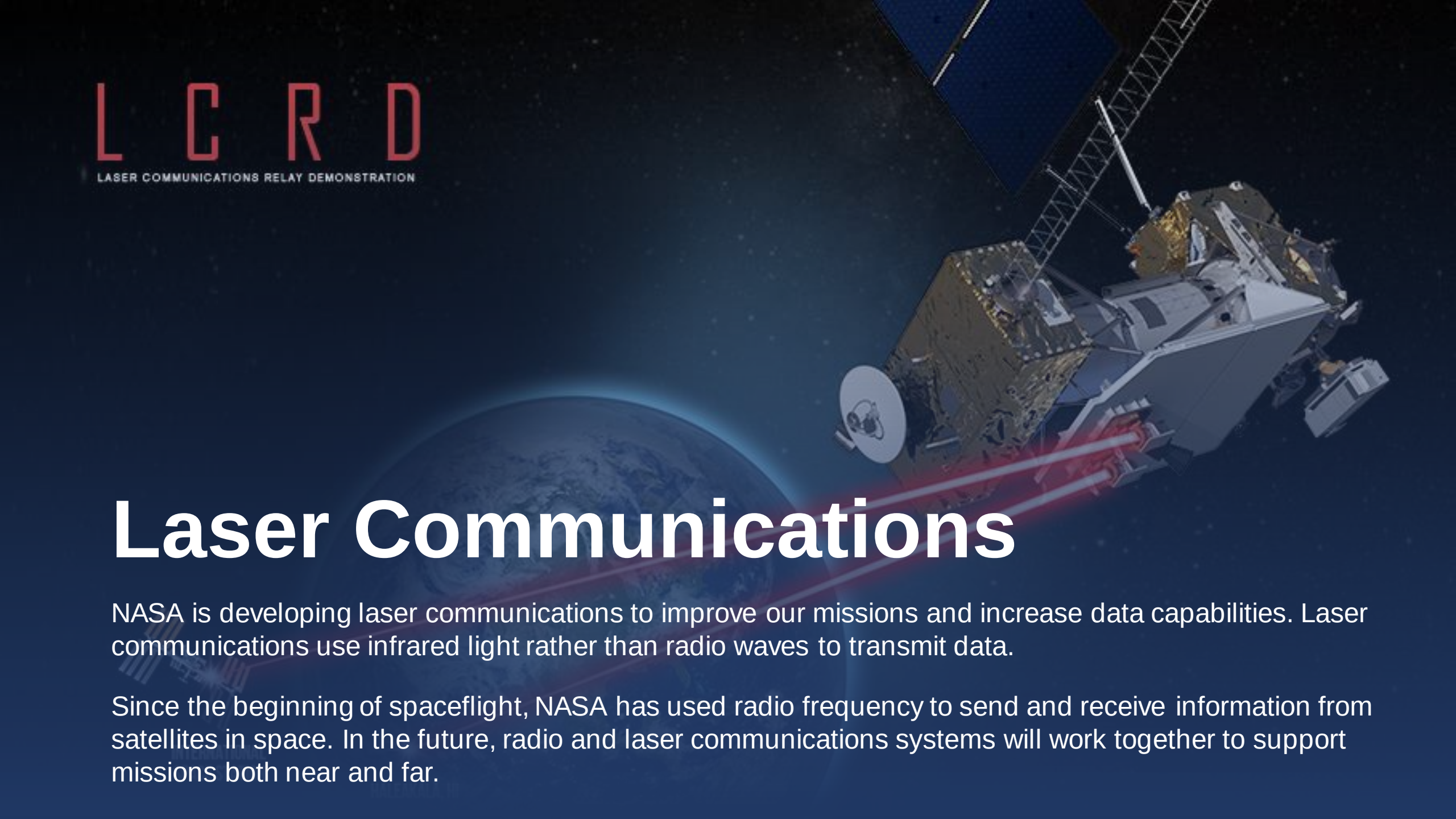

EXPLORESPACE TECH
TECHNOLOGY DRIVES EXPLORATION

NASA’s Endeavor for the Moon

Over 50 years ago, Neil Armstrong and Buzz Aldrin took the first steps on the Moon as part of NASA’s Apollo 11 mission.

Now, through the Artemis program, NASA is establishing a renewed presence on the Moon. We will watch this journey through high-resolution videos sent back through laser communications technologies.



