National Aeronautics and Space Administration

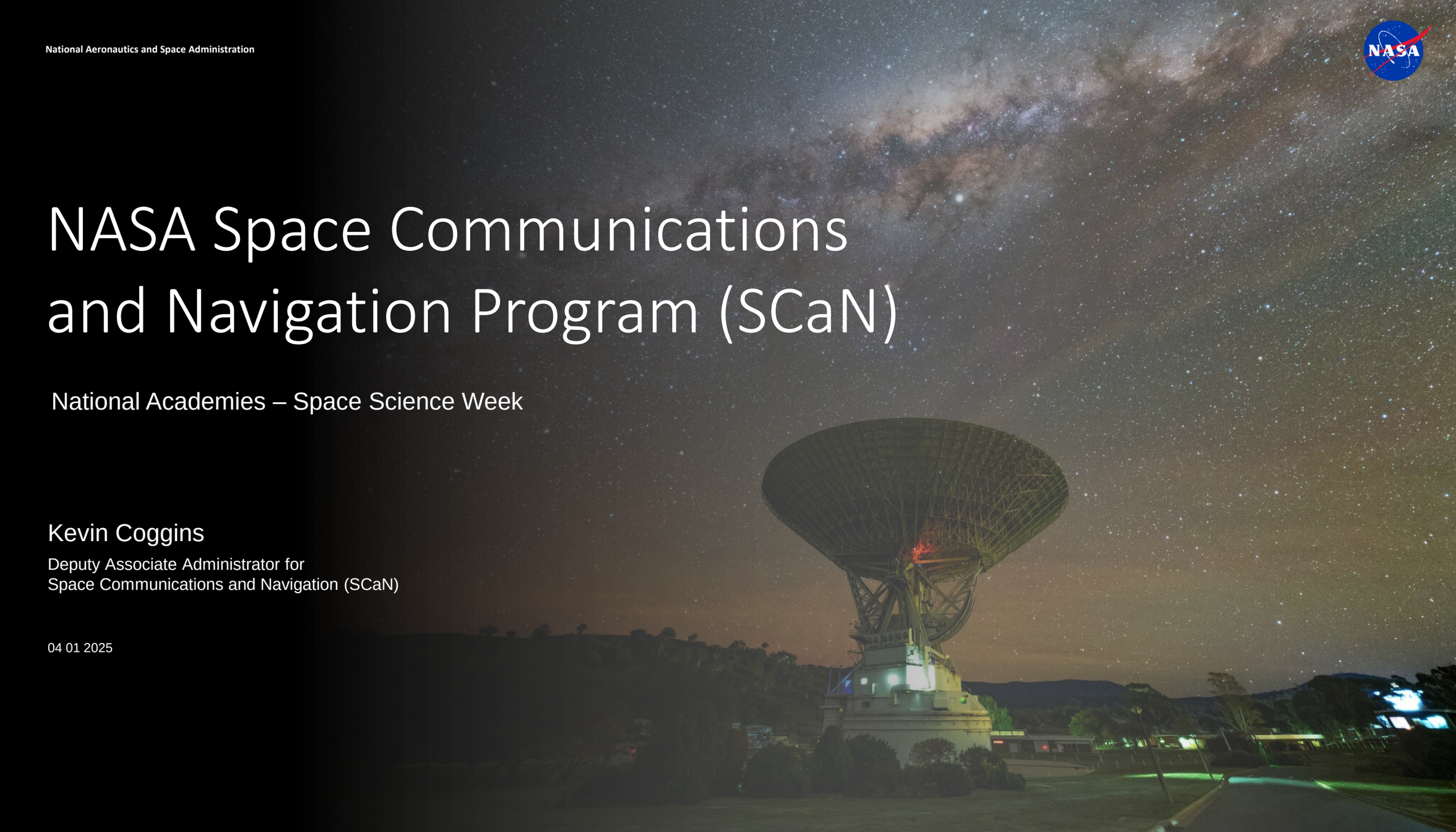
NASA Space Communications and Navigation Program (SCaN)

National Academies – Space Science Week

Kevin Coggins

Deputy Associate Administrator for
Space Communications and Navigation (SCaN)

04 01 2025



SPACE COMMUNICATIONS and NAVIGATION

SCaN Overview and Forward Vision

Science and Exploration, Enabled.

