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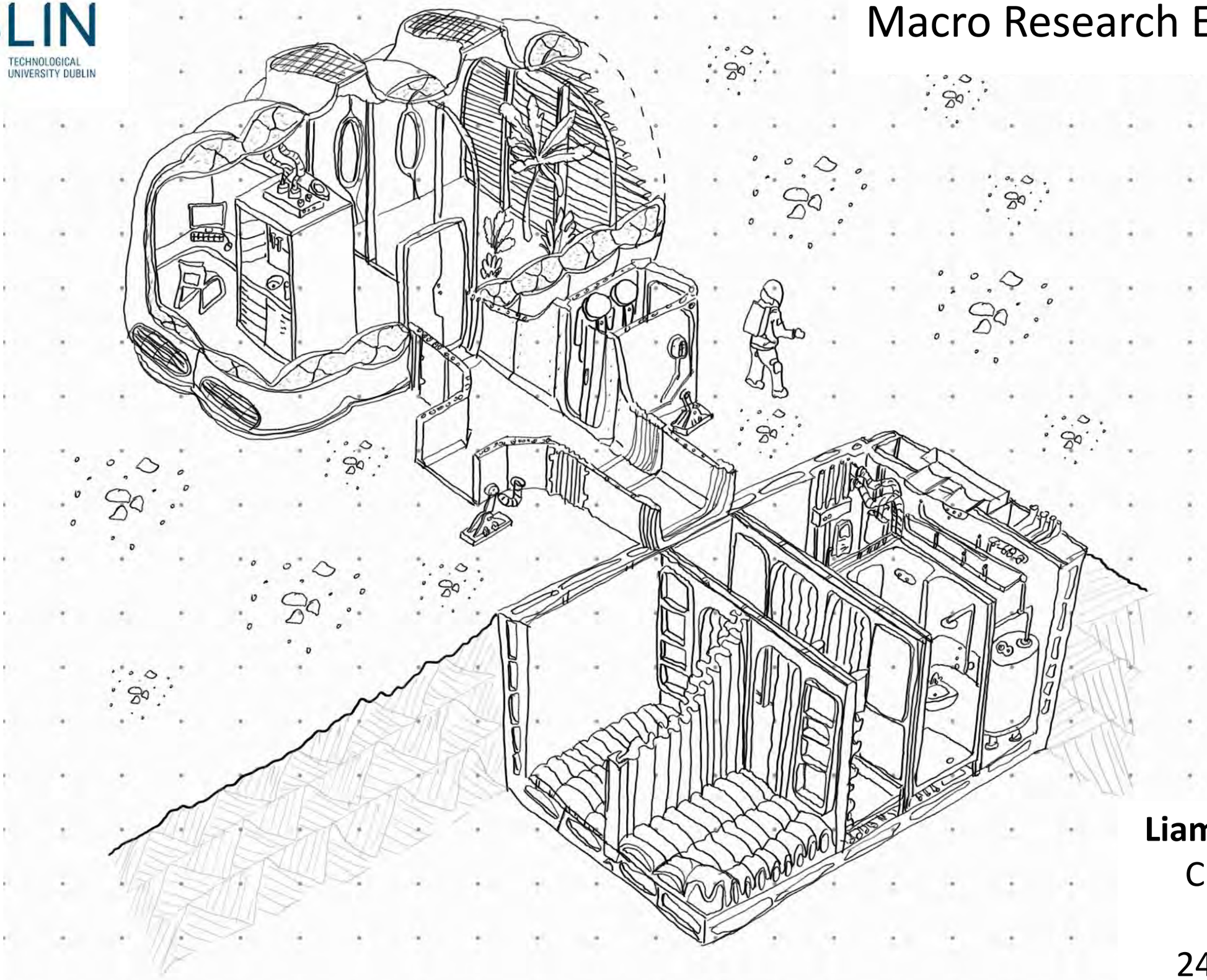
DUBLIN
TECHNOLOGICAL UNIVERSITY DUBLIN

TDS - Assignment T4.3

Macro Research Esquisse



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DT175 04
24/02/2021

Contents

Shackleton Hugh Broughton webinar notes	1
Architecture Today Hugh Broughton webinar notes	2
A Case for Mars book notes	2,3
Ice Station book notes	3,4
The Martian House 3D sketch study	5-8
The Martian House plans	8-9
The Martian House elevations, section & 3D	10
Objectives brainstorm	11
Experiments ideas	11-13
Mars Facts infographic	13-14
Halley VI 3D & panel joint detail sketches	15
Halley VI snowdrift strategy sketches	16
Halley VI connected modules 3D sketch	17
Halley VI construction sequence	17-19
Map of Antarctica	19
Halley VI bedroom module plan, section & elevation	20
Defective & amended panel joint detail	21
Delivery method to site sketches	22
Research focus options brainstorm	22
Infographic icon sketches	23-24
References	25

Shakleton HBA Talk 30/01/21

- Antarctica population : 2000.

- Temp. drops to -55°C.
- Never above freezing.

- February - November : 105 days of darkness.
- Physcdigycdy challenging.

- Halley III-IV designed to be burried.

- Belgium station = zero-carbon.

- Testing
- Air tightness.
- See if it could all fit together.

- Aerogel in glazing.

- Snow drift test
- Model in water.
- Set a current in water.
- Pour coord in the water.
- Take model out to see sand settlement.

- Blinds to black out the sun in the summer.

Qs

Halley VI?
- Hydroponics.

Insulation?
- Used PIR foam for insulation.
- Stops water freezing within panel.

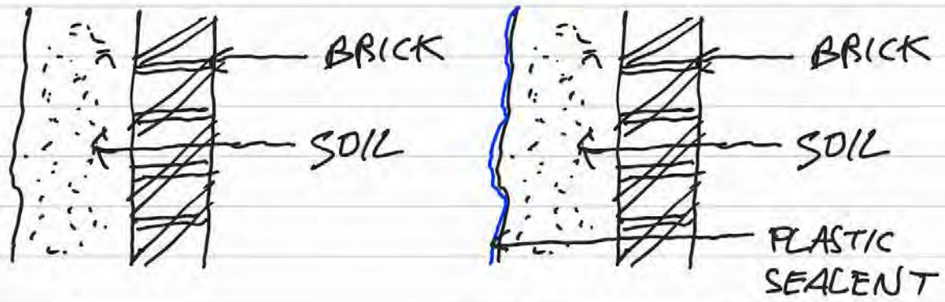
Mars house?
- Water usage - recycled water.
- Aergonomics of social spaces.
- Exercise spaces.

Architecture Today 2/2/2021

- Tests
- One of
  - 0.1 m^3 @ 4 air tightness.
- Train carriage style connections between modules.
- Double glazed system filled with aerogel.
- Zinc corrodes slowly.
- First principals design.
- CHP provide heat and electricity.
- Some stations powered by wind turbine farm.
- Vacuum drainge.
- Low water using fittings.
- Management of recommended shower time.

A Case for Mars

- Mars soil can be used to create bricks.
  - ↳ Contains iron, calcium, sulphur
- Brick vaults must be <u>covered in soil</u> to pressurise.
  - ↳ 2.5m deep
  - ↳ 1m may be enough.
  - ↳ creates radiation shield.
  - ↳ provides thermal insulation



- Potentialy leak air
- Potentialy slow down air leakage

- Mars dense atmosphere sheilds solar flares.
- Mars was once covered in water.
- Should position a base close to Northern polar cap.
  - ↳ 2,000,000 m^3 of water ice.
- In places soil is 40-60% water by weight.

- could freeze a brick instead of bake?

Ice Station Notes 17/2/21

- Sits on a shifting ice shelf.
- Subject to high winds.
- Annual build-up of snow.
  ↳ Burried previous stations.

- Months of light and dark.
  ↳ lamp simulates daylight (closed windows).

- Ship arrives twice in the summer.

- Lowest temp in the winter on record : -55°C.

- Snow never melts
  ↳ Blown by prevailing winds.
  ↳ Builds up against buildings.

  Base is lined perpendicular to winds direction.

- 7.2m of snow per year.

- Legs jack up building once a year during the summer.

- 106 days of darkness.

- Location is temporary
  ↳ ice shelf moves and breaks into ice bergs.

- Capacity :
- Summer : 16
- Winter : 52

UK / South Africa

- Modular construction - Prefabricated
  ↳ 12 week summer construction period.

- Sledge tow max weight: 8.5 tonnes (3.5 tonnes in the sledge)

- Skis can lock in place or rotate.

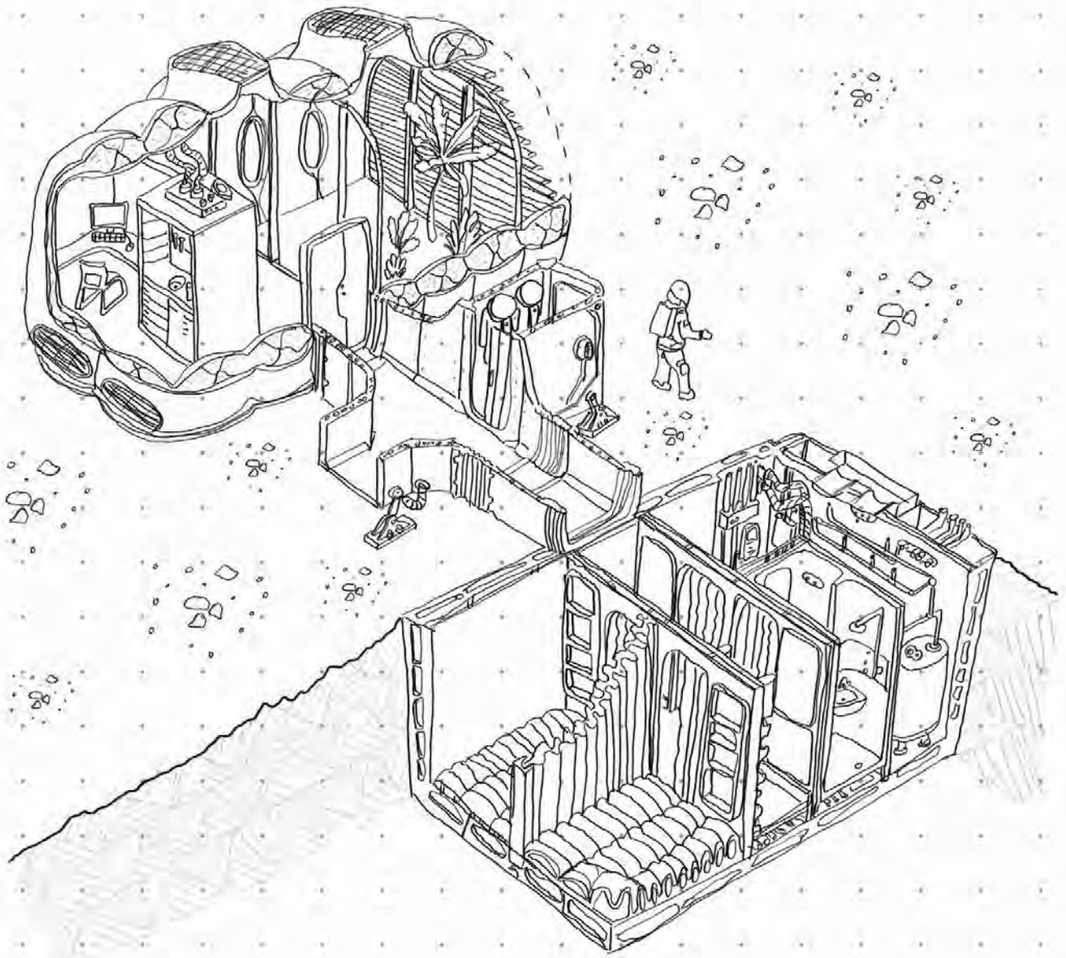
- Hydraulic legs.

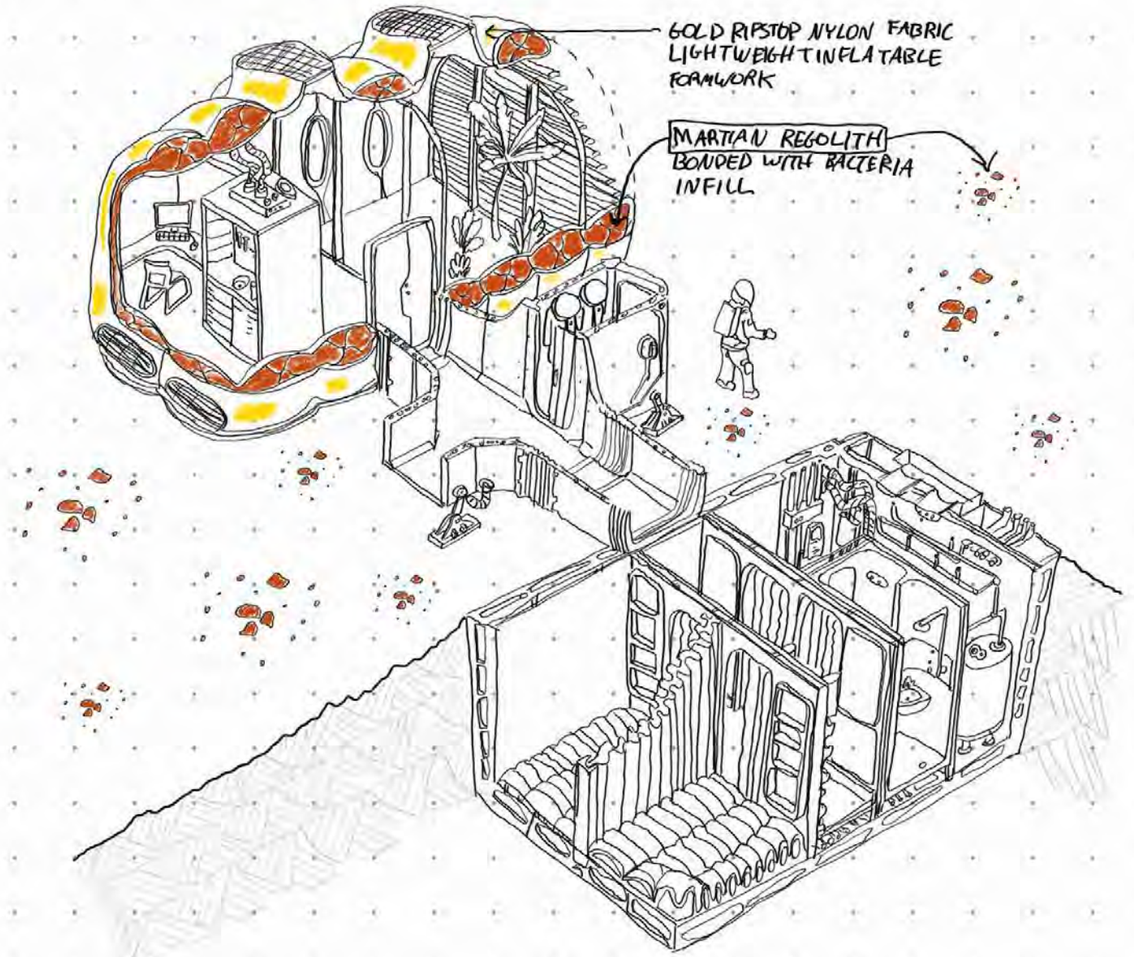
- Blue module erected in Cape Town to test hydraulics + air-tightness.

