# Request for Information (RFI)

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## EXECUTIVE SUMMARY

KBR stands ready to assist the Office of Space Commerce (OSC) in the development, integration, and execution of the OSC basic safety service and the Traffic Management System for Space (TraCSS) program. As the lead integrator for the DoD's Joint Task Force Space Defense (JTF-SD) Commercial Operations (JCO) organization, KBR has a distinct vision for how OSC should organize, contract, and execute the delivery of Space Traffic Management (STM) services. KBR believes that the JCO construct provides an important baseline for OSC to use in the initial phase of STM service standup. Incorporation of commercially provided SDA data, in conjunction with existing DoD and other government data, is a key element for the delivery of STM services. KBR recommends that OSC builds out TraCSS with technical and contracting approaches that allow for a healthy SDA marketplace, while providing a discrete set of basic services for free to satellite owner/operators (O/Os). If done correctly, OSC's basic safety service will enable the DOD to offload STM responsibilities and capabilities, establish norms of space operations like maneuver planning and execution, and provide a globally sustainable space environment for the future.

The fundamental concern with offering basic safety services is how to provide free government services while creating a robust and competitive marketplace for those same or related products and services. Two fundamental questions must be answered: 1) What information is contained within the system (i.e. within TraCSS) and how is it accessed and distributed to different groups? 2) How should OSC organize and acquire data and information in order to provide basic safety services? We offer a recommendation for the first question within our response to question C1 below. The second question can be addressed by analyzing different models ranging from a centralized OSC operations center to a decentralized licensed provider model. The models present different costs and impacts to the state of the market and industry's ability to sell and resell products and services among the different government and industry customers. KBR stands ready to assist OSC with this analysis based on our deep experience in STM, the JCO, and success within the recent OSC GEO pilot; we welcome follow-on discussions with OSC on this topic.

This initial phase offering basic safety services should focus on the development of the TraCSS program and the integration of various data, information, products and services. In this initial effort OSC should seek to maximize the use of existing USG data and information and augment it with purchased commercial data and information. OSC will need to determine whether to contract with commercial SDA service providers for services or integrated personnel support, or OSC could consider a decentralized approach such as licensing providers and paying them to provide Basic Services to O/Os. The choice should facilitate later phases of STM into more advanced and routine services not listed in the preliminary proposed list.

KBR offers responses to the RFI questions below and offers additional recommendations to successfully implement an initial basic safety service. We look forward to continued dialog and support to this important effort.

## A. 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 list of Basic SSA Services appears to provide most of the essential services to enable spaceflight safety by U.S. Owner/Operators (O/Os). However, it appears not all of the USSPACECOM Advanced Services (available for free with an SSA Sharing agreement) will be provided as OSC Basic Services. We recommend the OSC Basic Services offer the existing USSPACECOM SSA Sharing services, with some limited to emergency situations. The USSPACECOM SSA Sharing services for Anomaly Resolution, End-of-Life/Disposal, and Electro Magnetic Interference (EMI) Investigation (see Figure 1 below) should be offered and limited to emergency situations that present urgent hazards to other satellites (e.g., monitoring an uncontrolled drifting satellite, investigating EMI that negates commanding a satellite, or screening to support optimal disposal orbit). Additionally, the SSA Sharing agreement offers Early Orbit Determination which is described as "by confirming Space Surveillance Network tasking and providing two-line element sets of the objects." This task should be addressed within Service 3) Routine Collision Assessment and Service and 6) Launch Collision Avoidance, by rapidly adding orbital information to TraCSS to facilitate surveillance of these new objects.
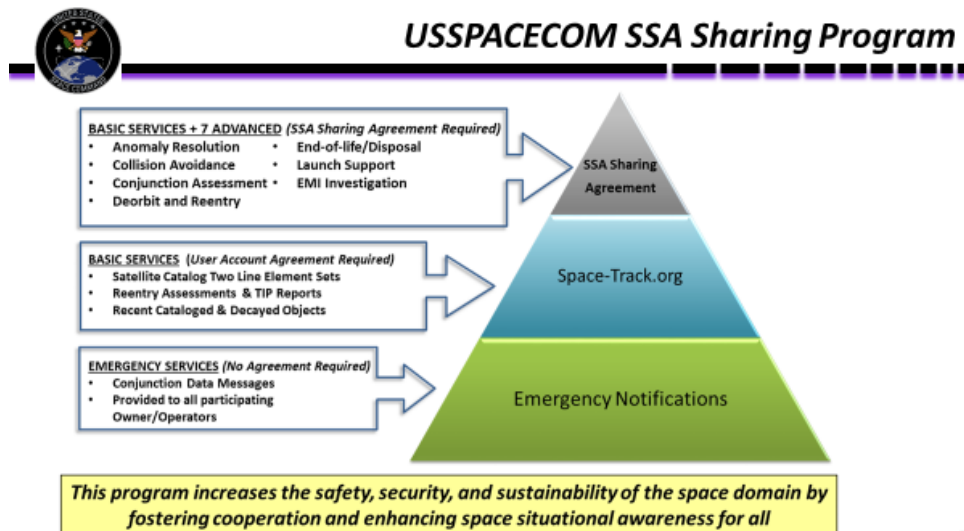