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

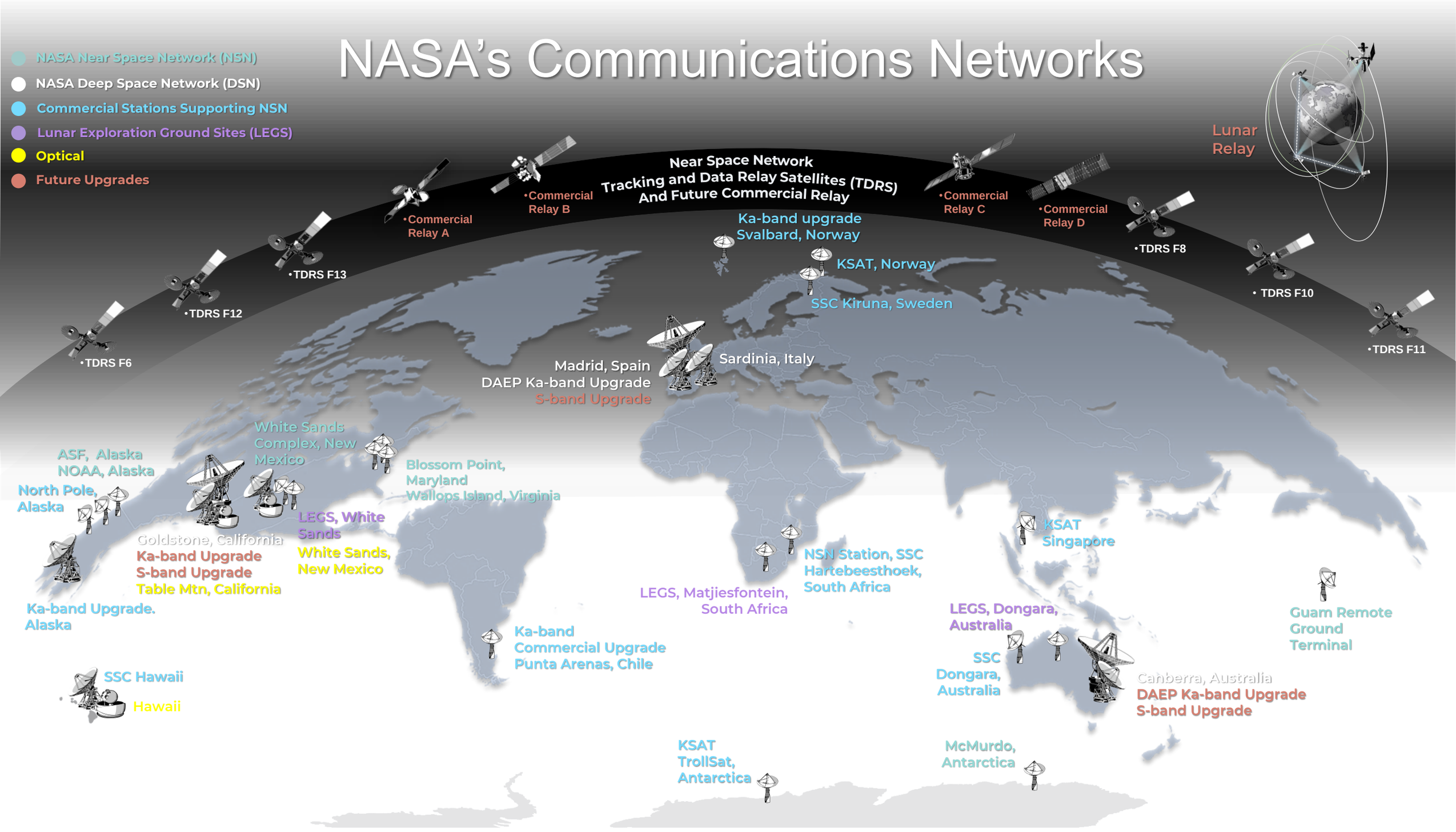
Space Communications and Navigation

- Serves as the enterprise responsible for all 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

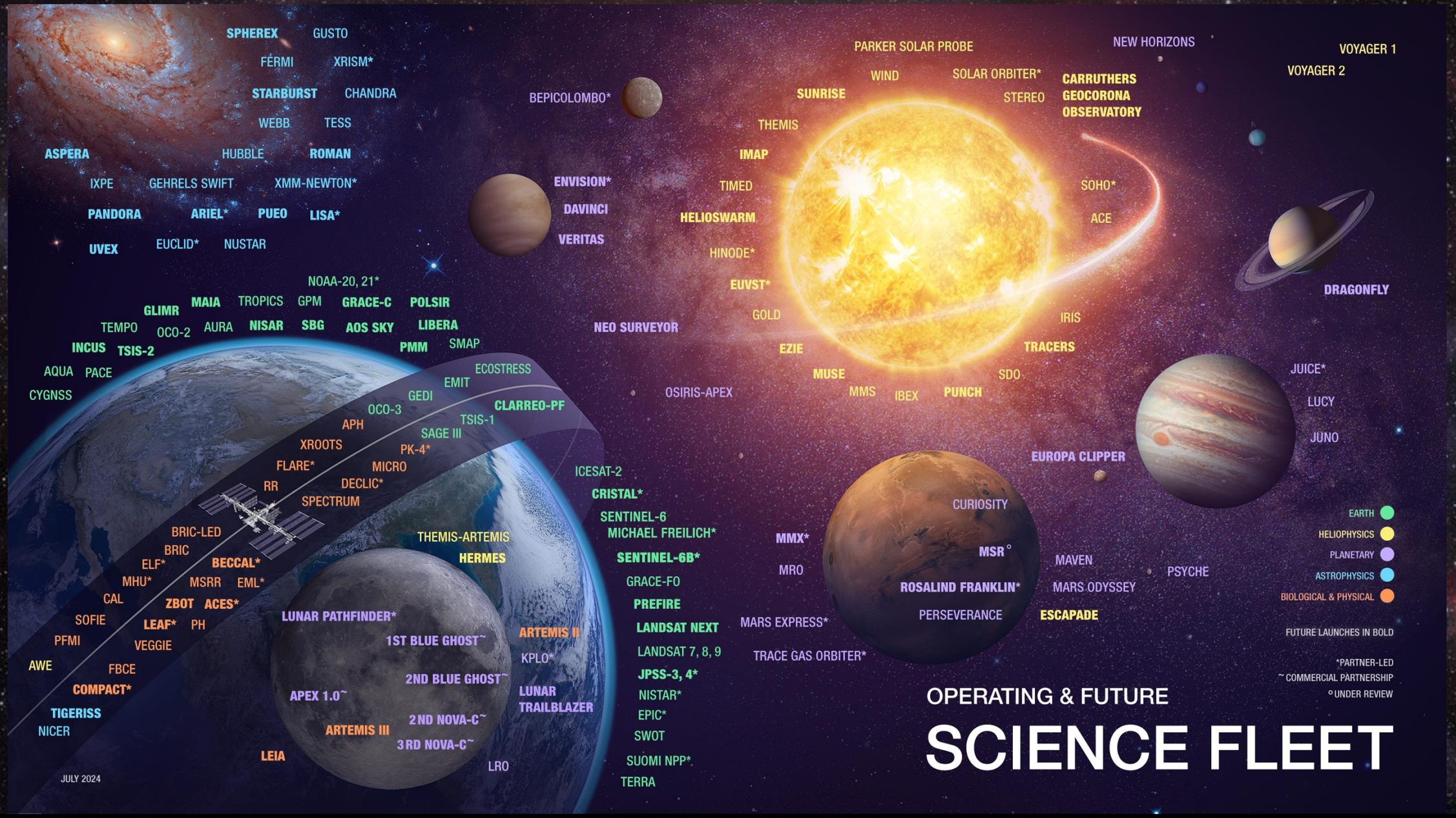
- **Engage** as one team, one mission, one network
- **Execute** with sound technical and programmatic fundamentals
- **Evolve** the network to satisfy mission customer needs of the future
- **Empower** our science and exploration partners