- 7.5% - average damage of materials on construction sites
  ↳ Must account for this by bringing additional materials.

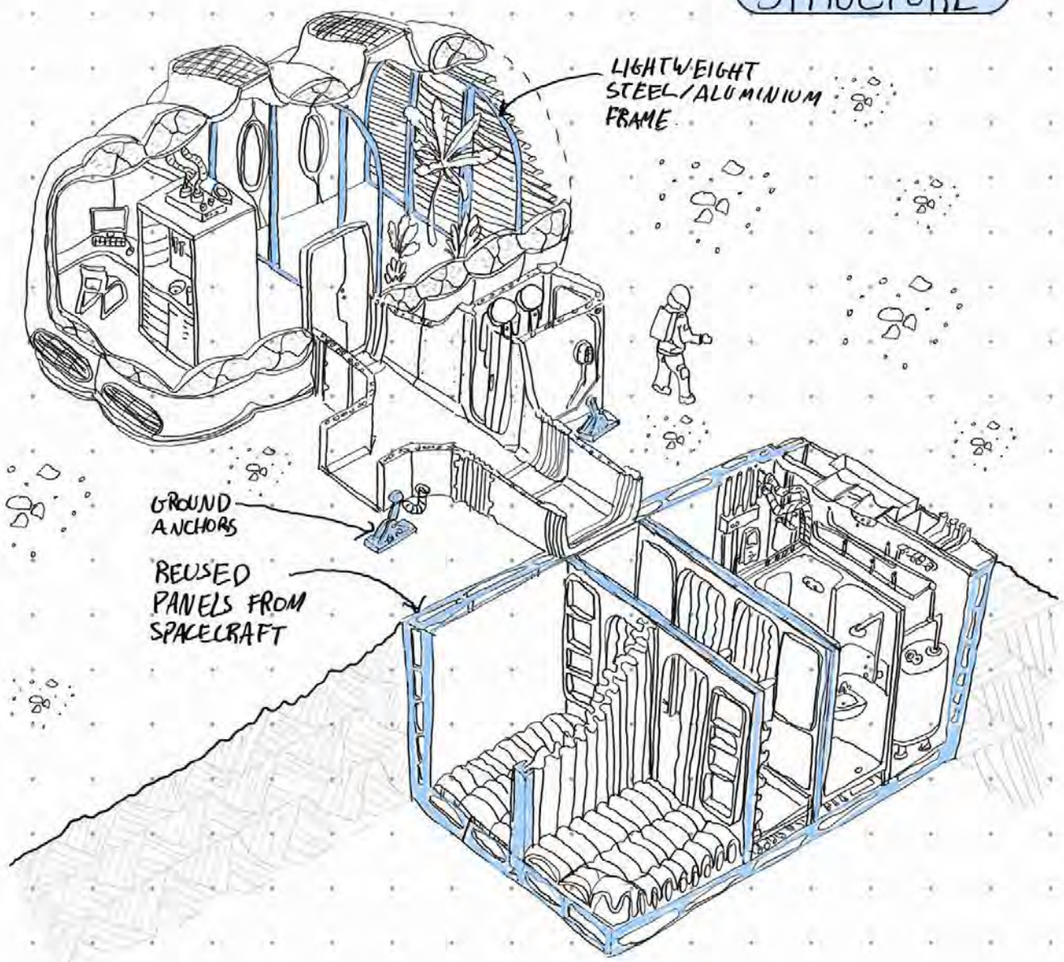
- Trellebory connectors between modules.

- Water sourced by melting snow in a melt tank.

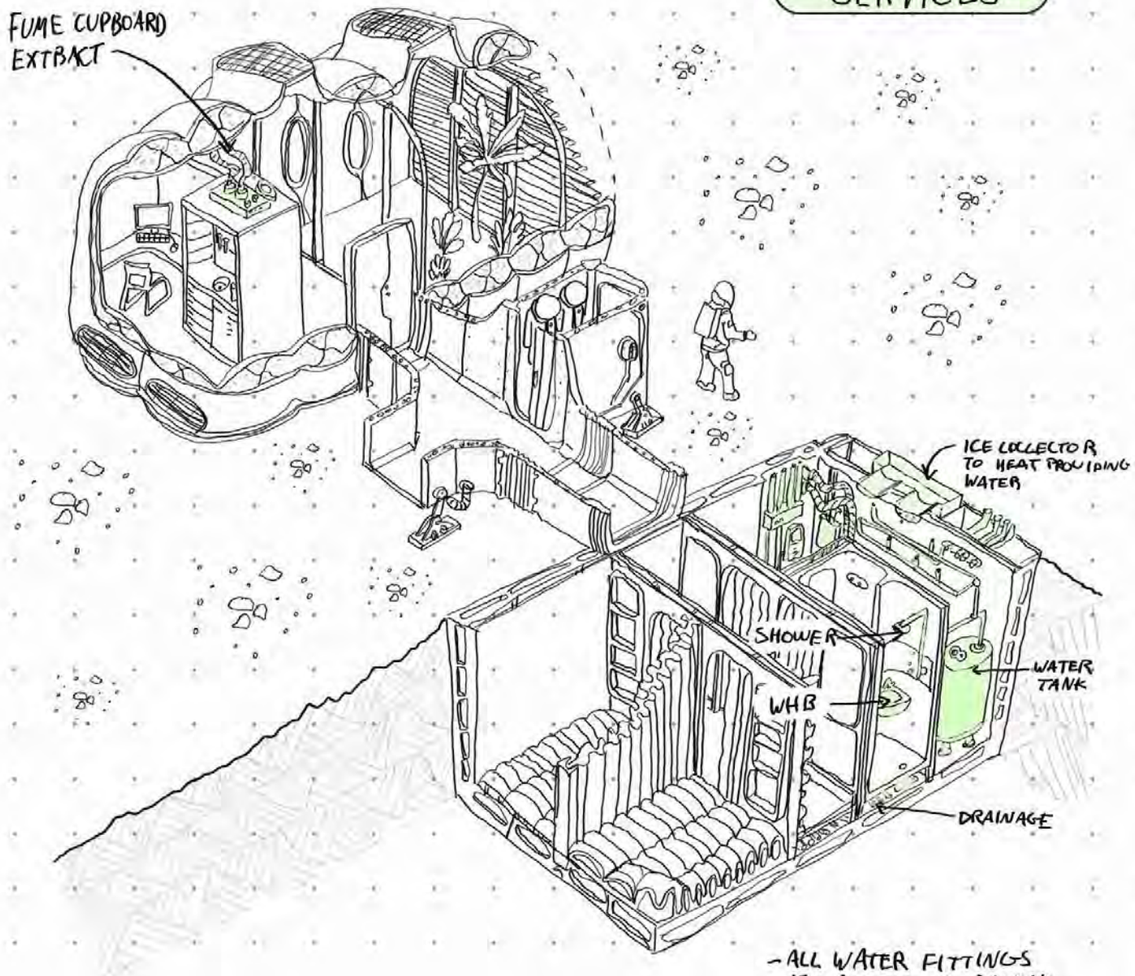



GOLD RIPSTOP NYLON FABRIC
LIGHTWEIGHT INFLATABLE
FORMWORK
MARTIAN REGOLITH
BONDED WITH BACTERIA
INFILL

STRUCTURE

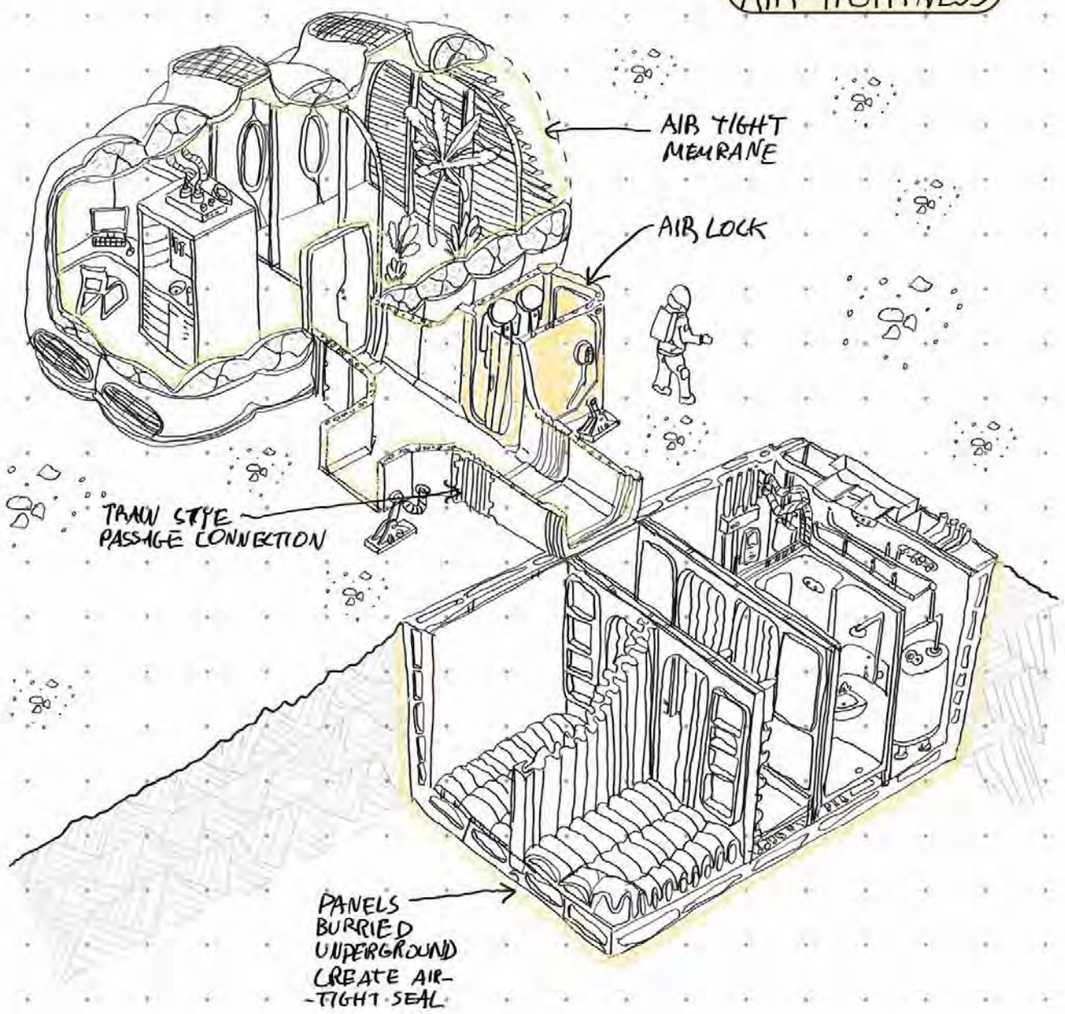


SERVICES

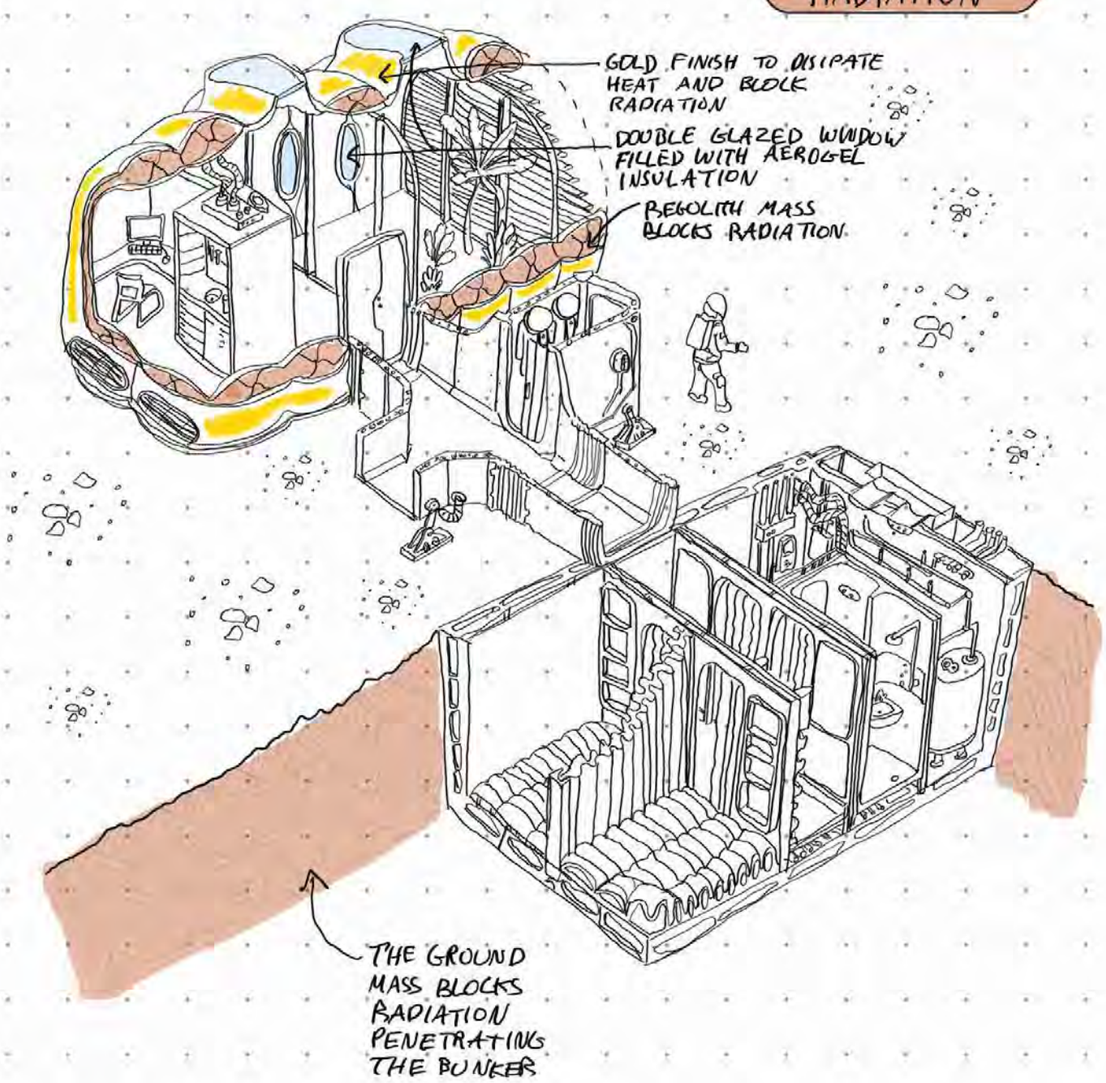


- ALL WATER FITTINGS TO BE WATER SAVING.
- VACUME DRAINAGE SYSTEM.

