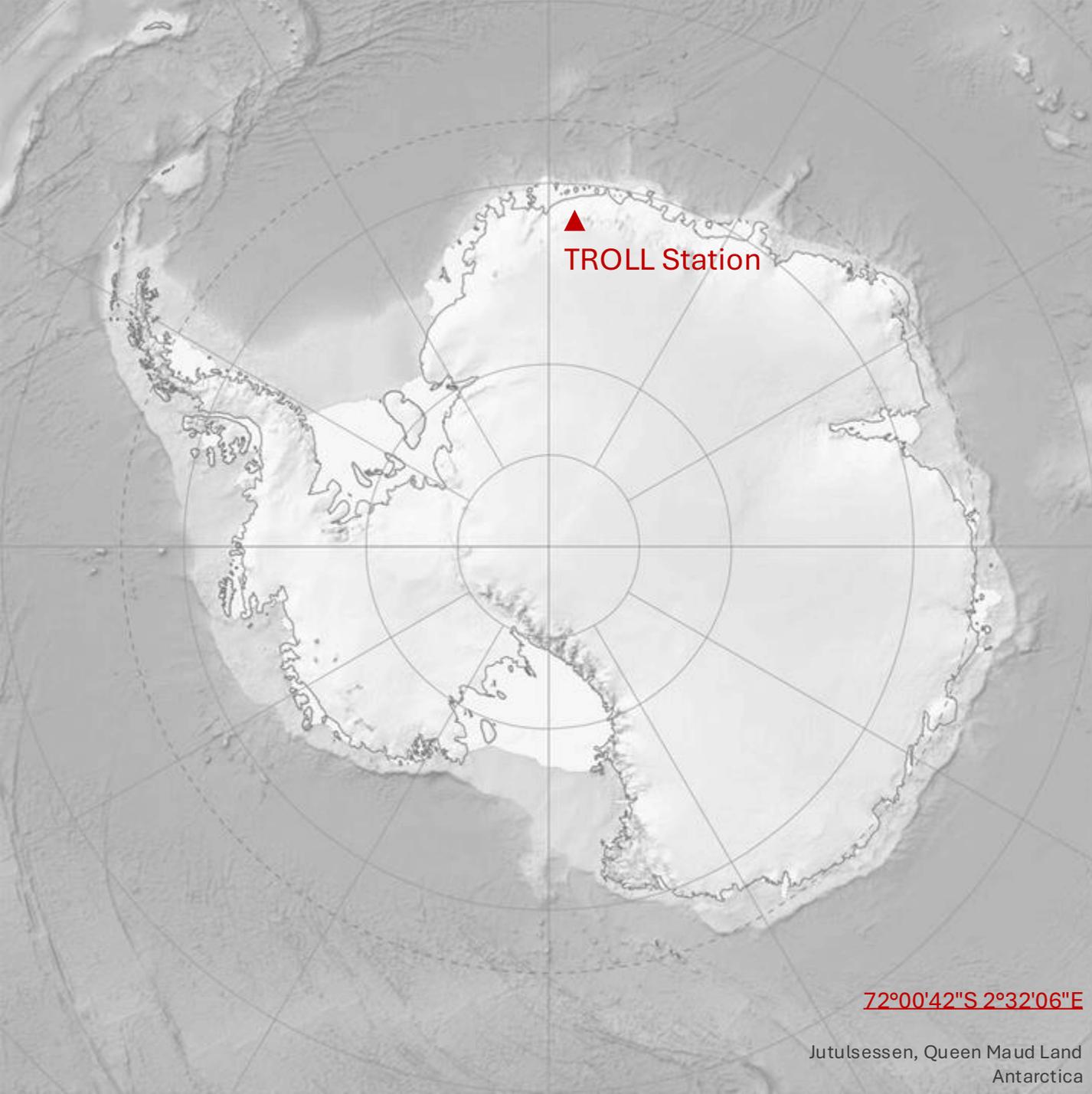


Mission-driven habitability

Designing habitats to support mission-driven confinement,
TROLL Station Containers



Weather conditions

Annual mean temperature \ -25°C [-13°F]

