Request for Information on Commercial Capabilities in Space Situational Awareness Data and Space Traffic Management Services

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INTRODUCTION

The Association of Space Explorers (ASE) is an international nonprofit professional and educational organization of over 400 flown astronauts and cosmonauts from 38 nations. Membership in ASE is open to individuals who have completed at least one orbit of the Earth in a spacecraft.

ASE member countries include Afghanistan, Austria, Belgium, Brazil, Bulgaria, Canada, China, Costa Rica, Cuba, Czech Republic, Denmark, France, Germany, Hungary, India, Israel, Italy, Japan, Kazakhstan, Malaysia, Mexico, Mongolia, Netherlands, Poland, Romania, Russia, Saudi Arabia, Slovakia, South Africa, South Korea, Spain, Sweden, Switzerland, Syria, Ukraine, United Kingdom, United States and Vietnam.

ASE fully supports activities aimed at making operations in earth orbit safe, efficient, and collegial. ASE supports this effort by the U.S. Department of Commerce (Department), via the Office of Space Commerce to seek "information from interested parties on: Specific capabilities commercial entities might currently and in the future provide through an open architecture data repository to the public to enhance the space situational awareness (SSA) data and the space traffic management (STM) services the U.S. government currently provides; SSA, STM, and orbital debris mitigation best practices; and perspectives on the appropriate regulatory structures the Department should adopt to drive the development and responsible use of such SSA and STM enhancements in order to protect national interests and further encourage U.S. commercial space investment."

Resistance by the Intelligence Community (IC) to include basic orbital information for their assets in a collective catalog is myopic. There are plenty of other government, commercial, and private telescopes capable of observing their spacecraft on a daily basis. To pretend IC assets are somehow invisible to the rest of the world is unrealistic.

Addressing all of these challenges will require a well thought out, coordinated, and structured program.

OVERVIEW OF COMMENTS

The Association of Space Explorers through its members has been actively involved in Space Traffic Management (STM) and orbital debris for some time. ASE agrees with Presidential Space Policy Directive 3 (SPD-3) which states:

"(b) Space Traffic Management shall mean the planning, coordination, and on-orbit synchronization of activities to enhance the safety, stability, and sustainability of operations in the space environment."

"(d) A STM framework consisting of best practices, technical guidelines, safety standards, behavioral norms, pre-launch risk assessments, and on-orbit collision avoidance services is essential to preserve the space operational environment."

In October 2017 ASE members supported the development of an AIAA Institute Position Paper on Space Traffic Management (STM): "Balancing Safety, Innovation, and Growth." The Executive Summary of this paper which is included with these ASE comments states "the safety of all space operations today and the assurance of a usable space environment for generations to come depends on how well we can design and perform effective Space Traffic Management (STM). While the problem is international in scope, paradigms established in the US will help inform and create a starting point for dialog with the global community regarding the institution of an approach satisfying the needs of all space-faring nations." The AIAA paper states a "framework is suggested by the AIAA to begin to address some of the more pressing issues related to STM." This AIAA framework enumerates five areas vital to the development of a viable STM&OD program:

- Organizational Oversight
- Collision Avoidance & Data Sharing
- Debris Mitigation
- Behavior Guidelines/Code of Conduct
- Comprehensive Communications Strategy

In addition, in March 2019 ASE provided comments in response to a Federal Communications Commission NPRM titled "Mitigation of Orbital Debris in the New Space Age" which is included with these ASE comments and addressed the following STM&OD topics:

- A Central Controlling Authority
- Tracking Devices
- Spacecraft and Object Categorization
- Spacecraft Ownership
- Flight Rules (Operational Rules)
- Mission Planning
- Launch
- On Orbit
- Vehicle Retirement/Deorbit
- Liability
- Orbital Debris Ownership
- Observation Frequency
- Periodic Conjunction Studies
- Unique Entities
- Size of the Object Catalog
- Conjunction Studies
- Management Oversight
- Size of the STM Domain
- Financial Impacts
- International Applicability

The STM&OD framework suggested by the AIAA Institute Position Paper on Space Traffic Management (STM): "Balancing Safety, Innovation, and Growth", and ASE's comments provided to the Federal Communications Commission NPRM titled "Mitigation of Orbital Debris in the New Space Age" are appropriate in response to the Department of Commerce Request for Information on "Commercial Capabilities in Space Situational Awareness Data and Space Traffic Management Services."

