AEGIS-CLASS ROVER

Aegis-Class Lunar Surface Mobility Platform

Formal Technical Dossier

February 2026
Architecture Reference Document — Not for Hardware Commitment

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1. Executive Summary

The Aegis-Class Rover is a pressurized, long-duration lunar surface mobility platform designed to support sustained operations at the lunar south pole and other high-value exploration sites. It combines:

- Extended-duration crew habitation (30–60 days)
- Wide-track stability for low-gravity terrain
- Integrated power and thermal architecture optimized for low solar elevation
- Suitport-based dust boundary control
- Radiation storm shelter capability

The vehicle is architected as a surface infrastructure element, not a short-sortie exploration rover. It is intended to operate as part of a distributed logistics network including orbital habitats, surface outposts, and ISRU systems.

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2. Mission Architecture & Operational Concept

2.1 Primary Mission Roles

- Polar water prospecting support
- Surface logistics transport
- Mobile command for construction and field operations
- ISRU equipment towing and servicing
- Emergency shelter and crew lifeboat

2.2 Operational Regime

Parameter	Value
Nominal Crew	2–4

Parameter	Value
Emergency Crew	Up to 6 (short-duration)
Mission Duration	30–60 days
Nominal Range	~100 km (extendable)
Cruise Speed	10–15 km/h
Maximum Speed	25 km/h (terrain limited)

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3. Design Philosophy — Constraint Hierarchy

The rover geometry is derived from a strict constraint chain:

1. Interior standing height (2.1 m clear)
2. Exterior hull dimensions
3. Center of gravity (CG) height
4. Track width and static stability requirement
5. Roof footprint for power/thermal systems
6. Radiator and solar array sizing
7. Electrical and thermal system capacity

This ensures traceability from crew habitability to vehicle mass and stability.

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4. Dimensional & Stability Parameters

4.1 Exterior Geometry

Parameter	Value
Overall Length	~10.0 m
Overall Width (with treads)	4.6–4.8 m
Track Width (center-to-center)	4.0 m
Wheelbase	6.5 m
Height to Cabin Roof	3.45 m
Height to Array Top	3.90 m
Ground Clearance	~0.50 m

4.2 Stability Metrics

Parameter	Value
CG Height	~1.54 m above ground

Parameter	Value
Static Stability Factor (SSF)	1.30
NASA Target (Crewed)	≥ 1.2

The 4.0 m track width provides margin for dynamic loads, slope traversal, and cargo asymmetry.

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5. Mass Budget (Baseline Configuration)

Subsystem	Mass (kg)
Chassis, Suspension, Drivetrain	1,200
Pressure Hull & Structure	1,000
Underfloor Systems (Batteries, Tanks)	800
ECLSS + Interior Equipment	600
Radiator Assembly (6 m^2)	60
Roof Solar Array (20 m^2)	110
Deployable Wing Arrays (10 m^2)	75
Fuel Cell + Reactants	180
Crew (3 × 80 kg)	240
Remaining Systems + Margin	~1,135
Gross Vehicle Mass	**~5,400 kg**

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6. Mobility Architecture

6.1 Structural Frame

- Rigid aluminum or carbon-alloy chassis
- Multi-axle geometry (6-wheel configuration assumed)
- Independent terrain-following suspension

6.2 Wheel System

- Non-pneumatic titanium mesh flex wheels
- Designed for regolith abrasion and thermal cycling
- Wide stance for lateral slope stability

6.3 Autonomy & Navigation

- LIDAR + visual SLAM

- Manual, remote, and autonomous modes
- Return-to-base and preplanned route capability
- Real-time hazard detection

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7. Command Module & Habitability

7.1 Interior Dimensions

Parameter	Value
Interior Length	8.0 m
Interior Width	3.4 m
Interior Height	2.1 m clear
Gross Volume	~57 m³
Net Habitable Volume	~38–42 m³

7.2 Functional Zones

- Zone A: Forward Command
- Zone B: Central Workspace / Galley
- Zone C: Crew Quarters / Medical
- Zone D: Systems Bay
- Zone E: Suitport Vestibule

7.3 Cabin Atmosphere

Parameter	Value
Total Pressure	55.2 kPa (8.0 psia)
O_2 Partial Pressure	21.4 kPa
O_2 Fraction	38.7%
Temperature	18–22°C
Relative Humidity	40–55%

Reduced pressure lowers structural mass and reduces EVA prebreathe requirements.

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8. Life Support & Consumables

8.1 ECLSS Components

- Dual-bed CO_2 scrubber
- Trace contaminant control
- Humidity condensation loop
- Water recovery (85% nominal)
- High-pressure O_2/N_2 storage

8.2 Water Budget (3 Crew, 60 Days)

Category	Gross Demand
Drinking	360 kg
Food Rehydration	90 kg
Hygiene	90 kg
Medical / Contingency	36 kg
Total Gross Demand	576 kg

With 85% recovery, net makeup requirement ≈ 86 kg.
Vehicle carries ~200 kg at mission start.

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9. Suitport & Dust Management

9.1 EVA Architecture

- External suitport docking
- No full-cabin depressurization required
- Faster ingress/egress
- Reduced atmosphere loss

9.2 Vestibule Systems

- Dedicated HEPA filtration
- Electrostatic dust precipitation
- Sticky mat threshold control
- Cyclonic vacuum
- Mandatory wipe-down protocol

Fallback capability: traditional airlock mode.

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10. Radiation Protection

10.1 Solar Particle Event Shelter

- Deployable water-wall shielding
- 8–12 cm water equivalent
- Underfloor water tanks provide bottom shielding

Estimated severe SPE dose reduced from lethal exposure range to survivable emergency exposure range.

10.2 Galactic Cosmic Radiation

- 0.3–0.6 mSv/day baseline
- 60-day exposure within occupational limits

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11. Power Architecture

11.1 Electrical Loads

Mode	Power
Cruise	~4,590 W
Station-Keeping	~2,170 W
Peak	~8,890 W

11.2 Generation Strategy

Source	Capability
Roof SSSRA Array (20 m²)	~724 W @ 6° sun
Deployable Wing Arrays (10 m² tilted)	~3.5 kW combined
Fuel Cell	1–3 kW sustained
Battery Storage	40–60 kWh
Outpost Recharge	Logistics-based

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12. Thermal Architecture — SSSRA

12.1 Radiator Tier

- Area: 6.0 m²
- Operating Temperature: 310 K
- Degraded net rejection: ~255 W/m²

- Peak rejection capacity: ~1,530 W

12.2 Solar Tier

- Roof shading array: 20 m²
- Deployable wing arrays: 10 m²
- Low-emissivity backside coating
- Heading-independent rejection performance

12.3 Mass & CG Impact

- Total assembly mass: ~85–110 kg
- CG rise: ~0.02 m (negligible)

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13. Development Phasing

Phase 1

- Uncrewed demonstrator
- SSSRA thermal validation
- Dust and suitport testing

Phase 2

- Crewed 7-day sortie capability
- Partial closed-loop ECLSS

Phase 3

- Full 30–60 day mission capability
- ISRU integration and surface logistics chain

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14. Programmatic Position

The Aegis-Class Rover is designed to:

- Bridge short-duration sorties and permanent surface habitats
- Enable distributed surface industry
- Operate as part of a broader cislunar logistics architecture
- Provide safe, stable, long-duration surface mobility without requiring immediate fixed megastructure deployment

15. Document Status

This document defines the baseline dimensional, mass, power, thermal, and human factors architecture for the Aegis-Class Lunar Surface Mobility Platform.

Status: Architecture Reference
Not a hardware commitment