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LUVMI-M ROVER

Payload User Guide

October 2026 update



Your Mission, Our Rover

Why Partner With Us?

Mobility: Go beyond static landers with a rover that travels where your science is.

A full service: We handle integration, testing, surface ops, and data return.

Heritage you can trust: 35+ years of experience in space systems and 7+ years of operating commercial payloads on the ISS through our ICE Cubes Service.

Location, location, location! Join a landmark mission to one of the most scientifically valuable locations on the Moon: the Lunar South Pole.

Key Payload Specs (Baseline)

Mass	Up to 20 kg (shared)
Interfaces	5 V, 12 V, 28 V lines CAN, RS422, SpaceWire, Ethernet
Power	30 W average available; up to 250 W peak (shared)
Data	100 kbps downlink, 10 kbps uplink (shared)
Thermal	-50°C ... +50°C, heaters available where necessary
Transit	Limited power and data available to payloads
Mission 1	10 – 14 days; at the lunar South Pole

How It Works

1. Contact us with your payload or proposal.
2. We will guide you through the integration & interface definition.

Mission 1 Profile

Destination:	**Lunar South Pole**
Scheduling:	**Q1 2029**
Lunar Lander:	Blue Moon Mark 1
Environment:	High volatile content, low sun angle

Let's talk: moon@spaceapplications.com

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1 INTRODUCTION

This guide is intended to support commercial, academic and institutional teams interested in mounting payloads on the LUVMI-M lunar rover. It gives an overview of the rover's capabilities, payload interface options and the steps to participate.

Space Applications Services and Aerospace Applications North America are excited to bring over three decades of experience into the development of the first European commercial payload service to the Moon. We already operate a well-established service on the International Space Station, and are now extending our offer of a reliable and innovative end-to-end service to the lunar surface.

2 LUVMI-M ROVER

2.1 About the LUVMI-M Mission 1

LUVMI-M Mission 1 marks the first lunar mission led by Space Applications Services. The mission is planned for launch in the second half of 2028 and will touch down at the rim of the Shackleton Crater, one of the Moon's most scientifically valuable locations.

At the core of the mission is LUVMI-M, a compact, mobile rover weighing 20 kg and capable of carrying an equivalent mass of up to 20 kg of payloads. The rover is designed for a 14-day surface mission with up to 5 km of traverse and will be teleoperated from Space Applications Services' well-established control rooms.

2.2 What Makes Our Rover Unique?

LUVMI-M is a compact mobile rover with a flexible platform for lunar surface payloads. Its mobility, 1:1 mass-to-payload ratio and extensive end-to-end integration support distinguish it from static landers and other traditional exploration assets.



The LUVMI rover family was first developed in 2016 and continuously updated. By selecting LUVMI-M for your payload, you gain access to a platform whose architecture draws on an established design and previous test campaigns of ground models.



Payload operations are teleoperated remotely from the payload team's offices or from Space Applications Services' LUVMI-M Mission Operations Centre in Brussels. With over 7 years of experience in payload control services on the International Space Station, you can trust our interaction and mission control.



The rover supports a wide range of payload types (internal, external or deployable) with flexible power, data and mechanical interfaces, plus optional enhancements tailored to individual payload needs.



Space Applications Services offers a full end-to-end support for payload pre-launch activities, as well as post-landing surface operations and data delivery.

2.3 LUVMI-M Subsystems Overview

Navigation
The LUVMI-M rover navigates with a combination of on-board autonomy and teleoperations. Stereo cameras provide a 3D map of the lunar surface, and hazard detection cameras allow for efficient and safe driving.

