Business Proposal for 2025 NASA Space Apps Challenge
Commercializing Low Earth Orbit (LEO)

Project Title: Space Trace

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Executive Summary

Space Trace is a web-based platform designed to address one of the most pressing challenges in modern space operations, the deconfliction of commercial low-Earth orbit (LEO) flight paths. As the number of private launches, small satellites, and reusable vehicles increases, the risk of orbital congestion and in-space collisions is growing rapidly. Space Trace provides an accessible, real-time solution to help operators visualize, register, and coordinate space activity safely and efficiently.

Our platform features an interactive 3D globe interface where users can register planned flights by inputting flight information. Once submitted, those trajectories become visible to themselves and other participants on the globe, creating a transparent, shared situational awareness environment. The system automatically detects and highlights potential conflict areas between registered flights and existing satellites, allowing users to proactively adjust mission parameters before a conflict occurs.

By encouraging collaboration among private sectors worldwide, Space Trace hopes to bridge the current communication gap between companies and organizations that often operate in isolation. Through shared visibility and cooperative planning, it helps prevent avoidable collisions and ensures that the rapidly expanding commercial space sector can grow sustainably and responsibly.

Problem Need

The rapid commercialization of space has transformed LEO into a busy, dynamic, and dangerous environment. Thousands of new satellites, private spacecraft, and reusable launch vehicles are entering orbit each year, driven by falling launch costs and the growth of private space ventures. However, this expansion has created a critical coordination challenge: there is no unified, transparent system for commercial entities to communicate, plan, and deconflict their operations in orbit.

Today, most orbital traffic coordination is handled through fragmented channels. Government agencies such as the U.S. Space Command and national space authorities track orbital objects and provide warnings, but participation by private operators is largely voluntary. Many companies rely on proprietary tools or internal systems, and cross-company communication is minimal due to competition, data privacy, and lack of standardization. This leads to blind spots where two or more organizations may unknowingly schedule missions or maintain orbits that put their assets on potential collision courses.

With thousands of satellites and spaceflights operating in shared orbital regions, even small errors in trajectory or timing can result in catastrophic outcomes, collisions that generate long-lasting debris fields, disrupt communications, and increase the cost and risk of future missions. Without a cooperative, real-time framework for flight registration and conflict detection, the risk of accidental interference or collision will only continue to rise as space becomes more congested.

There is a clear need for a neutral, accessible, and globally available platform that allows commercial operators to voluntarily share non-sensitive flight data and visualize potential overlaps with other missions. Such a system must not depend on government oversight, but instead empower companies to coordinate proactively.

Space Trace directly addresses this need by providing a shared environment for commercial spaceflight registration, visualization, and deconfliction by building trust and transparency between operators who currently have no reliable means of coordination.

Proposed Solution

Space Trace is a web-based platform that promotes global cooperation and transparency in LEO by enabling private and public space operators to register, visualize, and deconflict their flight paths in real time. Built with accessibility and openness at its core, Space Trace aims to provide a free, universally available tool that helps prevent orbital conflicts through shared awareness rather than regulation.

The minimum viable product of Space Trace features an interactive 3D globe interface where users can register planned missions by entering flight information. Once submitted, these flight paths are rendered on the globe and visible to other participants, creating a shared view of space activity. The system automatically detects and highlights potential conflicts, such as overlapping trajectories or timing collisions, allowing operators to identify and resolve risks before they become dangerous.

Space Trace integrates data from satellite tracking APIs, providing users with visibility into existing orbital assets. This ensures that registered flights are coordinated not only with other participant missions but also with the broader set of satellites already in orbit.

The platform emphasizes voluntary cooperation, allowing companies to share only the information they choose, fostering collaboration without compromising proprietary mission details. By providing a free and accessible tool for real-time deconfliction, Space Trace empowers operators worldwide to coordinate safely, reducing the risk of collisions and supporting the sustainable growth of commercial space activity.

Market Analysis

The commercial space sector is growing rapidly, with hundreds of private companies launching satellites, cargo missions, and reusable spacecraft into LEO each year. This surge has created a crowded orbital environment where potential conflicts between spacecraft and satellites are increasingly common. Current space traffic management relies largely on fragmented communication channels, proprietary systems, or government tracking services. Smaller operators, academic institutions, and international participants often have limited access to real-time coordination tools, leaving them vulnerable to unintentional orbital conflicts.

