NASA

STARSHIP ASCENT MODULE

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RISD ID
Design for Extreme Environments
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DESIGN BRIEF

> Design an 8 person crew ascent module for the SpaceX Starship to lift-off from Mars and embark on an 18 hour to 1 week mission on route to earth.

LIMITATIONS

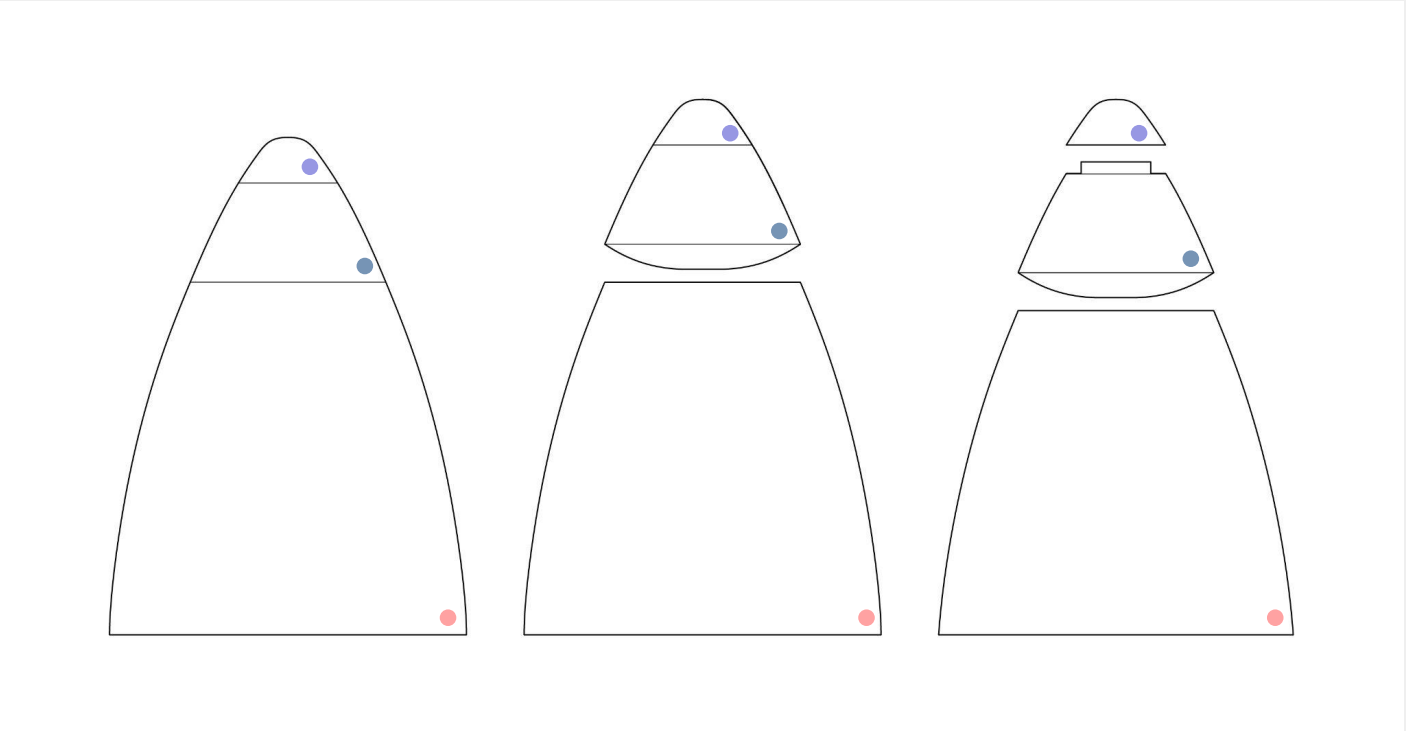
- Must carry 8 people from the surface of Mars into orbit
- Have enough sustenance and space for a mission length of 18 hours up to a week in the worst case scenario

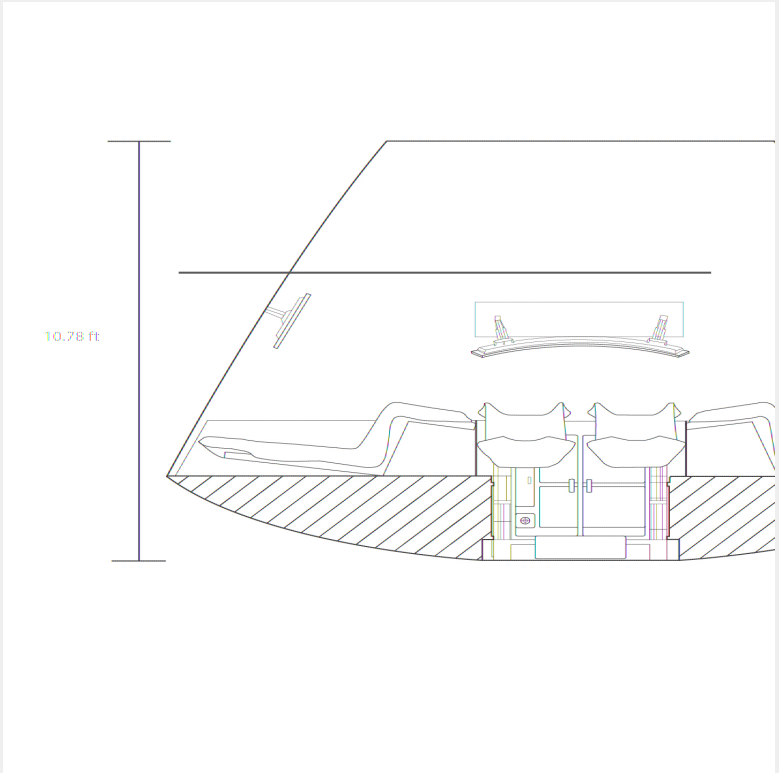
STARSHIP ORTHOGRAPHIC

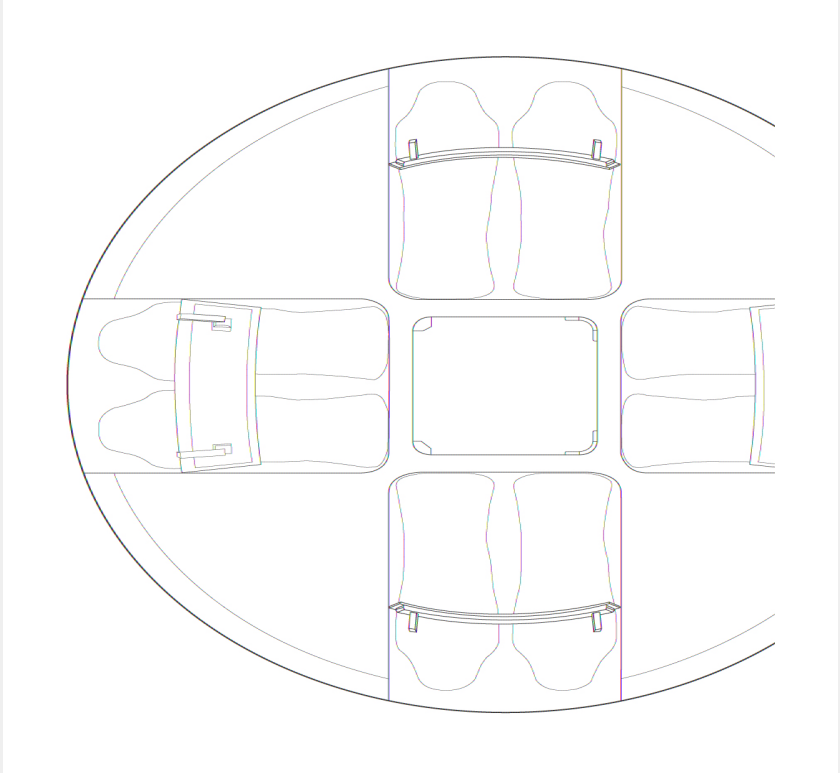
Nose Cone:

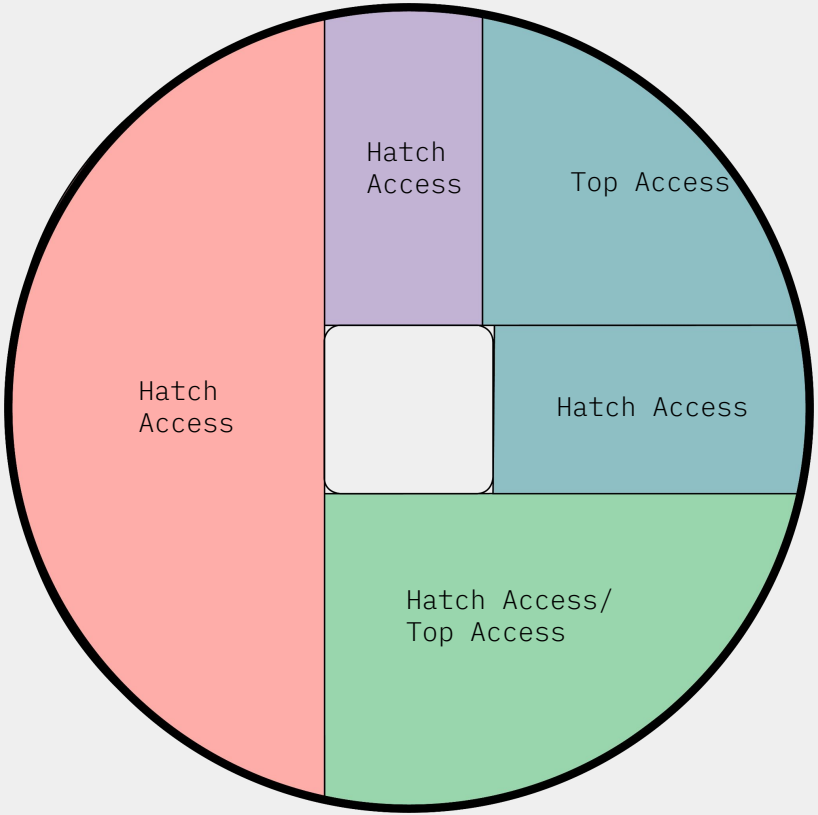
Ascent Module:

Greater Starship:




10.78 ft





Storage:

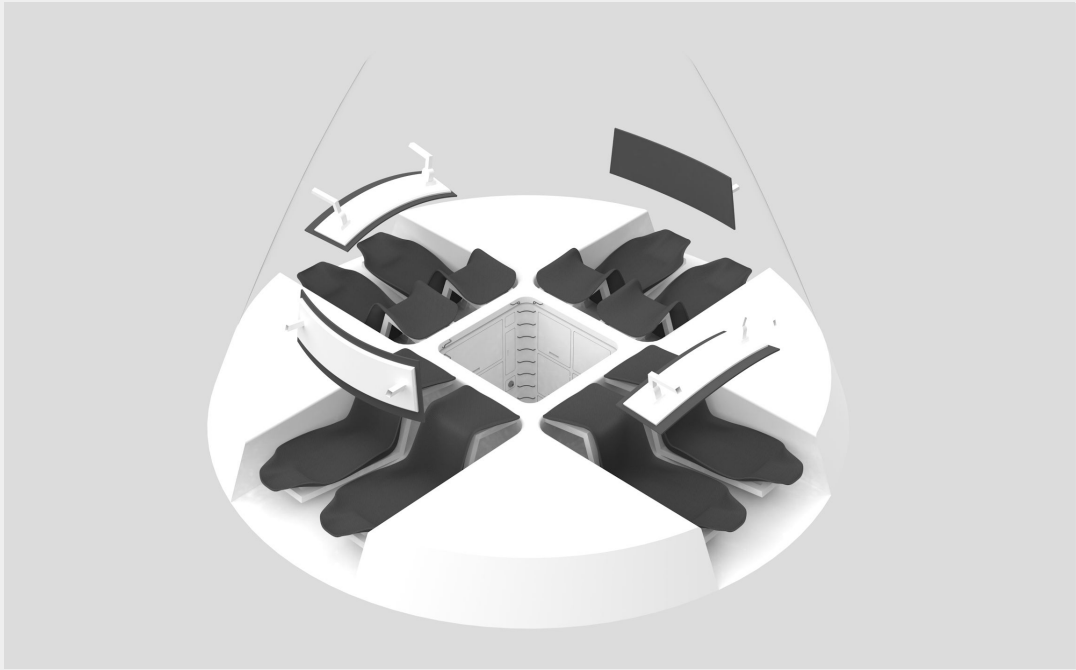
ECLLS:

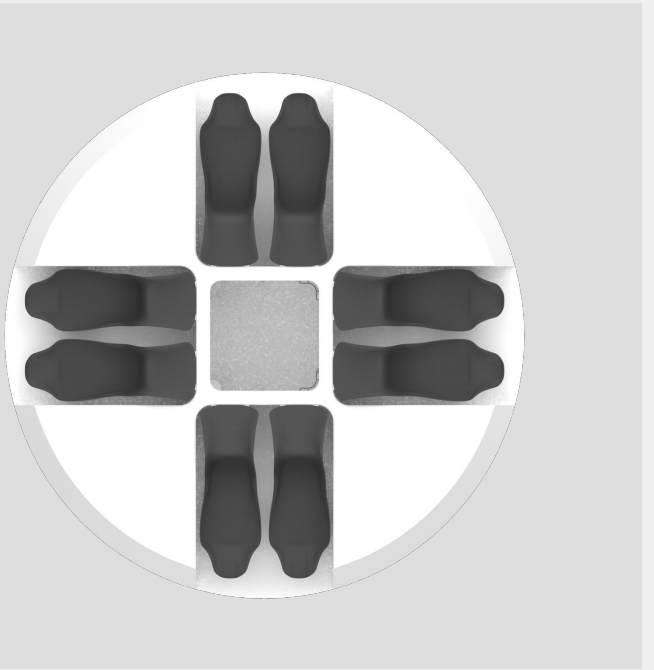
Waste System:

Sample Storage:

