A NATIONAL SPACE LOGISTICS SYSTEM

GORDON ROESLER

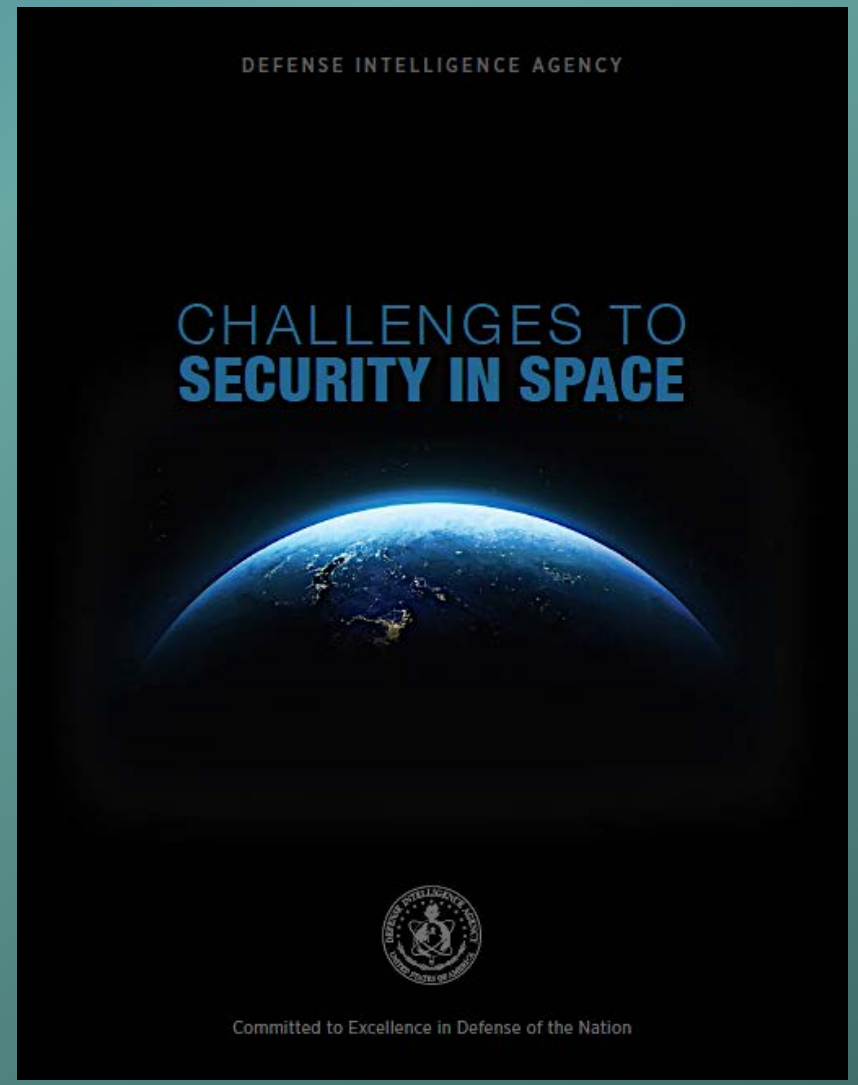
DMMI Workshop: Logistics and Manufacturing under Attack

JUNE 4, 2021

ROBOTS IN SPACE® LLC

WHAT ARE WE CONCERNED ABOUT?

- **“Chinese and Russian military doctrines indicate that they… view counterspace capabilities as a means to reduce U.S. and allied military effectiveness”**
- **“Both reorganized their militaries in 2015, emphasizing the importance of space operations”**
- **“Both states are developing jamming and cyberspace capabilities, directed energy weapons, on-orbit capabilities, and ground-based antisatellite missiles”**



WHAT WOULD WE LIKE TO CHANGE?

- **Logistics for crewed and uncrewed systems are vastly different**
  - **The ISS is serviced regularly, mostly by humans**
  - **By contrast, *satellites* are never inspected, maintained, or repaired**
  - **Where else in human endeavor is that the case for a $1B system?**
- **Launches are chartered per payload**
  - **Slips in the payload force slips in the launch**
  - **Everyone's cost goes up**
- **Spacecraft are more often restricted by fairing than by mass**
- **Maneuvering on orbit is life-limiting**

WHAT IS A DESIRABLE END STATE?

