Graduate Projects
Integrated Lunar Occupation Outpost (IgLOO)

Lecture Presentation

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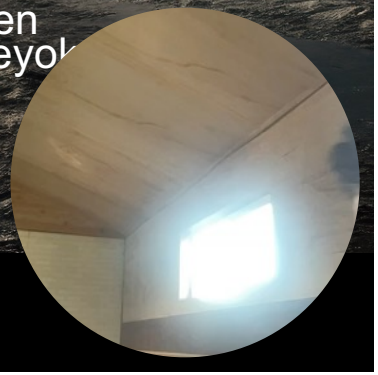
October 14, 2024



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Agenda

- Project Overview
- Project Organization
- Deliverables
- Team Progress
- Project Concerns
- Questions

Project Overview

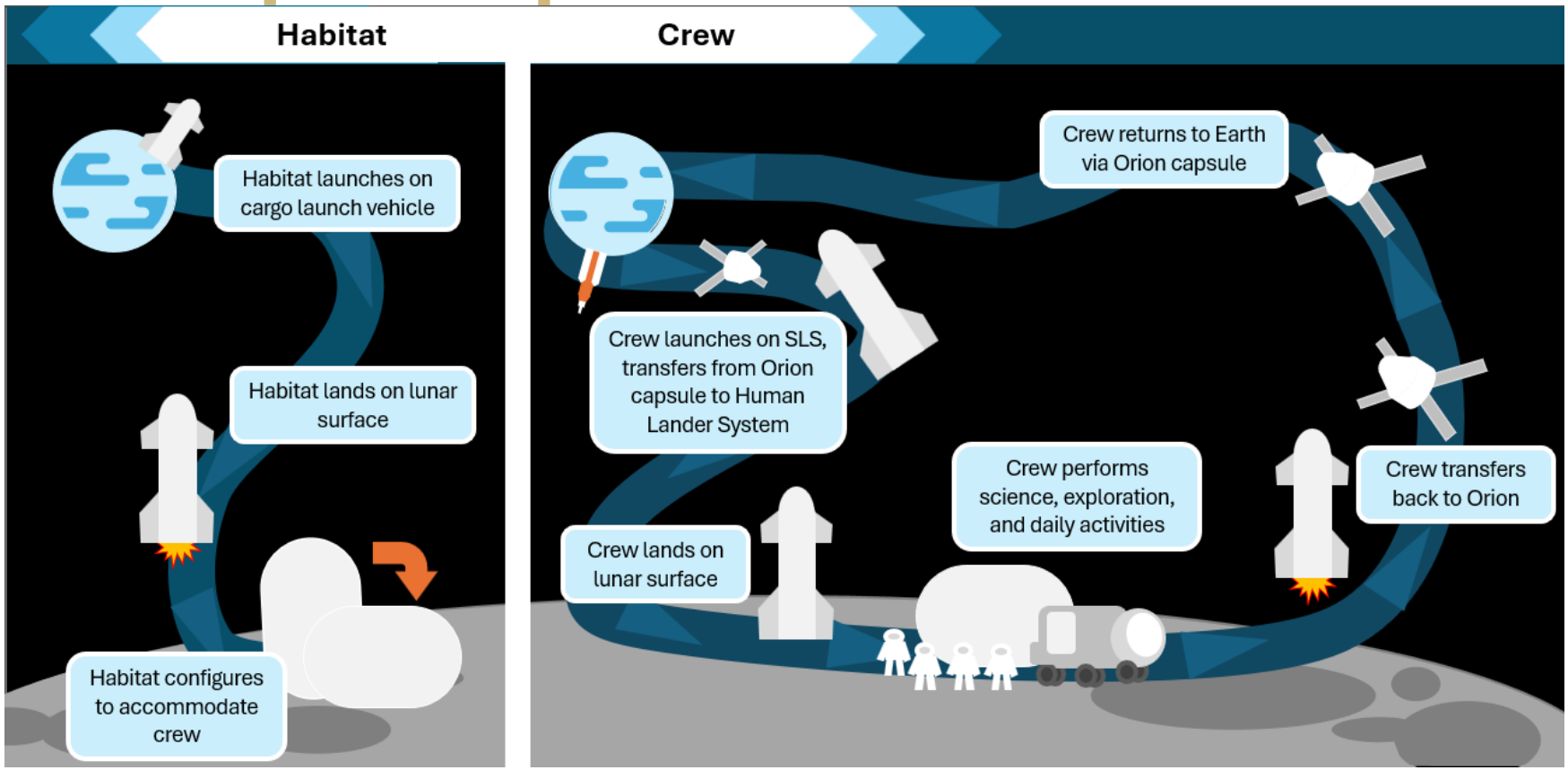
Project Purpose

Motivation
Enable safe human Earth-Lunar operations as part of larger program of Lunar habitat missions to the Moon.

Purpose
Lunar habitat mission will be required to support human operations on the Lunar surface. The IgLOO architecture is intended to advance the state-of-the-art Lunar habitat design.