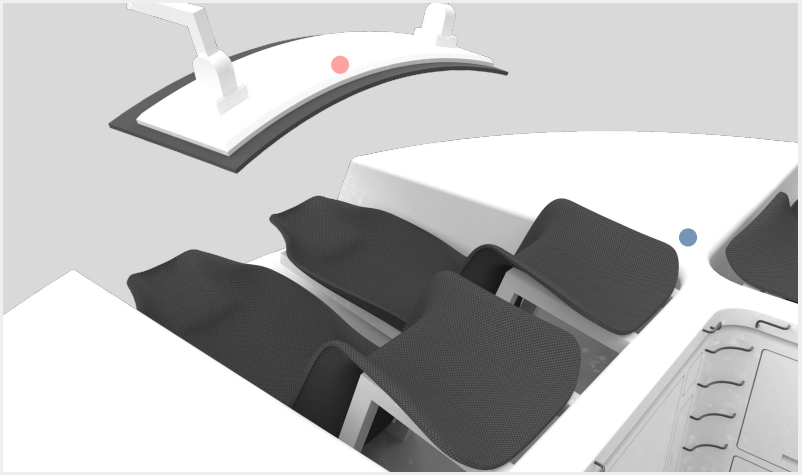
CABIN LAYOUT

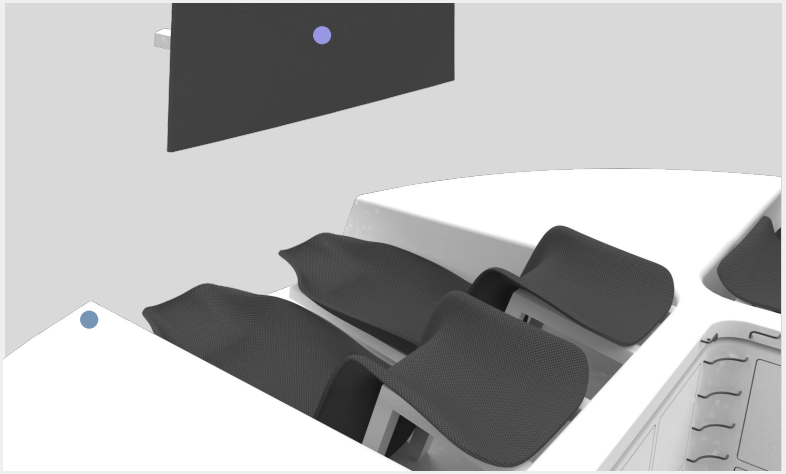
SEATING LAYOUT

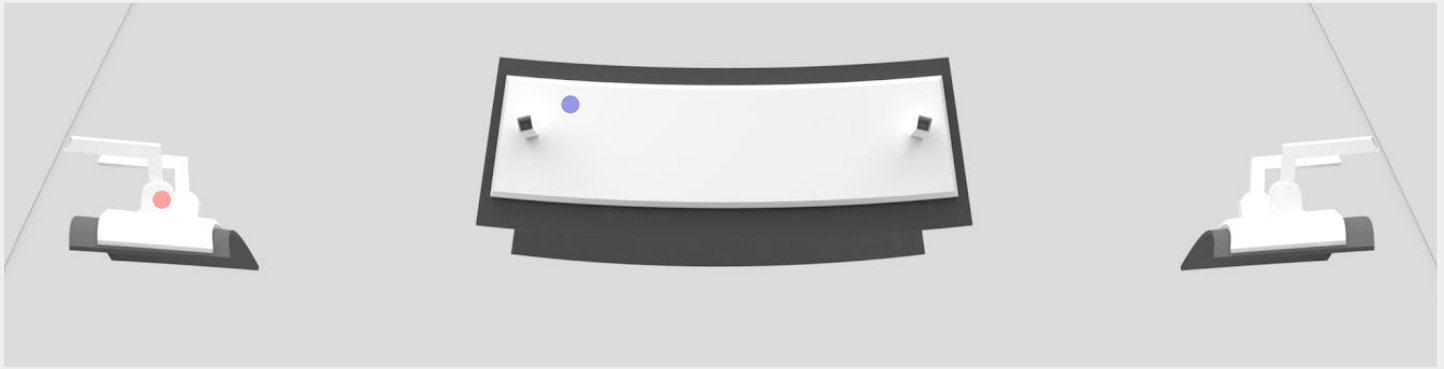




CABIN RENDERS







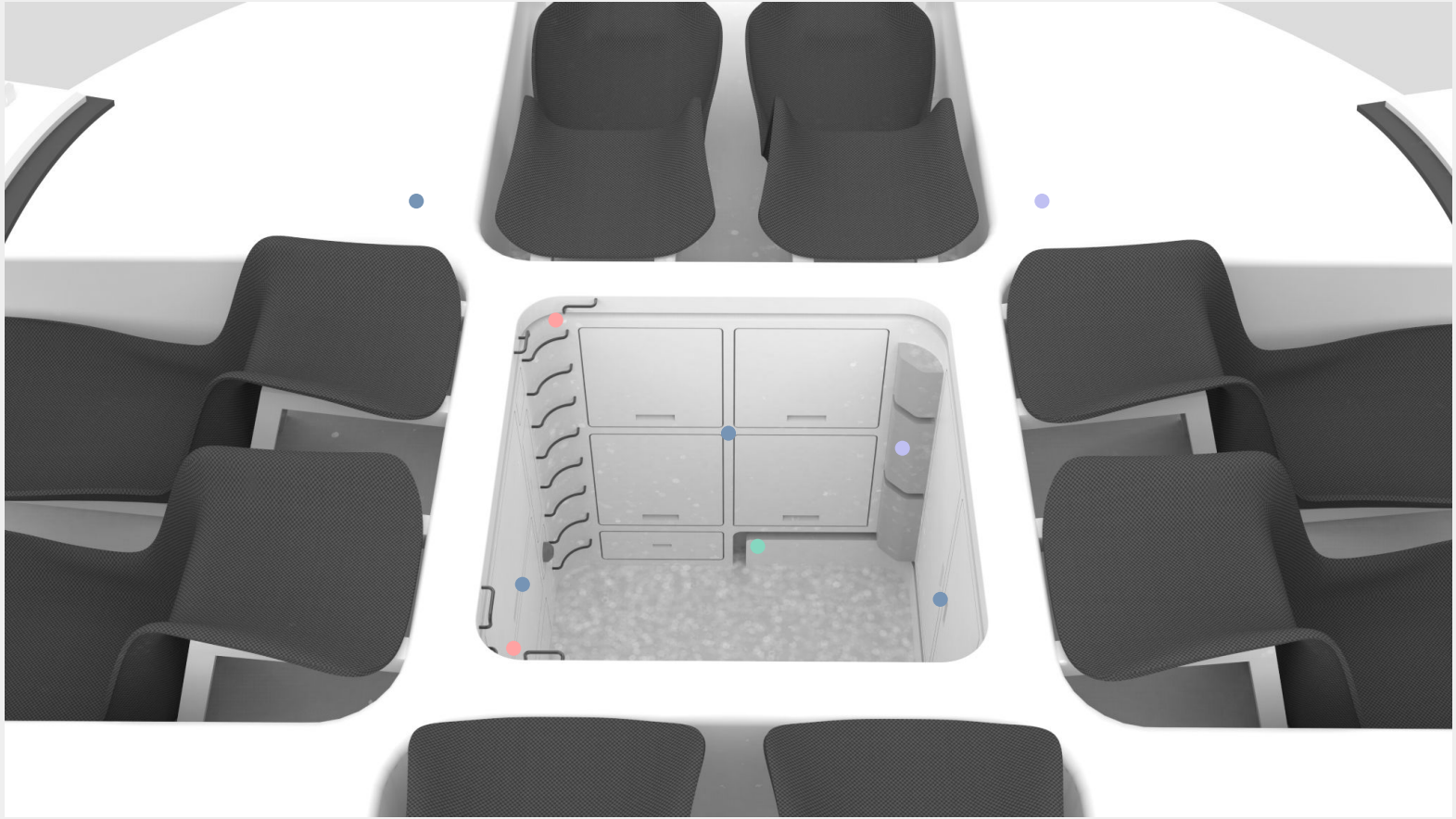
Storage: ● Launch Orientation: ● Orbit Orientation: ●

