Space Traffic Coordination for Safety & Sustainability

Office of Space Commerce IAF Space Traffic Management Committee IAC2024

Richard DalBello, Director

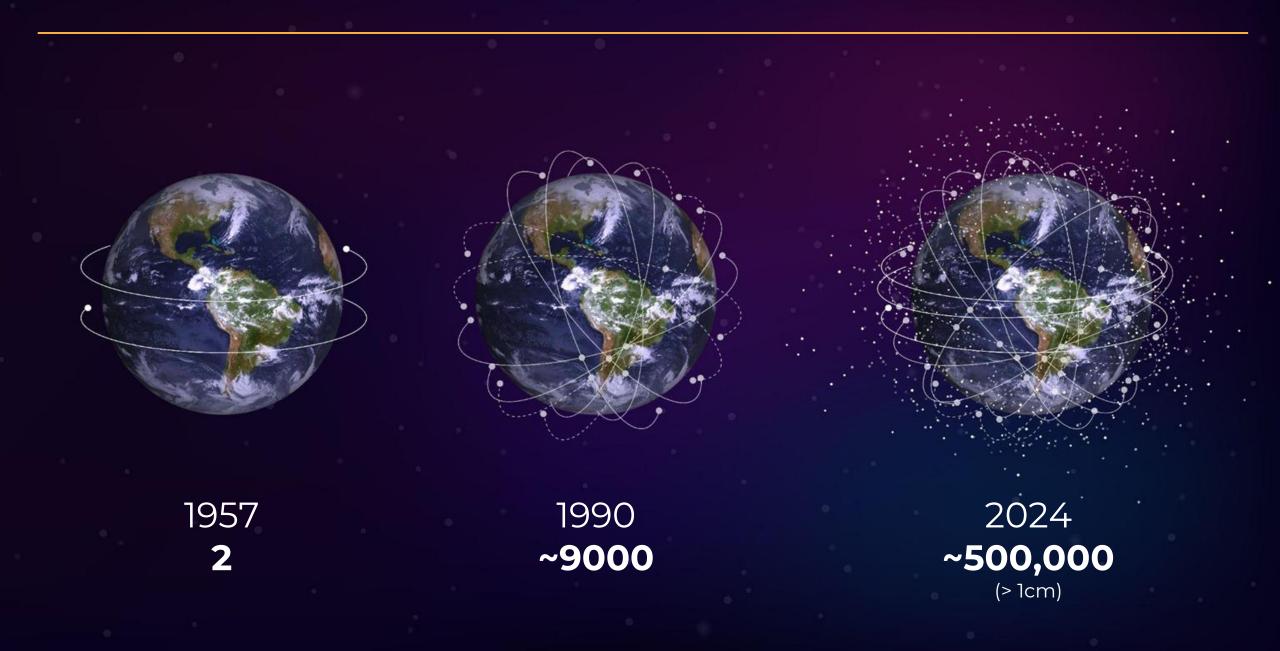
Office of Space Commerce

National Oceanic and Atmospheric Administration

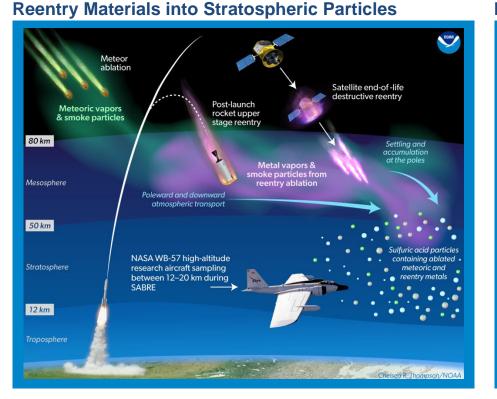
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Visualizing the Problem – Growth of Human Artifacts in Space



Sustainability is More than Space Debris



Dark and Quiet Skies



Lunar Debris



Orbital Loading Challenges



Structure increases capacity, but limits individual freedom

- Who gets to park in what spaces?
- Who, if anyone, enforces the rules?

Current SSA Limitations



• Traditional SSA approaches have several known limitations:

- Limited sensors and field of view
- Ephemeris updates can occur at a slow cadence
- Ephemeris calculations may include errors- sometimes 100 meters or more
- Challenges keeping up with a dynamic environment, i.e. constantly maneuvering satellites
- Owner/Operator Ephemeris can contribute to safety, but there are still concerns:
 - Wide range of quality, particularly between established and new operators
 - Limited insight into how ephemeris is generated
 - Limited insight into maneuver planning and changes



TraCSS will provide access to selected SSA data and information to spacecraft operators and governments, including:

- SSA data and information
- Conjunction screening every 4 hours using catalog and o/o ephemerides
- Risk assessment support information
- Detection and notification of emergency events
- Candidate maneuver screening
- Anomaly reporting







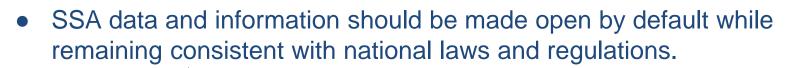
The TraCSS Data Policy seeks to significantly advance transparency and openness.

- Conjunction Data Messages (CDMs) are shared with the operators involved in the conjunction
 - Countries have access to CDMs for all spacecraft affiliated with their nation
- TraCSS will also support and facilitate free and open sharing of data via our website, with no log-in required, including:
 - TraCSS Satellite database
 - TLE Catalog
 - Owner/operator ephemerides.
 - Emergency event notifications (conjunction messages for events that exceed a defined risk threshold)

TraCSS Listening Session: Proposed User Agreement & Data Sharing Policy



World Economic Forum SSA Data and Information Sharing Principles



- Spacecraft owners/operators should share as openly as possible:
 - up-to-date contact information,
 - ephemerides,
 - manoeuvre plans, and
 - spacecraft characteristics (including size, mass, dimensions and manoeuvre capabilities)
- Spacecraft owner/operator information should be provided to at least one SSA provider. This provider should then make the data available to all other SSA providers.
- Government SSA providers should share conjunction warnings and other information.



