SCaN Next Generation Communications Capabilities

a Beacon of Light into NASA's Future

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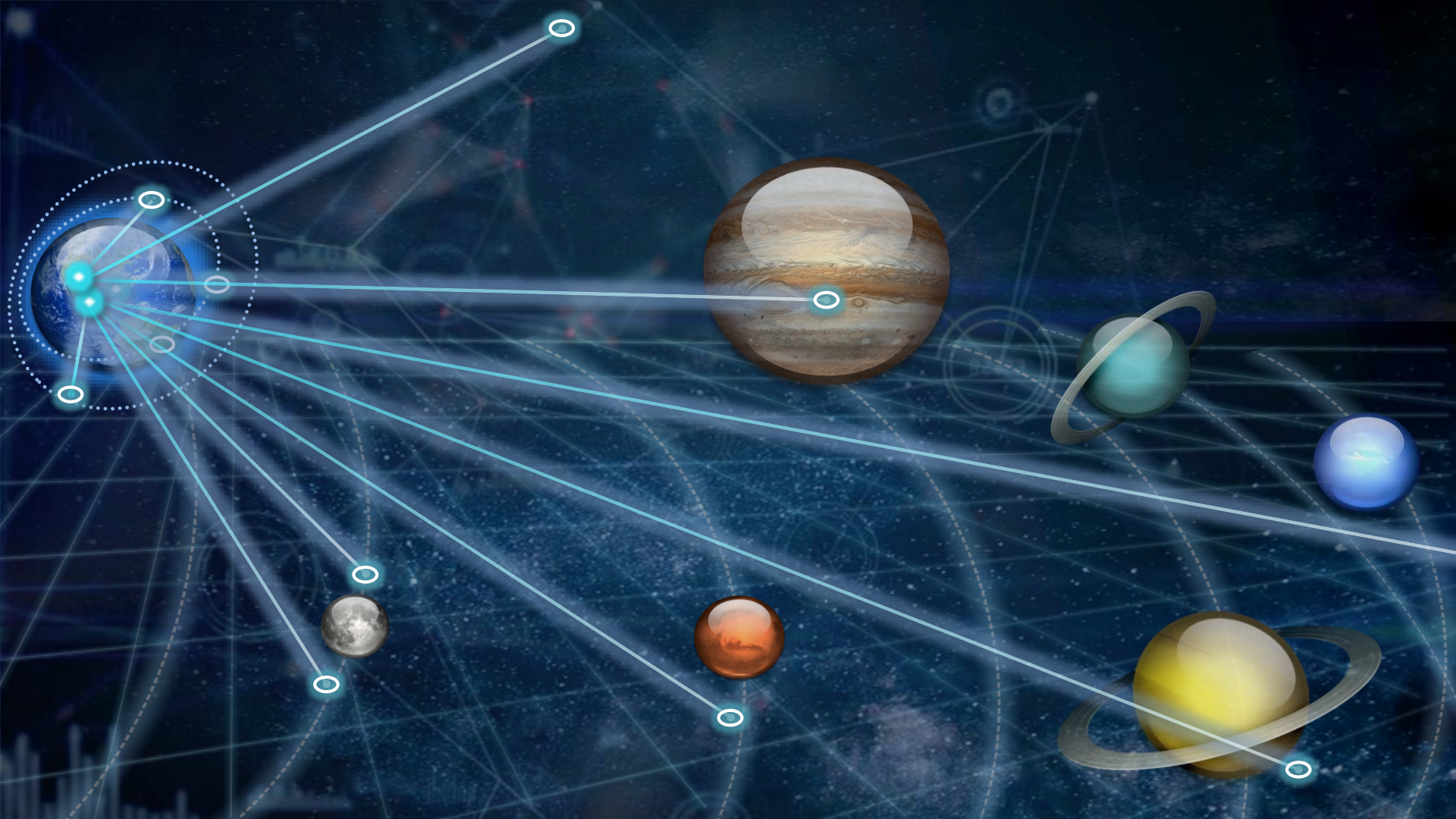
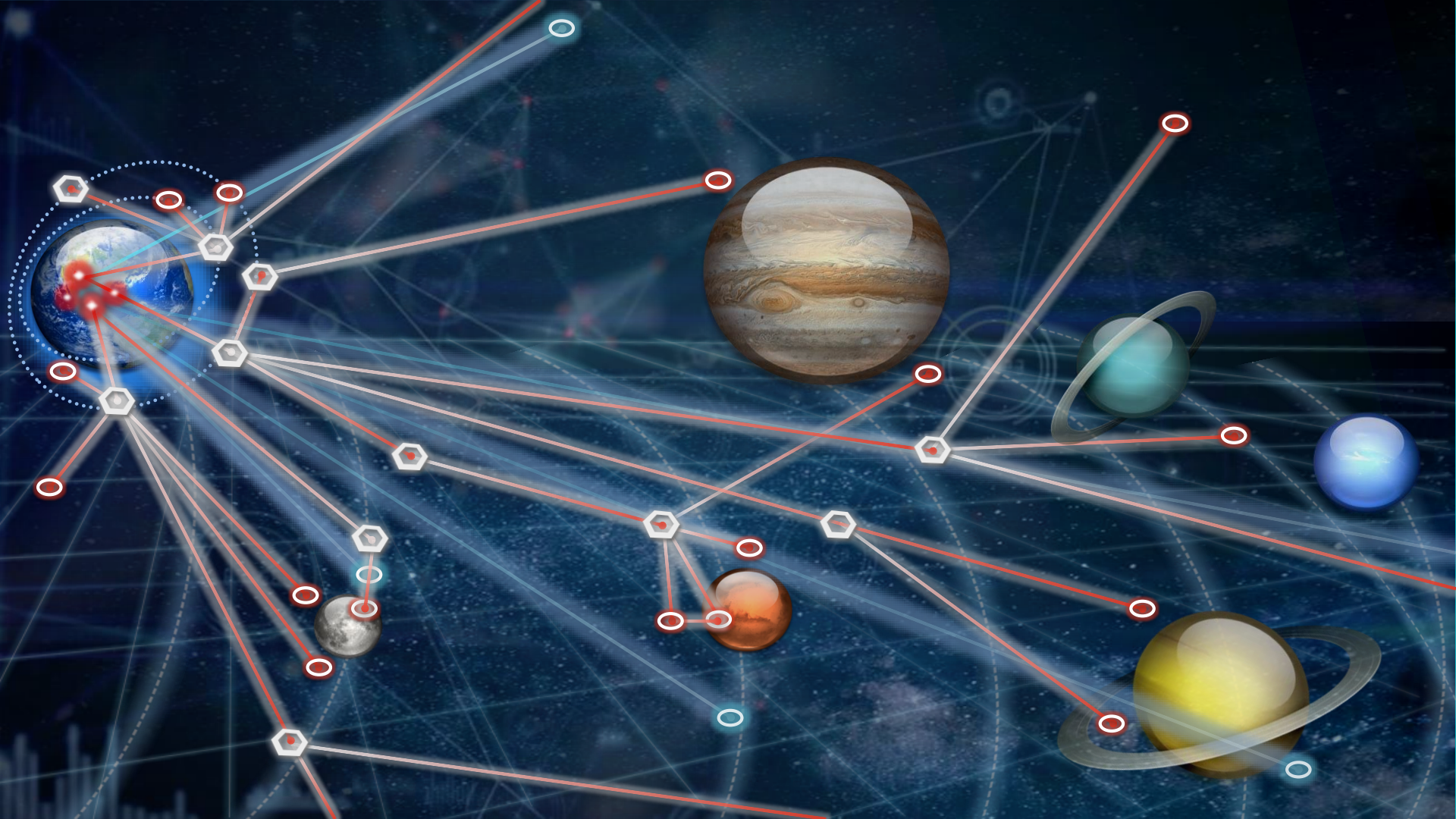
Decade of LIGHT





