Before the

OFFICE OF SPACE COMMERCE

Washington, D.C. 20230

In the Matter of	)	
	)	
Request for Information on Scope of Civil Space Situational Awareness Services	)	RTID: 0648-XV190
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COMMENTS OF ASTROSCALE U.S. INC.

February 27, 2023

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Astroscale U.S. ("Astroscale") hereby respectfully submits Comments to the Office of Space Commerce's (OSC) Request for Information (RFI) in the above-referenced proceeding.[1] Astroscale thanks the OSC for its persistent efforts to establish a civil space situational awareness (SSA) service and the opportunity to provide operator insight into desirable features of such a program.

I. Introduction

Astroscale is a global leader in the in-space servicing, assembly, and manufacturing (ISAM) industry. Our mission is to secure the safe and sustainable development of space for the benefit of future generations. Through the creation of technologies, advancement of business cases, and contributions to inform sustainable policy, Astroscale is shifting the course of space operations away from the status quo "throwaway" culture towards a "servicing culture" and broader paradigm of responsible stewardship of the space environment. The OSC's civil SSA service– TraCSS – will facilitate this desired shift towards sustainability. Astroscale hopes that these Comments will assist the OSC in building TraCSS to serve owners, operators, and space infrastructure to come.

[1] Request for Information on Scope of Civil Space Situational Awareness Services, 88 Fed. Reg. 4970 (Jan. 26, 2023) [*hereinafter* OSC RFI].

II. Civil SSA Data: The Pathway to a Safer Tomorrow

With an estimated ten-fold increase in satellites by 2030,[2] new spacecraft that will transcend the static orbits of old,[3] and recent debris-generating events,[4] space operators are embarking into cluttered, debris-filled waters. Development of a high quality, "free of fee" civil SSA service is a tangible measure that the U.S. government can pursue to help mitigate further creation of space debris, allowing humanity to reap the benefits of orbital technology for generations to come. Clarifications, desired modifications, and substantive reflections on the OSC's proposed services are discussed in detail below.

(1) Satellite Attributes, Capabilities, Status, and Point of Contact. 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.[5]

Astroscale supports the provision of Basic Service #1, described above, through TraCSS. Maintenance of the general catalog and provision of information on space objects is a function currently carried out by the 18th Space Control Squadron (18th SPCS), and it would be a net positive for this to continue being provided in a civil, publicly-available SSA service.[6] The maintenance of a primary database, along with providing points of contacts, enables owners/operators (O/O) to be

[2] U.S. GOV'T ACCOUNTABILITY OFF., GAO-22-105166, LARGE CONSTELLATIONS OF SATELLITES: MITIGATING ENVIRONMENTAL AND OTHER EFFECTS 2 (SEP. 2022).
[3] NAT'L SCI. & TECH. COUNCIL, EXEC. OFF. OF THE PRESIDENT, IN-SPACE SERVICING, ASSEMBLY, AND MANUFACTURING NATIONAL STRATEGY 6 (2022), https://www.whitehouse.gov/wp-content/uploads/2022/04/04-2022-ISAM-National-Strategy-Final.pdf.
[4] Morgan McFall-Johnsen, *A Secret Russian Satellite has Broken Apart in Orbit, Creating a Cloud of Debris that Could Last a Century*, BUSINESS INSIDER (Feb. 8, 2023) https://www.businessinsider.com/russian-satellite-breaks-up-orbit-space-debris-could-last-century-2023-2; Meghan Bartels, *Defunct US Weather Satellite Breaks Up in Earth Orbit*, SPACE.COM (Mar. 25, 2021) https://www.space.com/defunct-weather-satellite-noaa-17-breaks-up.
[5] OSC RFI, *supra* note 1, at § II(1).
[6] COMBINED FORCE SPACE COMPONENT COMMAND, SPACE-TRACK HANDBOOK FOR OPERATORS 3-4 (Aug. 28, 2020) https://www.space-track.org/documents/Spacetrack_Handbook_for_Operators.pdf [*hereinafter* Space-Track Handbook for Operators].

proactive in space safety actions. Given the importance of a database to overall space safety, Astroscale urges the OSC to include this capability in an initial offering of TraCSS, and asserts that this service is a priority, essential to ongoing operations.

