



## Request for Information on the Scope of Civil Space Situational Awareness Services

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## Part A: Scope of Proposed Basic SSA Safety Services

### **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?**

The list of proposed orbital safety services in this RFI covers many functional areas. We agree that the services designated as “Included” would indeed provide adequate capabilities for TraCSS; however, some of the “Included” services we judge to be unnecessary for a basic service, and would be more fitting as advanced services. At a fundamental level, and to not over-complicate the first version of TraCSS, we encourage the USG to simply replicate the functionality provided in the existing public safety service via 18th / 19th Space Defense Squadron (SDS) via space-track.org.

However, it is difficult for us to answer this question in premise without knowing two critically important factors.

First, will the US Government (USG) aim to procure the proposed basic services that power TraCSS, or will it aim to build those services directly, such that TraCSS is a fully government-owned, government-operated system? As a commercial SSA analytics provider, our main concern is whether or not the basic services will adversely affect our business. If the proposed basic services are to be procured, we would expect that there be a solicitation and formal evaluation process by which the USG selects commercial providers.

Second, will the resident space object (RSO) data that is fueling TraCSS come from the current SSN high-accuracy catalog of the objects, or a catalog that is provided by the commercial industry and procured by the USG? This is an important aspect of the system and our hope is that the U.S. government implements a process that does not put SSA companies that do not have direct access to data collection systems at a disadvantage.

### **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?**

This question is likely meant for satellite owner-operators, but we will address it from the perspective of a commercial SSA service provider. The single biggest factor that would be beneficial to us to provide the basic safety services to the broader owner-operator community (via TraCSS) would be access to the same high-quality orbital data products that the 18th / 19th SDS currently has. Specifically, access to Vector Covariance Messages (VCMs) for the full High Accuracy Catalog (HAC) would allow us to provide equivalent or superior conjunction risk assessment, avoidance maneuver planning, and other proposed basic services.

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

The current services provided by the DoD deliver a robust baseline for spaceflight safety. Satellite operators are already provided with Conjunction Data Messages (CDMs) three times per day, in addition to manually-performed special screening requests. This functionality delivers the most essential data and services needed for ensuring the safety of flight.

There is certainly room for improvement in enhancing the scalability, reliability, and accessibility of the system overall. Beyond these services, satellite operators could choose to develop processes for ingesting the data and streamlining the decision-making process, or procure such advanced services from third-party SSA service providers.

**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?**

We believe the proposed “Included” basic services for TraCSS cover the essential services that satellite operators would need to execute their missions safely, and in fact, some of the “Included” services are not essential and would fit better as advanced services procured separately from third-party service providers and/or in-house developed by the operator. Our comments on the proposed basic vs. advanced services are provided in Appendix A.

**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?**

Currently, the DoD updates the publicly available space object catalog once per day, with conjunction alerts being sent out three times per day. We believe the three times per day cadence is sufficient for TraCSS as a basic safety service. For a majority of conjunction events, CDMs delivered three times per day should suffice, except for very high-risk events. In those instances, additional tasking and updating primary and secondary state solutions more frequently has been proven to be valuable. This is another area where advanced services procured via third-party SSA providers would be beneficial, where companies such as Kayhan Space can provide routine or on-demand screenings at cadences higher than three times per day if satellite operators desire. As such, making the updated catalog available publicly three times per day (or more) would be beneficial. Additionally, approved US-based commercial SSA providers should have access to the full VCMs at that same cadence.

Additionally, the USG should consider making CDMs more accessible and realistic through better astrodynamics, atmospheric drag modeling, and covariance realism. As the number of objects in space increases, it is essential to warn operators multiple days in advance about a conjunction event which can then be updated by subsequent new solutions. This has a more pronounced impact on the decision-making process of satellite operators that utilize low-thrust propulsion systems or differential drag phenomena to make small adjustments to their satellite orbits to avoid a potential high-risk conjunction event. Delivering conjunction warnings with longer lead times requires precise predictive astrodynamics, realistic state uncertainty prediction, and better atmospheric drag modeling.

## **Part B: Impacts of Proposed Basic SSA Safety Services on Commercial SSA Providers**

**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?**

As a US commercial SSA service provider, we believe that the current commercial SSA service provider capability set is very mature and strong, and can provide all the proposed basic services in this RFI, as well as many advanced ones.

The commercial SSA services market is very competitive. SSA service providers constantly aim to outperform and/or underprice their competitors to a point that many of the proposed basic services in this RFI are already provided for free to satellite operators. The SSA service provider market competition results in a variety of options for satellite operators to choose from with varying degrees of service quality vs. cost.

