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DEVELOPMENT (D3)Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and
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THE SPACE SUPERHIGHWAY: SPACE INFRASTRUCTURE FOR THE 21ST CENTURY

Abstract

Today, there is little space infrastructure to support logistics, payload hosting, and sustainable space operations. Dedicated missions are launched with their payloads and are not supported by other systems even through end-of-life. This does not allow for extended mission lifetime, on-orbit repair, mobility without regret, or debris mitigation and removal.

This paper will present 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 sectors. The Space Superhighway is a disaggregated, commercial-first space infrastructure that contains three primary components:

1. Regional hubs that provide utilities to hosted payloads and logistics storage, refueling, and services to the space transportation network
2. Sustainable transportation network that provides rapid and responsive mobility, transports logistics between regional hubs, and supports responsible disposal and debris mitigation

3. Earth-to-orbit logistics that provides routine, low-cost access to space that fosters a competitive commercial launch industry

Previous investments in terrestrial infrastructure (transcontinental railroad and interstate highway system) supported national growth by providing transportation, refueling, and services. Space infrastructure expands these functions to space to enhance deep space exploration and support operations for government, commercial, and international users. The Space Superhighway utilizes a commercial-first, “infrastructure-as-a-service” approach which contains industry-owned and operated assets with government anchor tenants for commercial services.

Space infrastructure protects cislunar activity and commerce, brings logistics to space, enables sustainability in space operations, promotes interoperability and international partnerships, kick starts the space economy, leverages emerging technologies, and creates a new era in space. Civil, defense, and commercial space sectors would use a common infrastructure to support missions such as Earth science, technology demonstration, STEM opportunities, spacecraft fleet servicing, in-space assembly and manufacturing, and space domain awareness.

Along with a description of the Space Superhighway concept, the paper will discuss potential first steps to establish the initial building blocks of space infrastructure. The nations that lead the development of space infrastructure will define norms of behavior, develop needed capabilities, and provide international leadership.

The ages of naval and air power have been joined by the age of space power, and the fates of the great nations in this century and the next will depend in no small part on their ability to explore, navigate, leverage, and master this new space frontier.