While a database of primary assets is an overall net positive, the OSC should carefully consider the specifics of what information regarding satellite attributes, capabilities, status, and points of contact are collected and distributed publicly.

- *Basic satellite attribues (approximante dimensions, mass).* Astroscale agrees that TraCSS should collect – and make publicly available – information on the approximate dimensions of a space object. As pointed out in additional SSA services below, this information will help space actors evolve better risk models (including more realistic hard-body radius). Regarding mass, Astroscale supports requiring operators to publicly provide their launch mass (sometimes called "wet mass"); many operators already provide this information. However, OSC should not necessarily make on-orbit mass information publicly available. Such mass updates can reveal potentially commercially sensitive information, such as remaining fuel and orbital maneuvers previously undertaken. Instead, Astroscale supports the OSC maintaining information on a spacecraft's mass and allowing O/Os to select the publication of this information, as is currently done with Orbital Parameter Messages.[7]
- *Satellite trajectory change capabilities and current status.* It is unclear how the OSC defines "trajectory change capabilities," and Astroscale urges OSC to release a definition to allow the industry to provide more definitive feedback on this suggested basic SSA service. Generally, Astroscale supports TraCSS continuing the current practice of requiring O/Os to mark their designated satellites as "maneuverable," "not maneuverable," or

[7] *Id.* at 28-32 (noting that an operator's allowed to select PUBLIC or PRIVATE when submitting an Orbital Parameter Message, and that the metadata of such a message includes information on the space object's mass).

"unknown maneuverability," as is done in Space-Track.org.[8] To go a step further, Astroscale urges the OSC to allow O/Os to also publicly indicate how much advanced notice an operator would like to conduct a collision avoidance maneuver. For instance, an operator could indicate a preference for 48 hours notice to conduct a maneuver.[9]

- *24/7/365 contact information*. Astroscale concurs that O/O contact information should be collected, publicly disclosed, and updated whenever a material change is made. Furthermore, Astroscale urges the OSC to mandate satellite O/Os publicly disclose contact information for assets.[10] Astroscale additionally notes that this reporting requirement is similar to one placed upon FCC space station and earth station licensees.[11]

(2) Receipt and Sharing of Predictions O/Os Ephemerides. 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.[12]

Astroscale agrees with the OSC that SSA Basic Service #2 is a priority, essential to ongoing operations, and should be included in the initial TraCSS offering. The receipt, storage, and use of O/O ephemerides is already common, with most operators currently providing ephemerides, and potentially covariances, to the 18th SPCS.[13] Astroscale supports collection and storage of O/O ephemerides and covariances being a publicly available service. O/O ephemerides and covariances

[8] *Id.* at 7 (noting Primary Representative responsibilities).
[9] Additionally, if the OSC would like to simplify these disclosures, they could create tiered categories, e.g. operators that require less than 24 hours' notice, 24-48 hours' notice, and so on.
[10] At present, an O/O can designate contact information as PUBLIC or PRIVATE in Space-Track.org. Contact information that is PRIVATE cannot be seen by other users, only the 18th SPCS. Space-Track Handbook for Operators, *supra* note 6, at 9.
[11] *E.g.*, 47 C.F.R. § 5.703(c); 47 C.F.R. § 25.228(e)(2); 47 C.F.R. § 25.259(b).
[12] OSC RFI, *supra* note 1, at § II(2).
[13] COMBINED FORCE SPACE COMPONENT COMMAND, SPACEFLIGHT SAFETY HANDBOOK FOR SATELLITE OPERATORS 15-22 (Aug. 2020) https://www.space-track.org/documents/Spaceflight_Safety_Handbook_for_Operators.pdf (noting Ephemeris formats that are accepted by the 18 SPCS) [*hereinafter* Spaceflight Safety Handbook for Satellite Operators].

support collision assessment (CA) probabilistic calculations.[14] Additionally, O/Os should be encouraged to provide an ephemerides outlook that supports predictive CA screenings for a sufficient window of time;[15] this information should be updated as regularly as possible without creating undue burden on the O/O.