HATCH IDEATION

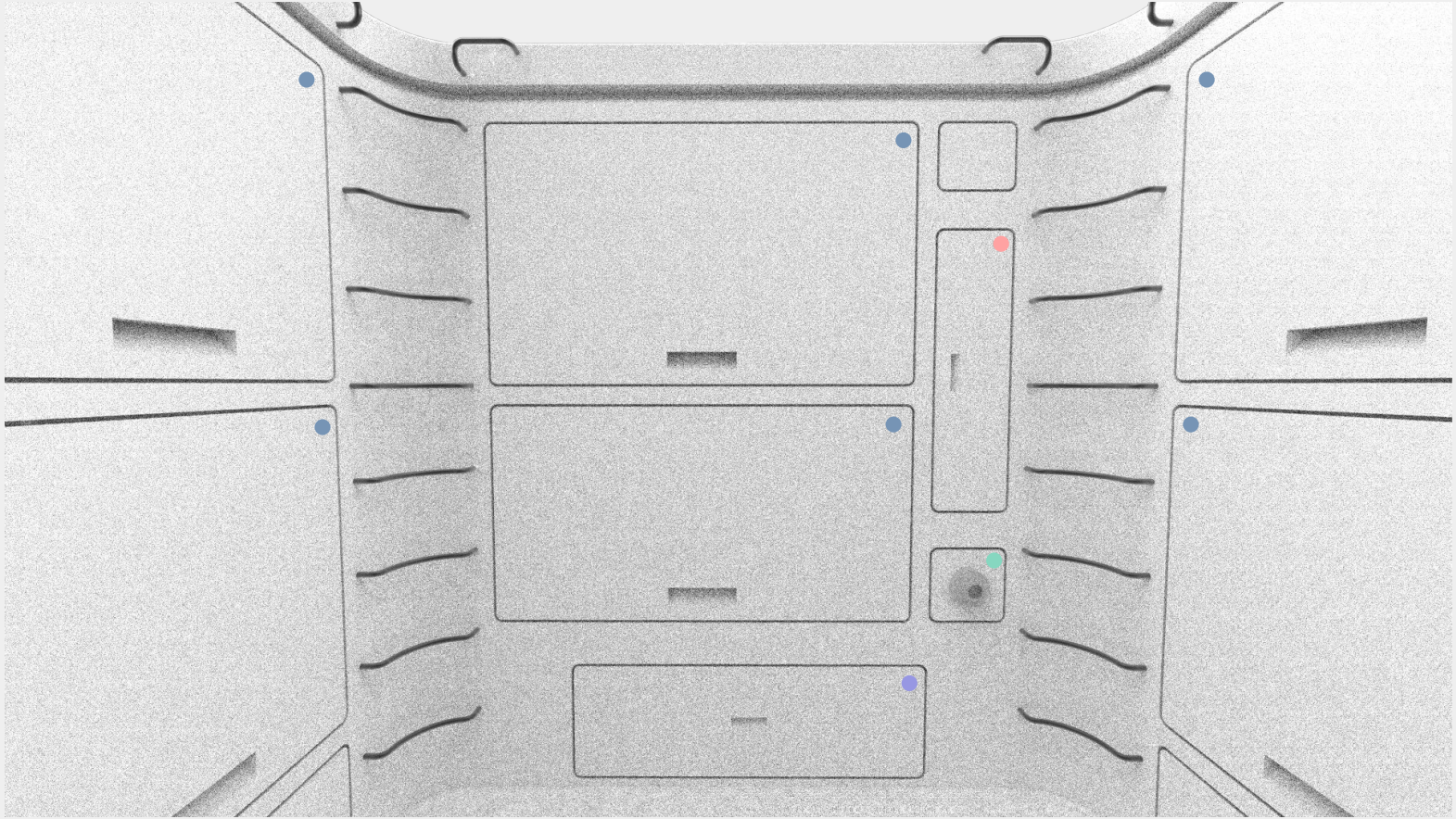
HATCH PROTOTYPING

HATCH TESTING

HATCH DESIGN

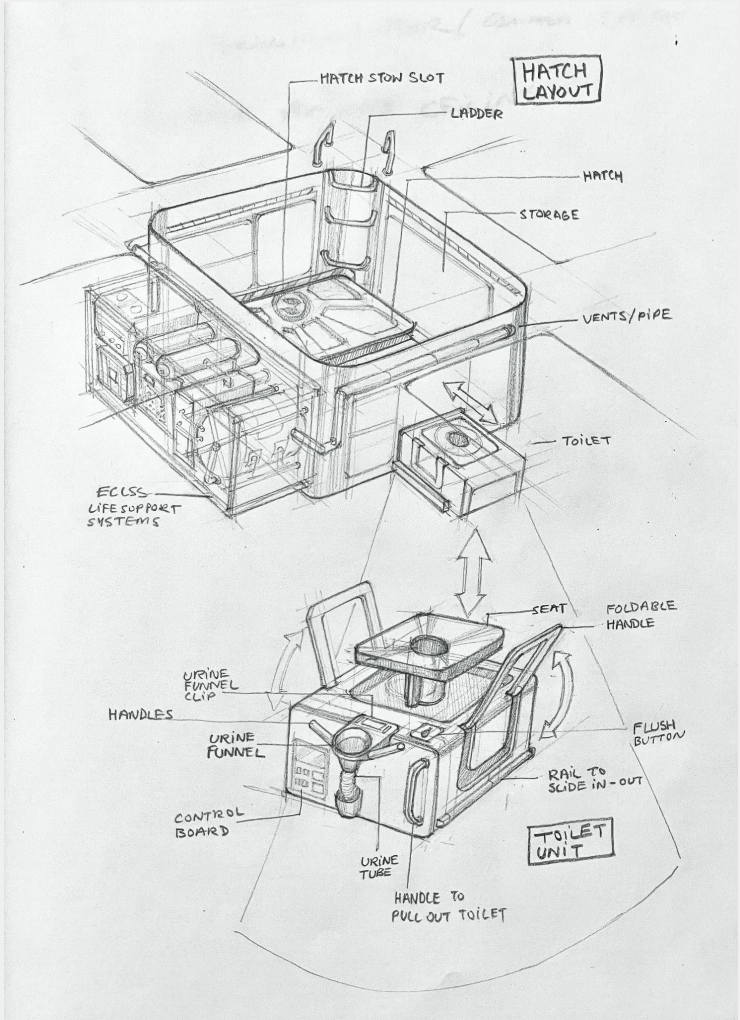


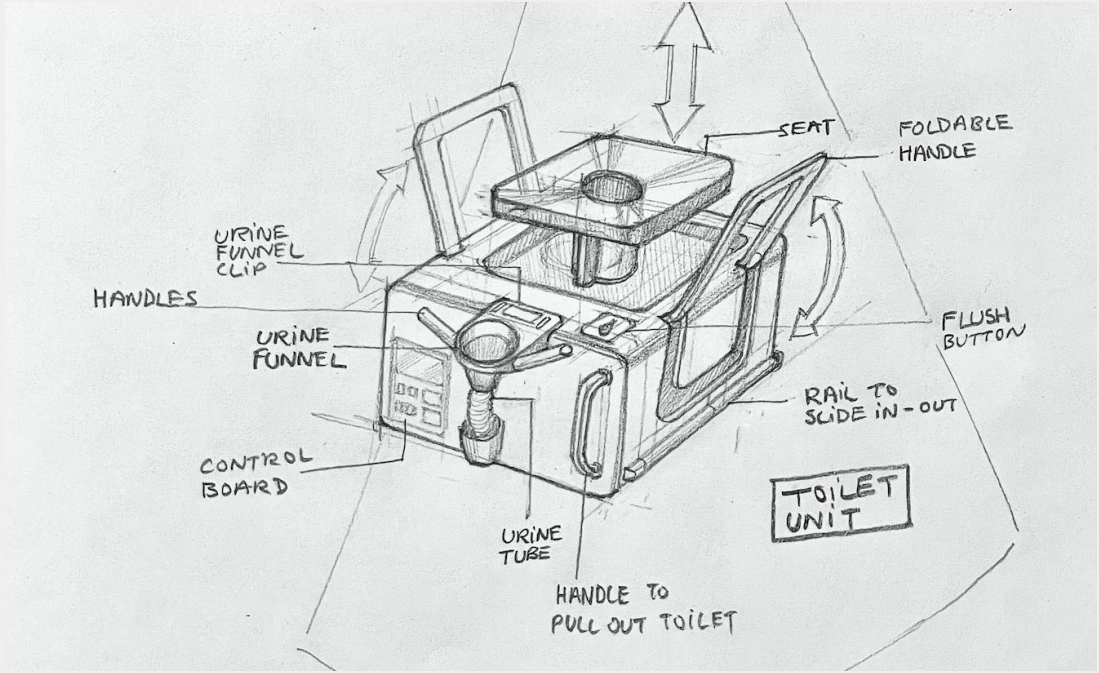
Storage: Ladder: Soft Storage: Hatch Rail:



Storage: Medical: Solid Waste: Liquid Waste:

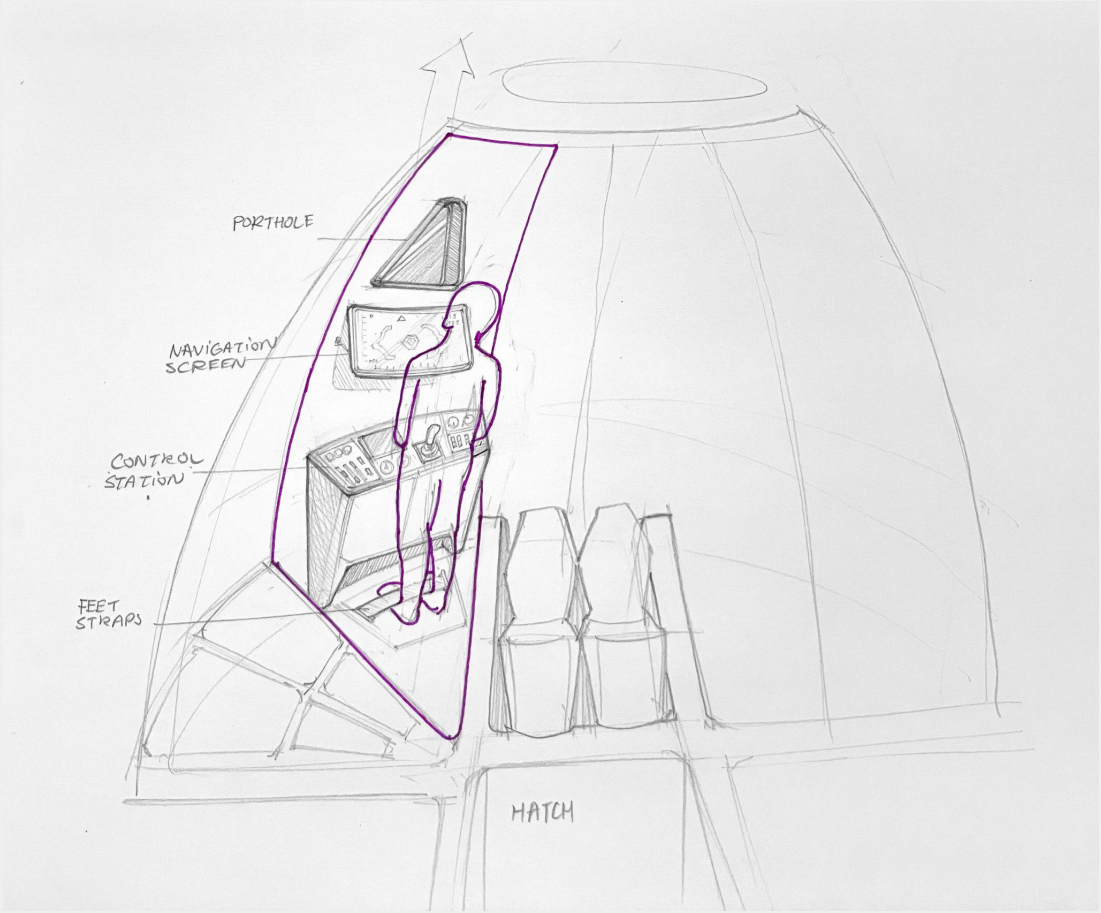
CONCEPT SKETCHES

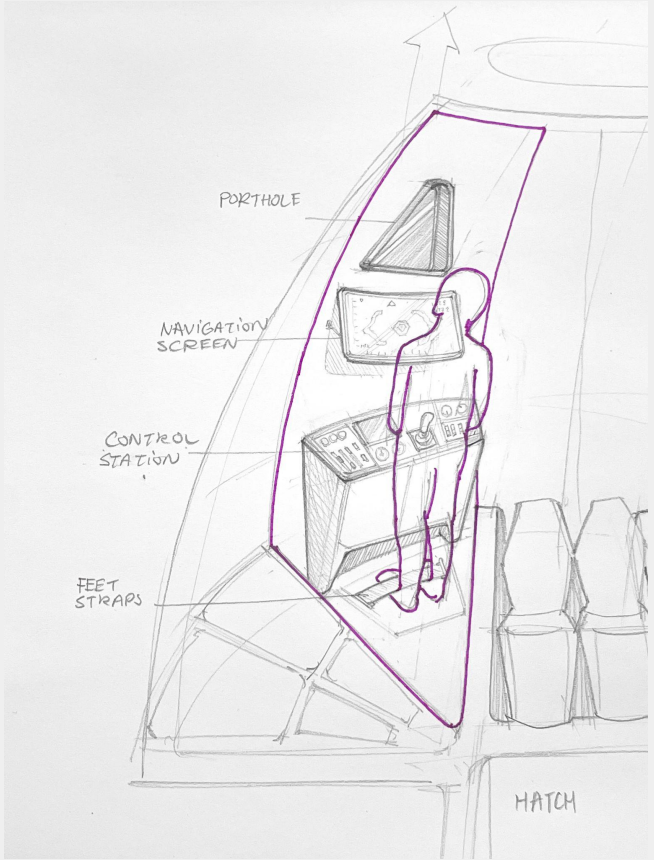




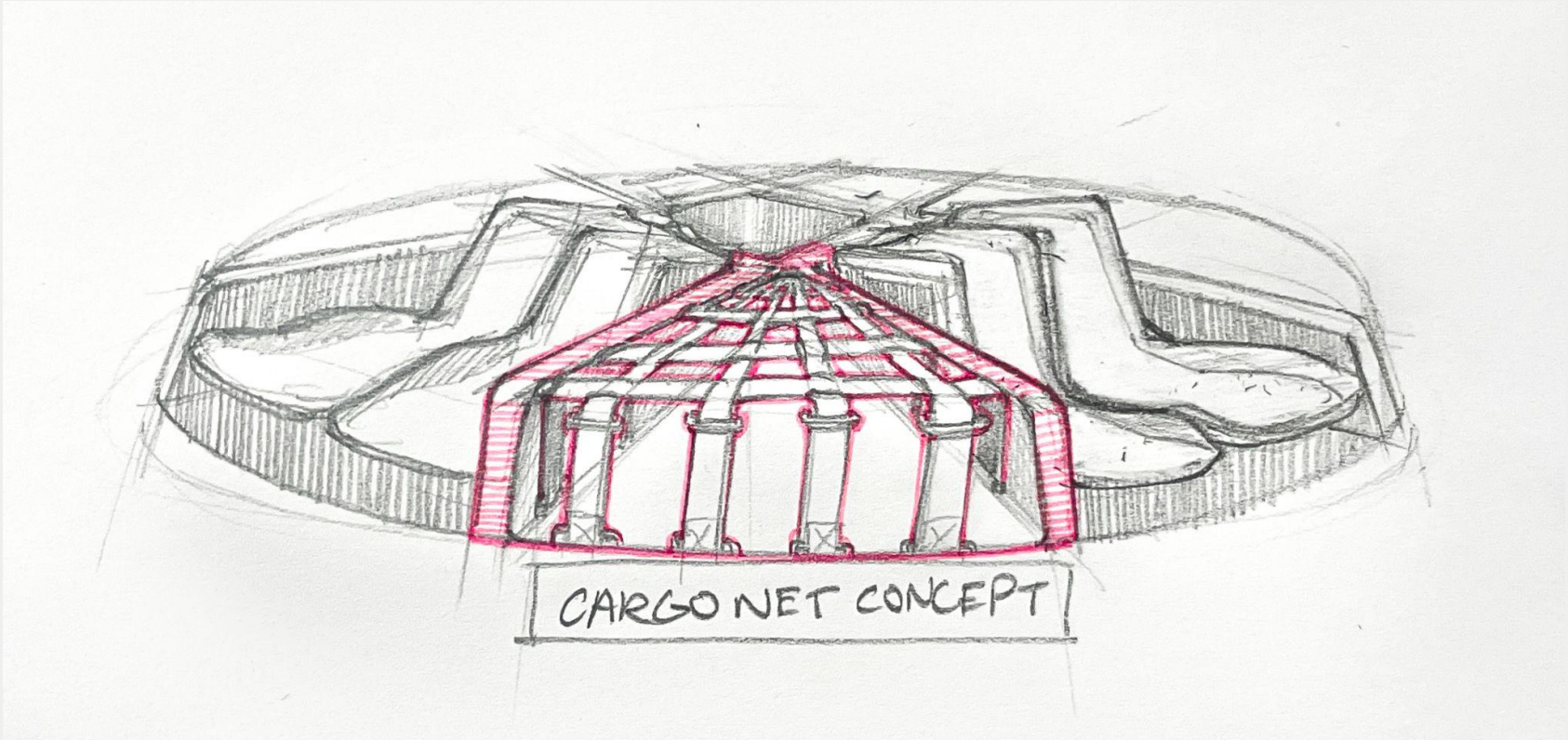
HATCH DETAIL SKETCH

TOILET IN-USE SKETCH

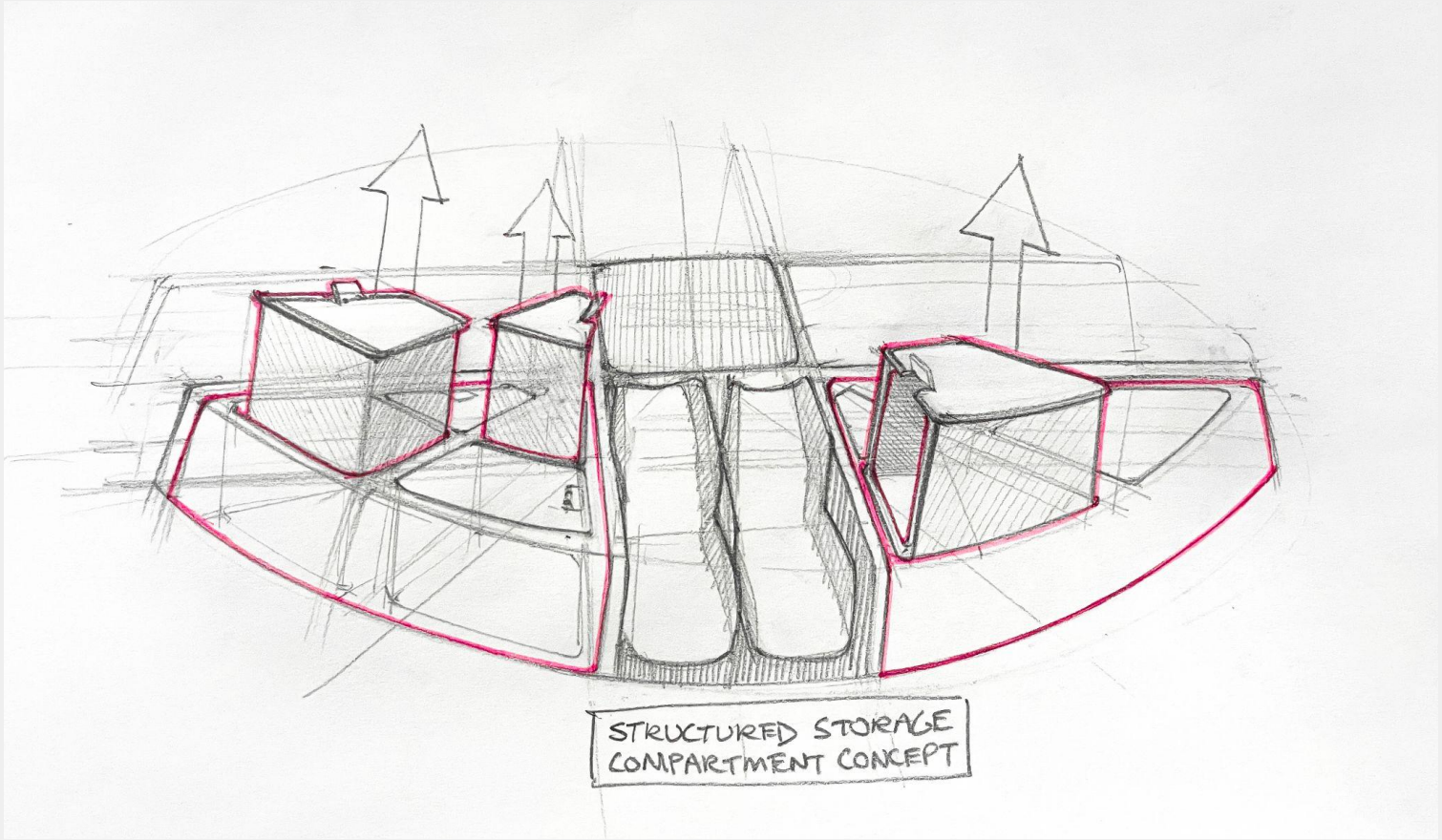




Crewman Optical Alignment System (COAS) CONCEPT

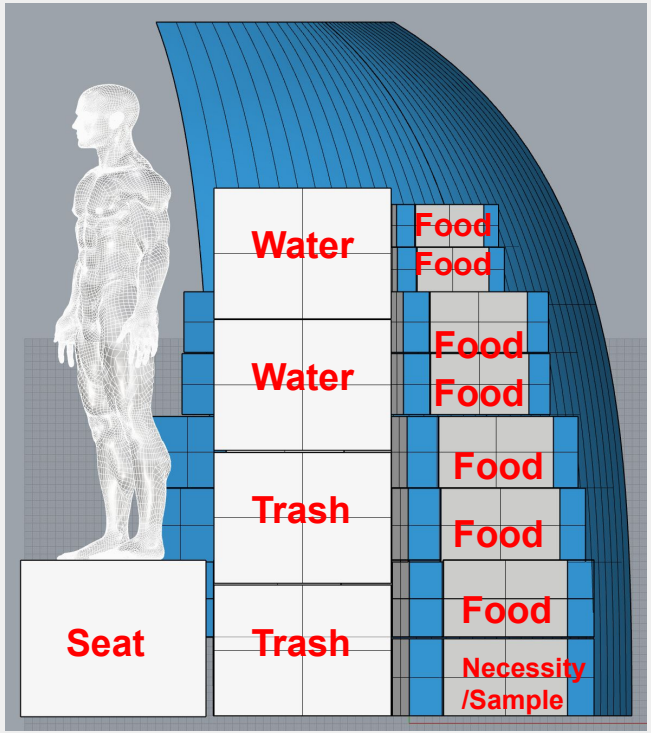