Laser Communications

NASA is developing laser communications to improve our missions and increase data capabilities. Laser communications use infrared light rather than radio waves to transmit data.

Since the beginning of spaceflight, NASA has used radio frequency to send and receive information from satellites in space. In the future, radio and laser communications systems will work together to support missions both near and far.

The Benefits

Laser communications will provide significant benefits for missions, including:

- 10 to 100 times more data than current radio frequency systems in a single downlink
- Decreased size, weight, and power requirements

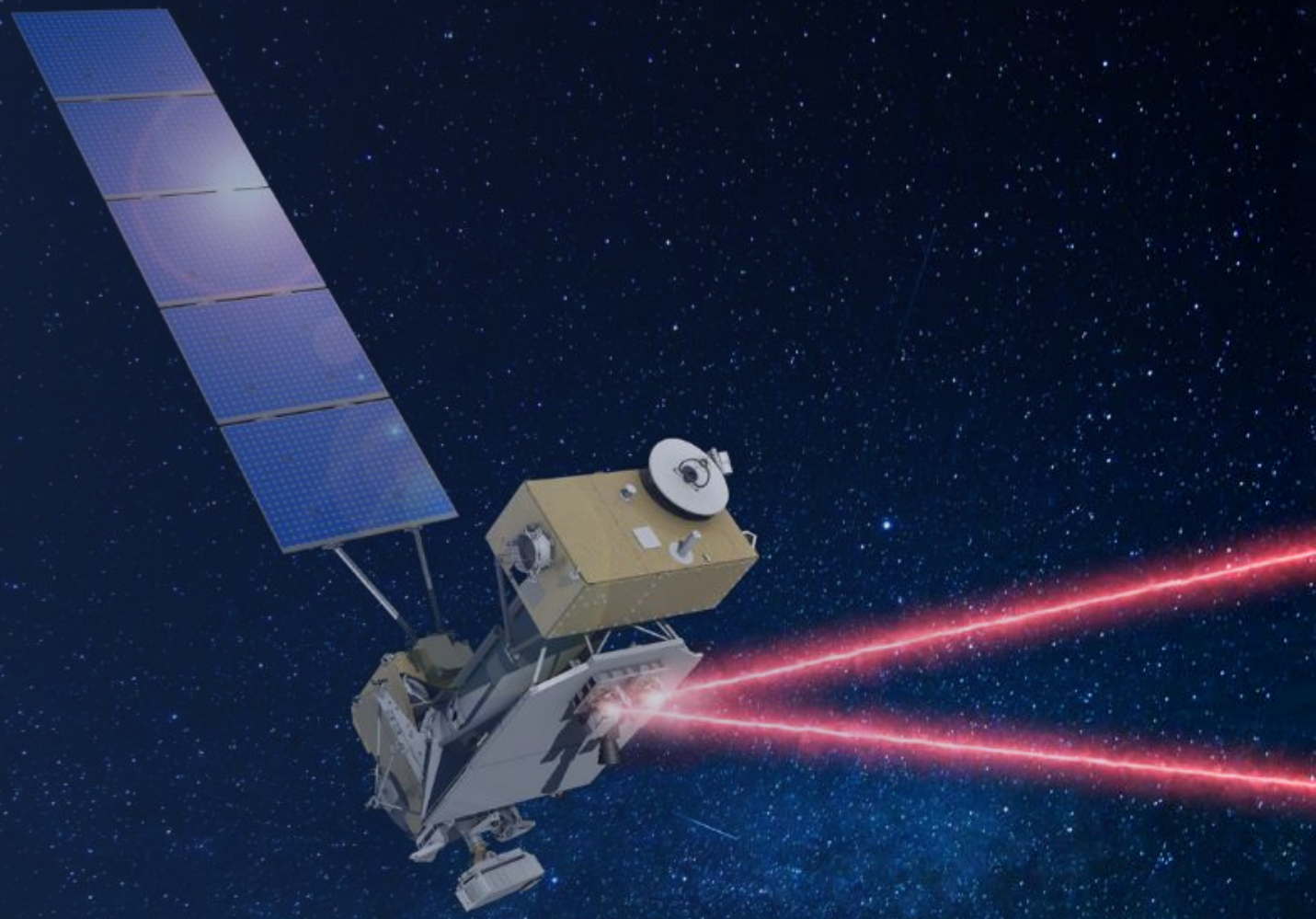
With laser communications supplementing radio, missions will have unprecedented flexibility.