Figure 1: USSPACECOM's SSA Sharing Services and Tiers

2. **What proposed basic safety SSA services are essential to your ongoing operations? If the U.S. Government were to prioritize the delivery of individual services as part of TraCSS, which ones should be provided soonest?**

   KBR supports the technical integration, coordination and execution of JCO commercial SDA activities for the DOD. KBR is also an SDA services provider, producing high-fidelity analysis and input for a majority of the basic services and other advanced SDA services

through the use of KBR developed software applications (e.g. Space Domain Characterization and Control System (SDCCS), Iron Stallion, Web Waterfall, SatXzibit). To do that work, the critical capability needed is not necessarily receiving the products from the proposed Basic Services, but accessing the TraCSS content. KBR requires access to a comprehensive satellite catalog and O/O ephemeris; access to maneuver, launch or other planned activity parameters; and information on capabilities and events such as satellite capabilities, reentries, and weather that affects KBR's analyses which are conducted.

3. **WHAT, IF ANY, ADDITIONAL CAPABILITIES BEYOND THOSE CURRENTLY PROVIDED BY THE DOD SHOULD BE INCLUDED IN THE TRACSS?**

TraCSS should include O/O ephemeris to support highly accurate assessments by commercial industry partners offering SSA services. We recommend adjusting the Basic SSA Service "(2) Receipt and Sharing of Predictions O/Os Ephemerides" to allow broader industry access to O/O ephemerides. The current description limits O/O ephemerides to other O/Os only: "To receive predicted ephemerides from O/Os, store them in a manner that makes them <u>available for download by other interested O/Os.</u>" Companies offering orbital analytics services should have access to the O/O ephemerides to generate highly accurate assessments.

The highest priority for individual Basic Services should be those services that are required to enable safe spaceflight:
- (3) Routine Collision Assessment (CA) Screening and Conjunction Data Message (CDM) Production
- (6) Launch Collision Avoidance (COLA) Screenings
- (8) Re-entry Management and Assessment
- While not a listed service, another priority should be the development of the TraCSS satellite catalog that will be publicly available and would consist of merged or organized information from multiple sources such as the DoD satellite catalog, state vectors, and O/O ephemeris. The TraCSS database needs to be publicly accessible and should support SDA industry innovative efforts and O/O space operations.

The JCO offers examples of additional information to reside in TraCSS. Public Satellite Research Analysis (PSRA) products would provide notices and indications of ongoing and upcoming events. PSRA information is publicly available information from feeds, news sites, amateurs, and other sources that may or may not be credible or accurate but do provide insights and indications that could be verified by other means. Additionally, TraCSS could provide data quality, metrics and statistics that could identify system problems such as outages, latencies, or missing data that would alert participants to problems. The addition of PSRA information should not have negative impacts on industry. Quality assessments, metrics or outages should be addressed carefully, as industry reputations may be impacted.