Summer \ November 9th to February 1st, midnight sun

Winter \ May 15th to July 27th, polar night

Want to learn more about weather data? →

Staff and housing

Number of staff **peak season**, summer \ 35

Number of staff **off season**, winter \ 6

Area under roof \ 1500 m²

Max. number of visitors at a time \ 70

Showers \ Yes

Laundry facilities \ Yes

Power supply - period \ 24 hours

Power sources at station \ Diesel, oil, gas, solar, wind

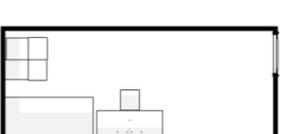
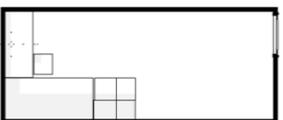
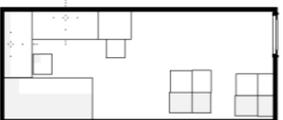
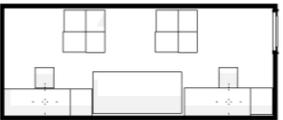
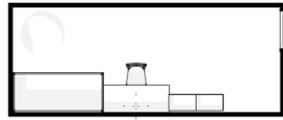
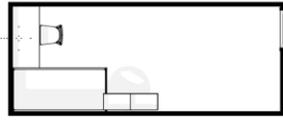
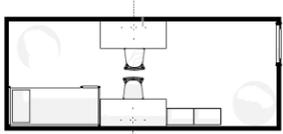
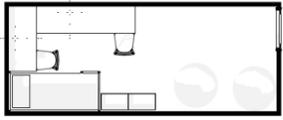
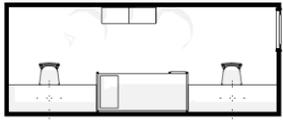
Waste management \ Yes