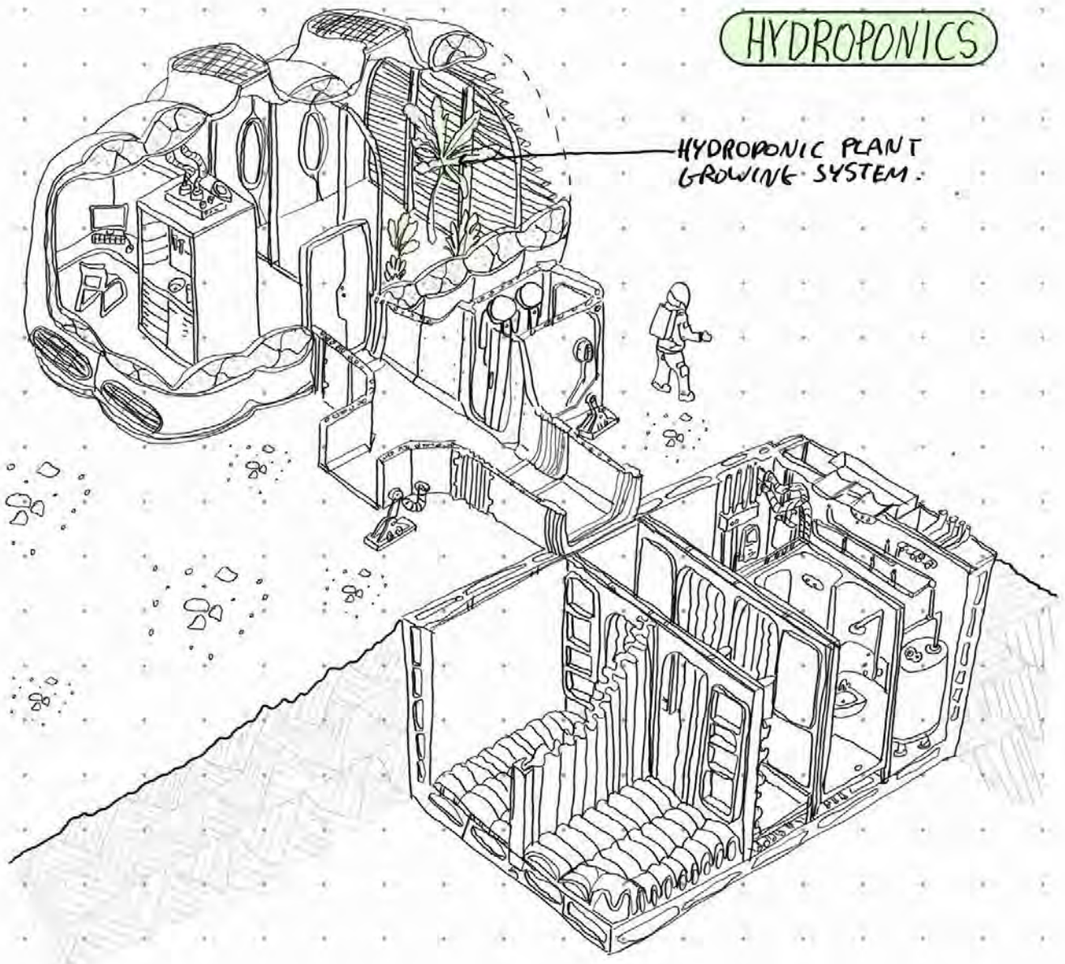
AIR-TIGHTNESS

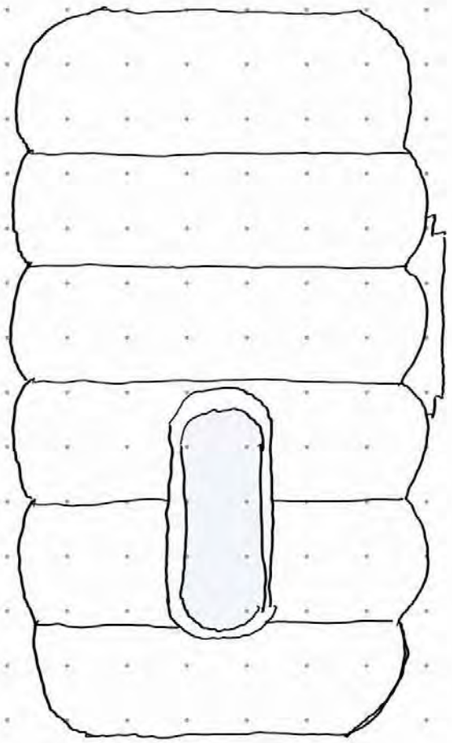


RADIATION

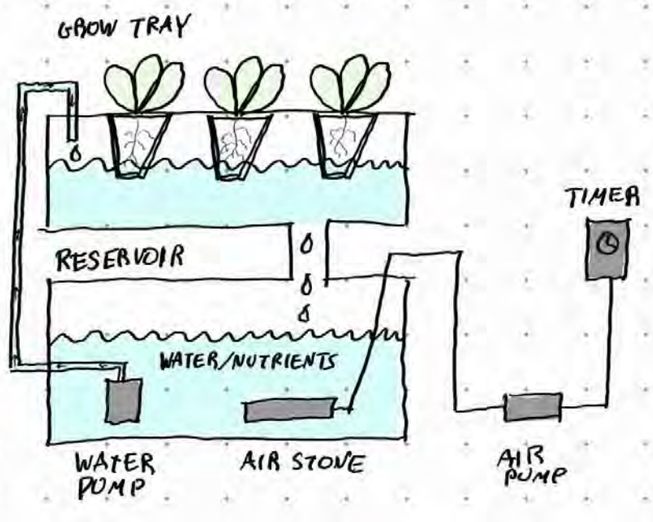


HYDROPONICS

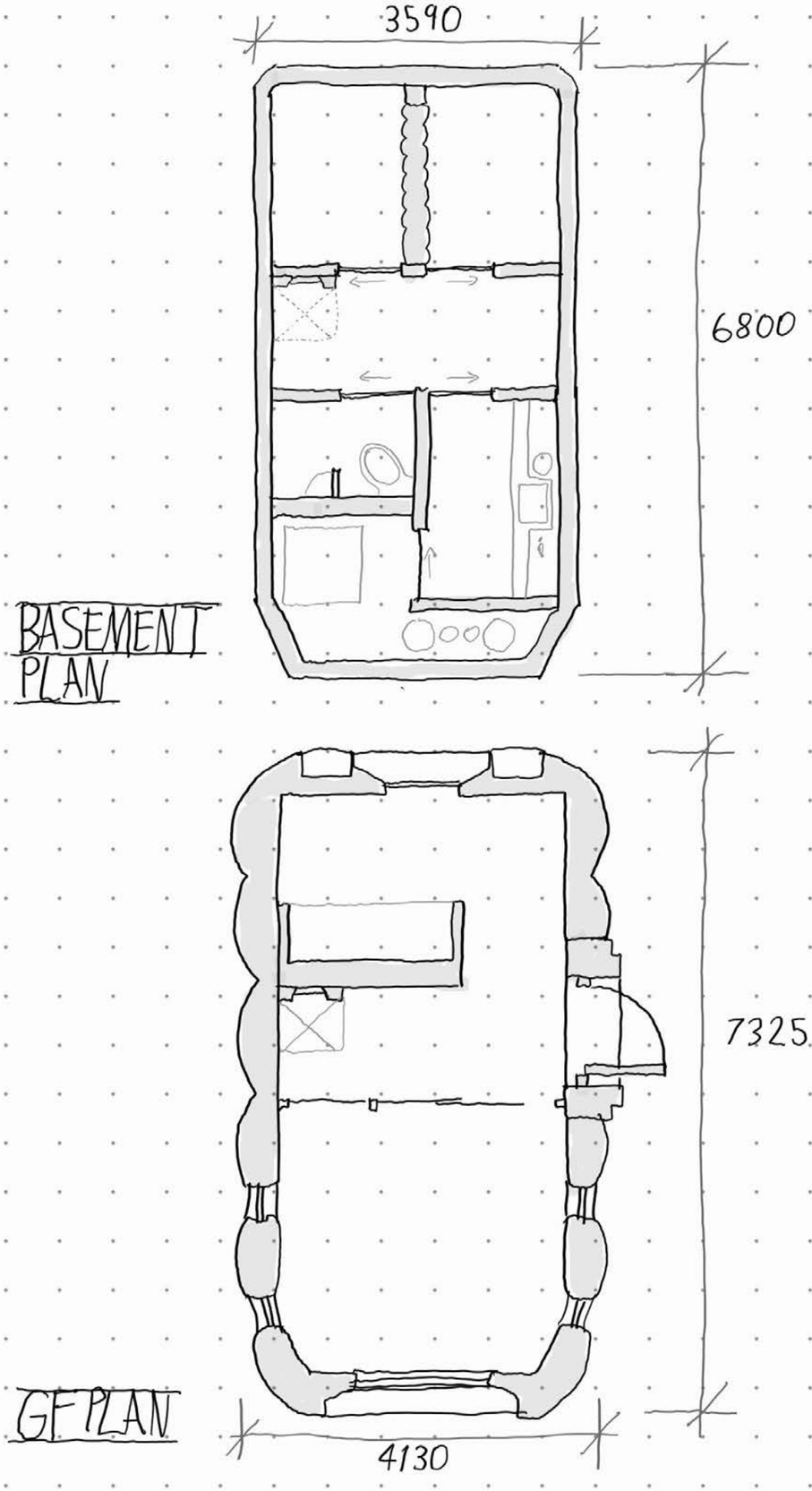


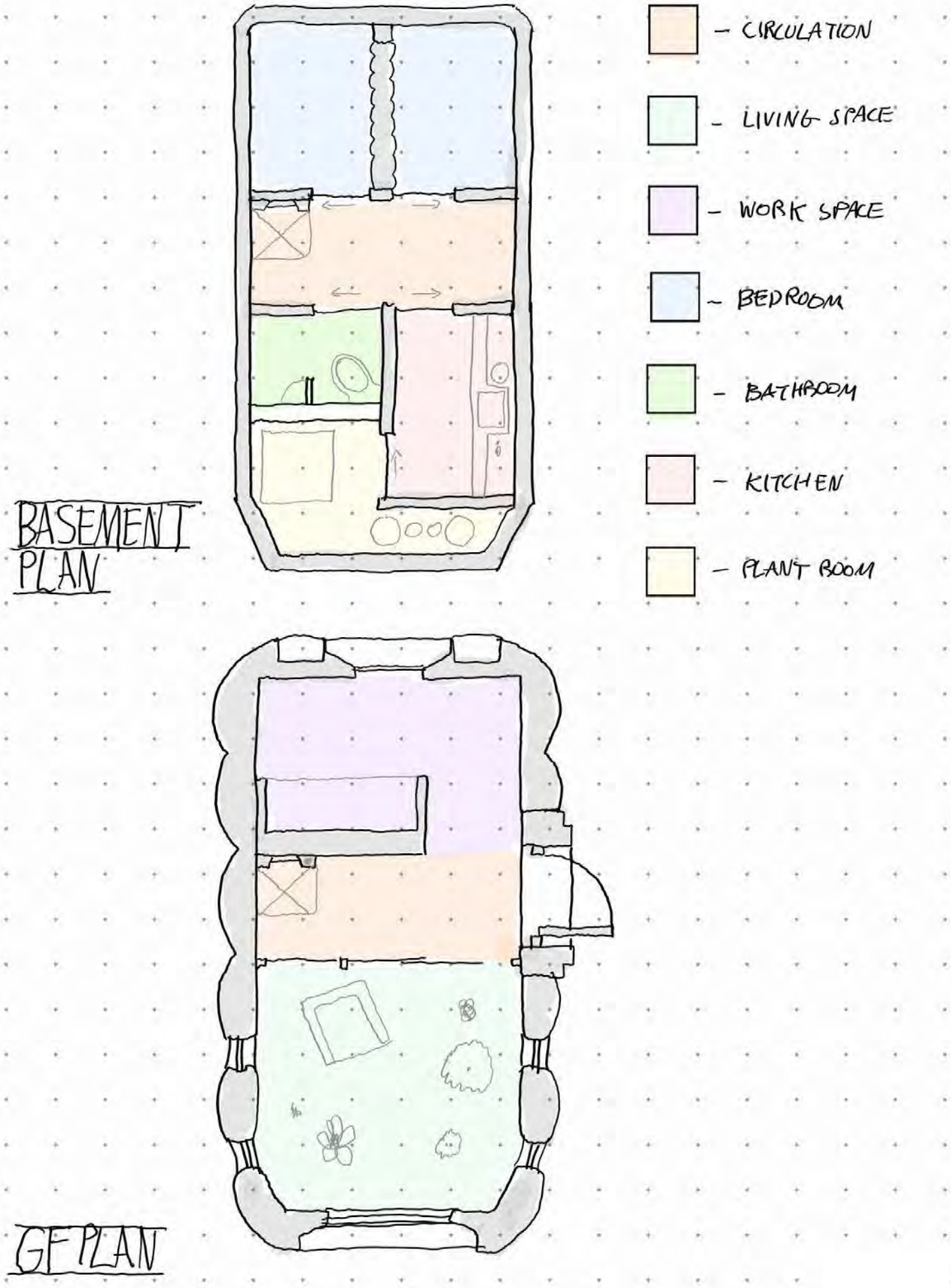


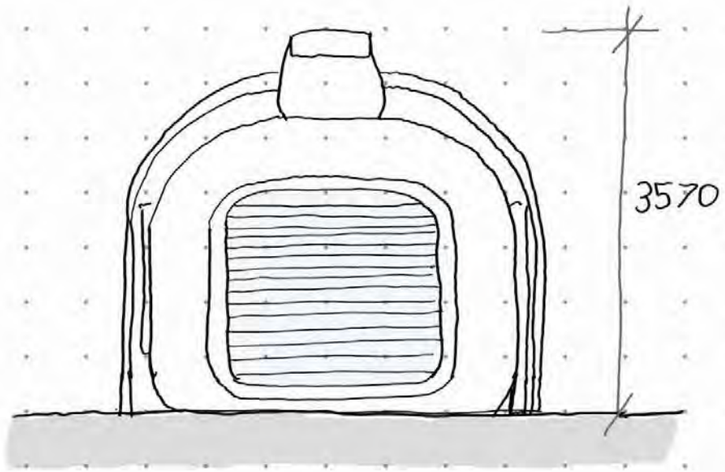
ROOF PLAN



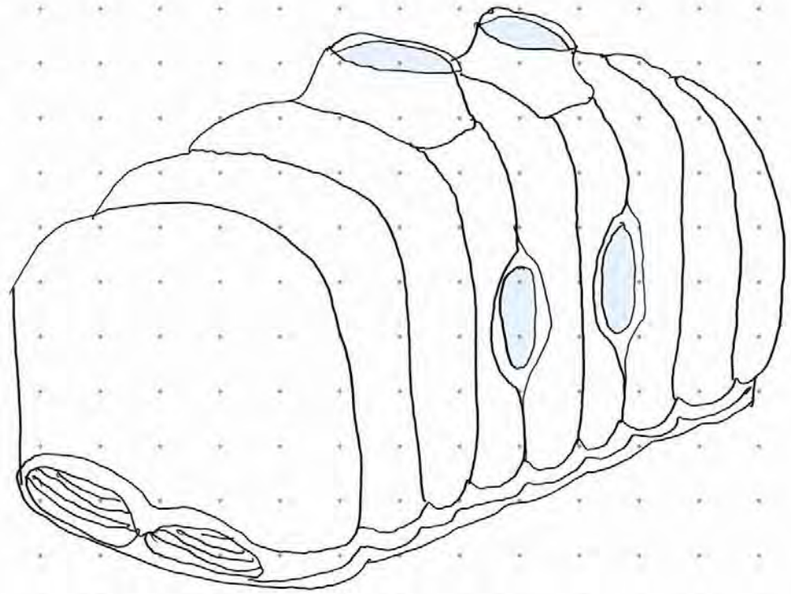
HYDROPONICS SYSTEM


3590
6800
BASEMENT PLAN
7325
4130
GF PLAN

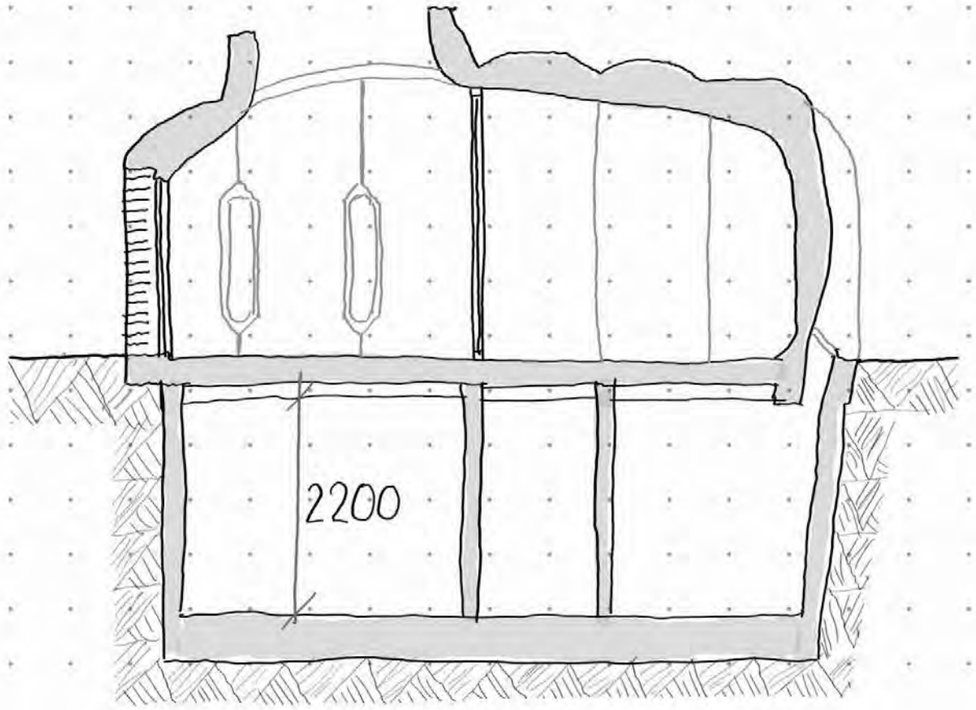