4. **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?**

Anomaly Resolution, End-of-Life/Disposal, and EMI investigation services in the event of emergency situations that present collision hazards to other satellites could be offered (e.g., monitoring an uncontrolled drifting satellite, investigating EMI that negates commanding a satellite, or screening to support optimal disposal orbit). Limiting service to emergency situations supports spaceflight safety, while leaving industry to offer broader, more advanced analytical services that support an O/O's need to develop and execute their anomaly resolution and end-of-life plans. Making a distinction between emergency and routine situations allows industry to market routine services, and it sets the O/O expectations on when they will receive OSC basic services and when they would need to seek to provide or acquire these services themselves for routine use.

5. **WHERE APPLICABLE, AT WHAT LEVEL OR HOW OFTEN SHOULD THE SERVICE BE PERFORMED?**

The limited Anomaly Resolution, End-of-Life/Disposal and EMI Investigation services could be performed as needed, when an O/O requests service or when a hazardous situation is identified.

6. **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?**

As a services vendor we can achieve higher frequency of products and services than a potential government provider. However, higher frequency products and services is only valuable to an OSC center and O/Os if they know what to do with that much data (especially changing data) or are able to continually assess updates as they arrive.

## B. IMPACTS OF PROPOSED BASIC SSA SAFETY SERVICES ON COMMERCIAL SSA PROVIDERS

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, KBR has the capability to provide high-fidelity analysis and input for a majority of the 14 proposed Basic Services using our software applications (e.g. Iron Stallion). KBR would be interested in discussions regarding that capability and options including hosting KBR analytical micro-services like Iron Stallion on OSC platforms, providing contracted services, or other options that build off our successful participation in the GEO Pilot program. KBR was able to apply lessons learned and continuously mature KBR capabilities offerings via core tenancy in both the JCO and GEO Pilot, providing significant impact and way forward to both enterprises.

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?**

No. KBR developed our SSA capabilities within the DOD SSA Sharing program and created products and services around those offerings.

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?**

The answer to this question depends on how different groups are able to access TraCSS content. In Question C1 we offer a recommendation for access groupings within TraCSS. KBR proposes the following four categories of SDA service providers for consideration, and suggests the following impacts would result from the OSC proposed list of free Basic Services:

a. Reference Services Providers: OSC will purchase products and services (e.g., satellite, bus and capability information), input them into TraCSS, and use them to enable the provision of Basic Services. The Reference Services and products will be shared at some level. OSC purchases will support those providers, while sharing the products and services will reduce the marketability of those services to others. In this initial OSC phase focused on a basic safety service, the OSC should seek to purchase the minimum information needed to augment USG data and to perform the 14 Basic Services and should make them available to approved SDA services providers. Most of this information should be available from O/Os as a condition of participation, while some information may need to be purchased, such as information on non-US licensed objects.

b. Surveillance Services Providers: OSC will purchase products and services (e.g., select satellite observation that provides expanded information to support Basic Services), input them into TraCSS, and use them to enable the provision of Basic Services. The Surveillance Services and products will be shared at some level. OSC purchases will

directly support those providers, while sharing the products and services will reduce the marketability of those services to others. One way to reduce impacts to Surveillance Service Providers would be to utilize the DOD catalog and purchase a limited set of satellite observations necessary to support accurate conjunction assessments, while leaving O/Os to purchase additional observations to support their subsequent maneuver planning. In this initial OSC phase focused on a basic safety service, the OSC should seek to purchase the minimum set of commercial satellite observations needed to augment USG data and to perform the 14 Basic Services and should make them available to approved SDA services providers. In later phases, the OSC could assess purchasing additional observations that would be needed to support the Basic Services that are on the list marked as Not Included.

