ARTEMIS: Advanced Reusable Transport for Exploration Missions

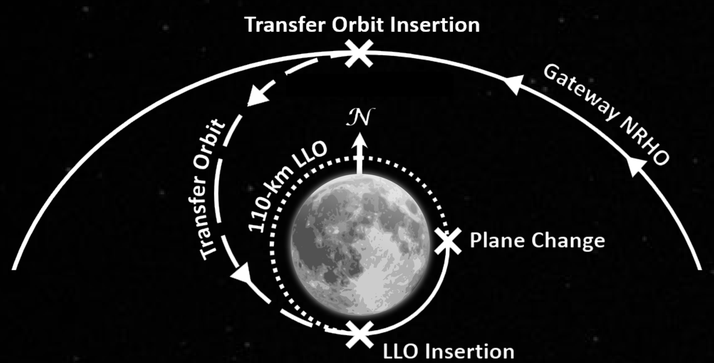
Faculty Advisors: Dr. Koki Ho, Dr. Michael Lembeck
Daniel Engel, Brian Hardy, Jacob Hawkins, Linyi Hou, Erika Jarosch, Rahil Makadia, Harsh Patel, Haoyun Qiu, Peter Sakkos, Edward Taylor

Concept of Operations

- Mission modes:
  - I. 6 days on surface with 2 crew and 500kg of cargo
  - II. 2 days on surface with 4 crew and 100kg of cargo
- Refueling using annual expendable Falcon Heavy launch
- Resupply using annual SLS-Orion MPCV launch co-manifest

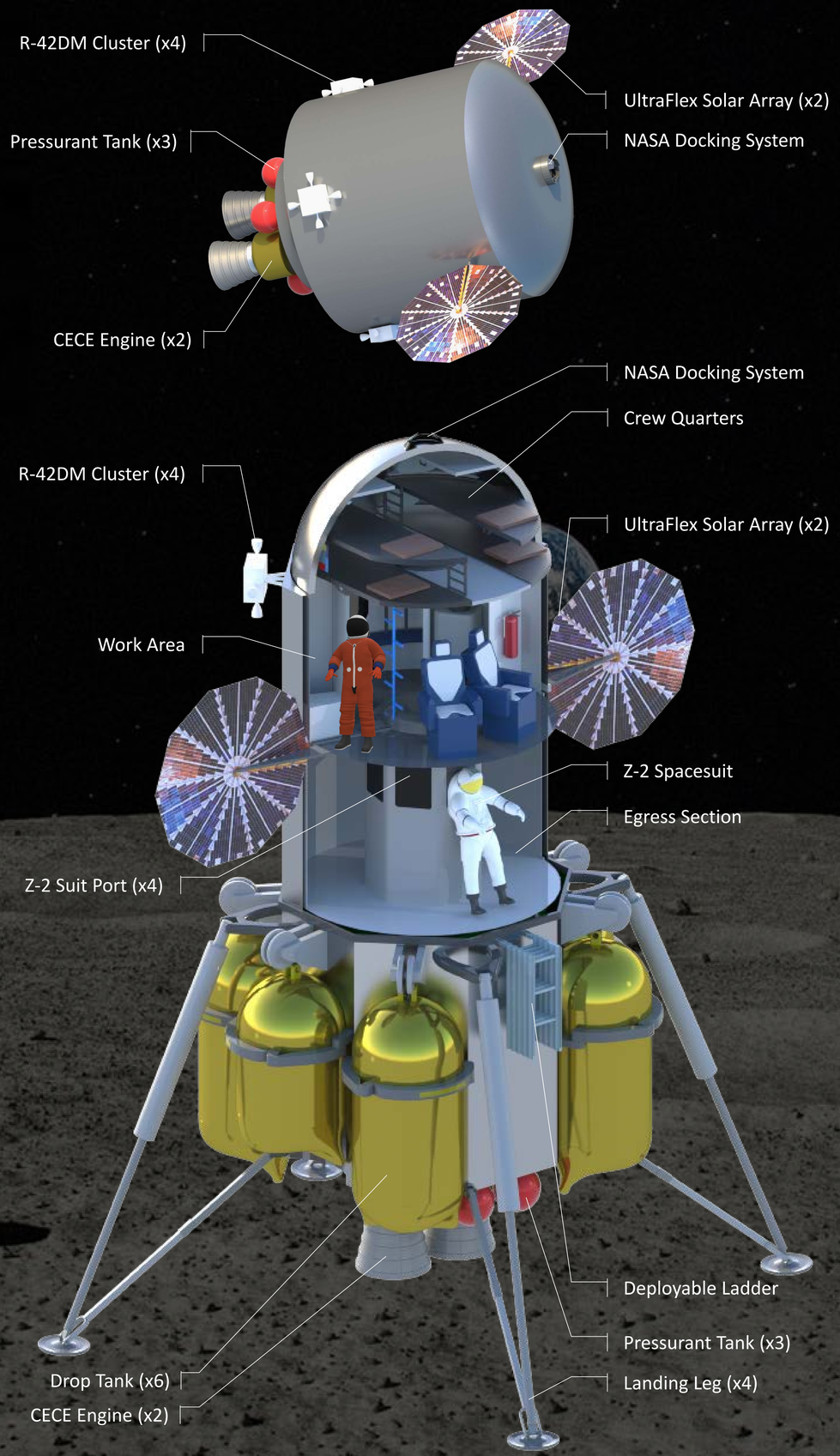
Mission Profile

- Orbiter performs 3-burn transfer from NRHO to 110km LLO
- LLO separation; lander and drop tanks continue to surface
- Drop tanks enable descent burn and detach on surface
- Lander performs ascent burn to dock with orbiter in LLO



Vehicle Subsystems

- Atmospheric Control and Regulation
- Crew and Vehicle Radiation Mitigation
- Drop Tanks (2x Liquid Oxygen, 4x Liquid Hydrogen)
- Dynamic Windows and Lighting Control
- Automatic CO_2 Fire Suppression
- MACES Flight and Z-2 EVA Suits
- Food and Water Systems
- Guidance, Navigation, and Control
- Landing Systems
- Micrometeoroid and Orbital Debris (MMOD) Shielding
- Power Generation and Storage
- Propulsion Systems
- Structural Components
- Telemetry, Tracking, and Command
- Thermal Control
- Waste Management



Key Technologies

- **AstroRad Radiation Vests —** Protect astronauts during high solar activity
- **Carbon Fiber Composites —** Lower the system mass while increasing the strength of the structure compared to Al
- **Drop Tanks —** Enables lower system mass and cost, with later lunar in-situ resource utilization
- **Electrochemical Windows —** Alongside lighting systems maintain consistent crew circadian rhythm
- **Lunar Laser Communications Array —** Fast uplink and downlink between the lander and ground control
- **Z-2 Suits —** Enable quick donning and doffing procedures whilst providing lunar dust mitigation

Development Timeline

2019 – System-wide concept study complete
2021 – Design requirements outlined; construction begins
2022 – Static model complete; crew training begins
2024 – Construction ends; integration and testing begins
2026 – ARTEMIS launched using two New Glenn rockets
2027 – Validation mission with two-pilot crew; first expendable Falcon Heavy refueling mission
2028 – First fully crewed ARTEMIS mission

Cost Profile and Business Plan

- ARTEMIS Total Cost – US$ 8.25 billion
  - Design and Development – US$ 2.99 billion
  - Manufacturing and Testing – US$ 2.41 billion
  - Launch and Operations – US$ 2.85 billion
- Business Plan - 60% NASA, 20% International Partners, 20% Commercial Partners
  - Saves NASA US$ 3.30 billion