

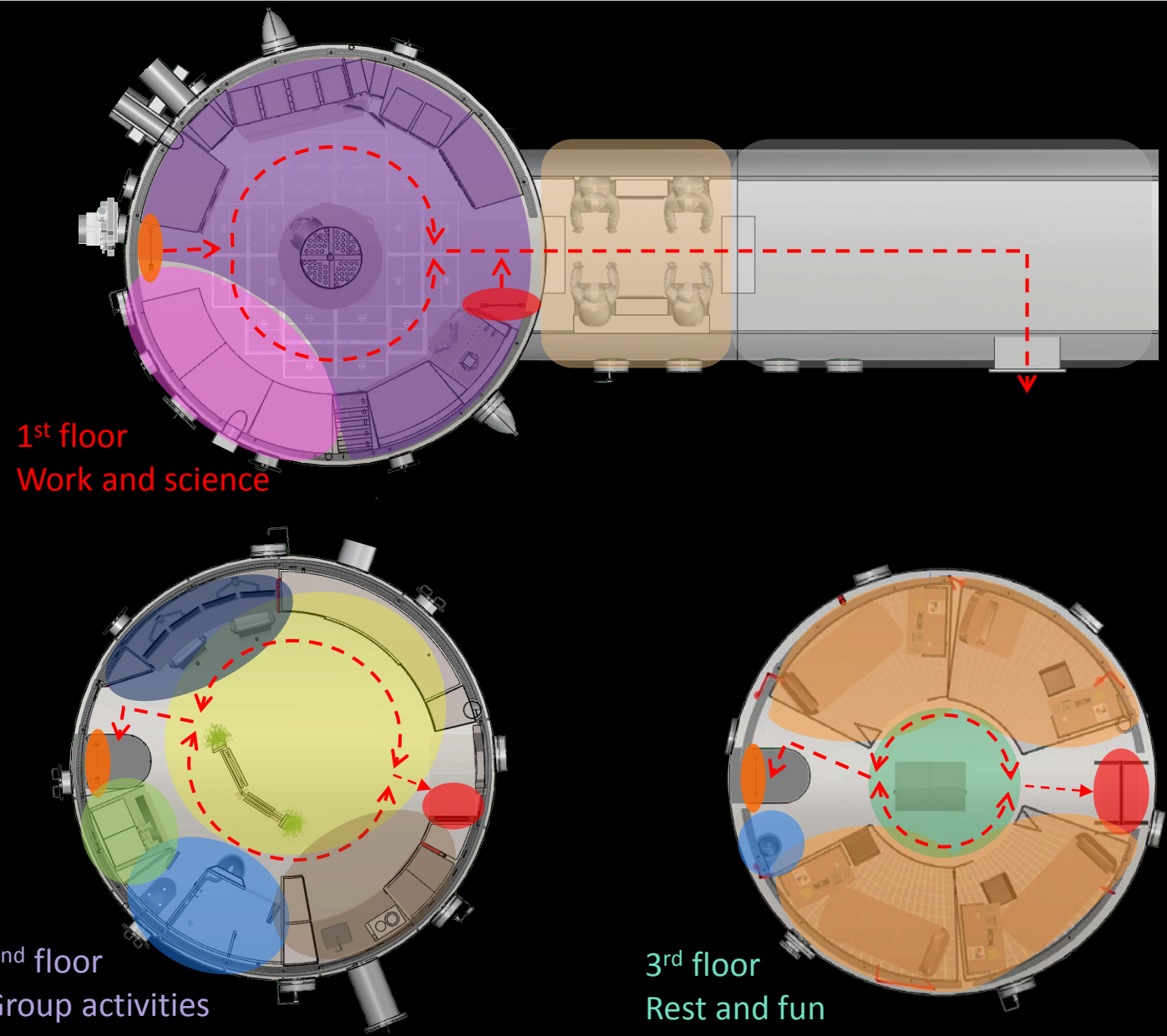
Hestia - Mars Analog Design

Space Systems Tech Studio
SICSA – University of Houston

Suzana Bianco
Shunsuke Miyazaki
Sai Prabhath Kadchi

- Concept
- Secondary Structure
- Utilities distribution
- Overview of Entire Habitat
- First Floor Design
- Second Floor Design
- Third Floor Design

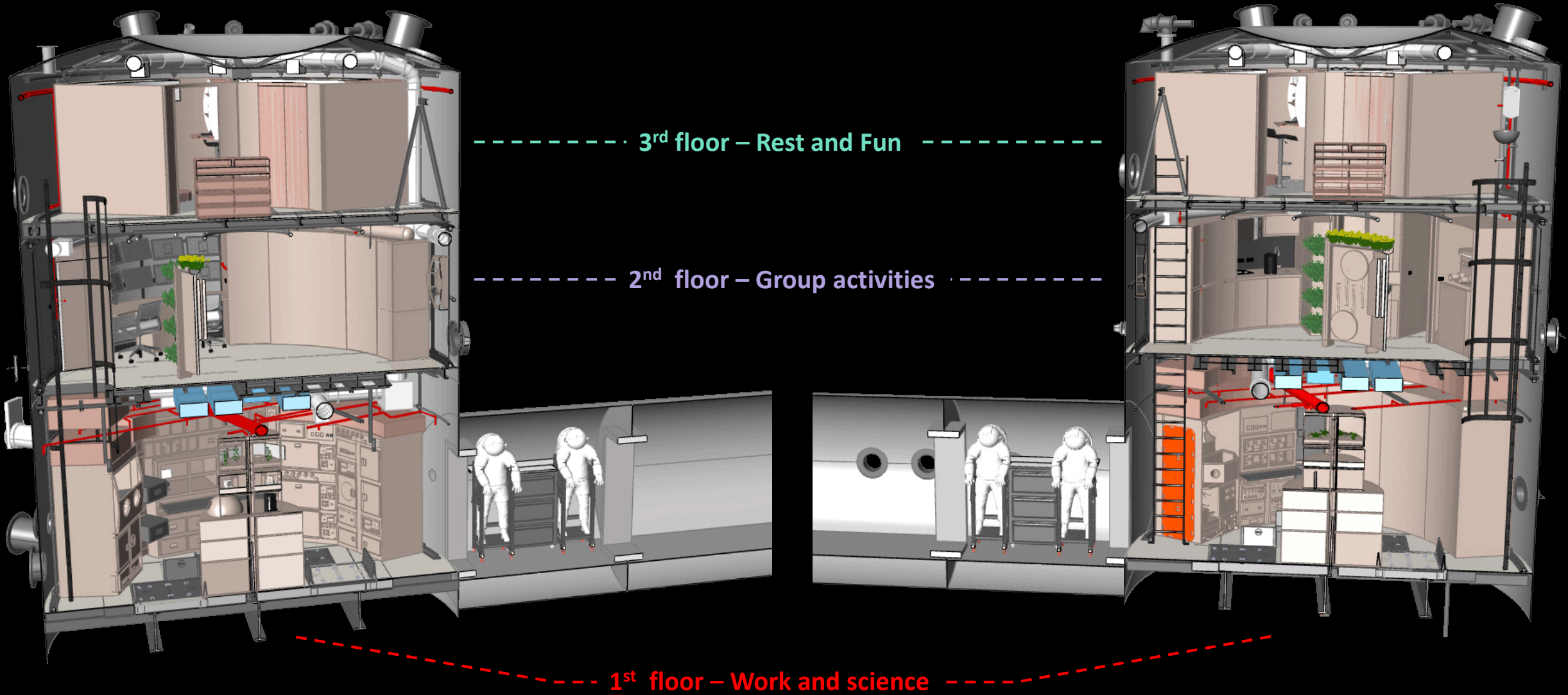
- 1st floor**
 - Mission sciences
 - ECLS
 - Suit maintenance
 - Dust porch
 - Common**
 - Vertical access
 - Emergency egress
 - 2nd floor**
 - Mission operations
 - Fitness
 - Hygiene
 - Galley
 - Recreation
 - 3rd floor**
 - Crew quarters
 - Medical bay
- > Emergency egress path



1st floor
Work and science

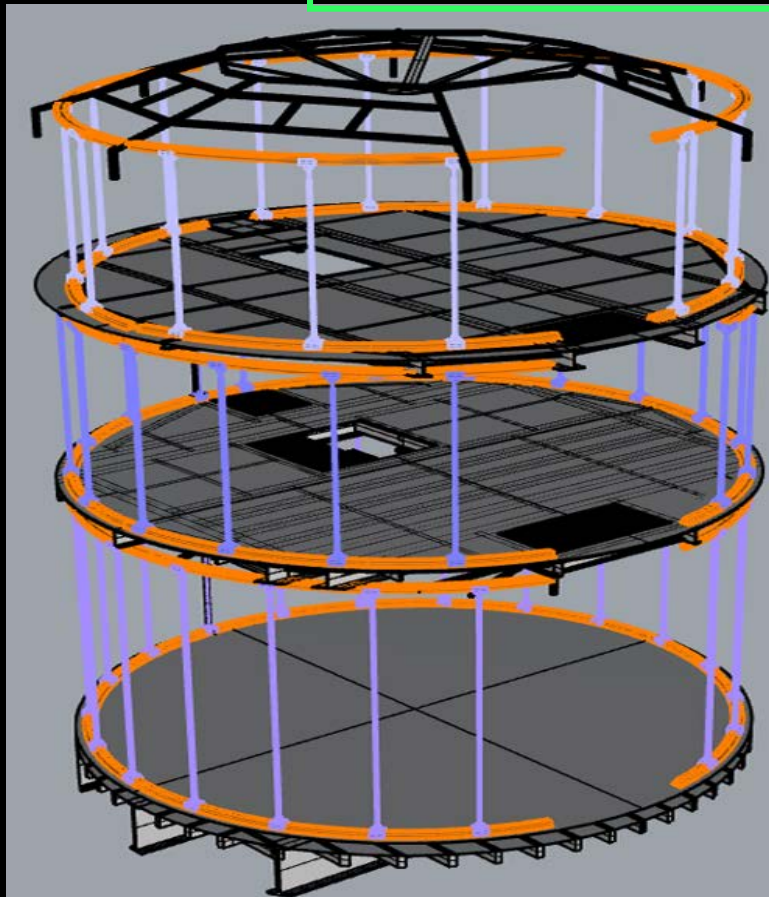
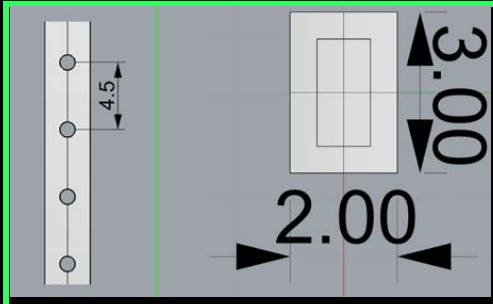
2nd floor
Group activities

3rd floor
Rest and fun



SECONDARY STRUCTURE – ENTIRE AND SECTIONAL VIEW

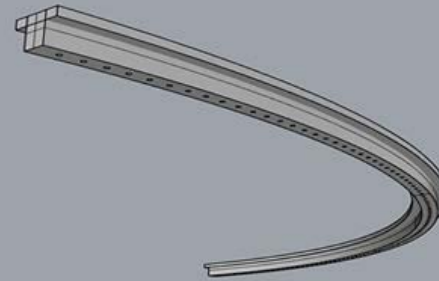
Column Height:
1st Floor = 295cm
2nd Floor = 210cm
3rd Floor = 195cm



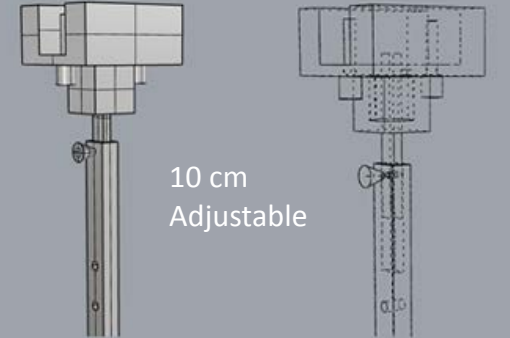
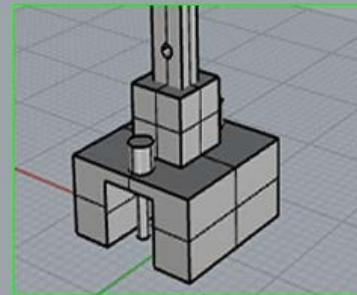
Column



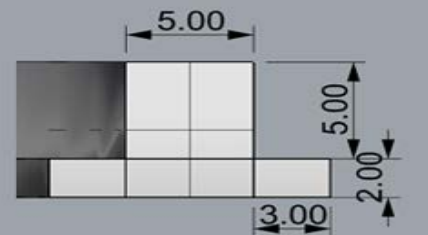
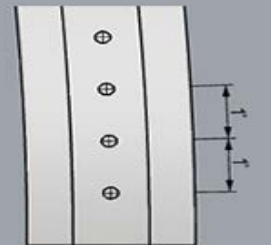
Stopper Rail

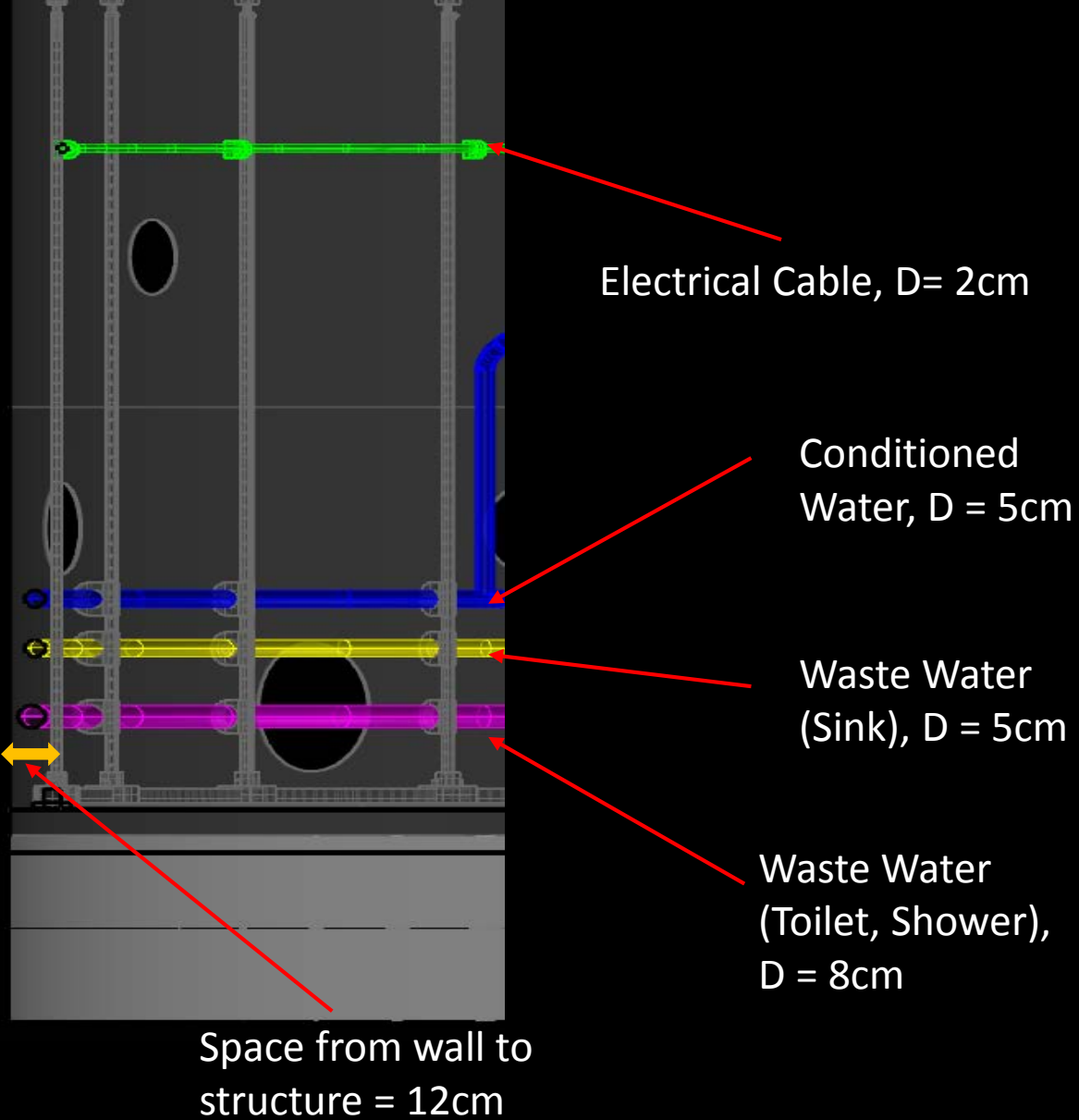
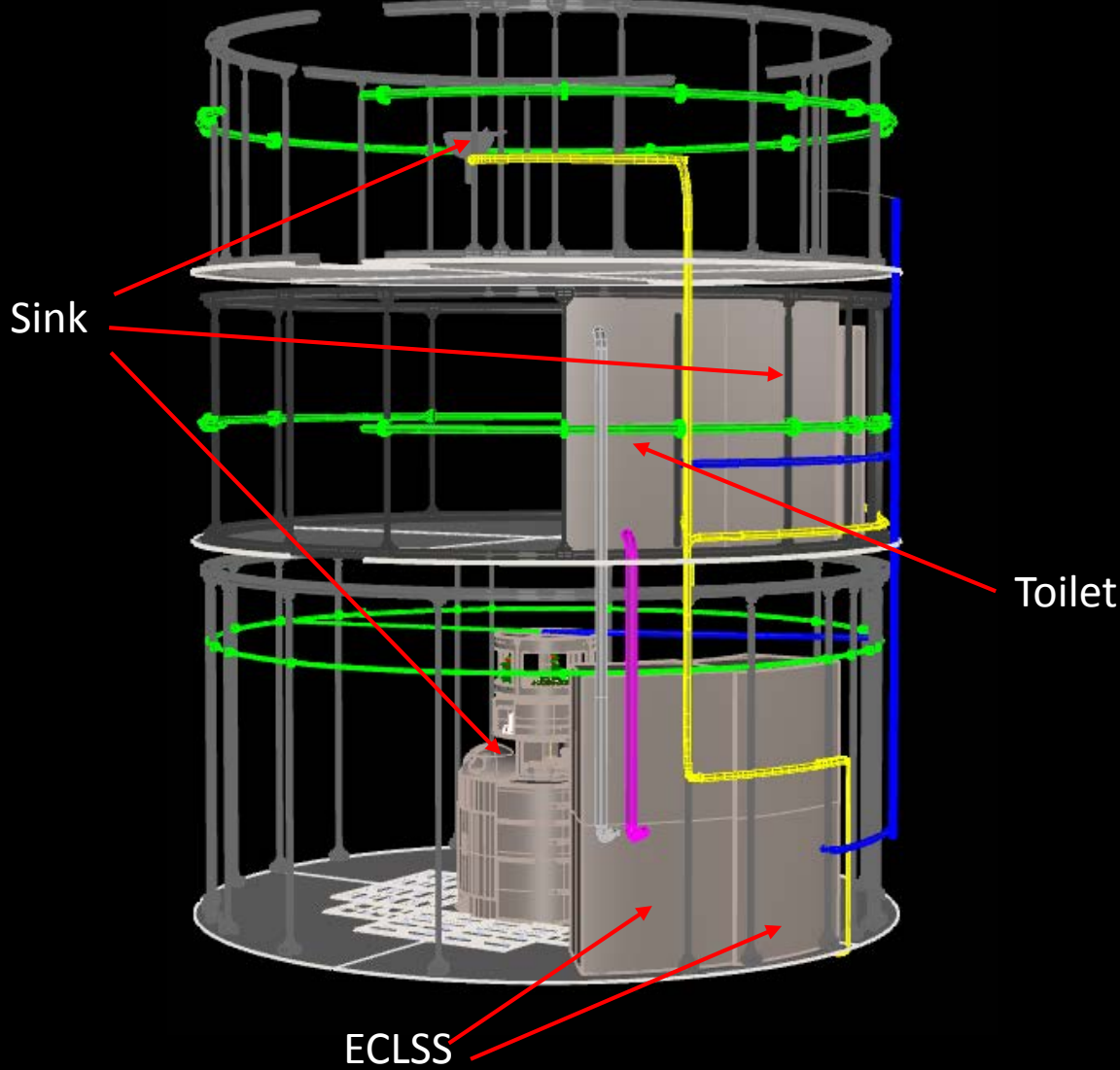


