Medical Emergency Designers for Interplanetary Crisis Situations (MEDICS)
Mid-Semester Presentation

Date: 03/13/2023

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Agenda

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

Project Overview

Project Purpose

Motivation:

Support the advancement of long-duration human exploration missions

Purpose:

CU BIOASTRO and CU ADEM created a space medicine course (MiSSE) that:

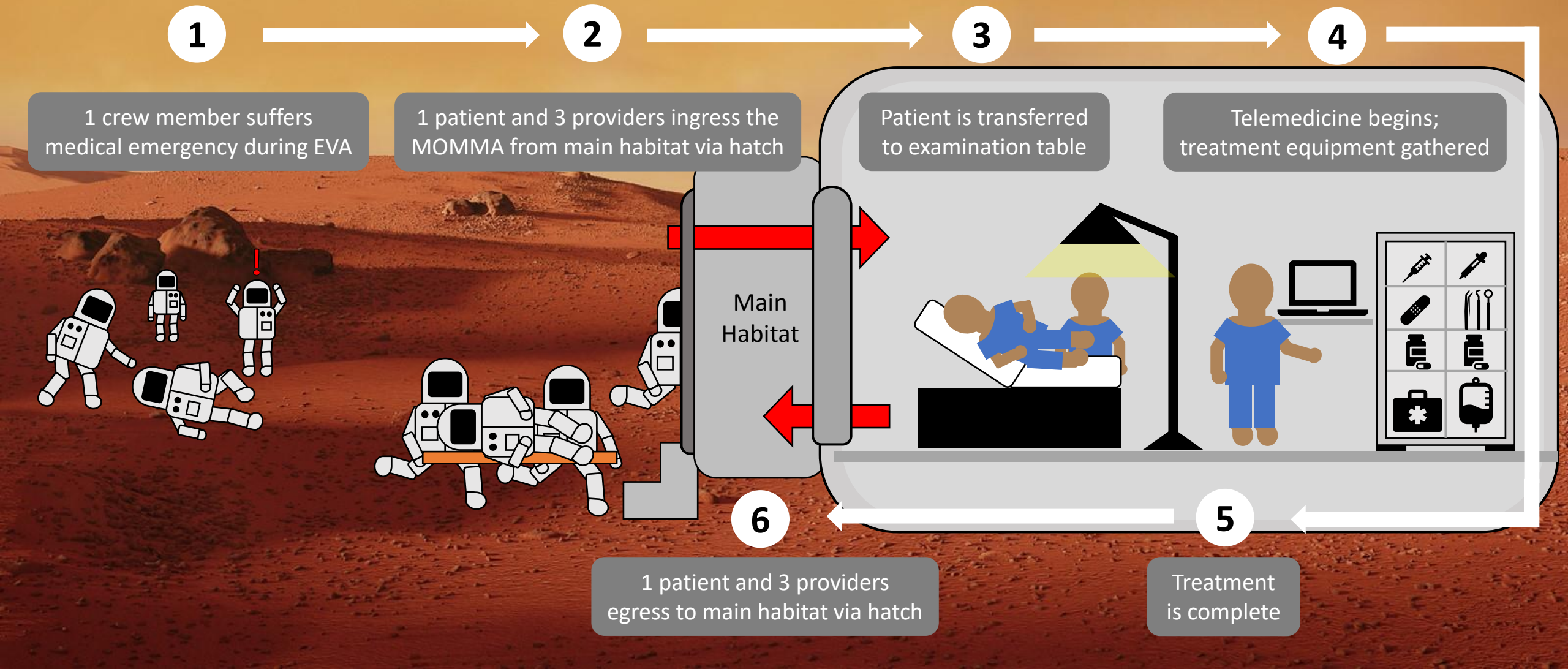
- Bridges the gap between engineering and medicine
- Teaches students medical care in extreme and remote environments through lecture and in-field scenarios

Source: CU ADEM

Goal:

Design and build out a medical bay that can be used in extreme and remote environments

Medical Operations Module for Mars Analog (MOMMA)
Concept of Operations (ConOps)



