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Recommendations for NOAA's Traffic Coordination System for Space (TraCSS)

IN RESPONSE TO NOAA'S REQUEST FOR INFORMATION ON THE SCOPE OF CIVIL SPACE SITUATIONAL AWARENESS SERVICES

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Subject: Request for Information on Scope of Civil Space Situational Awareness Services

Dear Mr. Dyer:

Booz Allen Hamilton (Booz Allen) respectfully submits the following response to the National Oceanic and Atmospheric Administration's (NOAA) Office of Space Commerce (OSC) request for information regarding the scope of civil space situational awareness (SSA) services. We view the proposed solicitation as an opportunity to provide thoughtful recommendations on the future of NOAA's Traffic Coordination System for Space (TraCSS) and an opportunity to develop a partnership by providing mission-driven solutions based on our extensive space domain expertise.

For more than 100 years, the Federal Government has turned to Booz Allen to solve their toughest problems. Our firmwide culture of collaboration and innovation combined with our experience in directly assisting our government clients in shaping the future of space traffic management make us the ideal partner.

For any technical questions, please contact me at 202-346-9180, and for any contractual questions please contact our Lead Contracts Administrator, Judith-Anne Martin, at 703-377-0012.

Sincerely,

Katharine Day

BOOZ ALLEN HAMILTON INC.
Katharine Day
Principal

1 INTRODUCTION

Booz Allen Hamilton (Booz Allen) is pleased to respond to the National Oceanic and Atmospheric Administration (NOAA) Office of Space Commerce's (OSC) request for information regarding the scope of civil space situational awareness (SSA) services.

For over 30 years, we have been directly involved in assisting our government clients in the space mission area, specifically working to shape the future of space domain awareness (SDA) across the Department of Defense (DoD) Space Command and Control, National Reconnaissance Office (NRO) SSA and through our support directly to the Combined Space Operations Center (CSpOC) at Vandenberg and the National Space Defense Center (NSDC) in Colorado Springs for the SDA and Space Defense missions.

Booz Allen applauds the Department of Commerce (DoC) and NOAA for their dedication to the development of a comprehensive, integrated space traffic management (STM) solution. We believe our experience supporting those operating in space perfectly aligns with OSC's mission to foster the conditions for the economic growth and technological advancement of the U.S. commercial space industry. NOAA has the authority and funding to define what the future of the space operating environment looks like, and to coordinate with the commercial sector and the DoD in delivering a unified STM solution. We are prepared to help NOAA in reaching their objectives and will utilize this response to outline the challenges presented by current SSA efforts, our recommendations for helping NOAA achieve a successful Traffic Coordination System for Space (TraCSS) and answer NOAA's specific questions regarding the scope of SSA services provided.

2 CURRENT CHALLENGES

The challenge of safe and effective STM is significant. A recent example of the growing challenge occurred in 2020 with the near collision of two decommissioned satellites. Fortunately, the satellites crossed paths without incident, but analytics estimated they missed by a mere 18 meters. Had they collided it would have created a debris field of approximately 12,000 fragments larger than one centimeter. In addition to the debris created, there was also the risk of collateral damage to nearby satellites as the collision debris path dispersed with no time to move satellites that could be impacted. With the launch projections over the next 10 years, if improvements are not made, the issue is not if something will collide, but when.

DoD and commercial SSA services aimed at reducing this risk have grown significantly, yet their SSA services remain siloed and incomplete. To be successful, TraCSS must incorporate existing DoD services and combine them with commercial SSA services into one comprehensive platform. The following challenges outlined in Table 1 further highlight this need.

TABLE 1. CHALLENGES WITH SILOED GOVERNMENT AND COMMERCIAL SSA SERVICES

Mission Area	Challenge
Networks	Aging sensors arranged in a point-to-point configuration lack extensibility. In some cases, sensors are tied directly to specific end points (Non-Traditional Data Pre-Processor [NDPP] or Communication Services Project [CPS]). Upgrades are difficult and lacking modern IP compatibility.
Data formats	Data formats are not standard. Data format standards have not been applied consistently over the years creating extract/transfer/load data parsing difficulty and labor-intensive processing times.