NASA's Communications Networks



Space Missions

Missions rely on SCaN for critical communications and navigation capabilities



SCaN is adopting commercial solutions to provide cost-effective, global, low latency, high throughput services to users

Building on decades-long relationships with **commercial direct-to-Earth (DTE)** providers, and **integrating new providers** based on robust multi-player—and multidomain—market.

Approaching relevant technology projects to **leverage Commercial-off-the-shelf (COTS) products and build-in pathways to commercialize** end capabilities.

Continuing to **collaborate with stakeholders** to define NASA's future network architecture and the strategies for its implementation.

CRITICAL TOPIC 1

TDRS Flyout and Next Gen Relay

NASA's Tracking and Data Relay Satellite (TDRS) system is in decline

TDRS is used by NASA missions and international and commercial operations

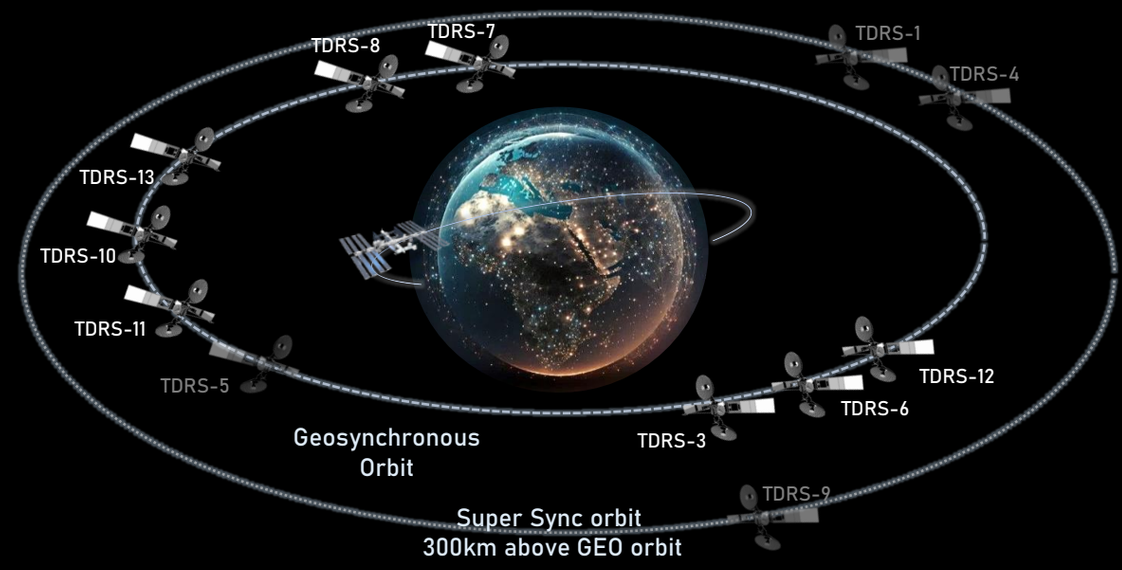
TDRS provides tracking and data relay services between low-earth orbiting spacecraft and ground facilities

- The first TDRS was launched in 1983
- Several spacecraft are 30+ years old
- 7 aging spacecraft still provide services
- **The space segment will not be replenished**

To preserve capacity and manage risks, NASA has stopped accepting new users on the TDRS network

NASA Decision

Effective November 8, 2024, NASA discontinued offering TDRS services as part of the Near Space Network (NSN) service catalog