BASEMENT PLAN
GF PLAN
- CIRCULATION
- LIVING SPACE
- WORK SPACE
- BEDROOM
- BATHROOM
- KITCHEN
- PLANT ROOM



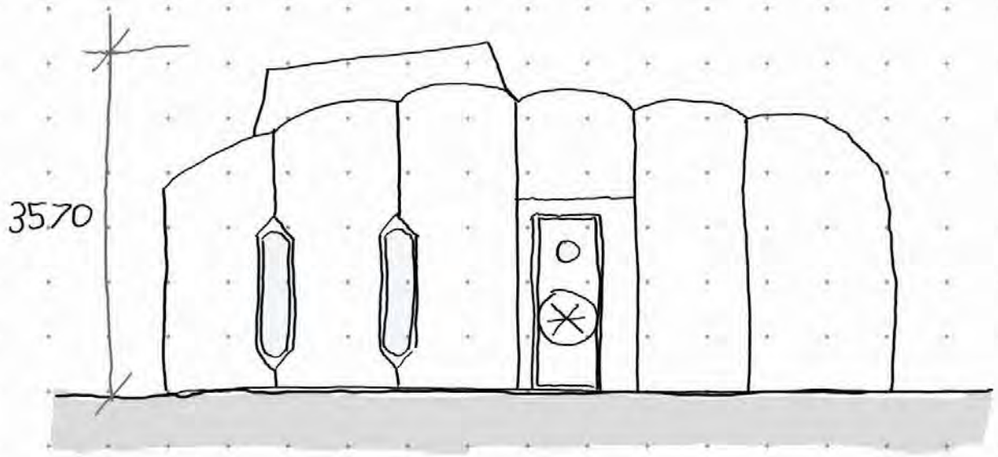
ELEVATION



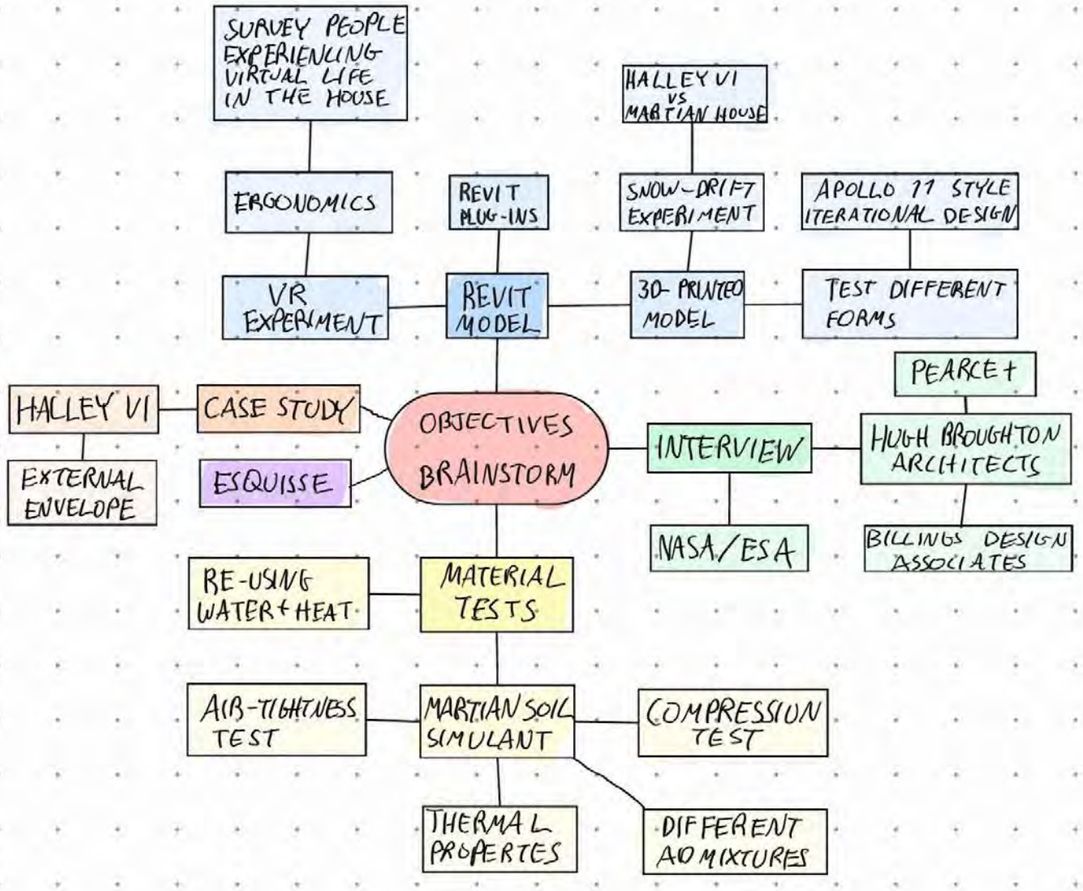
3D



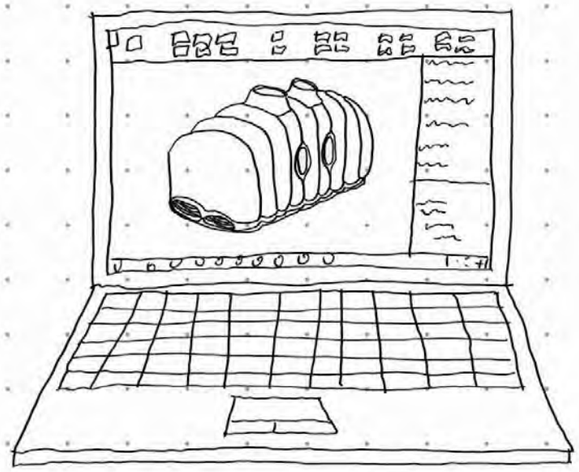
SECTION



ELEVATION



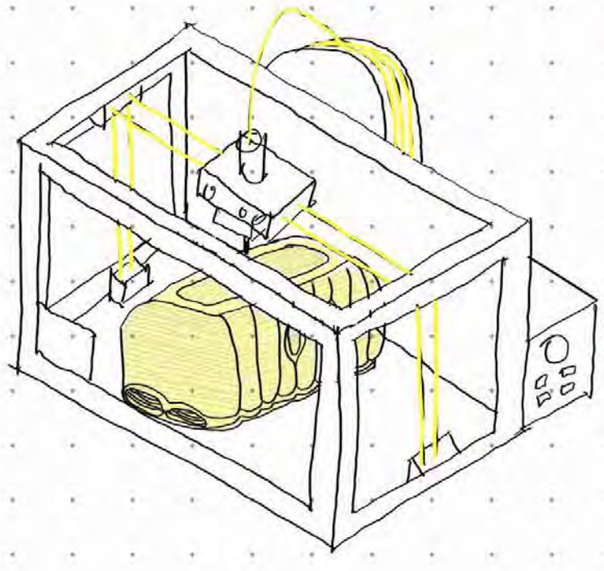
REVIT MODEL



PROS:
- ACCESSIBLE
- MANY PLUGINS AVAILABE
  ↳ VR
- USED TO CREATE 3D PRINTED MODELS.