Data rights	Proprietary data rights in commercial observations increase cost significantly with private industry providing solutions with less-than-optimal data rights to the government (for example, unexpected and significant operations and maintenance (O&M) costs after investing in establishing a free/open baseline architecture).
Operator resources and training	Approximately 64 military and 25 civil service staff are permanently assigned to 18 Space Control Squadron (SPCS). They do not have the ability to support the increasing commercial requirements. The U.S. Space Force (USSF) and U.S. SPACECOM leadership have recognized the limitations to providing SSA and deconfliction to commercial operators as the market is expanding by an order of magnitude in the next 7 years. Maintaining the status quo will only bring further challenges and necessitates the transition to NOAA OSC.
Analytics	Minimal analytics are available to alleviate resource constraints. There is a large technical debt in the current DoD SDA solutions causing long delays in capabilities to modernize existing aging architectures and solutions. Current DoD SDA software is not keeping pace with modern approaches (e.g. extensibility and modularity; there is a huge need for NOAA OSC to develop a modern software platform).
Cross Domain Solutions (CDS)	There is a lack of CDS capability from DoD to controlled unclassified information (CUI) / Commercial side including reduced throughput and processing. The current DISA gateways perform high to low transfers from DoD to SpaceTrack.org with non-optimal processing and transfer timelines of data.
Communications	There is insufficient information regarding ownership of satellites causing gaps or delays in communication in the event of a conjunction notice and adjudication.
Standards	There are currently no global standards or regulatory framework applied to STM. The absence of minimum standards and governing principles only exacerbates the other challenges, particularly data formats and communication.
Funding	A commercial space data market has emerged over the last decade with increasing growth continuing over the next several decades. Federal funding is limited but investment is critical to the growing STM arena, especially to create a baseline integrated platform with common standards. Only NOAA is equipped to take on this mission with its broad authority and broad responsibility. Space is critical to our way of life and economy, and we can't solely depend on the commercial industry to ensure it is safeguarded.

With these challenges in mind, there are a few areas of need that NOAA should consider as it takes on STM and stands up the TraCSS system:

- An open architecture platform solution and data repository to integrate the dozens of space data providers in a clear and consistent manner while addressing gaps in data availability and sources
- A system integrator to interface/absorb critical data feeds into one unified system and to develop a solution that conforms to federal standards and rules
- Speed and accuracy of STM services provided and an extensible and flexible solution that can adapt to the changing market and takes advantage of evolving technology

The current collection of assets that monitor space objects are controlled by the DoD and commercial providers. However, the collection of data is either a pay for service at a significant cost, or currently

maintained by the DoD. NOAA will require an open architecture system that has the same capabilities as the space surveillance network (SSN) and include a catalog of services from commercial industry. In this scenario, the government and commercial entities will have access to the equivalent SDA capability thus creating the trusted platform for all stakeholders to access.

3 RECOMMENDATIONS

Booz Allen appreciates NOAA's goal of implementing a comprehensive, integrated STM solution. TraCSS will provide a faster, more reliable system that reduces risk and improves operational safety. Due to the number of commercial providers and the varied nature of services provided, we recommend NOAA look for a trusted data integrator who can collaborate with the different data providers and, through the use of a cloud-based, modular platform, provide a catalog of SSA safety services. As the system integrator, Booz Allen would work closely with NOAA's OASIS data lake effort, Skyline operational environment, and near-term Horizon research and development (R&D) sandbox to establish the TraCSS modular platform and onboard commercial services and data processing capability.

To achieve these goals, we recommend NOAA consider these key system requirements that we further expand upon in Section 3.1 and illustrate in Figure 1 following the recommendations.

- **Trusted System Integrator** – The challenge of integrating multiple commercial data sources with the previously-built DoD architecture requires an experienced and trusted system integrator and modular platform provider. NOAA requires data-agnostic solutions to work with the numerous commercial data providers with experience implementing common commercial standards. Using a trusted integrator approach, there is a need to support the data providers who likely have little experience working in the federal space or understand federal requirements (such as cyber security rules, cross domains, operational acceptance, etc).
- **Cloud Based Infrastructure** – Utilizing a cloud-based infrastructure with a platform that is open and extensible for modern capabilities will ensure an agile, high-availability system that can also incorporate future capabilities and innovation.
- **Phased Delivery –** A phased approach, beginning with a previously established Minimum Viable Product (MVP) for Phase One at initial operating capability (IOC) in 2024 will help to ensure a smooth and successful transition to TraCSS.
- **Zero Trust Protections –** Layered cyber security solutions, provided by a trusted integrator with zero trust experience, will be required to ensure a secure system that can securely ingest data from DoD and commercial services.
- **Catalog of Services –** Utilizing a microservices mesh architecture can enable the delivery of a catalog of services to DoD and industry. Multiple delivery mechanisms could be utilized to assist with the timeliness, accuracy, and breadth of services provided.
- **New Modern System Framework –** Fully achieving the scope of TraCSS requires modern and innovative approaches to SSA. Avoiding technical debt and utilizing artificial intelligence/machine learning (AI/ML) analytics, among other innovative solutions, can be achieved by implementing a new framework instead of attempting to modernize existing SDA capabilities.