STRUCTURE OF ASE COMMENTS

Each of the specific requests for information are listed below with an ASE Comment, reference to the AIAA Institute Position Paper titled "Space Traffic Management (STM): Balancing Safety, Innovation, and Growth", or to ASE's Comments provided in response to the Federal Communications Commission NPRM titled "Mitigation of Orbital Debris in the New Space Age".

Before responding to each of these requests, it is important to restate the need for a solid framework on which to build a STM&OD Program. Without any one piece of the framework, the entire program will fail.

- If one is collecting good observation data, but there is no mechanism to validate its utility, it has little value.
- If one knows the position of all objects in earth orbit, but doesn't have the ability to calculate conjunctions, the data is of little value.
- If ones knows when potential conjunctions will occur, but doesn't have the ability to communicate warnings in a timely manner to the parties involved, it is of little value.
- If two parties are advised of a potential conjunction, but they are under no obligation to alter their orbits, what good is the information?

Coordinating, managing, and enforcing the rules, policies, procedures, and protocols of an STM&OD program will require strong management from the very beginning. ASE encourages the federal government to select one office to lead this effort and empower them with all of the tools and resources they will need to get the job done.

ASE FCC Comment #1: A Central Controlling Authority

"A Space Traffic Management and orbital debris program will require a Central Controlling Authority to coordinate and regulate all associated interrelated activities."

ASE encourages the Department of Commerce and the White House to work with the Congress to resolve the long-term issue of oversight authority as quickly as possible as the matter is becoming urgent.

AIAA Institute Position Paper: "Space Traffic Management (STM): Balancing Safety, Innovation, and Growth"

“Oversight Organization or Body: The key to a sustainable, stable, and successful STM approach is the identification of a responsible body or organization for monitoring, oversight, and enforcement. Doing so would provide a clear centralized location for coordination with industry and other entities, rather than having different functional elements of a space tracking management system spread across different organizations. For the near term, as a structured solution to this challenge is developed, responsibility should fall to the Federal Aviation Authority (FAA), so that the DoD may focus its attention on national security issues in space. In order for the FAA to be successful in this regard, they will require:

1. **Legislative Authority:** Congress needs to act immediately to make the FAA the lead government agency to perform these functions for Civil and Commercial satellites. Military agencies must be collaborative partners in assisting the development and transfer of STM capabilities to the FAA.

2. **Adequate Funding:** The development of a reliable STM system will require suitable and sustainable funding. Marginal or inadequate funding will delay development raising the risk of a significant accident.

3. **Immunity for Liability of Actions:** The FAA should not be legally liable for any outcomes or events resulting from the execution of their assigned duties.

4. **Program Plan:** A detailed program plan must be developed that outlines a vision for STM and operationalizes an approach that includes not only the development of activities, schedules, and funds, but also the interagency agreements needed to move STM forward.

5. **Coordination with International/Industry Partners:** The development of any STM program should not be conducted in a vacuum. The United Nations and other foreign governments, along with the global space industry, should be made aware of the efforts of the US and FAA and invited to comment and make suggestions on ways to improve upon their proposals.

6. **Arrangements to attain sensor information:** The STM program hinges on the ability to see RSOs using a multitude of sensors. As such, the FAA should have a robust program to attain sensor information (if not data) from both government and commercial sources. This would include cooperative requests for additional sensor taskings in the event of a pending collision and/or a post-collision incident.

7. **International Coordination:** At the same time that the U.S. community works to develop an initial framework for STM, appropriate discussions with the international space community must be included in the effort to support an eventual transition to an international program.”

A. Commercial Enhanced SSA/STM Capabilities

(1) In the context of SPD-3,[14] *what specific capabilities could commercial entities currently provide through an open architecture data repository to enhance the limited STM services and SSA data the U.S. government provides to the public? These capabilities can include, but are not limited to, developments in sensing, analytics, visualization, data sharing, and data management. How will those commercial capabilities, servicing both government-sponsored and non-government-sponsored*

activities change in the next 10 years, and what emerging commercial capabilities will develop in that time?

(2) What attributes of an open architecture STM/SSA data repository are essential to providing accurate data to mitigate risk of collision and enable SSA and STM services?

(3) What service-oriented open architecture data repository models and examples should guide the Department as it develops the open architecture SSA/STM data repository? These models and examples should highlight maximum use and exploration across sensitive, multidimensional data sources and tools while protecting any sensitivity of these data.

(4) What STM-related incentives, such as regulatory approaches to orbital debris mitigation, will encourage industry to make America their flag of choice for commercial space activities?