Through the Communication Services Project (CSP), SCaN is adopting commercial solutions to continue providing space relay (SR) services to near-Earth users

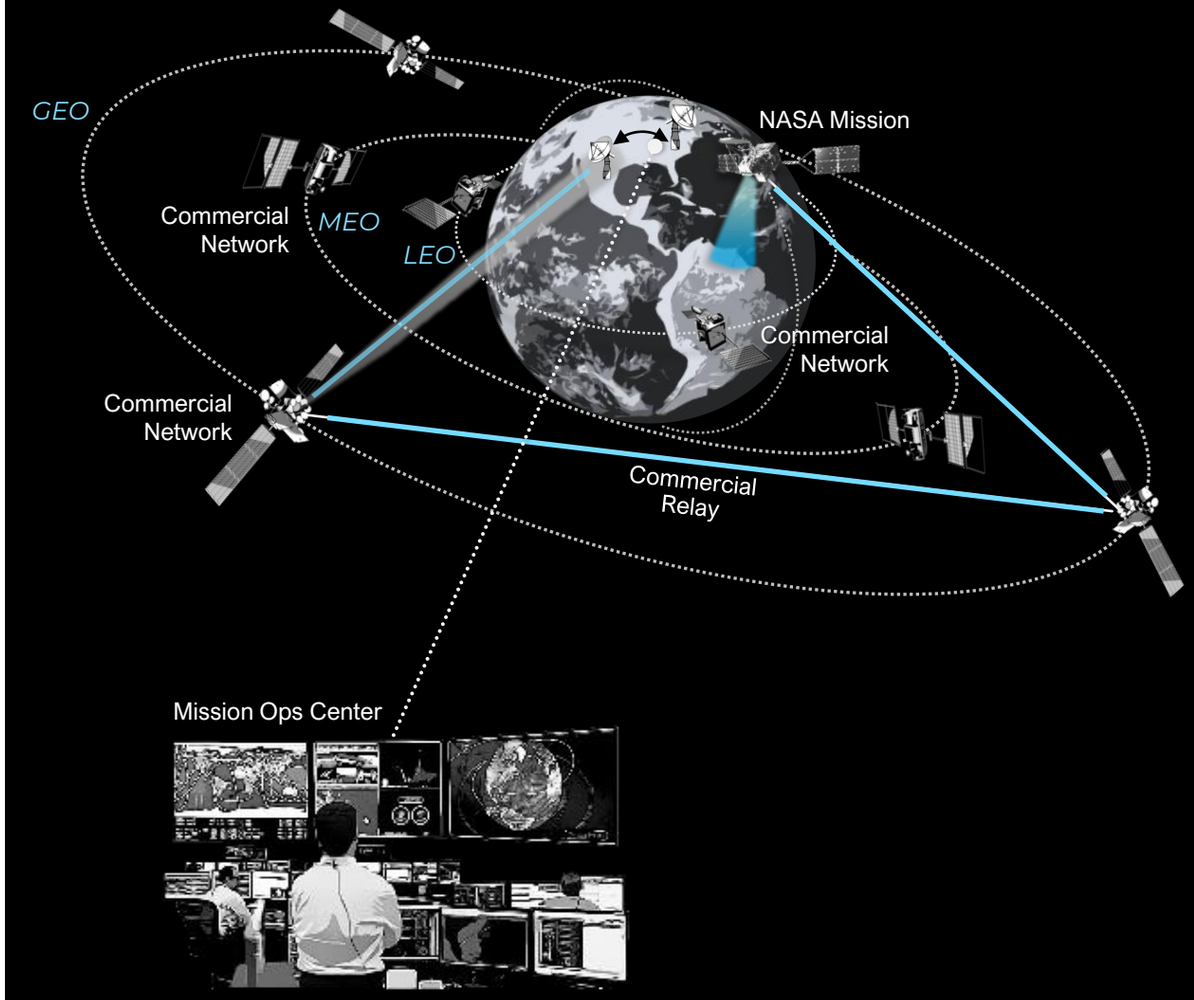
NSN will use commercial service providers to maintain critical SR capabilities

SCaN is continuing to execute against and mature a strategy developed in 2020 to maximize commercial services

NASA announced on April 20, 2022 that CSP awarded six contracts with emerging providers

SCaN is also executing risk mitigating tech demos to address commercial satcom's use of different frequencies, proprietary waveforms and protocols

Commercial SR services from CSP will provide transformative new capabilities to science missions



Looking Ahead

- **NASA Funded Space Act Agreement (FSAA) investment:** $278.5M
- **Commercial matching investment:** $1.5B
- Vendors are progressing through their agreed milestones through mid-2027

CSP's Six FSAA Partners are Demonstrating Services for Relevant NASA Use Cases

Partners	Service Type Demonstration	Use Case	Band	Architecture
amazon | project kuiper	File Delivery	Science data	Optical	LEO
SPACEX	File Delivery	Mission data	Optical	LEO
Viasat +Inmarsat	File Delivery	Science data	Ka	GEO
	Direct Access	LEOP and TT&C	L	GEO
SES	File Delivery	Science data	Ka	MEO
	Direct Access	LEOP and TT&C	C	GEO
TELESAT	File Delivery	Science data	Ka	LEO
	Direct Access	LEOP and TT&C	C	GEO

