https://www.federalregister.gov/documents/2023/01/26/2023-01556/request-for-information-on-scope-of-civil-space-situational-awareness-services

Below in **RED** are ExoAnalytic Solutions' response to the RFI questions:

**COMMENTS ON BASIC SAFETY SSA SERVICES**

**(1) Satellite Attributes, Capabilities, Status, and Point of Contact (Included)**. To maintain a database of primary (protected) assets, which contains basic satellite attributes (approximate dimensions, mass), indicates satellite trajectory change capabilities and current status, and includes 24/7/365 contact information to coordinate mitigation actions for conjunctions between active satellites.

a. This should be included in TraCSS
b. This should be available in the initial offering
c. The government should develop and maintain this list

**(2) Receipt and Sharing of Predictions O/Os Ephemerides (Included).** To receive predicted ephemerides from O/Os, store them in a manner that makes them available for download by other interested O/Os, and use them as the representation of the primary object for collision assessments (CA) screenings, risk assessment, and (when appropriate) mitigation planning.

a. This should not be included in TraCSS. Owner operator predicted ephemerides are typically inaccurate and would subsequently lead to leaks and false alarms in the CDM process. If it were included, this service should say that O/Os would upload future maneuver plans. If your process required O/O ephemeris to work, then by definition there is not a "robust satellite catalog". O/O ephemeris can be very useful post-launch, especially for multi-manifest launches and should be part of service #1 above. However, the process should not rely on having O/O ephemeris because it is often inaccurate and in most cases will not be available because many operators (ex. Russia, China) will not participate
b. The ability to upload O/O future maneuver plans should be available in the initial service.
c. Integration of O/O maneuver plans into future ephemerides should be a commercially provided service.

**(3) Routine Collision Assessment (CA) Screening and Conjunction Data Message (CDM) Production (Included).** To screen primary objects against a robust satellite catalog, both routinely and on demand; and to generate CDMs for objects that violate the particular physical volumes used for the screening activity.

a. This should be included in TraCSS
b. This should be available in the initial offering.
c. The government should purchase this service commercially.

Implicit in this service is the availability of a "robust satellite catalog". We believe that the current public space-track.org satellite catalog does not meet this definition and that the government should purchase a "robust satellite catalog" as a commercial service.

**(4) Special CA Screening and CDM Production (Included).** To perform an on-demand screening against a robust satellite catalog for a particular submitted ephemeris or set of ephemerides (usually for a confirmatory or speculative screening as part of maneuver planning).

a. This should be included in TraCSS
b. This should be available in the initial offering.
c. The government should purchase this service commercially.

Implicit in this service is the availability of a "robust satellite catalog". We believe that the current public space-track.org satellite catalog does not meet this definition and that the government should purchase a "robust satellite catalog" as a commercial service.

O/O maneuver plans should be part of service #2 and in this case, there would be no need for a special service. Unless this was for operators that typically do not include their maneuver plans.

**(5) Data Quality Evaluation (Included).** To perform a first-order evaluation of the orbit determination and propagation of the (usually secondary but in principle both) objects' state estimates and covariances in order to determine whether these inputs are of sufficient quality to serve as a basis for a durable risk assessment calculation

a. This should not be included in TraCSS. This should be an internal Govt managed process that is managed to drive performance of the program.
b. This should be available to support the initial offering
c. The government should develop and maintain an independent quality assurance process to ensure a "gold standard" service

**(6) Launch Collision Avoidance (COLA) Screenings (Included).** To perform timely screenings of a set of launch nominals against a robust satellite catalog in order to identify specific launch times during a launch window that would create unacceptably high collision risk and therefore should not be used.

a. This should be included in TraCSS
b. This should be available in the initial offering
c. The government should purchase this service commercially.

**(7) O/O Ephemeris Generation and Curation with Covariance (Included).** To use O/O telemetry and on-board GPS state information, as well as potentially other commercial tracking information, to generate a reliable predicted O/O ephemeris that includes covariance at each ephemeris point and incorporates planned maneuvers (and maneuver execution error).

a. This should be included in TraCSS
b. This should be available in the initial offering
c. The government should purchase this service commercially.

**(8) Re-entry Management and Assessment (Included)**. To perform re-entry forecasting and event pacing assistance for primary objects undergoing either natural decays or managed deorbits in order to assist the DoD in orchestrating the overall decay and decataloguing process.

a. This should be included in TraCSS
b. This should be available in the initial offering
c. The government should purchase this service commercially.

**(9) Precision Probability of Collision Calculation (Included).** To include in each generated CDM a PC calculation that uses more advanced approaches for determining the appropriate hard-body radius (HBR) and employs a calculation technique appropriate to the particular dynamics of the encounter.

a. This should be included in TraCSS
b. This should be available in the initial offering
c. The government should purchase this service commercially.