c. <u>Basic Services Providers</u>: KBR would be in this category. These providers would perform the tasks required for the 14 Basic Services, whether as contracted support to an OSC Operations Center, or contracted or licensed to provide these services to O/Os. This is the group most impacted by the OSC proposal. If OSC contracts with Basic Service providers, those companies will likely have a single customer in the OSC, since the OSC will be delivering those products for free to US civil and private O/Os. Basic Services providers may or may not market to customers who are not involved in the OSC space traffic management program such as foreign governments and foreign owner-operators. Basic Service providers who are not contracted for support to OSC will have limited customers within the US. OSC will need to contract for support to perform these Basic Services, and options range from contractor support within an OSC operations center, to paying licensed SDA services providers to work directly with O/Os, to a JCO-like model where OSC runs an operations center with contracted SDA service provider teams.

d. <u>Advanced Analytics Services Providers</u>: KBR is currently in this category. This group provides routine and emergency analytical services such as maneuver planning, refining predictions, or creating visualizations and models. This group is least impacted, as long as OSC limits the list of free Basic Services to those services necessary to support spaceflight safety and does not expand beyond the services provided by the ongoing USSPACECOM SSA Sharing program. Advanced Analytics Services providers have already developed diverse products and services from experience with the SSA Sharing program and would likely easily adapt to OSC's modifications. OSC would not contract for these services but would instead encourage O/Os to contract for these advanced analytical services to support routine operations.

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. KBR is not a spacecraft owner/operator.

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**5. ARE THERE UNIQUE ADVANTAGES TO THE GOVERNMENT PURCHASING AND REDISTRIBUTING CERTAIN COMMERCIAL SERVICES RATHER THAN LEAVING THESE TO THE COMMERCIAL MARKETPLACE?**

A government STM system could be a well-controlled and centralized system that is constantly monitored and validated by multiple entities for accuracy, trustworthiness and completeness. A commercially run system would not be as open to such external auditing and inspection activities and would likely resist reporting on its performance and trustworthiness. A commercially run system could evolve faster and provide innovative services more quickly but could be hindered by competing companies working within the same system.

The JCO and AFRL's DRAGON Army development branch experience offers several tenets that could be applied to the OSC initial effort, as both efforts involve government management of commercial operations. The tenets learned within the JCO are:
- Government-run operations (e.g., Government leads)
- Independent and dynamic data monitoring
- Potential utility and strengths of having a military data baseline or access
- Limit sole-source or vendor lock situations where data quality, availability, and price allow
- Develop a government baseline and standards that can easily integrate a wide range of commercial services

## C. TENETS OF PARTICIPATION AND RECEIPT OF BASIC SSA SAFETY SERVICES

**1. WHICH BASIC SSA SAFETY SERVICES IDENTIFIED FOR INCLUSION IN TRACSS SHOULD BE MADE PUBLICLY AVAILABLE?**

The content and access for TraCSS should be more clearly defined to enable industry impact assessment. After reviewing the OSC documentation, the proposed Basic Services, and sharing tiers for USSPACECOM's SSA Sharing program (see Figure 1), we recommend categorizing SDA services and organizing TraCSS to facilitate a common framework. The OSC program will provide free <u>Basic Services</u> that are being defined here, while industry SDA providers will market <u>Reference Services</u> (satellite, bus and capability information), <u>Surveillance Services</u> (observations of satellites) and <u>Advanced Analytics Services</u> (routine and urgent analytical services such as maneuver planning, refining predictions, or creating visualizations and models). Some companies may provide multiple categories of services.