Space Relay Continuity: CSP will Deliver Services by 2031

1 Demonstrations Continue

- Flight demos between 2024 - 2027
- Current partners expected to have operational services as early as 2025

2 Requirements Development

- Continue to collaborate with the mission community to finalize Service Requirements
- Identify need for backward compatible services and cost to deliver

3 Pursue acquisition and prepare for transition

Provider Pool & Catalog of Validated Services

Provider A	Provider B	Provider C
L-band TT&C	High Rate Optical	Low Latency Fwd/Rtn
Launch Service	Always on connectivity	Ka-band HDR
Wide Field of View		

All services are verified & validated before being added to the Catalog and made available to Missions

4 Verification & Validation

- Validate capabilities before transitioning to operations

5 Target: Portfolio of Services

- Managed by the Near Space Network
- Portfolio approach provides diversity
- NASA as one of many users / buyers

Space Relay Momentum: CSP Providers are on Schedule

- SES's Ka-band testing with mPOWER and Planet spacecraft a success
- Amazon Kuiper prototype satellites launched and tested
- Starlink optical connectivity with crewed Dragon spacecraft demonstrated
- Viasat and Rocket Lab partnered to demonstrate data relay services
- Inmarsat will demo with Blue Origin New Glenn launch
- Polylingual Experimental Terminal (PExT) is launching; will demo of services with multiple vendors

CSP can provide information on direct commercial service acquisition to missions seeking SR services before 2031 validations

Optical Demonstration

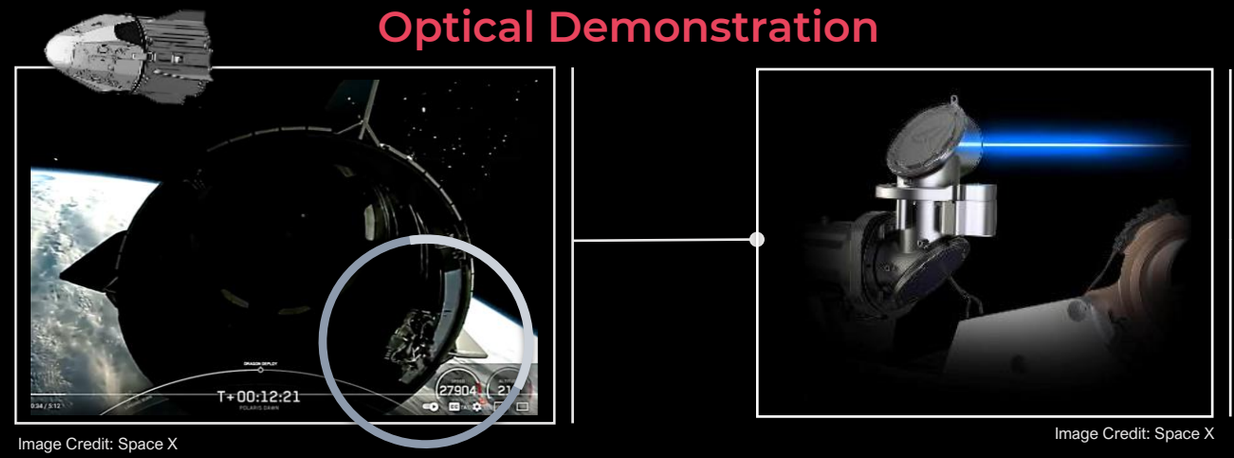
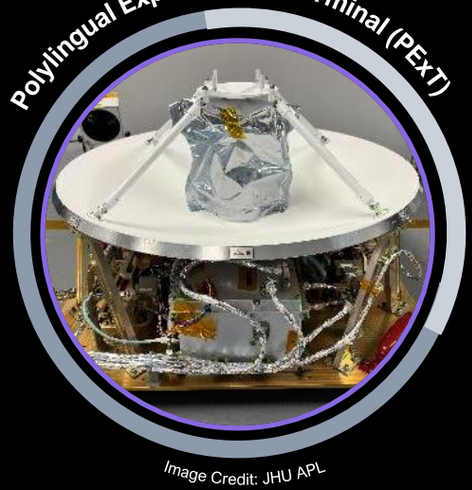