CONS:

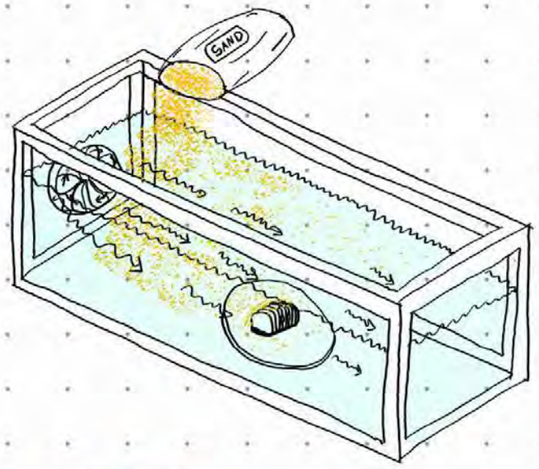
3D PRINTED MODEL

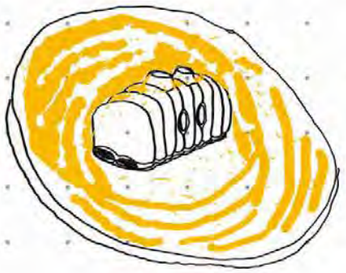


PROS:
- ACCESSIBLE
- TEST DIFFERENT FORMS
- PROVIDES ABILITY TO UNDERTAKE PHYSICAL TESTS ON A VIRTUAL MODEL

CONS:
- ONLY SMALL-SCALE MODELS.
- MADE OF PLA PLASTIC
  ↳ NOT OF WHAT WILL BE USED FOR CONSTRUCTION ON MARS

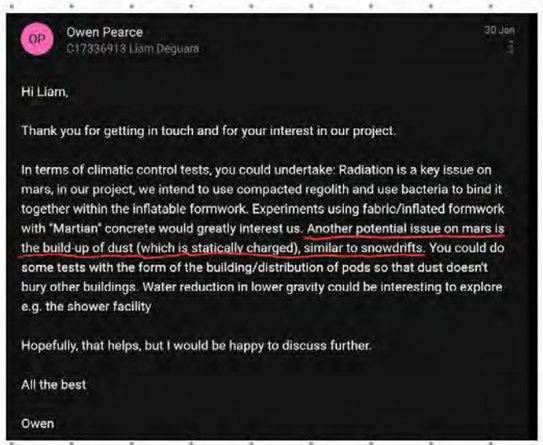
DUST DRIFT TEST

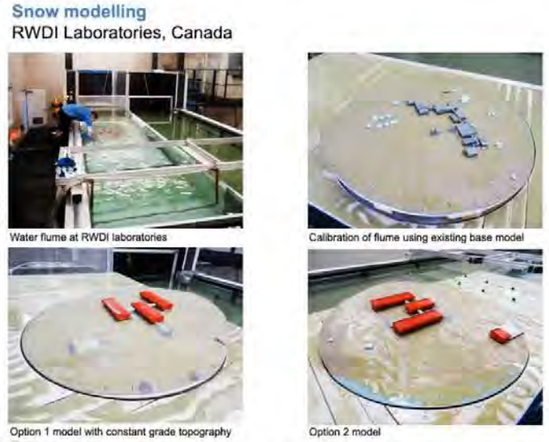




PROS:
- TESTS A SCENARIO THE BUILDING WILL EXPERIENCE.
- APROVED TESTING METHOD BY HUGH BROUGHTON ARCHITECTS.

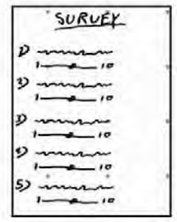
CONS:
- LOTS OF EQUIPMENT
- DIFFICULT TO TOTALLY REPLICATE REAL WORLD SCENARIO

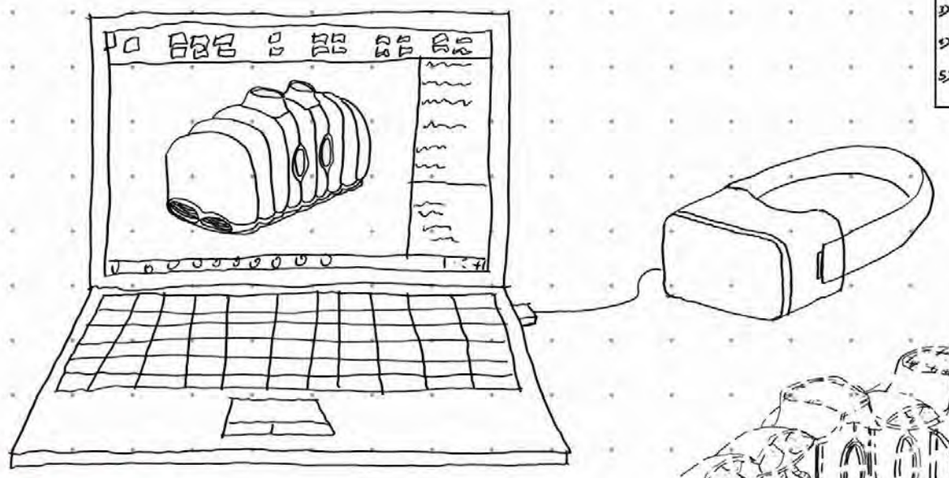


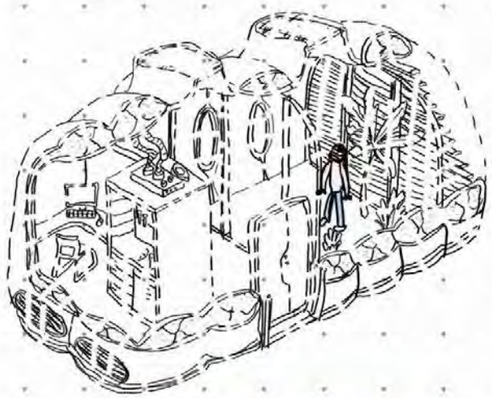


HBA SNOW DRIFT TESTS ON MODELS

VR EXPERIMENT





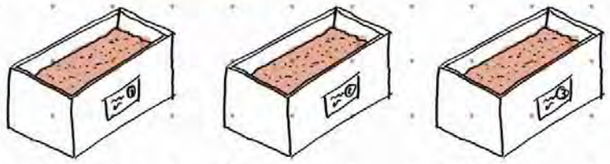


PROS:
- ACCESSIBLE
- TESTS PEOPLES INTERACTIONS WITH A 1:1 SCALE VIRTUAL MODEL OF THE BUILDING.
- SURVEY PEOPLES EXPERIENCE TO MAKE DESIGN ITERATIONS.
  - ↳ ERGONOMICS

> "We look very carefully at the ergonomics of the social spaces to make sure that you could still provide space that people could be as a community but also on their own and very importantly on those missions where you are on very low gravity that you would be able to take lots of exercise to keep your muscles in shape" - Hugh Broughton

CONS:
- DOESNT REPLICATE LOW GRAVITY.
  - ↳ HOWEVER A VR HEADSET COULD BE WORN BY AN IDIVIDUAL IN A LOW GRAVITY SIM OR ONBOARD THE ISS. →

MATERIAL TESTS



BINDING ADMIXTURE 1

BINDING ADMIXTURE 2

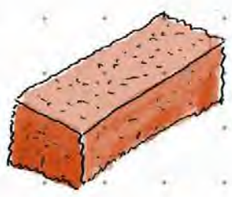
BINDING ADMIXTURE 3

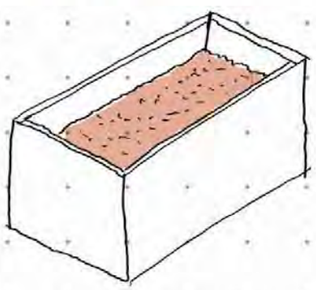
PROS:
- CLOSEST TEST THAT SIMULATES CONDITIONS ON MARS.
- TESTS BUILDABILITY
- TESTS THERMAL PERFORMANCE.
- TEST STRUCTURAL INTEGRITY.
- TEST DIFFERENT BINDERS.

CONS:
- EXPENSIVE (€20 p/kg + €37 POSTAGE)
  - ↳ CAN ONLY CONSTRUCT SMALL SCALE PROTOTYPES.

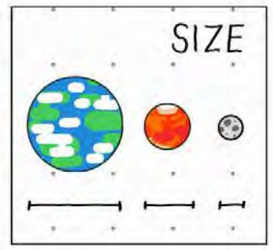
Element	Brown Powder, Weight %
Zirconium	0.275
Iron	29.193
Chromium	0.330
Vanadium	0.389
Titanium	2.926
Aluminum	9.705
Silicon	57.110

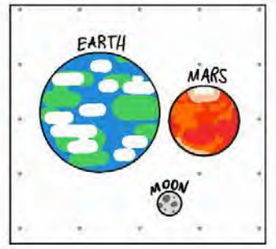
- CRUSHED BASALT FROM A QUARY IN THE MOJAVE DESSERT.

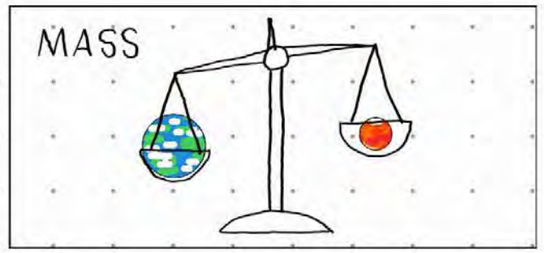


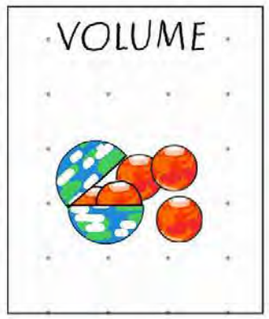


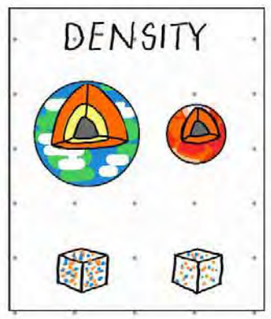
> Unlike the moon, no surface samples from Mars have been returned to Earth. But orbiters have recorded surface compositions across the entire planet, and robotic explorers have carried out deeper investigations at various sites. A major ingredient of much of the Martian surface is basalt, an iron-rich rock typically associated with volcanoes on Earth. So that's where NASA researchers go to look for appropriate Mars simulants. - NASA

