Lunar Logistics
Drivers & Needs
What are Logistics Items?

Items needed to sustain life, maintain systems, and allow for productive science and utilization activities

- Food, water, and air
- Spares parts and other similar products
Composition of Logistics Items

**Consumables**
Commodities that support the conduct of mission activities not related to a specific activity.

**Maintenance Items**
Planned replacement hardware and tools for known limited lifetimes and scheduled replacements.

**Spares**
Items and tools for unplanned corrective maintenance.

**Utilization (Payloads and Research)**
Hardware and items (e.g., science, research, capability demonstration, outreach) that are integrated but not required for crew or vehicle operations.

**Outfitting**
Hardware or components that are flown after the initial module delivery for permanent installation or use.

**Packaging, Overhead, and Carriers**
Materials required to safely and effectively transport and store logistics items.
Established processes allow for proper assessment of logistics systems and consistent analysis of architecture concepts.

Note: The process for estimating logistics item needs for conceptual missions does not dictate requirements for future missions.
Lunar Logistics Drivers

- Mission Duration
- Crew Size
- ECLSS Architecture
- EVA Cadence

Environmental Control and Life Support System
Extravehicular Activity
## Mission Duration and Crew Size

### Total Required Logistics (kg)

<table>
<thead>
<tr>
<th>Surface Mission Duration</th>
<th>2 Crew</th>
<th>4 Crew</th>
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<tbody>
<tr>
<td>7 Days</td>
<td><img src="image1.png" alt="Graph" /></td>
<td><img src="image2.png" alt="Graph" /></td>
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<tr>
<td>14 Days</td>
<td><img src="image3.png" alt="Graph" /></td>
<td><img src="image4.png" alt="Graph" /></td>
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<tr>
<td>21 Days</td>
<td><img src="image5.png" alt="Graph" /></td>
<td><img src="image6.png" alt="Graph" /></td>
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<tr>
<td>28 Days</td>
<td><img src="image7.png" alt="Graph" /></td>
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Note: Does not include pressurized carriers or tank mass.
ECLSS Architecture and EVA Cadence

A representative breakdown by mass of logistics needs for a conceptual Open-loop ECLSS lunar surface mission with a significant planned cadence of EVAs.
• The architecture must be based on comprehensive, accurate estimates of logistics item needs and include assessments of suitable logistics sub-architectures to deliver those needs.
• Logistics items are everything not initially delivered as part of a vehicle or element dry mass needed to support missions.
• Crew size, mission duration, ECLSS sub-architecture capabilities, and planned EVA cadence are the primary drivers for the total logistics needs.
• Water, gases, and food dominate overall logistics needs by mass.
Lunar Logistics

Drivers and Needs

Introduction:
Lunar exploration requires the movement of resources, people, and parts of vehicles and equipment. This necessitates the development and implementation of advanced logistics. This White Paper looks at the concept of logistics, drivers for lunar logistics, and identifies the types of logistics needs that need to dominate overall needs.

NASA has established a consistent process for developing initial estimates of logistics needs for conceptual exploration mission planning. This process, which is based on NASA’s spaceflight expendables and inputs from technical experts, provides a comprehensive assessment of the logistics needed to support exploration missions. This White Paper will identify specific lunar logistics needs and allow for proper assessment of logistics systems and detailed plans. The process for estimating logistics needs is based on empirical data collected from past missions. This process is used as a reference for future missions. Future logistics needs are determined based on detailed mission requirements. However, the process described here provides a reasonable initial estimate of logistics needs.

Composition of Logistics Items

Logistics items are all the equipment and supplies needed to support mission activities and are not part of a vehicle or element dry mass. The logistics needs vary significantly for different mission types. Logistics items can be divided into the following categories:

- Consumables: includes consumables driven by core non-vehicle needs (encapsulation, and personnel) [example of specific items include food, clothing, personal items, operational supplies, hygiene items, tools, or space suits].
- Maintenances items: includes maintenance items (mechanical, electrical, and electronics) [example of specific items include tools, spare parts, and electronics].
- Spares: includes spares and associated tools that address corrective maintenance for unforeseen component failures or component failures. Spares and maintenance items will need to be assessed on a case-by-case basis.
- Utilization goods and residuals: includes additional hardware and tools (tools, lounges, service, and spares) that are not required for core or vehicle operations. For exploration mission planning, mission and analysis vectors are typically defined rather than specific utilization hardware, as the latter is driven by specific mission objectives.

Outfitting: Subsystem hardware or components that are flown after the initial mission delivery. For permanent installation or use, they are defined as UTIL. Equipment that is not permanently integrated into the integrated logistics plan. Outfitting components are primarily for mission requirements that are not addressed within the initial logistics mission. These items will need to be identified and included in the SLLP. Spares, consumables, and outfitting items will need to be added to the integrated logistics plan. Outfitting components are typically for mission requirements that are not addressed within the initial logistics mission. These items will need to be identified and included in the SLLP. Spares, consumables, and outfitting items will need to be included in the integrated logistics plan.

Packaging, overhead, and container: Items required to safely and effectively transport and store each of the logistics items. This category does not include any equipment, personnel, or consumables that are required for the logistics mission. This category would also include items that are designed for transport, such as containers that are specifically designed for lunar logistics.

These drivers, along with the reference usage of logistics items, are significant. The reference items are used as a starting point for logistics needs. More detailed analyses are required for specific mission types. This White Paper will provide a comprehensive overview of lunar logistics needs.