(6) What actions will strengthen partnerships in effective development of SSA and STM services?

AIAA Institute Position Paper: "Space Traffic Management (STM): Balancing Safety, Innovation, and Growth"

"Several technical steps are required to develop a comprehensive, effective collision avoidance program:

1. Accurate observational methodologies and modeling techniques are imperative to understanding, tracking, and predicting the orbits of all satellites and significant debris. Currently, scientific taxonomy does not exist to accurately describe and uniquely identify orbiting objects. Unfortunately, all of these objects are modeled as simple spheres, reducing the accuracy and utility of orbital trajectory determination used to predict potential collisions. Simple geometric approximations of objects in a densely populated orbital environment are not adequate to support collision avoidance strategies; modeling techniques must be improved beyond simple spherical geometries.

2. More sophisticated modeling techniques must be accompanied by additional observational data (telescopes, radars, lasers). A database of all available sensors, as well as the identification of new sensor systems required to create more accurate databases for Resident Space Objects (RSOs) should be created.

3. Increasing numbers of sensors surveilling space objects, and pooling of observational data is necessary to increase the frequency and numbers of observations needed to monitor the growing population of satellites and debris in earth orbit. Decreasing dependency on DoD

sources without excluding releasable information can make sharing easier and broaden non-DoD participation in official space object tracking, without introducing unmanageable additional risk. This will require a central entity to collect all observational data, ensure its accuracy, and create the “Data Lake” suggested by Dr. Jah7. With more accurate and timely orbital information and better propagation models, spurious conjunction warnings can be reduced.

4. Once advanced modeling techniques are combined with sufficient observational data (data lake), adequate state vectors and information trajectories can be used to develop propagation predictions for orbiting objects. Well-developed propagation models can be used to predict potential conjunctions, even before new spacecraft are launched. For preflight analyses, simple orbital information (RA, Dec, inclination, etc.) can be used to identify obvious conflicts. This would prevent placing satellites into occupied orbits. Shortly before launch, more detailed and current data could be used to identify specific conjunctions to coordinate both launches and orbital insertions. Once in orbit, more sophisticated methods will be required. The challenge is building adequate propagation models to provide actionable data in advance to support decision making (e.g. for satellite orbit insertion or collision avoidance maneuvers). Consequently, the baseline assumptions and error margins of the prediction models have to be well understood and documented throughout the community. Standardization and agreement on assumptions, uncertainties in data, and confidence levels in analytical methodologies are crucial to building assurance in any conjunction warning system or decision making algorithms.

5. In order for a STM system to remain relevant and useful for adequate space situational awareness, the catalog of debris objects needs to be continually updated with all sources of information, (e.g. sensor systems, analytical methods, responsible individuals or companies, etc.). An agreed to list of the type and scope of data on each object necessary for a functional catalog should be established.

6. A collision avoidance function should issue alerts and warnings with sufficient lead time, and realistic measures of uncertainty, for operators to further analyze the information and perform a maneuver if needed, within an appropriate reaction time window. The probability of any collision is never based upon knowing the truth, because the truth is never known until after the event happens or not. This is to underscore that the probability of any collision is determined by the analyst’s belief in their current and predicted knowledge of the resident space object population. Collision probabilities will become lower with increased knowledge (reduced uncertainty) of current and predicted locations of resident space objects. In other words, a community-wide pool of both independent and disparate sources of information available to analysts is the single-most important capability that will effectively reduce collision warnings and enable increased actionable knowledge to support decision-making processes. Moreover, additional metrics are needed above and beyond reports of collision probabilities. A collision probability is a scalar value that in no way provides insight into the type, quality, or quantity of information sources used in deriving it. This is part of the problem. A collision probability of 1e-2 in the absence of any other information could trigger a maneuver, but what if that number was achieved with only a single sensor? Most decision-makers would want at least two independent sources of information to either confirm or refute a given belief or hypothesis. This gets to the heart of orbital safety: deriving and defining

metrics that provide actionable knowledge where actionable implies realistic measures of confidence.

7. There will always be a certain amount of smaller sized debris that cannot be tracked. To harken back to the aviation analogy, small 'bird strikes' of micrometeoroids are inevitable for any spacecraft, but more analysis is required to understand the orbital population and distribution of unwarned damaging objects that cannot be avoided. A better understanding of what constitutes lethal debris along with models that provide insights into risk exposure, can aid space craft developers to better protect high value assets through design options such as shielding. As an extreme example, satellites without appropriate shielding against micrometeoroids for their environment run the risk of mission loss, not to mention also becoming a new debris object.