Satellites that receive the same care as other highly expensive systems

Standard interfaces and procedures

Cadenced launches—”airline-like”

Robust supply chain

Cheap, accessible propellant on orbit

LOGISTICS BEYOND LEO

“If you’re not thinking about logistics, you lose”

Reusable in-space transportation

Depots and stations

Support modularization and commoditization

Projected benefits:

- **Speedier response to events**
- **Keep pace with technology**
- **Expand the industrial base**
- **Reduce costs per project**
- **Enable cadenced launch**
- **Low-cost hardware qualification**
- **Government as customer**

Military Spacepower Core Competencies

Space Security establishes and promotes stable conditions …
Combat Power Projection integrates defensive and offensive operations …
Space Mobility and Logistics (SML) enables movement and support of military equipment and personnel in the space domain, from the space domain back to Earth, and to the space domain.
Information Mobility provides timely, rapid and reliable collection and transportation of data …
Space Domain Awareness (SDA) encompasses the effective identification, characterization and understanding …

FINDINGS OF AN INDEPENDENT THINK TANK

40 space leaders from industry, government and academia

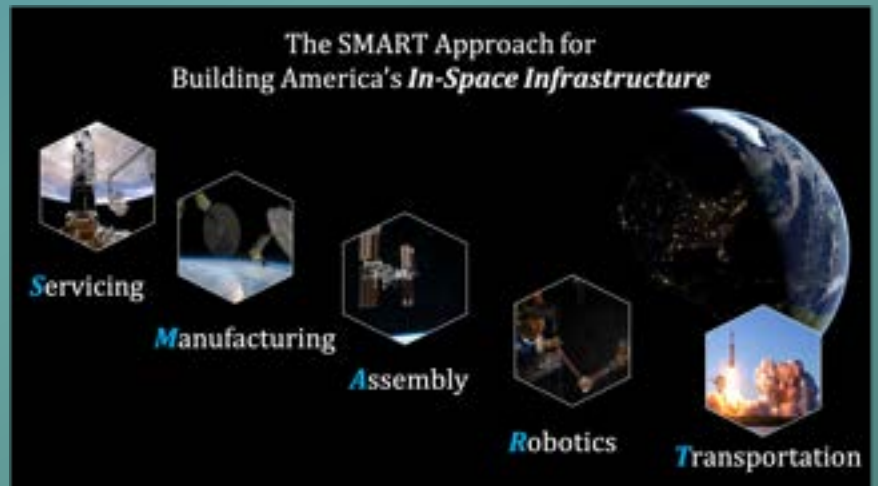
Focus was on SMART technologies (servicing, manufacturing, assembly, robotics and transport)—66 concepts assessed

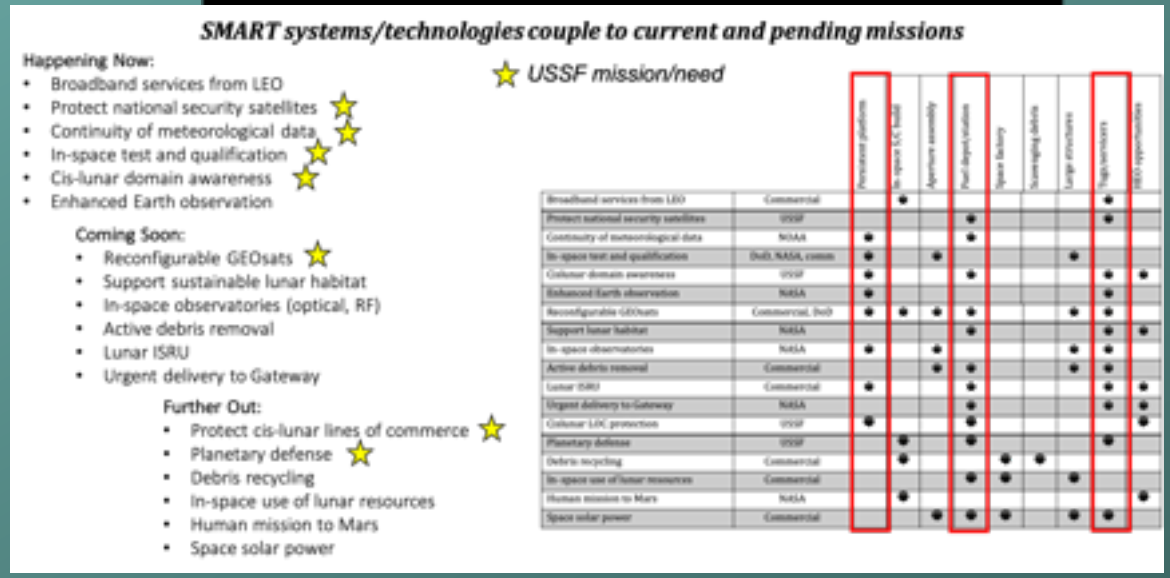
SMART technologies assessed to enable:

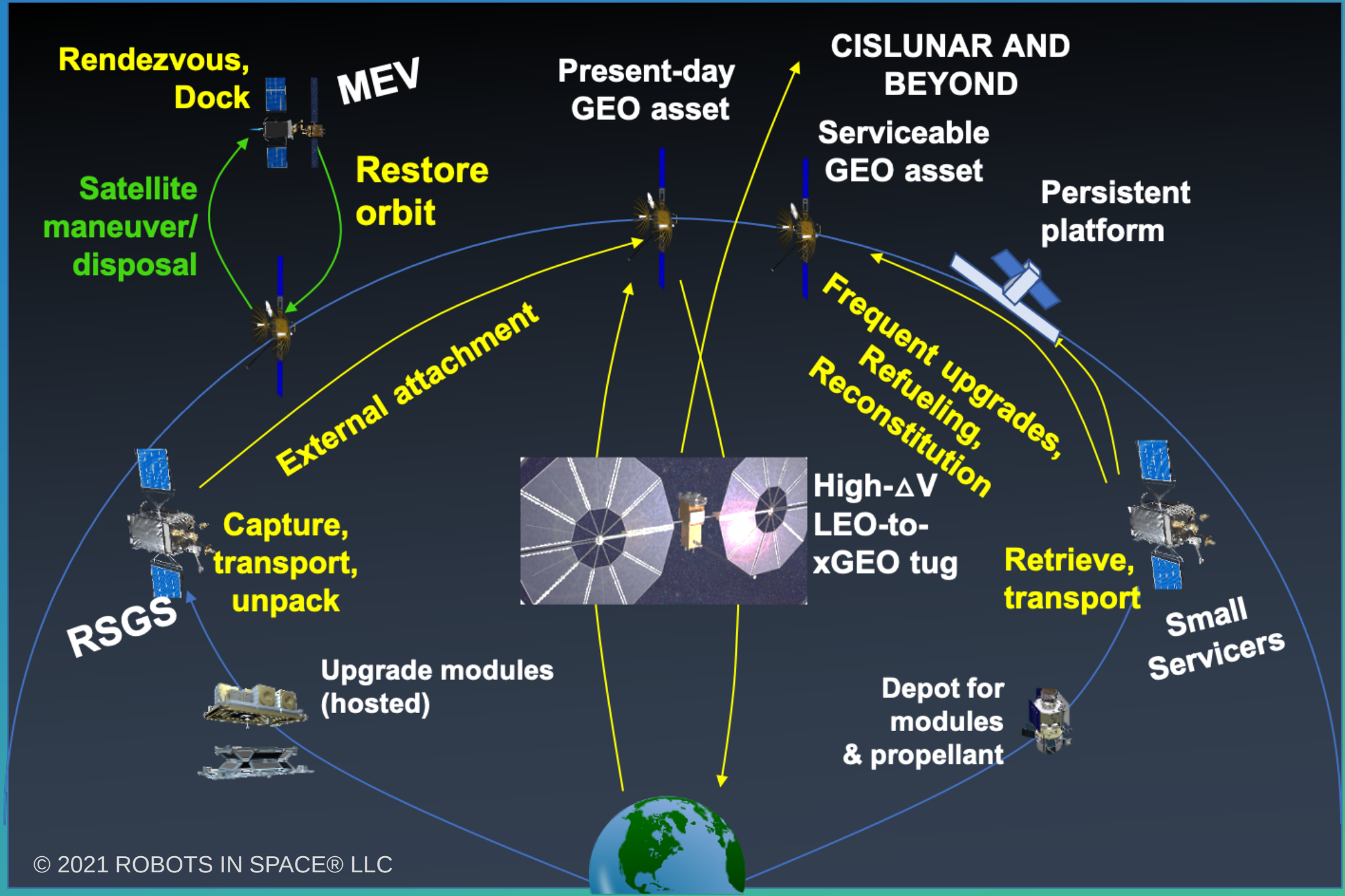
- **Move and maneuver without regret**
- **Build in space for space**
- **Service, sustain and renovate**

Top recommendations: persistent platform, long-range transfer vehicle, fuel depot