Hazard(ous) management \ Yes

Want to learn more about ongoing missions? →

72°00'42"S 2°32'06"E

Jutulsessen, Queen Maud Land
Antarctica



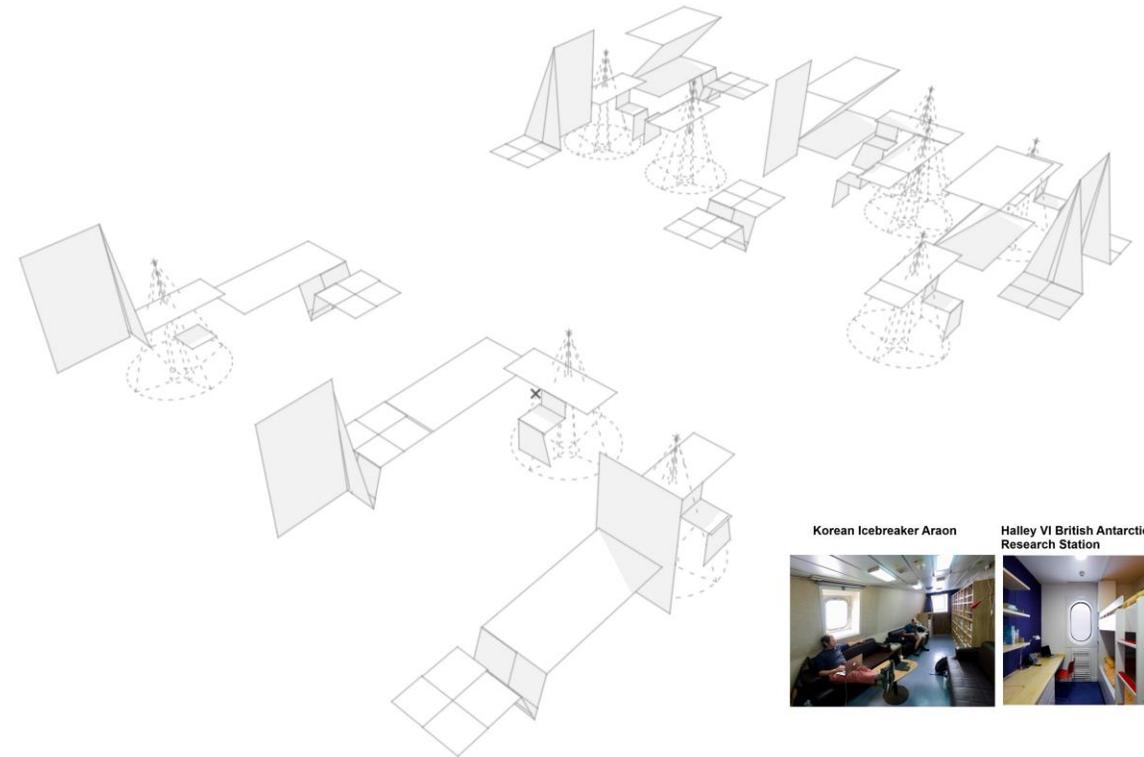
2 person container

1 person container

Design ideas

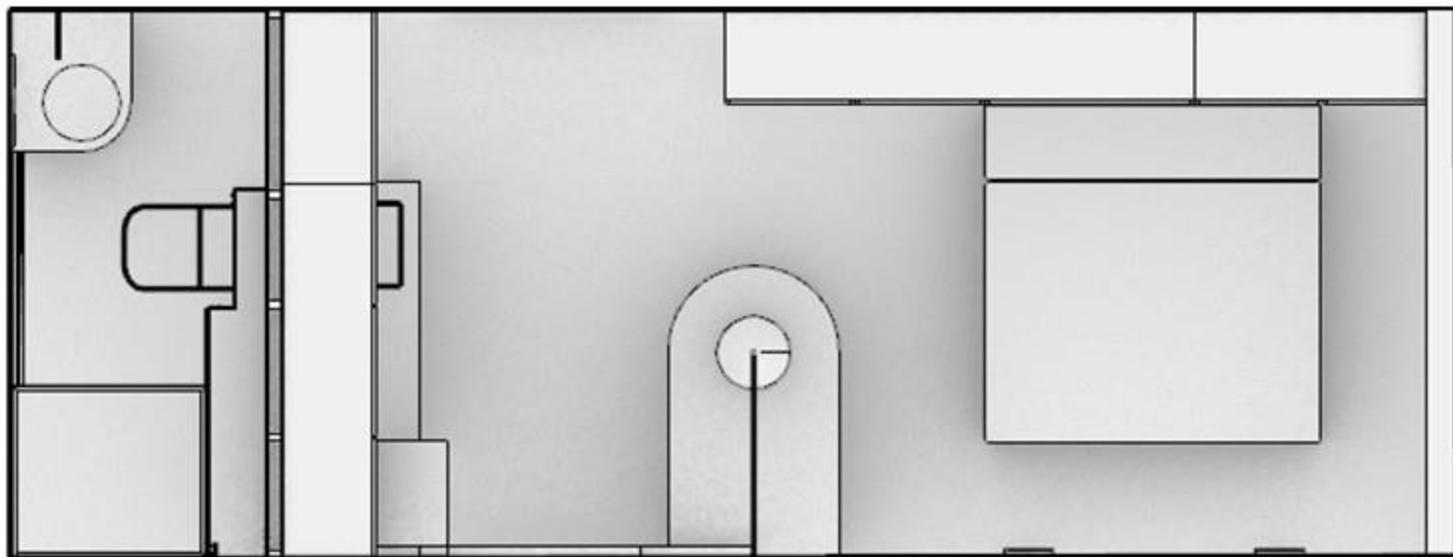
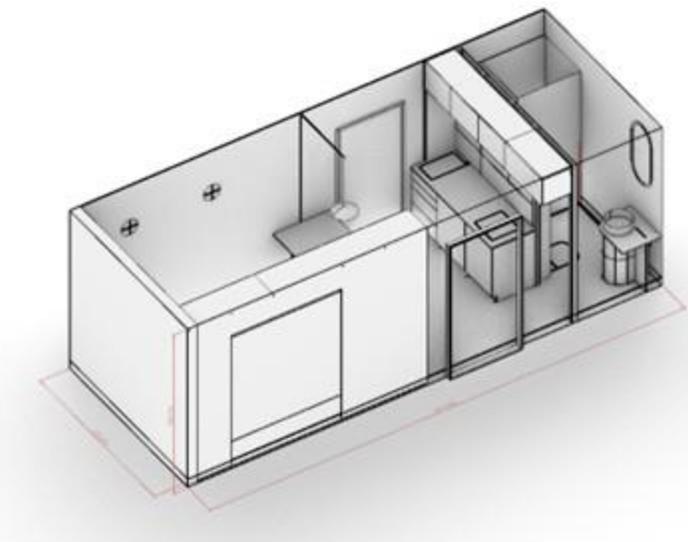
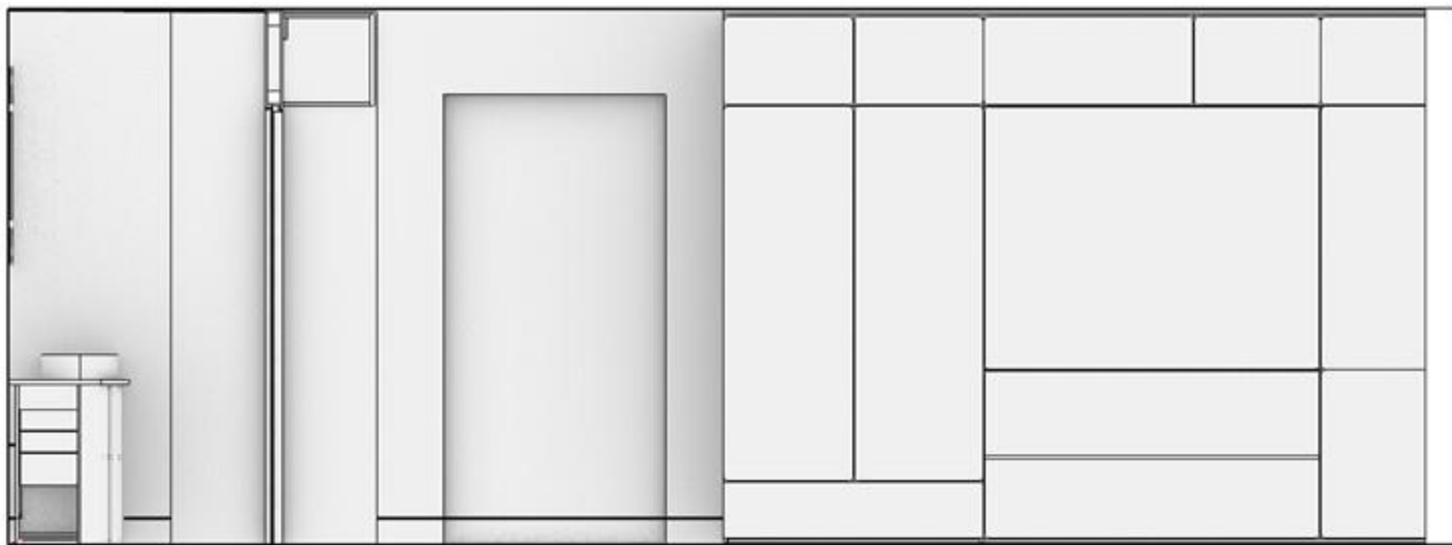