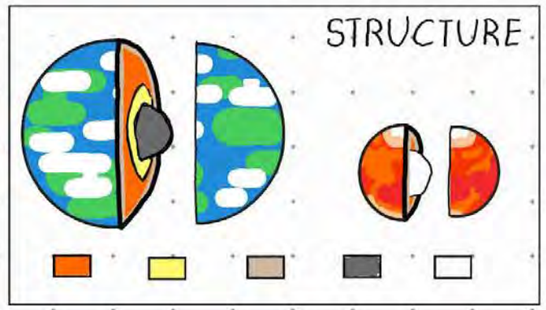


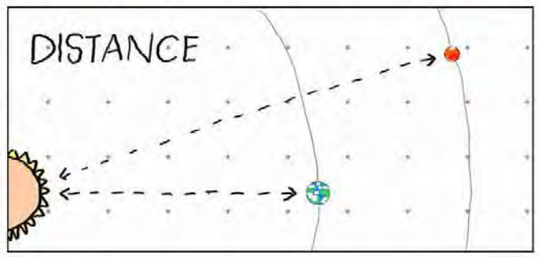


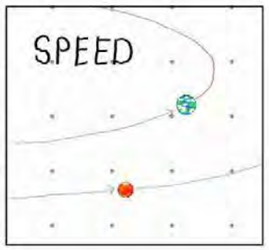


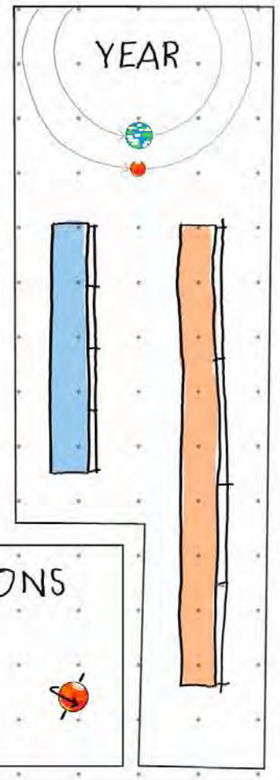






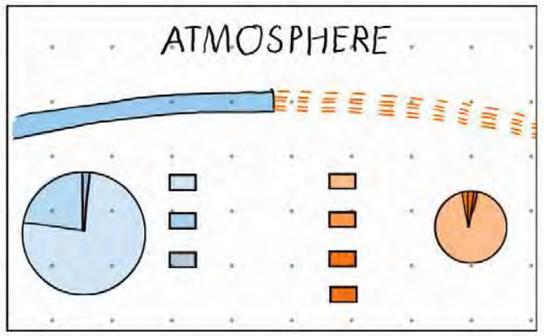


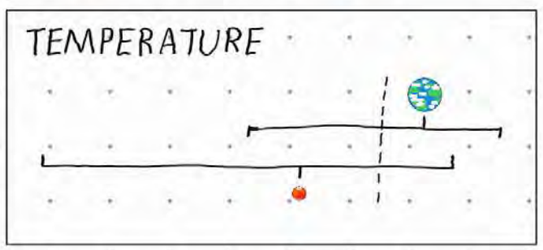

SPEED


YEAR


DAY


TILT / SEASONS


ATMOSPHERE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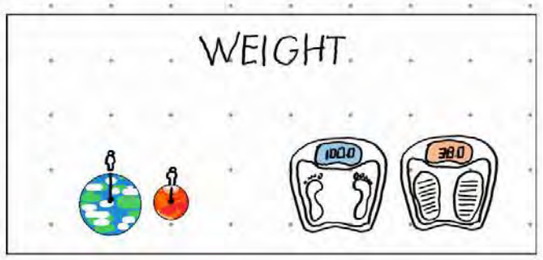
WEIGHT
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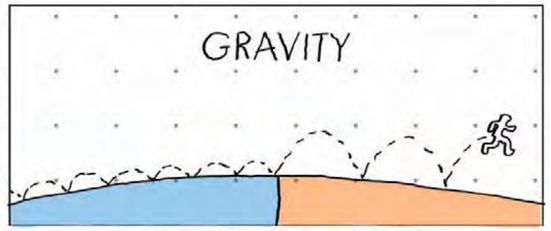
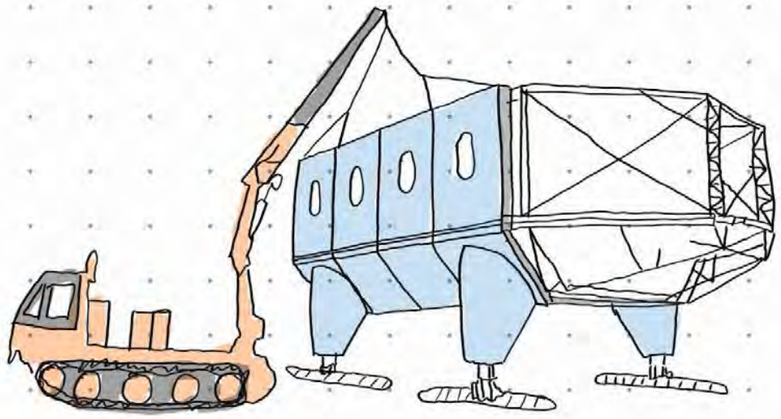
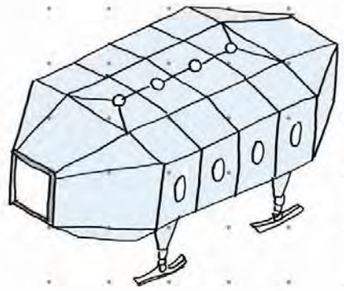
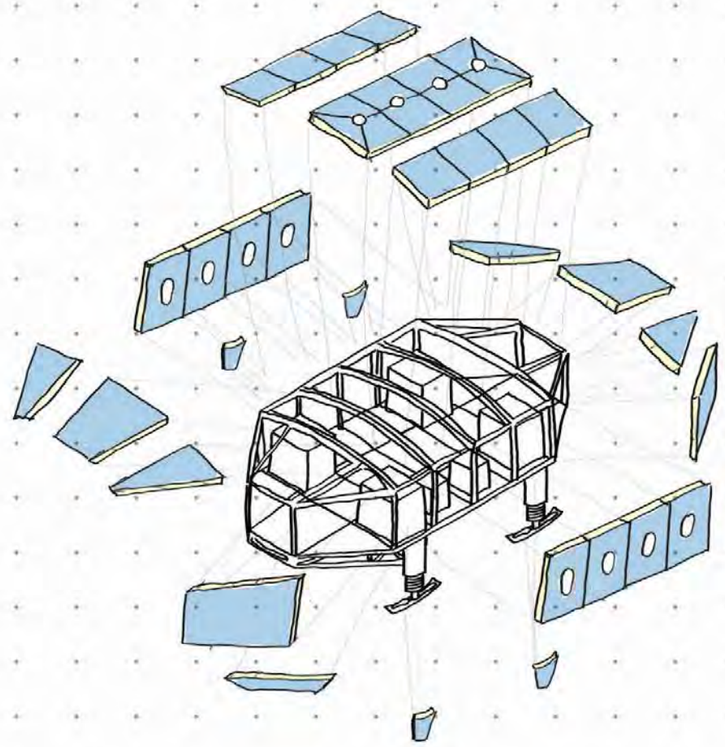
380

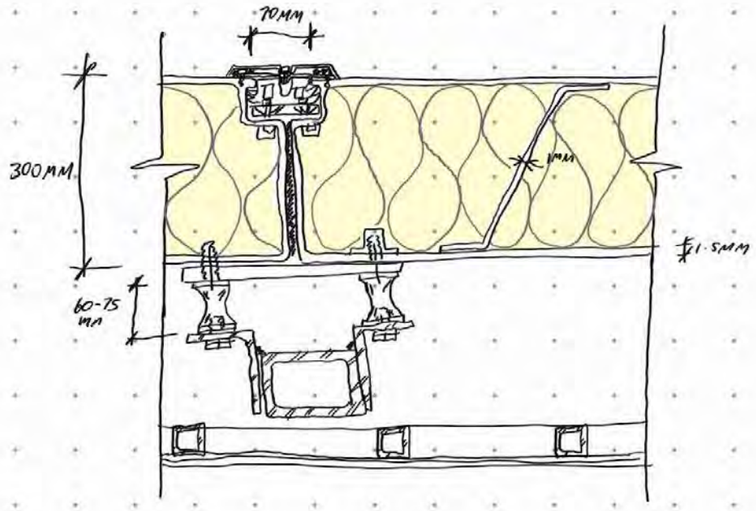

GRAVITY

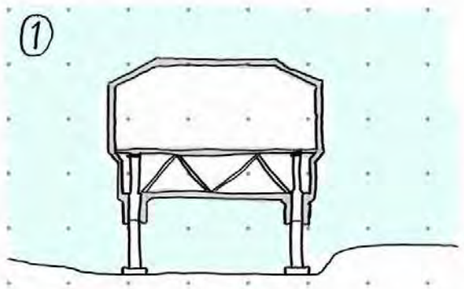
HALLEY VI







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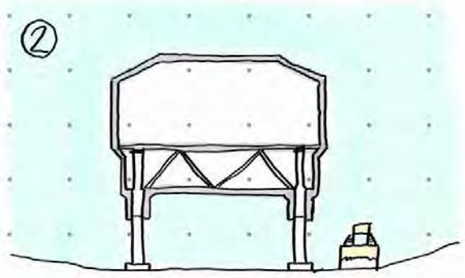
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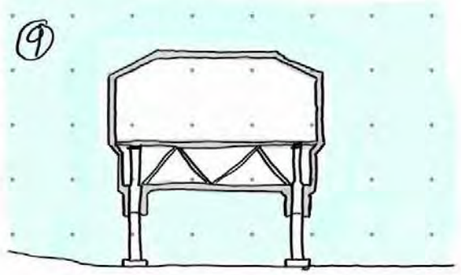
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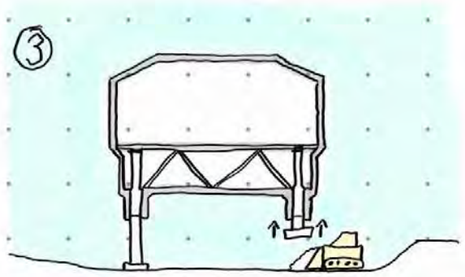
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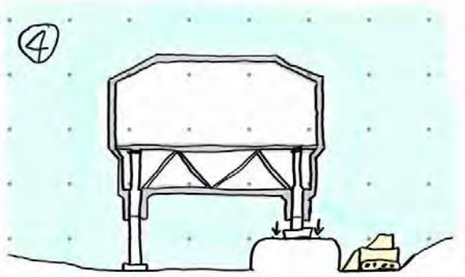
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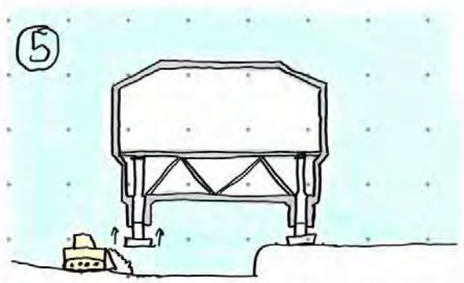
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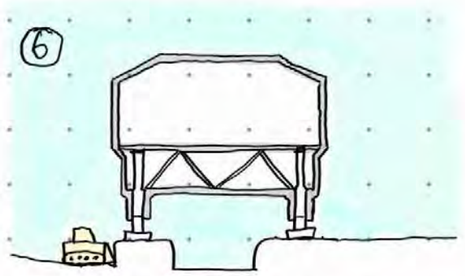
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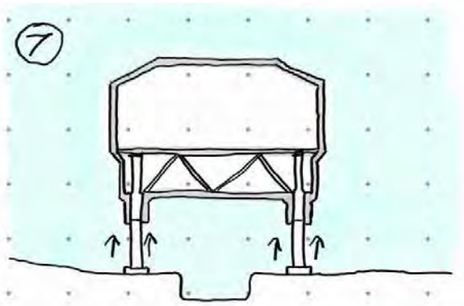
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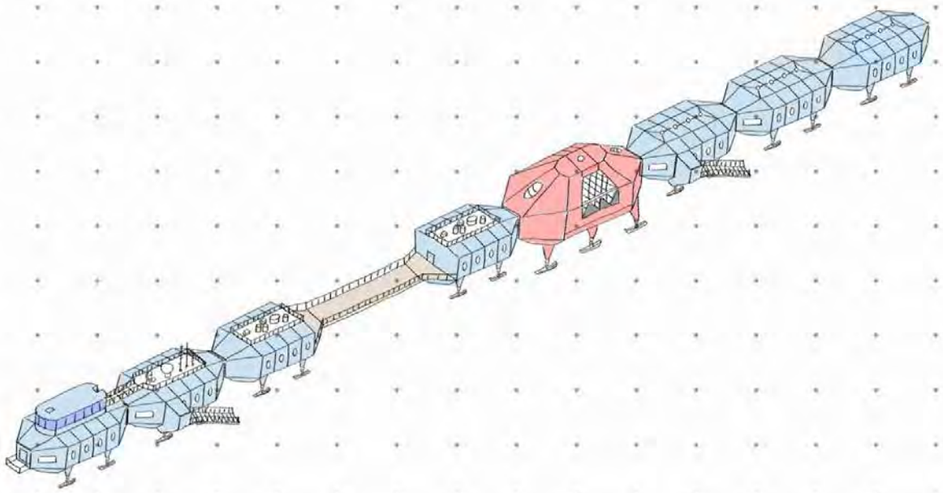
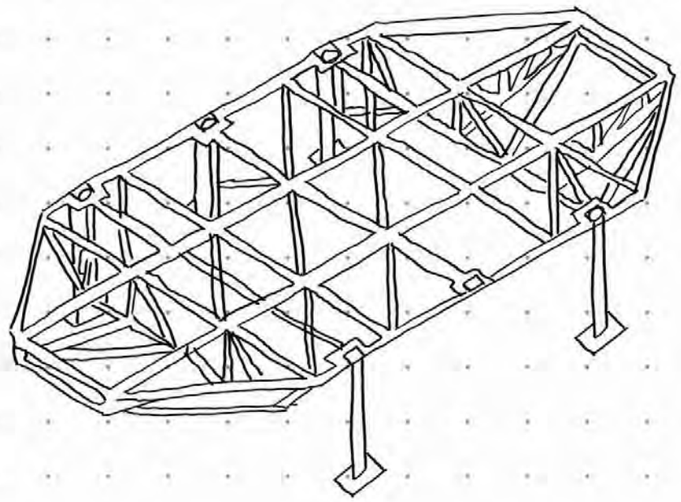
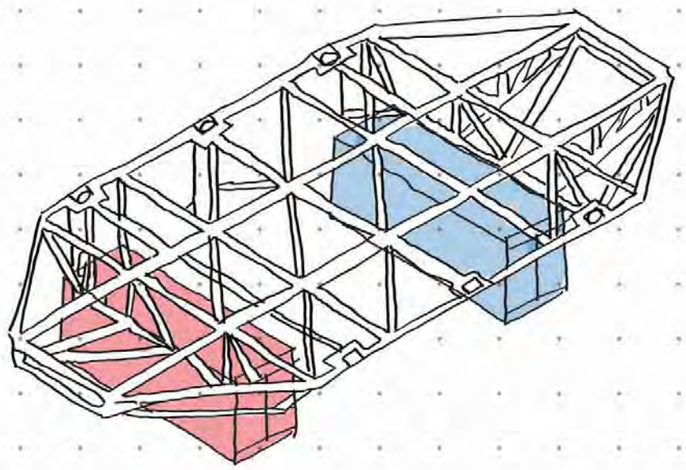
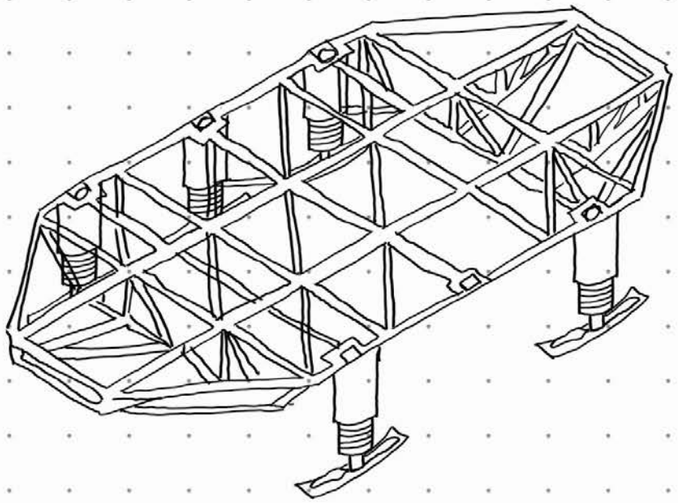
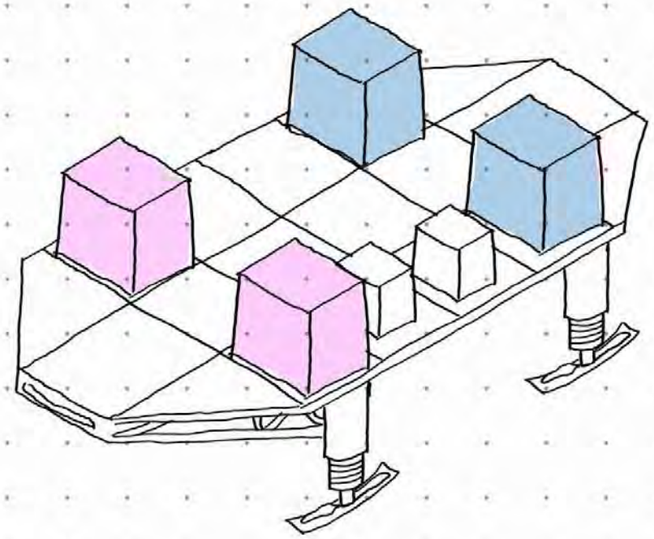
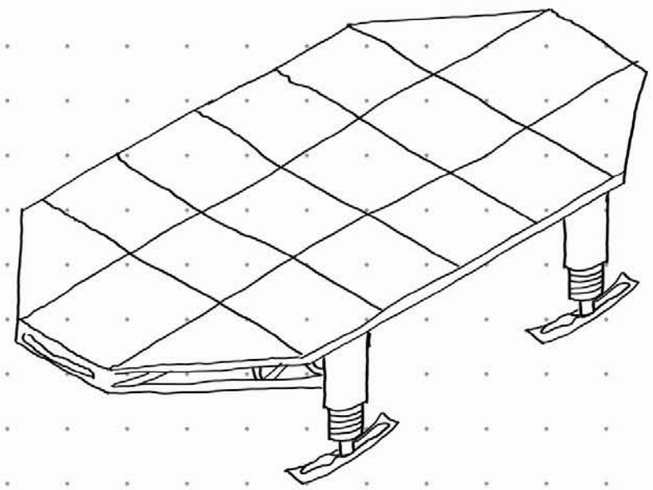