Project Objectives

Conceptual

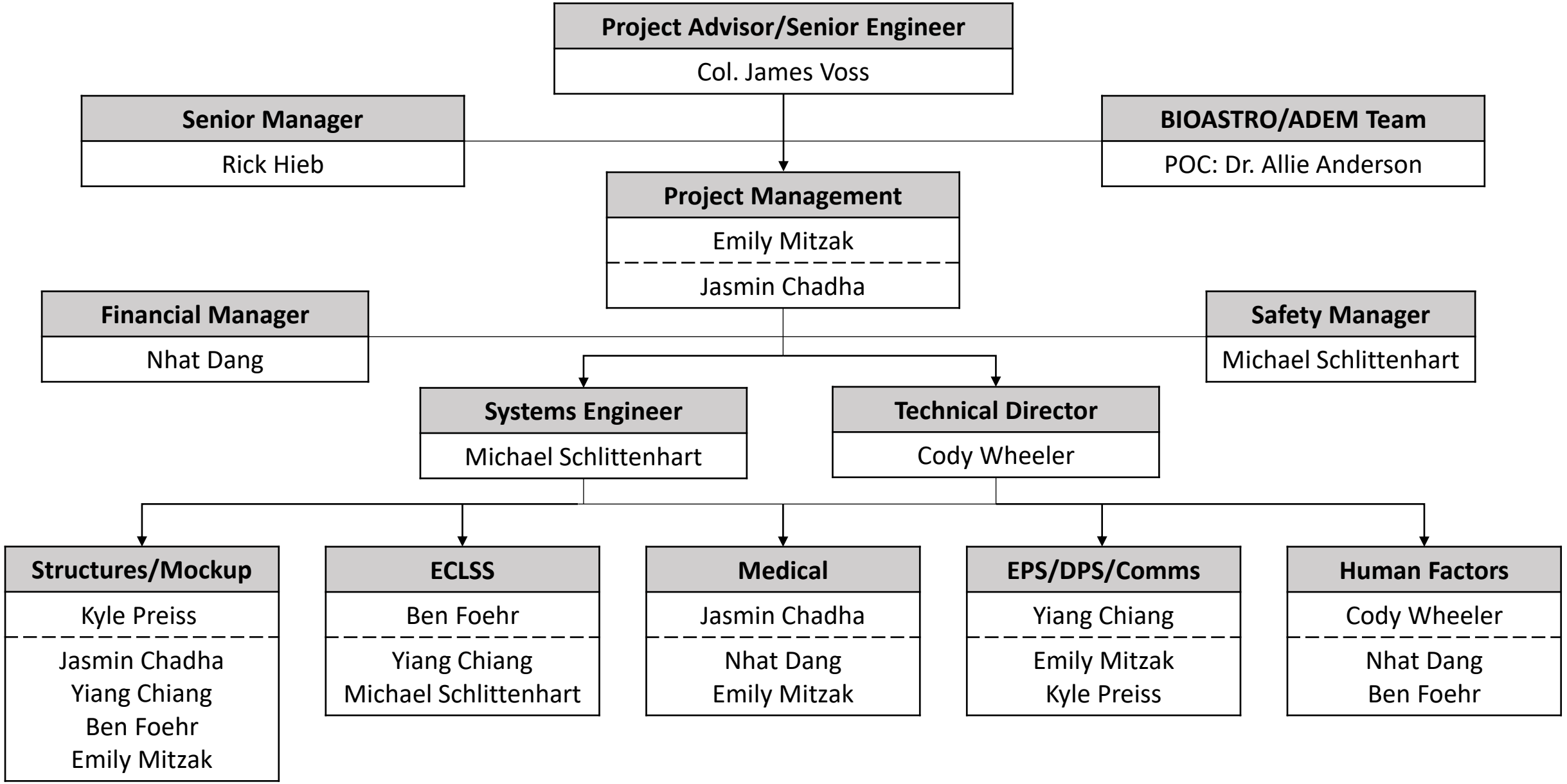
1. Complete a conceptual design of the medical bay to be used on the Martian surface

Physical

1. Design and fabricate a low-fidelity examination area
2. Design and fabricate a high-fidelity hatch with temporary support structure
3. Perform Human Factors Testing on the low-fidelity examination area
4. Perform Human Factors and Functional Testing on the high-fidelity hatch

Source: BMJ Journals

Project Organization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Project Management
Emily Mitzak
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Financial Manager
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Structures/Mockup
Kyle Preiss
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Yiang Chiang
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ECLSS
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Michael Schlittenhart
Medical
Jasmin Chadha
Nhat Dang
Emily Mitzak
EPS/DPS/Comms
Yiang Chiang
Emily Mitzak
Kyle Preiss
Human Factors
Cody Wheeler
Nhat Dang
Ben Foehr

Deliverables

No.	Description	Date Due
1	Kickoff Briefing, SOW review, delivery of Project Plan, Schedule, and Budget	Jan 26, 2023
2	Technical Interchange Meetings (TIM)	Feb 3, 2023, then as required
3	Weekly Status Updates	Feb 7, 2023, then weekly
4	Functional Decomposition Report	Feb 16, 2023
5	Mockup Trailer Trade Study Presentation and Report	Feb 23, 2023
6	System Requirements Review and Report	Mar 2, 2023
7	Design Definition Review and Document	Mar 9, 2023
8	Midterm Detailed Status Review and Report	Mar 21, 2023
9	Human Factors and Functional Test Readiness Review, Safety Review, and Test Plan delivery	Apr 6, 2023
10	Final Detailed Status Review and Report	May 4, 2023

Conceptual Objectives

Physical Objectives

Team Progress

Design Concept – CAD Overview, Floor Plan

Legend:

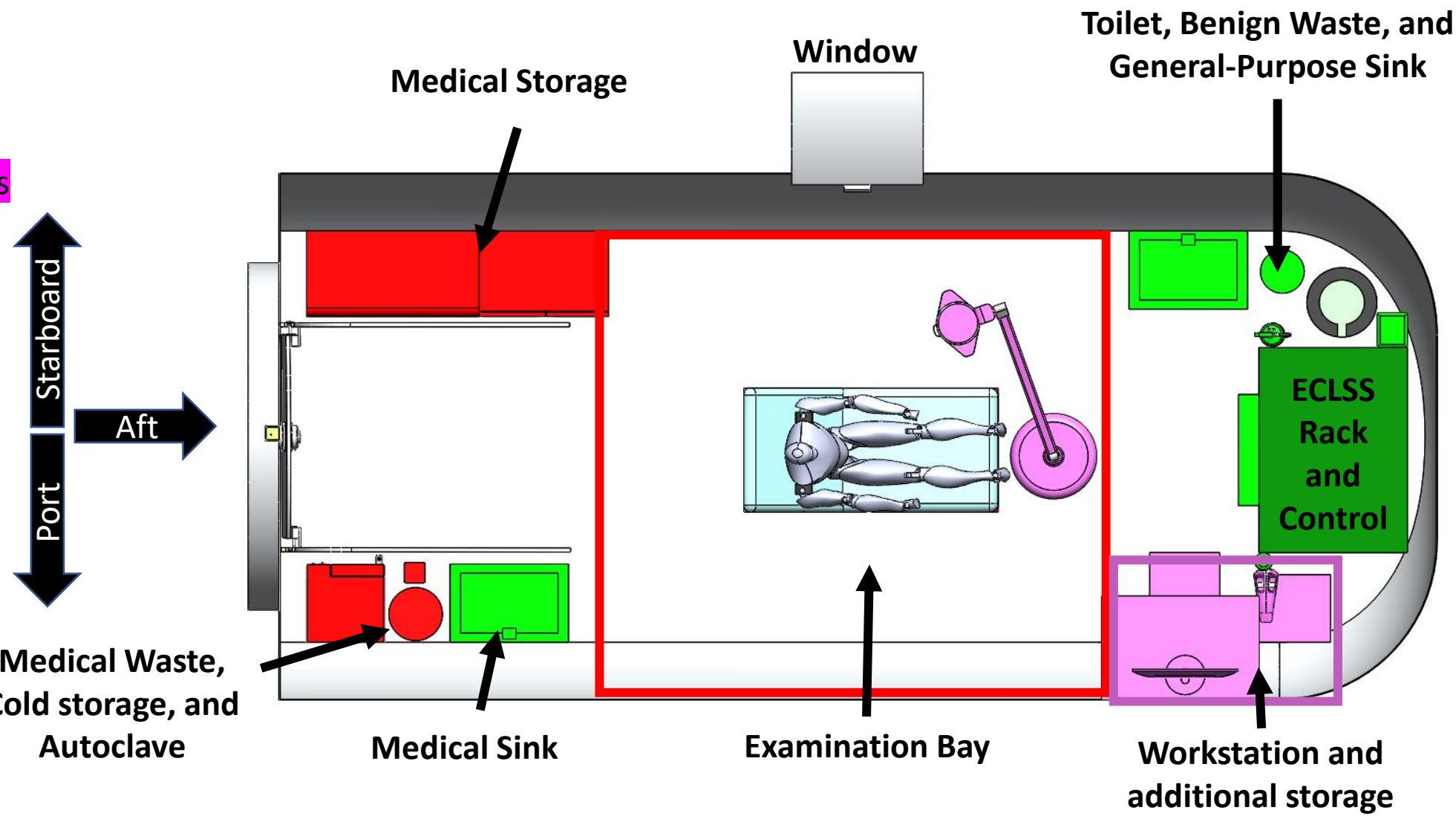
Green = ECLSS

Red = Medical

Pink = Crew Accommodations

Yellow = EPS/DPS

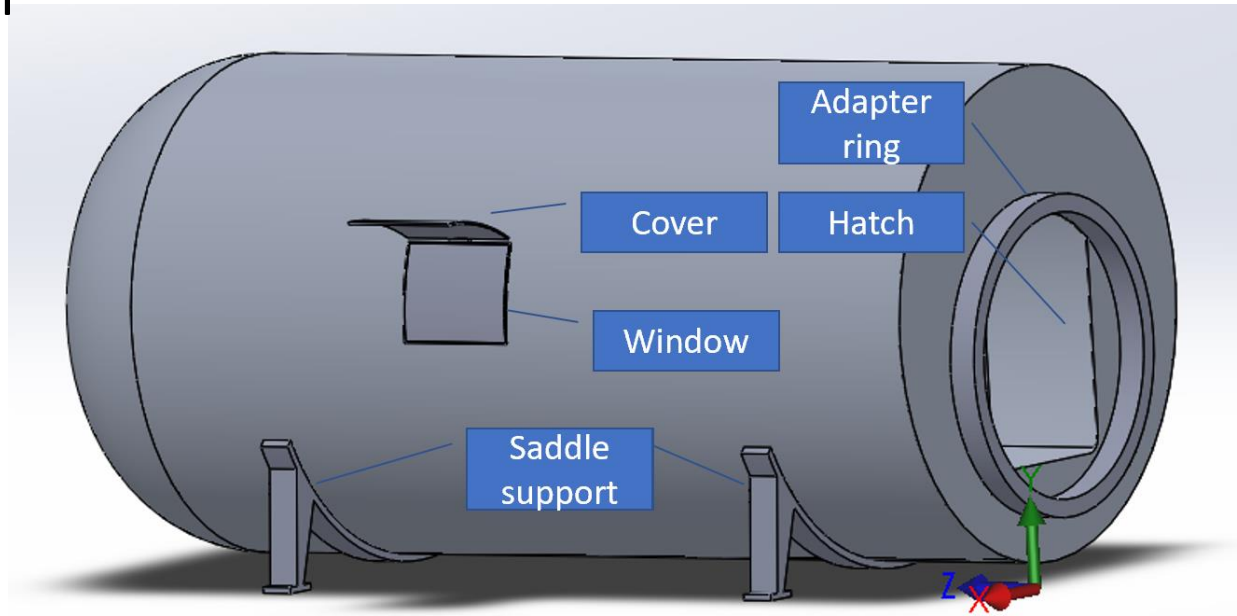
White = Structures



Structures

Design Tasks

- Design a conceptual pressure vessel to be used as a Mars medical habitat
  - Must maintain a habitable environmental pressure (14.7 psi)
  - Connect to a larger Mars habitat
  - Be large enough to facilitate medical procedures