Goal
Develop a conceptual design of a Lunar Habitat and conduct a mockup build for human factors testing of the design.

Concept of Operations

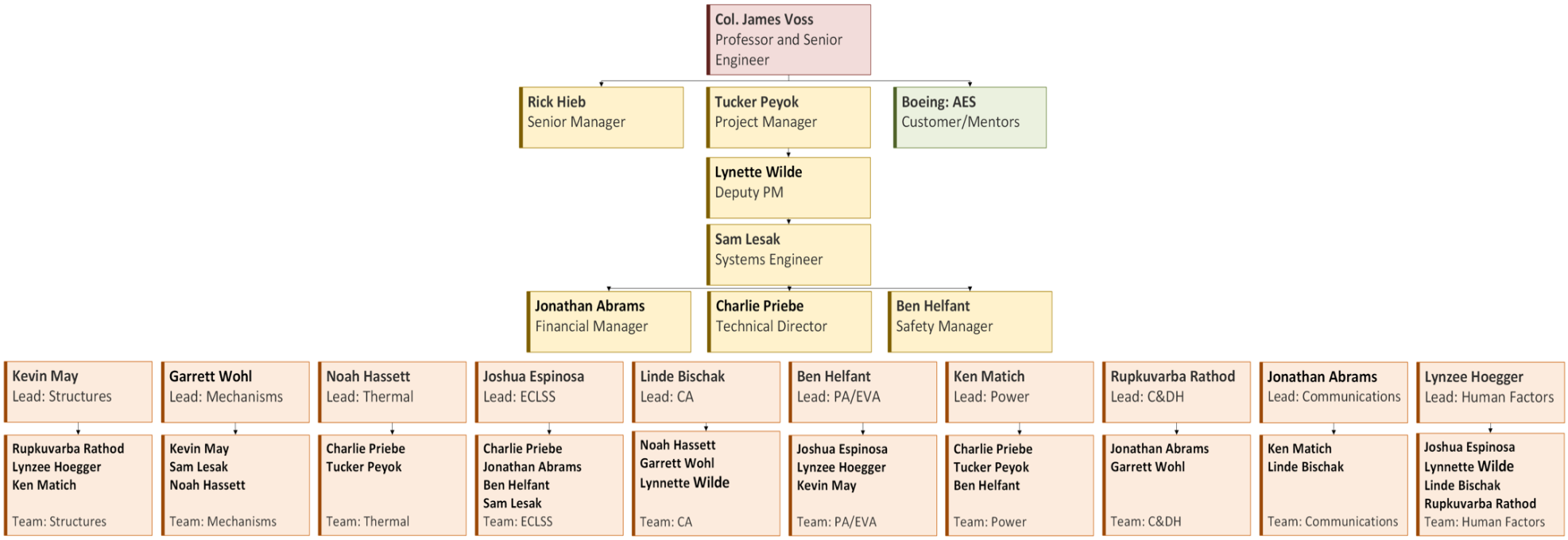


Functional Objectives

FO #	FO Requirement	Responsible Subsystems
FO 1	Launch IgLOO Habitat	Systems, Structures
FO 2	Arrive on the Lunar Surface	Systems, Structures
FO 3	Enable Lunar Science and Exploratory Operations	EVA, Structures
FO 4	Support a Crew of Four for up to 37 Days	ECLSS, Crew Accommodations, Payload Accommodations
FO 5	Enable Habitat Operations and Reusability	Systems, Structures, Thermal, Power, Communications, Command and Data Handling

