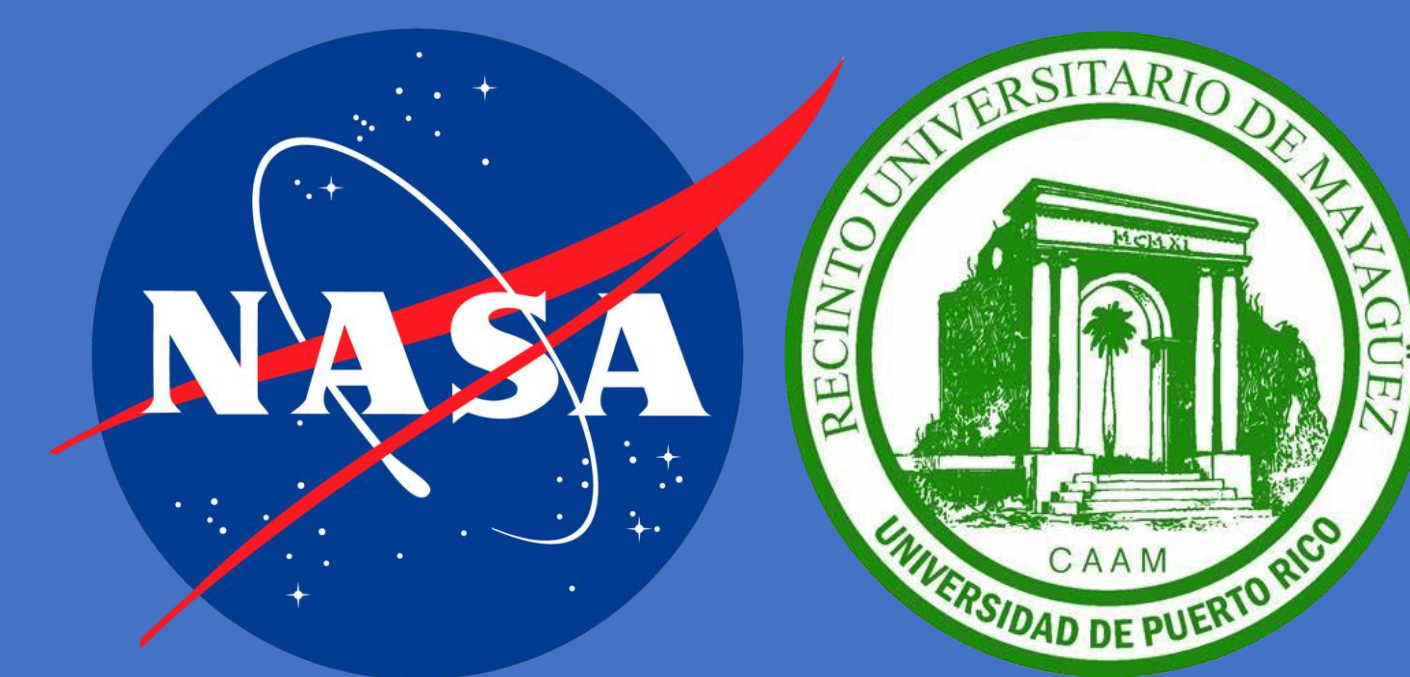


# The Space Superhighway: Space Infrastructure for the 21<sup>st</sup> Century

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## Abstract

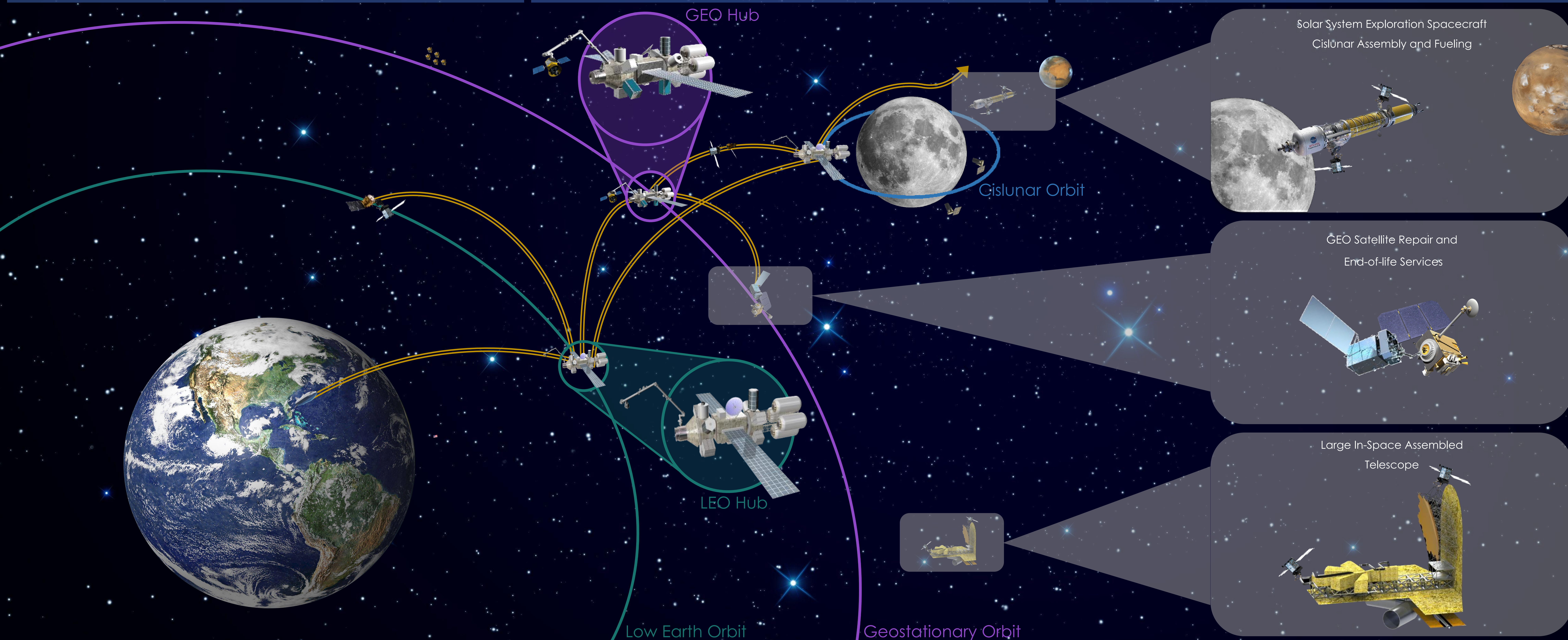
This poster introduces a concept for space infrastructure developed with input from multiple U.S. government agencies called the Space Superhighway, which could support civil, commercial, and national security space activities. The Space Superhighway is a commercial-first space infrastructure that contains three primary components: regional hubs, a sustainable transportation network, and Earth-to-orbit logistics. Civil, commercial, and national security space sectors could use this common infrastructure to support missions such as satellite servicing, Earth science, and space domain awareness, among others. It utilizes a commercial-first, “infrastructure-as-a-service” approach which contains industry-owned and operated assets with government anchor tenants for commercial services, enabling extended mission lifetime, on-orbit repair, maneuver without regret, and debris mitigation and removal. The Space Superhighway is the space infrastructure needed for the 21<sup>st</sup> century.

## Background & Motivation

During the 21<sup>st</sup> century, the opportunity for a new revolutionary infrastructure is on the horizon – space infrastructure. A Space Superhighway could serve as a new interconnected infrastructure system, facilitating sustainable operations and transportation around LEO, GEO, cislunar space, and beyond. The development of this new infrastructure, in a parallel to the transcontinental railroad and interstate highway system, could provide new means of transportation, new servicing hubs and standards to support refueling and servicing, and new aggregation depots and asset pipelines to support economic growth. The support for space infrastructure to achieve these goals has gained traction in the U.S. government and commercial sectors. The U.S. Space Force views space as a key element to global infrastructure [1] and the capability of the Space Superhighway to improve mobility and logistics as an enabler to its mission [2].

## Overview

The Space Superhighway is a concept for space infrastructure that could evolve to support civil, commercial, and national security space sectors. Below is a notional diagram of the Space Superhighway concept, which consists of regional hubs and sustainable transportation network. Regional Hubs are strategic footholds in space that serve as the service stations and ports of the Space Superhighway located