



Space Communications and Navigation  
Science & Exploration, *enabled.*

National Aeronautics and  
Space Administration



**Presented to:**  
NASA Advisory Council –  
Human Exploration and Operations

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*Presenting For*  
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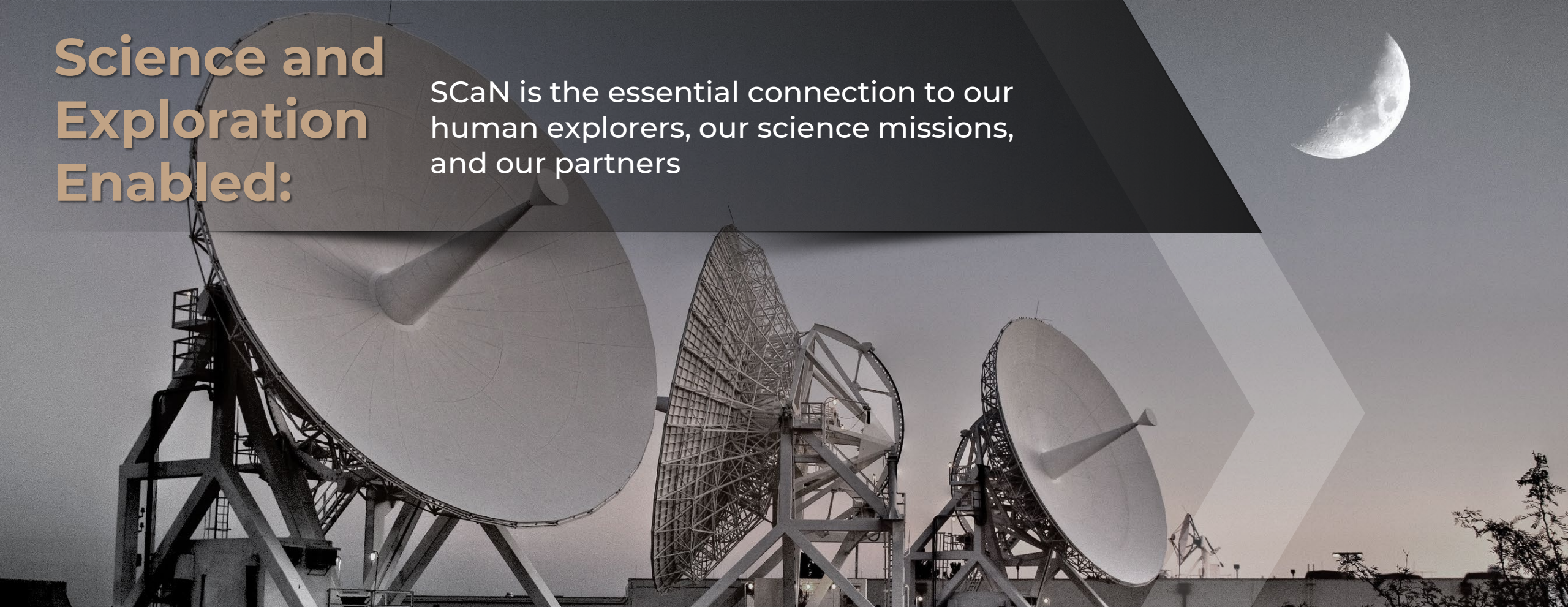
# SCaN Updates



*September 2024*

# Science and Exploration Enabled:

SCaN is the essential connection to our human explorers, our science missions, and our partners



**Space Communications and Navigation (SCaN)** Serves as the enterprise responsible for all of NASA's space communications activities.  
24/7 Global Near Earth and Deep Space Communications and Navigation Services  
100+ Missions currently enabled by SCaN

## Focal Points for Change: Strategic Evolution

**Engage**  
as One Team,  
One Mission,  
One Network

**Execute**  
with Sound Technical  
and Programmatic  
Fundamentals

**Evolve**  
the Network to  
Satisfy Mission  
Customer Needs of  
the Future

**Empower**  
Our Science and  
Exploration  
Partners

# NASA's Communications Networks

- NASA Near Space Network (NSN)
- NASA Deep Space Network (DSN)
- Commercial Stations Supporting NSN
- Lunar Exploration Ground Sites (LEGS)
- Optical
- Future Upgrades