Project Organization

Org Chart


Col. James Voss
Professor and Senior Engineer
Rick Hieb
Senior Manager
Tucker Peyok
Project Manager
Boeing: AES
Customer/Mentors
Lynette Wilde
Deputy PM
Sam Lesak
Systems Engineer
Jonathan Abrams
Financial Manager
Charlie Priebe
Technical Director
Ben Helfant
Safety Manager
Kevin May
Lead: Structures
Rupkuvarba Rathod
Lynzee Hoegger
Ken Matich
Team: Structures
Garrett Wohl
Lead: Mechanisms
Kevin May
Sam Lesak
Noah Hassett
Team: Mechanisms
Noah Hassett
Lead: Thermal
Charlie Priebe
Tucker Peyok
Team: Thermal
Joshua Espinosa
Lead: ECLSS
Charlie Priebe
Jonathan Abrams
Ben Helfant
Sam Lesak
Team: ECLSS
Linde Bischak
Lead: CA
Noah Hassett
Garrett Wohl
Lynnette Wilde
Team: CA
Ben Helfant
Lead: PA/EVA
Joshua Espinosa
Lynzee Hoegger
Kevin May
Team: PA/EVA
Ken Matich
Lead: Power
Charlie Priebe
Tucker Peyok
Ben Helfant
Team: Power
Rupkuvarba Rathod
Lead: C&DH
Jonathan Abrams
Garrett Wohl
Team: C&DH
Jonathan Abrams
Lead: Communications
Ken Matich
Linde Bischak
Team: Communications
Lynzee Hoegger
Lead: Human Factors
Joshua Espinosa
Lynnette Wilde
Linde Bischak
Rupkuvarba Rathod
Team: Human Factors

Stakeholders

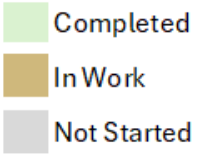
- The Boeing Company
- CU Boulder Bioastronautics
  - Colonel Jim Voss
  - Rick Hieb
- CU Boulder Graduate Projects
  - Chris Koehler
  - Joey Shy

Sub-Systems

- **Structures**
  - Provides the physical boundary for the habitat and maintains a pressurized environment
- **Mechanisms**
  - Designs all moving components, such as the hatches of the habitat
- **Thermal**
  - Ensures thermal equilibrium within the habitat is maintained at a level suitable for the crew
- **Environmental Control and Life Support Systems (ECLSS)**
  - Fulfills all the crew's biological needs (keep them alive)
- **Crew Accommodations (CA)**
  - Provides equipment crew will need to remain productive, happy, and healthy
- **Payload Accommodations/Extravehicular Activity (PA/EVA)**
  - Provides equipment crew will need to achieve scientific and mission goals
- **Power**
  - Generates, conditions, and provides electrical power to the habitat so that all components can function
- **Command and Data Handling (C&DH)**
  - Sends commands to and receives telemetry data from the other subsystems
- **Communications**
  - Enables voice, video, and data exchanges between ground and the habitat
- **Human Factors**
  - Ensures that the habitat layout and design are compatible with the crew and maximizes human efficiency