in multiple orbits of interest. The regional hub is the centerpiece of space infrastructure, providing destinations that drive logistics and traffic throughout the Space Superhighway. The Sustainable Transportation Network provides rapid and responsive mobility in space. This would also provide vital services to space operations, such as transporting cargo and propellant between regional hubs and other locations, moving payloads and instruments to higher energy orbits without the need for dedicated launch, and supporting responsible end-of-life disposal, debris mitigation, and other necessary functions to ensure sustainable space operations.



## Use Cases

- Large In-Space Assembled Space Telescope
- Persistent Platform (Earth Science/Astrophysics, Tech Demonstrations, etc.)
- Cislunar Space Assembly of Mars Transit Vehicle
- GEO/LEO Satellite Propellant Refueling
- Mega Constellation Disposal
- ISS, Gateway and Commercial LEO Destinations
- Solar System Exploration Spacecraft Cislunar Assembly and Fueling

## Conclusions

Today, there is little space infrastructure to support logistics, payload hosting, and sustainable space operations. The future of spaceflight will require more ambitious missions to support the commercial space sector, expand our knowledge of the Earth and the cosmos, ensure the safety of space assets, and extend human presence throughout the Solar System. Achieving these ambitious science, security, commercial, and human exploration missions is not feasible using the traditional paradigm. Space infrastructure would bring terrestrial-like logistics capabilities to space. The increased activity in space would provide opportunities for space domain awareness and rapid response to avoid disasters and other threats. Leveraging this new paradigm of space operations would kick-start a new space economy, enabling new industries, scientific discoveries, and national security capabilities. Leveraging space infrastructure and its ecosystem would promote even more modular spacecraft using common standards and norms, further reinforcing the potential growth. By investing in these necessary capabilities, partnerships, and standards now, the U.S. government would help create a new era in space.

## References:

- [1] Air Force Space Command, *The Future of Space 2060 and Implications for U.S. Strategy: Report on the Space Futures Workshop*, September 5, 2019.
- [2] Olson, J. et al. “State of the Space Industrial Base 2021: Infrastructure & Services for Economic Growth & National Security,” November 2021.

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