  - Have a window with a protective cover
- Construct a high-fidelity mockup of the hatch
  - Will be used next semester for the MiSSE (Medicine in Space & Surface Environments) class



Mockup Design

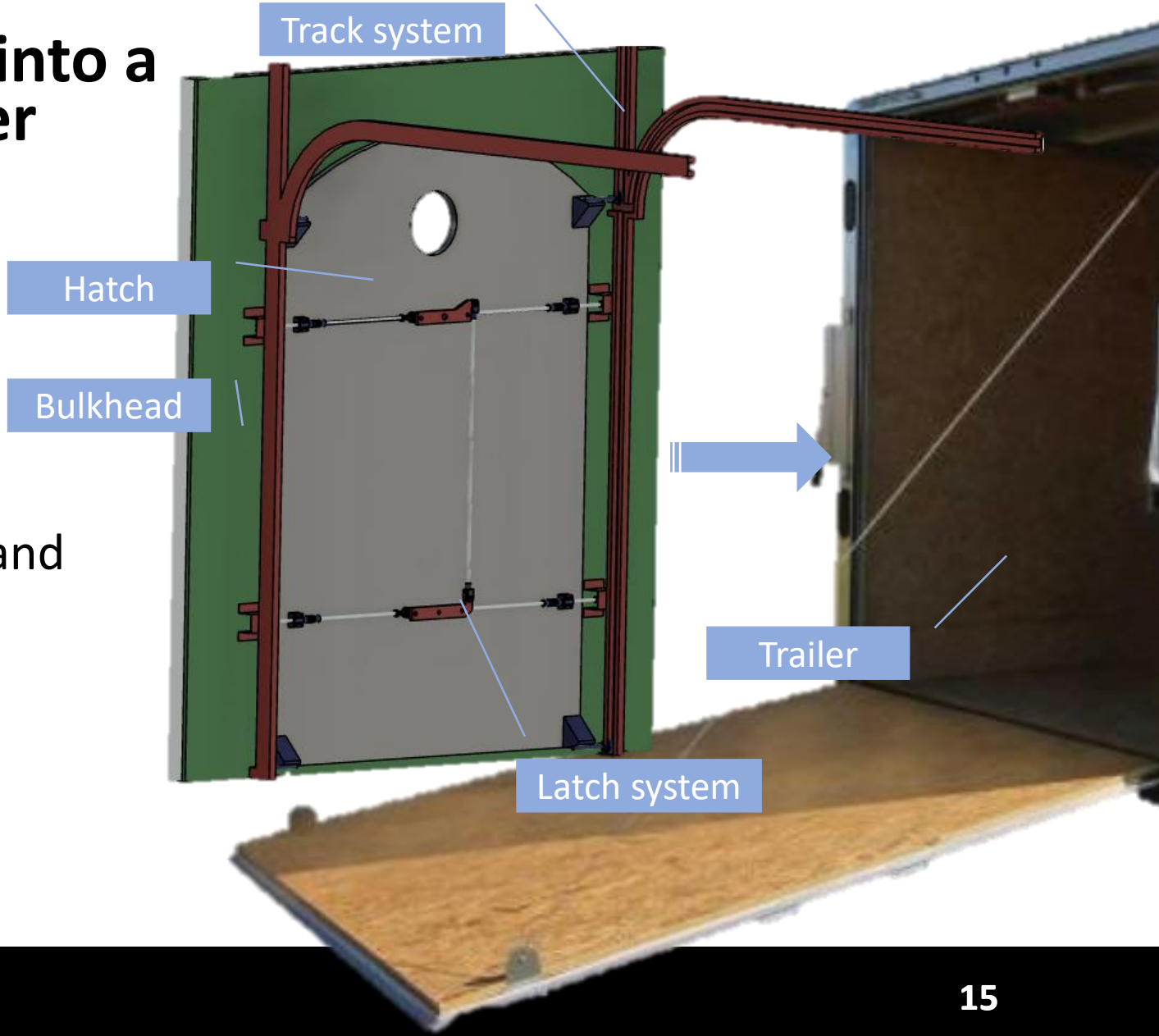
Hatch system to be inserted into a teaching trailer next semester

Design elements:

- A track system to stow the hatch
- A latching system to seal the hatch
- A window
- A mock pressure equalization gauge and valve