Near Space Network: Tracking and Data Relay Satellites (TDRS)



Ka-band upgrade  
Svalbard, Norway  
KSAT, Norway  
SSC Kiruna, Sweden

Madrid, Spain  
- DAEP Ka-band Upgrade  
Sardinia, Italy

White Sands Complex, New Mexico  
Blossom Point, Maryland  
Wallops Island, Virginia

ASF, Alaska  
NOAA, Alaska  
North Pole, Alaska

Goldstone, California  
- Ka-band Upgrade  
- Table Mtn, California  
LEGS 1, White Sands  
White Sands, New Mexico

- Ka-band Upgrade  
Alaska

LEGS 2, Matjiesfontein, South Africa  
NSN Station, SSC Hartebeesthoek, Africa

KSAT Singapore

Ka-band Commercial Upgrade  
Punta Arenas, Chile

LEGS 3, Australia

SSC Dongara, Australia

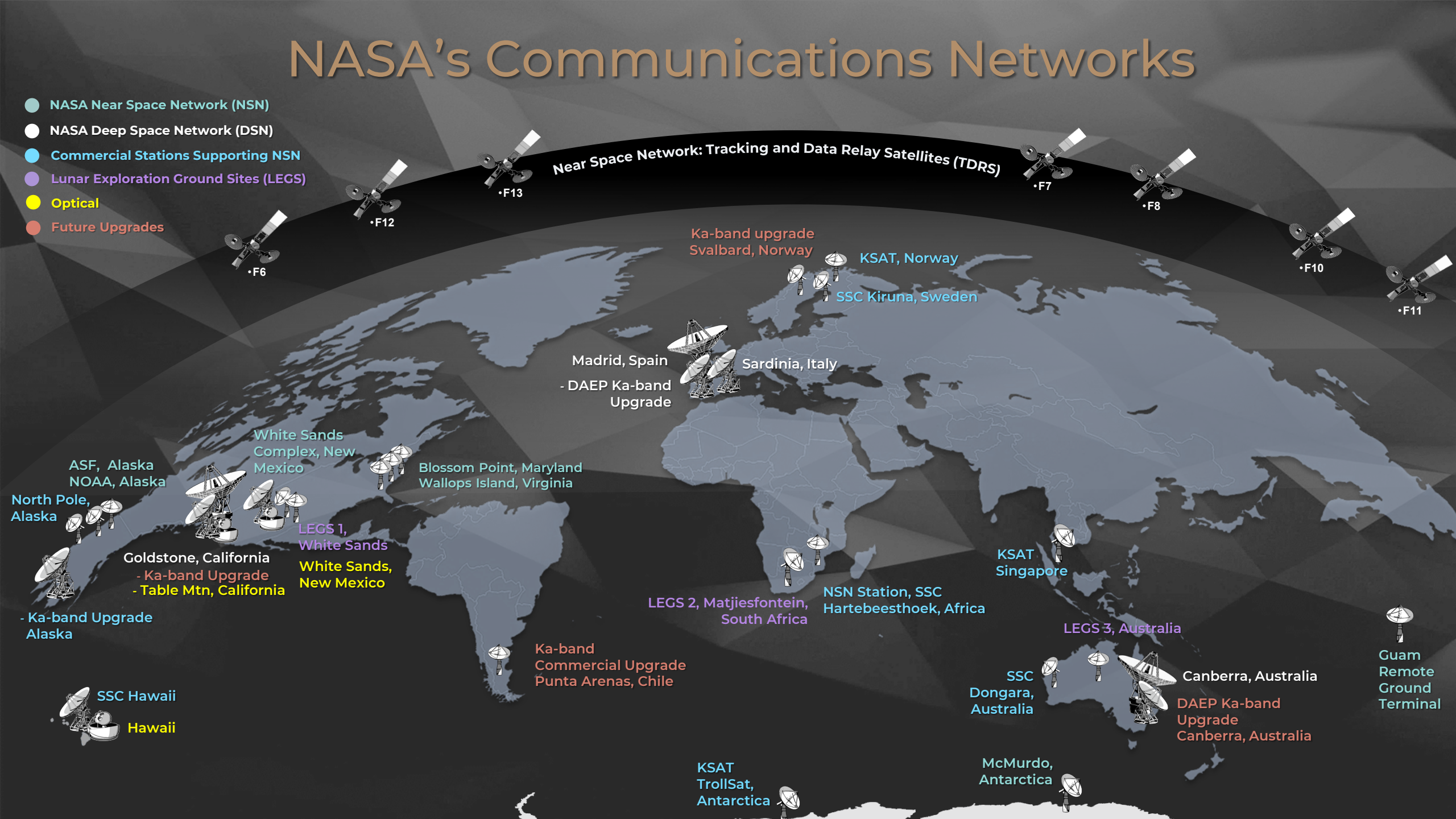
Canberra, Australia  
DAEP Ka-band Upgrade  
Canberra, Australia