Image Credit: Space X

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

CRITICAL TOPIC 2

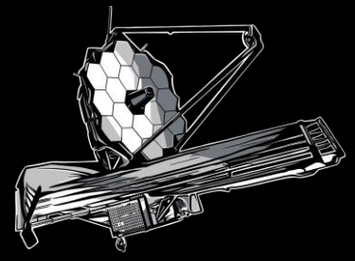
Next Gen Lunar and Solar L1/L2 Support

Artist Concept-ESA

Deep Space Network (DSN) Demand is Rising

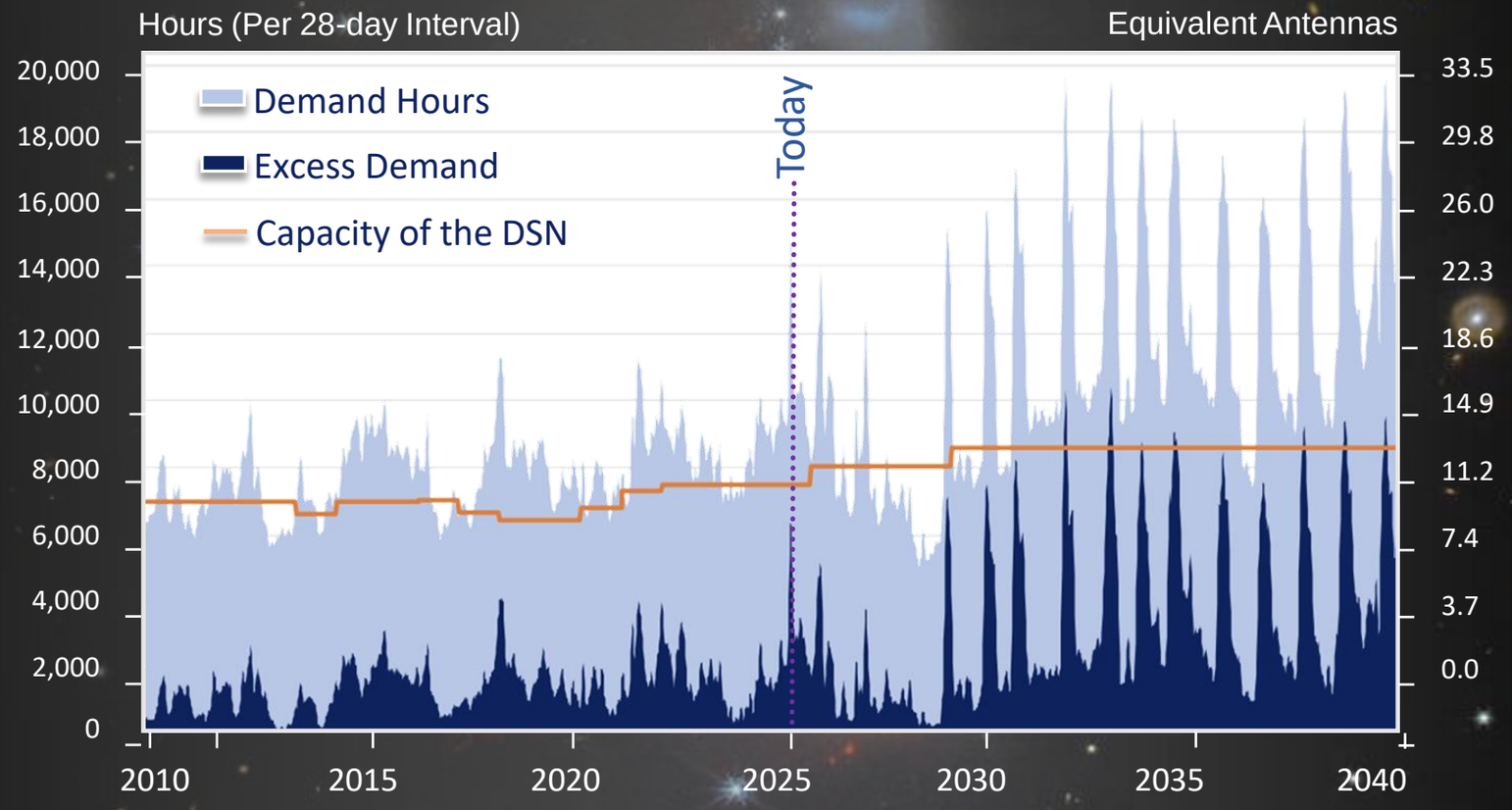
High-demand missions are already impacting the DSN

- Each Artemis launch leads to a major demand spike; these challenges grow with later missions
- Infrastructure support has not kept up
- New antenna builds to be completed by 2030 will alleviate some load



JWST

SLS



NASA Office of the Inspector General, 7/12/23

Lunar Exploration Ground Segment (LEGS)