Skills used:

- Composites
- Welding
- Brazing
- Machining
- 3D printing
- Mechanisms

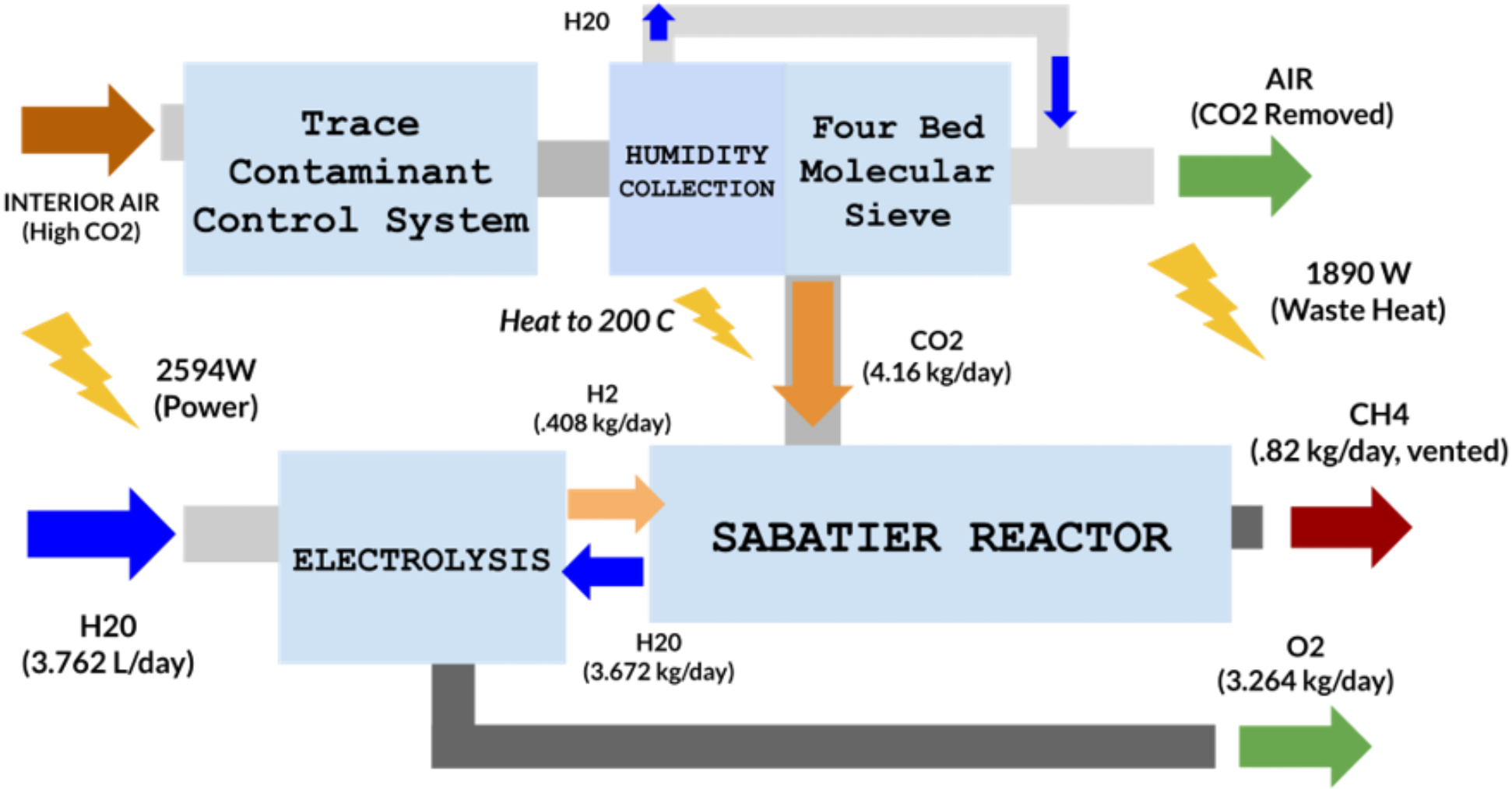


ECLSS

ECLSS Overview

- MOMMA must act as life support system for up to a year in case of emergency
- **Atmospheric Revitalization and Reclamation** removes CO2 and Trace Gasses, and generates Oxygen
  - Uses Sabatier Reactors, Electrolysis devices, charcoal filters, and zeolites
- **Thermal Control** removes heat generated from MOMMA and sends to main habitat
  - Uses Coldplates and Heat Exchanger
- Other systems, like water provision and waste disposal, can be accomplished through connections to theoretical main Habitat

