

LUNET

Lunar Utility Node & Exchange Terminal

A Standardized Infrastructure for Lunar Mobility and ISRU Integration

1. Overview

The **Lunar Utility Node & Exchange Terminal (LUNET)** is a standardized network of surface and orbital utility nodes designed to support routine, repeatable lunar transportation and operations. LUNET enables refueling, recharging, diagnostics, and logistics coordination for lunar surface and cislunar vehicles, including the Aegis Short-Hopper and compatible platforms.

Rather than treating lunar mobility as a sequence of bespoke missions, LUNET establishes **persistent infrastructure**. It converts the Short-Hopper from a single-use lander into a true **inter-base mobility platform**, capable of autonomous operations at scale and sustained cadence.

LUNET is explicitly designed to integrate with lunar ISRU pipelines and orbital propellant handling, allowing vehicles to carry **only the propellant required for the next leg**, rather than for end-to-end missions.

LUNET is designed as standalone infrastructure, deployable independently of any single vehicle or station architecture.

2. Node Classes

Each LUNET node is modular, upgradeable, and deployable via rover, Hopper, or lander.

| Node Type | Typical Location | Primary Role |
|----------------------|--|--|
| ISRU Base Node | Permanently shadowed regions (e.g., Shackleton) | Water handling, electrolysis interface, fuel staging |
| Static Midrange Node | Mid-latitude sites (e.g., Mare Imbrium, Lalande) | Refuel, recharge, diagnostics |
| Mobile Node | Deployable or temporary sites | Field operations, scouting, contingency support |
| Orbital Node | Compatible orbital platforms (e.g., crewed or uncrewed logistics hubs) | Cryogenic interface, power, and logistics exchange |

3. Standard Capabilities

Refueling

- Supports **LOX / LH₂** in cryogenic cartridge or pumped transfer formats
- Cartridge swap or direct coupling supported
- Passive boil-off management with optional active cooling
- Designed for rapid turnaround rather than long dwell times

ISRU-aligned handling philosophy:

- **Water** acts as the primary long-duration buffer
- **Oxygen** is accumulated and inventoried
- **Hydrogen** is treated as a short-dwell, near-use commodity rather than a bulk inventory product.

This reduces power burden, tank mass, and system brittleness while improving operational resilience, consistent with a water-buffered ISRU architecture.

Recharging

- Solar + battery or RTG-based electrical supply
 - Standardized high-voltage power interface
 - Supports vehicle recharge and node-local storage
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Diagnostics & Data

- Local telemetry upload and health checks
 - Relay to mission control or connected orbital assets
 - Node-level fault isolation and status reporting
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Optional Utilities

- Water refill (life support, thermal mass, processing feedstock)
 - Navigation beacon and comms relay
 - EVA shelter or rover docking interface
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4. Interfaces & Compatibility

LUNET nodes are designed for interoperability with:

- Aegis Short-Hopper (Commercial and Retail variants)
- Lunar Surface Propellant Tanker (LSPT)
- Aegis Mammoth Car (node and tank module delivery)
- Third-party landers using certified LUNET interfaces

Standard Interfaces

- **LUNIFUEL™ Coupler** – Cryogenic LOX/LH₂ interface
 - **LUNELINK™ Port** – Power and data connection
 - **Node Cartridge Format** – Cryo-compatible tank
2.5 m diameter × 10 m length
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5. Deployment & Logistics

| Node Type | Delivered By | Refueled / Resupplied By |
|----------------------|---------------------------------------|--|
| ISRU Base Node | Heavy lander / Rover | On-site water processing |
| Static Midrange Node | Lander / Short-Hopper | LSPT tanker |
| Mobile Node | Hopper or Rover | Prefilled or LSPT |
| Orbital Node | Compatible orbital platform or lander | Lunar or orbital ISRU pipelines (e.g., water → LOX/LH ₂) |

Deployment kits are pre-assembled or flat-packed and include **autonomous startup and checkout procedures**.

6. Network Architecture Example

Pole → Mid-Latitudes → Equator

- Hop 1: Shackleton ISRU Node → Mare Imbrium Node
- Hop 2: Mare Imbrium Node → Equatorial site

Network Effects

- Enables low-delta-v, repeatable hops
 - Supports civilian, commercial, and research vehicles
 - Keeps vehicles lightweight and mission-flexible
 - Allows infrastructure to grow independently of vehicle design
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7. Operating Modes

LUNET nodes support multiple operating regimes:

- **Power-rich mode** – Electrolysis and oxygen accumulation prioritized
- **Demand-rich mode** – Rapid hydrogen production and transfer
- **Constrained mode** – Water buffering and minimum-viability support

These modes allow the network to adapt to power availability, traffic fluctuations, and maintenance cycles without interrupting operations.

8. Scalability & Licensing

LUNET is designed as **franchise-ready infrastructure**:

- Standardized deployment kits
- Third-party compatibility certification
- Automated resupply via LSPT or landers
- Shared node maps and telemetry synchronization

LUNET interface standards are maintained to support partners, licensees, and agencies.

9. Strategic Impact

- Establishes a repeatable baseline for lunar mobility vehicles
- Creates durable infrastructure rather than one-off missions
- Enables ISRU to scale incrementally without re-architecting vehicles
- Aligns physical system behavior with material physics rather than idealized demand models

Transforms lunar ISRU from demonstration into daily operations that can be planned, relied upon, and scaled.