LCRD

NASA’s Laser Communications Relay Demonstration (LCRD) is targeting November 22, 2021, for a launch from the Cape Canaveral Space Force Station.

LCRD will be NASA’s first laser communications relay system with two bi-directional optical links.

For its first two years in orbit, LCRD will demonstrate its capabilities with various experiments on the ground and in space.



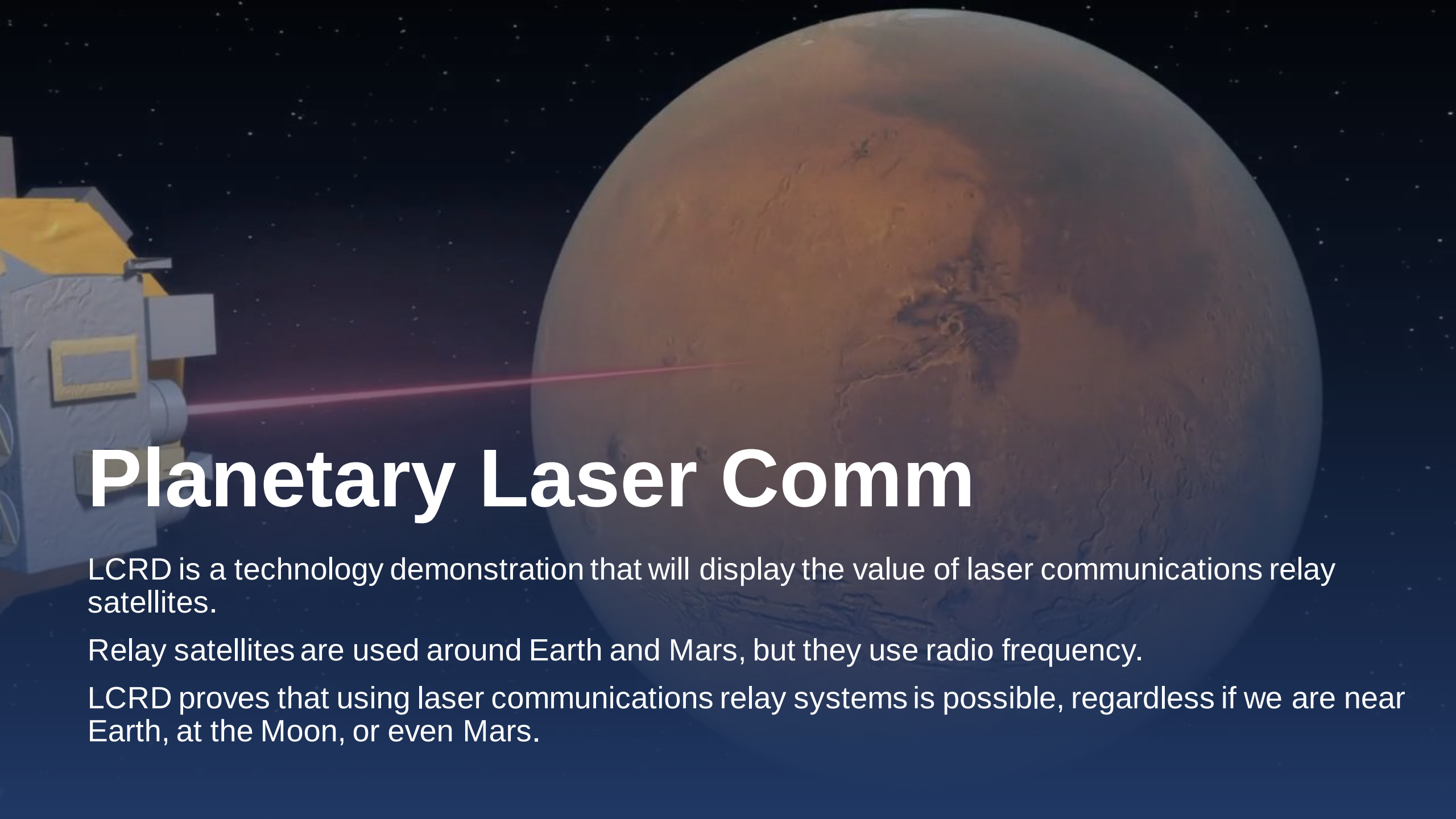
How Does LCRD Work?