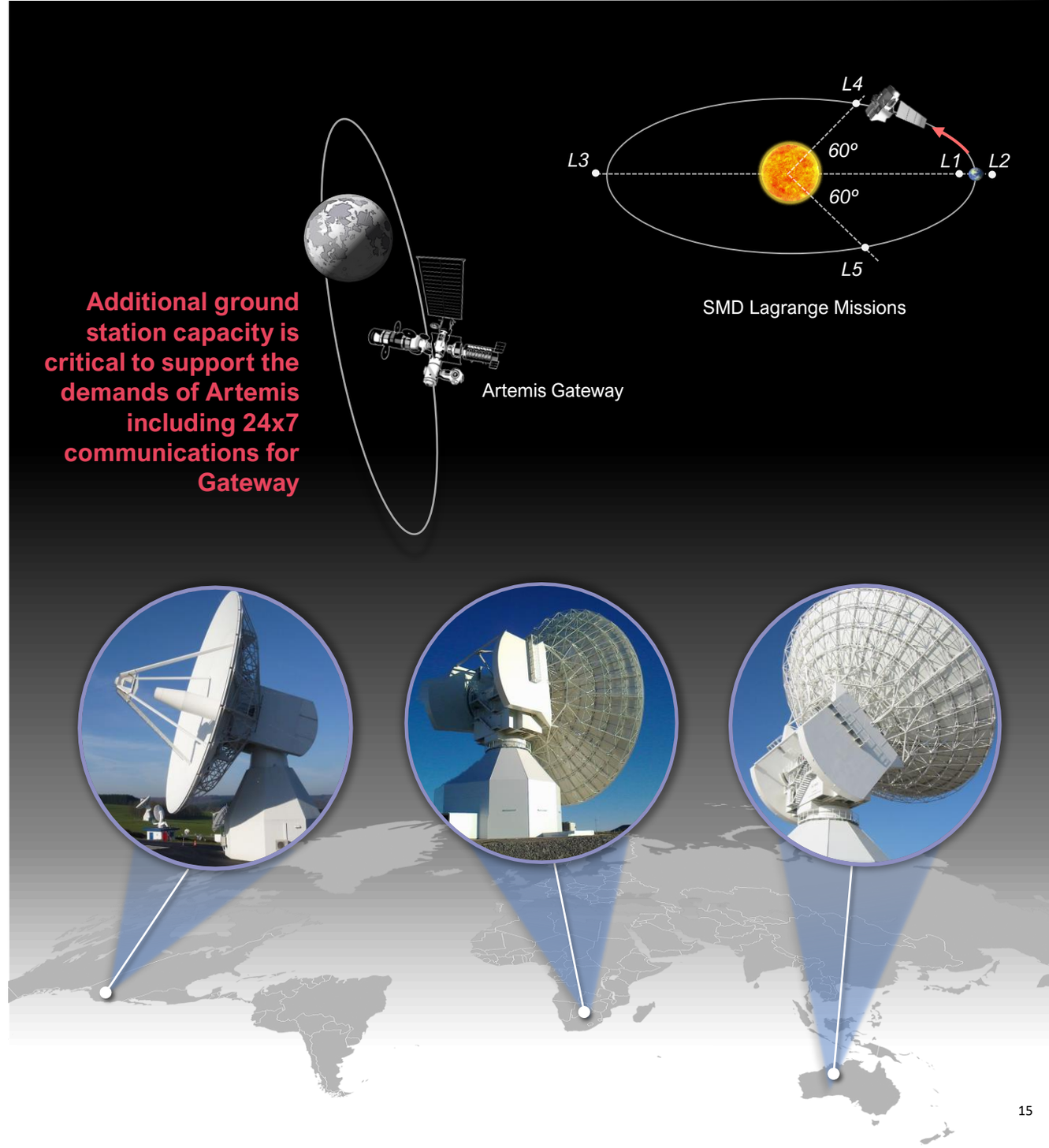
Lunar Exploration Ground Segment (LEGS) will provide critical capacity for cislunar and L1/L2 users via NSN

NASA is building “20-m class” LEGS antennas in US, Australia and South Africa to be government owned and commercial operated

LEGS 1-3 will ensure 24x7 service for Gateway; will be operational in time for Artemis IV

KSAT and Intuitive Machines were selected as part of an NSN RFP to offer interoperable “LEGS-Class” services using same service architecture, augmenting availability

Missions proposing inside the 2m km bubble should baseline to LEGS for DTE support



NASA SCaN and its Partners are Building Lunar Relay Infrastructure

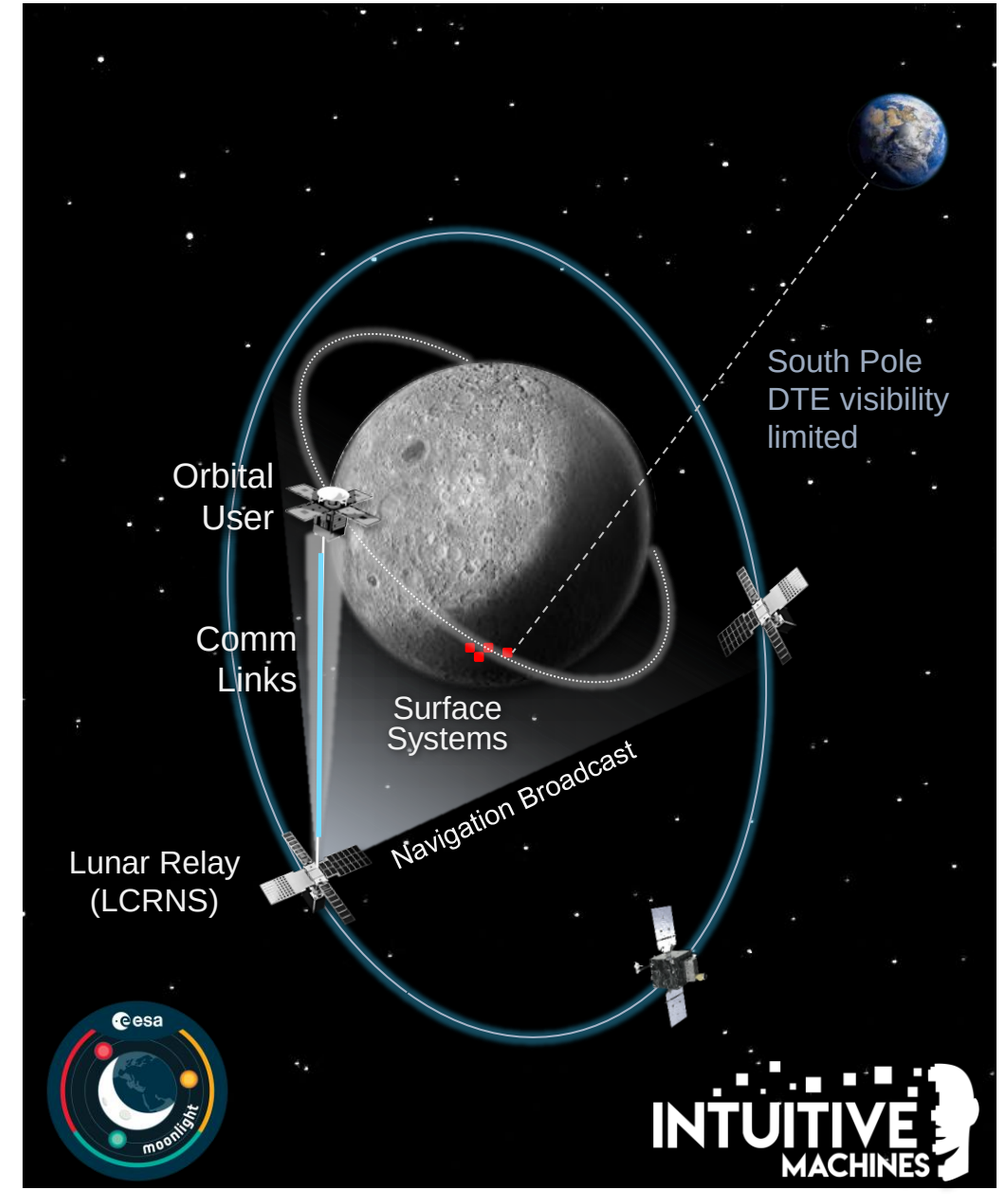
SCaN awarded Intuitive Machines a contract for Lunar Communications Relay and Navigation Systems (LCRNS)