Stopper Bolt

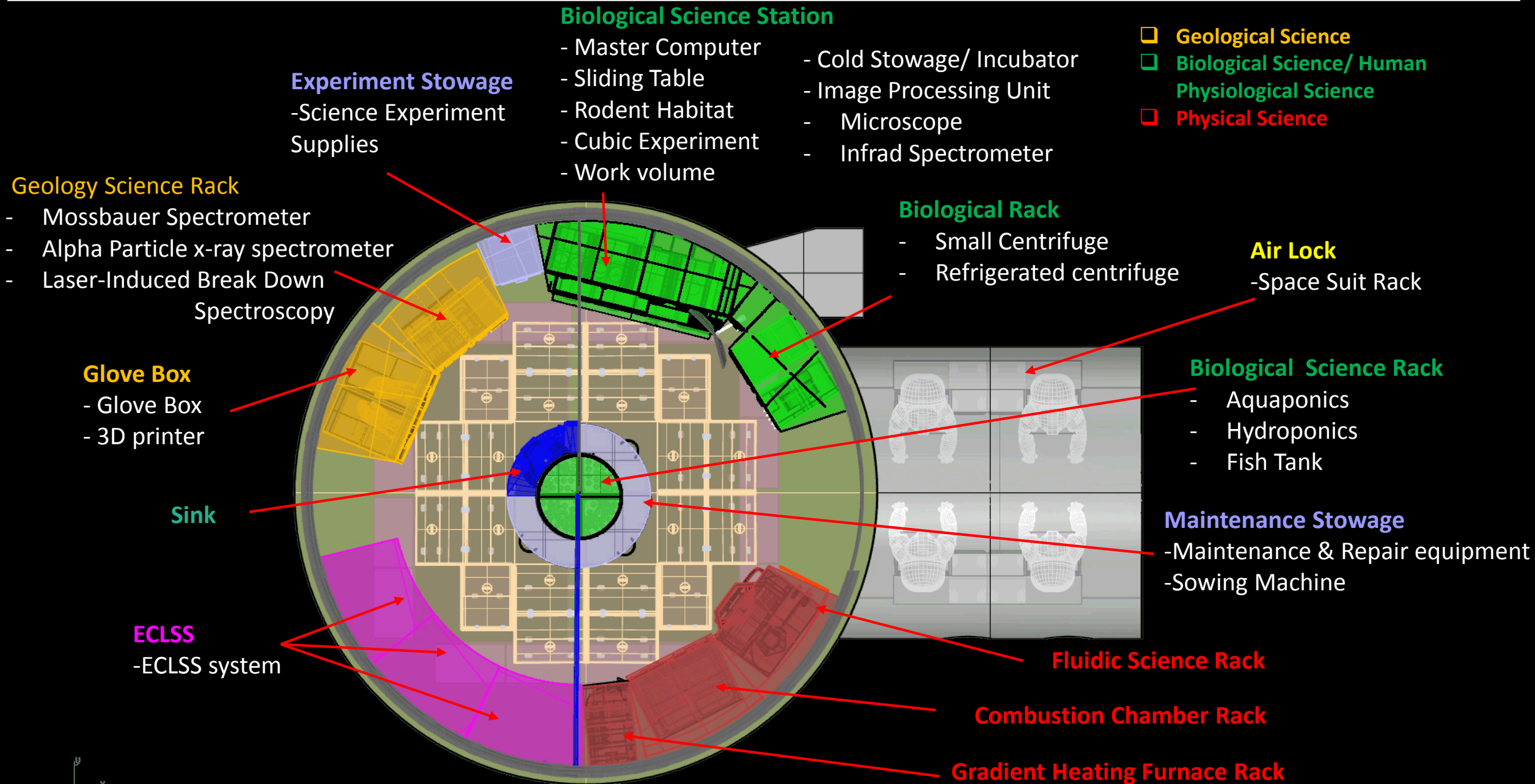


10 cm
Adjustable

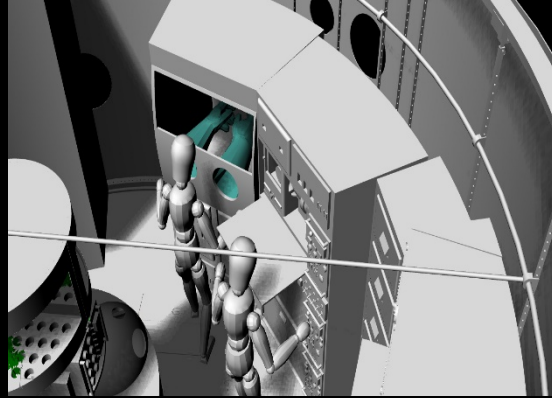
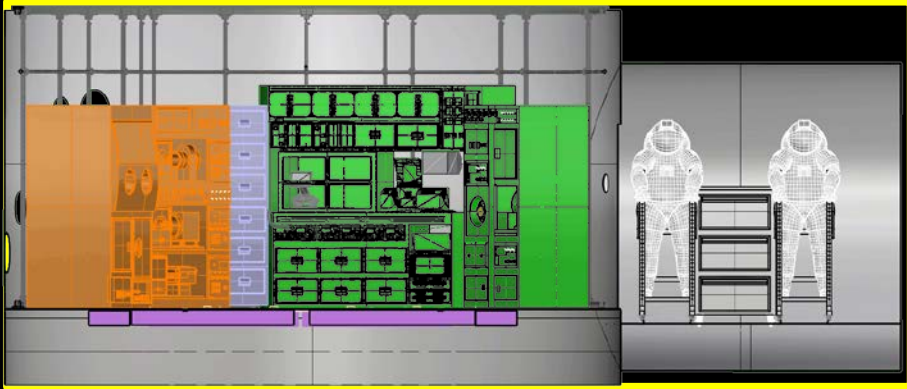




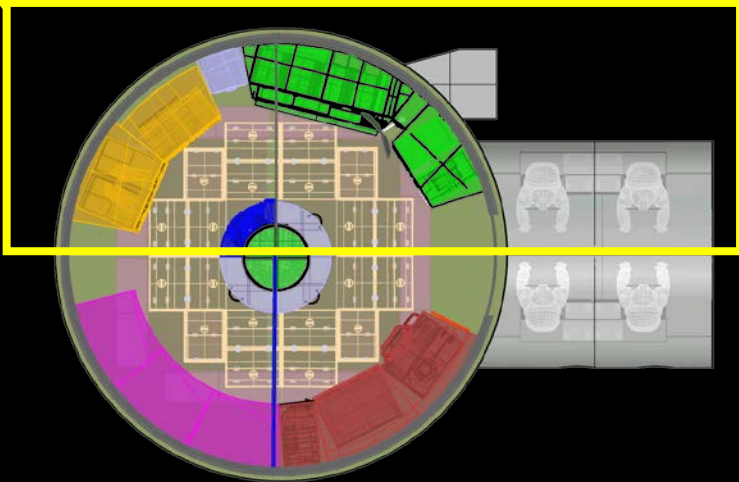
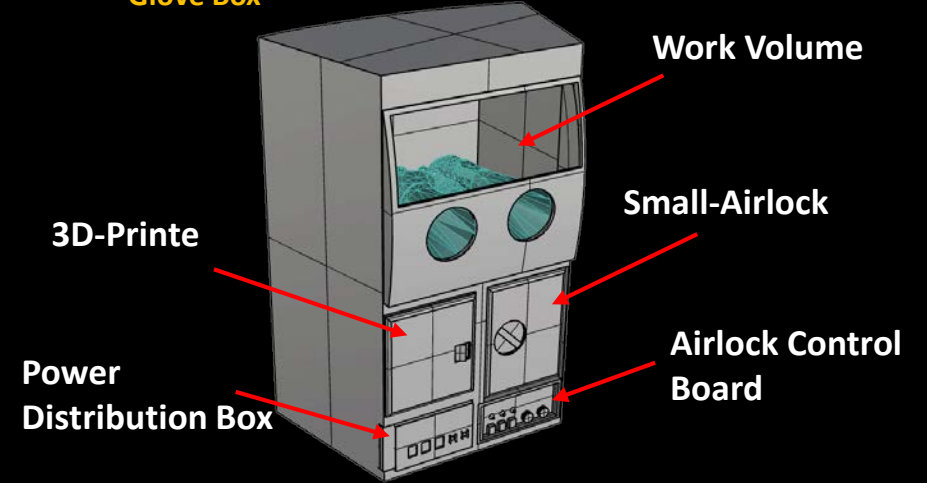
FIRST FLOOR – WORK AND SCIENCE



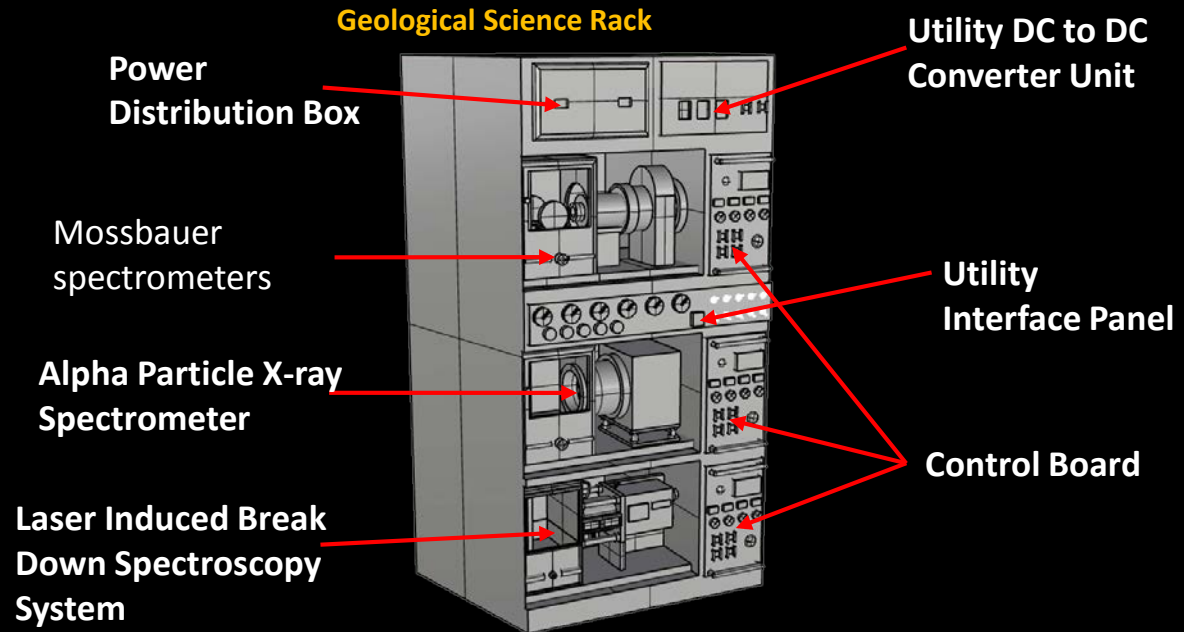
Geology Science Station



Glove Box

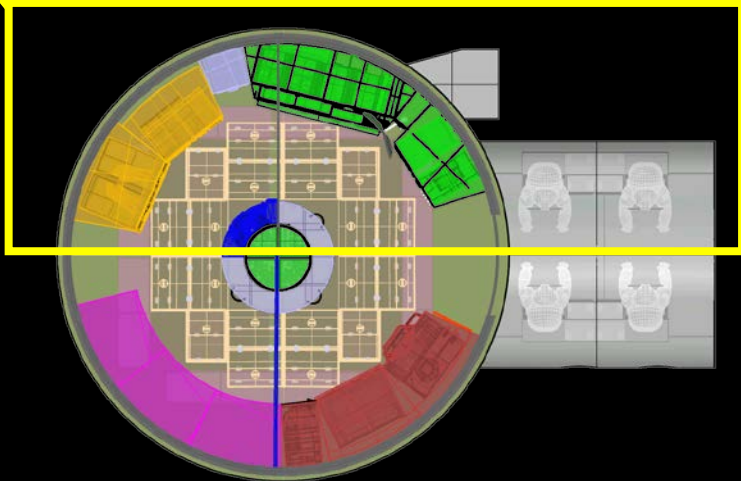
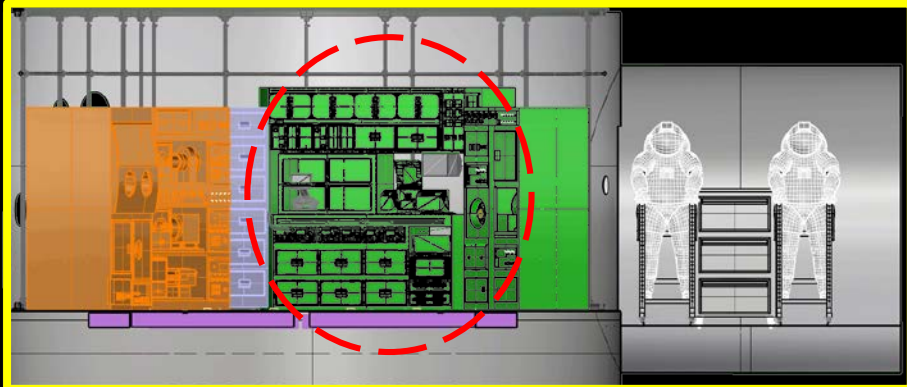