LCRD will relay data between two ground stations.

This means it will receive data from one station before sending it on to the next, serving as a communications go-between.

When data is received through one telescope, it will be processed by modems onboard and then sent back out the other telescope to the second ground station.

This mimics the way a future laser communication network might receive data from a spacecraft before forwarding it on to a ground station on Earth.



Planetary Laser Comm

LCRD is a technology demonstration that will display the value of laser communications relay satellites.

Relay satellites are used around Earth and Mars, but they use radio frequency.

LCRD proves that using laser communications relay systems is possible, regardless if we are near Earth, at the Moon, or even Mars.

LCRD

The U.S. Space Force Space Test Program Satellite 6 (STPSat-6) is hosting LCRD, 22,000 miles from Earth in geosynchronous orbit.

The payload will support missions in the near-Earth region, including the International Space Station.

LCRD, like many NASA missions, was created and planned by numerous partners, including:

- NASA's Jet Propulsion Laboratory
- Massachusetts Institute of Technology – Lincoln Laboratory
- U.S. Space Force
- Northrop Grumman
- United Launch Alliance

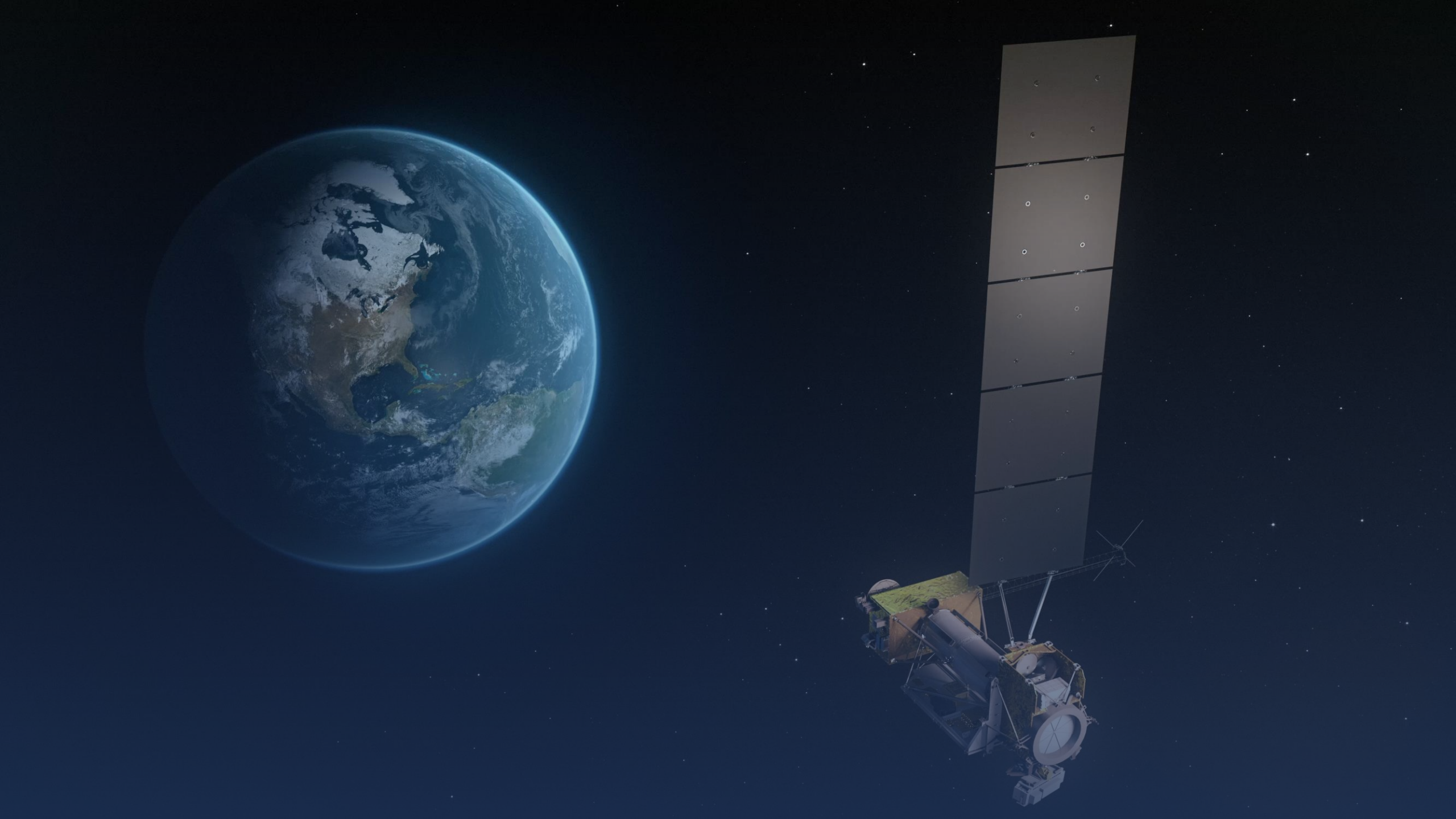
LCRD Experimenters

LCRD will spend two years validating its capabilities with a variety of experiments.

These experiments will increase the aerospace community's knowledge about laser capabilities.

The LCRD Experimenters Program is open to anyone from NASA, other government agencies, industry, academia, and more.

There are opportunities to still be involved. Learn more at https://go.nasa.gov/3tUZFkq



Ground Stations

LCRD’s ground stations are at Table Mountain, California, and Haleakalā, Hawaii.

These locations were chosen for their minimal cloud coverage, as clouds can block laser transmissions.

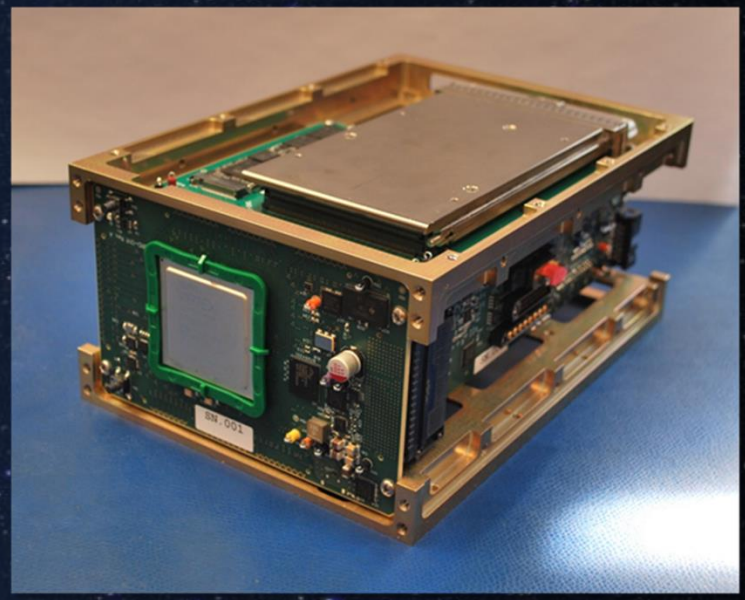

LLCD
Lunar Laser Communications Demonstration
2013
ILLUMA-T
Integrated LCRD LEO User Modem and Amplifier Terminal
2022
DSOC
Deep Space Optical Communications
2022
2021
LCRD
Laser Communications Relay Demonstration
2022
TBIRD
TeraByte Infrared Delivery
2023
O2O
Orion Artemis II Optical Communications System

T-BIRD

The Terabyte Infrared Delivery (TBIRD) mission is a free space high-data-rate laser communications demonstration.

Although the size of a shoebox, TBIRD will demonstrate a downlink of 200 gigabits per second - an extremely rare capability.