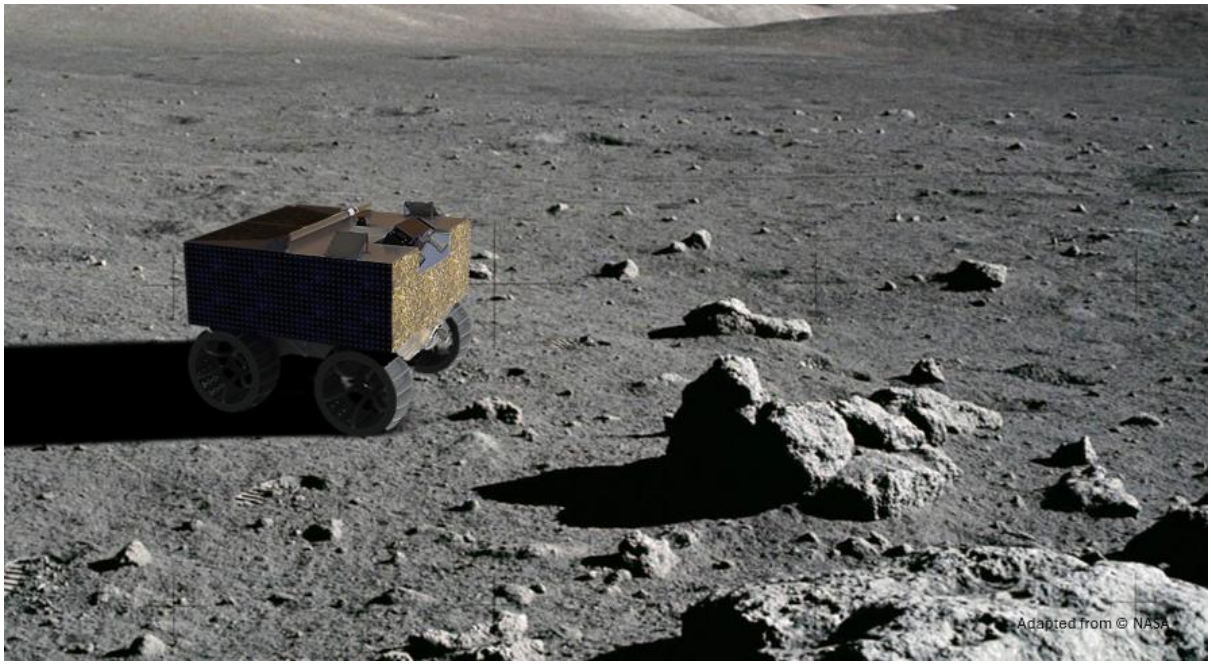
Mobility
LUVMI-M has a top speed of 5 cm/s and can handle slopes of up to 15 degrees. A traverse of up to 5 kilometers and over 30 sites of interest is baselined for each LUVMI-M mission.

Power
Solar panels and batteries sized for extended traverses and payload operations.

Thermal control
Available capability to maintain avionics and payloads within operational temperature ranges on the lunar surface.

Avionics
Supports various data interfaces and includes onboard payload data storage.

Communications
Redundant communication links to the lander and to relay satellites for surface-to-Earth connectivity.

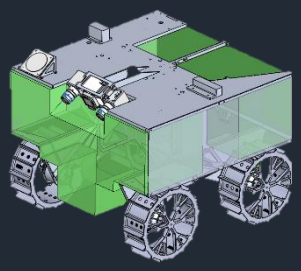


3 PAYLOADS

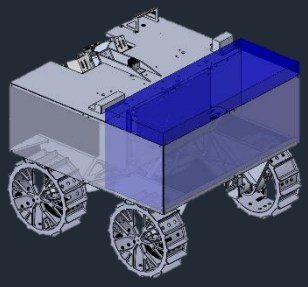
Your payload will travel with reliable connections for power, data, and structure. This chapter summarizes the key rover interfaces. For full technical details, we are happy to help you with any questions via **moon@spaceapplications.com**.