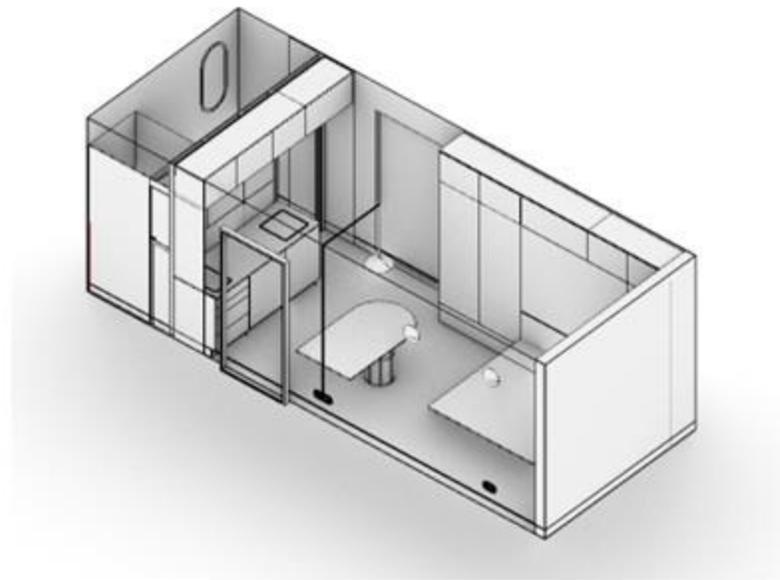
Looking at other arctic research stations such as the Halley VI British Antarctic Research station, a few alternatives were designed with the minimally required furniture. They were designed with both 1 and 2 people in mind. As such, these spaces contain beds, tables and extra leisure objects such as a bookshelf and a reading chair.