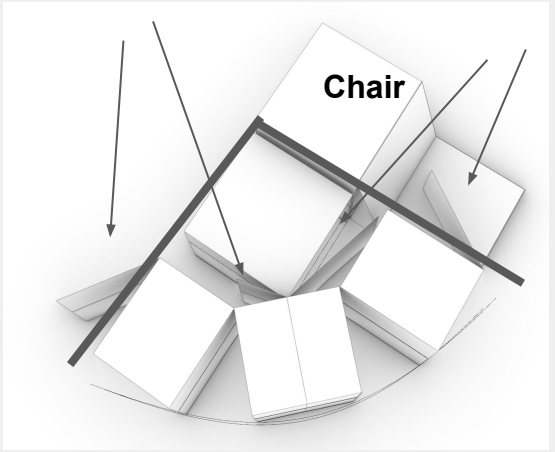
CARGO NET STORAGE CONCEPT

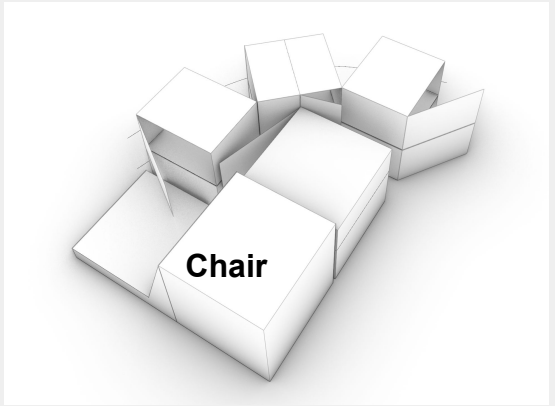


STRUCTURED STORAGE CONCEPT

ALTERNATE CONCEPT

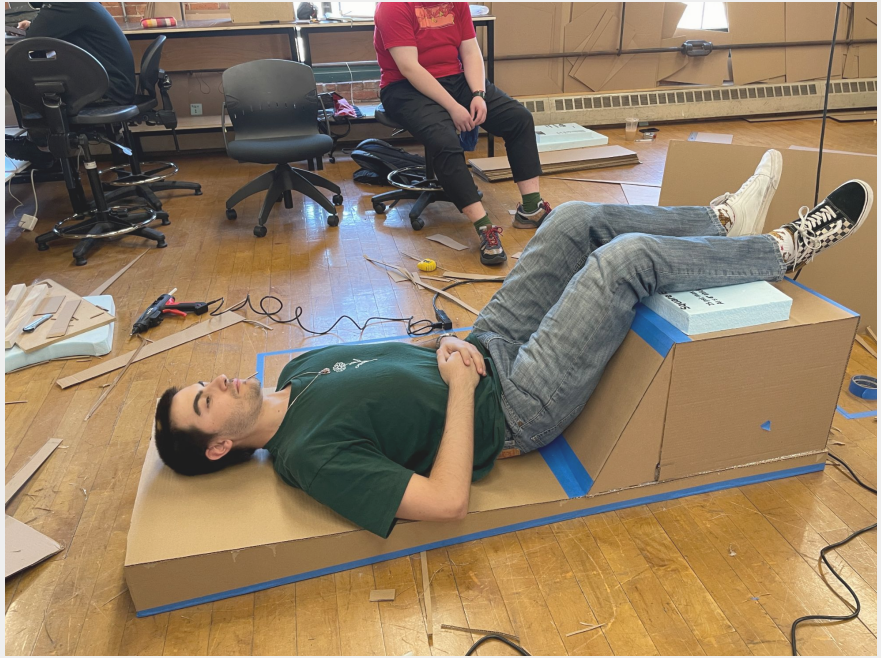




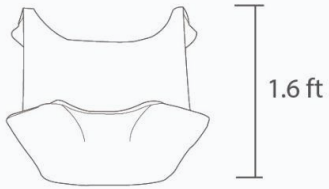


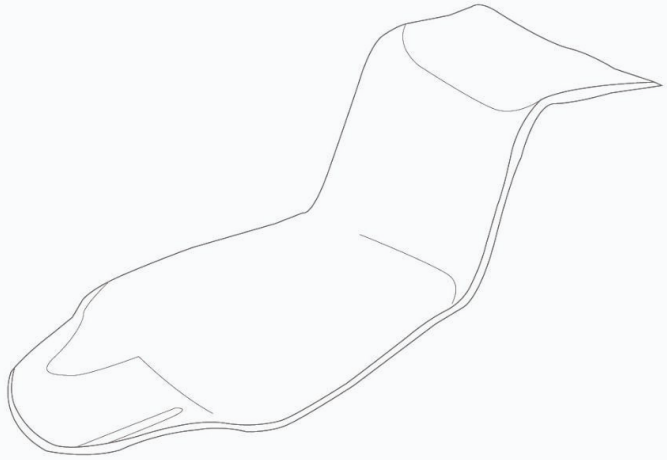
STORAGE CONCEPT - Focus On Human Interaction