Concept of Operations

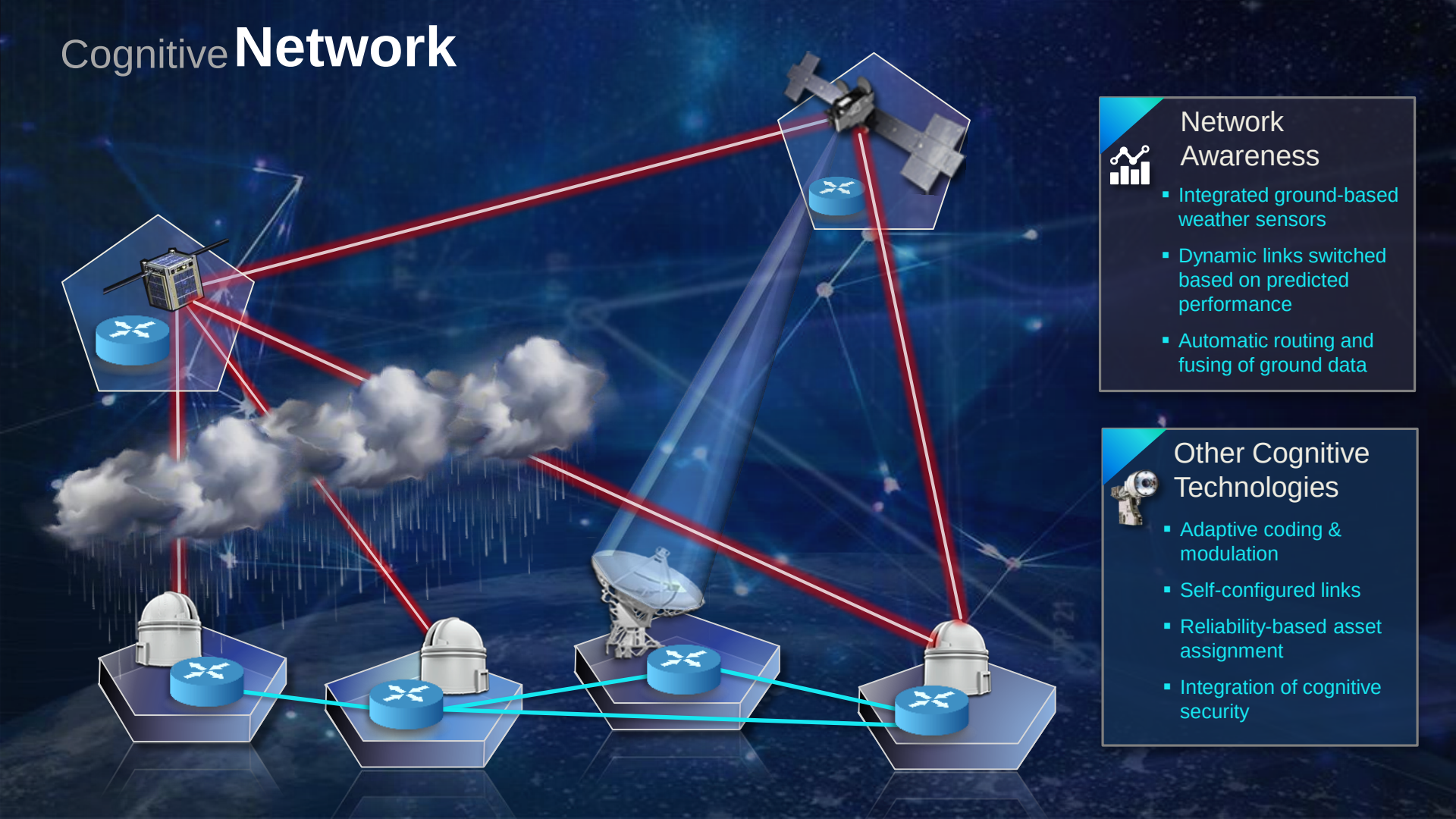
RF Network

RF Network
Near Earth DTE

RF Network
Near Earth DTE
Near Earth Relay

RF Network
Near Earth DTE
Near Earth Relay
Deep Space DTE

Cognitive **Network**



Network Awareness

- Integrated ground-based weather sensors
- Dynamic links switched based on predicted performance
- Automatic routing and fusing of ground data

Other Cognitive Technologies

- Adaptive coding & modulation
- Self-configured links
- Reliability-based asset assignment
- Integration of cognitive security

Technology **Timeline**

Recent Successes

LADEE/LLCD (2013)

- First two-way space optical communications and first demonstration of “space internet” over a laser link

SCaN Testbed on ISS (2012)

- **Cognitive radio step forward**

2012 - 2013

Near Earth Direct-to-Earth

Technologies in the pipeline include:

- 100 Gbps user terminal
- 100 Gbps low cost ground station
- **Cognitive algorithms development**

2019

Near Earth Relay

Technologies in the pipeline include:

- 2.88 Gbps GEO relay & two ground stations (2019)
- 2.88 Gbps user terminal(2021)
- 100 Gbps GEO relay, user and ground station (2023)
- **Cognitive networking development**

2019 - 2023

Deep Space DTE

Technologies in the pipeline include:

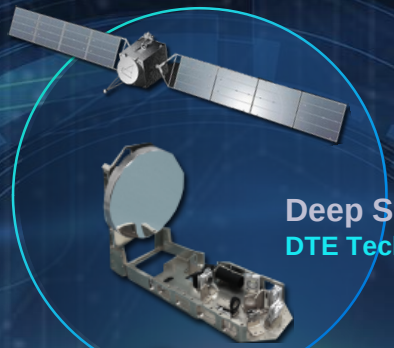
- 200 Mbps ground station
- 200 Mbps user terminal
- **Cognitive Network to the edge of the solar system**

2023

Demonstration Timeline

Near Earth
DTE Technologies

Near Earth
Relay Technologies



Deep Space
DTE Technologies

2019 — 2019-2023 — 2023

200 G LEO DTE: 200 Gbps Demo

- Demonstrates space technologies based on COTS products
- Cube-sized, low SWaP user terminal
- User-site installable ground station: eliminates data backhaul

LCRD: 1.244 Gbps Optical Relay Demo

- Demonstrates routing of optical signals in a hybrid environment (RF/optical)
- Hosted GEO relay payload on AFRL's STPSat-6; based on LADEE technology
- Two optical ground stations; one RF station
- Cognitive demonstration

ILLUMA-T: 2.88 Gbps Relay User

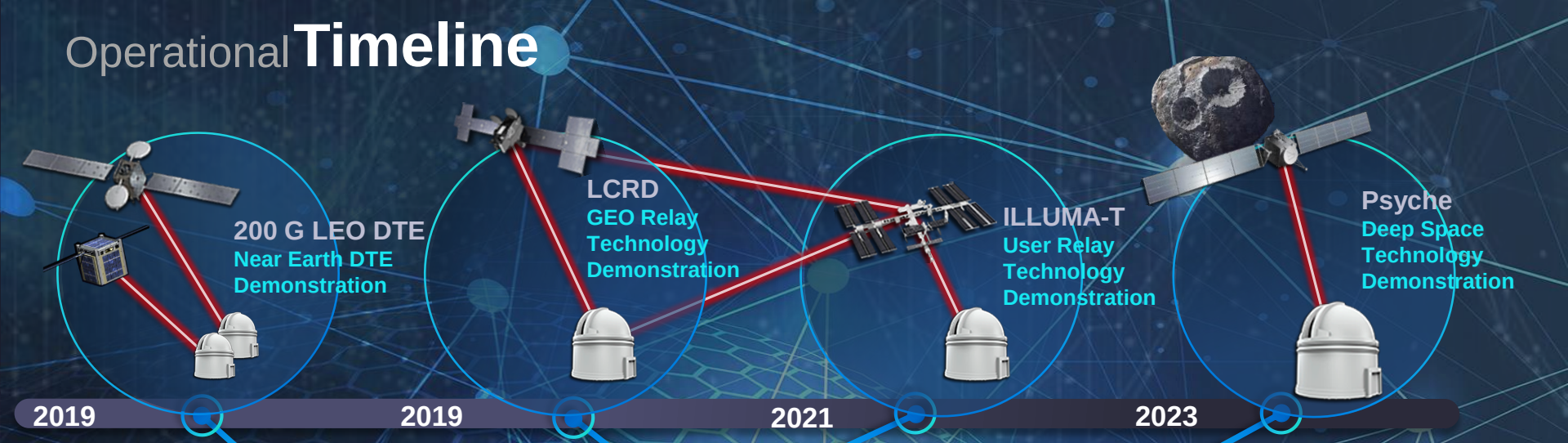
- Demonstrates LEO satellite acquisition and tracking in a GEO relay system (LCRD)
- ISS ⇔ LCRD ⇔ Earth
- Second generation user terminal: lower cost and SWaP

Psyche: 200 Mbps Demo

- Demonstrates deep space optical link
- Launch on Discovery 2023 mission
- Five (5) meter Palomar telescope
- Funded by STMD/TDM

Demonstrations — 2019 — 2019 — 2021 — 2023

Operational Timeline



Near Earth DTE Operational Services

Initially two SCaN operated ground stations; other added incrementally

- Scheduling
- Ground data buffering and routing
- **Cognitive algorithms**

Relay Operational Services

Reuses LCRD and adds two more GEO relay node to the network

- Based on LCRD design
- Augments near earth DTE network
- **Cognitive networking in operations**

Deep Space Operational Services

Adds deep space class terminals to the architecture

- Based on first generation terminals
- Ready to support missions starting in 2026

Operational 2024 | 2025 - 2027 | 2026

Decade of LIGHT
https://www.nasa.gov/directorates/heo/scan/index.html