3.1 Recommendations on TraCSS Framework and Delivery of Services

Recommended Framework: Trusted Data Integrator

Booz Allen acknowledges NOAA's desire to work collaboratively with the commercial SSA industry and recommends the selection of a vendor who can effectively ingest multiple data sources, cleanse and standardize the data, and distribute the services as required. The integrator should work collaboratively with industry and develop a coalition of operators, data providers, insurance providers, and other participants. To date, there are over 30 companies that are providing various components of SSA/STM, in addition to military and international sources of information. All of these data sources need to be effectively combined into one platform, which would be best achieved by a single integrator, to achieve all of the services required by NOAA and industry.

The following table highlights the importance of the integrator role to an effective TraCSS solution.

TABLE 2. TRACSS SYSTEM INTEGRATION NEEDS

Service	Need
Cloud Based Platform	NOAA needs to stand up the design and architecture of the TraCSS program for civilian SSA and STM. The integrator will engage with cloud vendors and data providers throughout the lifecycle of the system to manage quality, cost and schedule, and offer a highly available system 24/7.
Modern, Modular Architecture	NOAA requires a modular architecture that ensures the technical maturation of portions of TraCSS without having to recreate the entire system. This modular, agnostic platform should include a data processing layer ingesting data source into standardized, parsed, transformed information in a reusable and consistent manner for the platform, applications, and users to access and fuse into matured, actionable information.
Certification to Operate (FedRAMP/ATO)	Any government-hosted system will require a certificate to operate and must be Fed Ramped to sit on government IT infrastructure and the cloud. The integrator will maintain system documentation and ensure it is meeting all Fed Ramp requirements so regular reporting can occur. However, if the system is contractor owned and operated (COCO), the system may not require an Authority to Operate (ATO) or FedRAMP.
Data Ingestion and Validation	NOAA needs an integrator to gather and work with a growing set of more than 30 commercial vendors. There is a need to ingest large amounts of data quickly, ideally leveraging a common commercial standard. Booz Allen participates in the USSF Data Governance Council (DGC) who is working towards defining a common commercial standard so we can bring that knowledge and data.
Data Standardization and Cleansing	With a consortium of commercial vendors there is a need to standardize, cleanse, and fuse large amounts of data quickly.
Data and System Security / Zero Trust	There is a need to protect data housed in the system and ensure and authenticate users and data providers. Layered cyber security, in-depth solutions are required to ensure zero trust.
Agnostic Data Delivery	Data must be provided easily to the public/user base, some for free/some based on a payment / subscription-based model.
Stakeholder Engagement	With many users and providers of data there must be a clear communication and engagement mechanism and strategy.

System Collision Communication	NOAA must determine how to architect system collision communication in the event of an expected collision. Today email communication occurs and what is needed is near real time alerts to operators with recommendation.
Project Management Oversight and System Reporting	Maintaining system requirements, determining system upgrades, and managing and planning for system costs are all required activities to support a new government capability There must be accountability for system performance and availability through service level agreements (SLA).

Recommended System: Cloud-Based Infrastructure

Booz Allen recommends the use of modern, cloud-based infrastructure, with containerized frameworks and microservices that will provide NOAA with the ability to support current and future STM requirements. Additionally, reusing matured, cloud-based platforms that have been successfully utilized on client contracts with cyber zero trust protections built-in will be key. Understanding the time and budget constraints NOAA faces, the selection of a vendor with previously built infrastructure that can easily be utilized for TraCSS, can provide significant time and cost savings.