The number of spacecraft orbiting Earth has increased rapidly in recent years, from fewer than 1,500 in 2014 to more than 9,800 today, and more than 80 rations are involved in space activity. Satellites have become critical to the global economy, providing communications, timing, navigation and information services that support global industry. Individuals rely on

satellites for their daily weather reports, directions and internet connectivity. While the increasing activity provides significant benefits to individuals on Earth, it also poses challenges for space safety and sustainability as space becomes increasingly congested and the risk of unintentional collisions increases.

Space situational avareness (SSA) – the ability to monitor the location of objects in orbit, predict their future location and warn of potential collisions – provides the foundation for space safety and sustainability ² Accurate SSA information promotes greater understanding of evolving conditions in space and prevents collisions that create harmful debris. SSA information and services also provide the foundation for the stability and predictability needed for the continued growth of the global space sector.

Information sharing among space actors improves the accuracy and effectiveness of SSA information and services. Space safety requires spacecraft operators around the world to communicate with SSA providers and with each other to avoid potential collisions. As the number of SSA providers worldwide grows, it is becoming increasingly important that these providers coordinate and share information to improve their predictions and avoid providing conflicting information to operators. There are significant opportunities for improving global SSA data and information sharing to support space safety and sustainability, even while protecting valid national security and commercial competitiveness interests.

Adopting the United Nations' (UN) Guidelines for Long-term Sustainability of Outer Space Activities of the Committee on the Paraefal Lises of Outer Space Activities of the Committee B1) has promoted consensus on the importance of SSA data sharing. Many industry and government best practices documents have reinforced the importance of this issue? Yet significant gaps in data sharing remain. This paper identifies key actors and data to be exchanged and proposes principles for alebal SSA data and information sharino.

SSA data and information

Many actors in the space sector involved in providing and using SSA information and services could exchange various types of data and information to improve space safety.

SSA service providers to spacecraft operators:

Governmental and private entities operate many sensors that observe objects in space. Meanwhile, private and governmental SSA service providers use these observations to generate and update a catalogue of space objects — a listing of objects in space and their locations at a given time. Because space objects generally move in predictable orbits, SSA providers can also conduct analyses of these observations over time to generate predictions of where space objects will be in the future and to identify potential collisions or conjunctions between objects. Timely provision of these conjunction warnings to satellite operators enables them to respond and avoid potential collisions.

In addition to SSA information and services, SSA providers and organizations with relevant expertise may share their knowledge by providing training for spacecraft operators. Such training helps ensure that spacecraft operators can efficiently use the information and products provided.

Spaceraft operators to SSA service providers: Satellite and other spacecraft operators should proactively seek to receive and use these SSA services (including conjunction warnings) in accordance with national law and regulations. Spacecraft operators also have a lundamental role to play in data sharing. Usually, spacecraft operators have more precise and timely information about the orbital location and trajectory of their spacecraft (spacecraft ophemerides) than SSA service providers do, and they inevitably know more about their own contact information and wanceouver plans. SSA providers need all this information to supply timely warnings, and fellow operators need it to coordinate a response.

Owners or operators could supply SSA providers with these plans when planning manoeuvres. This would enable the incorporation of planned manoeuvres into the predictions of future spacecraft locations, thereby greatly enhancing the accuracy of conjunction analyses.

The "Global SSA Future" Vision





We envision a global coordinated system of space situational awareness providers, with a series of national or regional hubs providing information and services to spacecraft operators. These centers will be supported by networks of international and commercial partnerships.



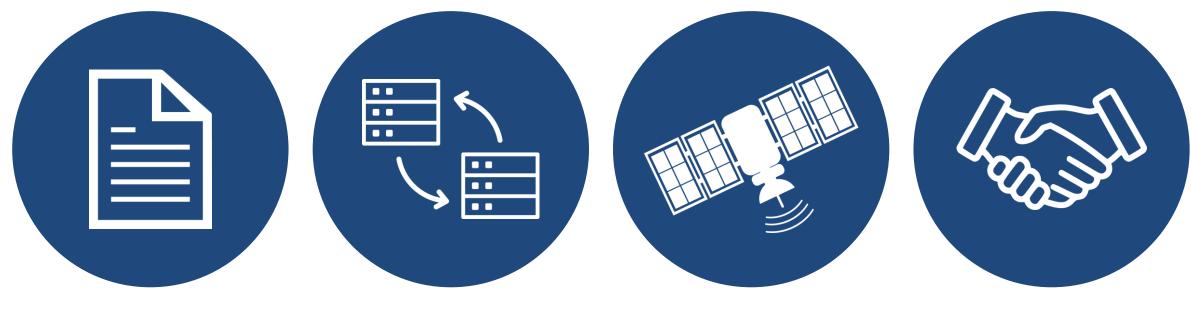
Government services will be augmented by a **robust global commercial space situational awareness sector that provides value-added services** to support business intelligence and other advanced services.



The Department of Commerce is committed to maintaining an **open and transparent system** that enables global coordination with other global SSA providers.

"Global SSA Future" Implementation





SSA Data Standards SSA Information Sharing Principles Satellite Operator Engagement International Partnerships & Communication





TraCSS webpage

https://www.space.commerce.gov/tracss

News, videos, and information on engagements, including past and upcoming public listening sessions



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