Astroscale urges the OSC to ensure that TraCSS information is updated as quickly as possible upon receipt of new O/O predictive ephemerides submissions. Currently, the 18th SPCS updates orbital information for the entire high-accuracy catalog every 8 hours.[16] For O/Os that rely on the government-provided basic service to support mission operations, an 8-hour turn-around time can be untenable. In rendezvous and proximity operations (RPO), updates to orbital information for items in the SSA catalog are needed, at minimum, every 90 minutes to support environmental understanding and identify conjunction candidates.

(3) Routine Collision Assessment (CA) Screening and Conjunction Data Message (CDM) Production. 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.[17]

Astroscale agrees with the OSC that SSA Basic Service #3 is a priority, essential to ongoing operations, and continuous routine CA screening and conjunction data message (CDM) generation for objects in OSC's catalog should be included in the initial TraCSS offering. With the advent of increasingly accurate, precise, and timely data from commercial SSA providers, Astroscale also

[14] NAT'L AERONAUTICS AND SPACE ADMIN., NASA SPACECRAFT CONJUNCTION ASSESSMENT AND COLLISION AVOIDANCE BEST PRACTICES HANDBOOK 84 (Dec. 2020), https://nodis3.gsfc.nasa.gov/OCE_docs/OCE_50.pdf ("Because probability-based methods for satellite conjunction risk assessment in almost all cases require a covariance for their calculation, realistic covariances for both the primary and secondary objects in a conjunction are important.") [*hereinafter* NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook].
[15] NASA recommends an outlook of 7 days of predicted ephemeris for LEO spacecraft, and 14 days for other orbits. *Id.* at 10.
[16] Spaceflight Safety Handbook for Satellite Operators, *supra* note 13, at 5.
[17] OSC RFI, *supra* note 1, at § II(3).

supports OSC's procurement of additional data for public use through TraCCS to facilitate enhanced space safety.

Astroscale supports the provision of CA screenings and CDM production as a publicly available service. Preferably, the privacy of CDMs issued to O/Os through TraCSS should largely be maintained. As CDMs are only actionable by the O/O of an object, widespread release could result in misinterpretation by external stakeholders that do not have complete information on the situation or positioning of the O/O's satellites. However, in instances of increased risk, it may be appropriate for the OSC to bring in other resources – which may or may not require disclosing the existence of a CDM.[18] Additionally, in the event of collisions, Astroscale would support the release of relevant CDMs in support of any post-incident investigations.

Finally, Astroscale urges the OSC to consider how to account for rendezvous and proximity operations (RPO) events for TraCSS' CDM generation. During the execution of certain RPO between in-space servicing spacecraft and client spacecraft or objects, 'false positive' conjunction risk levels between the two objects may be observed. Astroscale would like the OSC to consider a mechanism similar to Space-Track.org's ability to "Hide Intra-Constellation CDMs" for objects involved in RPOs,[19] but continue to CA screening for other objects that could conjunct with a set volume around the servicer and client vehicle. Once a servicer spacecraft and a client are docked, paused CA screenings and CDM generation could continue for the combined stack.

[18] Spaceflight Safety Handbook for Satellite Operators, *supra* note 13, at 14 (noting that there are certain situations where 18 SCPS can increase tasking priority, and ensure the catalog is accurately reflecting objects for emergency reportable events).

[19] An extension of Space-Track.org's "Hide…CMD" function for RPO operations should include the ability to hide CDMs between objects designated to different users (not just intra-constellation). Space-Track Handbook for Operators, *supra* note 6, at 13.