Booz Allen proposes building on the work NOAA has completed and also leveraging a solution like our BASE-C, a modern, highly available cloud-based, run-time environment modeled from proven NRO and DoD Space Domain platform solutions. BASE-C is built on modular architecture, is Kubernetes based, contains an agnostic data layer and data fusion layer (with various input data formats), and has zero trust built in. We develop and integrate BASE-C on Booz Allen's Solution Center, our integrated software development environment which delivers a continuous ATO (cATO) pipeline to greatly accelerate time-to-market.

BASE-C can be used as the operational foundation and solution center that will provide modern mission services by integrating existing commercial capabilities while connected to accredited high to low CDS with Unified Data Library (UDL) access. Our recommended approach of establishing a modular TraCSS data foundation is low risk due to our repeatable infrastructure as code (IaC) scripts that we can quickly recreate the high availability cluster and BASE-C platform with cyber/zero trust secure configurations tested and accredited at Top Secret/Sensitive Compartmented Information (TS/SCI) and above requirements.

Recommended Delivery: Phased Approach

A phased delivery approach ensures a successful transition to TraCSS and long-term operations. We recommend Phase One (2024) should focus on IOC and incorporating the commercial space warnings and notifications from 18th Space Defense Squadron (SDS) into the TraCSS platform. Phase Two (2024-2026) and Phase Three (2026-2028) would expand on the services provided, further automate, and apply AI/ML capabilities where feasible, refine the overall product and user experience, and ultimately achieve what NOAA defines as final operating capability (FOC).

Recommended Solution: Zero Trust Protections

Booz Allen recommends a Zero Trust foundation with multiple layers of cyber defenses as the necessary network, data, platform, microservices, and visualizations all require cyber protection. To assist in the implementation of zero trust, the TraCSS data solution should reuse proven cloud-based platforms with layered zero trust implementations already built in.

As the largest provider of cyber services in North America and an industry leader in Zero Trust planning and implementation, we have supported clients across the public and private sector with requirements

ranging from fundamentally shaping how defense networks are secured with Zero Trust to helping Fortune 500 companies drive adoption. Specifically, Booz Allen currently works directly for the DoD's Space Systems Command (SSC) SDA organization to develop and execute on the cloud-based platform hosting SDA applications. In support of this modular platform, Booz Allen has expanded the repository of customized accredited and secured hardened containers meeting all stringent regulatory testing and cybersecurity requirements.

Recommended Delivery: Catalog of Services

To ensure TraCSS is sustainable long term, we recommend NOAA explore creative approaches to the delivery of services outlined within the Request for Information (RFI), as well as funding of these services. As outlined in Figure 1, a subscription-based service, with different tiers of services that ultimately provide value over current or basic services could be developed. Delivering this catalog of services via application or similar online products would ensure ease of use and significant value add. The core benefit of this approach includes the ability to offer value-add services by sharing the cost with industry. This is especially important for NOAA given the existing commercial industry and significant spend on critical safety data. NOAA should prioritize the selection of an industry partner and integrator who can develop and implement the business model, manage the complexities involved with ingesting 30+ sources of data, particularly data rights, and security and legal needs surrounding proprietary data. Additionally, approaching TraCSS with this framework allows for easy incorporation of existing data providers and DoD. Commercial product providers and developers would easily be able to discover and access data through the catalog to support further development.