SCaN is establishing standards (LunaNet Technical Baseline) for interoperable communications & position, navigation, and timing (C&PNT) for both its commercial and international partners (e.g., European Space Agency's Moonlight)

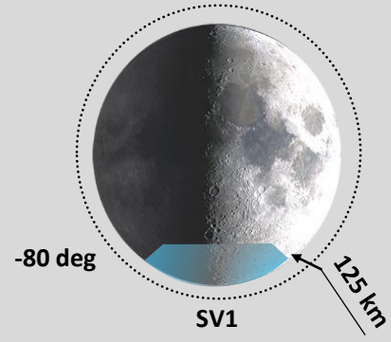
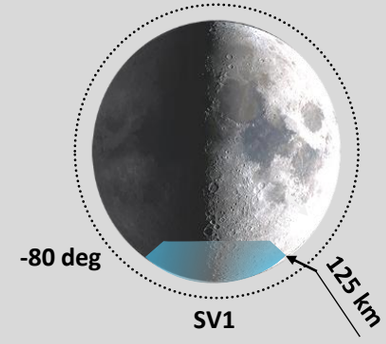
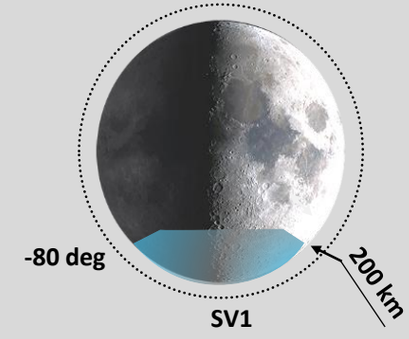
SCaN's plan for lunar relay will:

- Address lunar south pole coverage gap and navigation challenges
- Aggregate surface comms, reducing DTE load
- Reduce the user burden

Pre-validation services may be available directly via IM, or via the LCRNS project in a "test subject" capacity for flight-level checks



Requirements and Increments

Increment	Alpha	Bravo	Charlie
Service Volume			
Capabilities	• Communication support • % Coverage of Earth Day – 70% (all bands) • RF and waveform compatibility with LunaNet Interoperability Specification • Single augmented forward signal (AFS) (position, navigation and timing (PNT))	• Enhanced communication support • % Coverage – 75% Ka-band, 90% S-band, 70% AFS (2 links) • RF and waveform compatibility with LunaNet Interoperability Specification • Multiple augmented forward signal (PNT)	• % Coverage - 75% Ka-band, 90% S-band, 40% AFS (4 links, max spatial GDOP<6) • Full set Lunar Communications Relay and Navigation Services (LCRNS) Services Requirements Document (SRD) and Initial Operating Capability (IOC) requirements

Readiness	ARTEMIS III	ARTEMIS IV	ARTEMIS V
M2M Relay Comm Need	Demo Opportunity	Required	Required
M2M Relay PNT Need	Demo Opportunity	Demo Opportunity	Required

Synopsis and Conclusion

- SCaN is evolving the network to meet new challenges, and support its users
- NASA is suspending acceptance of new mission commitments for TDRS; CSP will deliver near-Earth space relay services through the NSN by 2031
- **SCaN will provide guidance to NASA missions who intend to work directly with space relay providers**
- Missions that seek DSN support will compete for limited resources with high-priority users such as Artemis and James Webb Space Telescope
- LEGS and LCRNS will help relieve the oversubscribed DSN and are moving forward rapidly
- **Missions proposing inside 2m km should baseline to LEGS and/or LCRNS, depending on requirements**

SCaN SPACE COMMUNICATIONS AND NAVIGATION

Science and exploration, enabled.