ECLSS Design



EPS, DPS, Comms

EPS, DPS, Comms Overview

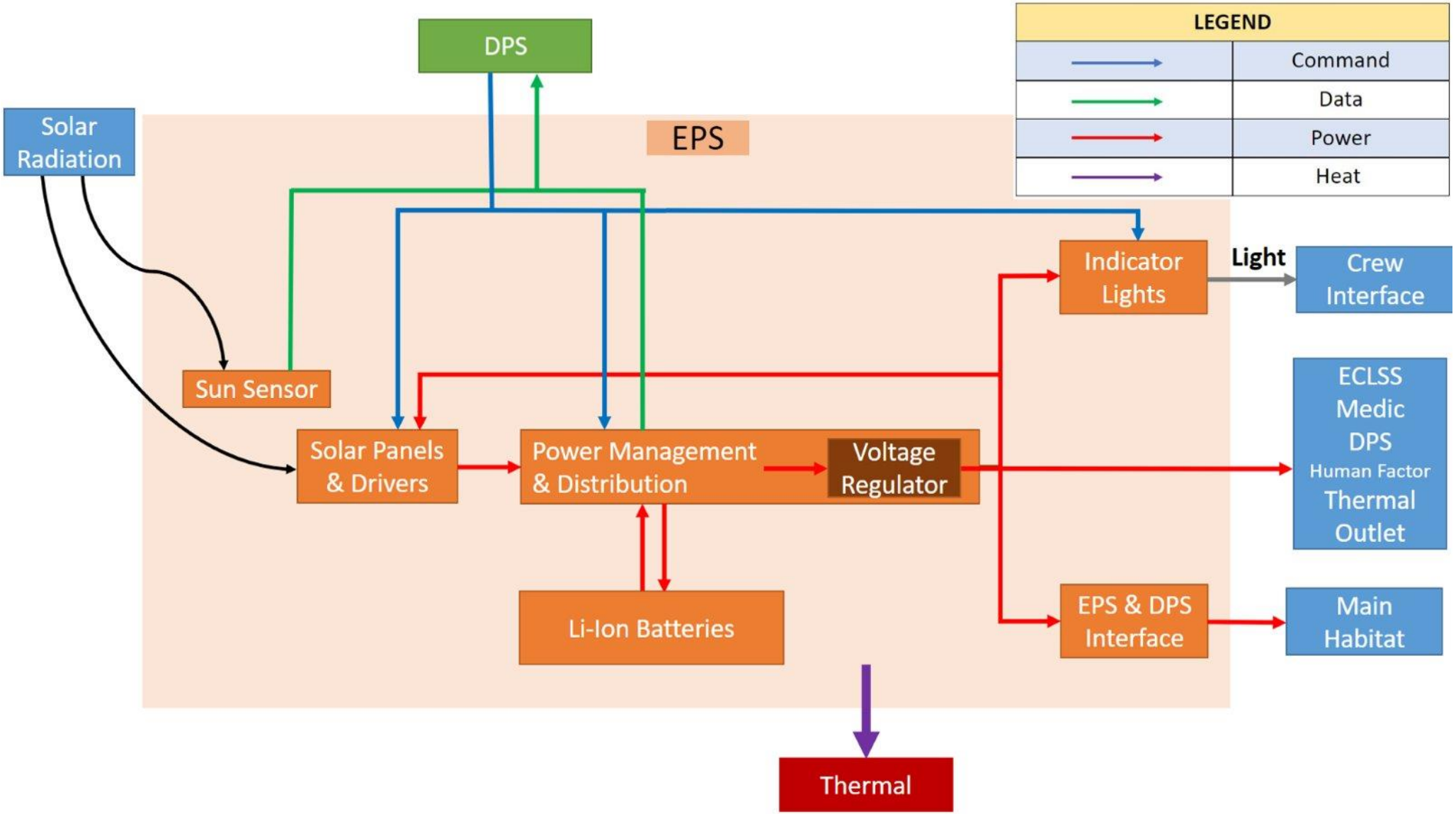
EPS:

- Power generation
- Power storage
- Power management, distribution, and transfer
- Circuit protection

