



# MOONLIGHT

## PIONEERING COMMUNICATION AND NAVIGATION FOR LUNAR EXPLORATION

Moonlight is the European Space Agency's (ESA) Program enabling connectivity and navigation services from the lunar surface and to the Earth by delivering a constellation of satellites around the Moon.

### WHY MOONLIGHT?

With over 400 lunar missions planned by space agencies and private companies in the next twenty years, Moonlight represents a crucial step toward sustainable lunar exploration and the development of a robust lunar economy. The program aims to support both institutional and commercial missions, enabling precise autonomous landings, surface mobility, and high-speed, low-latency data transfer between Earth and the Moon.

This infrastructure will be essential not only for humanity's return to the Moon but also for establishing a stable and long-term presence.

### THE ROLE OF THE EUROPEAN CONSORTIUM

As part of the above strategy, on October 15, 2024, Telespazio signed a contract with ESA for the development of a satellite constellation aiming to provide communication and navigation services for future lunar missions. The project, called Lunar Communication Navigation Service (LCNS), involves a consortium of specialized companies, with Telespazio as the prime contractor and overall system integrator.

The consortium includes companies such as Hispasat, Viasat, Thales Alenia Space Italia, Surrey Satellite Technology Limited, Qascom, MDA, KSat, Telespazio UK, Telespazio Iberica, and as University SDA Bocconi, POLIMI, CRAS, and SIA for the design, realization, and operational qualification of the system.

### CONNECTING THE FUTURE OF LUNAR EXPLORATION

LCNS lays the foundation for a stable and sustainable future in lunar exploration, fostering international cooperation and creating new commercial opportunities within the lunar economy. With an innovative infrastructure, this Programme enables future missions to rely on a dependable network for communication and navigation, supporting both human and robotic exploration and advancing new goals in space exploration.

### THE LCNS SERVICE INFRASTRUCTURE

LCNS service infrastructure is built in a way that non-homogeneous capabilities can be used in harmonised way exploiting the potentiality of Moon exploration. The NAV perfectly complement the COM part as positioning over the Moon is of a paramount importance to explore lunar surface in a reliable way while communication ensure the way to control lunar activities.

The LCNS infrastructure consists of three key elements:

- **Lunar Space Segment:** a constellation of five satellites, with four dedicated to navigation and one to communication. These satellites will provide high-speed, low-latency communication services, along with precise navigation signals that will enable autonomous landings and surface mobility. The satellites will be positioned to ensure extensive coverage of the lunar South Pole, an area of particular interest for future missions due to resources like ice in the “eternal darkness” craters and “peaks of eternal light,” which are ideal for solar energy harvesting. The constellation of LCNS satellites is designed to provide optimized service coverage of the lunar south pole, both for communication and navigation.
- **Lunar Earth Ground Segment:** three ground stations on Earth together with a state-of-the-art Ground Segment deployed over commercial cloud, playing a key role in monitoring and managing the entire infrastructure. The constellation is planned to be controlled at the Telespazio Fucino Space Centre, which was instrumental in transmitting images of the Apollo 11 Moon landing in 1969. The EGS infrastructure will be crucial in ensuring the continuity of services and the connection between the Moon and Earth, coordinating all operations of the constellation and supporting the communications and navigation network.
- **Lunar User Segment:** granting LCNS services access for end-users through Qualified Type Approval lunar user terminals (LUT) aiming first to validate the communication and navigation services once during the in-orbit qualification and then to provide end-to-end services to final user.

## INTEROPERABILITY AND INTERNATIONAL COOPERATION LCNS

Radio Frequency Communication and Navigation links adhere to the International Communication Systems Interoperability Standard (ICSIS) developed by an international body to enable interoperable, cross-supportable, and compatible communications between space vehicles and systems, ground infrastructure, and lunar assets.

LCNS will be part of the LunaNet and as that will adhere to LunaNet Specification (LNIS) for the service provision.