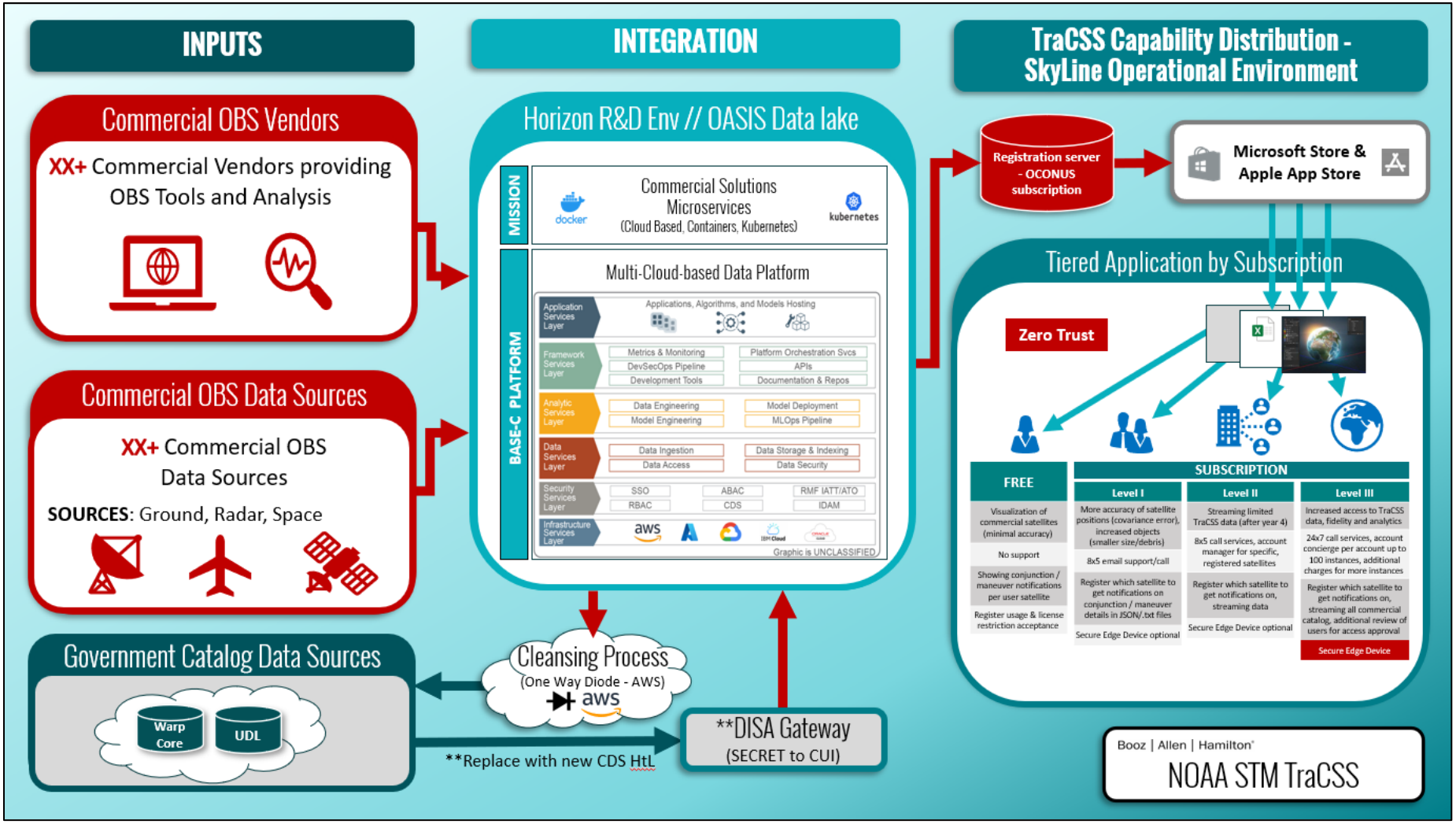
Recommended Solution: New Modern System Framework

For NOAA to avoid significant technical debt, we recommend against establishing the base capability for TraCSS on the repurposing of the 18th SDS SDA components. It has been proven multiple times that the effort and technical debt involved in modernizing the existing DoD SDA system is beyond NOAA's risk tolerance could ultimately take longer, cost more and result in a less capable system. As outlined in the previous recommendations, a cloud-based, modular platform built incrementally by a trusted integrator will enable a modern solution that can evolve over time.

NOAA should also consider it important for the selected data integrator to have existing AI/ML capabilities that can increase the automation of STM tasks, alleviate the need for some resources and ensure a positive user experience for TraCSS participants.

In 2020, Space Domain Awareness Inc. created a "license plate" for all satellites. This identification could be used as a valuable tool to assist space conjunctions by constantly monitoring the orbital path of known satellites combined with the tracking of debris. Incorporating AI/ML could produce higher accuracy conjunction notices that could be sent as automated conjunction notices to the owners of at-risk satellites. These automated conjunction notices would address multiple timeliness and communication issues and provide higher accuracy predictions.

FIGURE 1. RECOMMENDED TRACSS OPERATIONAL FRAMEWORK



3.2 Recommendations to Inform the Development of Basic SSA Safety Services

Scope of Proposed Basic SSA Safety Services

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?***

   The current services and proposed services, while providing adequate data, do not do so in a sufficient manner. Current solutions are too slow and therefore could pose a threat to safety, particularly as additional satellites are added, and the system continues to expand and evolve. NOAA must consider the delivery model of these services and ensure that the platform is scalable for the influx of commercial satellites over the next several decades. The following table shows the current commercial STM services provided, highlighting the need for an integrator to ensure one comprehensive TraCSS.