The planes of the objects were used to create some foldable objects.



Korean Icebreaker Araon

Halley VI British Antarctic Research Station

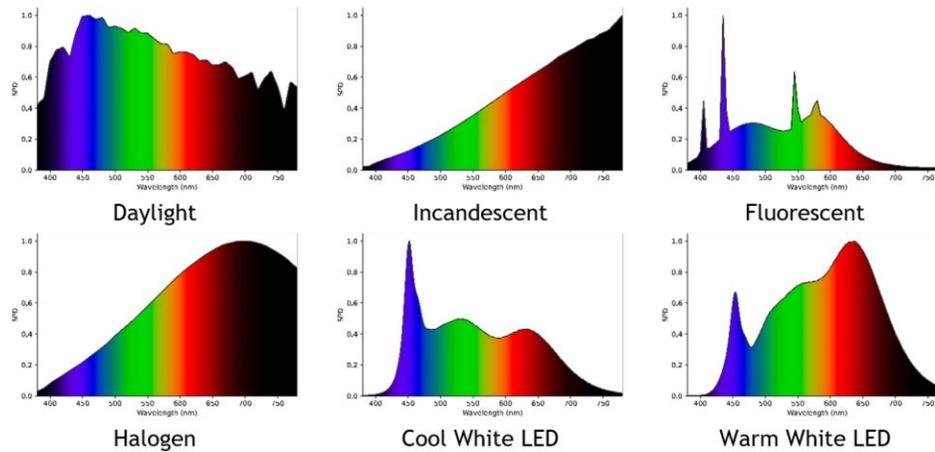
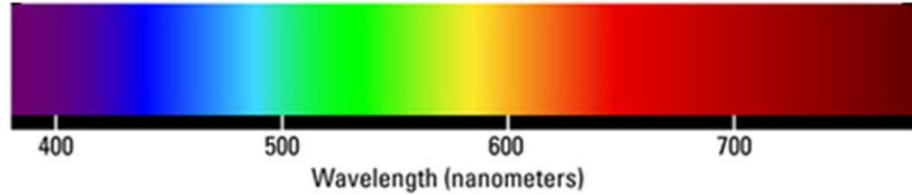


Artificial light and Well-being

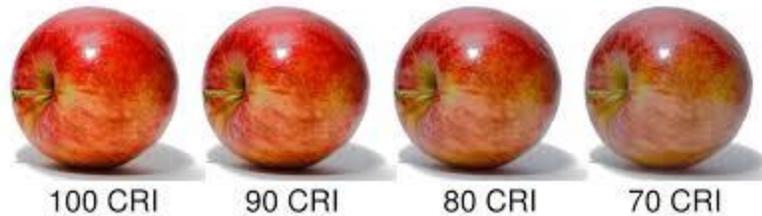
Circadian rhythm and melanopic lighting

Using LED lighting at different CCTs can help regulate circadian rhythm.

- Cold White Light LEDs promote wakefulness: produce bright light heavy with blue light which suppresses melatonin production.
- Warm Light LEDs promote restfulness: produces low levels/ no blue light, allowing the person to go to sleep