Geological Science Rack

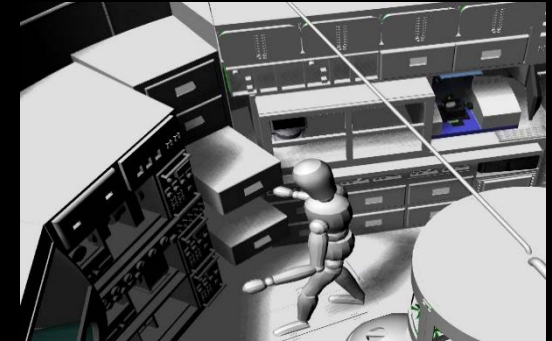


Experiment Apparatus Drawer

Biological Science Station



Size =
Volume = 0.0535 m³
Total = 0.321 m³



Cubic
Experiment Lab

Bone
Densitometer

Utility DC to DC
Converter Unit

Rodent Habitat
Total 20 mice

Power
Distribution Box

Work Volume

Monitors

Microscope

Infrared
Spectrometer

Cold Storage/ Incubator
Control Board

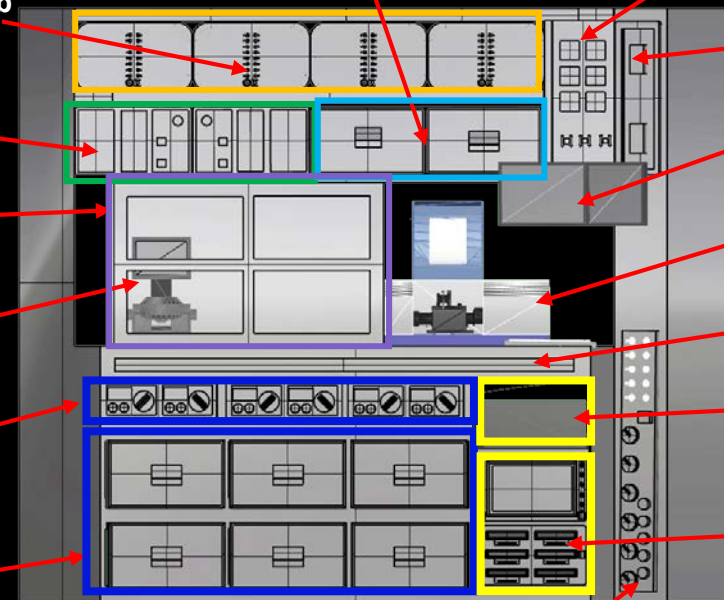
Sliding table

Cold Storage/ Incubator
-80 C ~ 40C

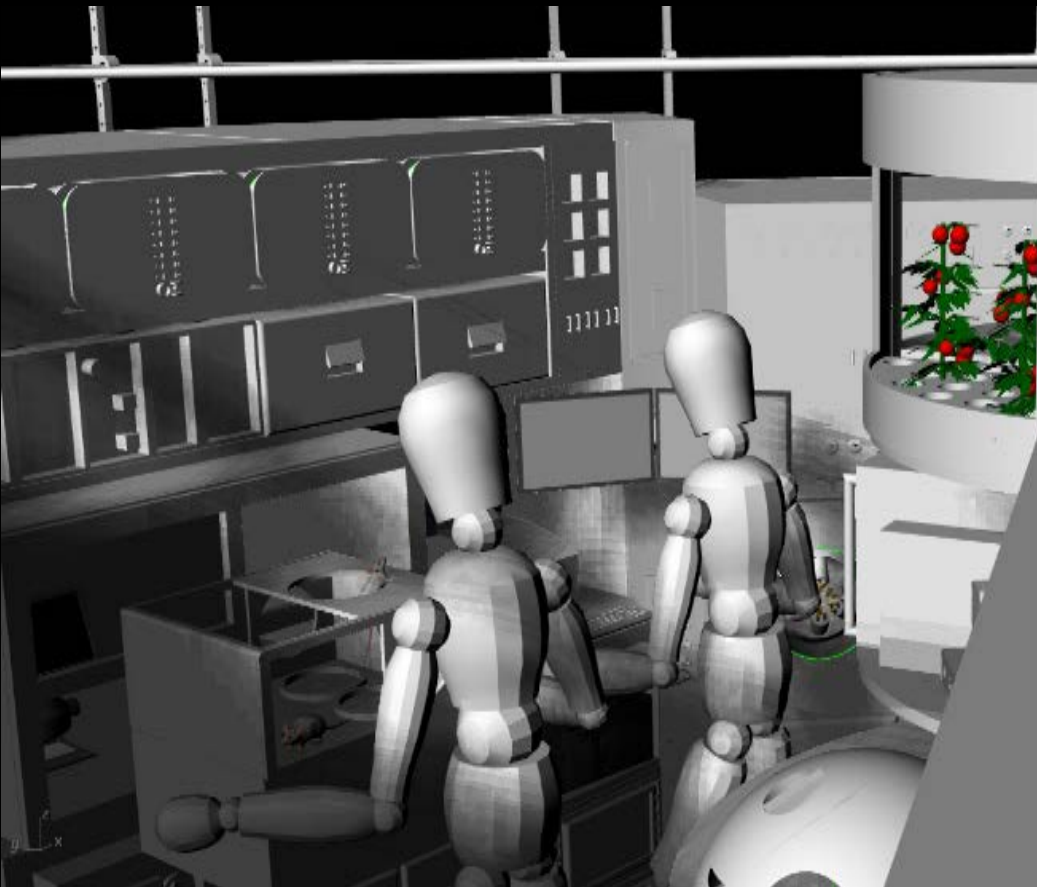
Master
computer

Image Processing
Unit

Utility
Distribution Panel

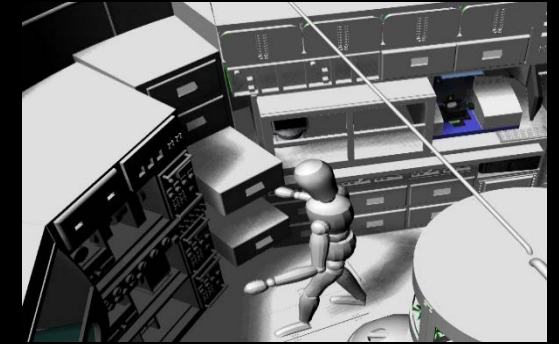


Biological Science Station



First Aid
 Portable Extinguishers
 Portable Oxygen Mask

Size =
 Volume = 0.0535 m³
 Total = 0.321 m³



Utility DC to DC
 Converter Unit

Cubic
 Experiment Lab

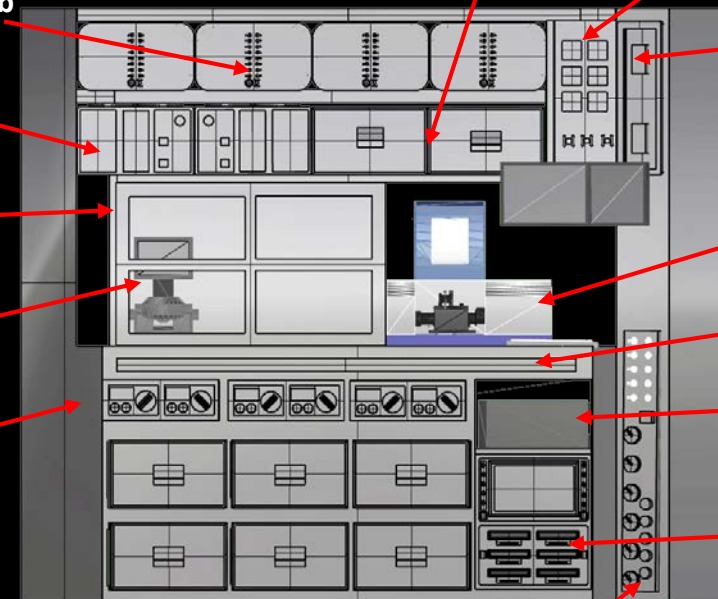
Rodent Habitat

Work Volume

Microscope

Cold Storage/ Incubator
 Control Board

Cold Storage/ Incubator



Power
 Distribution Box

Monitors

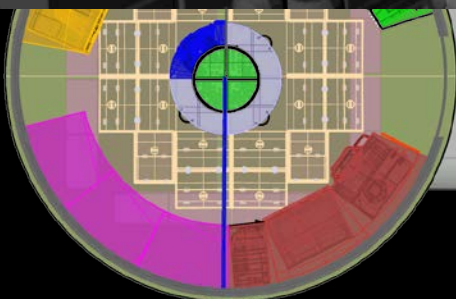
Infrad
 Spectrometer

Sliding table

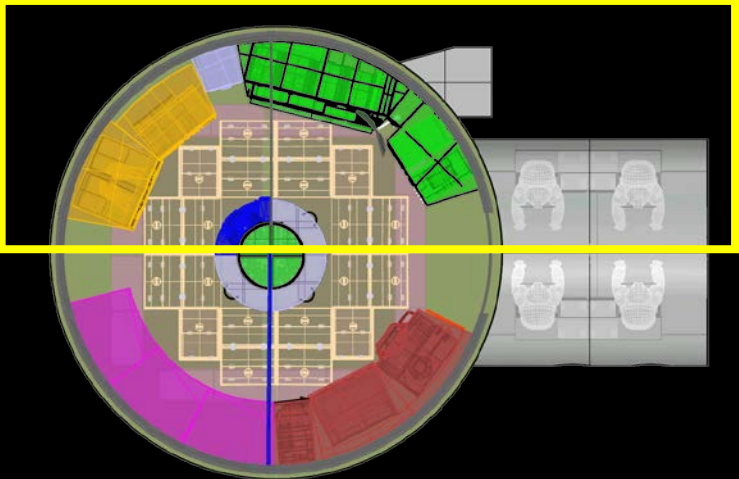
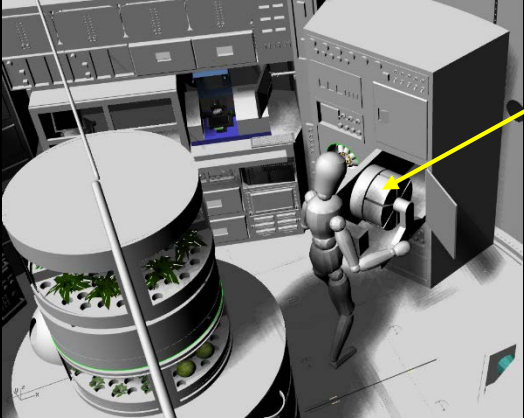
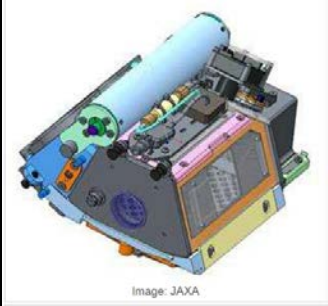
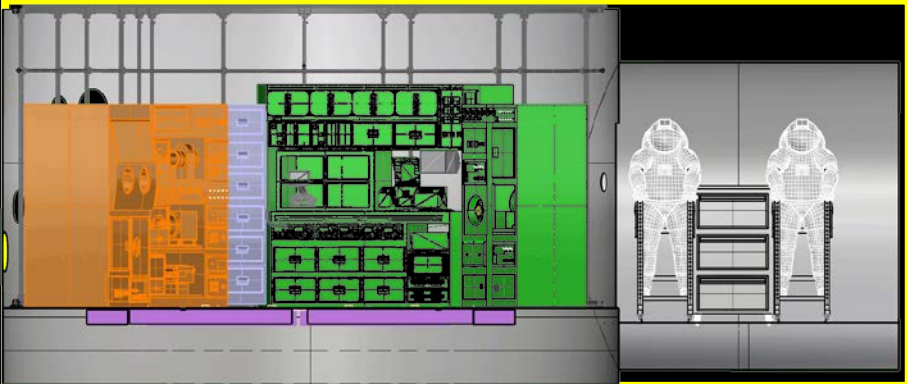
Master
 computer

Image Processing
 Unit

Utility
 Distribution Panel



Biological Science/ Human Physical Science Rack



Utility DC to DC Converter Unit

Centrifuge Control Board

Refrigerated Centrifuge

Power Distribution Box

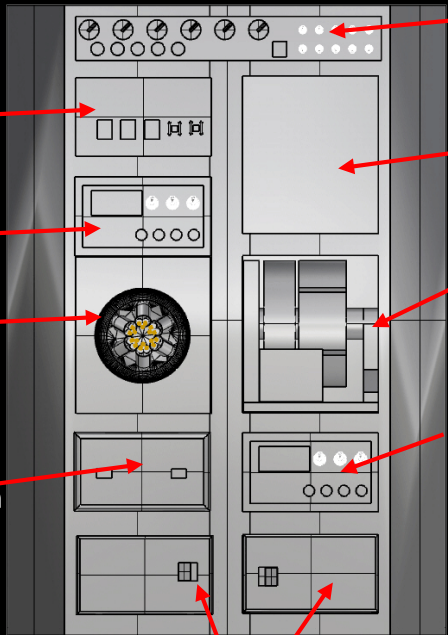
Utility Distribution Panel

Future Experiment payload

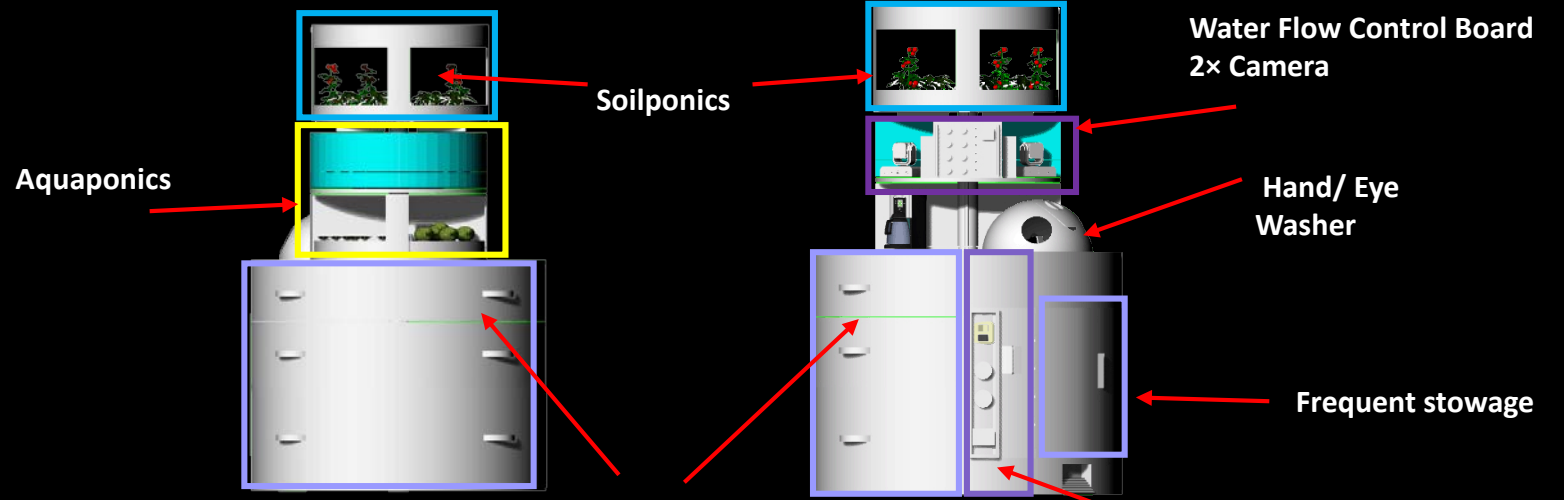
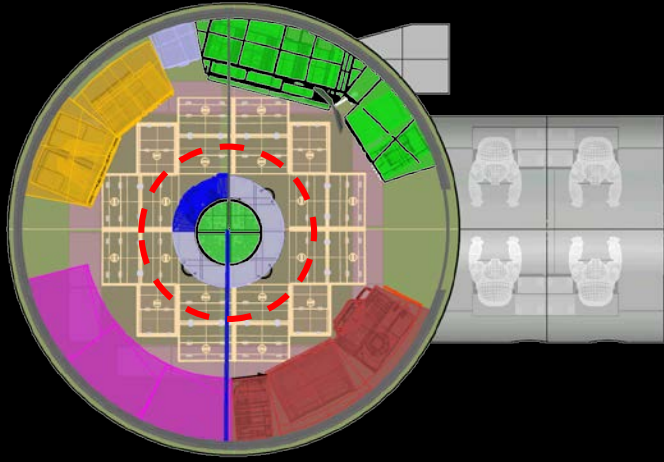
1G Compartment equipped with small centrifuge