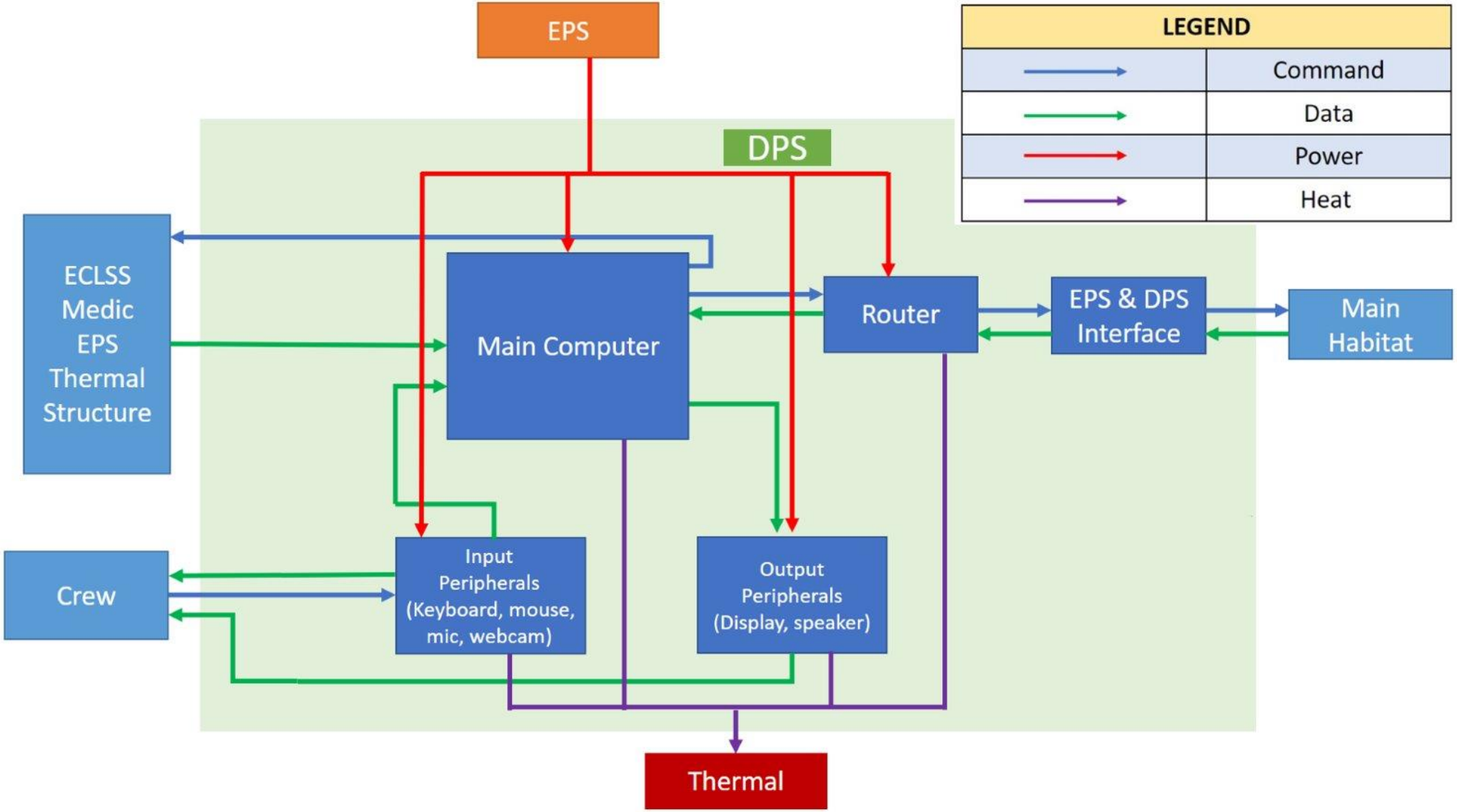
DPS & Comms:

- Transfer voice and data between MOMMA and Main habitat
- Display data on monitors in MOMMA
- Allow crew to commend or program device behavior if necessary