Light emission spectrum of different light sources

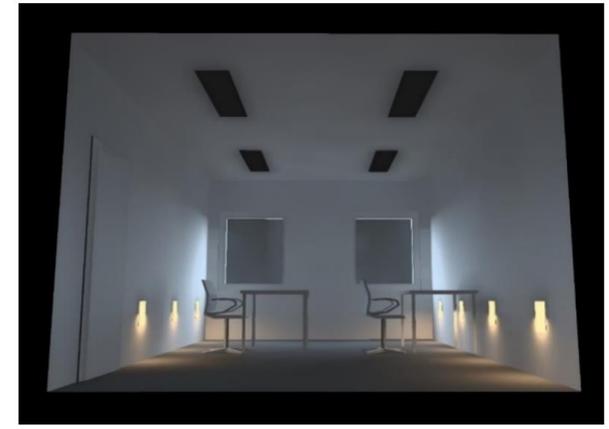
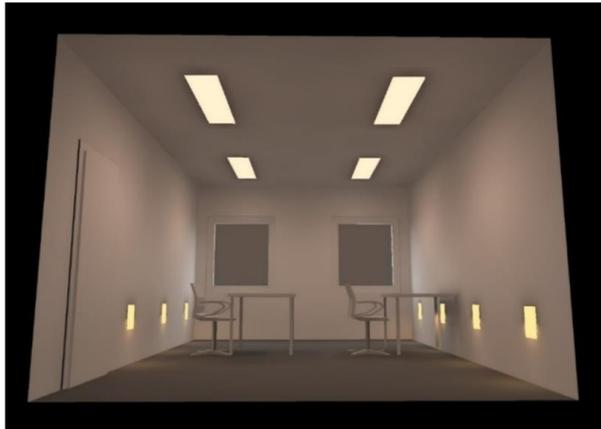
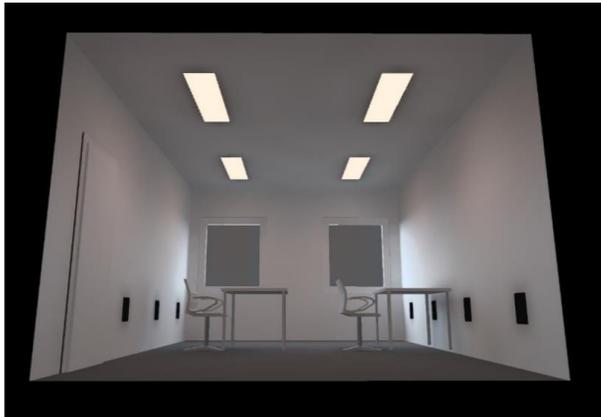
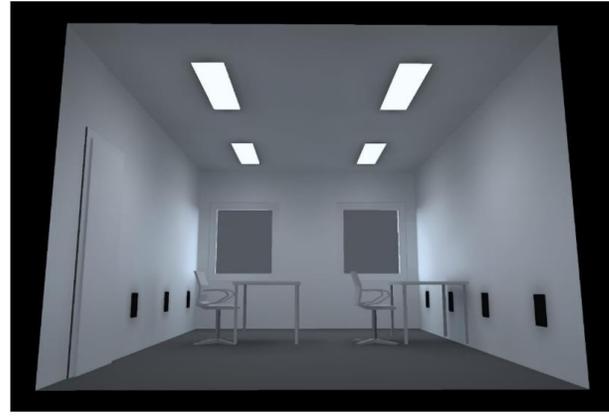
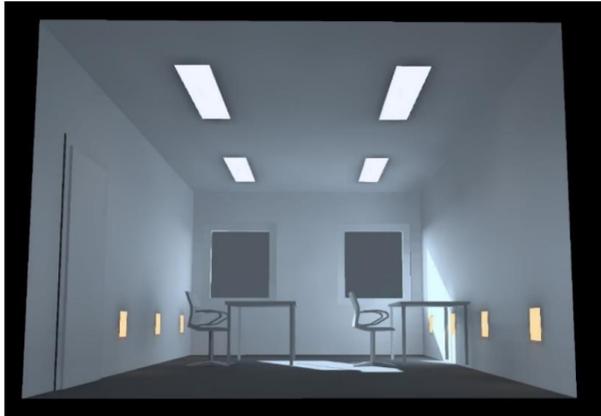


Colour rendering index grades and effects

Wellbeing and colour rendering index (CRI)

CRI is a measure of the similarity of colour representation under artificial light as compared to sunshine.

Most LEDs have a CRI of 90 or higher so they provide visual comfort and a pleasant atmosphere similar to natural conditions.



Initial Ideas for Lighting Cycle

Day – Night lighting cycle

The initial idea is based on creating a cycle with cool white light in the morning that slowly increases in brightness to wake the person up and reinvigorate them for the day. As time progresses, the light warms in color allowing the body to enable melatonin production and get ready for bed, also dimming in the process.

This cycle is activated with a switch in the morning and is only on when the PIR sensors detect a person going about their day to day tasks in the container.