Data sharing must include cooperation between military and civil agencies. Some classified objects and most classified missions can perhaps remain undisclosed in the future but the conjunction probability of a live (maneuverable) satellite with any object (dead, alive, disclosed, or hidden) must be shared so that if the best solution is to maneuver the acknowledged object to reduce risk and preserve National security, the acknowledged object has a reasonable window of opportunity to succeed and its operator has a reasonable degree of certainty that the unplanned consumption of fuel was warranted. And similarly, should there be civil or commercial objects that a persistent non-military collection enterprise supporting STM sees more accurately or more timely way than a military counterpart, that information must be shared with operators of sensitive military objects. Given the right trust environment, collaborating on assessments, models, and methods can be a distinctive advantage to safety and security."

B. STM, SSA, and Orbital Debris Mitigation Best Practices

(1) *In the context of enhanced SSA/STM data, what best practices, technical guidelines, minimum safety standards, behavioral norms, and orbital deconfliction protocols should be adopted by the United States? Of these, are there any that should only be adopted in the United States if they are also adopted globally? If globally, what is the appropriate forum for such adoption?*

(2) *What pre-launch and on-orbit collision avoidance support services or technologies exist that will mitigate risk of collision, and improve situational awareness, and how should they be incorporated into best practices?*

(3) *What U.S. actions might incentivize global adherence to SSA/STM standards and compliance with space treaty obligations?*

(4) *What research methods for tracking whether international commercial entities are implementing such standards and best practices will assist in facilitating global adoption of a standards set of SSA/STM best practices?*

AIAA Institute Position Paper: "Space Traffic Management (STM): Balancing Safety, Innovation, and Growth"

"Behavior Guidelines (Code of Conduct): A code of conduct defining rules, regulations, treaties, and agreements required to develop a uniform, effective, and safe STM system should be created. Such codes exist in the maritime and aviation domains. Without a common code of behavior, the space community risks operational confusion, potentially leading to increased numbers of collisions, resultant debris, and the loss of utility of entire orbital bands. Developing a code of conduct is a significant undertaking, requiring the participation of all stakeholders. Various components of an effective Code of Conduct include:

1. The Code of Conduct for satellite operators must be tied to timely and actionable orbital information on all objects. The community will need to establish what information is vital to document each object, in order to predict behavior early enough to take actions to avoid collisions.

2. Clear policies and licensing that goes beyond frequencies and GEO slot assignments are essential. For example, policies and procedures that meter sequencing and integration into other orbits would be beneficial.

3. Technical and operational safety standards for highly dynamic activities such as rendezvous, proximity operations, and satellite servicing should be developed to provide a basis for predictable behavior. The recent DARPA program, CONFERS, is an example of such an effort.

4. Documentation establishing what information needs to be shared and exchanged for STM purposes (including incident management) should be agreed on and widely disseminated. In addition, identification and elucidation of the consequences for failure to follow guidelines established is imperative to creating an effective Code of Conduct."

ASE FCC Comment #3: Spacecraft and Object Categorization

"A clear set of definitions are required for all objects in earth orbit. In order to establish a set of guidelines for operations, objects must be categorized so that a set of priorities can be formulated. An initial set of categories would be:

> **Crewed Spacecraft:** An aerospace vehicle containing human beings completing all or part of its mission in earth orbit.
>
> **Active Spacecraft:** A spacecraft operating in earth orbit capable of performing maneuvers to change its orbit. Active spacecraft, crewed and un-crewed, have the ability to use propulsive devices and consumables to effect orbit change. Spacecraft remain classified as "Active" until the ability to perform such maneuvers has been lost either due to mechanical failure or the expenditure of all propulsive consumables.
>
> **Passive Spacecraft**: A spacecraft operating in earth orbit not capable of performing maneuvers to change its orbit. Spacecraft remain in a "Passive" classification as long as

they are determined to be operational. When that functionality is lost (inert objects), they are reclassified as “Space Debris”.

Space Debris: This category includes all inert objects in earth orbit that are both natural and man-made in origin.”

ASE FCC Comment #5: Flight Rules (Operational Rules)

“The purpose of flight rules (operational rules) is to establish a pre-agreed to set of actions to be taken when events occur. Rules are typically based upon a scenario which requires action by one or more parties to avoid an undesirable outcome. Specific rules result from the review and debate of alternative courses of action and are ultimately agreed to by the parties involved. In that way, when a situation does occur time is not wasted reviewing options and debating. Instead action is taken in a timely manner to secure a positive outcome.