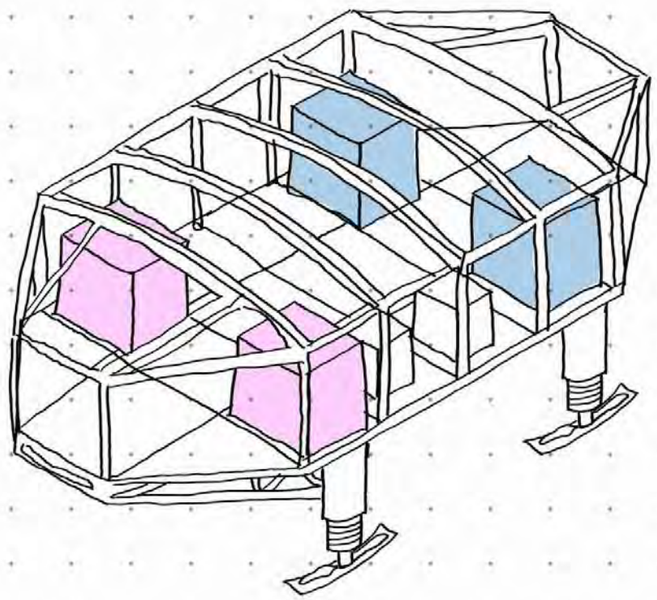


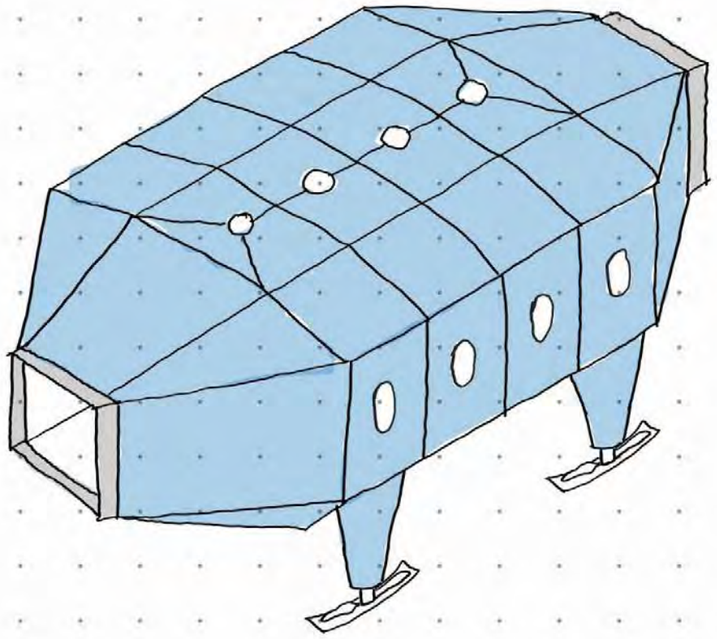


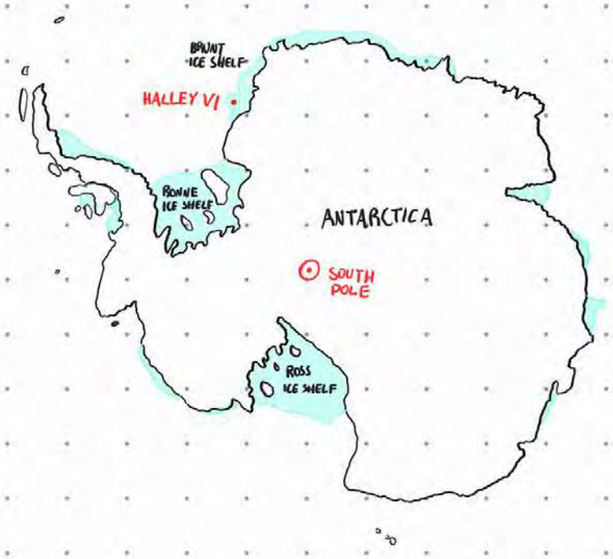


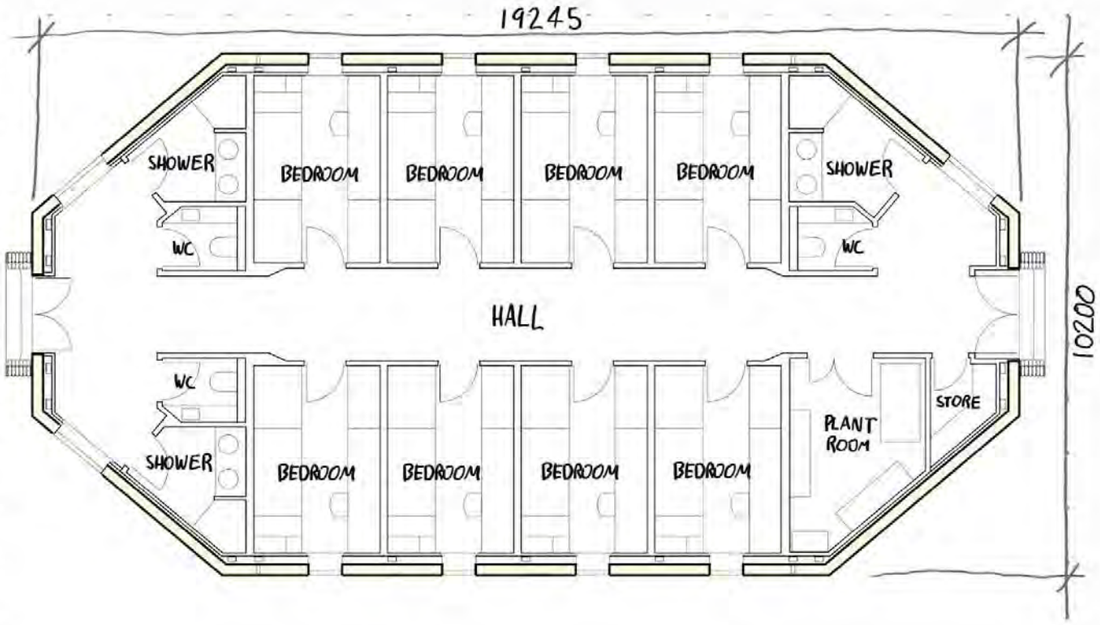


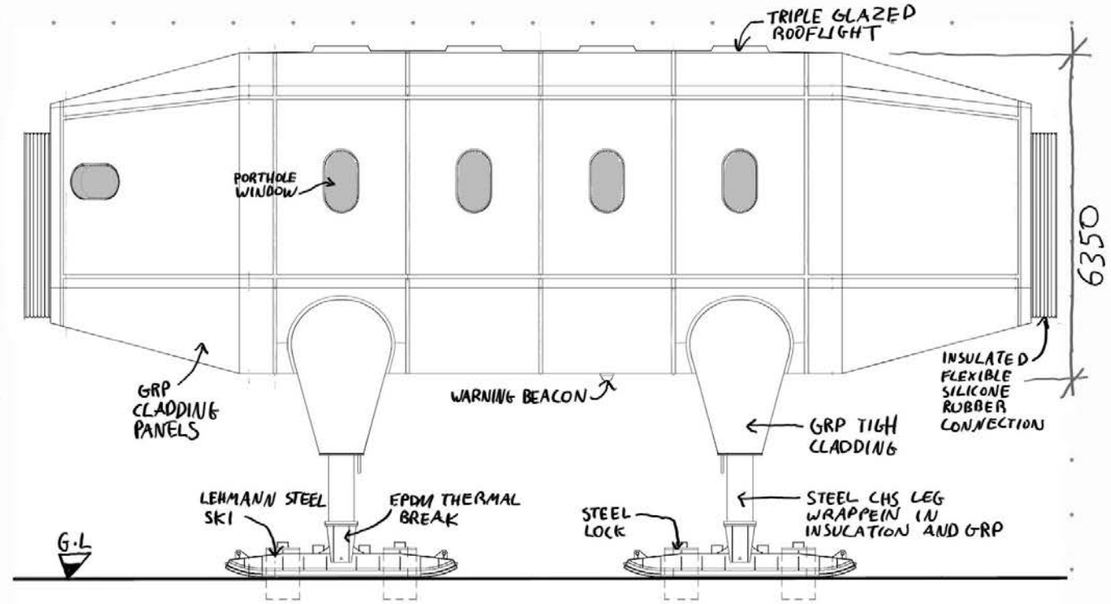


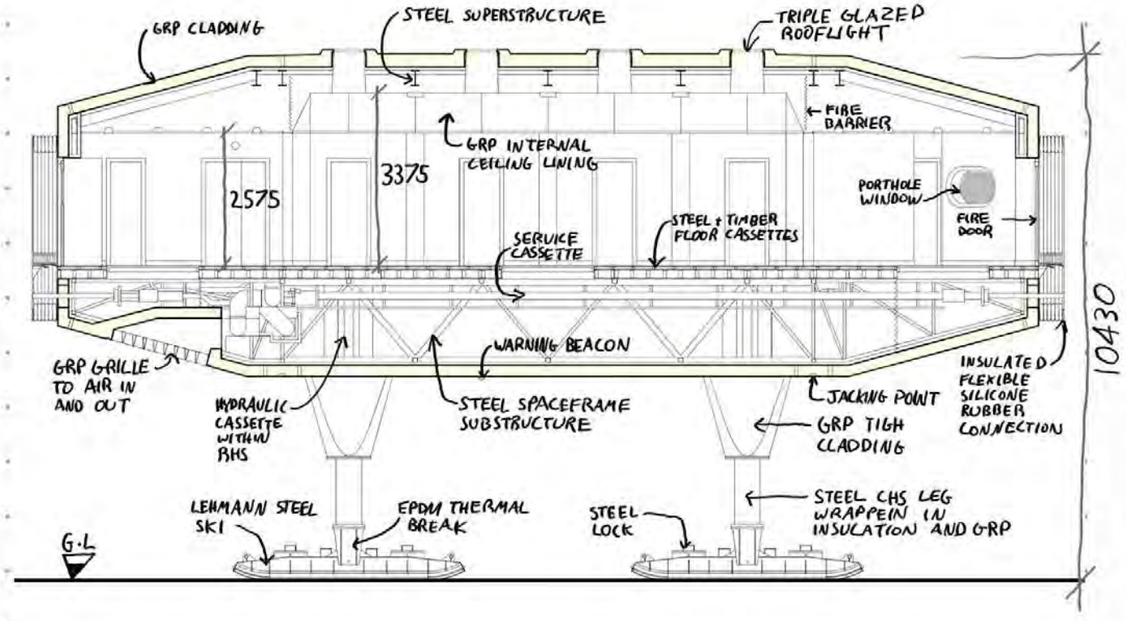


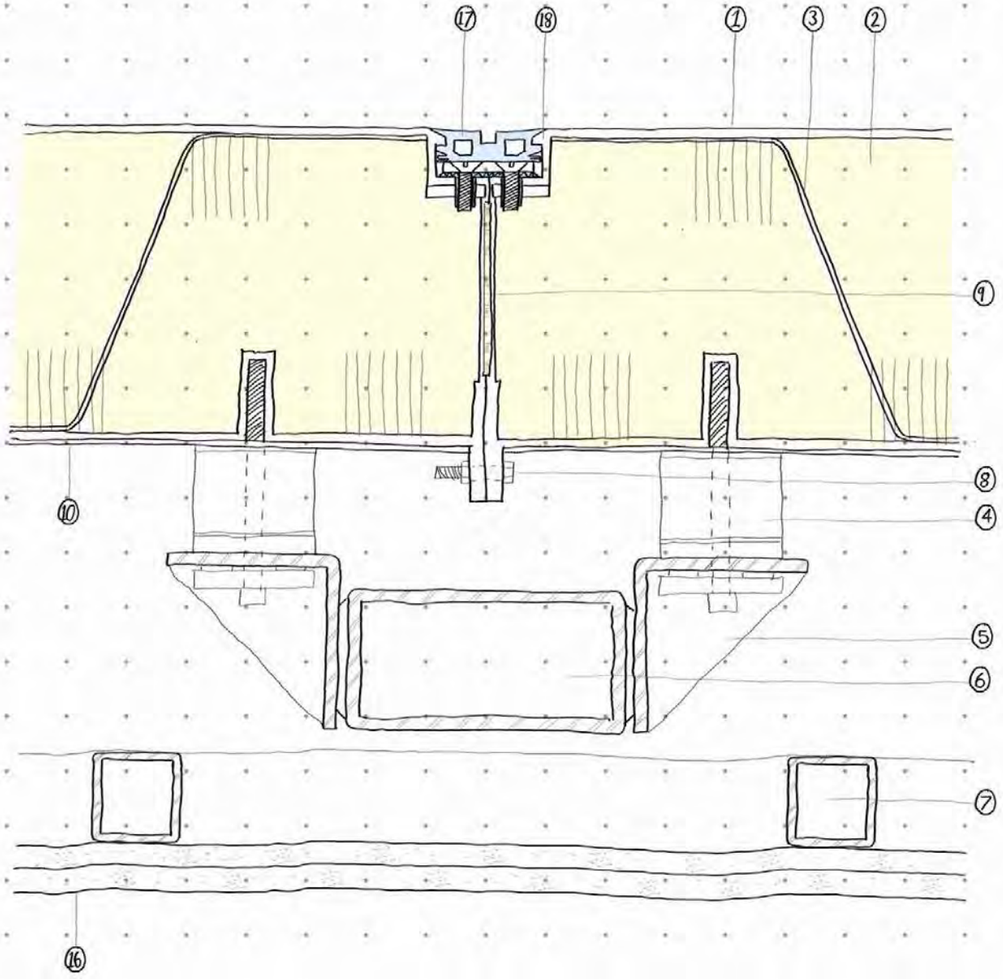



BRUNT ICE SHELF
HALLEY VI
RONNE ICE SHELF
ANTARCTICA
SOUTH POLE
ROSS ICE SHELF


19245
10200
SHOWER
BEDROOM
BEDROOM
BEDROOM
BEDROOM
SHOWER
WC
WC
HALL
WC
SHOWER
BEDROOM
BEDROOM
BEDROOM
BEDROOM
PLANT ROOM
STORE