Insulation, Walls, Windows

Insulation \ Opposed to the typical R-20, extreme weather conditions require R-30 to R-60 and above

- R-60 Values are accomplished through blown-in cellulose, air pockets, and vapor barriers
- Low moisture system ensures no mold

Analysis \ High R-Value is essential to keeping personnel in a comfortable environment year-round

Application \ Potential use of rigid foam board as a material, along with air pockets to provide extra insulation

Windows \ Important to introducing sunlight during the summer solstice

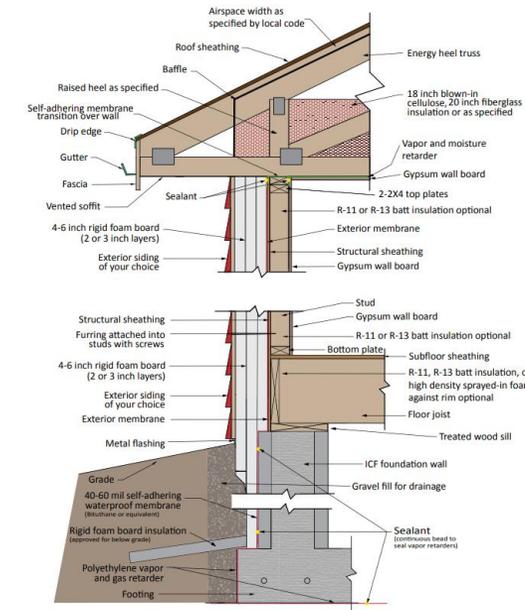
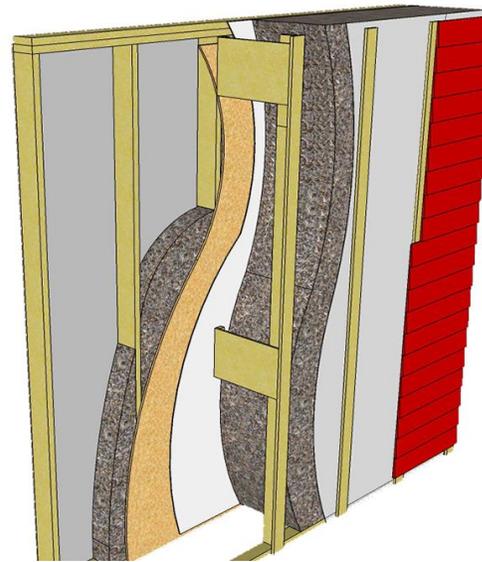
- Multi-pane, **high-insulation glazing**
- Equipped with thermally broken frames and tight seals
- Designed to reduce heat loss and handle strong winds

Analysis \

\ Small to moderate in size to trade visibility for performance

\ More glass is beneficial for human health, but becomes increasingly more expensive and harder to maintain

Application \ Windows still should be considered as an area of heat loss and should be avoided as such



Human Perception & Atmosphere in Extreme Environments

Aim:

To enhance emotional well-being, spatial orientation, and comfort through perceptive and atmospheric intelligence.

Main issue:

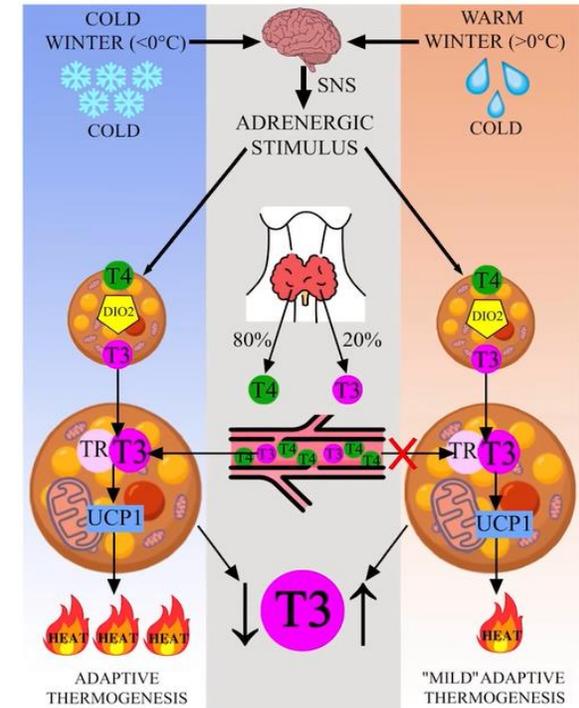
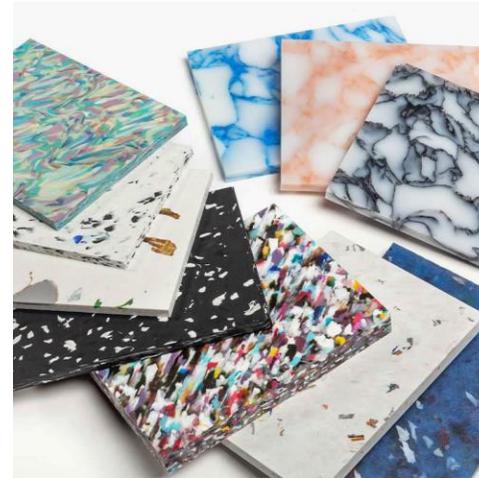
mood disturbances, cognitive impairment, sleep disruption