Centrifuge Control Board

Stowage Locker

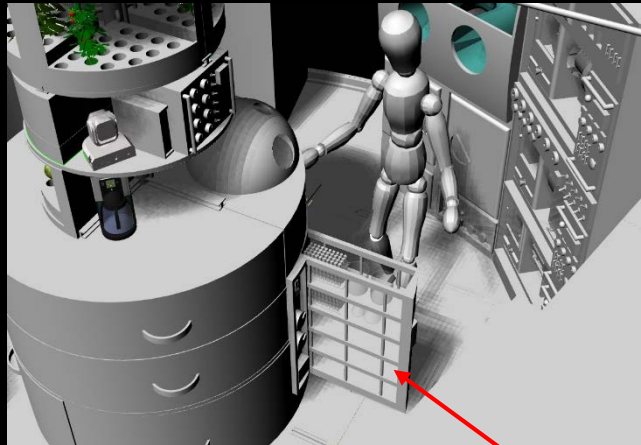


Biological Science / Maintenance Stowage / Sink

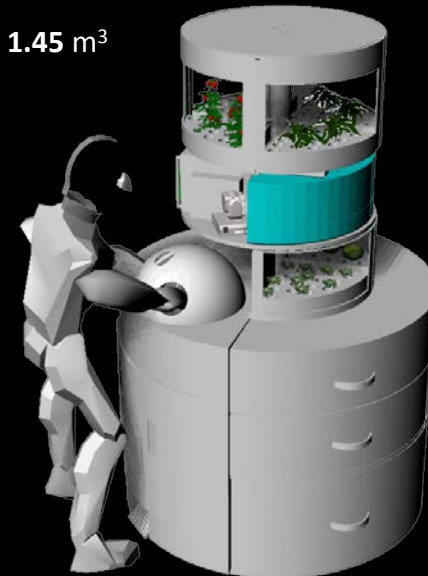


Maintenance & Repair
equipment
Total Volume = 1.45 m³

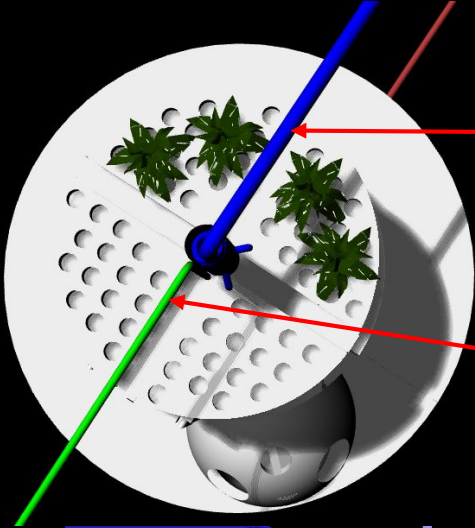
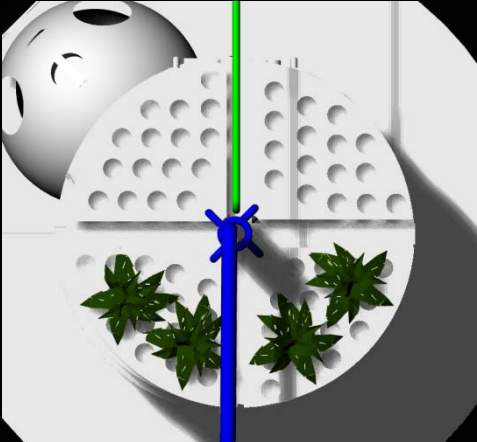
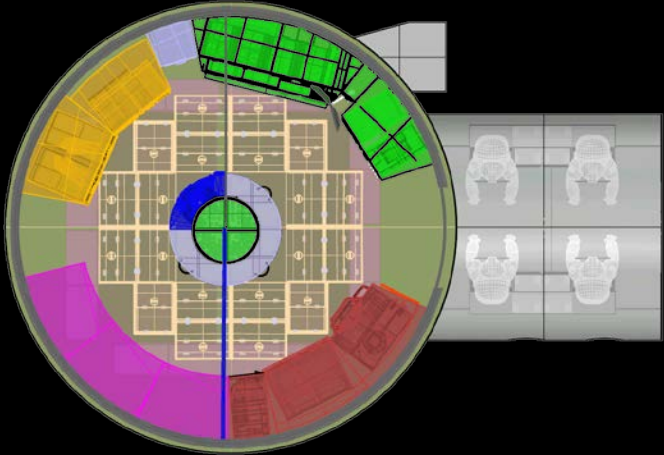
Experiment Apparatus
Washer /Dryer



Experiment Apparatus
Washer /Dryer

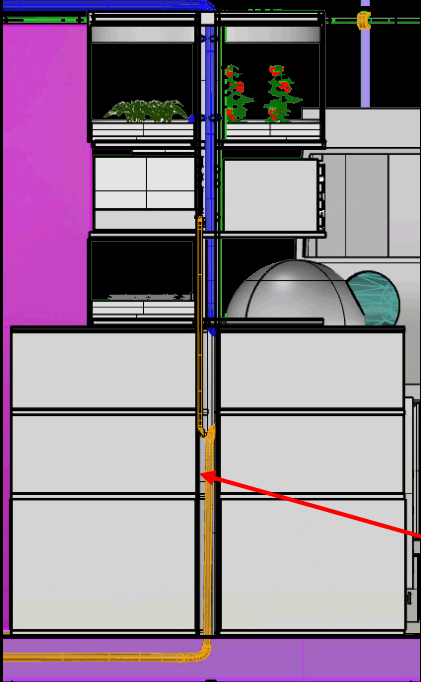
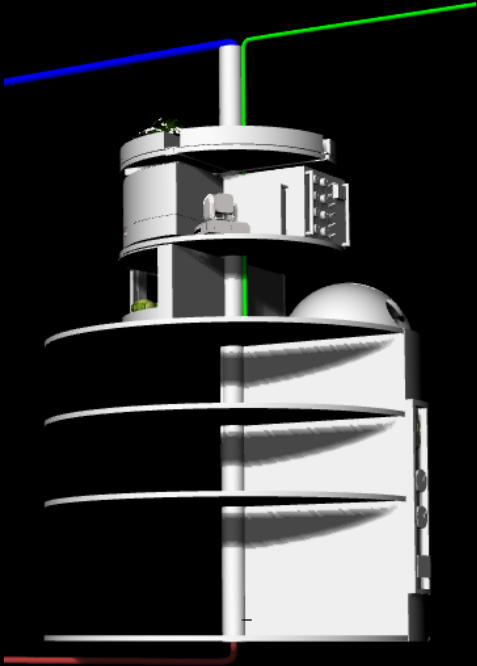


Biological Science / Maintenance Stowage / Sink



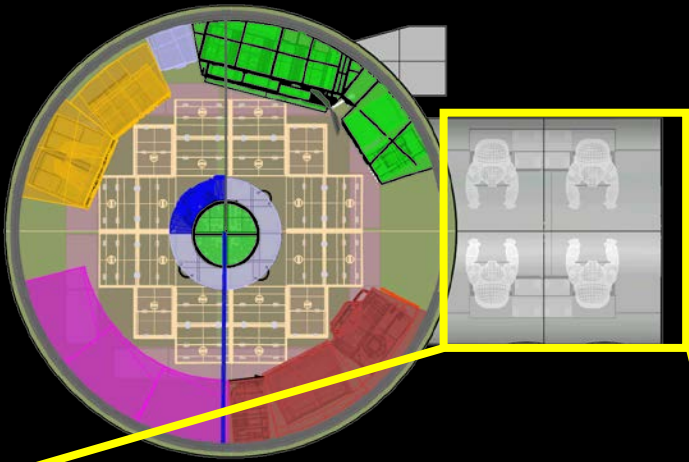
Conditioned Water Pipe

Data Transfer and Electricity Supply

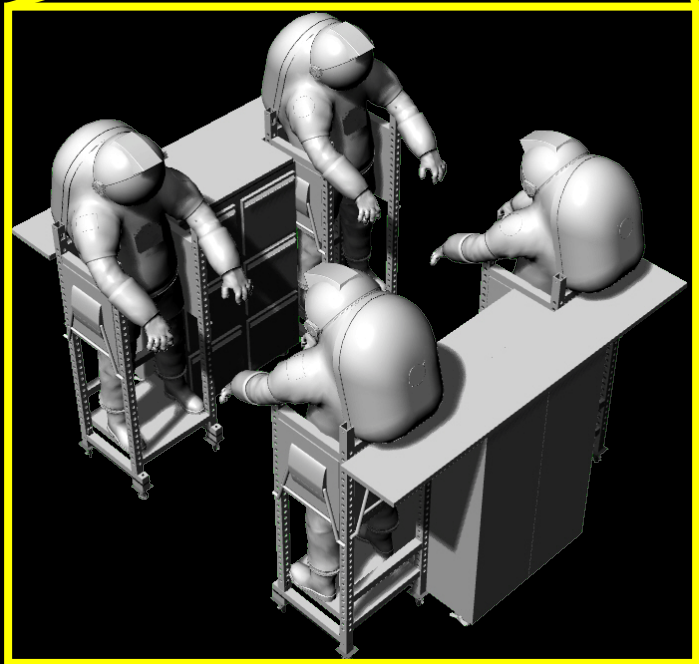
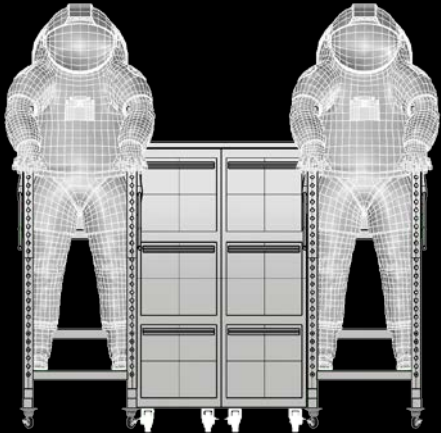


Waste Water Pipe

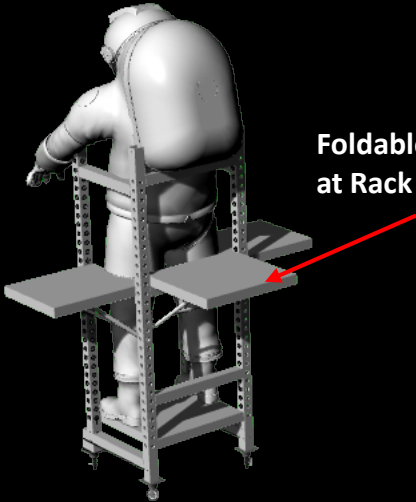
FIRST FLOOR – WORK AND SCIENCE



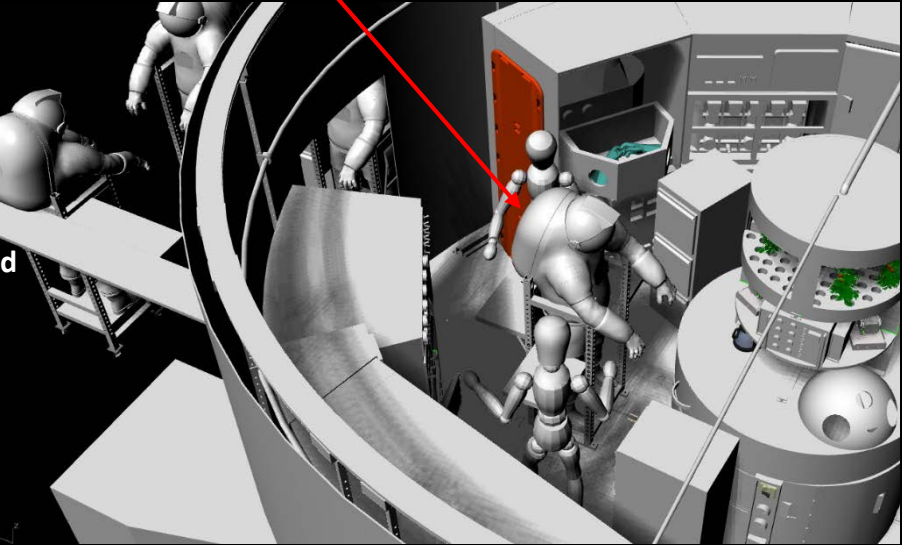
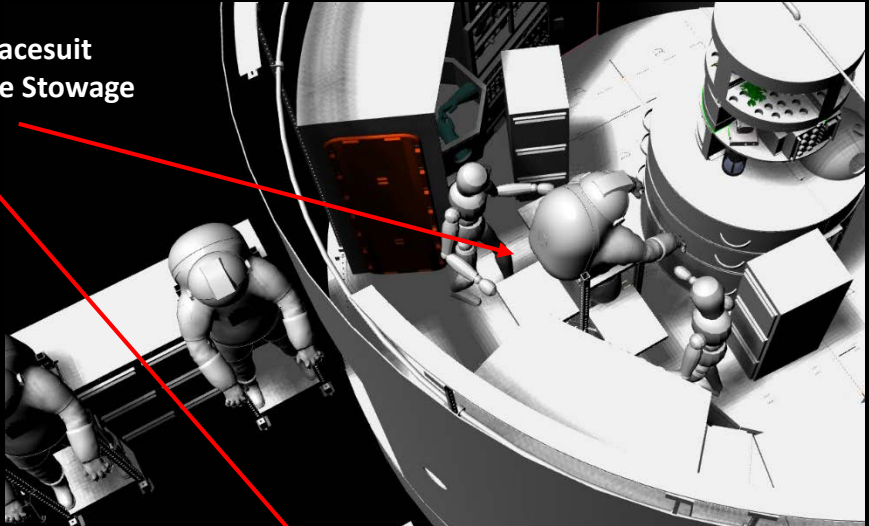
Z-2 Spacesuit ×2
Maintenance Stowage ×2

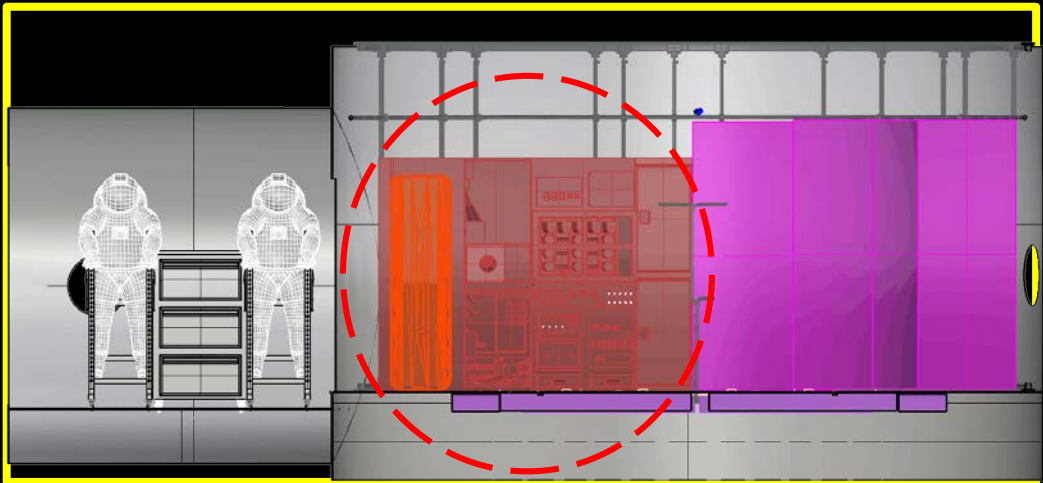


Foldable table attached
at Rack



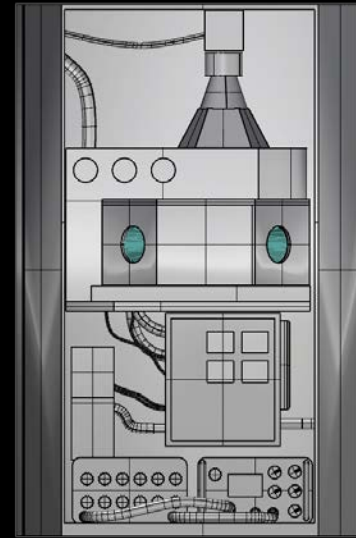
Bring Z-2 Spacesuit
Maintenance Stowage
into floor



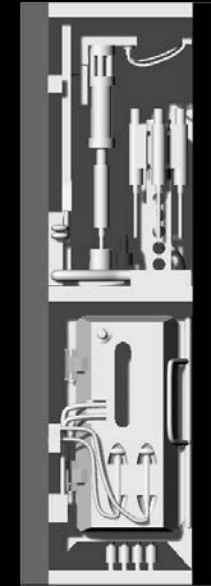


Geology Science Station

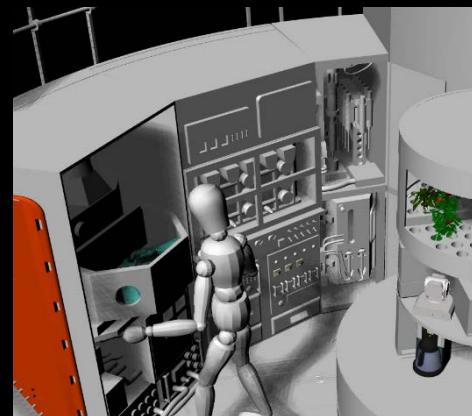
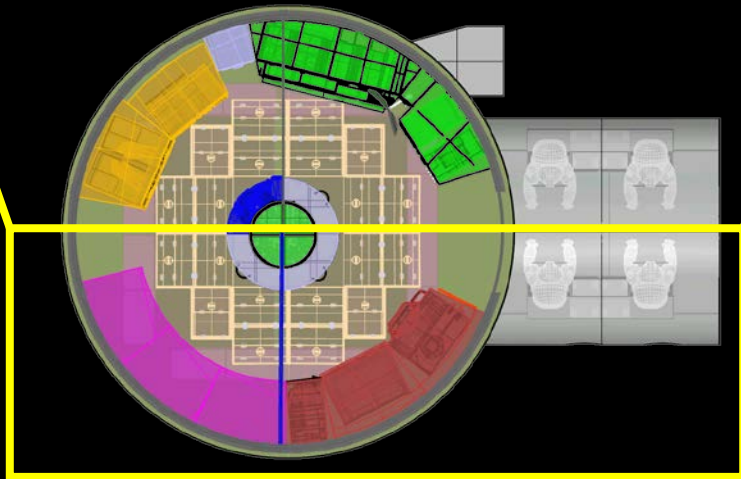
Multi Purpose Science Rack