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

The current services provided by the DoD deliver a very robust baseline for spaceflight safety. However, an area that would have the most impact on our services is having access to Vector Covariance Messages or VCMs, as discussed above. VCMs contain the uncertainty of the state vector of the RSOs within the catalog that will allow the service providers to compute probabilities of collisions for close encounters. Currently, VCMs are not shared outside of the USG. We would like to see VCMs become available to approved US-based SSA service providers, just as the SP catalog and state vectors are today.

**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?**

Please see Appendix A for our comments.

**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?**

N/A.

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

As discussed earlier, today SSA service providers are more than capable of providing all the proposed basic and advanced services. A model that would perhaps be beneficial to the O/Os, but also allow a healthy competitive SSA services market to thrive, is for USG to procure a limited set of proposed basic services from the SSA service providers, and provide them for free to satellite operators. These basic services would be akin to what the DoD is currently providing to O/Os.

Beyond that, the USG should leave it to the commercial marketplace to provide additional services to operators.

## Part C: Tenets of Participation and Receipt of Basic SSA Safety Services

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

If by “public” it is meant that these services are available to anyone and everyone, we believe the space weather indices and sensitivities are valuable pieces of space environment data that should be publicly available. Both the operational and research community can take advantage of these data sources.

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

Owners and operators of spacecraft should be encouraged to share their predicted ephemerides and predicted maneuver plans within TraCSS. These data should be accompanied by enough relevant information about their spacecraft as well as the dynamical and force models that are used to generate the predicted ephemeris files. Having this information is essential for the evaluation and comparison purposes of solutions derived from different sources.

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

It is in the interest of the space operator community to openly share their predictive satellite ephemerides and maneuver plans with other operators and SSA service providers and this should be part of the tenets for participation in TraCSS.

### **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?**

There could be a process for warning the operators if they fail to adhere to the tenets of participation. OSC can further recommend approved US-based SSA services providers to the operators that might be failing to adhere to the tenets of participation, simply because they lack the capabilities to do so. If the failures are repeated without meaningful action by the operators to address them, they could lose their access to the platform.

## Part D: General Feedback

### **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?**

There are a few items of importance to note that are not covered or discussed in this solicitation.

#### **Standardization of the Atmospheric Drag Model**

Atmospheric drag is the largest and the most unknown perturbing force acting on spacecraft in the LEO regime. There are many physics-based as well as empirical models for the estimation and prediction of atmospheric density. These models, while all valid, can result in different density estimations and predictions, resulting in different predicted ephemeris outcomes.

Satellite owner-operators use different models to propagate the trajectory of their satellites, which is also different from the High Accuracy Satellite Drag Model (HASDM) that the USSF uses to generate the SP ephemerides and the CDMs.

With so many different models there does not exist a common baseline for the validation of the owner-operators provided ephemerides. TraCSS should implement a system similar to the HASDM process that uses near-real-time satellite tracking observations to make corrections to a baseline model. It should also make such a system available to satellite operators so that everyone is using the same accurate model for computing the drag perturbation factor.

### **Access to VCMs**

As discussed, VCMs contain essential pieces of information, a.k.a. the state uncertainty of the RSOs, within the catalog that will allow the SSA service providers to compute probabilities of collisions for close encounters. Currently, VCMs are not shared outside of the USG. We would like to see VCMs become available to approved US-based SSA service providers, just like the SP catalog and state vectors are today.

### **SSA Data Sharing Agreements**

Today, the DoD has established a very clear process for satellite operators and SSA service providers to get access to conjunction warnings and the SP catalog. There are also clear procedures within that agreement to allow SSA service providers to get access to the data on behalf of their customers. Based on the material covered so far by the OSC, it is yet unclear how the OSC is planning to handle that initial engagement and agreement process. Will the OSC follow a similar model to the DoD or will it lay out a different procedure for the owner-operators and SSA service providers to engage with TraCSS and get access to different levels of data or services? Some clarification about this engagement process would be very helpful for the community to understand what they will do operationally once TraCSS is up and running.

### **The certification process for service providers**

The RFI alludes to the possibility of the OSC procuring the proposed basic services from existing SSA service providers and redistributing it for free to owner-operators. While we support this approach, it is unclear how SSA service providers would be selected. Will there be a certification process to qualify SSA service providers? If so, we are interested in learning more about that certification process.

## APPENDIX A

### Feedback on Proposed TraCSS Orbital Safety Services

#### 1. Satellite Attributes, Capabilities, Status, and Point of Contact (Included)

- a. Should the capability be part of TraCSS? Partial agree. Points of contact are critical for O/O coordination, but things like satellite mass and dimensions are more supplemental.
- b. If yes, should it be included at the start or added later? O/O points of contact should be available from day 1.

#### 2. Receipt and Sharing of Predictions O/Os Ephemerides (Included)

- a. Should the capability be part of TraCSS? Yes, we fully agree.
- b. If yes, should it be included at the start or added later? Starting from day 1.