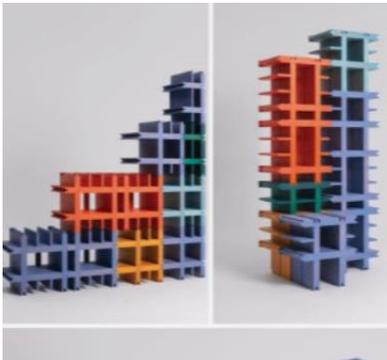
Visual: Months of darkness or brightness disrupt circadian rhythm > Use adaptive, tunable lighting

Spatial: Small repetitive container modules cause spatial fatigue > Reconfigurable Voronoi geometry adds variation.

Tactile: Cold, smooth surfaces feel impersonal > Textured recycled plastic gives warmth and softness.

Psychological: Isolation reduces emotional engagement > Interactive environment creates agency and connection.

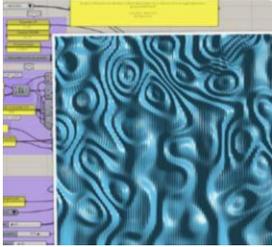
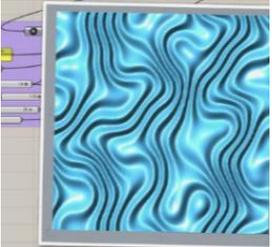
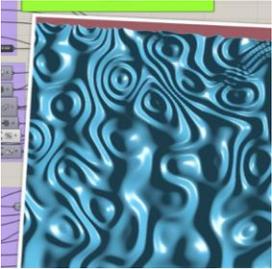
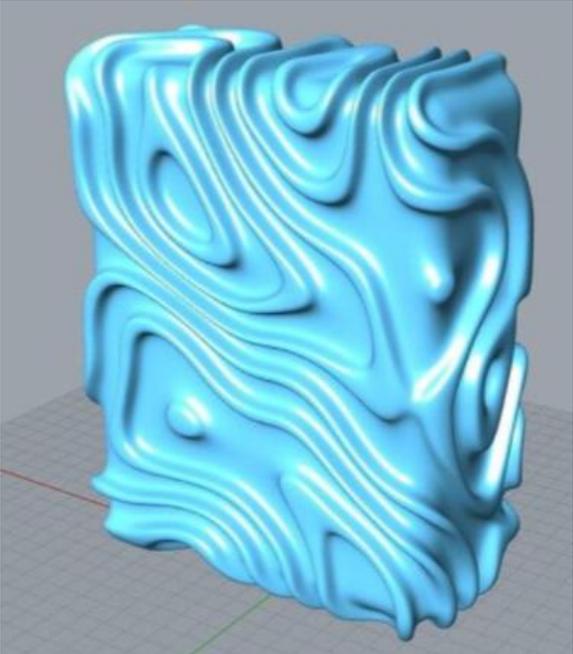




First impressions and assembly options

1. Basic foldable elements (90' , 180')
2. Attached elements
 - 2.1. point grid pinned
 - 2.2. linear (or other) attached
 - 2.3. linear inserted
3. "Puzzle" elements
4. "Harmonic" foldable elements
 - 4.1 horizontal
 - 4.2. vertical
5. Sliding elements (hidden inside walls / floors/ ceilings)

Example of possible geometry



**Example of possible geometry
- impressions**



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