What follows are an initial set of flight rules (operational rules) for review and debate. The list is not intended to be complete, but simply to serve as a starting point for a more extensive effort.

General Flight Rules (Operational Rules):

1. Crewed spacecraft have priority over all other vehicles and objects in orbit.
2. Active spacecraft (un-crewed) will maneuver to avoid conjunctions with crewed spacecraft, passive spacecraft, and debris.
3. Active spacecraft will advise the Central Controlling Authority well in advance of any planned maneuvers.
4. If a conjunction is predicted between two active spacecraft, the spacecraft with the longest remaining active lifetime will maneuver.
5. Every effort will be made to notify affected parties at least 72 hours in advance of any predicted conjunctions.”

ASE FCC Comment #8: On Orbit (see complete paper for other flight phases)

“Spacecraft owners are responsible for conducting conjunction studies in association with the Central Controlling Authority to ensure no conflicts will exist during launch, post insertion, and on orbit with their primary payload, any secondary payloads, boosters, or jettisoned hardware. Because spacecraft do not always end up in the orbits intended during mission planning and launch, it is necessary to perform a conjunction study once all payloads reach orbit if a deviation has occurred. Further, conjunction studies will be performed periodically for all objects in earth orbit to verify no conflicts have developed.

If a maneuver is planned for an Active Satellite, that activity will be coordinated with the Central Controlling Authority to verify the maneuver does not result in a conjunction. Once the planned maneuver has been completed, if the resulting orbit is not as expected, a conjunction study will be performed to verify no conflicts were created.

On Orbit Flight Rules (Operational Rules):

1. Spacecraft owners will perform a conjunction study in association with the Central Controlling Authority once their payloads have reached orbit if any of the orbits are different than intended.
2. Spacecraft owners will advise the Central Controlling Authority of any debris placed in orbit as a result of their activities.
3. Spacecraft owners will advise the Central Controlling Authority of any planned maneuvers by their spacecraft well in advance of such activity.
4. Spacecraft owners will perform a conjunction study in association with the Central Controlling Authority before any planned maneuvers are performed to verify that no conflicts will be created.
5. Spacecraft owners will advise the Central Controlling Authority of any change in the functional status of their spacecraft.
6. Crewed spacecraft will have priority over all other vehicles and objects in orbit.
7. Active spacecraft will maneuver to avoid conjunctions with passive spacecraft and debris.
8. If a conjunction is predicted between two active spacecraft, the spacecraft with the longest remaining active lifetime will maneuver.
9. Every effort will be made to notify affected parties at least 72 hours in advance of any predicted conjunctions."

C. Appropriate SSA/STM-Related Regulations To Spur U.S. Space Commerce

1. *What existing policies and regulations, across agencies, positively and negatively enhance SSA/STM use and related orbital debris mitigation?* [17]

2. *How do such existing policies and regulations encourage U.S. and allied space commerce investment, and how should they be revised?*

3. *What emerging trends in space missions and proposed commercial spaceflight activity, including spacecraft safety standards, protection requirements, satellite tracking standards, and satellite control standards, impact existing and future SSA and STM policies and regulations? How should these trends drive revision to those policies and regulations?*

4. *How can the proper regulatory environment drive a space activity insurance market that encourages investment?*

5. *What, if anything, should the Federal government do to encourage insurance parameters for space activities that will encourage responsible space activities and make the U.S. the flag of choice for leading space innovators?*

6. *Are there any other policies or regulations that the Department should consider in the context of SSA, STM, and orbital debris mitigation in order to promote the United States as the flag of choice for space commerce?*

7. *What specific capabilities and technologies could commercial entities provide to characterize the small, millimeter-sized orbital debris population to improve the orbital debris impact risk assessments to support the development and implementation of cost-effective protective measures for the safe operations of future space missions?*

The international community is looking to the United States to address STM&OD. There is no illusion as to the needed scope of such a program, nor the effort that will be required to make all of the pieces of this framework play together. Without restating comments already made, this is a leadership opportunity for the United States.

ASE FCC Comment #2: Tracking Devices

"As outlined in this NPRM, the FCC should make the reduction, control, and tracking devices for orbital debris part of spacecraft licensing."