The challenge for a government STM system is how to provide enough information and services to enable operators to safely conduct space operations, while offering paid advanced information and services to foster a competitive commercial SDA industry that can sell and resell products and services outside of that STM system. Given that challenge, OSC should seek to 1) maximize the use of existing government information, 2) purchase the minimum Reference and Surveillance Services and 3) limit the list of free Basic Services to those services required to enable safe spaceflight. This information should reside within TraCSS with distinct access tiers so industry can sell and resell some of that information to others. Figure 2 depicts a proposal for TraCSS content and who may access it. Figure 3 depicts the different service provider groups and how they would be contracted to provide products and services. The figure shows general relationships and opportunity for contracted products and services. The final OSC organizational model would affect the realistic opportunities for selling and reselling products and services. As mentioned in our response to Question B3, the Basic Services Providers would be most affected by the contractual relationship structure, while the Reference and Surveillance Providers would be impacted by how their products are shared once in TraCSS. The Advanced Analytics Service Providers need access to information in TraCSS to perform the advanced analytical services for O/Os which are not part of the 14 proposed Basic Services.
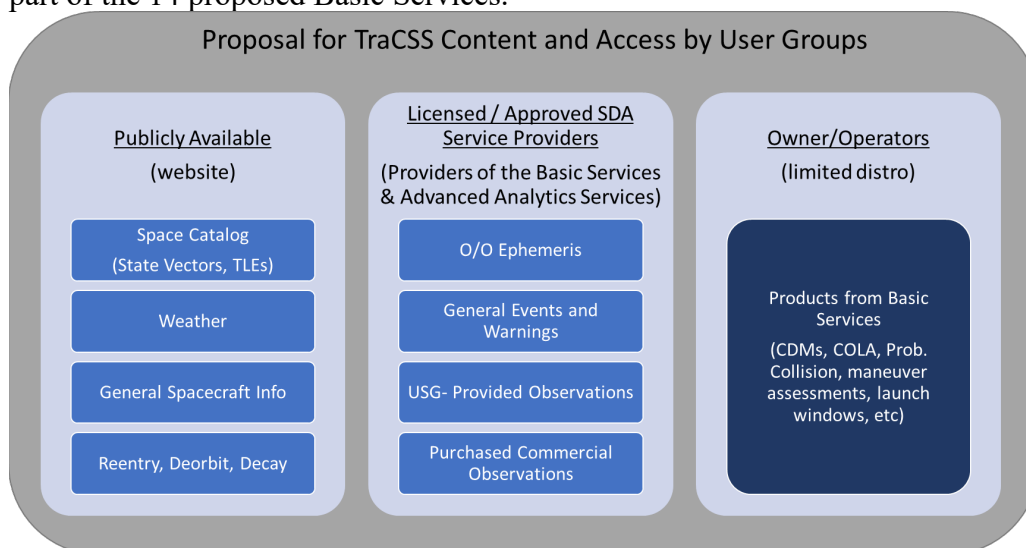


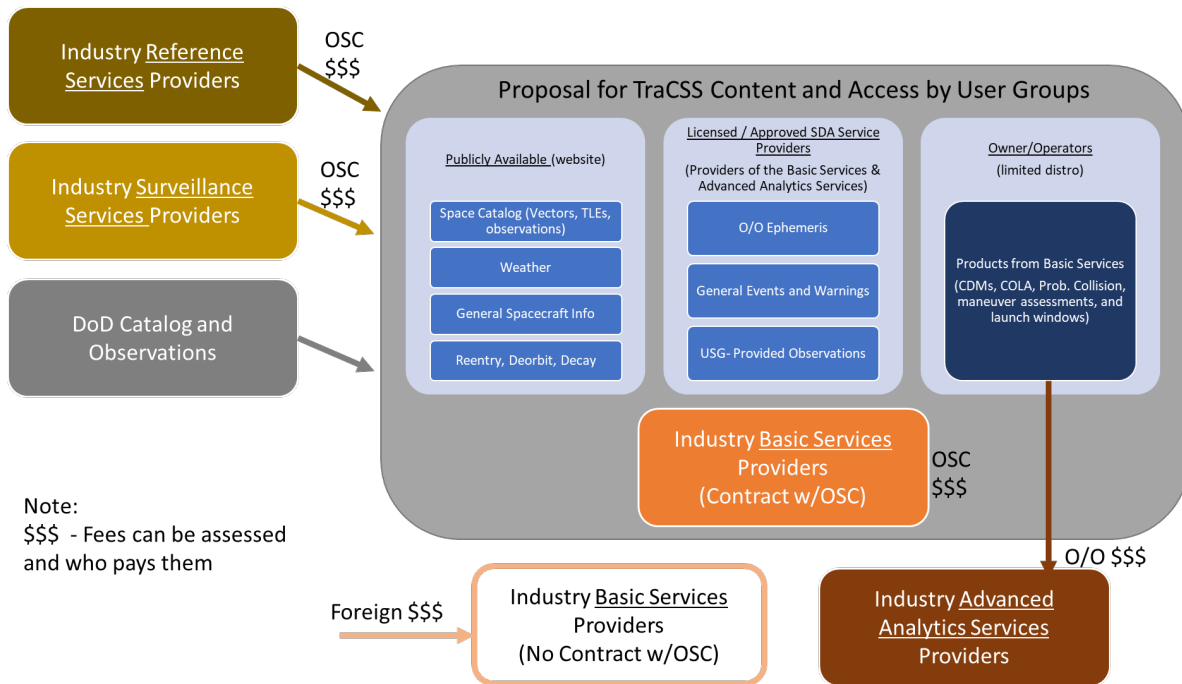*Figure 2. KBR Proposal for TraCSS Content and Accessibility by SDA Provider Groups*