Guam Remote Ground Terminal

SSC Hawaii  
Hawaii

KSAT TrollSat, Antarctica

McMurdo, Antarctica



# Executive Summary

## **SCaN is resetting to become future and stakeholder oriented**

- Leaders are rebuilding the organization from the ground up to support its core functions: operations, capability development, and stakeholder engagement
- Personnel are working to address priority areas and turn SCaN into an Agency model for programmatic excellence

## **Stakeholder input is key to making budget-driven prioritization decisions and identifying gaps**

- SCaN has completed a prioritized activity list based on active stakeholder engagement efforts

## **Our approach to commercial partnerships will be the key to SCaN's future**

- NASA is investing in the commercialization of Near Space communications; our approach to Space Relay in LEO is a model for future efforts
- A commercial-first approach to domains with business cases saves resources while providing enhanced capabilities; we are bringing this vision to life for both DTE and relay support for cislunar assets
- The program has begun to identify future needs and gaps; a commercial partnership approach is primed to help SCaN and the Agency make commercial services sustainable for distances at and beyond cislunar space

# Becoming One Team: The SCaN North Stars

## Putting Our Team in Alignment

Provide reliable, robust, and resilient space communications and navigation capabilities to enable safe execution of NASA missions.

Architect, develop, and partner to deliver the space communications and navigation capabilities of the future

Demonstrate world-class leadership through responsive engagement with communications and navigation stakeholders inside and outside the agency

# Customer Focus Example: Building an Integrated Priorities List

As part of its New Approach, in April 2024 SCaN worked with our entire set of stakeholders to build an integrated priorities list to inform our budget including representatives from SMD, ESDMD/M2M, GSFC, GRC and JPL

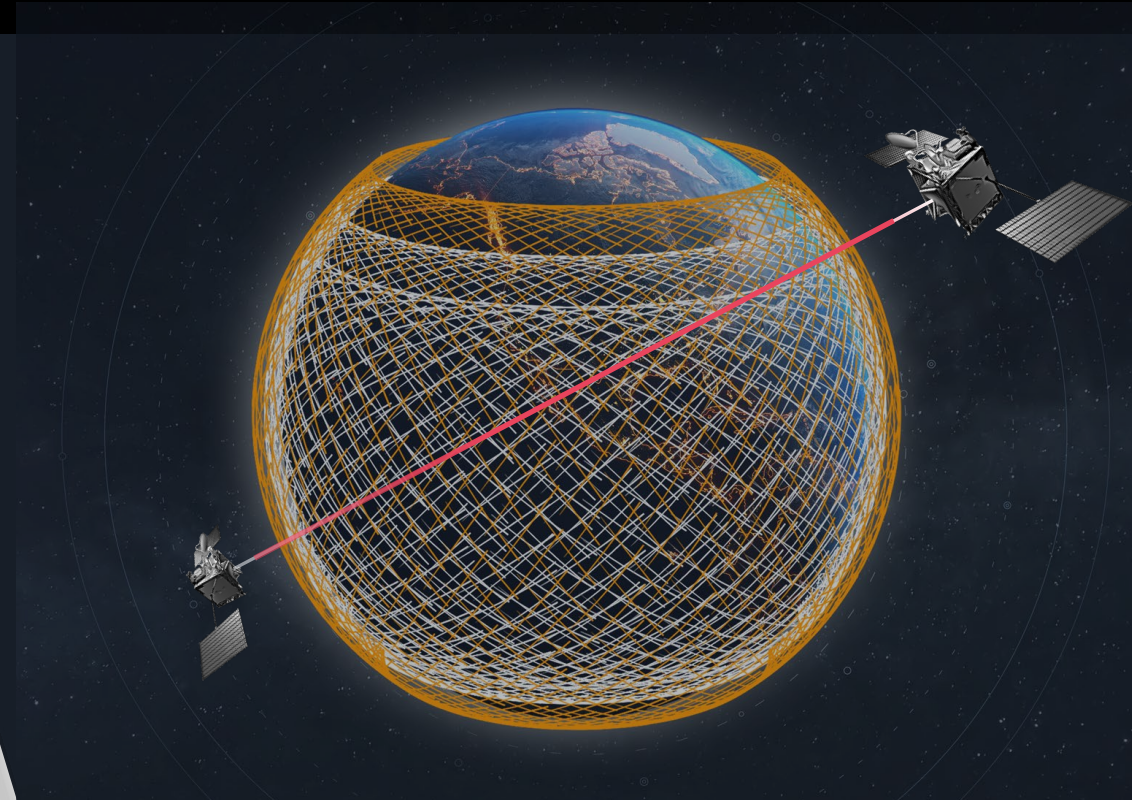
This was a key input to the budget cycle, with a vision to adequately fund projects so that SCaN can deliver key capabilities to our science and exploration partners on time