CHAIR IDEATION

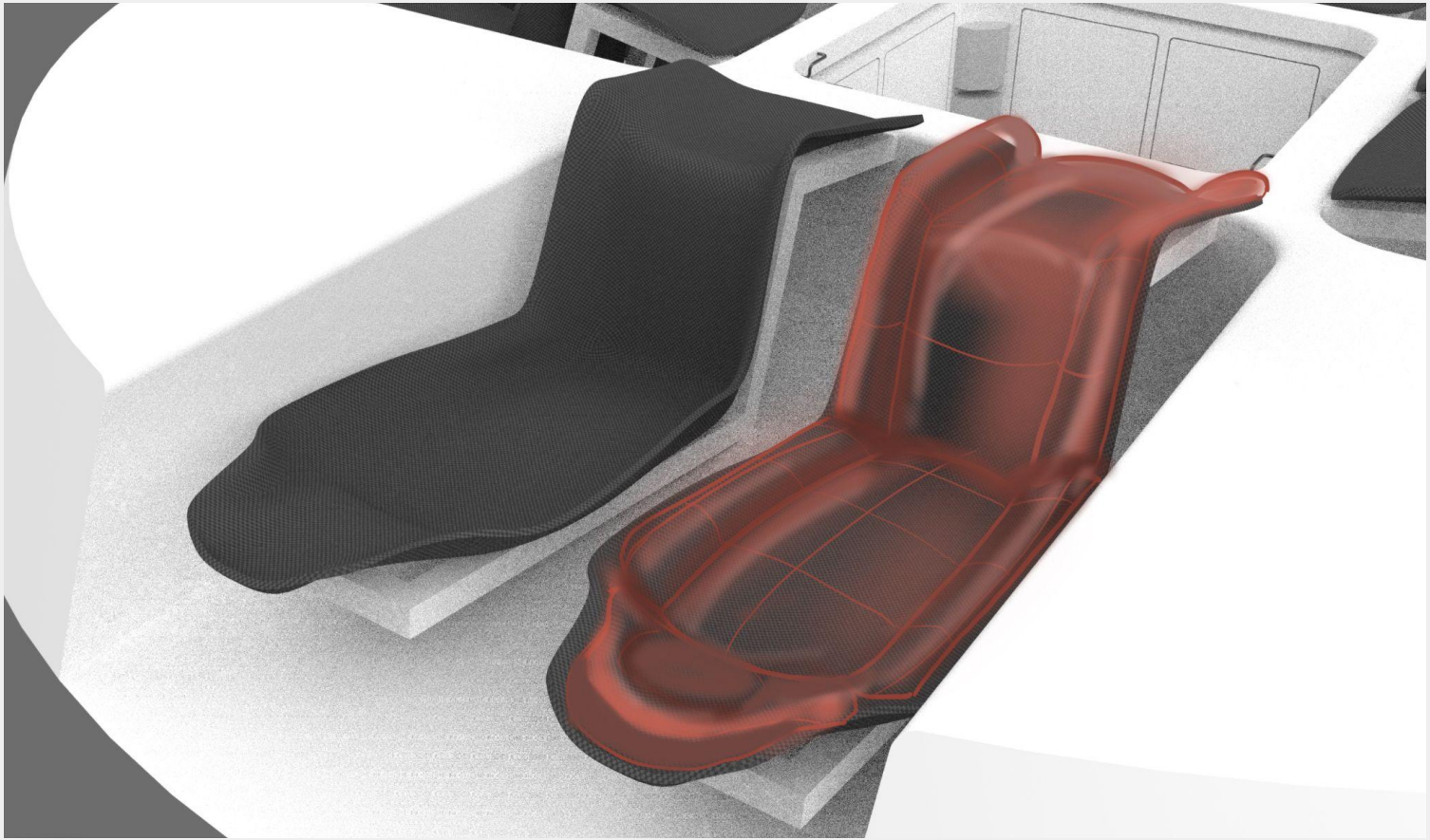


SEAT TESTING



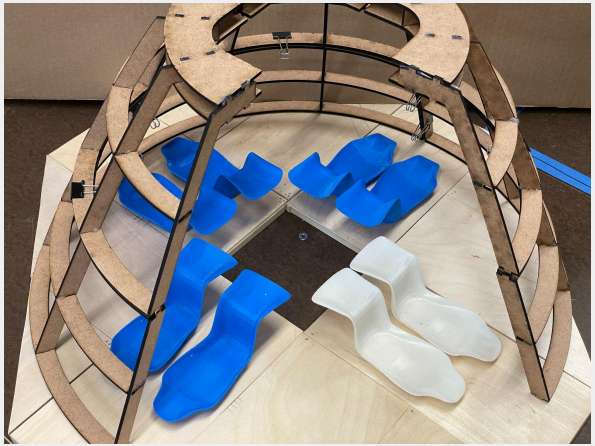


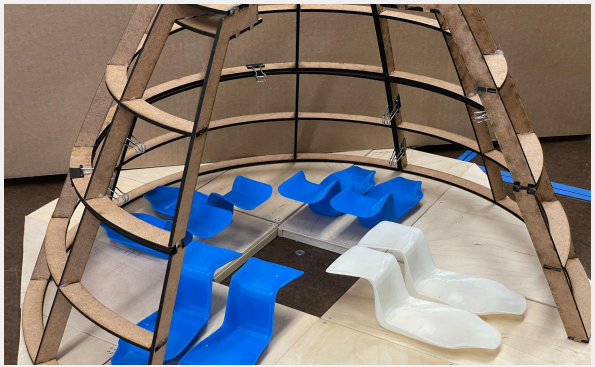
CHAIR ORTHOGRAPHIC



CHAIR RENDER

1:10
SCALE MODEL





1:10 SCALE MODEL

Thank You

Questions

Handles/straps

4-corner solutions

Upper space usage

Food and Water placement

Food/Rehydration

Overall Layout Thoughts

Sleeping Orientation/ configuration

Display Critique

Where best to add portholes/windows

APPENDIX

Human Factors (consumption)

Item	Single Astronaut Daily Amounts	Total Trip Amounts
Food	2500 Calories	150,000 Calories
Water	2 quarts	29 Gallons
Oxygen	20 Cubic Feet	1120 Cubic Feet
Waste	1 Pound	56 lbs

