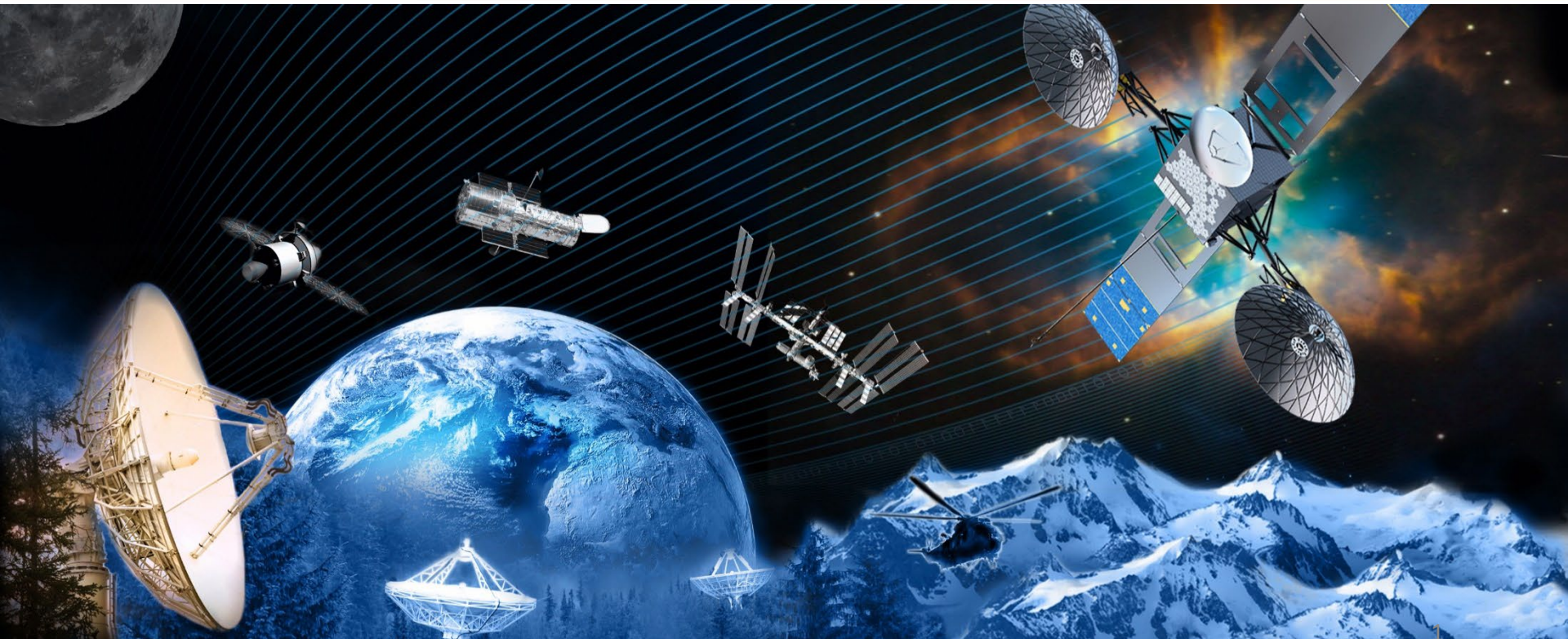




Exploration & **SPACE** Communications

More than you ever imagined...