EPS, DPS, Comms Design



EPS, DPS, Comms Design



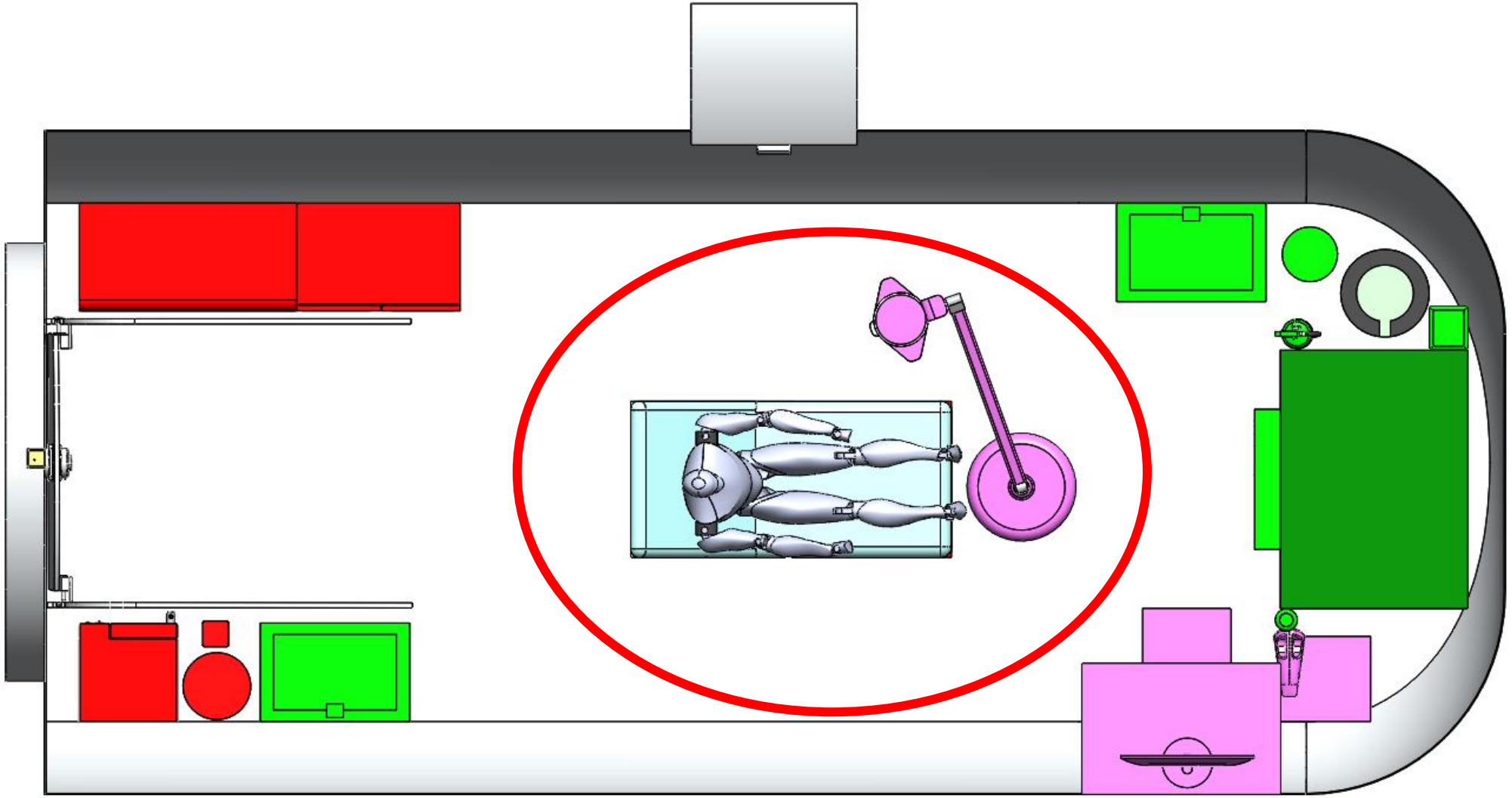
Medical

Medical Overview

The purpose of the medical subsystem is to:

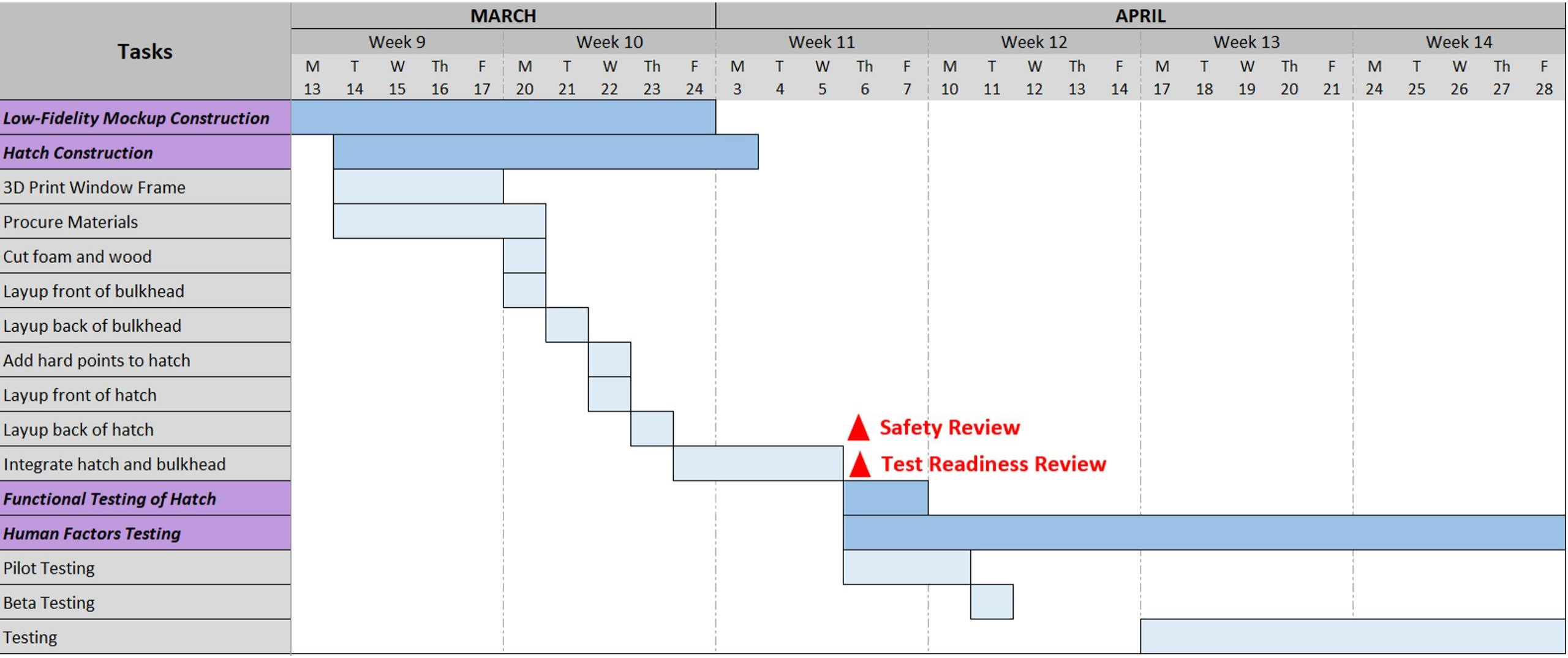
- Enable monitoring of vital signs
- Provide and store diagnostic equipment
- Provide and store treatment equipment and supply
- Provide telemedicine capability
- Provide and store pharmaceuticals
- Enable sterilization of medical equipment
- Contain medical waste

Medical Design



Human Factors

Human Factors Overview



Project Concerns

Project Concerns

- Space for Human Factors testing
- Complex scheduling for Human Factors testing
  - Require 4 test subjects per session
- Material lead times
- Potential manufacturing errors by team
- Exceeding this semester’s budget
  - Medical equipment


Trauma Alert/Activation Criteria
TRAUMA TEAM ROLES AND RESPONSIBILITIES
Questions?