3.1 Payload Hosting Options

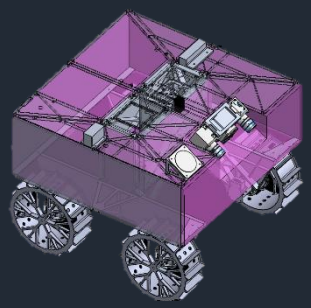
LUVMI-M offers multiple ways of fixing your payload to our rover:



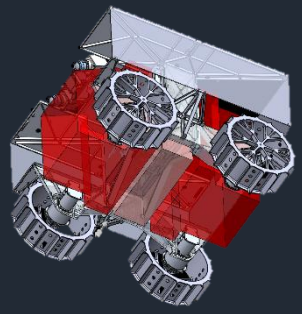
Terrain visibility (rover front)
230 x 540 x 350 cm³
ideal for terrain imaging, radar, volatile, mineral sensing



Deep space visibility (top deck)
200 x 580 x 390 cm³
ideal for remote imaging, thermal, radiation, plasma, laser sensing.



Environment protection (chassis interior)
590 x 540 x 200 cm³
ideal for volatile, chemical, biological, sensitive electronics



Surface visibility (chassis bottom)
550 x 315 x 350 cm³
ideal for regolith, subsurface, elemental, neutron sensing

3.2 Electrical and Power

LUVMI-M provides three standard electrical interfaces to support a wider range of lunar payloads. All power lines are protected and independently switchable. Power is supplied through dedicated lines with defined voltage levels and current limits:

Voltage Line	Type	Voltage Range	Max Current
28 V	Unregulated	24 – 33.6 V	4 A
12 V	Regulated	Fixed	4 A
5 V	Regulated	Fixed	4 A

Your payload's power budget changes depending on whether the rover is driving or parked. Here is a quick overview:

Rover State	Average Available Power (for the entire suite)	Comments
Stationary	30 W	Short-term peaks allowed (baselined no higher than 250 W)
Driving	3 W	Can be continuous or duty-cycled (e.g. 15 W across 20% of the time)

3.3 Data and Communication

LUVMI-M supports a suite of standard protocols during operations:

Available Protocol	CAN	UART	Ethernet	SpaceWire
Max Data Rate	1 Mbps	10 Mbps	100 Mbps / 1 Gbps	100 Mbps

Data connection for payloads depends on the operational context. Here is a quick overview of the maximum availability shared by all payloads:

Function	Maximum Availability (for the entire suite)
Uplink (commands)	10 kbps
Downlink (telemetry)	100 kbps
Downlink during driving	Reduced rate
Storage capacity	400 MB per day

3.4 Thermal Interface

Flexible thermal control options are provided to make payloads operate and survive within their required temperature ranges.

Thermal Interface Options	Description
Survival heaters	Thermostat- or thermistor-controlled heaters
Conductive mounting to LUVMI-M	Payload mounting on rover baseplate to establish a thermal path
Isolated mounting	Payload mounting with thermal isolation, for independent temperature control through radiators, MLI or coatings. Recommended for payloads active during rover driving.



If your payload has unique needs with regards to power delivery, data connectivity or thermal management, we encourage you to contact the LUVMI-M team early in the design process.

4 LUNAR ENVIRONMENT

4.1 First Mission: South Polar Landing Site

The LUVMI-M Mission 1 is set to land on the Lunar South Pole. An example traverse on the Shackleton-De Gerlache Ridge is shown below.

Traverse Characteristics

The planned route of up to 5 km will be designed to maximize exposure to solar illumination and traversability. The slopes of this route are gentle, with a maximum incline of 15°.

Scientific importance

The rover is capable of traversing small permanently shadowed craters, which are particularly interesting to lunar volatiles studies, of less than 100 meters in diameter. The Shackleton–de Gerlache Ridge region is mentioned by Spudis et al. (2008)[1] to contain deep crustal materials and possible ejecta from the South Pole-Aitken impact. As such, it promises to contain some of the Moon's oldest surface materials.



Planned route for the LUVMI-M Mission 1 (blue) in reference to the Shackleton crater.

