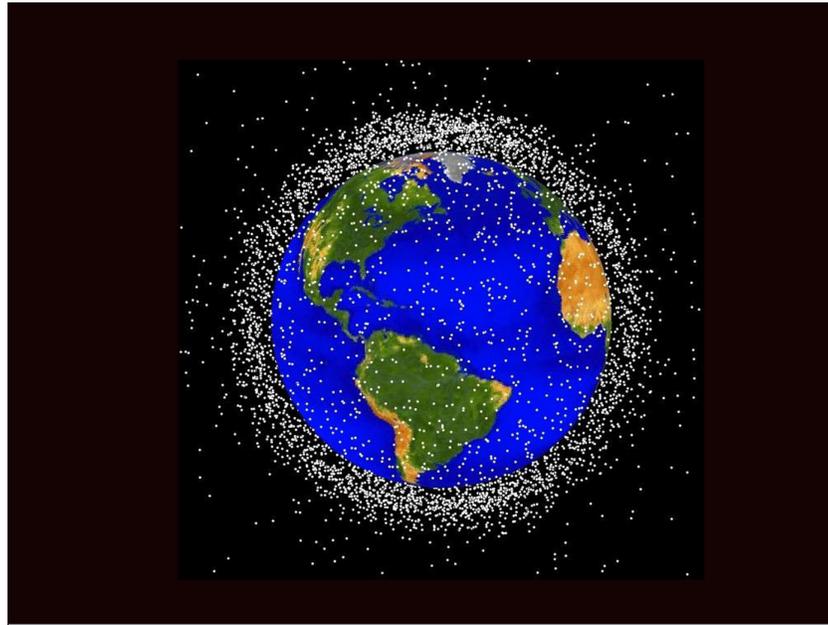




## TECHNOLOGY SOLUTION

### Information Technology and Software



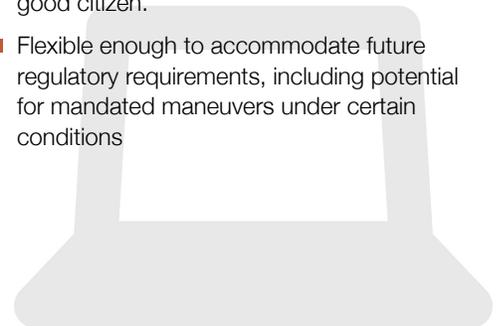
# Space Traffic Management (STM) Architecture

Highly scalable, decentralized, open-architecture data exchange platform for STM

Space is becoming increasingly congested due to rising numbers of on-orbit satellites and debris objects. Despite growing awareness of the orbital debris problem, recent developments such as launch ride sharing, growth in availability of small launch vehicles, and particularly large scale satellite constellation deployments, are dramatically increasing on-orbit congestion. Uncontrolled growth will severely affect future space operations. NASA Ames has developed a novel patent-pending technology known as Space Traffic Management (STM) which provides a robust framework for on-orbit coordination of activities to enhance the safety, stability, and sustainability of operations in the space environment. The STM system is critical for ensuring that the expanding orbital population operates safely and efficiently, avoiding collisions and radio-frequency interference while still facilitating widespread space operations in an increasingly congested space environment. Additionally, it meets the objectives associated with the transition of civil STM from the Department of Defense to a civilian entity.

#### BENEFITS

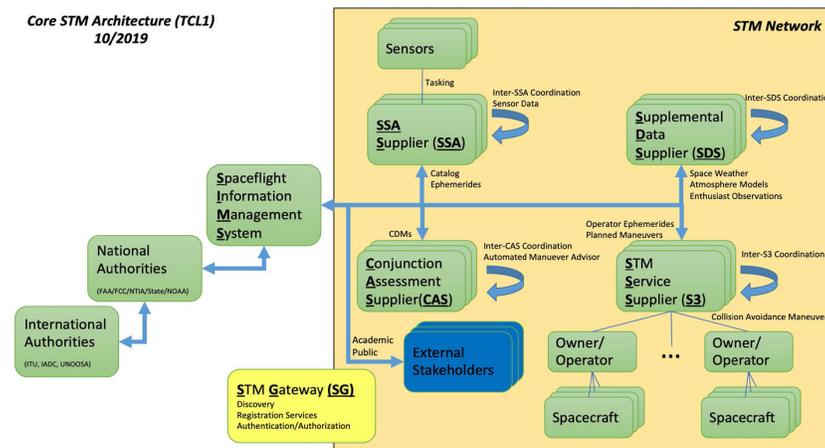
- Improved space traffic management systems are becoming a necessity to protect commercial and other space assets as low Earth orbit congestion increases.
- Provides standardized roles, an open-access architecture, and Application Programming Interfaces (APIs) to interface between the participants and reduce barriers to entry.
- Enables a common operating picture for space situational awareness.
- Enables any interested entity to join the system and be discoverable as a new participant in the system.
- System is designed to grow as the number and variety of participants grows.
- Enables automation between participants to make the system sustainable and scalable.
- Provides safe operations with cooperative management between diverse set of participants.
- Reduces the STM burden for small owner/operators, and makes it easy to be a good citizen.
- Flexible enough to accommodate future regulatory requirements, including potential for mandated maneuvers under certain conditions



## THE TECHNOLOGY

As ever larger numbers of spacecraft seek to make use of Earth's limited orbital volume in increasingly dense orbital regimes, greater coordination becomes necessary to ensure these spacecraft are able to operate safely while avoiding physical collisions, radio-frequency interference, and other hazards. While efforts to date have focused on improving Space Situational Awareness (SSA) and enabling operator to operator coordination, there is growing recognition that a broader system for Space Traffic Management (STM) is necessary. The STM architecture forms the framework for an STM ecosystem, which enables the addition of third parties that can identify and fill niches by providing new, useful services. By making the STM functions available as services, the architecture reduces the amount of expertise that must be available internally within a particular organization, thereby reducing the barriers to operating in space and providing participants with the information necessary to behave responsibly. Operational support for collision avoidance, separation, etc., is managed through a decentralized architecture, rather than via a single centralized government-administered system.

The STM system is based on the use of standardized Application Programming Interfaces (API) to allow easier interconnection and conceptual definition of roles to more easily allow suppliers with different capabilities to add value to the ecosystem. The architecture handles basic functions including registration, discovery, authentication of participants, and auditable tracking of data provenance and integrity. The technology is able to integrate data from multiple sources.



Proposed STM architecture

## APPLICATIONS

The technology has several potential applications:

- The Space Traffic Management (STM) Service Supplier (S3)
- Space Situational Awareness Supplier (SSA)
- Conjunction Assessment Supplier (CAS)
- Supplemental Data Supplier
- Owner/Operator (O/O) - already commercialized, STM will allow seamless interaction between operators
- Universities and research institutions

## PUBLICATIONS

Patent No: 11,780,612

<https://ntrs.nasa.gov/citations/20190034067>

<https://arc.aiaa.org/doi/abs/10.2514/6.2019-2004>

<https://ieeexplore.ieee.org/abstract/document/8569343>

[technology.nasa.gov](https://technology.nasa.gov)

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