**(10) Collision Consequence and Debris Production Potentials (Included).** To calculate, using an appropriate model, an estimate of the number of trackable debris fragments that would be generated if a particular conjunction were to result in a collision.

a. This should not be included in TraCSS. The idea should be to avoid all collisions and operators don't really need to know the information this service would provide to make their decisions. This is really a government internal analytic tool to support other analyses.

**(11) Conjunction Object Solution Improvements with Additional Tracking (Included).** To obtain additional tracking on the satellites involved in conjunctions of interest (typically the secondary objects), improve these objects' predicted states at the conjunction time of closest approach (TCA), and calculate higher-fidelity risk assessment metrics with this improved information.

a. This should be included in TraCSS
b. This should be available in the initial offering
c. The government should purchase this service commercially.

**(12) Expected Tracking Determination (Included).** To generate a pass schedule and probabilities of detection for obtaining additional commercial tracking for conjunction-related objects, so that O/Os can infer the potential benefit of additional tracking and be able to schedule mitigation action decision points appropriately.

a. This should not be included in TraCSS. This is at best a government internal tool for understanding the additional secondary screening support available to them. Secondary tracking should be purchased as a service commercially.

**(13) Risk Assessment Time History Plots (Included).** To produce time-history plots of conjunction risk assessment parameters of interest to allow assessment of conjunction event phasing and stability.

a. This should not be included in TraCSS. The idea should be to avoid all collisions and operators don't really need to know the information this service would provide to make their decisions. This is really a government internal analytic tool to support other analyses.

**(14) Space Weather Sensitivity (Included).** To provide warnings about space weather perturbative events and to assess the effects the perturbation-induced atmospheric density uncertainty will have on conjunction risk assessment parameters.

**(15) Fusion of CA Products (Not Included).** To combine CA products, such as CDMs or predicted ephemerides, from multiple providers into a single, higher-fidelity product that can then be used to enable CA risk assessment.

Implicit in all of these services is the availability of a "robust satellite catalog". We believe that the current public space-track.org satellite catalog does not meet this definition and that the government should purchase a "robust satellite catalog" as a commercial service. In addition, there is an expectation of a Quality Control/Assurance process (5) that should be making quality assessments continuously. The results of this process should lead to higher fidelity products, it is not universally accepted that fusion of multiple provider products into a single product is a good idea to achieve an improved answer.

**(16) Pc Variability (Not Included).** By considering bounding scale factors for the "true" size of the primary and secondary objects' covariances, to generate a matrix of possible Pc values to allow risk assessors to assign a more conservative "high-water-mark" Pc value.

**(17) Additional Concierge Services (Not Included).** To provide on-call, personalized telephone support at all times by CA subject matter experts to assist O/Os with the interpretation of conjunction screening and risk assessment products.

a. This should be included in TraCSS
b. This should be available in a future offering
c. The government should purchase this service commercially.

**(18) Anomaly Resolution (Not Included).** To arrange for the obtaining and interpretation of anomaly resolution SSA products, such as point signatures (radar cross-section and/or photometry), time-series satellite signatures, and radar and optical imaging.

a. This should be included in TraCSS
b. This should be available in a future offering
c. The government should purchase this service commercially.

**(19) Design-time Assistance for Improved CA (Not Included).** During the satellite construction and mission design phase, to assist O/Os in the prudent selection of mission orbits, satellite construction decisions to produce favorable light pollution properties, and the proper build-out of effective O/O ephemeris construction and CA software and procedures.

a. This should not be included in TraCSS
b. This should be available in a future offering, but it is in general a separate process that could be supported by the "robust satellite catalog"
c. The government should purchase this service commercially.

**(20) Maneuver Trade Space (Not Included).** To assemble a visual aid that identifies particular maneuver times and intensities (and, for some maneuver types, durations) to achieve the desired level of conjunction risk reduction (for both the main conjunction and any other conjunctions that the particular maneuver might introduce).

**(21) Optimized Maneuver Recommendations (Not Included).** In addition to the parameters in service (20) above, to include satellite contact restrictions, spacecraft maneuverability limitations, and O/O optimality preferences to construct a recommended maneuver plan to mitigate the main conjunction and ensure against the creation of any serious derivative conjunctions.

**(22) Breakup Detection, Tracking, and Cataloguing (Not Included).** To commission routine surveillance tracking to detect satellite break-ups; and upon the detection of a break-up, to increase supplementary surveillance tracking to collect break-up uncorrelated tracks (UCTs), perform UCT processing, obtain dedicated tracking on new candidate objects, and suggest/perform cataloging actions for stable candidates for which the country of origin can be established.

a. This should be included in TraCSS
b. This should be available in the initial offering
c. The government should purchase this service commercially.

If you are not doing this, you do not have a "robust satellite catalog"

**(23) Maneuver Detection and Processing (Not Included).** To commission heightened surveillance tracking on maneuverable objects; execute maneuver detection algorithms against the tracking obtained from such heightened surveillance; and for objects for which maneuvers are detected, perform appropriate maneuver processing to create a durable post-maneuver state estimate.

a. This should be included in TraCSS
b. This should be available in the initial offering
c. The government should purchase this service commercially.