[1] Spudis, Paul D., et al. "Geology of Shackleton Crater and the south pole of the Moon." *Geophysical research letters* 35.14 (2008).

4.2 Mechanical Environments

Payloads experience their highest mechanical loads during launch, including accelerations, vibrations, acoustic pressure, and shocks. These loads vary with payload mass and mounting location on the rover. Space Applications Services will work with customers to define and verify these conditions.

Acceleration Axial / lateral loads during launch.

Vibration Sine and random vibrations during launch.

Acoustic Peak during launch. Maximal expected levels are around:

Oct. Freq. (Hz)	100	200	500	1000	2000	5000	10000
Acc. Env. (dB)	130	131	124	117.8	112.5	107	102

Shock During fairing separation, landing, and rover deployment.

Frequency (Hz)	100	1000	10000
Shock Response (G-peak)	20	1000	1000

4.3 Pressure and Humidity Environments

LUVMI-M and its payloads will be exposed to varying pressure and humidity conditions throughout the mission:

Mission Stage	**LUVMI-M Pressure**	**LUVMI-M Humidity**
Pre-launch	~101 kPa	50 ± 15% (< 90%)
Launch	< -6.2 kPa/s	50 ± 15%
Transit & Surface Operations	3.2×10^{-5} kPa	0%

Prior to launch, LUVMI-M and its payloads are processed in climate-controlled facilities. However, transport may briefly expose hardware to environments of up to 90% humidity. The most significant pressure change occurs during launch, as payloads undergo rapid depressurization while the vehicle passes through transonic speeds. Afterwards, the payloads are exposed to deep space vacuum for the remainder of the mission.

4.4 Thermal Environment

From pre-launch through to deployment and lunar surface operations, LUVMI-M will experience a broad range of thermal conditions:

Mission Stage	LUVMI-M Temperature Range
Pre-launch and Launch	0 to +27 °C
Transit	-50 to +50 °C
Surface Operations	-100 to 0 °C (Mission 1)

Surface temperatures along the planned traverse vary significantly due to changing illumination and terrain conditions. Payloads should be designed to tolerate these temperature fluctuations or to leverage the rover's own thermal interfaces (see Section 3.4) to maintain the required operational stability.

4.5 Radiation Environment

LUVMI-M is expected to experience a moderate radiation environment along its trajectory, which includes a brief transit through the Van Allen belts in Low Earth Orbit (LEO), a longer interplanetary transfer, and up to 14 days of lunar surface operations.

Amongst these phases, the highest radiation rates occur during the short passage through the Van Allen belts. Across the transfer and surface phases, exposure is mainly from Galactic Cosmic Rays (GCRs). As the LUVMI-M Mission 1 is approaching a solar minimum, higher GCR levels are expected, though the probability of intense solar particle events occurring will be lower.

The dose rates across mission phases are estimated as follows:

Mission Stage	Stage Duration	LUVMI-M Radiation Dose Rate*
Transit (LEO)	15 minutes	< 20 rad/day
Transit (interplanetary)	7.5 days	< 0.5 rad/day
Surface Operations	14 days	< 0.25 rad/day
Total Ionizing Dose		< 1 krad

* Values do not include the rates in the case of a major solar particle event.

4.6 Particle and Contaminant Environment

The lunar environment presents unique particulate and contaminant conditions throughout the mission phases:

Pre-launch	Assembly, integration and maintenance activities are guided by Planetary Protection regulations. LUVMI-M and its payloads should be handled in ISO Class 8 cleanrooms or better, following ECSS-Q-ST-70-01 standards.
Transit and Landing	During landing, the lander's engines may release trace amounts of propellant and vent helium pressurant post-touchdown. Additionally, lunar landings cause dust to be lifted, which gradually resettles over a period of hours to days. For sensitive payload components, shielding options can be implemented to provide additional protection.
Surface Operations	Lunar regolith is fine, sharp and electrostatically charged, which can cause it to adhere to external payload surfaces. Payloads mounted externally should assess any vulnerability to these effects.