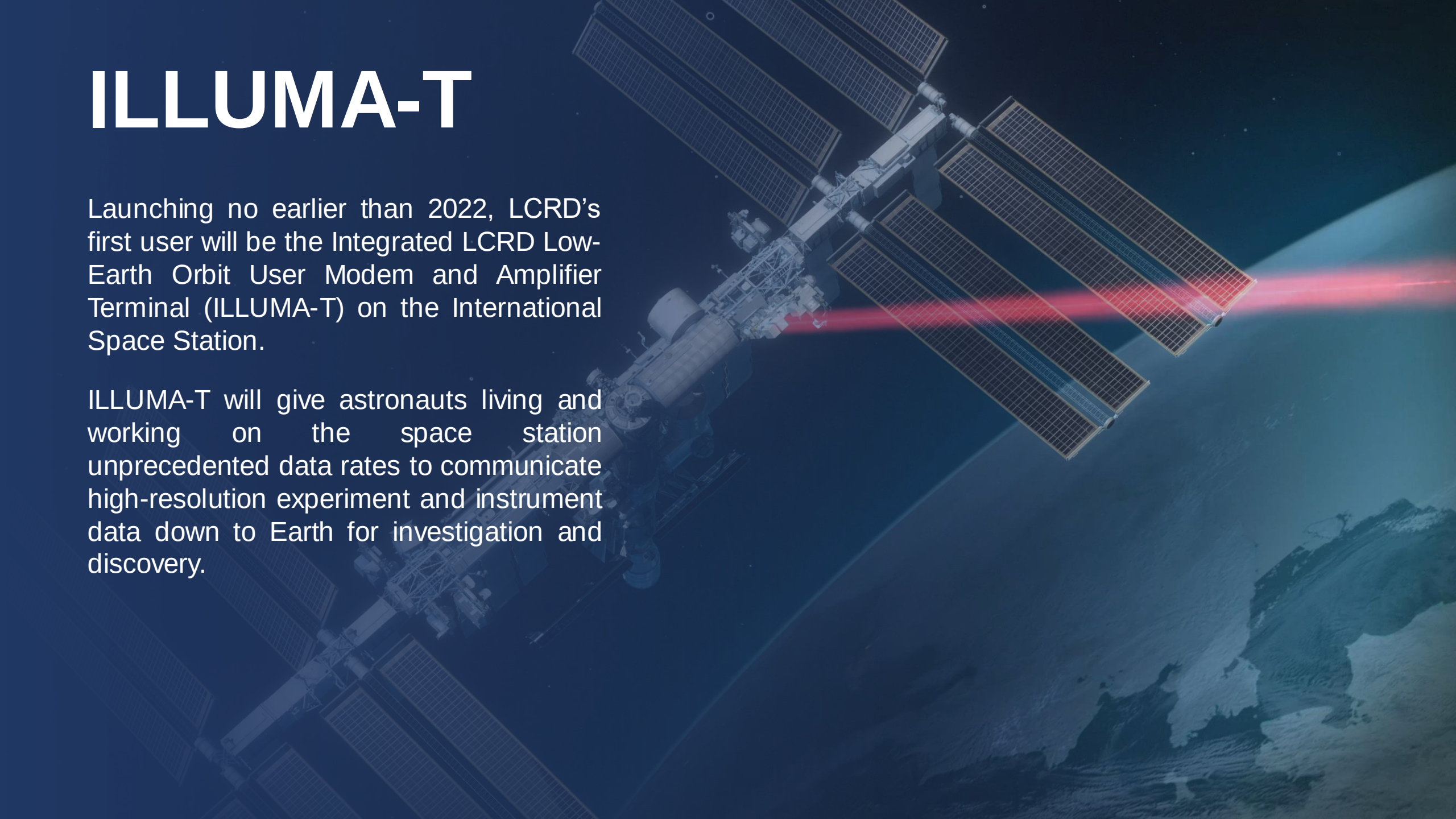
TBIRD is a joint mission between NASA and MIT-LL.



ILLUMA-T

Launching no earlier than 2022, LCRD's first user will be the Integrated LCRD Low-Earth Orbit User Modem and Amplifier Terminal (ILLUMA-T) on the International Space Station.

ILLUMA-T will give astronauts living and working on the space station unprecedented data rates to communicate high-resolution experiment and instrument data down to Earth for investigation and discovery.



O2O

The Orion Artemis II Optical Communications System (O2O) is a laser terminal flying on NASA's second Artemis II mission.