Sample Cartridges



Furnace



Utility DC to DC Converter Unit

Water Pump Unit

Combustion Control Board

Combustion Chamber

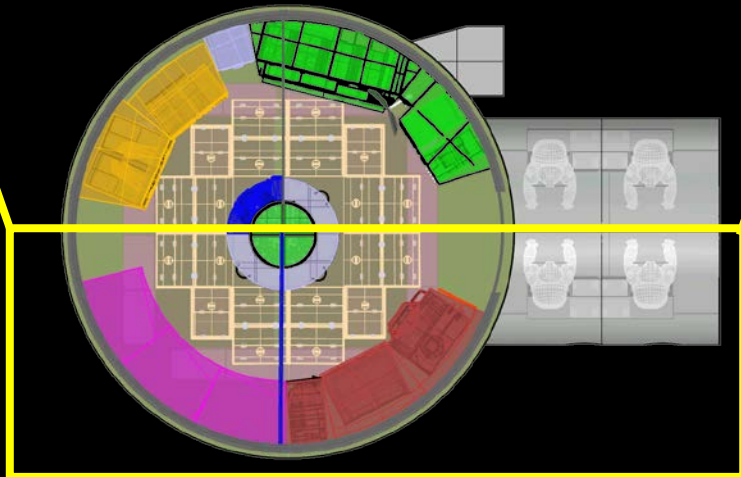
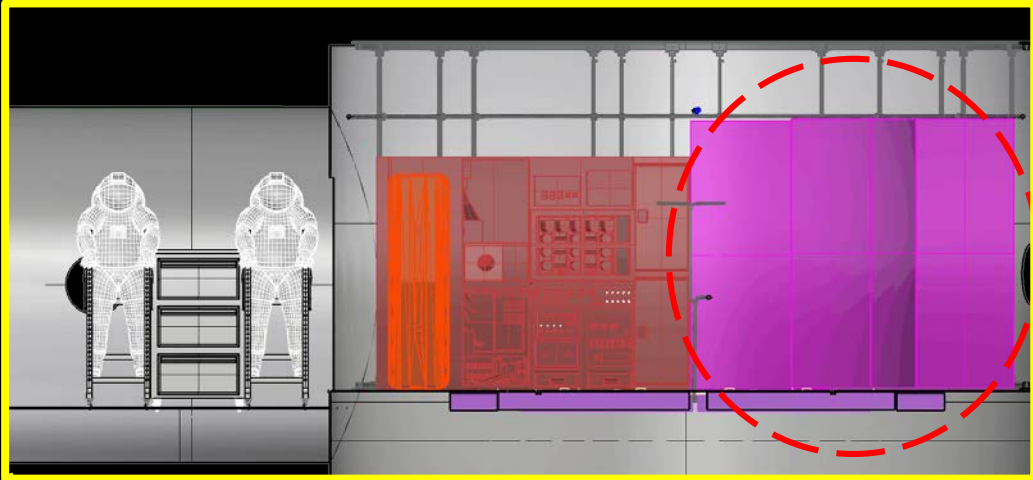
Power Distribution Box

Utility Distribution Panel

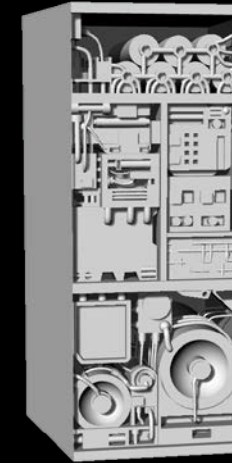
Drawer

Furnace Control Board

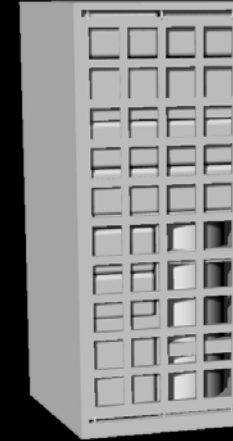
Drawer



ECLSS Hardware Rakes



ECLSS spare and consumable items Storage



- ❑ ECLSS with Logistic Reduction Technologies
- Oxygen Generation Assembly
- Water Processing Assembly
- Urine Processing Unit
- Heat Melting Compactor

Volume: 1 Rack = 2.12 m³, Total Volume = 6.37 m³

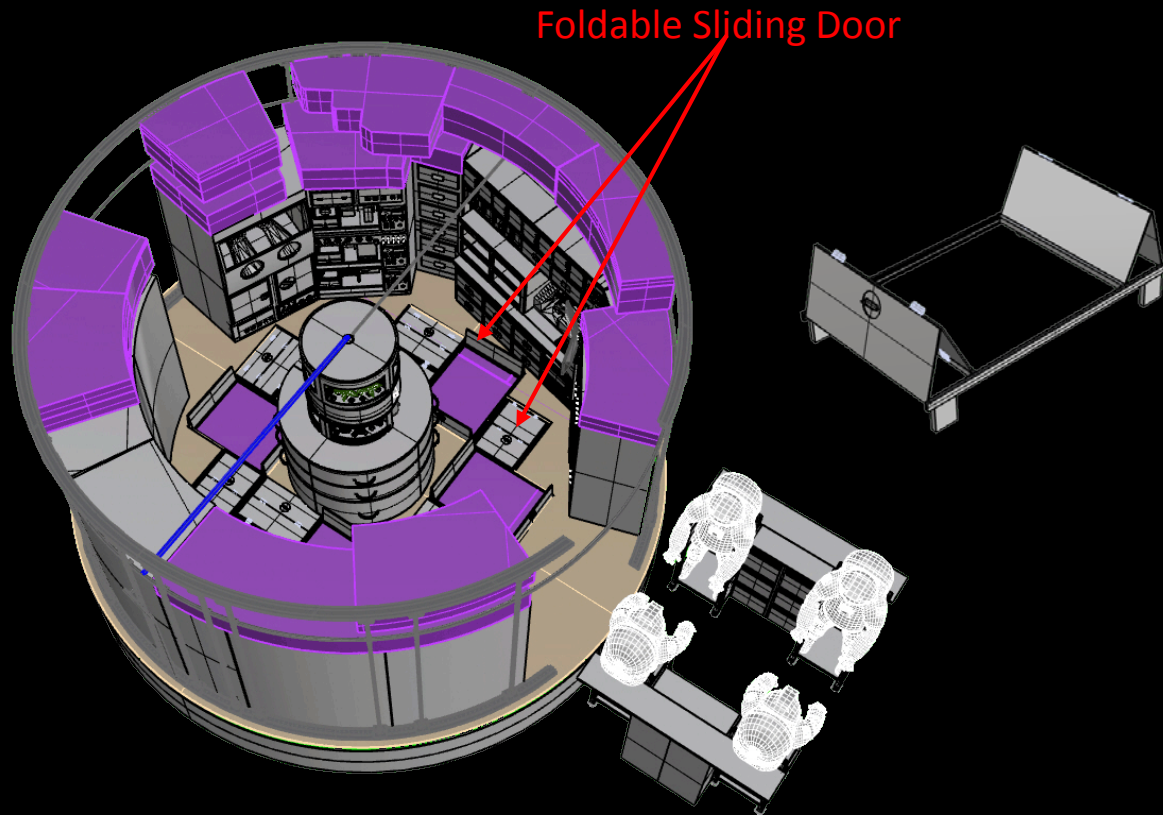
2 Racks = ECLSS System

1 Rack = ECLSS supply Stowage

FIRST FLOOR – WORK AND SCIENCE

Purple = Infrequent Stowage = Total Volume = 6.33 m³

- ❑ Above Racks: Sub Total Volume = 4.02 m³
- ❑ Underneath (Available Depth = 15cm): Sub Total Volume = 2.31 m³



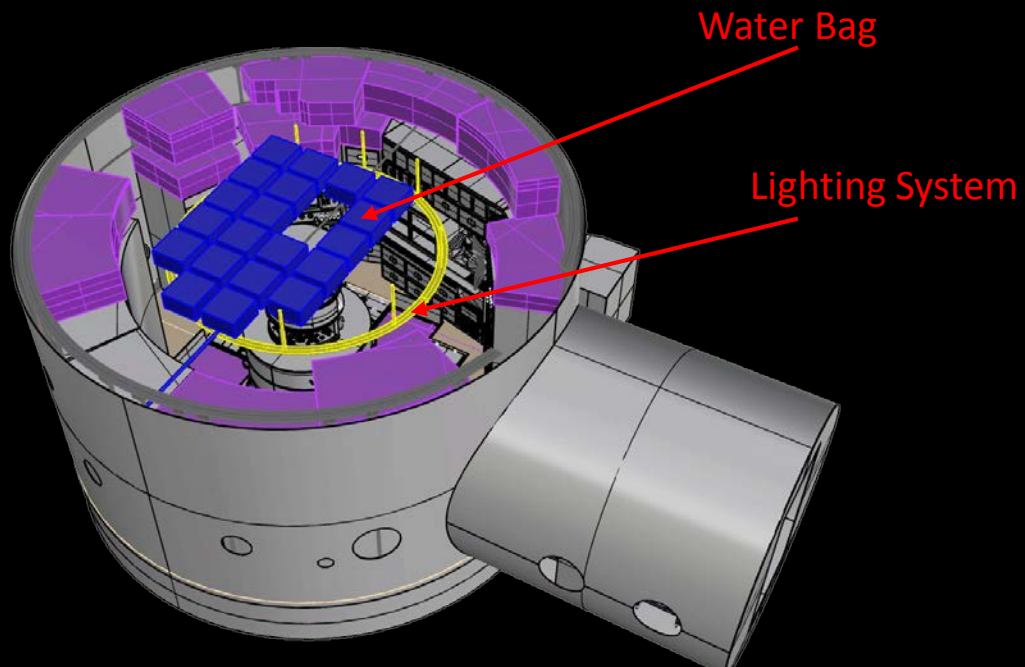
Water bag Size = $0.4\text{m} \times 0.4\text{m} \times 0.2\text{m} = 0.032 \text{ m}^3 = 32\text{L}$

The number of bags = 20

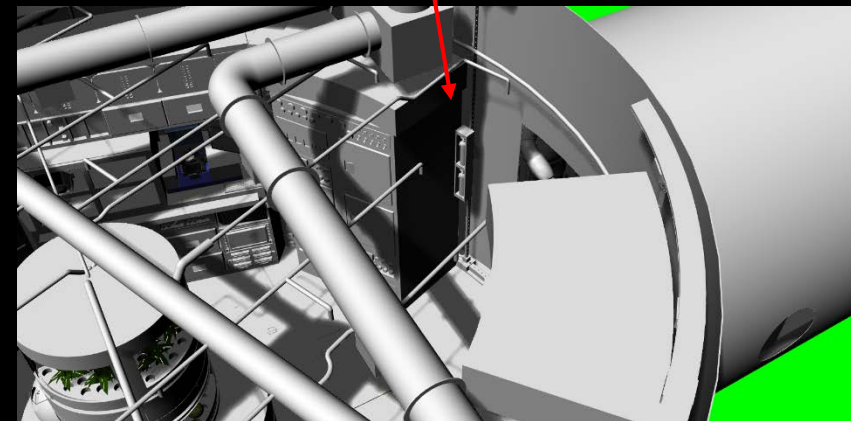
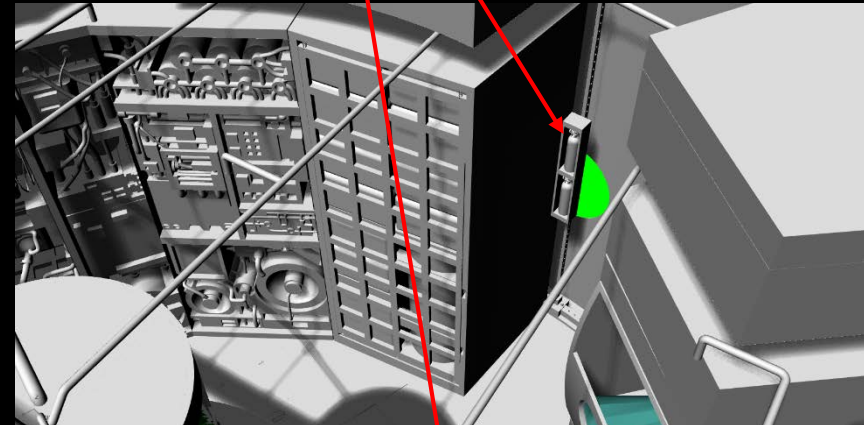
Total Water Amount = $640\text{L} = 640\text{kg}$

4 crew for 90days

- Estimated at least amount of Water= about 142kg with 94% recycle rate(+30% margin)



Portable Extinguisher equipped at entrance and ladder



SECOND FLOOR – GROUP ACTIVITIES

Control center

- Communications systems
- Operations station
- Dedicated storage
- Data storage
- Servers

Recreation

- Sliding projection screens
- Flower and herb garden
- General storage
- Foldable chairs
- Video games

Access Ladder

Fitness

- Med-2
- Treadmill
- Exercise bike
- Video and audio

Hygiene

- Toilet
- Shower
- Wash basin
- Washing machine

Galley

- Sink
- Microwave
- Cooktop
- Food storage
- Cold storage
- Utensils storage
- Dining table/chairs