TABLE 4. COMMERCIAL STM SERVICES AND PROVIDERS

		STM Services	Providers
INCLUDED	1	Satellite Attributes, Capabilities, Status, and Point of Contact.	Multiple
	2	Receipt and Sharing of Predictions O/Os Ephemerides.	Minimal
	3	Routine Collision Assessment (CA) Screening and Conjunction Data Message (CDM) Production.	Multiple
	4	Special CA Screening and CDM Production.	Multiple
	5	Data Quality Evaluation.	Multiple
	6	Launch Collision Avoidance (COLA) Screenings.	Minimal
	7	O/O Ephemeris Generation and Curation with Covariance.	Minimal
	8	Re-entry Management and Assessment.	Multiple
	9	Precision Probability of Collision Calculation.	Multiple
	10	Collision Consequence and Debris Production Potentials.	Multiple
	11	Conjunction Object Solution Improvements with Additional Tracking.	Minimal
	12	Expected Tracking Determination.	Multiple
	13	Risk Assessment Time History Plots.	Multiple
	14	Space Weather Sensitivity.	Unknown / None
NOT INCLUDED	15	Fusion of CA Products.	Minimal
	16	PC Variability.	Multiple
	17	Additional Concierge Services.	Minimal
	18	Anomaly Resolution.	Minimal
	19	Design-time Assistance for Improved CA.	Unknown / None
	20	Maneuver Trade Space.	Minimal
	21	Optimized Maneuver Recommendations.	Minimal
	22	Breakup Detection, Tracking, and Cataloguing.	Multiple
	23	Maneuver Detection and Processing.	Multiple

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

   Booz Allen believes a core service capability, underlying a number of included and not-included services in Table 4, is needed in addition to a high-fidelity atmospheric drag model with the ability to forecast change conditions that affect space object motions. The atmospheric drag model service must incorporate improved neutral density environment characterization and responses to external space weather effects. This capability is critical to create a reliable space traffic model that can maintain gap-less custody of space objects during and after the occurrence of space weather events. Space weather data also needs to be integrated into NOAA's solution.

   Additionally, it is our understanding that there are gaps in the DoD's current system and its detection of smaller objects in space, with a significant amount of debris that is not tracked under 5cm. However, there are a myriad of commercial resources that can track individual objects down to 2cm using a series of optical telescopes and radars.

   We recommend NOAA select an integrator who can effectively integrate high fidelity atmospheric drag models with these tracking resources into one platform. Combining these models, commercial data sources, and the data provided from the SSN could cover a significant gap in tracking debris and dramatically reduce the loss of custody of space objects.

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?***

   Booz Allen believes the basic services and capabilities outlined within the RFI are sufficient. We urge NOAA to focus on the efficacy of the manner in which these services are provided. As outlined in section 3, a trusted integrator utilizing a modular platform that incorporates existing data services can ensure timely and accurate collection and synthesizing of critical data needed for NOAA to effectively meet its STM mission.

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?***

   These assessments should be occurring in near-real time with real time notices and communication. Once data is collected, modelling the data, and incorporating AI/ML, can enable the assessments to be conducted and communicated as expediently as possible. AI can be used for higher quality data and products supporting the STM mission as well as to automate conjunction notices and spacecraft to spacecraft awareness of conjunctions. Rapid dissemination of critical warnings and alerts should be automated with quality or reliability scoring on probability of occurrence. Affected owners and operators (O/O) should be expected to respond to these advisories to reduce or eliminate risks to themselves and others.

Impacts of Proposed Basic SSA Safety Services

1. ***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?***

   Yes, these services are available at a cost to the commercial industry today. There is the lack of an open architecture platform and data repository leading to gaps in completeness of data, availability, and ability to use data to model the entire commercial space. Additionally, the cost of these commercial services can be significant. Booz Allen is concerned with NOAA's ability to offer the SSA safety services outlined in the RFI for free when the current commercial business model would not be sustainable if provided without additional forms of funding or a subscription-based service.