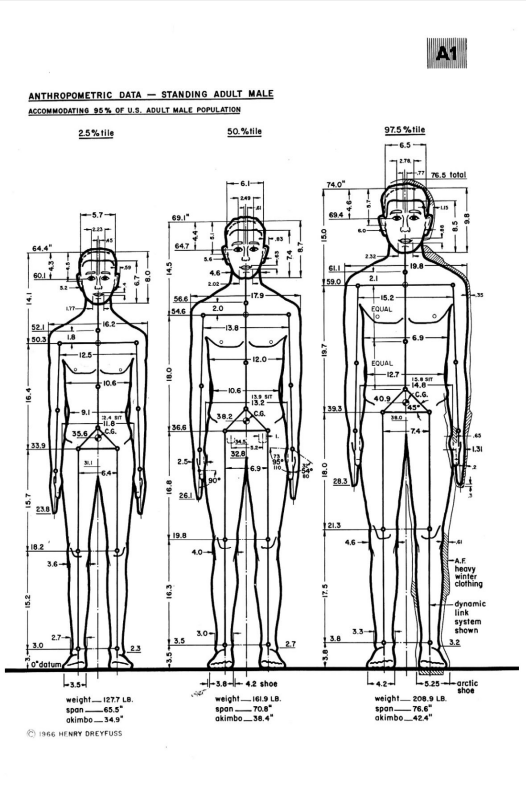
Propellant

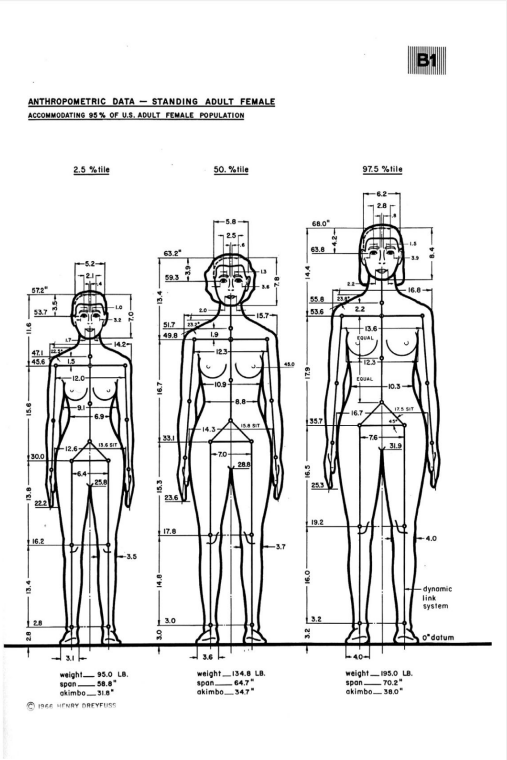
- Spacex's Draco and SuperDraco engines provide a fault-tolerant launch system
- 8 SuperDraco's offer around 570,000 newtons of thrust
- 16 Draco thrusters form the Reaction Control System (RCS)
- Hypergolic non-cryogenic Nitrogen tetroxide + Monomethylhydrazine
- In Situ Resource Utilization (ISRU) may be a better system design for martian but what not considered for this report as ISRU is not a tested reality yet for the first martian missions

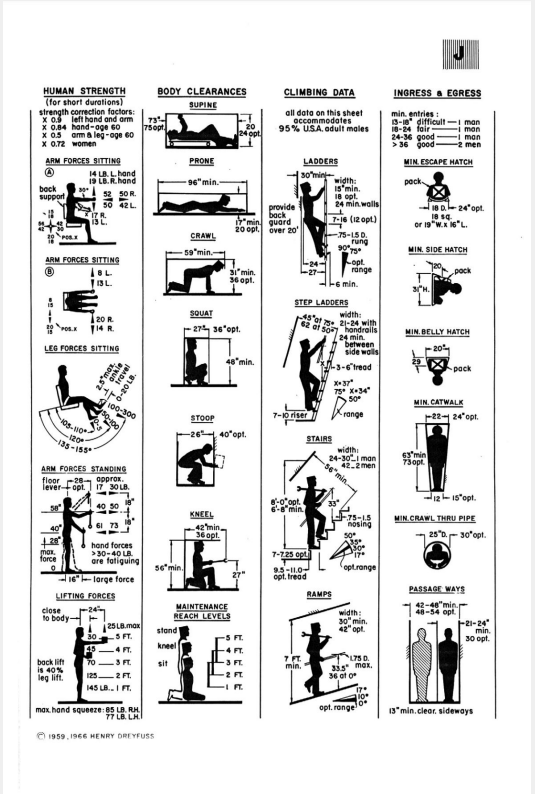
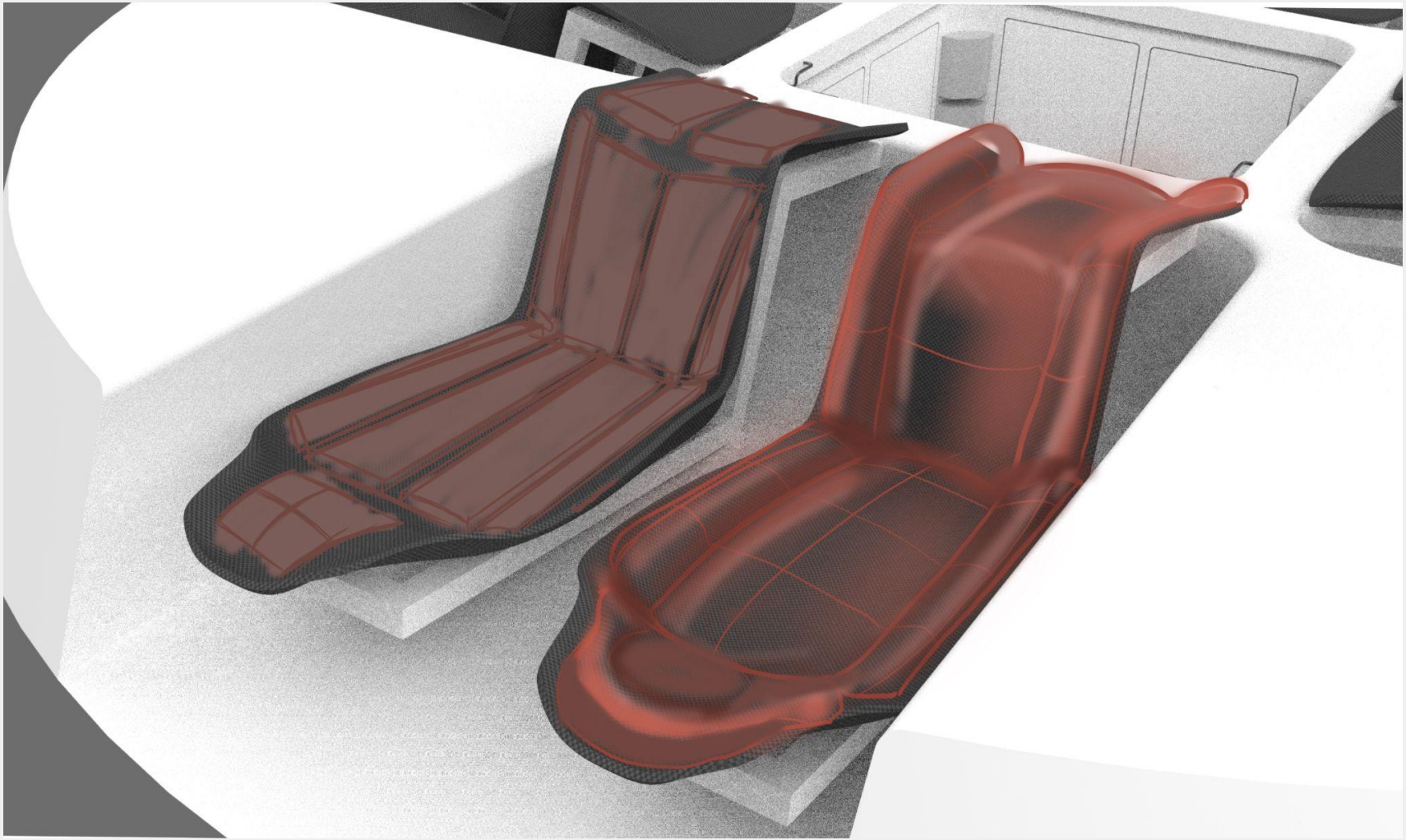
Volumetric and Mass Estimates

Food Storage	Water Storage	Biological Waste	Sample Storage
Mass: 60 lbs	Mass: 247 lbs	Mass: 56 lbs	Mass: 1500 lbs
Volume: 0.4 ft^3	Volume: 3.96 ft^3	Volume: 0.9 ft^3	Volume: 6.2 ft^3

ECLLS	Personel	Fuel (N_2O_4+CH_3NH_2)	Structure
Mass:~1000 lbs	Mass: 1,120 lbs	Mass: ~1500 lbs	Mass: 56,000 lbs
Volume: 50 ft^3	Volume: 20 ft^3	Volume: ~9 ft^3	Volume: 938.29 ft^3


A1
ANTHROPOMETRIC DATA — STANDING ADULT MALE
ACCOMMODATING 95% OF U.S. ADULT MALE POPULATION
2.5% tile
50.% tile
97.5 % tile
weight — 127.7 LB.
span — 65.5"
akimbo — 34.9"
weight — 161.9 LB.
span — 70.8"
akimbo — 38.4"
weight — 208.9 LB.
span — 76.6"
akimbo — 42.4"
© 1966 HENRY DREYFUSS


B1
ANTHROPOMETRIC DATA — STANDING ADULT FEMALE
ACCOMMODATING 95% OF U.S. ADULT FEMALE POPULATION
2.5 % tile
50. % tile
97.5 % tile
weight — 95.0 LB.
span — 58.8"
akimbo — 31.8"
weight — 134.9 LB.
span — 64.3"
akimbo — 34.7"
weight — 195.0 LB.
span — 70.8"
akimbo — 38.0"
© 1966 HENRY DREYFUSS


J
HUMAN STRENGTH
(for short durations)
BODY CLEARANCES
CLIMBING DATA
INGRESS & EGRESS
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