*Figure 3. SDA Provider Groupings and Relationships within OSC's Basic Safety Service*

2. **WHAT, IF ANY, INFORMATION SHOULD OWNERS AND OPERATORS OF SPACECRAFT BE REQUIRED TO PROVIDE TO OSC TO PARTICIPATE IN TRACSS?**
   Owners and operators should provide the following information as a minimum, as this set includes information necessary for the provision of Basic Services and additional information necessary to enable the broader STM proposal as presented here and per the above KBR recommendation:
   - O/O ephemerides that enables Basic Service (2) Receipt and Sharing of Predictions O/Os Ephemerides; and (7) O/O Ephemeris Generation and Curation with Covariance
   - Maneuver Plans that enable Basic Service (4) Special CA Screening and CDM Production
   - Reentry/Deorbit/Disposal Plans that enable Basic Service (4) Special CA Screening and CDM Production; and (8) Re-entry Management and Assessment
   - Launch plans to enable Basic Service (6) Launch Collision Avoidance
   - Satellite reference information that supports Basic Service (1) Satellite Attributes, Capabilities, Status, and Point of Contact
   - List of SDA service providers contracted for Succession Services (or other services) so that OSC may add those SDA service providers to its Licensed/Approved List for TraCSS access
   - Information to support surveillance such as beacons, RF frequencies that enable Passive RF surveillance, etc
   - Status of Satellites that enables minimal understanding of satellite health and its maneuverability (e.g., does it have the ability to maneuver to avoid a collision)

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3. **WHAT, IF ANY, ACTIONS SHOULD OWNERS AND OPERATORS AGREE TO TAKE TO PARTICIPATE IN TRACSS AS PART OF THE TENETS OF PARTICIPATION?**

O/O should be active participants in the program, and should commit to safety, stability, and security of spaceflight operations.  O/Os should:
- Commit to spaceflight safety and accepted guidelines (e.g., avoid harmful interference, debris mitigation)
- Support and implement USG norms of behavior as they're developed (e.g., DOD 2021 "Tenets of Responsible Behavior in Space")
- Utilize/Implement Succession Services, whether in-house or contracted to an SDA services provider (e.g., orbital analytics that enable responsible space operations)
- Provide information in the formats and/or frames requested by OSC (e.g. O/O ephemeris), and to the desired location, on a Machine-to-Machine level.
- Pre-produce maneuver plans in the form of ephemerides
- Participate in the development of risk management frameworks for collision mitigation and notify OSC of all actionable events (maneuvers, etc)
- Participate in OSC's development of standards (e.g., messages, data, reports) and best practices
- Report interference and environmental hazards
- Provide multiple personnel and operations center points of contact, with redundant paths and protocols for effective communications

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?**

OSC would have several ways to encourage improved participation but should continue to provide services and information to any affected O/Os during an urgent spaceflight safety situation.  OSC could:
- Withhold those affected services that require the missing information (incomplete COLA or Launch screening services)
- Notify the O/O that products are available for use, contingent upon the release of participant information
- Notify the O/O of intent to limit TraCSS access for O/O and SDA service provider data sets (see above graphic for KBR-proposed Content and User Group access)