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VIA EMAIL

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National Oceanic and Atmospheric Administration
U.S. Department of Commerce
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Re: Comments of Intelsat US LLC on Request for Information on Scope of Civil Space Situational Awareness Services, Docket No. 2023-01556 [RTID: 0648-XV190]

To Whom It May Concern:

Intelsat US LLC ("Intelsat") appreciates the opportunity to respond to the Request for Information ("RFI") referenced above on the Scope of Civil Space Situational Awareness ("SSA") Services issued by the U.S. Department of Commerce, Office of Space Commerce ("OSC").[1] Intelsat supports OSC's efforts to establish and administer an open architecture data repository containing satellite tracking data and associated products and services and offers its recommendations below to further the program's effectiveness.

As one of the largest satellite operators in the United States, with a fleet of more than fifty operational satellites in orbit, Intelsat understands the crucial role that SSA plays in maintaining a safe, predictable orbital environment. Ensuring the safety of flight operations is a time and resource-intensive task that can only be accomplished through cooperation and coordination by all stakeholders—both civilian and government.

OSC seeks comment on several overarching questions relating to the general characteristics of the proposed open architecture data repository, the Traffic Management System for Space ("TraCSS") Program, including the scope of proposed basic SSA safety services; the impacts of proposed services on commercial SSA providers; and the tenets of participation and receipt of basic SSA safety services.[2] Intelsat provides responses to each of the three thematic questions and their associated sub-questions below.

[1] *See Request for Information on Scope of Civil Space Situational Awareness Services*, Request for Information, RTID Docket No. 0648-XV190, U.S. Dep't of Commerce, 88 Fed. Reg. 4970 (Jan. 26, 2023).

[2] *See id.* at 4972.

SECTION A. THE SCOPE OF PROPOSED BASIC SSA SAFETY SERVICES

A1. For each of the services discussed [in the RFI], OSC is seeking public input about whether the service should be included in TraCSS, and if so, whether it should be part of the initial offering or added in the future.

Intelsat agrees with OSC that the following services should be included as basic services in TraCSS because they improve operators' decision making processes with respect to SSA and collision avoidance:

- Satellite Attributes, Capabilities, Status, and Points of Contact;
- Receipt and Sharing of Predictions from Owners/Operators' ("O/O") Ephemerides;
- Routine Collision Assessment ("CA") and Conjunction Data Message ("CDM") Production;
- Special CA Screening and CDM Production;
- Data Quality Evaluation;
- Launch Collision Avoidance ("COLA") Screenings;
- O/O Ephemeris Generation and Curation with Covariance;
- Re-entry Management and Assessment;
- Precision Probability of Collision ("PC") Calculation;
- Collision Consequence and Debris Production Potentials;
- Conjunction Object Solution Improvements with Additional Tracking;
- Expected Tracking Determination;
- Risk Assessment Time History Plots; and
- Space Weather Sensitivity.

Intelsat also agrees with OSC that the following products and services—while useful—are not needed as basic services in TraCSS:

- Fusion of CA Products;
- PC Variability;
- Design-time Assistance for Improved CA;
- Maneuver Trade Space; and
- Optimized Maneuver Recommendations.

Intelsat further recommends that OSC include Breakup Detection, Tracking, and Cataloguing; Maneuver Detection and Processing; Anomaly Resolution; and Additional Concierge Services as basic services in TraCSS because they are essential to ensuring adequate flight safety in the orbital environment. Additional Concierge Services are especially important in this context because they provide a means for smaller, less experienced operators to seek help and support and, additionally, allow operators to receive 24x7x365 updates on SSA issues that may arise. The European Union's Space Surveillance and Tracking ("EU SST") program recognizes the importance of concierge services and, accordingly, provides all operators access to these services in its basic offering.

A2. Does the proposed basic safety SSA service provide sufficient data to allow ongoing operations of orbital assets at a level equal to or beyond that currently provided by the Department of Defense ("DoD")?

Intelsat anticipates that the proposed basic safety SSA services would be sufficient, assuming that the TraCSS program, at a minimum, includes the above-mentioned basic services. To provide operators with highly reliable and useable SSA data, TraCSS should also possess the following functionalities:

- Generate an optimal robust satellite catalog (that contains both ephemerides and covariance information) by fusing all available data including Space Surveillance Network ("SSN") observations and other observational data, including government-purchased, commercially sourced observations, operator contributed observations, planned maneuvers, and ephemerides. The ephemerides derived in this catalog should also incorporate known maneuver plans.
- Screen primary objects against the robust satellite catalog, both routinely and on-demand; and generate CDMs for objects that violate the predefined physical volumes and/or PC thresholds used for screening activity.
- Provide maneuver detection and repaid orbit determinations for maneuverable non-cooperative satellites.

A3. What proposed basic safety SSA services are essential to your ongoing operations? If the U.S. Government were to prioritize the delivery of individual services as part of TraCSS, which ones should be provided soonest?

Routine CA screening and CDM production are the most essential of services for flight safety and should therefore be among the initial services offered by the TraCSS program.