Think tank now briefing NASA, DoD audiences







THE TECHNOLOGY IS IN HAND

2007

DARPA’s Orbital Express demonstrates autonomous rendezvous, robotic-assisted docking, module replacement, propellant transfer

2019

Northrop Grumman’s MEV-1 docks with Intelsat 901, provides station-keeping propulsion

2021

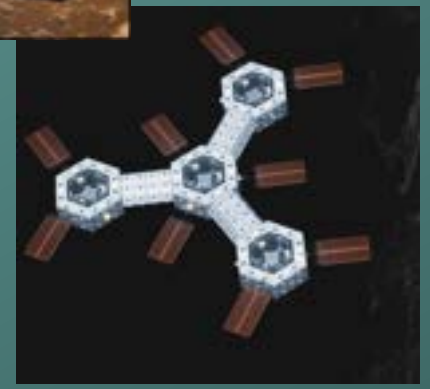
Lockheed Martin announces that GPS 3F satellites will be serviceable

2023

DARPA/Northrop Grumman RSGS system launches to enable on-orbit repair, inspection, and module attachment

DEFENSE INNOVATION UNIT: THREE RELEVANT PROJECTS

PROJECT 1: ORBITAL OUTPOST



Self-contained and free flying

Capable of supporting:

- **space assembly**
- **microgravity experimentation**
- **logistics and storage**
- **manufacturing**
- **training, test and evaluation**
- **hosting payloads**

Phase I studies complete, options in contracting

DEFENSE INNOVATION UNIT: THREE RELEVANT PROJECTS

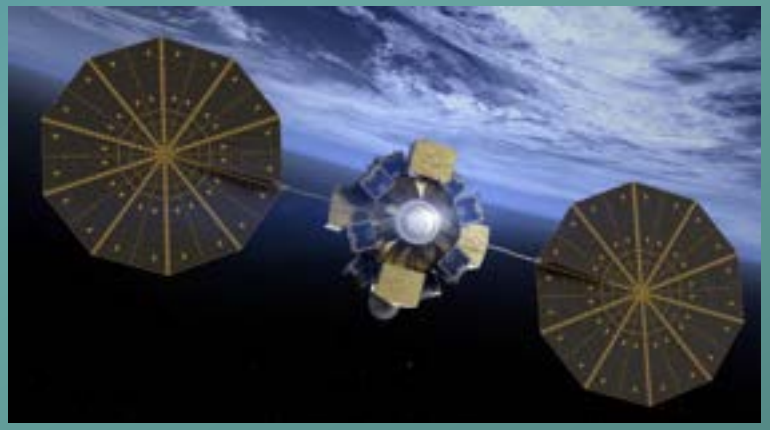
PROJECT 2: MULTI ORBIT LOGISTICS

Low cost, responsive access to GEO and other exotic orbits

Support logistics, on orbit servicing, assembly, manufacturing

Orbit transfer vehicles, fuel depots and other in-orbit mission enhancement opportunities

Phase I studies in progress



DEFENSE INNOVATION UNIT: THREE RELEVANT PROJECTS

PROJECT 3: MODULARITY FOR SPACE SYSTEMS

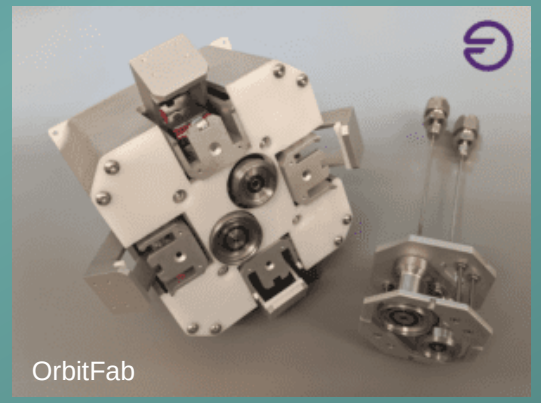
Tie together Orbit Outpost, Multi Orbit Logistics, and other systems like DARPA's RSGS