Multi function area: can be used in a variety of ways

Emergency egress



Access ladder

Emergency egress

Control center

Recreation area



Emergency egress

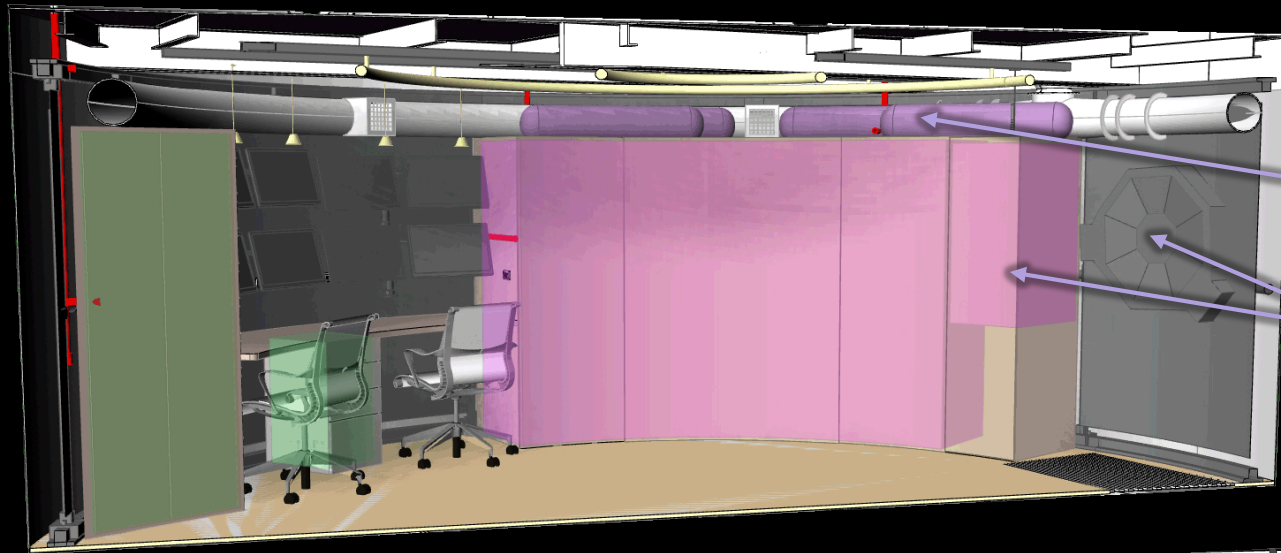
Access ladder

Galley

Hygiene

Fitness

SECOND FLOOR – GROUP ACTIVITIES

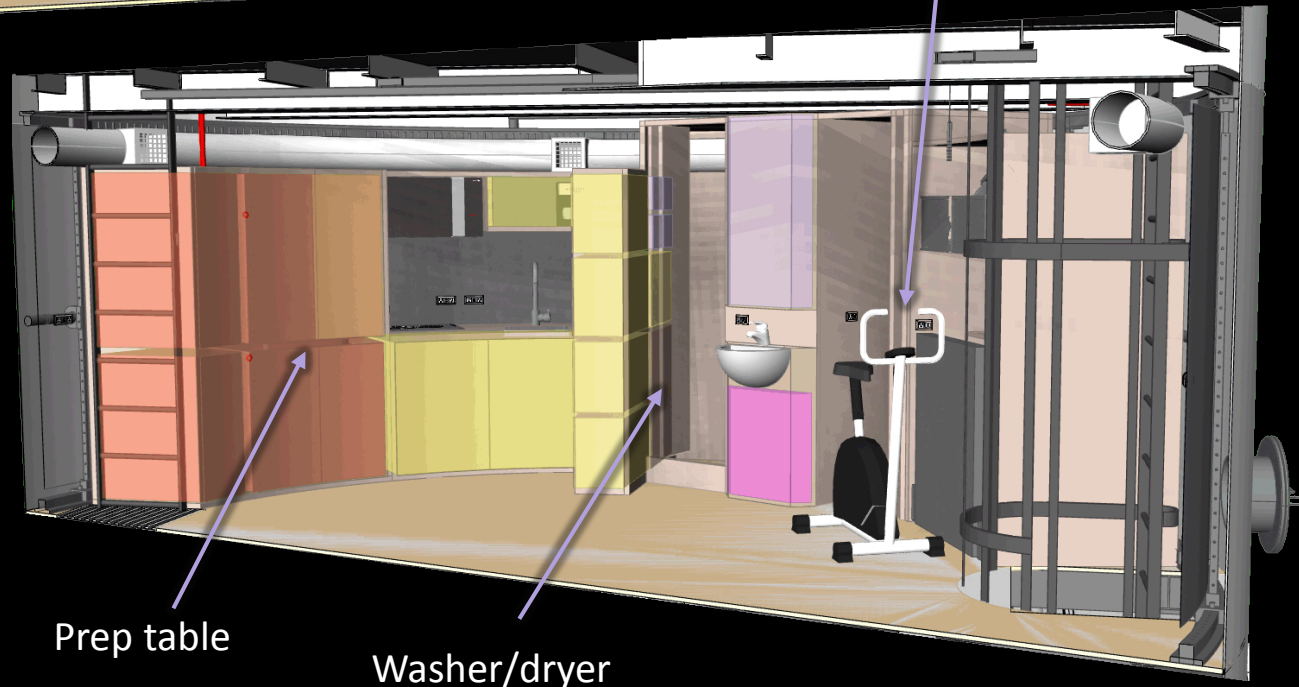


Stowed chairs

Omni treadmill

Exercise bike

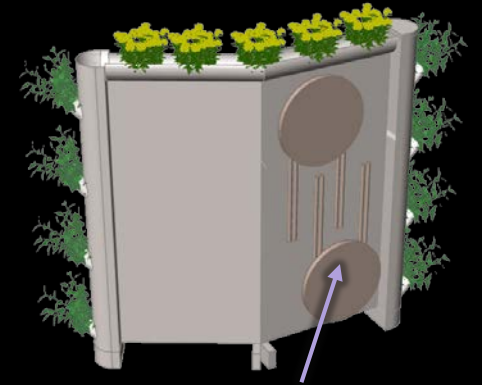
- Storage areas
- General
- Mission dedicated
- Freezer
- Refrigerated
- Food/ utensils
- Personal



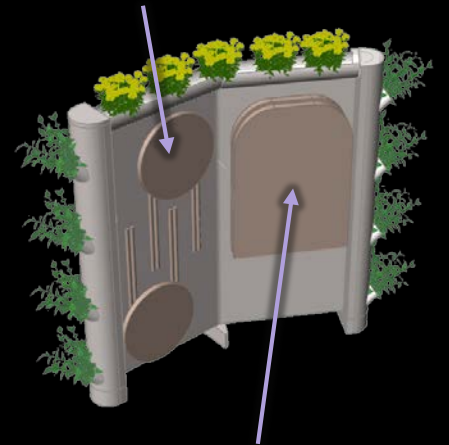
Prep table

Washer/dryer

Dividing panel with herb and flower garden

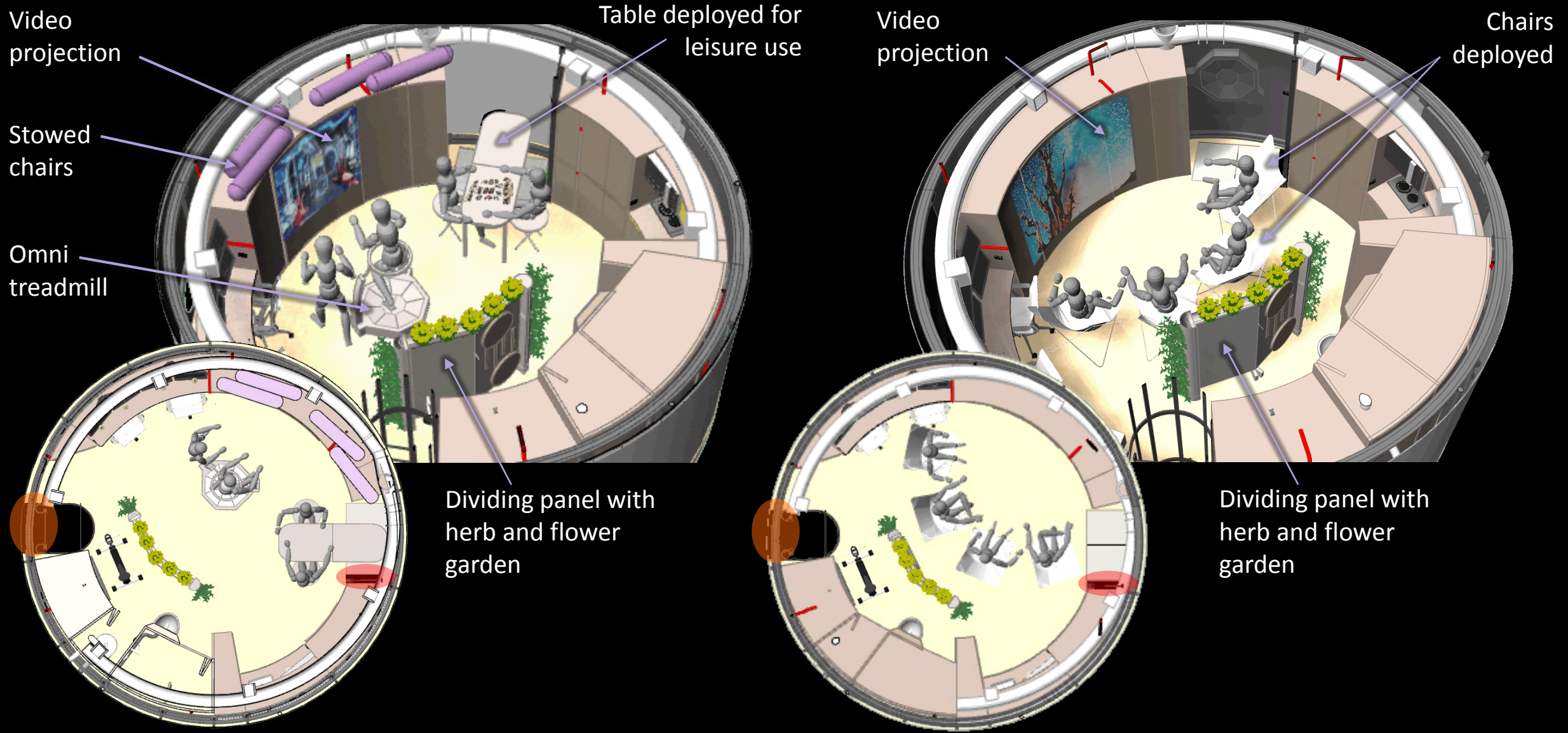


Foldable stools



Foldable table

SECOND FLOOR – GROUP ACTIVITIES



SECOND FLOOR – GROUP ACTIVITIES

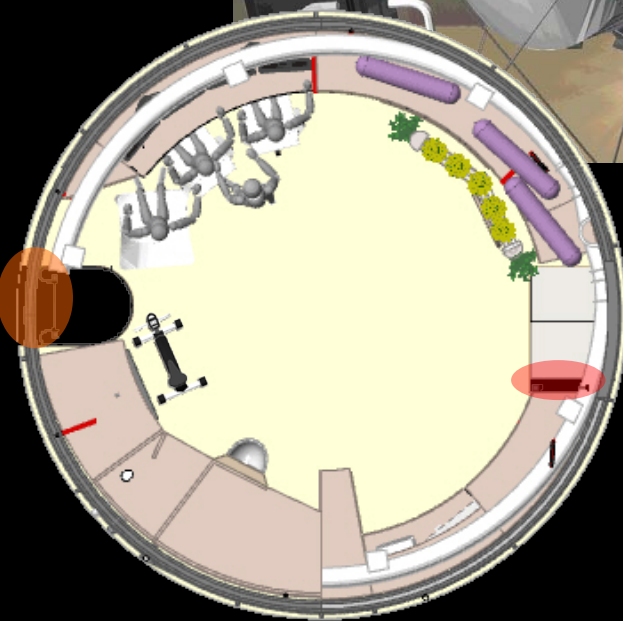
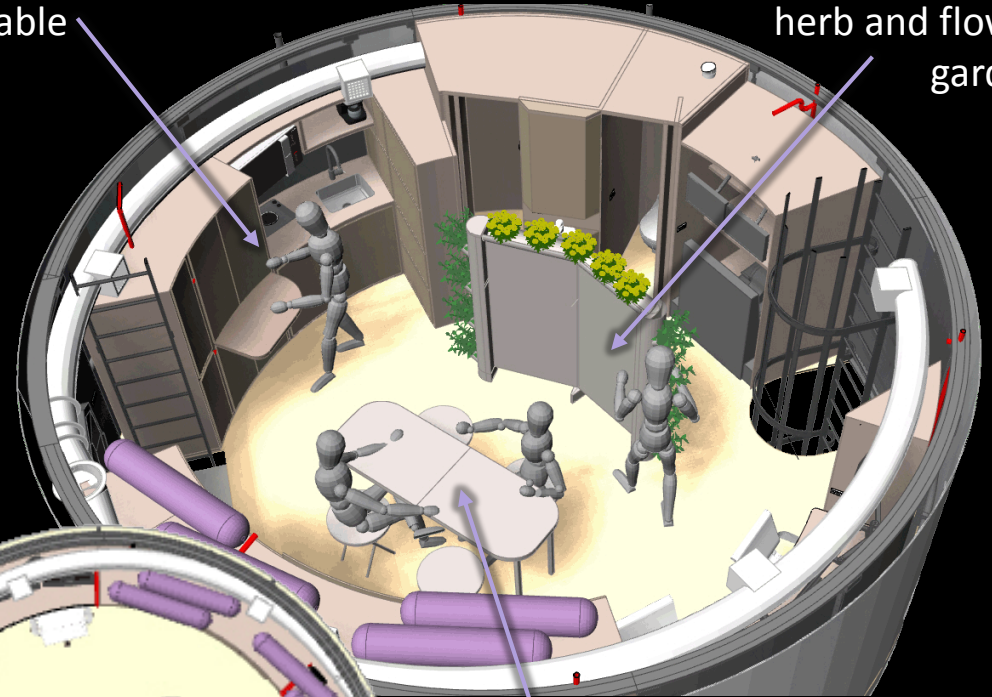
Mission operations station

Dedicated storage, data, servers



Galley with deployable prep table

Dividing panel with herb and flower garden



Crew can huddle together in the operations station

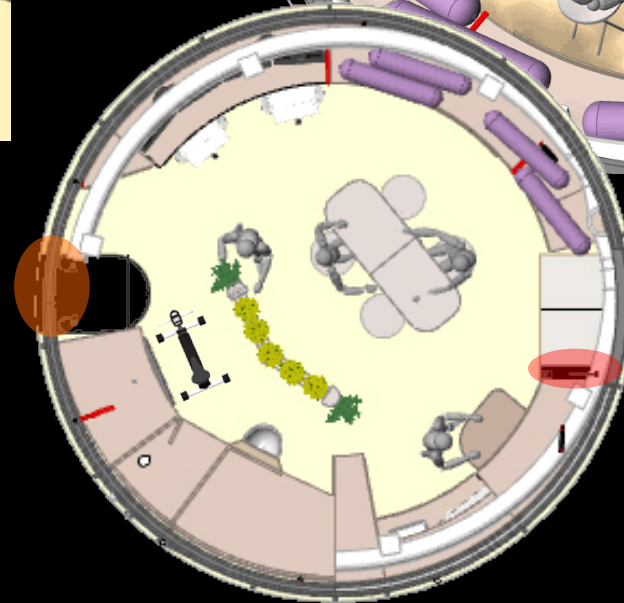
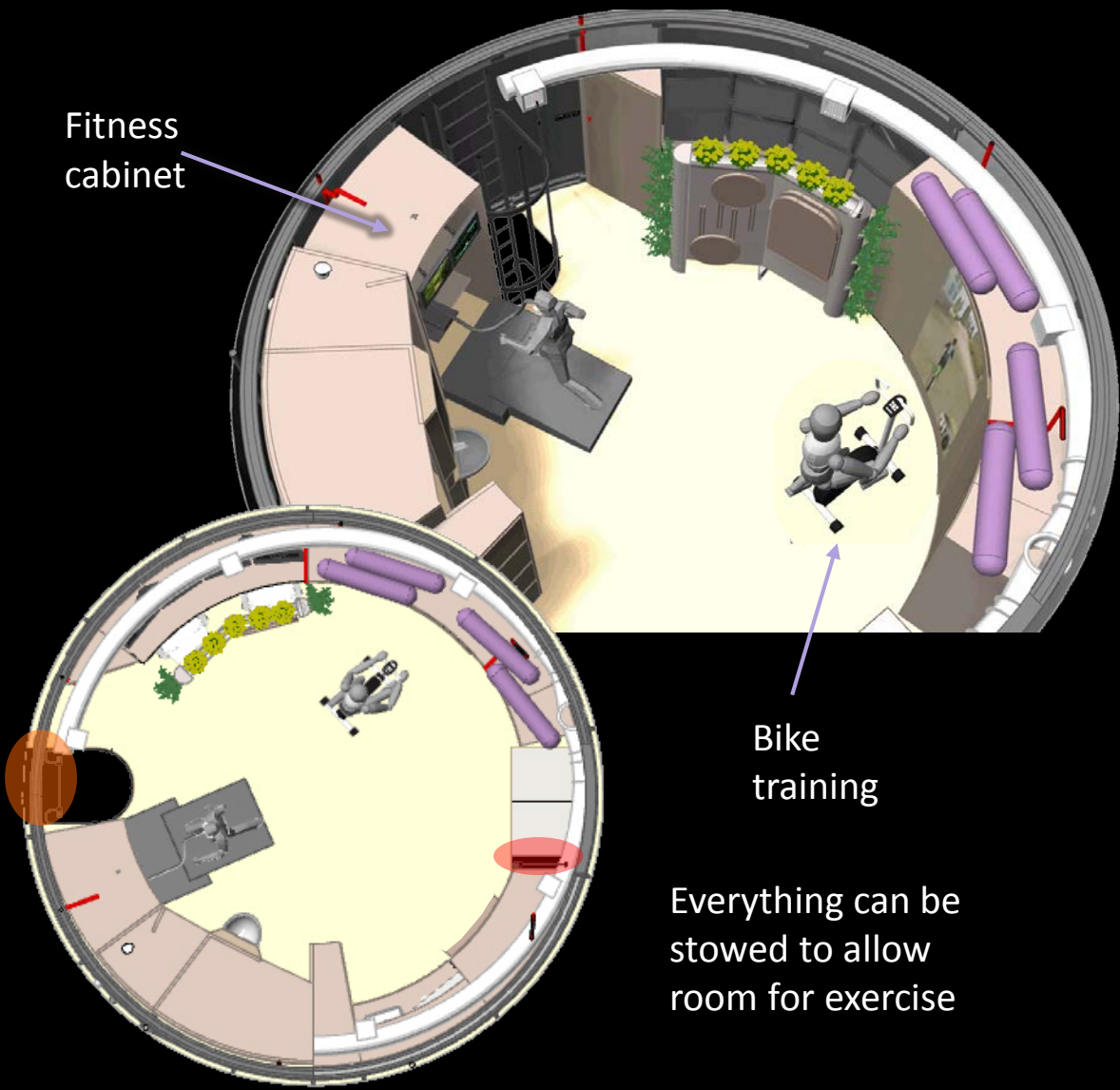


