Integrated System-of-Systems Modeling Tools for Site Selection

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Sustainable Lunar Surface Architecture depends upon complex infrastructure services.

Value Proposition and Cost Analysis require demand forecasting & understanding operational scalability.

Models & Tools are necessary to capture end-to-end infrastructure of various mission operations.

Integrated, model-based framework enables optimization and analysis at the pace of industry development.

System-of-Systems approach including technical, operational, business, and demand models represents a wholistic infrastructure roadmap.
Lunar Economy Analysis Platform

- Optimize Power Grid Architecture
- Multivariate Lunar Path Planning
- Model Mission Prop Consumption
- Analyze Illumination vs Height, Time
- Refueling Logistics & CONOPS
- Calculate ISRU Infrastructure Needs

Design Features

- Integrated lunar infrastructure system-of-systems analyses
- Modular tools in a common environment
- Object-oriented modeling
- Common data structure
Example Integrated System-of-Systems Model

**INPUT:** Artemis Surface Missions Over Time

- Propellant Demand Tools
- Time-Phased Prop Demand
- Refueling Architecture Tools
- Update Demand for Refuel
- ISRU Sizing Tools

**OUTPUT:**
- Optimized Architecture for Propellant Refueling, ISRU Commodity Production, & Surface Power Grid
  - Includes catalog of all elements required, total mass, total power usage, and recurring cost estimate
Basecamp: Site Power Study

Cost of Grid, LVSAT Only

Cost of Grid, One FSP

Cost Including Launch, LVSAT Only

Cost Including Launch, One FSP

Comparative Cost of Basecamp Options

Value proposition analysis drives site selection
Exploration & Mobility

Combine various data to inform mobility capabilities

Long Traverse Exploration Example

Light Chasing Path Planning Accounting for Slope Avoidance

Crew Walk-Back Analysis

Crew Traverse & Emergency Return Path Assessment

Illumination Analysis Example

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In-Situ Resource Utilization: System Modeling

Map technical capabilities to demand forecasting
Determine total infrastructure of interdependent elements

Production Rate & Power over Time
Mobility Vehicle Count over Time
Production Rate vs. Power
Closing Remarks

• Lockheed Martin Space has captured a number of relevant perspectives on site selection and lunar infrastructure within the following AIAA ASCEND paper:

• Please reach out if you have comments, questions, or are interested in comparing model-based data artifacts on lunar infrastructure systems

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