(4) Special CA Screening and CDM Production. 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).[20]

Astroscale agrees with the OSC that SSA Basic Service #4 is a priority, essential to ongoing operations, and that this service should be included in TraCSS as part of an initial, publicly available offering. Specifically, the on-demand screening of submitted ephemeris or set of ephemerides against the government space object catalog is a service that 18th SPCS already provides, and that OSC should continue using TraCSS.[21] As the service description implies, this service should be conducted whenever an O/O submits a request.

Astroscale generally notes that there are many commercial providers of on-demand ephemerides screening. Following the NASA recommendation, Astroscale supports using commercially developed services when they offer "improvement and innovations" beyond those available from the government service. However, application of the NASA recommendation would retain TraCSS as both a baseline and supplement to commercial CA screenings and CDM production. [22] To ensure that on-demand screening is accurate, on-demand queries must be processed against the most-complete space object catalog.

[20] OSC RFI, *supra* note 1, at § II(4).
[21] *See* Spaceflight Safety Handbook for Satellite Operators, *supra* note 13, at 6-8 (screenings for Special files, for the purposes of planning).
[22] *See* NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook, *supra* note 14, at 27-8 (NASA recommendation that O/Os use the service offered by USSPACECOM as a baseline and supplement to commercial services, as some commercial collision avoidance calculations are based upon insufficiently accurate TLE information).

(5) Data Quality Evaluation. To perform a first-order evaluation of the orbit determination and propagation of the (usually secondary but in principle both) objects' state estimates and co-variances in order to determine whether these inputs are of sufficient quality to serve as a basis for a durable risk assessment calculation.[23]

Astroscale understands the impetus behind suggested basic SSA safety service #5, but at this time feels more information needs to be provided on for industry to provide substantive comments on this suggested service.

Data evaluation will be an essential aspect of TraCSS ingesting O/O data that is then used to support risk assessment calculations. There is potential value in the provision of such a service. However, transparency on the exact mechanism of *how* the evaluation will take place is needed for Astroscale or other industry players to provide substantive feedback. Astroscale suggests further evaluation of providing SSA service #5 before integrating it into an initial TraCSS offering.

(7) O/O Ephemeris Generation and Curation with Covariance. To use O/O telemetry and on-board global positioning system 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).[24]

As currently conceived, Astroscale does not support the provision of basic SSA safety service #7 by TraCSS. The service as described is too vague to allow industry to provide substantive feedback and implicates the revelation of highly sensitive information.

O/Os should not be required to provide the government with telemetry and on-board global positioning system (GPS) information. Telemetry and GPS information allows parties to reverse-engineer on-orbit hardware and software, information that is incredibly proprietary for commercial operators. Understanding that no cybersecurity system is completely immune or unbreachable,

[23] OSC RFI, *supra* note 1, at § II(5).
[24] *Id.* at § II(7).

O/Os would face a significant risk of exposure of propriety information if required to provide both telemetry and GPS information to be aggregated in a government platform.

As an alternative to the provision requiring telemetry and GPS data, Astroscale offers that the OSC could ingest ephemeris data with their covariance matrixes.[25] O/Os commonly generate both ephemerides and covariance matrixes together, creating minimal burden on an O/O to provide both. In addition, the ephemerides and covariance matrixes together support the intent of proposed basic SSA safety service #7 – increasing the overall accuracy of SSA information and services.

Finally, similar to commentary on proposed basic SSA safety service #5, Astroscale opposes the generation of "reliable" predicted O/O ephemeris until the government provides further information on how "reliability" would be adjudicated. As data evaluation and quality are complicated topics, and there is currently no clarity on what makes "reliable" predicted O/O ephemeris, Astroscale would like to see OSC establish the underlying analysis of reliable ephemeris before incorporating this element into TraCSS.

(8) Re-entry Management and Assessment. To perform reentry 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.[26]

Astroscale agrees with the OSC that SSA Basic Service #8 is a priority, essential to ongoing operations, and that this service should be included in an initial, publicly available TraCSS offering. At present, both end-of-life/disposal support, and deorbit support, are offered by the 18th SPCS through Space-Track.org.[27] TraCSS should continue to support this function.