Table and chairs deployed



Fitness cabinet

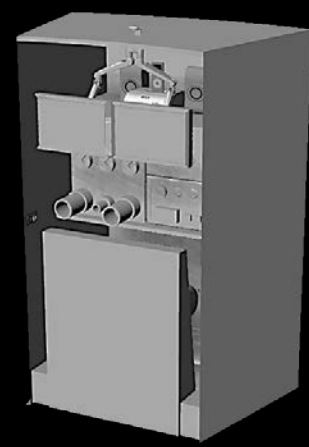
Bike training

Everything can be stowed to allow room for exercise

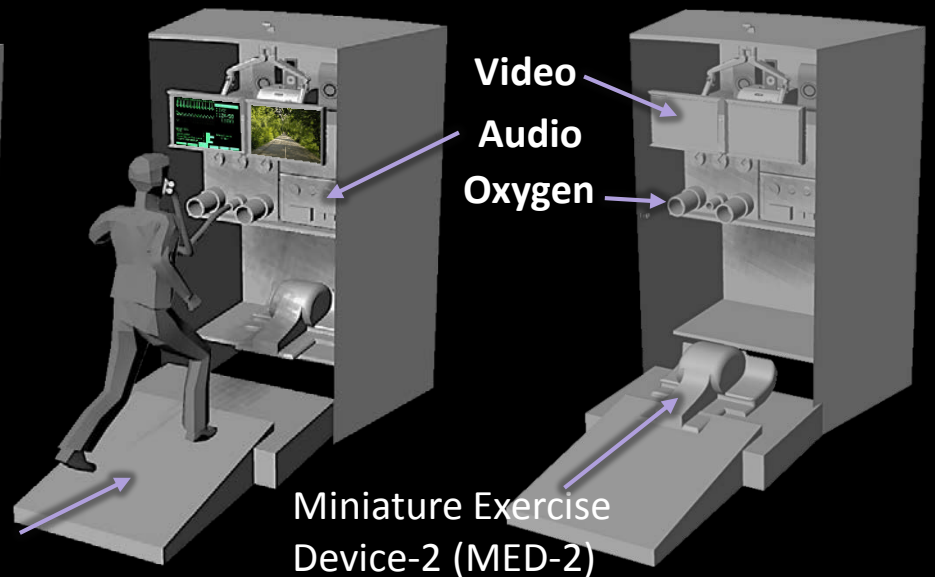
Bike training



Fitness cabinet



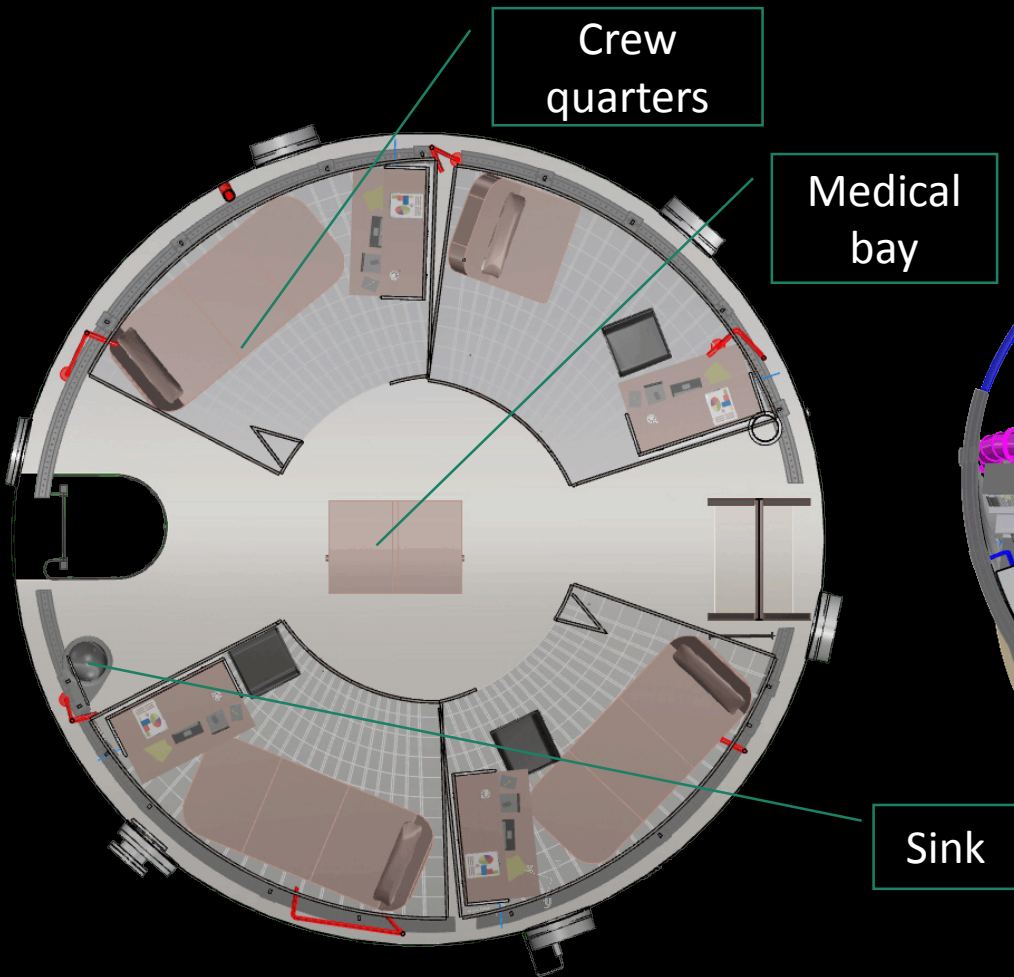
Video
Audio
Oxygen



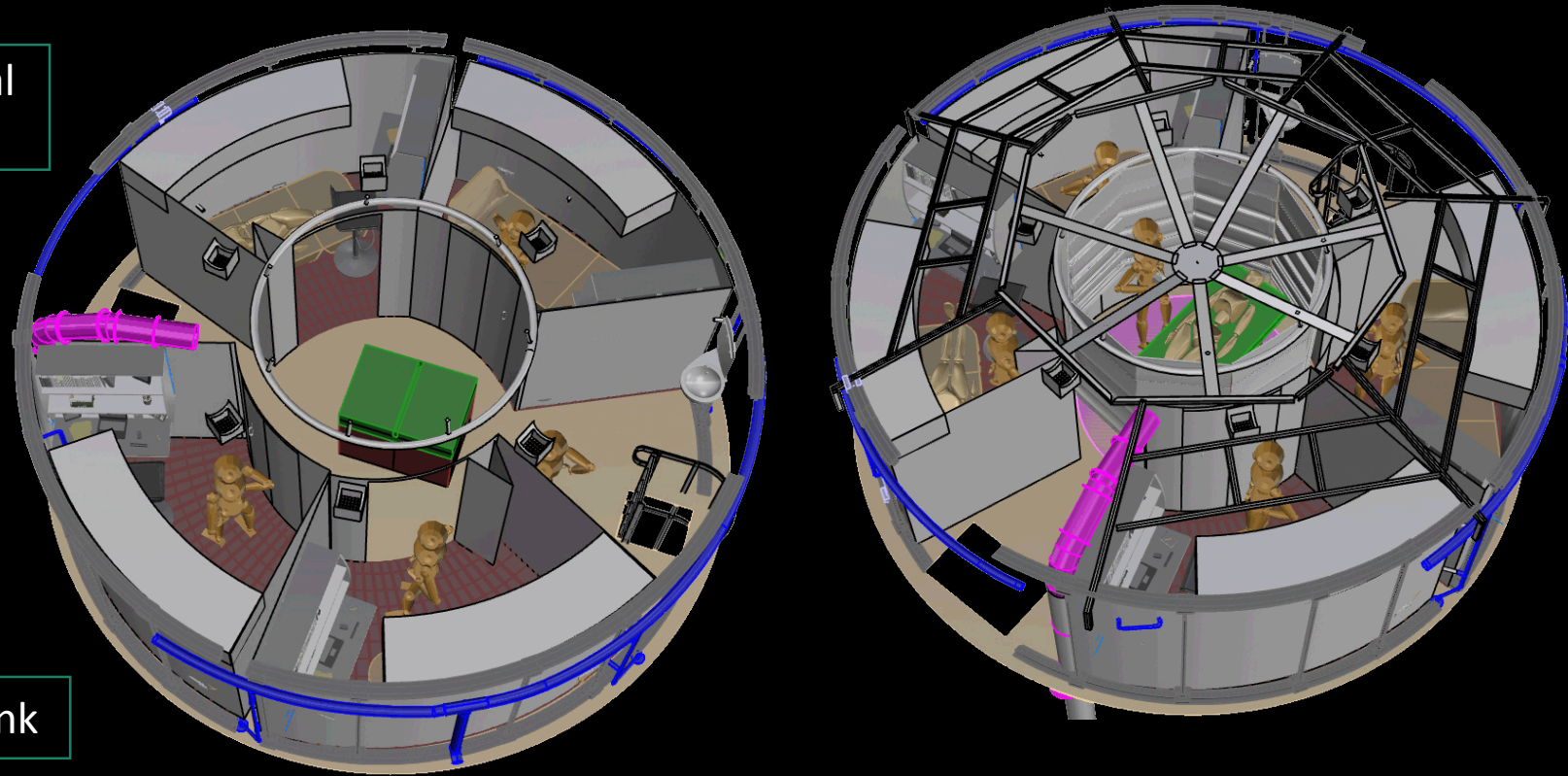
Treadmill

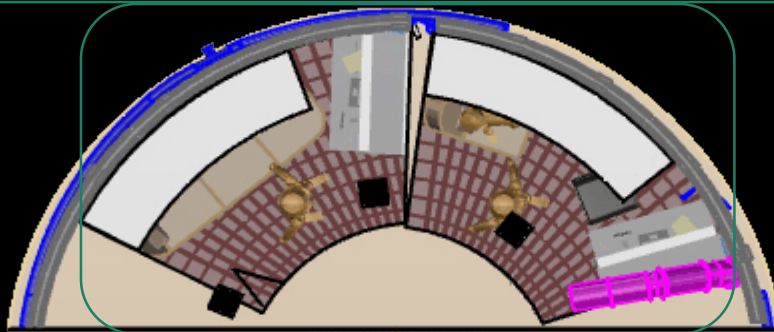
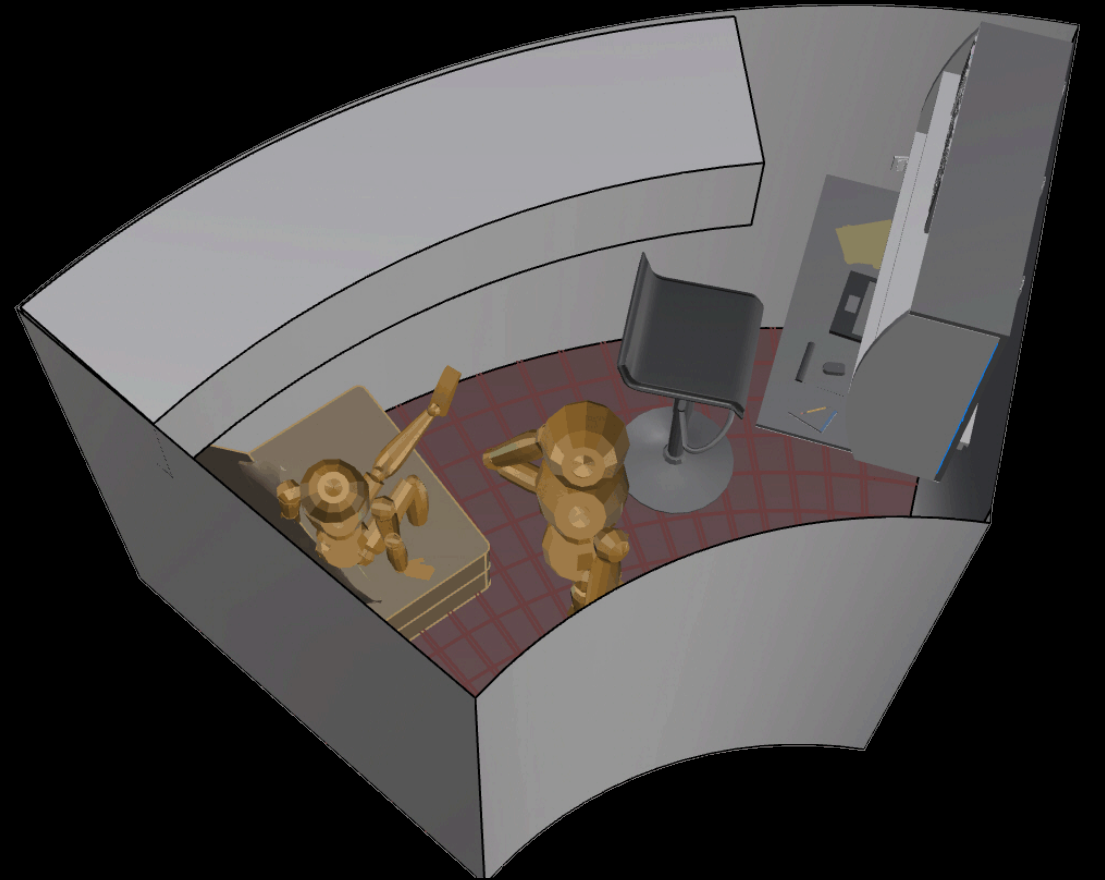
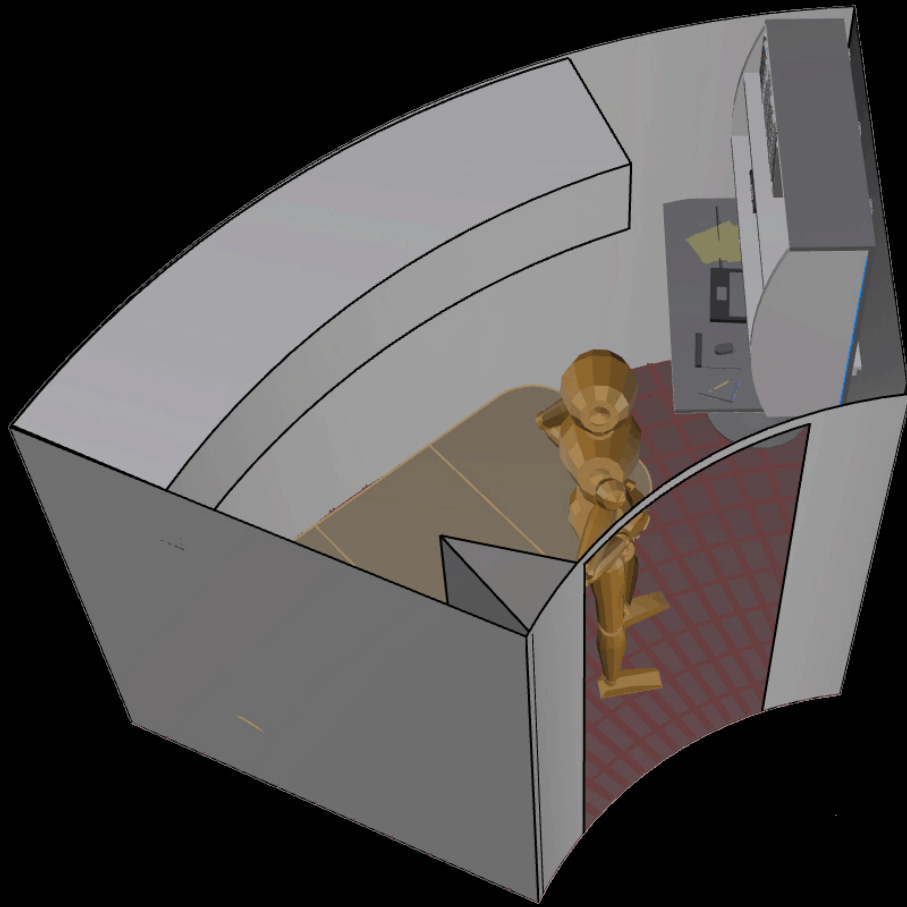
Miniature Exercise Device-2 (MED-2)