If you are not doing this, you do not have a "robust satellite catalog"

## RESPONSES TO QUESTIONS TO INFORM DEVELOPMENT OF BASIC SSA SAFETY SERVICES

### A. Scope of Proposed Basic SSA Safety Services

OSC seeks to clearly define and communicate the scope of basic safety SSA services to enable industry innovation of advanced services. OSC seeks responses regarding which SSA services should be included as part of TraCSS. OSC understands that the need to provide certain services through TraCSS may change over time. Similarly, some services may be necessary to include in the TraCSS initial offering only and others should be added in the future. For each of the services discussed above, 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. Additionally, OSC seeks input on whether the services should be developed by the government or purchased from commercial vendors and redistributed. Furthermore, OSC invites comment on the following questions for each of the 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 key implicit assumption in all of the services is a "robust satellite catalog". If these services are provided using the current DOD satellite catalog, then by definition none of the other services can provide any additional benefit. If, however, the DOC team procures a "robust satellite catalog" then these services are viable and will out perform DOD.

- 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?

  Must have a robust satellite catalog and independent data quality evaluation process! Then:

  (1) Satellite Attributes, Capabilities, Status, and Point of Contact
  (3) Routine Collision Assessment (CA) Screening and Conjunction Data Message (CDM) Production
  (4) Special CA Screening and CDM Production
  (6) Launch Collision Avoidance (COLA) Screenings
  (8) Re-entry Management and Assessment

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

  The two must do's to make this a success are to have a "robust satellite catalog" and an independent data quality evaluation process. Everything else is secondary.

- 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 cannot say this enough, the current satellite catalog is insufficient to support any of these activities. That has to be the priority.

- 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?

  A refined process should operate continuously and provide updates as soon as the "robust satellite catalog" is updated, or operator maneuver plans are changed.

**B. Impacts of Proposed Basic SSA Safety Services on Commercial SSA Providers**

OSC's provision of basic SSA safety services through TraCSS is intended to advance safety, stability, and sustainability in space and help the domestic commercial SSA industry grow. OSC is evaluating the potential impacts that the basic SSA safety services provided through TraCSS may have on the commercial SSA industry. OSC is seeking public input on whether there are any concerns with respect to commercial SSA providers with their own services or other value-added providers that may rely on governmental SSA basic safety services. Furthermore, OSC invites comment on the following questions:

- 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?

  The following services are all commercially available today, are affordable, and are currently being utilized by owners, operators, and other customers:

  (1) Satellite Attributes, Capabilities, Status, and Point of Contact (Included)
  (2) Receipt and Sharing of Predictions O/Os Ephemerides
  (3) Routine Collision Assessment (CA) Screening and Conjunction Data Message (CDM) Production
  (4) Special CA Screening and CDM Production
  (6) Launch Collision Avoidance (COLA) Screenings
  (7) O/O Ephemeris Generation and Curation with Covariance
  (8) Re-entry Management and Assessment
  (9) Precision Probability of Collision Calculation
  (11) Conjunction Object Solution Improvements with Additional Tracking
  (12) Expected Tracking Determination
  (17) Additional Concierge Services
  (18) Anomaly Resolution
  (20) Maneuver Trade Space
  (21) Optimized Maneuver Recommendations
  (22) Breakup Detection, Tracking, and Cataloguing
  (23) Maneuver Detection and Processing (Not Included)

- 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 offering of a low-quality, free service offered by the DOD currently limits us to providing a set of exquisite services for unique, complicated, or niche situations (ex. repositioning).

- 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?

  All of these services are competing with our current business offerings, however, if they were procured as commercial services by DOC then the loss of commercial business would be offset somewhat by providing it at scale for the entire community of operators.

- 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?

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

  Scale. Cost savings by buying in bulk. Quality assurance/control to ensure operators are getting a product that meets their needs. Performance screening to weed out bad service providers.

## C. Tenets of Participation and Receipt of Basic SSA Safety Services

OSC is seeking public input regarding what should be required to receive "free of fee" basic SSA safety services through TraCSS. OSC recognizes that certain basic SSA safety services should be made publicly available. For example, space objects from a current DoD catalog that are not sensitive to national security are currently made accessible to the public through the *Space-Track.org* website. OSC also recognizes that other basic SSA safety services should be available to all owners and operators. In response to previous RFIs, some comments suggested that OSC require owners and operators to provide operational information or act in good faith in response to the basic SSA safety services in order to participate in TraCSS. OSC also invites comment on the following questions:

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

  (3) Routine Collision Assessment (CA) Screening and Conjunction Data Message (CDM) Production
  (6) Launch Collision Avoidance (COLA) Screenings
  (8) Re-entry Management and Assessment

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

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