Network Services Overview



NASA's Space Communications Networks

Three networks: NEN, SN, DSN



Near Earth Network (NEN)

NASA and commercial ground stations provide communications services to missions in low-Earth orbit (LEO) out to 2 million kilometers (GSFC managed)

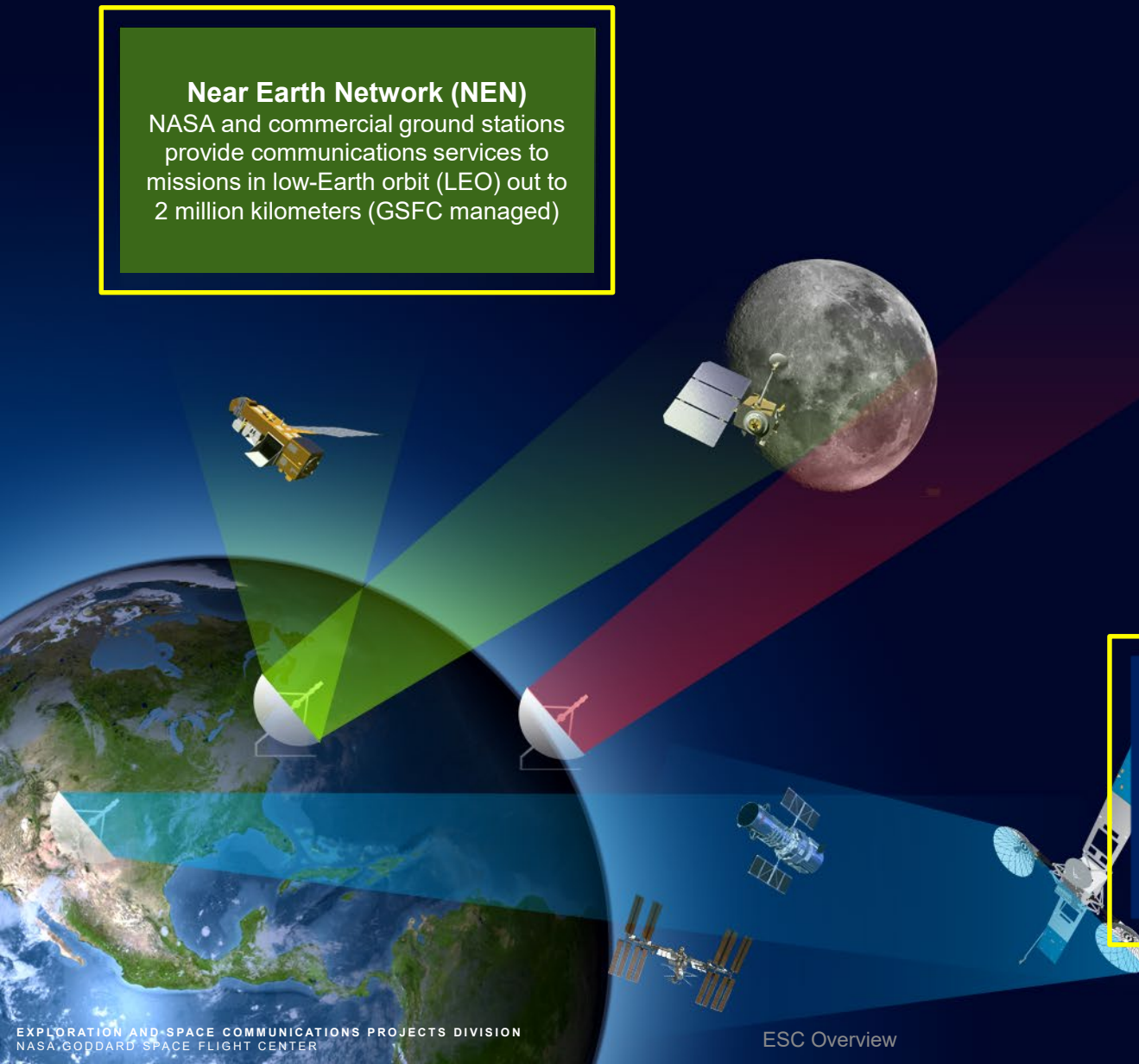


Deep Space Network (DSN)

Ground stations providing communications services to missions in the furthest reaches of our solar system and beyond

Space Network (SN)

Fleet of Tracking and Data Relay Satellites (TDRS) and their ground stations provide communications services to missions below geosynchronous orbit (GSFC managed)



Space Network (SN)



The SN's fleet of geosynchronous relay satellites communicate with the network's antennas on the ground. SN's ground segment has terminals in New Mexico and Guam, which control the strategically positioned Tracking and Data Relay Satellites (TDRS) to provide global space communications ideal for low latency mission needs.

