INPUT ON PLANNED SCOPE OF CIVIL SSA SERVICES
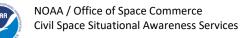

The Fred Orbot™ by Rogue Space Systems

**A Response to NOAA's Request for Information on
Scope of Civil Space Situational Awareness Services**
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Executive Summary

Rogue Space Systems Corporation (Rogue) appreciates the opportunity to provide input on the planned scope of basic SSA services to be provided via the Traffic Management System for Space (TraCSS) program. This scope of services greatly interests and affects Rogue and its in-space offerings for commercial and defense end-use. Rogue respectfully requests the ability to be kept apprised of developments, progress, and industry exchanges as the Office of Space Commerce (OSC) continues to solidify its basic SSA model and plans for implementation.

Rogue is a small, veteran-owned company establishing a commercial in-space services market for orbital robots (Orbots™) in low Earth orbit (LEO) Geosynchronous Orbit (GEO), and beyond. Founded in Laconia, New Hampshire, in 2020, Rogue designs satellite vehicles and subsystems to provide Orbot services that meet the demands of in-space operators and the growth of in-space operations. With robust architectures, Orbot form factors deliver many critical in-space services:

- SSA and SDA
- RPO and RPOD
- De-orbit assurance and on-orbit assistance
- Hosting

Rogue's corporate technology roadmap aligns with US National Security & Defense Policies and the US Space Force Space Power Doctrine's Cornerstone Responsibilities.

Figure 1 Rogue's in-development Orbot and AI-enabled technologies are prepared to meet the demands of in-space operators and the growth of in-space operations.

Contents

Terms Used

Terms	Definition
Basic [SSA] Safety Services	Minimum requirements to maintain safety, stability, and sustainability in an increasingly congested and contested environment
CA	Collision Avoidance
CDM	Conjunction Data Message
ISAM	In-Space Servicing Assembly and Manufacturing
O/O	Satellite Owner/Operators, both private and civil
OSC	Office of Space Commerce (Department of Commerce, National Oceanic and Atmospheric Administration)
PC	Probability of Collision
RPO	Rendezvous and Proximity Operation
RSO	Resident Space Object
SSA	Space Situational Awareness
TraCSS	Traffic Management System for Space

1   Scope of Proposed Basic SSA Safety Services

1.1   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 DoD?

In Rogue's view, the proposed SSA services are sufficient to meet the minimum thresholds for current basic safety measures. However, as the space economy evolves to include in-space servicing missions that require frequent orbital maneuvers, it's recommended that OSC also provide a flight planning service. This service should allow operators to file a flight plan with expected ephemerides and automatically provide notifications to other O/Os.

1.2   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?

Rogue is developing technologies to support rendezvous and proximity operations (RPO) and in-space servicing, assembly, and manufacturing (ISAM) through dedicated orbital robotic spacecraft (Orbots™). These operations inherently require frequent and significant maneuvers beyond station-keeping to approach and service other resident space objects (RSOs). This is an emerging market but is absolutely vital to the rapid commercialization of the space economy, which is assessed to surpass $1 trillion by 2030. As a result, it is imperative that space servicing companies such as Rogue have access to:

- Accurate ephemeris data (both current and predicted) that has been validated against multiple sources to prevent against spoofing or corrupted data
- Special CA screening to aid in maneuver mission planning
- Collision consequence (specifically focused on deliberate approach with low relative velocity)
- Data quality evaluation (for RSOs that are not capable of communicating their own position data)
- Re-entry management
- Notification system to announce planned orbital maneuvers, debris producing events, and intended/active ISAM operations
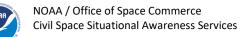
These data points are necessary not only for awareness of the target RSO, but also to enable safe maneuvering to and from each mission location. Under a phased delivery of these services, known and projected ephemeris data and special CA screening take priority for a space services company such as Rogue.

1.3   Are there any additional capabilities not listed that should be included in the basic SSA safety service to provide a baseline level of safety for owners and operators?

Rogue views several of the "not included" services as critical to SSA safety as the space economy becomes more congested and readily accessible to a growing number of commercial and private organizations.