Floor plan

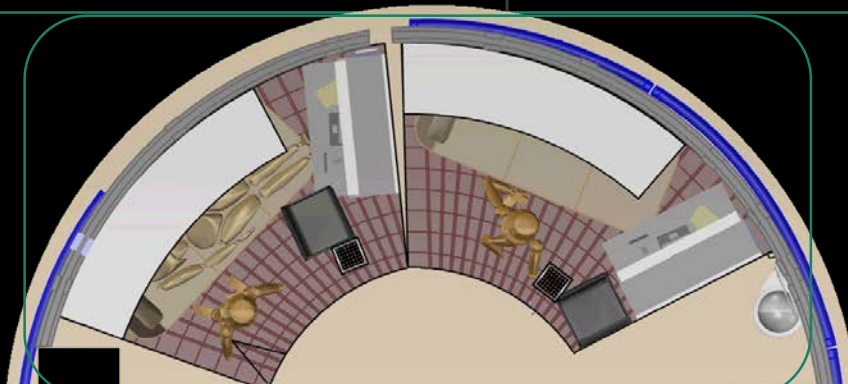
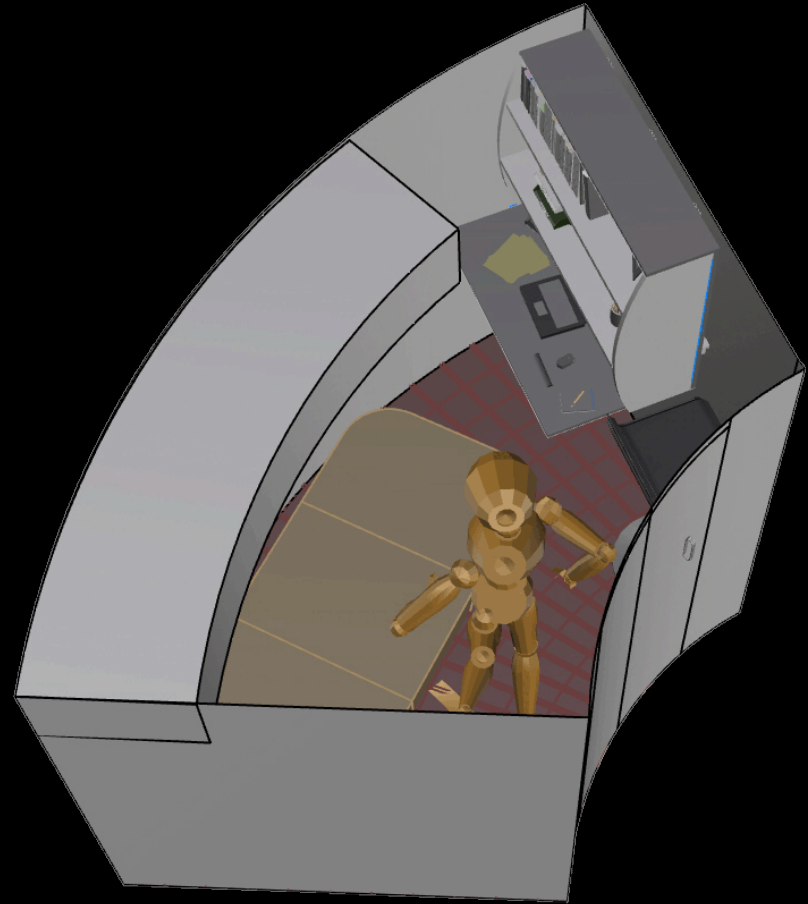
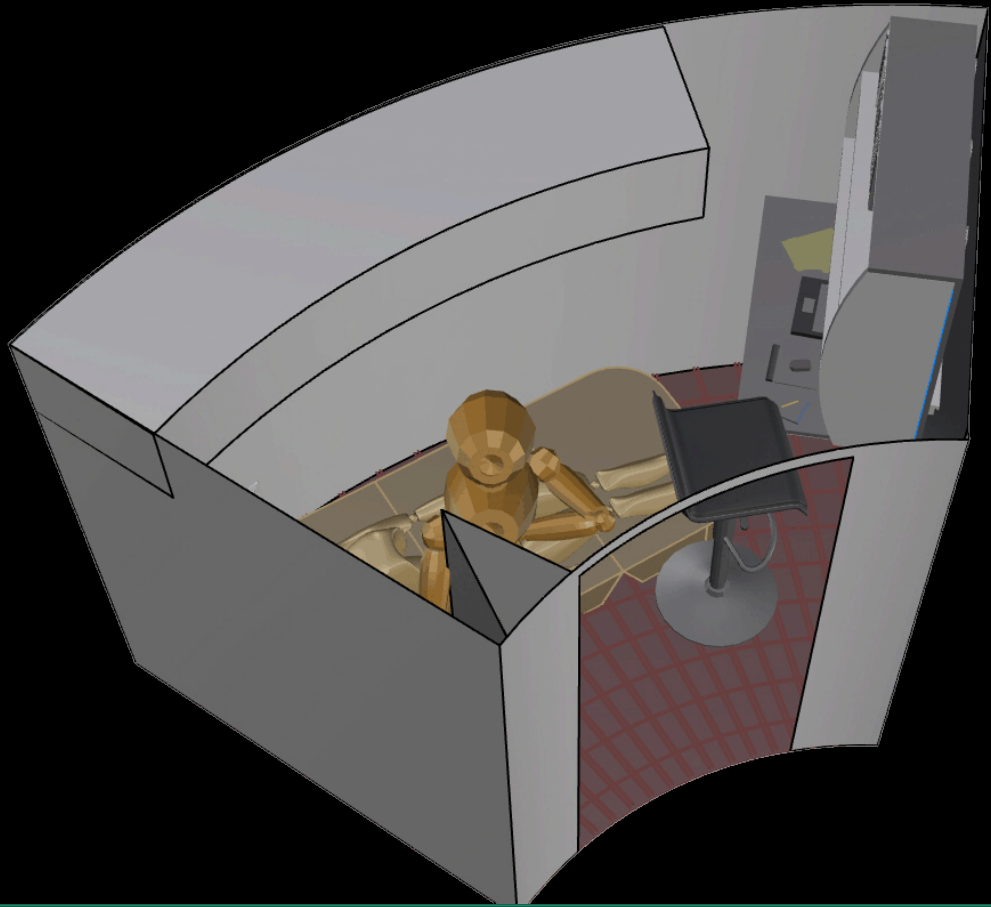


Two configurations of third floor

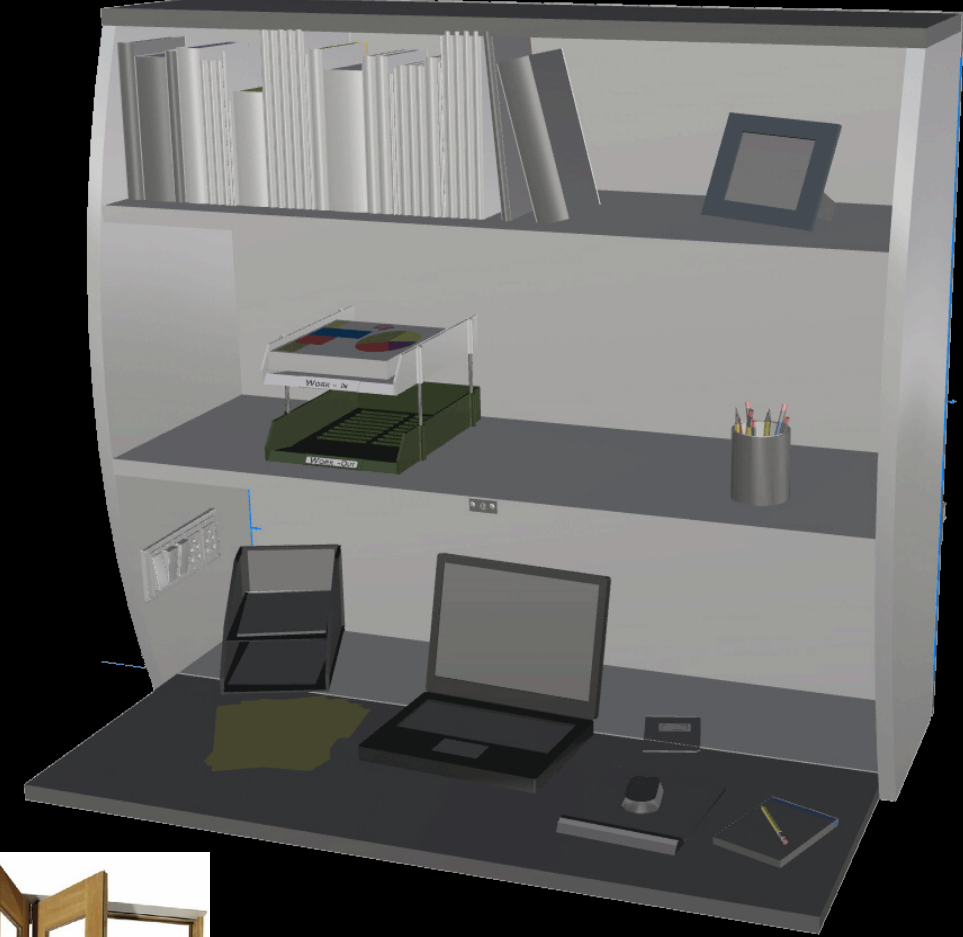
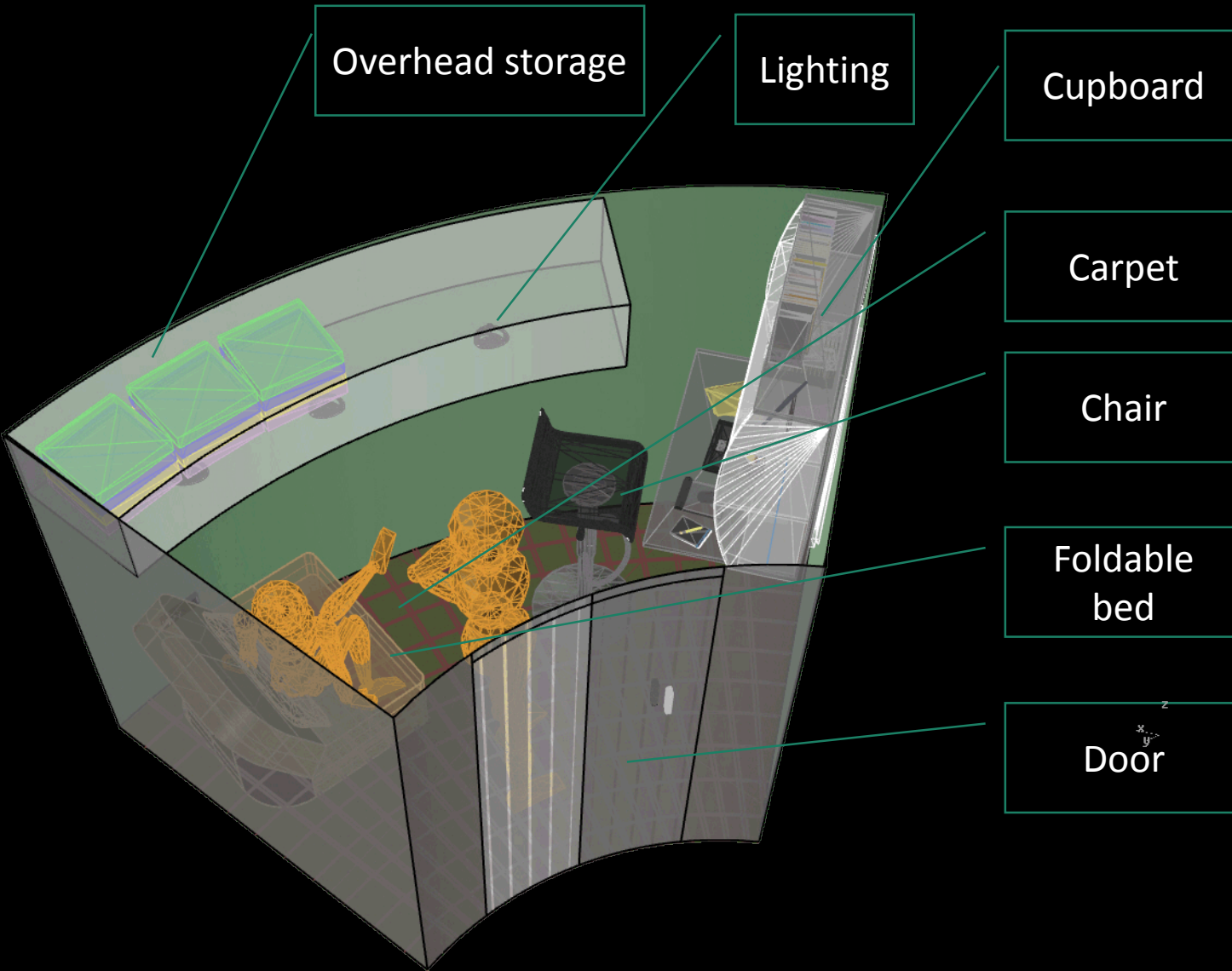


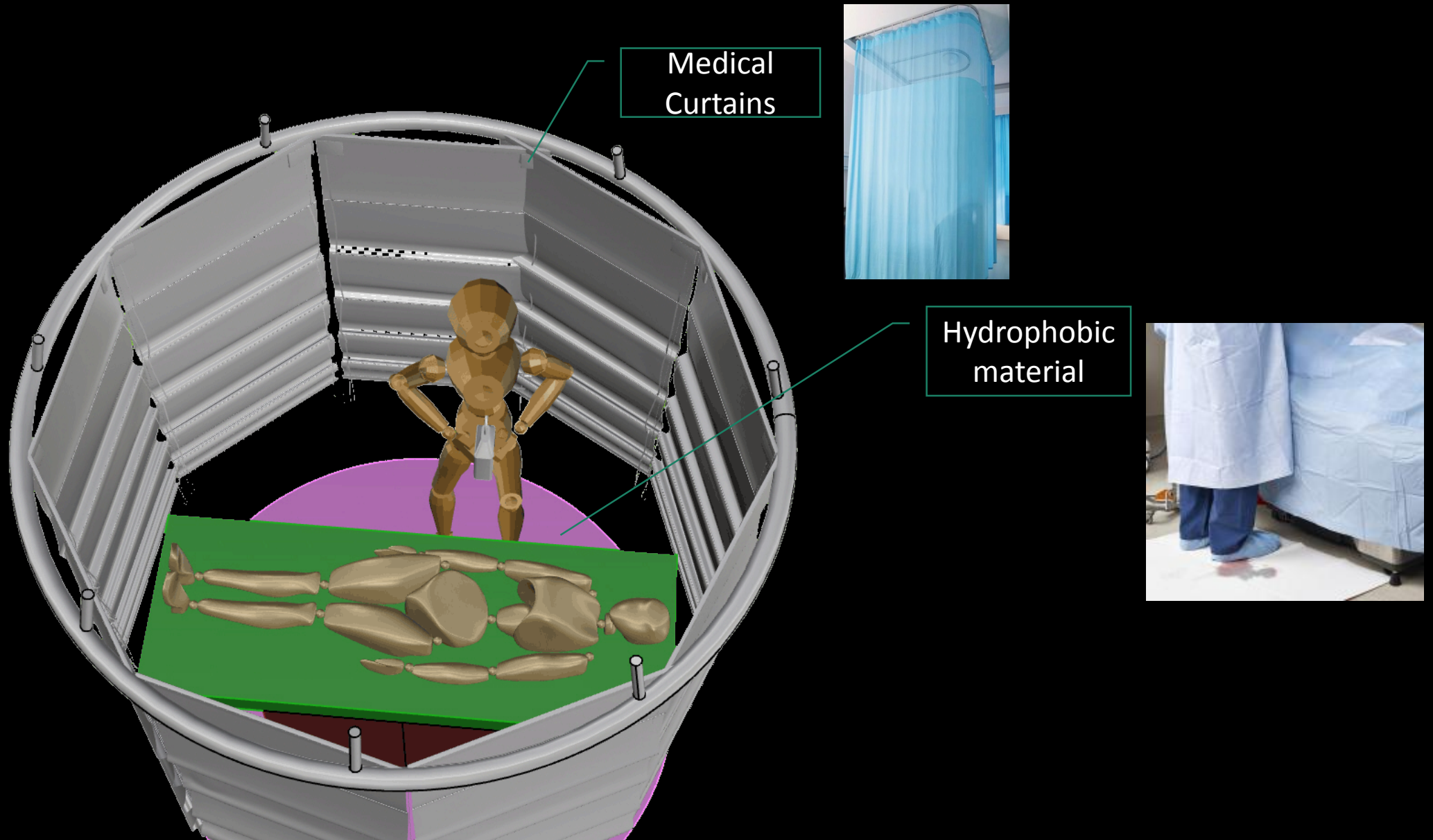


THIRD FLOOR — REST AND FUN



THIRD FLOOR — REST AND FUN







Suzana Bianco
B.Arch and Urbanism
UFF – Brazil

Hestia 2nd floor

Worked with industrial and infrastructure architecture for 6 years before beginning the Space Architecture program. Aims to be part of the team that designs the next generation of space crafts and habitats, taking humans to Mars and beyond.

In this project, applied architectural concepts to design an open area that allows different functions to be performed with maximum comfort.

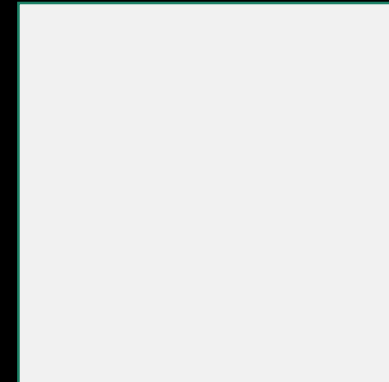


Shunsuke Miyazaki
M.S. in Sport Engineering,
RMIT Univ. – Australia
B.S. in Aerospace Engr.
B.S. in Applied Math
Minor in Economics, CU-
Boulder –U.S.A

Hestia 1st floor

Studied human performance for wearable intravehicular sport equipment for human spaceflight in master program. Currently, I'm working for space habitat and spacecraft design to enhance human performance.

In this project, design science experiemnt facility design by refering to apparutus equipped on ISS and Mars rover exploration



Sai Prabhath Kadchi
Degree
Where university if

Hestia 3rd floor

Write something

The following is the technical report of the Hestia Analog design.