Deliverables

Fall 2024 Deliverables



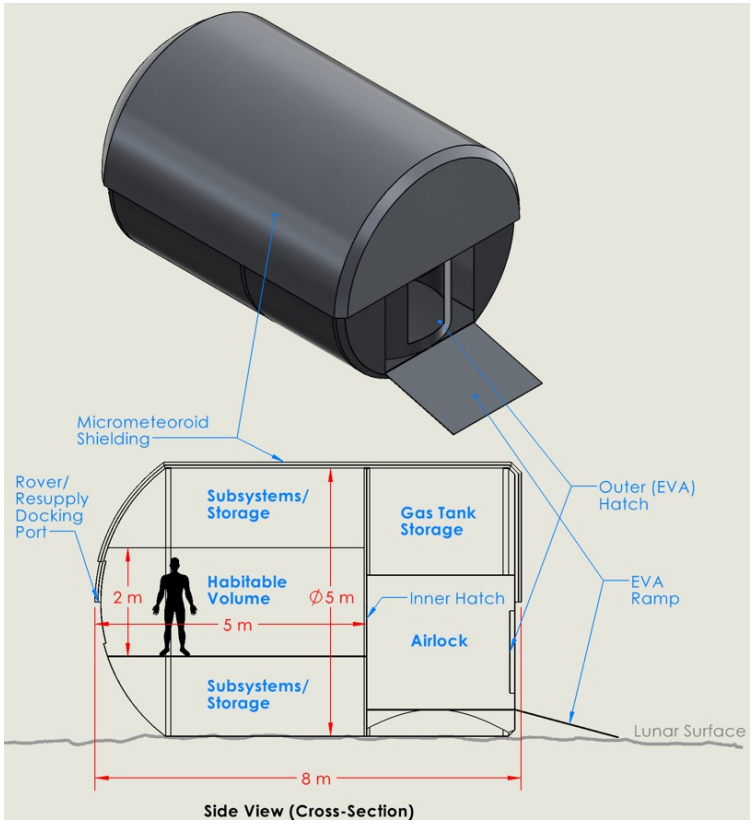
Task	Description
BIOASTRO – 1	Conduct a Kickoff Meeting with BIOASTRO management and Boeing to refine work to be completed in support of the IgLOO conceptual design and mockup build. Agree on scope of work to be performed.
BIOASTRO – 2	Conduct Technical Interchange Meetings (TIM) with BIOASTRO management and Boeing to verify the concept for the IgLOO mockup to support trade study needs and human factors evaluations.
BIOASTRO – 3	Complete systems engineering documents in support of the IgLOO design.
BIOASTRO – 4	Complete design of IgLOO.
BIOASTRO – 5	Complete work to repurpose the existing BIOASTRO habitat mockup.
BIOASTRO – 6	Complete limited human factors evaluations of the IgLOO mockup.
BIOASTRO – 7	Prepare and conduct additional meetings and reviews of program progress, readiness, and status.

Team Progress

Conceptual Design Overview

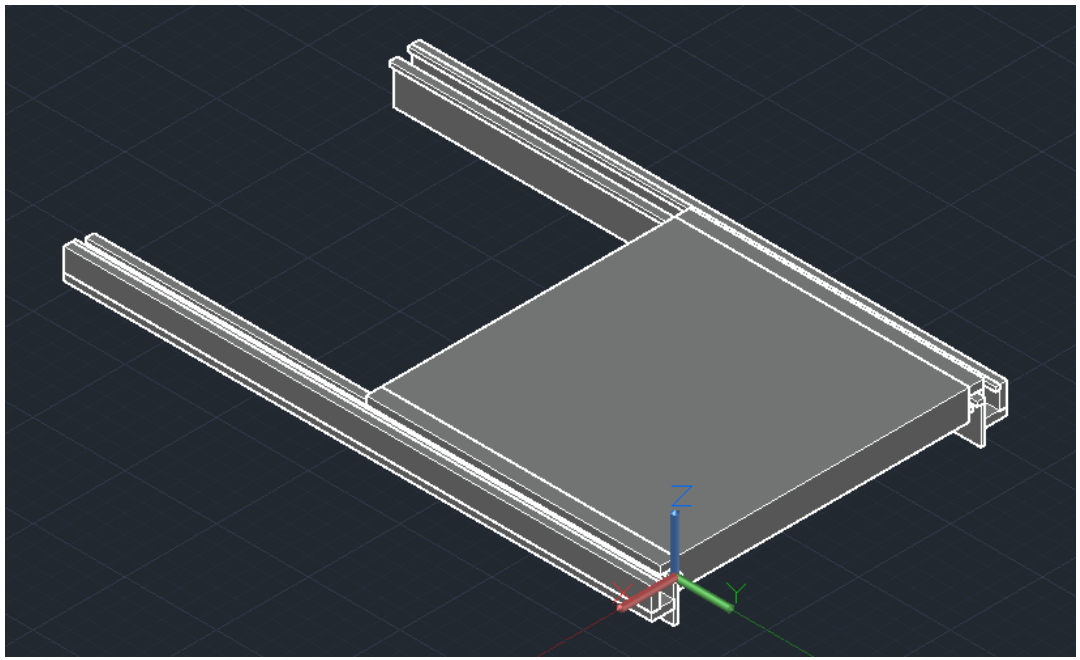
- Optimized for 4-person crew, 30-day missions (7 days contingency)
- Designed for 15-year operational lifespan
- Reconfigurable spaces for science, living, and radiation protection
- Advanced operations and control

