data and space traffic management services.

We note that DoC has, earlier this week, appointed a senior leader with substantial commercial and government experience to the Office of Space Commerce. We are hopeful that this additional leadership will bring a renewed and sharp focus on private sector capabilities and satellite operator equities to this mission area.

Rising concerns about congestion caused by extensive debris generating events, such as the thousands of pieces of hazardous debris caused by a November, 2021 Russian ASAT test conflicting with increasing beneficial uses of Low Earth Orbit for environmental monitoring, providing better Internet access in rural and underdeveloped areas, and other new applications, necessitate fully staffing the Office of Space Commerce to rapidly pursue a

commercial/international partnership approach to Space Situational Awareness that utilizes rather than attempts to replicate or compete with U.S. private sector capabilities.

Access to accurate, timely space traffic management services are essential to ensuring continued safe space operations for all, preserving U.S. leadership, and enabling U.S. industry to make increasing use of space. Mr. Chairman and members of the Subcommittee, as our nation continues to develop civil and commercial applications in space it is critical that we rapidly establish an effective, transparent, and enduring civil capability for space traffic coordination. To do this, we should take the following actions:

1. Establish a clear 1-, 5-, and 10-year vision for delivery of space traffic coordination capabilities, including fee-free basic services and data. Align DoC program activities in this area with national policy and consistent with DoC's mission by requiring DoC to promote – not compete with – U.S. private sector commercial interests by using today's existing, technically mature, validated, "best of class" U.S. commercial SSA capabilities, software, and analytic services, under DoC management, to meet the needs of the United States to implement an OADR, describe and provide the anticipated basic U.S. government-derived SSA data and basic STM services, and collaborate with civil and commercial space operators.

*Proven U.S. commercial SSA analytic capabilities and supplemental, multi-phenomenal SSA data from the U.S. private sector are available for deployment today to enable the Department of Commerce to deliver these basic space SSA data and STM services for a modest investment. Space development is moving too quickly for us to risk waiting for U.S. government development and international competition is fierce.*

2. Ensure that any transfer from DoD responsibilities for civil and commercial support to DoC qualitatively improves on the DoD products offered today to civil and commercial users.

*For example, Congress can require DoC to use validated U.S. commercial technology to process observational data from government SSA sensors, such as the Space Surveillance Network, and ingest operator data to derive timely and actionable information specifically for civil and commercial space flight safety. This is not an unsolved technical challenge and will leverage more than \$1 billion of taxpayer funds already being spent annually while protecting national security equities.*

3. Congress should curtail public investments to "re-develop" or "study" the need for near and mid-term government SSA data and STM processing capabilities where U.S. private sector capabilities exist today.

*National space policy, DoC's 2022 – 2026 Strategic Plan<sup>3</sup>, Federal acquisition regulations, prior studies, the record of U.S. government program development in this subject area, and common sense suggest that we should deploy and promote U.S. private sector commercial capabilities to solve known and mid-term anticipated challenges. Public research and development investments should be narrowly targeted to longer-term challenges where no such commercial capabilities exist and are unlikely to emerge through natural market forces.*

Thank you and I am happy to take your questions.

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<sup>3</sup> U.S. Department of Commerce 2022 – 2026 Strategic Plan pp 25 – 27, available at <https://www.commerce.gov/sites/default/files/2022-03/DOC-Strategic-Plan-2022%E2%80%932026.pdf>