Target Users for Space Trace MVP:

1. Private Space Companies: Companies of all sizes planning commercial launches or satellite deployments need an accessible, real-time tool to avoid conflicts with

other missions. Space Trace enables these operators to visualize trajectories and identify potential overlaps without relying on internal or expensive proprietary systems.

2. Research Institutions & Universities: Many universities deploy small satellites for research and technology demonstration. These operators often lack the resources or infrastructure to coordinate effectively with other space activities, making a free, easy-to-use platform especially valuable.

3. International Collaborators: Operators in countries or regions with limited national space traffic coordination infrastructure can participate voluntarily in a global system, gaining visibility into orbital activity while contributing to safer space operations.

4. Satellite Constellation Operators: Companies managing large satellite networks face increasing pressure to avoid congestion in shared orbital slots. Even if they already have internal coordination tools, Space Trace can provide additional situational awareness and foster cooperative engagement with other operators.

Market Landscape and Opportunity:

- The number of satellites in LEO is projected to grow by thousands annually, creating an urgent need for accessible deconfliction tools.

- Existing solutions are typically expensive, highly technical, or limited to government-approved operators, leaving a gap for free, collaborative, and user-friendly tools.

- By offering a web-based, open-access platform, Space Trace lowers barriers to participation, promoting global cooperation across private companies, research institutions, and international operators.

- Encouraging voluntary collaboration addresses the communication gap in commercial space operations, reducing the risk of collisions and orbital congestion while fostering a culture of shared responsibility.

Financial Plan

Space Trace is designed to be free and accessible to all users, from small academic operators to large commercial companies. The platform is built on low-cost, scalable technologies, allowing it to function as a sustainable service without charging end users.

MVP Costs and Sustainability

The minimum viable product focuses on essential features: flight registration, 3D globe visualization, and conflict detection using satellite tracking APIs. Key costs include:

1. Web Hosting & Cloud Services: Hosting the application and 3D globe visualization on scalable cloud infrastructure: approximately $20–$50/month.

2. API Access: Integration with satellite tracking APIs, leveraging free tiers sufficient for MVP use.

3. Development Tools & Libraries: Open-source web frameworks and 3D visualization libraries minimize software costs.

4. Maintenance & Updates: Ongoing bug fixes, minor feature updates, and server monitoring handled by the development team.

Initial funding could come from hackathon prizes, grants, sponsorships, or donations, keeping the platform fully free while proving the concept.

Funding at Scale

If Space Trace were adopted widely and became a fully operational platform, it could remain free through alternative funding mechanisms:

1. Grants and Government Funding: National space agencies, research foundations, or international organizations could provide funding for a tool that enhances orbital safety and international cooperation.

2. Corporate Sponsorships: Aerospace companies and satellite operators may sponsor the platform to support a safer space environment and demonstrate corporate social responsibility.

3. Donations and Crowdfunding: Individual donors, space enthusiasts, and educational institutions could contribute to platform maintenance and upgrades.

4. Partnerships with Research and Educational Institutions: Universities and research labs could co-fund or collaborate on Space Trace, given its value for student and academic projects.

By leveraging these funding sources, Space Trace could maintain global, free access while covering operational costs, scaling infrastructure, and continuing to provide a cooperative, transparent, and safe space environment for all operators.

Conclusion

Space Trace addresses a growing and urgent need in the commercial space sector: the safe coordination of LEO flights in an increasingly crowded orbital environment. By providing a free, web-based platform for real-time flight registration, visualization, and conflict detection, Space Trace empowers operators worldwide to collaborate proactively, reducing the risk of collisions and promoting sustainable growth in space.

We invite hackathon judges, potential collaborators, and industry stakeholders to support Space Trace by:

- Providing feedback to improve the platform's usability and accuracy.

- Connecting with potential partners or sponsors who share the vision of global orbital safety.

- Promoting awareness of cooperative spaceflight coordination and the importance of shared situational awareness.

By joining this initiative, participants can help foster a safer, more transparent, and cooperative space environment, ensuring that as commercial space activity continues to grow, it does so responsibly and inclusively.