ASE FCC Comment #4: Spacecraft Ownership

"All spacecraft have owners from the time of their manufacture, through launch, on orbit operations, and retirement/deorbit. The timeframe from manufacture through retirement/deorbit will be referred to as the spacecraft's lifetime. Ownership and responsibility exist for the entire lifetime of a spacecraft as follows:

1. Government developed spacecraft belong for their entire lifetime to the government that paid for their development, manufacture, and operation.

2. Commercial spacecraft (spacecraft built under contract for a commercial entity) are owned by the procuring company unless such company ceases to exist. If the procuring company no longer exists, ownership transfers to the country of origin.

3. Spacecraft developed for an academic institution belong to that institution unless the institution ceases to exist. If the academic institution no longer exists, ownership transfers to the country of origin.

4. Spacecraft developed for a private party belong to that party unless the private party ceases to exist. If the private party no longer exists, ownership transfers to the country of origin.

5. The sale or transfer of a spacecraft from one owner to another also transfers ownership and the associated responsibilities.

Spacecraft owners are responsible for the safe operation of their vehicles for their entire lifetime. Ownership and responsibility continue even after functionality is lost due to failures or the expenditure of consumables. Spacecraft transitioning from active to passive to space debris remain the responsibility of their owners."

ASE FCC Comment #10: Liability

"The owner(s) of a spacecraft are responsible for its safe operation from launch through retirement/deorbit. These responsibilities include a free and open exchange of information as well as adherence to the flight rules (operational rules). If a collision occurs due to a failure to comply with one or more rules, the owner(s) of the offending spacecraft will be liable for damages to the other party, loss of revenue, and the damages caused by any resulting debris.

Further, collisions do not vaporize the objects involved. Instead, large numbers of pieces (debris) are generated each at orbital speed in slightly different orbits. If a collision resulted from a spacecraft owner failing to maneuver, that owner is now responsible for all debris generated as a result of the collision. Even though the owner of the offending spacecraft could argue that a maneuver was not performed due to the low probability of a collision given the size of the error ellipsoids, that will not compensate for the losses experienced by the injured parties.

It will clearly be in the best interest of all parties operating in earth orbit to reduce uncertainties in orbits and positions as soon as possible. By doing so, consumables won't be wasted on maneuvers that really aren't required thus extending mission lifetimes as long as practical and massive financial judgements will be avoided."

ASE FCC Comment #11: Orbital Debris Ownership

"ASE supports the concept of orbital debris being the responsibility of the original owner just as with a spacecraft. Further, since spacecraft that experience failures or lose power effectively become debris, ownership and liability should be retained."

ASE FCC Comment #19: Financial Impacts

"Liability in the context of this discussion can result in the payment of significant amounts of money in direct damage compensation, loss of revenue, and punitive fees. It is quite possible that the threat of legal action resulting from a collision may be the best motivator for spacecraft owners and operators to play by the rules."

ASE FCC Comment #20: International Applicability

"It is the hope of ASE that the FCC will engage the United Nations Committee for the Peaceful Uses of Outer Space as a partner in this endeavor. Controlling orbital debris and making Space Traffic Management work for everyone operating in earth orbit will clearly require extensive international cooperation. As with operations on the seas and in the air, this can only work if we are all in this together."

RECOMMENDATIONS

ASE made a number of recommendations in response to the FCC NPRM. Those recommendations listed below are also applicable to this RFI.

> **"ASE FCC Recommendation #1:** ASE encourages the FCC through this NPRM to assume the role of Central Controlling Authority until the government decides which agency should be the Central Controlling Authority for the long term. Only through the efforts of strong leadership can a workable Space Traffic Management and orbital debris program be successful.
>
> **ASE FCC Recommendation #2:** Due to the international nature of this effort, ASE recommends that the FCC include the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) as a partner in this effort.
>
> **ASE FCC Recommendation #3:** Efforts should continue to address all technical aspects of Space Traffic Management and Orbital Debris.
>
> **ASE FCC Recommendation #4:** The FCC and COPUOS should host a conference to form a list of actions needed by the international community to address all Space Traffic Management and Orbital Debris issues."

SUMMARY

ASE fully supports activities aimed at making operations in earth orbit safe, efficient, and collegial which includes this effort by the U.S. Department of Commerce (Department), via the Office of Space Commerce to Request Information on "Commercial Capabilities in Space Situational Awareness Data and Space Traffic Management Services." From ASE's perspective, addressing the organizational issues within the United States government and establishing an initial framework for an STM&OD program need to be first priorities. Addressing all of these challenges will require a well thought out and structured program.