[25] Some ephemeris formats ingested by Space-Track.org do not include covariances. Spaceflight Safety Handbook for Satellite Operators, *supra* note 13, at 15.
[26] OSC RFI, *supra* note 1, at § II(8).
[27] Spaceflight Safety Handbook for Satellite Operators, *supra* note 13, at 14.

Astroscale additionally supports decataloguing as a basic SSA service that should be provided in the initial deployment of TraCSS. In a time of increased launches and large multi-satellite systems, a decataloguing function is a priority to ensure that the understanding of the space environment remains accurate and reduces performing needless calculations. Both re-entry management and decataloguing services should be conducted responsively whenever objects re-enter.

(9) Precision Probability of Collision Calculation. To include in each generated CDM a Probability of Collision (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.[28]

While an aspect of the proposed SSA Basic Safety Service #9 is essential and an ongoing priority, Service #9 also includes vague and forward-looking proposals that must be expounded upon before inclusion in a civil SSA service.

Astroscale agrees that including a probability of collision (PC) calculation with a CDM is a priority, basic service that should be provided as a publicly available service every time a CDM is generated. Astroscale understands that 18th SPCS performs this service currently – TraCSS should include an equivalent function, at minimum.[29]

Astroscale would like to see improvements in modeling appropriate hard-body radius (HBR) and calculations around dynamic interactions in the future. However, without further information on how these improvements will be achieved, Astroscale cannot provide substantive input on this proposed service, nor whether it should be government developed or privately procured.

[28] OSC RFI, *supra* note 1, at § II(9).
[29] Spaceflight Safety Handbook for Satellite Operators, *supra* note 13, at 9-11.

(10) Collision Consequence and Debris Production Potentials. 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.[30]

Astroscale does not believe the proposed SSA Basic Safety Service #10 is an appropriate safety service for inclusion in a civil service currently. Astroscale understands that the proposal for a collision consequence and debris production potentials service may arise from predicted scenarios in which an O/O has an extreme amount of CDMs to respond to and must "triage" the conjunctions.[31] However, modeling debris generated from a collision is still an evolving field. Before suitable comments can be provided, OSC should disclose further information on how "appropriate model[ing]" is conducted, and if guidance to O/Os on PC mitigation – including response thresholds – would be provided.

(11) Conjunction Object Solution Improvements with Additional Tracking. 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.[32]

Astroscale agrees that the proposed Basic SSA Service #11 is a service that should be included in TraCSS at some point. In general, it is in the best interest of all space actors to have high-fidelity data and information around conjunctions so that collisions can be avoided. With that said, Astroscale would encourage the OSC to further define aspects of this proposed service and seek comments before creating a mandate for the government to "obtain additional tracking."[33]

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[30] OSC RFI, *supra* note 1, at § II(10).
[31] NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook, *supra* note 14, at 32-4.
[32] OSC RFI, *supra* note 1, at § II(11).
[33] *See, e.g.,* Spaceflight Safety Handbook for Satellite Operators, *supra* note 13, at 14 (noting three instances when tasking for an object is automatically increased).

Additionally, Astroscale encourages TraCSS to provide clarity on how often an object is tracked, and an outreach contact for O/Os to ensure listed information is up to date.[34] If an O/O has received a CDM, insight on when the next potential object observation and catalog update will occur supports a go/no-go decision on taking a mitigation action presently or waiting for updated information.

(12) Expected Tracking Determination. 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.[35]

Astroscale agrees with the OSC that SSA Basic Service #12 is a priority, essential to ongoing operations, and that this service should be included in a publicly available TraCSS initial offering. To provide the most benefit, a pass schedule and probability of detection should be generated when a CDM for the correlating object is issued. Additionally, tracking detection probabilities should be conveyed with the same privity instituted between an O/O and the government in instances of CDM generation.