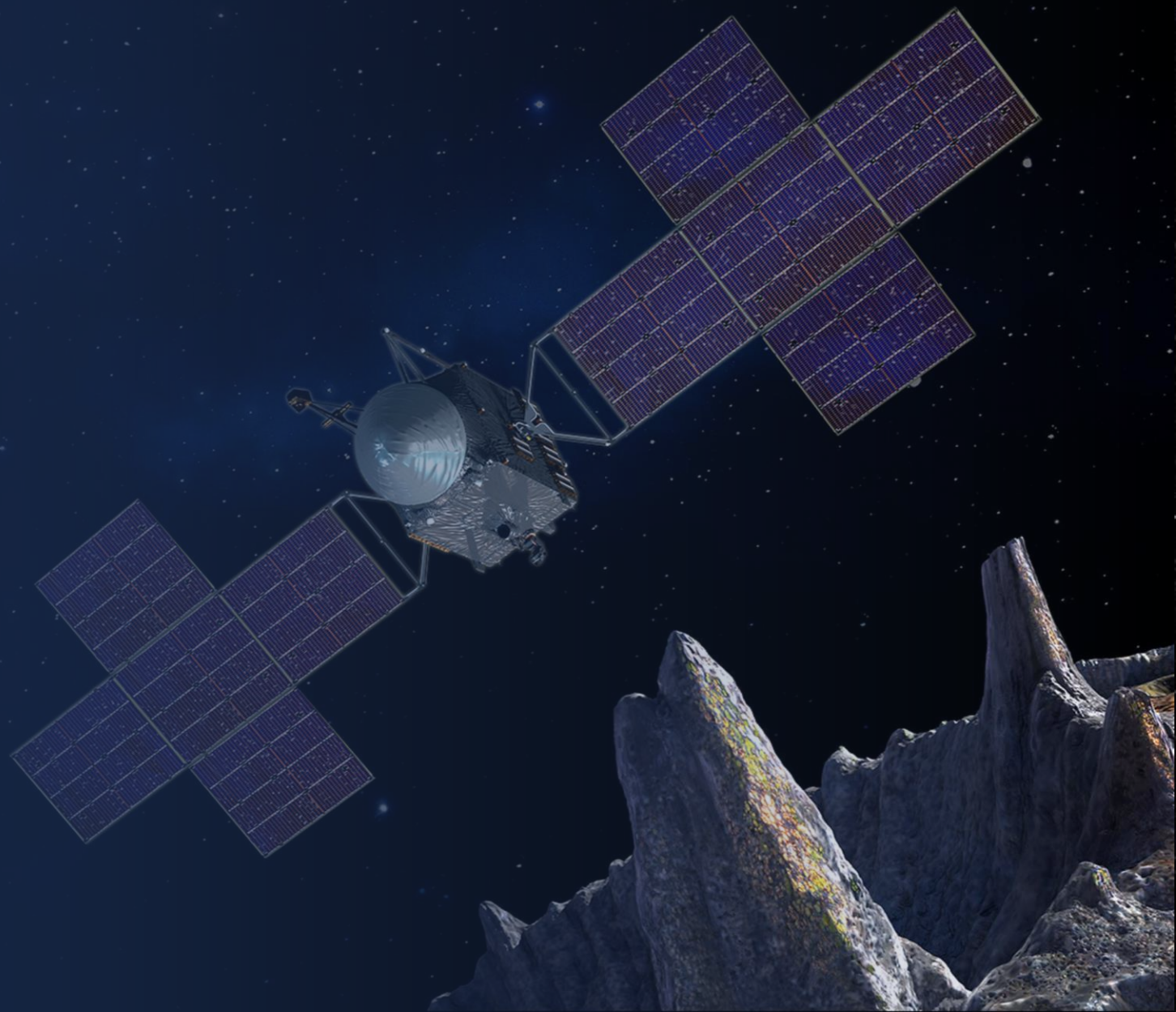
O2O will further demonstrate that laser communications are a viable option for lunar missions.

DSOC

NASA’s Psyche mission will host the Deep Space Optical Communications (DSOC) payload. Psyche is launching in 2022 and will reach its destination, the 16 Psyche asteroid, in 2026.

The DSOC payload will test laser communications technologies against the distinctive challenges presented by deep space exploration.

NASA’s Jet Propulsion Laboratory leads DSOC development.



Future Exploration

Through the Artemis program, NASA plans to establish humanity’s presence on the Moon, and laser communications will play a vital role.

NASA is developing LunaNet, a lunar communication and navigation architecture that will use radio frequency and laser communications to give missions internet-like capabilities on the Moon.

Watch LCRD Launch!

On November 22, 2021, NASA's LCRD will blast off to space and show the world the benefits of laser communications!

Follow along and watch the launch live on NASA TV and nasa.gov/live.

Resources:

- Visit nasa/gov/lasercomms for these resources:
  - STEM activities
  - Fact sheet, bookmark, poster (Spanish versions available)
  - Virtual wallpaper
  - Videos

Learn More:

- What is the Laser Communications Relay Demonstration? | NASA
- LCRD Overview Video | YouTube
- NASA Laser Communications (@NASALaserComm) | Twitter
- Optical Communications | NASA
- Technology Demonstration Missions | NASA