A4. What, if any, additional capabilities beyond those currently provided by the DoD should be included in the TraCSS?

Timely, accurate, and actionable SSA requires a robust satellite catalog and realistic covariance information. It is therefore important to obtain accurate positional knowledge, suitable for flight safety, and predictive collision avoidance informed by the best-available information from spacecraft operators, government tracking data, and commercial SSA data.

A4. Where applicable, at what level or how often should the service be performed? For example, comments may address how often routine collision assessments should be conducted as part of the basic SSA safety service. DoD currently provides these assessments three times a day. How often should OSC's basic safety SSA service provide these assessments?

Intelsat recommends using a model driven by observation and event data whereby operators receive updates as soon as OSC obtains new orbits and predictions on space objects. The timing of updates may also be dependent on the orbit regime of each space object and operators' preferences. For example, while updates for satellites in geostationary earth orbit ("GSO") are currently released every eight hours, releases occurring every hour or two would be more useful and relevant to operators.

SECTION B. IMPACTS OF PROPOSED BASIC SSA SAFETY SERVICES ON COMMERCIAL SSA PROVIDERS

B1. Are any of the basic SSA safety services readily available from the current U.S. SSA industry? If so, is the service affordable to owners and operators of spacecraft?

No. Most SSA industry services rely on the Special Perturbations ("SP") data and the PC metric is sometimes absent or unreliable due to inaccuracies in the covariance data. OSC can enhance these offerings by improving the process used to generate realistic covariance information, which is key to providing accurate PC information. Additionally, current SP products do not include planned maneuver information, which is important for safe flight operations and predictive ephemeris data.

B4. For O/Os, are any of the basic SSA safety services identified for inclusion in TraCSS duplicative of what O/Os of spacecraft are already responsible for obtaining or providing?

No. Owners and operators do not have the ability to track other objects for close approach analysis. Moreover, SSA safety requires cooperation and coordination among all operators—both civilian and government. It must be a joint effort to ensure safety of flight operations, not something that can be accomplished independently.

B5. Are there unique advantages to the government purchasing and redistributing certain commercial services rather than leaving these to the commercial marketplace?

Intelsat supports the purchase and redistribution of certain commercial services, beginning with basic services. This would provide further confidence in the TraCSS program among all stakeholders while also increasing demand (and thereby further innovation and development by the industry) for these services. The government may next consider opportunities to purchase and redistribute designated advanced services from the commercial marketplace, yielding similar results.

SECTION C. TENETS OF PARTICIPATION AND RECEIPT OF BASIC SSA SAFETY SERVICES

C1. Which basic SSA safety services identified for inclusion in TraCSS should be made publicly available?

Intelsat believes that all basic SSA services identified in the RFI should be made publicly available.

C2. What, if any, information should owners and operators of spacecraft be required to provide to OSC to participate in TraCSS?

Satellite Attributes, Capabilities, Status, and Points of Contact. Basic information, including satellite attributes, capabilities, status, and points of contact should be considered mandatory as part of the user agreement with OSC. In exchange for this information, the user should receive CA services provided by OSC. This system is used already by the Combined Space Operations Center ("CSpOC") for its existing CA services.

Information provided by operators should—at a minimum—include data/information on current operations and satellite parameters including:

1. Point of Contact Information
2. Identity of Authorizing Administration(s)/Registry
3. Pre-Service Calibration
    a. Description of the data produce reference frame and time systems
    b. An agreement to work with DoC to resolve any outstanding issues with reference frame and time systems to ensure consistency in the data, including
        i. Ephemerides
        ii. Maneuver Information (Time, Thrust, Delta-v, etc.)
        iii. Observational Data and Related Metadata
4. Spacecraft Characteristics
    a. Dimensions (Hard Body Radius or “HBR”)
    b. Mission/Flight Rules
        i. GEO – Station Keeping Longitude/Latitude Control Box
        ii. Low Earth Orbit (“LEO”) / Medium Earth Orbit (“MEO”) – Altitude/Inclination Plane Control Rules
    c. Spacecraft Mass
    d. Operational Status
        i. Operational
        ii. Decommissioned
        iii. Operations status
            1. Maneuvering Ability
                a. Chemical Thrusters
                b. Electrical Propulsion
                c. Differential Drag
                d. Others
                e. Unable to maneuver
            2. Unable to Receive Telemetry
            3. Unable to Track and/or Produce Orbit Knowledge of the Object
        iv. Spacecraft Anomaly Status
            1. Investigation
            2. Recovery
        v. Extended Mission Information
            1. Mission Extension - Docking
        vi. Backup/Storage/Standby Mode
        vii. Reentry Mode
        viii. Decayed
        ix. Unknown
5. Orbital Products
    a. Ten-day Predictive Ephemeris Incorporating Planned Maneuvers
    b. Planned Maneuvers

In addition to the general recommendations above, Intelsat suggests adding the following functionalities to the TraCSS service:

- Operators should be able to assign Points of Contact to specific objects. For example, it should be possible to associate GSO Satellite 1 with Point of Contact A and GSO Satellite 2 with Point of Contact B. To the extent possible, these Points of Contact should be considered "Public."
- Operators should only be required to provide total spacecraft mass as opposed to the mass of certain components or equipment. Information regarding the mass of certain components or equipment is unnecessary, and operators would likely be hesitant to disclose other metrics related to the mass of specific components due to concerns that they could be used by competitors to infer proprietary information on a given satellite, such as the remaining orbital maneuver life.
- The TraCSS system should contain information on trajectory change capabilities (*i.e.*, maneuverability). The trajectory change capability of a space object is one of the fundamental inputs that is used to determine whether an object can engage in collision avoidance maneuvers and what the timeline would be for such maneuvers if a collision threat is imminent. This information is critical for timely and effective responses to imminent collision threats and for overall flight safety. Information of interest would be the propulsion systems (chemical, electrical, drag differential, etc.) to provide input on the "effectiveness" of maneuvers.
- Operators should provide their planned maneuver information to improve the next generation of safety products and CA screening capabilities.
- Operators should equip satellites with trackable beacons to provide backup location and identification information to the OSC in case primary tracking mechanisms fail.

Receipt and Sharing of Ephemerides Data. OSC should consider sharing this information with non-TraCSS users with the permission of operators, given the significance of this data for space safety.

Routine CA Screening and CDM Production. Routine CA screening and CDM production are essential services for flight safety. To that end, Intelsat recommends revising the service description to state: "To screen primary objects against a robust satellite catalog, both routinely and on demand; and to generate CDMs for objects that violate the predefined physical volumes *and/or collision probability thresholds* used for the screening activity."

Additionally, a robust satellite catalog is essential to generating accurate positional information and actionable SSA and safety products. An optimal catalog would be independently created and managed by the OSC using SSN observations and other observational data, including government-purchased data, commercially-sourced observations, and O/O-contributed observations, planned maneuvers, and ephemerides.

Intelsat further recommends improving upon existing SSA products and services in the following ways:

- To derive realistic and consistent covariance information—which is a fundamental element of robust collision probability assessments—OSC should take care to supplement the data provided by O/Os with independently-sourced observations on those same satellites. This is particularly important because

O/Os do not always provide covariance information with their ephemerides. Additional complications associated with using O/O ephemeris including covariance realism, covariance propagation, frame conversions, etc.

- One of the limitations in existing SP data is that the SP ephemerides do not include information on planned maneuvers by O/Os. To address this gap, Intelsat recommends that OSC solicit planned maneuver information from O/Os and provide access to the data in the new optimal catalog.
- Non-cooperative spacecraft that are highly maneuverable threaten the safety and stability of the orbital environment. To mitigate the threat that non-cooperative spacecraft pose to fully-cooperative O/Os, OSC should collect and use all available observations to obtain and maintain accurate positional knowledge. These capabilities will further bolster OSC's ability to rapidly recover accurate positional knowledge when non-cooperative satellite maneuvers are detected.

C3. What, if any, actions should owners and operators agree to take to participate in TraCSS as part of the tenets of participation?

To ensure that owners and operators provide necessary information for TraCSS, OSC should require all users to sign a user agreement in exchange for the services provided. This user agreement should include a clause requiring all owners and operators to act in good faith and to use their best efforts to meet agreed data production requirements in exchange for use of TraCSS.

As a safeguard to encourage operators to provide key data to improve safety of flight, information provided should receive confidential treatment and be withheld from public distribution outside of the TraCSS Program indefinitely. OSC should share this information with third-parties not involved in the TraCSS Program only with the express, written consent of the operator. Moreover, the information sharing agreements between OSC and operators should state that the shared data and any products derived therefrom will be used only for the agreed-upon purposes.

C4. What should happen when owners or operators fail to provide the relevant information to OSC or fail to take actions consistent with the tenets of participation?

When owners or operators fail to consistently provide information pursuant to their TraCSS agreement, their actions (or lack of action) should be investigated by OSC to determine whether to impose penalties.

Because SSA is an endeavor that necessarily requires cooperation among operators, Intelsat also supports the creation of an information sharing clearinghouse where operators can obtain information on other operators' operations to inform their own SSA plans. However, if OSC creates a mechanism for information sharing among operators, it must also erect safeguards to guarantee that the recipients of proprietary or confidential information do not misuse or publicly release the data being shared. To deter or discourage this type of bad-faith behavior, Intelsat also suggests providing harmed operators with recourse if a participant violates the rules. Possible remedies or safeguards could include one or more of the following: (1) legally binding end-user agreements; (2) enforcement action by the Department of Commerce; (3) civil remedies, including breach-of-contract claims by harmed participants; and (4) suspension or expulsion from the TraCSS program and future SSA service offerings.

* * *

Intelsat looks forward to continuing discussions with the OSC to create and further bolster SSA services and products. The orbital environment is an increasingly congested place to conduct operations. Intelsat is hopeful that with the introduction of new SSA programs like TraCSS, OSC and other key stakeholders will move the needle towards safer and more sustainable operations in space.

Respectfully submitted,

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