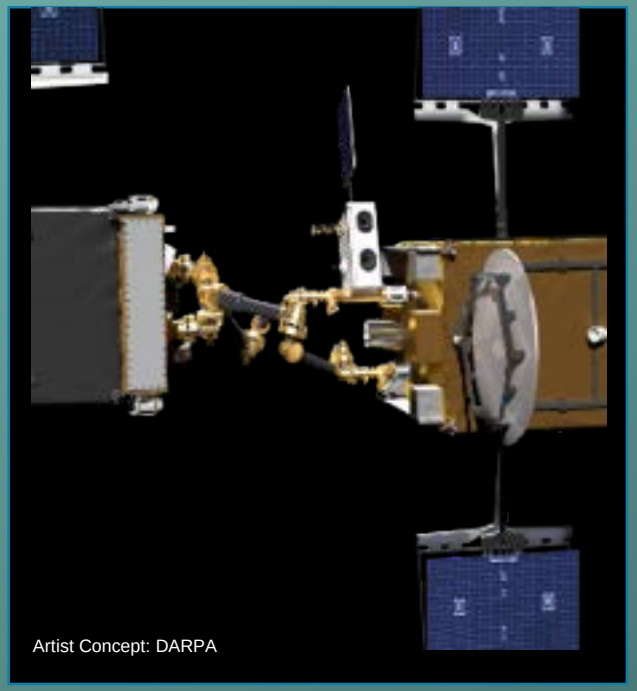
Reduce the cost of space robotics

Establish standard interfaces

Create the first modular payloads

Currently in source selection process





LOGISTICS AS DETERRENT

Modularity, depots and responsive launch make reconstitution credible

Maneuver without regret complicates adversary decision process

Replenishment of defensive hardware discourages attack

Integration with commercial and international partners poses an escalation quandary

A WHOLE-OF-NATION APPROACH

Ties together satellite constellations, stations, and servicers for multiple users

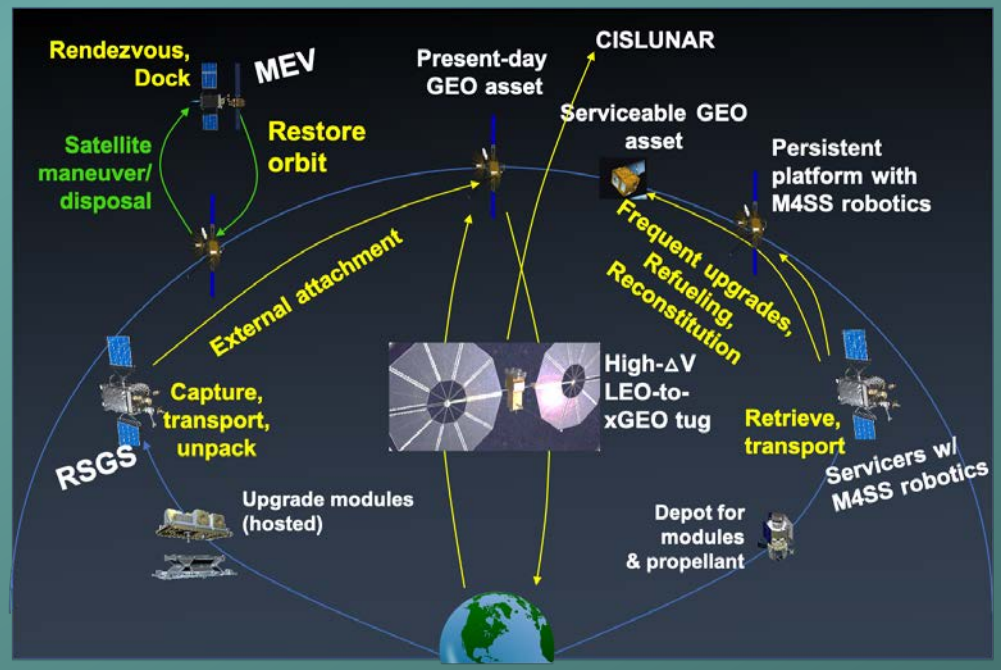
Supports Artemis and NASA science

Enables communications operators to respond to customer demands more quickly

Frequent tech upgrades

Enables cadenced launches

Expands space industrial base and space innovation base



NEXT STEPS

Near term: explore potential for infrastructure funding

- **Engage national leadership**
- **Define keystone programs between DoD, NASA, commercial**
- **Use OT mechanism for rapid start**
- **Aim to place first systems on orbit in 4-5 years**

Enduring effort: National Space Logistics System

- **Connect with sustainable lunar habitat**
- **Common modules and interfaces**
- **Attract investment with advance contracts**
- **7-10 year effort for full operational capability**

Logistics is the bridge between the economy of the Nation and the tactical operations of its combat forces. Obviously then, the logistics system must be in harmony, both with the economic system of the Nation and with the tactical concepts and environment of the combat forces.

--Rear Admiral Henry Eccles (1959)

Thank you for your attention and your ideas

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