Tracking and Data Relay Satellites



Guam Remote Ground Terminal



White Sands Complex, New Mexico

- Global coverage
- Forward and return services
- Data rates up to 1.2 Gbps
- Laser Comm Relay Demo (LCRD)
- Launching in 2021
- Ground stations in Hawaii and California

Near Earth Network (NEN)



The NEN uses ground-based antennas to provide “best-value” tracking, telemetry and command services to NASA missions operating in the near-Earth region. The NEN’s resources **continuously evolve to meet the changing communications needs of missions.**

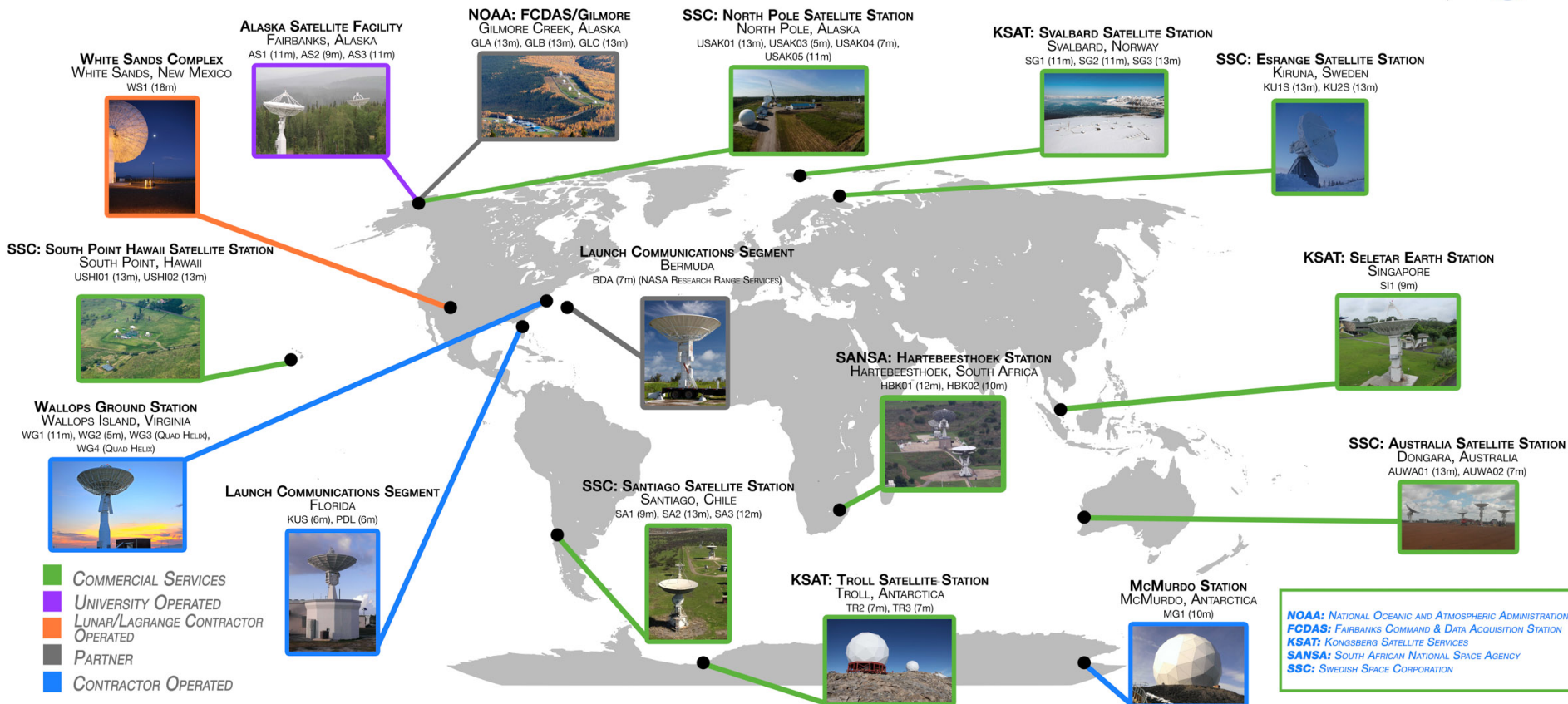


- Mixture of NASA-owned, university operated, commercial stations
- In Calendar Year 2019, the NEN supported 51,197 passes, providing 761,820 minutes of antenna contact time to 43 different user missions.

NEN Ground Stations

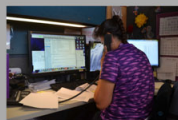
THE NEAR EARTH NETWORK PROJECT

National Aeronautics and
Space Administration



JULY 2019

SCHEDULING



The Near Earth Network (NEN) is comprised of tracking stations distributed throughout the world in locations as shown on this map.

The NEN provides Telemetry, Tracking, and Commanding (TT&C) and ranging services to an extensive and diverse customer base, which includes approximately 40 missions - from the high-rate Earth Observing System (EOS) missions such as Aqua, Aura, SMAR AIM, GOES, GPM, GRACE-FO, DSCOVR, and OCO-2, to Small Explorer (SMEX) missions including IRIS and RHES, to the Cygnus International Space Station Supply Vehicle.

PRE-MISSION TESTING



The NEN provides TT&C services for an average of about 150 passes per day. Commercial stations such as the KSAT: Svalbard Satellite Station in Norway and the SSC: North Pole Satellite Station in Alaska provide almost half of the 150 passes per day collectively.

PRE-MISSION PLANNING & ANALYSIS



- Space communications at Goddard and Wallops goes back to the beginning days of NASA.