SCaN is also working with Agency leadership to align our priority list with NASA's strategic vision



# Commercial Partnerships will be Key to Meeting SCaN's Goals

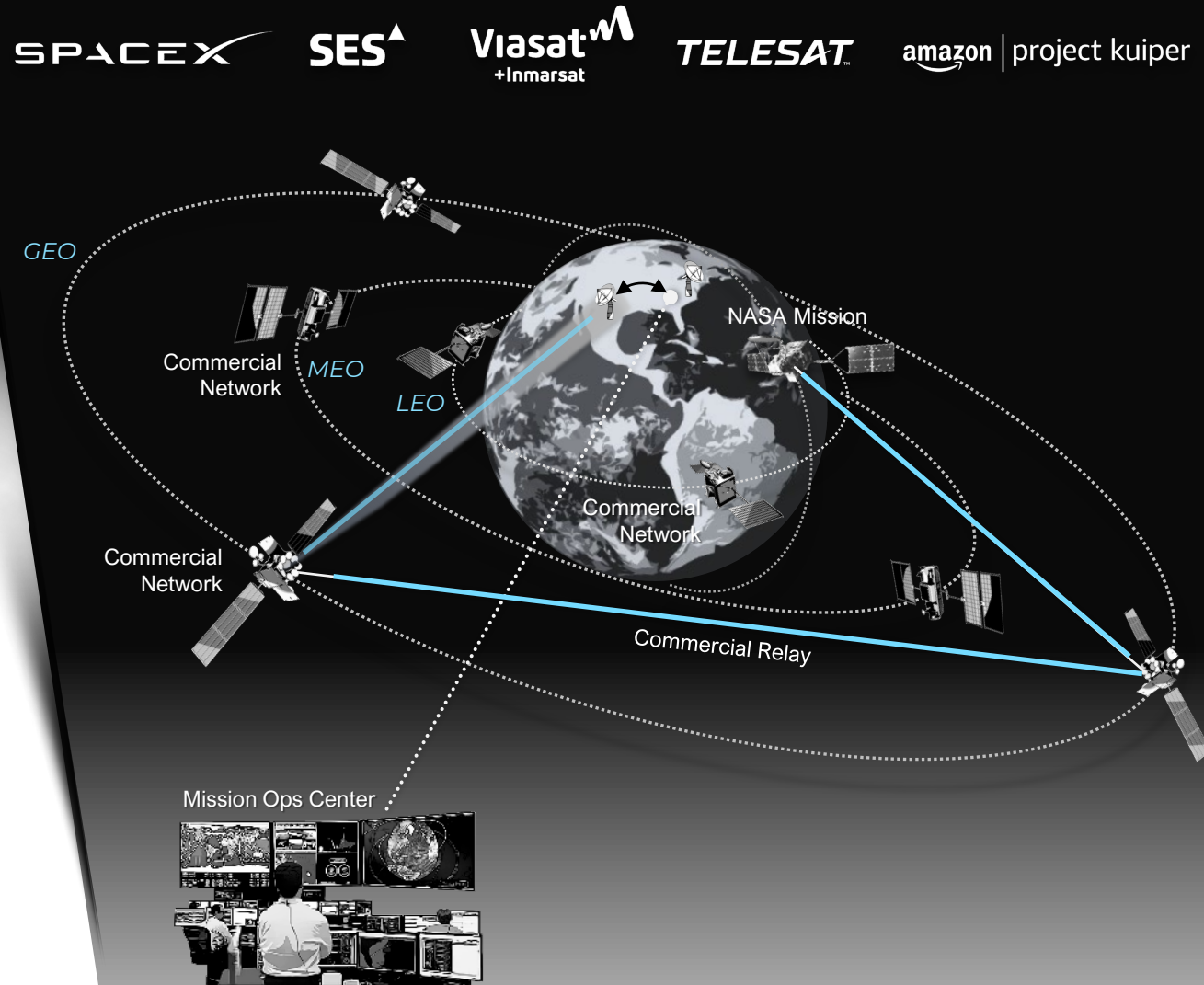
- Growth of commercial space sector has created robust non-governmental demand for space support services like communications
- Office of Management and Budget and National Space Policy encourage NASA SCaN to draw upon these commercial services wherever possible
- When there is a market case, commercial partnerships reduce costs and enhance capabilities—allowing NASA to focus its resources on pioneering forward work