4.7 Electromagnetic Environment

Payloads must be designed and tested in accordance with MIL-STD-461 or ECSS-E-ST-20-07C (EMC Test Methods). These standards define the limits and test procedures for both emissions and susceptibility of space hardware.

The EMC tests listed below should be followed to properly characterize interference and compatibility:

EMC Test	Referred Standard		Description
Conducted emissions	ECSS-Q-ST-20-07C	MIL-STD-461G (CE102)	Conducted electromagnetic noise from the payload on power / signal lines.
Radiated emissions	ECSS-Q-ST-20-07C	MIL-STD-461G (RE102)	Radiated electromagnetic emissions from the payload.

5 MISSION TIMELINE & OPERATIONS

5.1 Payload Development Roadmap

The timeline below outlines the key milestones towards delivery of the Structural and Thermal Model (STM), the Engineering Qualification Model (EQM), and the Flight Model (FM).

To support the validation of your payload's integration with the rover and lander, early-stage interface testing will be available from Q1 2027. The LUVMI-M rover had a successful PDR in summer 2026, and its CDR is planned for summer 2027.



Payload Interface Review

ICD agreement between rover and payload

Q1 2027

Payload Development Model Delivery

Mechanical, electrical and software model

Q3 2027

Payload Flight Model Delivery

Payload FM delivery to rover

Q1 2028

Integrated Rover Env. Tests

Rover environmental tests

Q3 2028

Launch

Payload ready and integrated

Q1 2029

5.2 Launch and Surface Operations

The key phases of the LUVMI-M Mission 1 are outlined below:

Launch & Transit

After integration on the lander, the rover will remain powered down through launch. The transit to the Moon is expected to last approximately 7 – 8 days. Note that during this phase, limited power-up windows may be allocated for payload or heater activation, subject to mission constraints.

Lunar Descent & Landing

The lander will execute the descent and landing at the Shackleton-de Gerlache Ridge. LUVMI-M and its onboard payloads will remain mechanically stowed until deployment is triggered post-landing.

Rover Deployment & Surface Mission

Once on the lunar surface, the mission is structured into three sequential operational phases:



Egress & Commissioning (0.5 days): Deployment from the lander garage, commissioning, mobility tests, and initial payload health verification.



Local Exploration (3 days): Scientific operations at sites within the lander vicinity (< 1,000 m).



Extended Traverse (7 – 10 days): The rover traverses up to 5 km and performs scientific operations outside the lander vicinity.

Rover operations and payload (de)activation commands are performed by rover operators at the Space Applications Services Rover Mission Control Centre (RMCC). Payload operations can be executed either by RMCC operators or by the payload team via a remote User Home Base terminal. Payload (de)activations and operations will be coordinated by the RMCC team in collaboration with the payload teams, based on payload requirements, power availability and other mission and system priorities.

Real-time communication with a latency of up to 5 seconds is maintained during surface operations, depending on the communication windows provided by the lander for local exploration and by the relay satellite services for extended traverses. Outside these communication windows, payloads may be activated through pre-programmed, time-tagged telecommands. The resulting data and telemetry are stored onboard and downlinked to the Lander Mission Control Centre during the next available communication window. Such unsupervised operations are only possible for payloads that are non-disruptive and present a low risk when operated without real-time supervision.



6 HOW TO JOIN?

Interested in flying your payload on LUVMI-M? Do you have questions or want to discuss with us your ideas? The LUVMI-M team is here to help and guide you. Contact us at **moon@spaceapplications.com**. LUVMI-M's dedicated payload user guide can be downloaded on **https://moon.spaceapplications.com/**.

ROM cost for flying your payload on LUVMI-M?
2.5 MEur/kg, one fee includes all.

End-to-end service:
Payload integration on the rover, rover and payloads environmental tests, launch, lunar lander, rover operations during 1 full lunar day, near real-time access to your payload telemetry/telecommand and data output.