While Astroscale agrees generating a pass schedule and probabilities of detection for obtaining additional commercial tracking is a priority, this service will only be beneficial if it is packaged with information on what sensors are *available* to task. The information is largely unhelpful if a commercial tracking service is already booked at the time implicated in a pass schedule. OSC should take this into consideration in conversations with commercial tracking service providers and consider whether there are ways to include information on sensor availability.

[34] *See id.* (noting that an O/O can contact a division to ensure Space-Track.org has correct and updated data).
[35] OSC RFI, *supra* note 1, at § II(12).

(13) Risk Assessment Time History Plots. To produce time-history plots of conjunction risk assessment parameters of interest to allow assessment of conjunction event phasing and stability.[36]

Astroscale agrees with the OSC that SSA Basic Service #13 is a priority, essential to ongoing operations, and that this service should be included in TraCSS as part of a publicly available initial offering. O/Os should be able to query TraCCS on demand to obtain time-history plots of conjunction risk assessment parameters to support mission planning and deployment.[37]

(14) Space Weather Sensitivity. 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.[38]

Astroscale agrees with the OSC that SSA Basic Service #14 is a priority, essential to ongoing operations, and that this service should be included in TraCSS as part of a publicly available initial offering.

Fluctuations in space weather have substantial impacts on mission planning and systems, from atmospheric drag changes to radiation exposure for electronics. The government is in the best position to aggregate and provide information on space weather – similar to current civil weather services. Therefore, TraCSS should ingest and update information on space weather as frequently as possible.

[36] *Id.* at § II(13).
[37] *See, e.g.,* NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook, *supra* note 14, at 73-4 (NASA representation of information on expected CA event rates).
[38] OSC RFI, *supra* note 1, at § II(14).

(17) Additional Concierge Services. 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.[39]

Astroscale encourages OSC to conclude that SSA Service #17 is a basic service that the government should facilitate provision of through TraCSS. Many small operators have assets in space, but little to no expertise in CA assessment and understanding CDMs. A government-sourced "moderator" would substantially support small operators during high-risk events; Astroscale notes that there are many commercial providers of this service. OSC identification of CA concierge service providers through TraCSS – in essence, acting as a store front – ensures that the widest possible O/O audience is aware that CA interpretation assistance exists, rather than leaving resource-limited companies to try and identify trustworthy and reliable CA subject matters experts on their own.

III. Conclusion

Astroscale thanks the OSC for the opportunity to provide comments on the proposed SSA services available through TraCSS. For ease of reference, the positions relayed above are captured in the following table:

Basic Safety SSA Service	OSC-provided?	Priority/essential to ongoing operations?	Further information needed to comment?
(1) Satellite Attributes, Capabilities, Status, and Point of Contact.	X	X	X – Regarding "trajectory change capabilities"
(2) Receipt and Sharing of Predictions O/O Ephemerides.	X	X	

[39] *Id.* at § II(17).

Basic Safety SSA Service	OSC-provided?	Priority/essential to ongoing operations?	Further information needed to comment?
(3) Routine Collision Assessment (CA) Screening and Conjunction Data Message (CDM) Production.	X	X	
(4) Special CA Screening and CDM Production.	X	X	
(5) Data Quality Evaluation.			X
(7) O/O Ephemeris Generation and Curation with Covariance.			X
(8) Re-entry Management and Assessment.	X	X	
(9) Precision Probability of Collision Calculation.	X – in part	X – in part	X – Regarding hard-body radius modeling
(10) Collision Consequence and Debris Production Potentials.			X
(11) Conjunction Object Solution Improvements with Additional Tracking.	X		X – Instances when additional tracking mandated
(12) Expected Tracking Determination.	X	X	
(13) Risk Assessment Time History Plots.	X	X	
(14) Space Weather Sensitivity.	X	X	
(17) Additional Concierge Services.	X	X	

Astroscale looks forward to the operational deployment of TraCSS and this government-facilitated step into the future of space sustainability.

Respectfully submitted,

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