- GSFC software and hardware engineers in the 80's and 90's conceived and were responsible for what is today the NASA NEN 10 meter and 11 meter ground stations at Wallops, Alaska, and McMurdo.
- Today, GSFC is fortunate to continue its leadership role for the Near Earth Network.
- The Near Earth Network (NEN) supports about 40 NASA and other agency satellites.

GLOBAL NETWORK MONITORING, CONTROL & COORDINATION



- The NEN collects about 1,500,000,000,000 science bytes/day, which is the equivalent of 100 two-hour DVD quality movies/day.
- Today the NEN average data rate is 100 million bits/sec and the highest satellite downlink rate is 300 million bits/sec from the Lunar Reconnaissance Orbiter.
- Future satellite data rates are expected to be an order of magnitude greater, four thousand million bits/sec.
- The NEN constantly strives to reduce costs, improve the reliability of data transmission, and meet new and evolving mission requirements.

ABOUT:

ESC Overview

www.nasa.gov

Launch Communications Segment



NASA's Near Earth Network Launch Communications Segment (LCS) will support the Orion spacecraft and the Space Launch System (SLS), which will be the most powerful rocket in the world.

Operational in 2019

The segment is made up of three ground stations:

- Kennedy Uplink Station (KUS)
- Ponce De Leon (PDL)
- Bermuda

During initial phases of launch, KUS and PDL will provide uplink and downlink communications between Artemis astronauts and mission controllers, giving them the data necessary to ensure crew safety.



Ponce De Leon

Future Capabilities



NEN Initiative for Ka-Band Advancement (NIKA)

- Operational 2021 for PACE and NISAR
- 5 antennas at 3 global locations to expand high-speed data services
- Achieving 3.5 Gbps
- Punta Arena, Chile
- Svalbard, Norway
- Fairbanks, Alaska



Antenna Arraying Demonstrations with WFIRST

- 600Mbps at Lagrange point 2



Optical Communications

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