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

   Current DoD SDA software is not keeping pace with modern approaches in modularity and impacts SSA service providers and users by providing delayed data and notification. We recommend that instead of building on current architecture, a newly designed modern architecture should be created by NOAA.

   Many of the current DoD SDA solutions have significant technical debt due to the original architecture being decades old and based on stove-piped legacy code and server-based infrastructure. The database of the current SDA capability was historically part of the same system (referred to as Stovepiped solution) embedded with the application and platform, however it is currently undergoing a transformation of hosting the Desktop as a Solution (DaaS) solution in a cloud based, modular, extensible infrastructure independent of the SDA mission capability infrastructure. The current SDA capability is delivered primarily on the SECRET enclave; however, the SDA applications support CUI, SECRET, SECRET/ releasable (REL) and TS/SCI operators. Our understanding is that USSF/USSPACECOM have determined that NOAA OSC has the responsibility to service the commercial owner/operator community.

3. ***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?***

   Yes, basic offerings will overlap with services currently for sale in the commercial marketplace to individual users/companies. Offering these basic services for free will disrupt the commercial space sales industry that has grown significantly over the last two decades. Given NOAA's desire not to disrupt the growing commercial marketplace, we recommend reconsidering this part of the business strategy and delivery model. We recommend a tiered level subscription model as an alternative for commercial service providers to have the ability to achieve sales goals while promoting innovation of increased capability.

   The disruption would be particularly felt due to NOAA contracting data rights and commercial services at the federal level for an integrated TraCCS solution distributed globally and providing these services for free, whereas today each service provider sells each service and data individually to multiple users. Procuring data and services through an integrated TraCSS offering will reduce the

point-to-point commercial sales direct to users. We believe having an integrated TraCCS solution is the right approach; commercial services will need to account for the approach and negotiate data and services with NOAA as well as offer increased solutions within the TraCCS offering (tiered levels) to achieve their sales goals. However, we do not believe the safety services would overlap as these were not developed by commercial providers for the purpose of human safety.

4. ***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

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

   These commercial providers will continue to use their resources and funding for pay services. Thus, if it is determined through increased studies that NOAA prefers to purchase/redistribute commercial services there will be a disruption from the market and commercial companies will charge/need to be recouped.

   In addition to commercial companies, there are military and international sources of information. The SSN network is understood, and information is sent to spacetrack.org for all space users but processing of that information to define risk and actions are left to the civil/commercial users. International space data sources need to be evaluated to determine if any gaps in observances can be filled.

Tenets of Participation

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

   As shown in Figure 1 raw data and basic services currently provided are publicly available and should continue to be publicly available. Additional services delivered in a comprehensive manner via an automated, intuitive system delivering low-latency customer-facing information, such as SSA advisory and warning information, and recommended courses of action, should be fee-based.

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

   To ensure operational safety, we recommend that spacecraft ephemerides and any changes in state to its orbital dynamics (e.g., maneuvering, reboost, change in drag affecting orbit dynamics, etc.) are included. Additionally, any planned maneuvers must be provided so that forecasting of conflict may be obtained.

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

   As with any complex system, NOAA should work to develop terms of use and what happens if terms of use are broken. O/Os should have a time limit (e.g., "within 24 hours") within which any change in state vector, anticipated maneuvers, any impacts to critical systems affecting an ability to maneuver must be reported in a manner defined by OSC. Additionally, there needs to be a determination of liability for the data providers and NOAA should considering building legal limited liability into the terms of use and participation agreements.

4. ***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?***

   Any action or lack of action violating the tenets of participation will result in potential denial of continued participation.

General Feedback

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?***

   Please see sections 2 and 3 for our additional recommendations and feedback.

4 CLOSING SUMMARY

Booz Allen thanks NOAA for the opportunity to provide feedback and recommendations on the future of Space Traffic Management. We look forward to continued dialogue throughout the finalization of these requirements to further understand the NOAA intent for TraCSS implementation. Our recommendations in this RFI response reflect our deep mission knowledge and experience in Space Domain Awareness and our technical solutions meeting the NOAA TraCSS anticipated requirements.

About Booz Allen

For more than 100 years, business, government, and military leaders have turned to Booz Allen Hamilton to solve their most complex problems. As a consulting firm with experts in analytics, digital, engineering, and cyber, we help organizations transform. To learn more, visit BoozAllen.com.