Satellite constellation mesh network in space.

# Space Relay Continuity: Commercializing NSN

- In 2020, SCaN defined a strategy to transition NASA's Low Earth Orbit missions to commercial SR services
- Our Near Space Network (NSN) will maintain critical space relay capabilities including global coverage for TT&C
- SCaN's Communications Services Project (CSP) awarded funded space act agreements (FSAAs) in 2022 totaling \$278.5 million to demonstrate how commercial satellites can support NASA missions





# Space Relay Continuity: Momentum is Building

- As a cohort, CSP providers are on schedule and 50% through their milestones
- SES's Ka-band ground testing with mPOWER successfully conducted with Planet's LEO flight-representative terminal
- Amazon Kuiper launched two prototype satellites and conducted extensive testing of its end-to-end optical communications payload and network architecture
- SpaceX successfully demonstrated optical connectivity between Starlink and a crewed Dragon spacecraft during the Polaris Dawn mission.
- Viasat and Rocket Lab partnered to demonstrate data relay services for LEO satellites
- Inmarsat plans a demo in March 2025 to support a Blue Origin New Glenn launch
- The SCaN-funded Polylingual Experimental Terminal (PEXT) will launch in early 2025 and be compatible with multiple commercial services

## Optical Demonstration

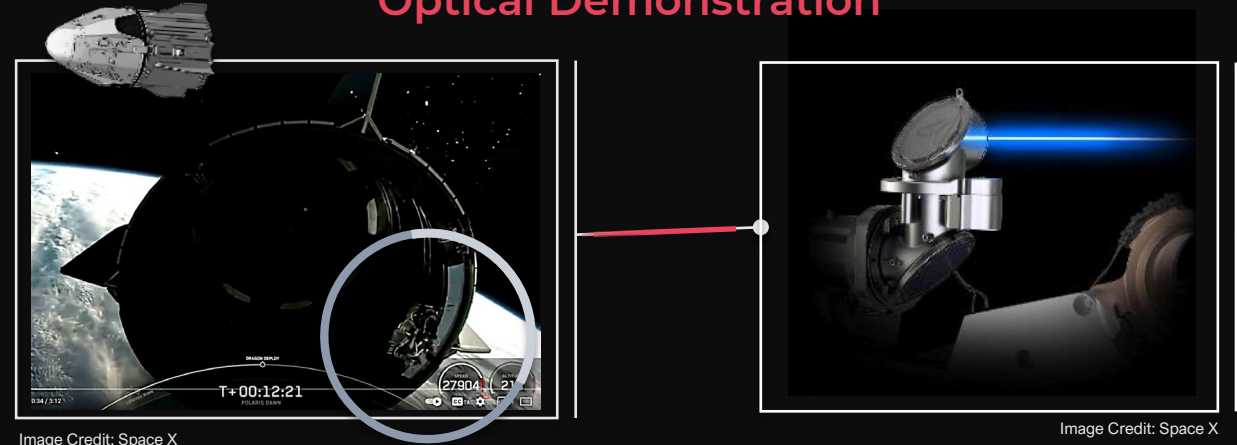


Image Credit: Space X

Image Credit: Space X

Polaris Dawn and Starlink Plug and Plaser

## Polylingual Experimental Terminal (PEXT)

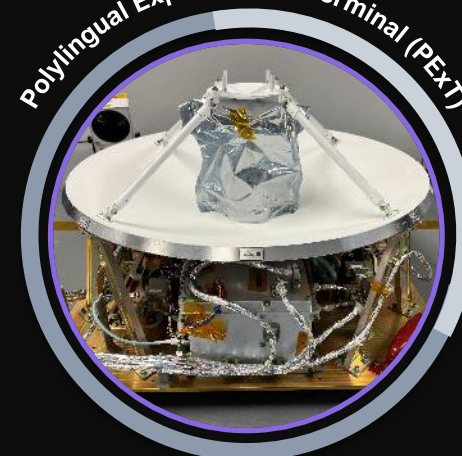


Image Credit: JHU APL

## Project Kuiper Prototype Satellite Launch



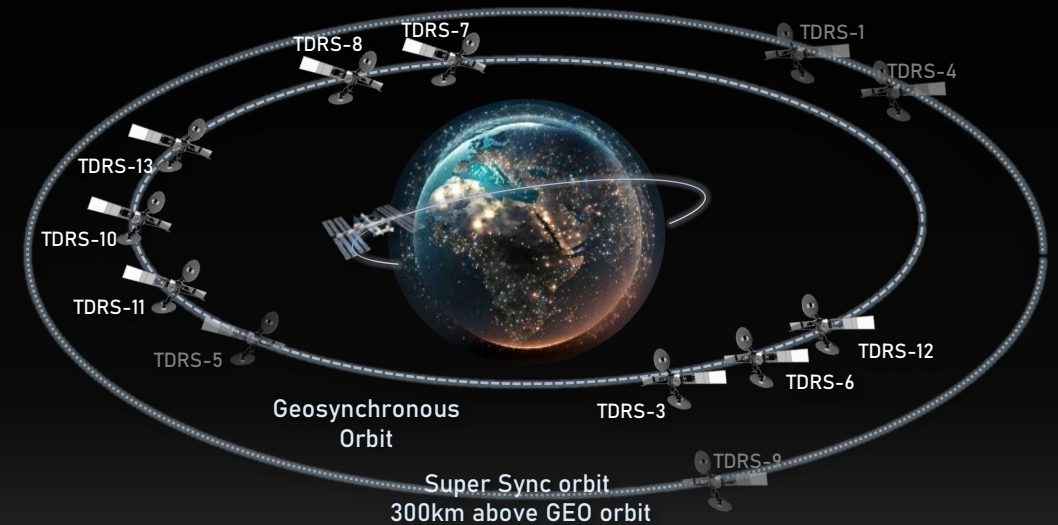
Image Credit: Amazon

# Space Relay Continuity: Phasing out TDRS

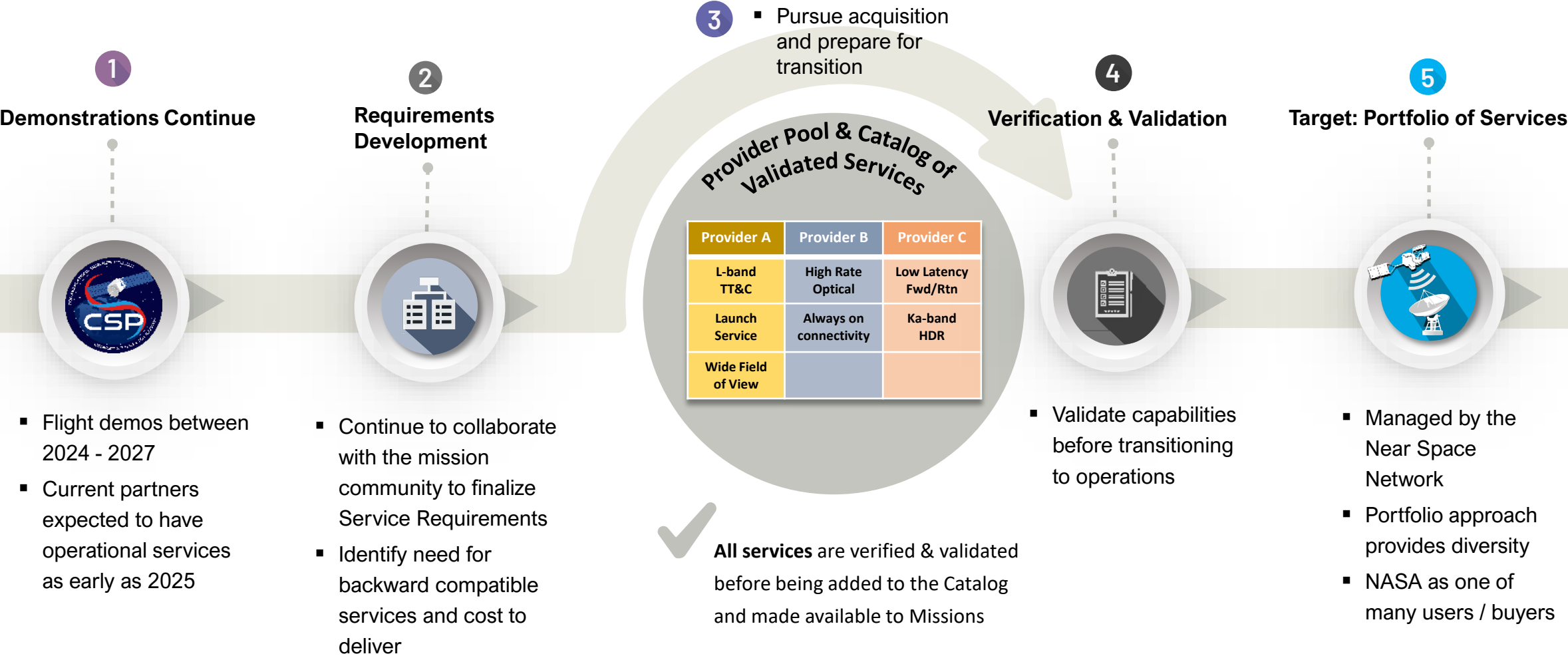
- The NASA Tracking and Data Relay Satellite (TDRS) system is in decline
- To preserve capacity for existing users and avoid introducing new risks, NASA has decided to stop accepting new users on the TDRS network
- O&M of the remaining TDRS fleet will be focused on retaining global coverage into the 2040s for current users (e.g., Hubble Space Telescope)