Engineering Support Provided
As payload developer, you have the choice of how much engineering support your payload requires from us.

Customers have the option to request end-to-end LUVMI-M services while performing their own payload development. Engineering support from Space Applications Services may consist of:

- Guidance during the payload development and testing
- Interface testing with the rover
- Safety and flight certification
- Software security
- Payload integration activities towards the LUVMI-M rover
- Pre-launch preparation activities
- Operational setup activities
- Data delivery

Alternatively, customers have the option of defining the scientific / technical requirements for their payloads, while we take care of design, development and testing activities in addition to the above-described end-to-end service.

LUVMI-M ROVER
Payload Questionnaire

Company / Organization		Date
Contact Person	Payload Name	
Email		Tel.

Type(s) of Payload(s):

☐ Scientific Instrument ☐ Commercial Payload ☐ Technological Demonstrator

☐ Educational Payload ☐ Imaging System ☐ Sample Collection / Handling Instrument

☐ Other (please specify): .....

Physical Properties

Estimated total payload mass: ..... kg

Estimated payload dimensions (L x W x H): ..... cm x ..... cm x ..... cm

Other payload dimensions[1] (L x W x H): ..... cm x ..... cm x ..... cm

Payload Maturity:

Current Technology Readiness Level (TRL): ..... Planned TRL in December 2026: .....

Has this payload flown in space? If yes, please provide details ☐ No ☐ Yes, ...

Power Interface:

During active operation: Continuous power need: ..... W Peak power (short duration): ..... W

During lunar traversal: Continuous power need: ..... W Peak power: ..... W

Can temporary unplanned power cuts be accepted? ☐ No ☐ Yes, max duration .....

Preferred power line(s)[2]: ☐ 5V@ 4 A ☐ 28 V@ 4 A ☐ 12 V@ 4 A ☐ ..... V @ ..... A

Data Interface:

Preferred data interface(s): ☐ CAN ☐ RS422 / UART ☐ Ethernet ☐ SpaceWire
☐ Other (please specify): .....

Estimated total data volume: ..... Mbits

Average data rate: ..... kbps Peak data rate (if applicable): ..... kbps

Data delivery preference[3]: ☐ Real-time ☐ Delayed (e.g. days later) ☐ Deferred after each session

Operations:

Typical duration of each payload operation: ..... hours

Does payload need to be controlled/monitored from Earth? ☐ No ☐ Yes, for .....

Is near real-time communication needed? ☐ No ☐ Yes

Temperature limits (if applicable): Operational: ..... < T < ..... °C Survival: ..... < T < ..... °C

Transportation:

Do you need access to the launcher shortly before launch? ☐ No ☐ Yes, ... days before

Power needed during transit (e.g. for heating / activation)? ☐ No ☐ Yes, ... W

[1] *If the payload consists of more than one component (e.g. a sensor head + electronics box), specify the separate dimensions here. If the payload has more than two components, please detail the dimensions in Question 2 on the next page.*

[2] *The LUVMI-M rover provides regulated power at 5 V and 12 V and unregulated (24-33.6V) power at 28 V with a maximum peak current draw of 4A per power line. If your payload requires a different voltage, please specify it explicitly; note that additional conversion hardware may be required in the payload.*

[3] *Due to limited bandwidth, large data volumes may be stored temporarily and downlinked after a delay. Please indicate whether deferred data delivery is acceptable, and specify any constraints related to data latency.*

Information about the payload (as available)

1. Briefly describe the payload and its objective(s)

2. List the main hardware elements and any critical rover interfaces (including required mounting locations, pointing needs, etc.)

3. Describe the type of data generated (e.g., images, telemetry, spectrometry data)

4. Detail any non-standard needs

5. Would you like to request any engineering support from Space Applications Services for your payload development? If so, please specify

6. If there is any other information you wish to provide, please detail it here