Layout – Conceptual Design

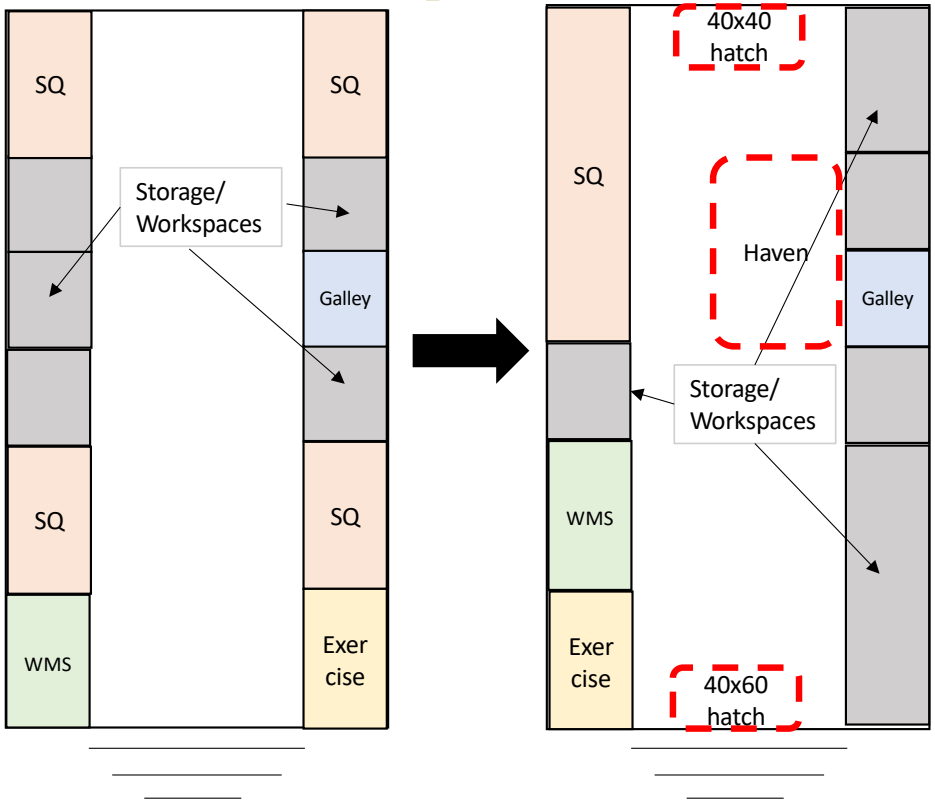


- Cylindrical habitat, ~8x5 m
- Separate habitat and airlock module
- 3 “hatches”
  - Docking port for rover/resupply
  - Inner hatch (habitat -> airlock)
  - Outer hatch (airlock -> surface)
- Total pressurized volume ~ 90 m^3
- Habitable volume ~ 20 m^3
- Habitat contains life support, crew accommodations, science payloads, etc.

Mechanisms



Mockup Build



Human Factors Testing

- November 12-22
- Will consist of groups of people testing various aspects of the habitat
  - Hatches, equipment, layout, etc.

Scan here to be added to our interest list for Human Factors Testing!

Project Concerns

Project Concerns

- Schedule
  - Transitioning to mockup build
  - Need to finish by end of October
  - Material procurement
- Design
  - Transition from conceptual to low/medium fidelity physical design
- Budget

Questions?

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