- NASA is assessing whether TDRS backwards compatible services are required and potential budget impacts

## NASA Decision

- Effective as of August 8, 2024, NASA will suspend acceptance of new mission commitments for TDRS support with the intent to remove TDRS services from the NSN catalog of available service offerings by November 8, 2024.



# Space Relay Continuity: CSP will Deliver Services by 2031



# Building On a Sustainable Approach to Commercial

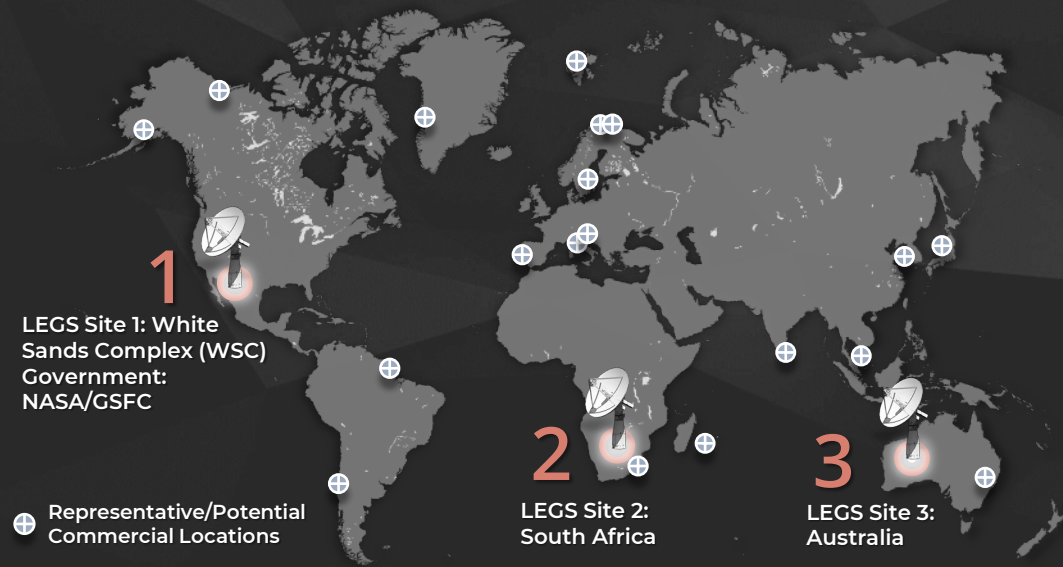
- NASA and SCaN aim to build an approach to commercial providers where we are partners, not just consumers
- Across various space communications domains, NASA needs to ensure there is a healthy ecosystem with enough business to keep multiple providers—and competition—alive
- That means assessing business cases and balance sheets as the Agency seeks new capabilities
- NASA also needs to honor their commitments so that private industry can be confident in their investments
- Conversely, partners must be held accountable to their investment and innovation obligations



