

# Moonlight

Towards a new paradigm in Lunar exploration

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**ESA - European Space Agency** 

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→ THE EUROPEAN SPACE AGENCY

## We are going back to the Moon.....



redits: BBC Science Focus Magazine



## ... and stay there

(\*) 3<sup>rd</sup> Edition Lunar Market – March 2023 – Northern Sky Research

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The case for cislunar Communication and Navigation services: a change of paradigm for Lunar exploration and commercialisation

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A dedicated **COM and NAV infrastructure** serving many moon missions

For a more efficient return to the Moon



Opportunity to kick start **new services**...

... and contribute to Moon economy

## ESA Roadmap



## **STEP 1: LUNAR PATHFINDER**

Low-rate satellite communications service + satellite navigation demonstrator

### Development

Pathfinder Service

### **STEP 2: MOONLIGHT CONSTELLATION**

High-data rate satellite communications and lunar-based dedicated navigation service

2025



# **Moonlight Vision**







To enable the delivery of Communications and Navigation Services that will support the current and next generations of institutional and commercial Lunar explorers

# **Moonlight Approach: Services**



Service development Approach: ESA supporting infrastructure development and acting as Anchor customer





Public-Private Partnership: Private sector as service provider
A dedicated constellation of satellites around the Moon

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# FOCUSING ON THE SOUTH POLE





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## Moonlight: Mission Architectural Concept (notional)





Links are named in-line with LunaNet spec

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### **Moonlight LCNS High-level Service Requirements**







High DataRate (KBand)Low Datarate (Sband)Upto 200Mbps/userUpto 1Mbps/user



Security functions



Slotted Real time services

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Based on GNSS technologies

Precise timing (sub µs)



One Way Ranging SISE ODTS (95%) IOC: 20 m FOC: 10 m



Position accuracy (95%) Orbiters: 100m Landing: 50m Surface: 10m

#### Lunar Communication and Navigation: Excellent cooperation on-going with NASA and JAXA



### SPACENEWS.





#### NASA and ESA sign lunar cooperation statement

by Jeff Foust - September 26, 2022



NASA Administrator Bill Nelson (left) and ESA Director General Josef Aschbacher signed a joint statement on lunar exploration cooperation Sept. 19 during the International Astronautical Congress. Credit: Twitter @AschbacherJosef

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Paris, 26 April 2023

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+ THE EUROPEAN SPACE AGENCY

Study Agreement between JAXA and ESA concerning future collaboration on Lunar Communication and Navigation

#### Dear Mr TSUTSUI,

ELI-E/2023-111

The purpose of this letter is to establish a cooperative agreement (hereinafter the 'Agreement') between the European Space Agency (ESA) and the Japan Aerospace Exploration Agency (JAXA) (hereinafter referred to individually as 'Party' or jointly as 'Parties') to consider potential cooperation on lunar communication and navigation capabilities, and with a view to, among other things, making the necessary preparations to support forthcoming decisions.

#### Article 1 OBJECTIVE AND SCOPE

 Considering that ESA and JAXA share an interest in developing lunar communication and navigation capabilities to service their respective lunar exploration missions and those of international and private sector partners, both agencies recognise the need to further exchange information based on the following common objectives: optimisation of available capabilities on both sides, provision of cross-support services while creating dissimilar redundancy, and pursuit of an incremental cooperation approach.

The scope of the collaboration under this Agreement should focus on studying further commonalities and identifying areas of potential cooperation for:

 use cases for lunar communication and navigation capabilities including specifically, but not exclusively Cargo delivery mission, Pressurised rover lunar surface excursion mission; Operations of yet to be determined science surface infrastructure;

- potential JAXA use of ESA/SSTL Lunar pathfinder services in suppor: of their planner lunar robotic missions;
- potential short-, medium- and long-term cooperation scenarios aimed at delivering integrated lunar communication and navigation solutions, interoperability demonstration, and or making services available to each other's missions;
   service requirements consolidation.

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Joint Statement on Lunar cooperation, including Lunar Communication and Navigation

Study Agreement ESA-JAXA on Lunar Communication and Navigation

#### **ENSURING LUNAR COMMUNICATION AND NAVIGATION INTEROPERABILITY**



- ESA is working closely with NASA and JAXA on the definition of the joint lunar Communication and Navigation international standards: LUNANET
- High level of consensus already achieved. Public LunaNet version released (Sept 2023) including PNT SiS interface
- Maturity of these standards allow to proceed with the Moonlight implementation phase in 2024
- Moonlight compliance to these Standards will ensure technical compatibility with NASA Artemis missions and will foster the development of Moonlight user commercial receivers (LunaNet compatible).



Technical Cooperation Moonlight/LunaNet (Sept 2023)

# Moonlight Lift Off : Implementation to start in Feb 2024







ESA has a produced a "*Moonlight White Paper*" summarizing the Objectives, organization and strategic importance of the Moonlight program, as presented for the ESA Ministerial Conference CM 22

#### MOONLIGHT PROGRAMME



A while paper introducing the programme to be submitted to ESA Council at Ministerial level of November 2022

esa

September 2022





# Moonlight ESA website ESA - Moonlight

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