For instance, anomaly resolution (Service 18) can significantly enhance the fidelity and accuracy of SSA data to improve services and inform O/Os. A maneuver trade space (Service 20) visual reference tool would provide a powerful tool to O/Os that may not have the tools available for rapidly planning a

collision avoidance maneuver. Additionally, this service is vital to O/Os that routinely conduct on-orbital maneuvers and orbit transfers to ensure a clear operation space. Optimized maneuvering (Service 21) is the crux of ensuring the safety of flight in space, by providing O/Os an initial plan for CA and de-confliction of all supporting functions. Maneuver detection (Service 23), though not a baseline requirement, is important to verify and validate information provided by O/Os is timely and accurate.

A communications (electromagnetic) interference model and notifications would be beneficial to O/Os. Public notifications of high probability conjunctions with potential debris generation along with debris models would provide O/Os decision space to plan avoidance maneuvers.

1.4   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?

The frequency of specific services is highly dependent on the actual service and the threat environment. Many of the services (i.e., Launch COLA, re-entry management, collision consequence, and those that aid on-orbit maneuvers) should be applications available to users for deliberate planning.

2   Impacts of Proposed Basic SSA Safety Services on Commercial SSA Providers

2.1   For commercial SSA service providers, does the current SSA capability offered by the DoD have any impacts on your current or future product offerings?

Future service offerings from Rogue can augment the SSA data currently available through the DoD. This includes mid- to close-range SSA data to improve fidelity of TraCSS models, characterization of RSOs, focused observation and screening of high-risk events, and even post-event assessments of collisions.

2.2   For commercial SSA service providers, do any of the basic SSA safety services identified for inclusion in TraCSS have any impacts or implications on your current or future product offerings? If so, which services proposed to be part of TraCSS would have an impact on your offerings and why?

The services that support orbital maneuvers will assist in executing collision avoidance maneuvers. Rogue sees these services as also informing optimal maneuver windows for the execution of in-space servicing, assembly, and manufacturing missions. As these types of missions become common, there is a distinct need to have an awareness of all potential hazards. Rogue's mid- to close-range SSA capabilities can contribute to data collection to significantly improve the fidelity and accuracy of services and models provided through TraCSS.

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

Rogue sees de-confliction and consistency for O/Os as the main advantages of enabling the Government to maintain or fund a central repository of SSA data, The Government must retain the ability to aid in optimized maneuver planning for both collision avoidance and in-space servicing requirements. The data and associated tools that are proposed through TraCSS give all stakeholders a common operating picture from which to plan future missions. Additionally, the advisory role proposed likely would not receive appropriate funding or broad participation solely through the commercial marketplace in the current environment.

3 Tenets of Participation and Receipt of Basic SSA Safety Services

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

All data collected by OSC should be maintained in a restricted-access database. However, access to individual services should be evaluated on the sensitivity of the data and justification from the user. Predictive models and projected ephemerides should be strictly controlled. It's recommended that a tiered approach for accesses be taken. As an example:

Tier 1	General User	Access to satellite numbers and two-line elements with a degree of error
Tier 2	Spacecraft O/Os	Access to ephemerides, CA, notifications, etc.
Tier 3	US registered	All services and notifications with exceptions for sensitive data / national security interests
Tier 4	USG and Cleared Defense Contractors	All

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

If the intent of OCS is to provide for safety of flight in space, then basic SSA data should be made available to any individual or organization that demonstrates a reasonable investment or interest in space operations. More sensitive data, such as planned maneuvers and data quality, can be restricted to a subset of users. However, there should not be a prerequisite to provide OSC with ephemeris data to benefit from the service.

4   General Feedback

4.1   *OSC welcomes feedback about any other related topics. For example, are there any matters not discussed above that OSC should or must consider before it provides basic SSA safety services through TraCSS?*

While this a US-led effort through the Department of Commerce, it is important that other nations and foreign O/Os are afforded the opportunity to participate in discussions and access TraCSS. Building a coalition that includes foreign partners will increase the inclination to participate and provide additional SSA data points, which ultimately improves the end product.

With the tremendous volume of debris, non-operational spacecraft, and a growing number of small satellites that lack sufficient propulsion, the probability of unavoidable conjunctions continues to increase. Having the predictive ability to identify potential conjunctions in space is of no value if neither object can execute collision avoidance maneuvers. This basic SSA safety service should also consider responsive mechanisms to facilitate maneuvers for RSOs when there is an exceptional risk of conjunction and debris creation.

Rogue and other space servicing companies are developing capabilities to assist orbital maneuvers and debris remediation. These companies that are trusted and verified through the Department of Commerce can potentially deploy response satellites for specific situations. These satellites would be capable of performing collision avoidance maneuvers for those conjunctions deemed exceptionally high risk.