#### 3. Routine Collision Assessment (CA) Screening and Conjunction Data Message (CDM) Production (Included)

- a. Should the capability be part of TraCSS? Yes, we fully agree.
- b. If yes, should it be included at the start or added later? Starting from day 1.

#### 4. Special CA Screening and CDM Production (Included)

- a. Should the capability be part of TraCSS? Partial agree, but with additional context. Currently, 18th / 19th SDS provides special CA screening requests that are manually performed by staff personnel, with CDMs returned over a timespan of hours. We support a baseline capability of at least this for TraCSS. However, commercial SSA providers can greatly improve on this with true on-demand high-performance screening services that can automate this process and deliver superior results for O/Os. This should be part of the advanced services procured separately.
- b. If yes, should it be included at the start or added later? N/A

#### 5. Data Quality Evaluation (Included)

- a. Should the capability be part of TraCSS? Yes, we fully agree.
- b. If yes, should it be included at the start or added later? Starting from day 1.

#### 6. Launch Collision Avoidance (COLA) Screenings (Included)

- a. Should the capability be part of TraCSS? Yes, we fully agree.
- b. If yes, should it be included at the start or added later? Starting from day 1.

#### 7. O/O Ephemeris Generation and Curation with Covariance (Included)

- a. Should the capability be part of TraCSS? We agree that generating high quality O/O ephemerides is vital to the success of TraCSS, but disagree that this service should be performed as part of TraCSS directly. Providing reliable ephemerides with realistic covariance is the responsibility of O/Os that generate those data. TraCSS should implement requirements for the validity of the ephemeris files and expect O/Os to provide data that meet those requirements.

- b. If yes, should it be included at the start or added later? N/A
- 8. Re-entry Management and Assessment (Included)**
- a. Should the capability be part of TraCSS? Yes, we fully agree.
  - b. If yes, should it be included at the start or added later? Starting from day 1.
- 9. Precision Probability of Collision Calculation (Included)**
- a. Should the capability be part of TraCSS? We disagree. The "standard" Pc calculation like the one provided in the CDMs today should be included as a basic service, however, "advanced" Pc calculation methods that take into account more variables should be an advanced service provided by 3rd parties.
  - b. If yes, should it be included at the start or added later? N/A
- 10. Collision Consequence and Debris Production Potentials (Included)**
- a. Should the capability be part of TraCSS? We disagree. This should be an advanced service provided by 3rd parties.
  - b. If yes, should it be included at the start or added later? N/A
- 11. Conjunction Object Solution Improvements with Additional Tracking (Included)**
- a. Should the capability be part of TraCSS? Yes, we fully agree.
  - b. If yes, should it be included at the start or added later? Ideally starting from day 1, but ok to be added later via tasking requests from approved 3rd party SSA data providers
- 12. Expected Tracking Determination (Included)**
- a. Should the capability be part of TraCSS? We disagree that this should be provided directly to O/Os via the TraCSS public service. However, this information may be provided to the USG as a by-product of #11 above. If there is a desire to share these expected tracking determination data for additional taskings directly to O/Os, this should be an advanced service provided by 3rd party SSA data providers
  - b. If yes, should it be included at the start or added later? N/A
- 13. Risk Assessment Time History Plots (Included)**
- a. Should the capability be part of TraCSS? We disagree. This should be an advanced service provided by 3rd parties. This is currently not part of the 18th / 19th SDS public service via space-track.org, and is an area that commercial SSA providers already offer advanced, mature services that O/Os are utilizing in daily mission operations for conjunction risk assessment and collision avoidance.
  - b. If yes, should it be included at the start or added later? N/A
- 14. Space Weather Sensitivity (Included)**
- a. Should the capability be part of TraCSS? Yes, we fully agree.
  - b. If yes, should it be included at the start or added later? Starting from day 1.
- 15. Fusion of CA Products (Not Included)**



Yes, we agree this is an advanced service and should not be included in TraCSS.

**16. PC Variability (Not Included)**

Yes, we agree this is an advanced service and should not be included in TraCSS.

**17. Additional Concierge Services (Not Included)**

Yes, we agree this is an advanced service and should not be included in TraCSS.

**18. Anomaly Resolution (Not Included)**

Yes, we agree this is an advanced service and should not be included in TraCSS.

**19. Design-time Assistance for Improved CA (Not Included)**

Yes, we agree this is an advanced service and should not be included in TraCSS.

**20. Maneuver Trade Space (Not Included)**

Yes, we agree this is an advanced service and should not be included in TraCSS.

**21. Optimized Maneuver Recommendations (Not Included)**

Yes, we agree this is an advanced service and should not be included in TraCSS.

**22. Breakup Detection, Tracking, and Cataloguing (Not Included)**

Yes, we agree this is an advanced service and should not be included in TraCSS.

**23. Maneuver Detection and Processing (Not Included)**

Yes, we agree this is an advanced service and should not be included in TraCSS.