# Near Space Network: Building Commercial Partners for Cislunar Space

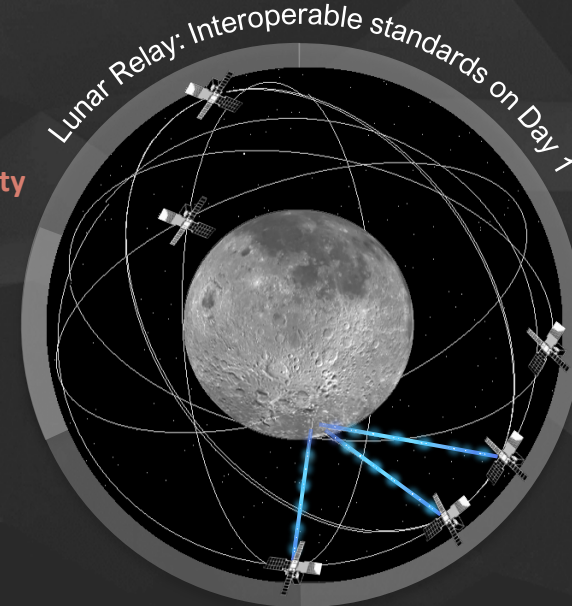
TWO SEPARATE approaches built on lessons from commercial services for LEO

- SCaN's Lunar Exploration Ground Stations (LEGS) - Building three initial antennas
- Commercial vendors are preparing to offer services that are interoperable with this service architecture



- Commercial LEO DTE market was grown by NASA through direct investments and as an anchor tenant
- Commercial stations now provide a majority of NASA's LEO DTE support

- SCaN has defined a LunaNet Interoperability Specification (LNIS) in partnership with ESA and JAXA that is traceable to M2M objectives



- SCaN has solicited for commercial lunar relay service providers

- ESA following SCaN's acquisition model with their Moonlight program

- Interoperability and vendor lock remain a key challenge for LEO commercial relay
- NASA is addressing these concerns in LEO through interoperable user terminals, and by supporting standards like 1550 nm for optical
- For lunar, we have a "green field" opportunity to take a standards-first approach

# The “Next Giant Leap”

SCaN is also tracking capability needs that will increase stress on already overallocated resources

- Increasingly data-intensive missions on the NSN and DSN
- Continued sustainment of the 70-meter DSN antennas
- DSN supporting human space flight for the first time in over 50 years starting with Artemis I
- Growth in cislunar demand for later (2030+) Artemis missions
- Future Mars science and exploration missions

Our partnerships with commercial providers in LEO and soon for cislunar are revolutionizing communications support in these domains

It is time to identify, acknowledge, and address gaps beyond LEO and cislunar

SCaN is ready to work with NASA, international, and commercial stakeholders to build a proactive enterprise plan for NASA’s Deep Space networks



# Synopsis

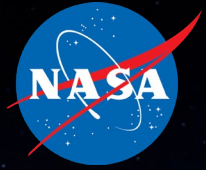
- **SCaN is resetting to be the leading 21st century space network** by reorganizing to support our core functions and address customer needs
- **Stakeholder collaboration is driving the program forward** and has already yielded an integrated priority list for all SCaN activities
- **Capability gaps are being identified** that SCaN must address in future years, including at Mars and for deep space
- **Commercial will be the key to meeting user requirements** while operating within budget
- **It is time for a sustainable, partnership-driven approach to commercial vendors** that can support Agency users while facilitating a dynamic space marketplace



# SCaN

## Space Communications and Navigation

National Aeronautics and  
Space Administration



Science and Exploration, Enabled. Together