TRIPLE GLAZED ROOFLIGHT
PORTHOLE WINDOW
6350
GRP CLADDING PANELS
WARNING BEACON
INSULATED FLEXIBLE SILICONE RUBBER CONNECTION
GRP TIGH CLADDING
LEHMANN STEEL SKI
EPDM THERMAL BREAK
STEEL LOCK
STEEL CHS LEG WRAPPEIN IN INSULATION AND GRP
G.L


GRP CLADDING
STEEL SUPERSTRUCTURE
TRIPLE GLAZED ROOFLIGHT
FIRE BARRIER
GRP INTERNAL CEILING LINING
3375
2575
PORTHOLE WINDOW
FIRE DOOR
SERVICE CASSETTE
STEEL + TIMBER FLOOR CASSETTES
10430
GRP GRILLE TO AIR IN AND OUT
WARNING BEACON
INSULATED FLEXIBLE SILICONE RUBBER CONNECTION
HYDRAULIC CASSETTE WITHIN RHS
STEEL SPACEFRAME SUBSTRUCTURE
JACKING POINT
GRP TIGH CLADDING
LEHMANN STEEL SKI
EPDM THERMAL BREAK
STEEL LOCK
STEEL CHS LEG WRAPPEIN IN INSULATION AND GRP
G.L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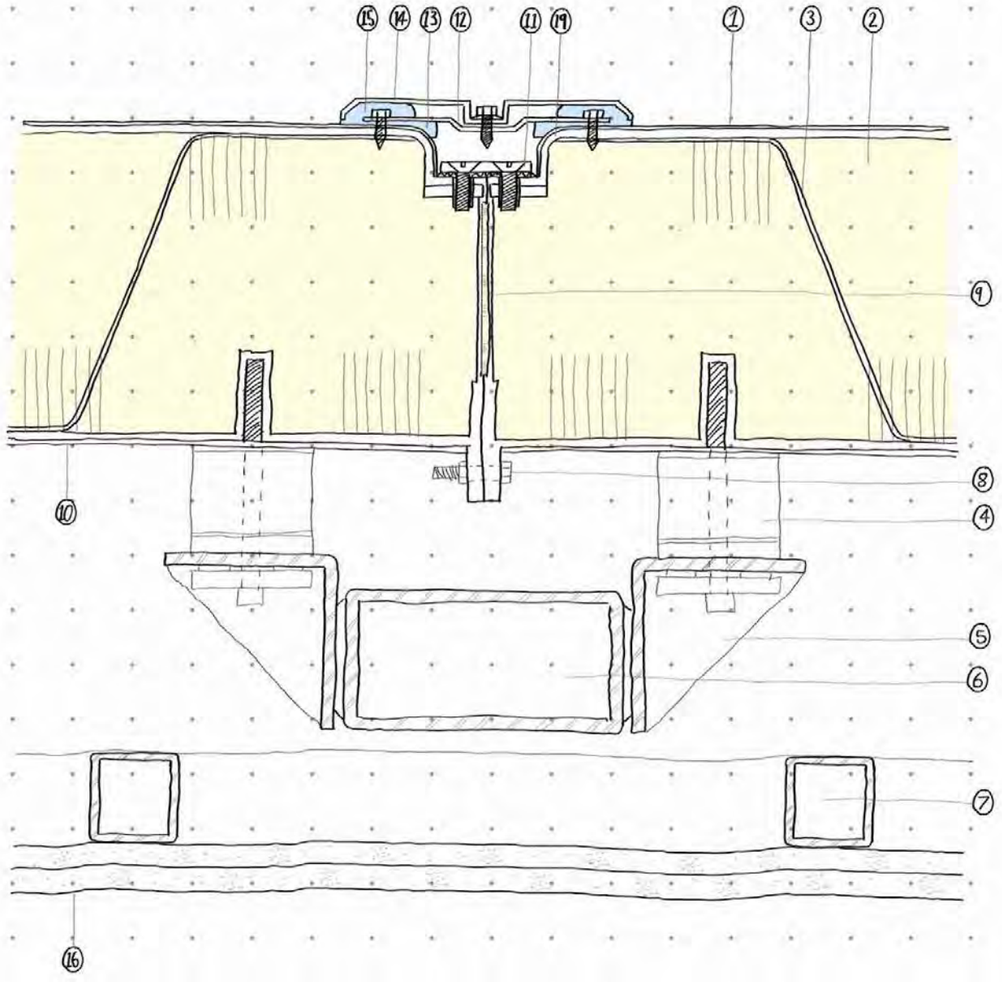
16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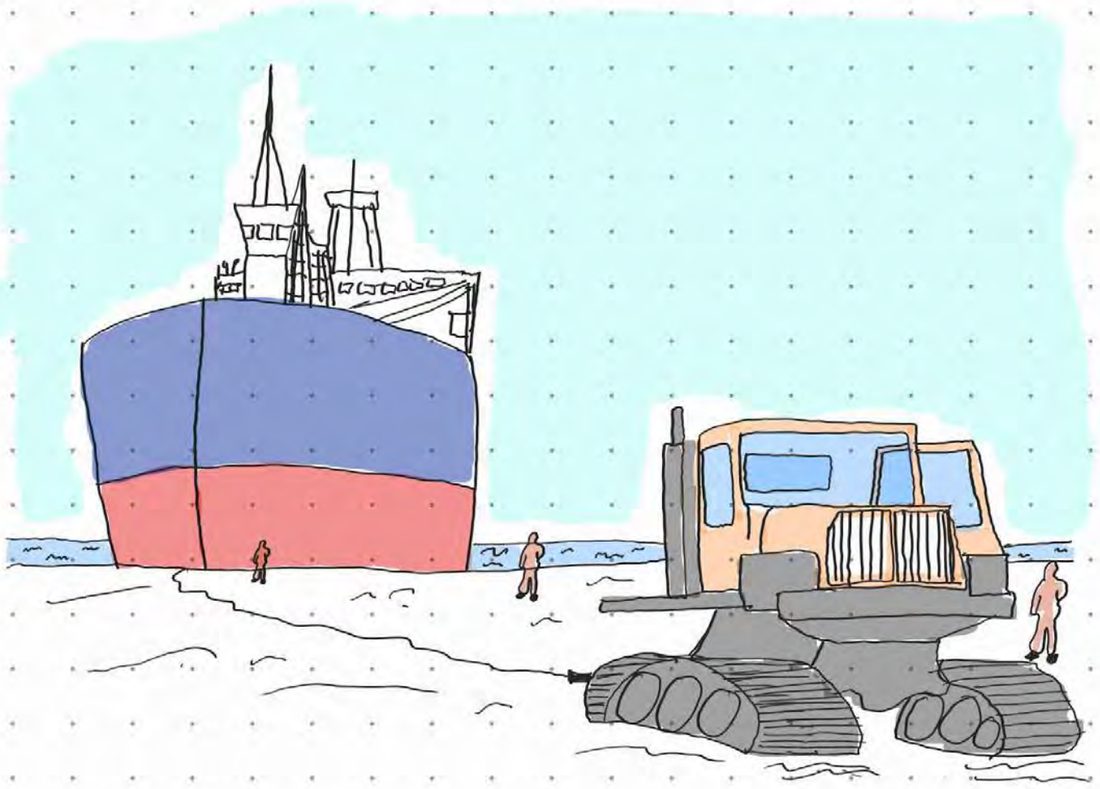
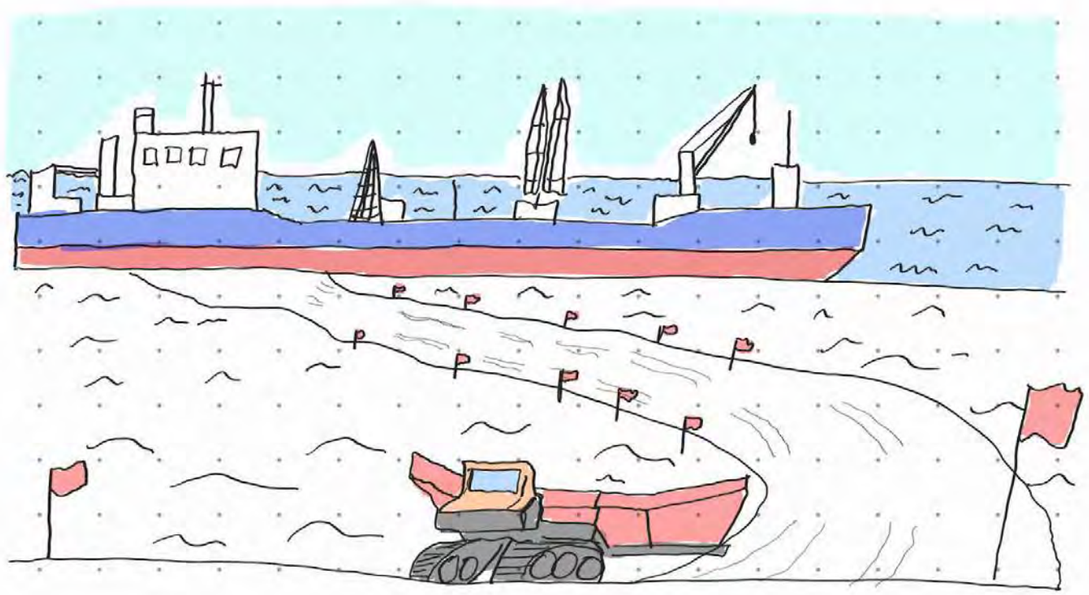
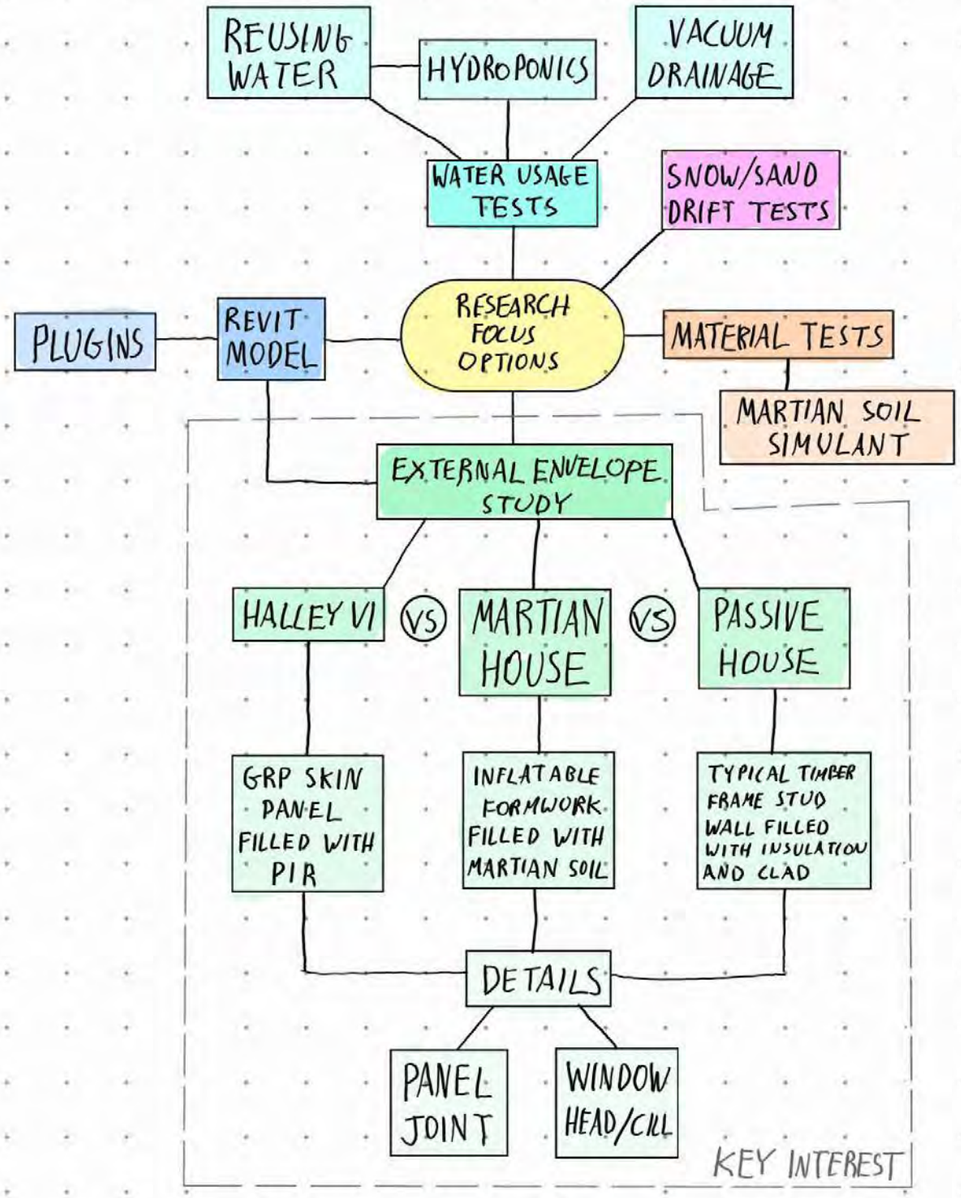
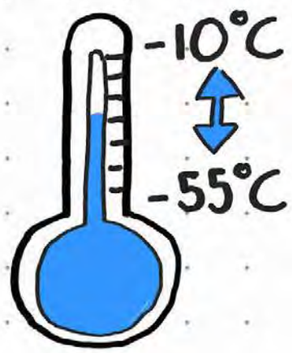
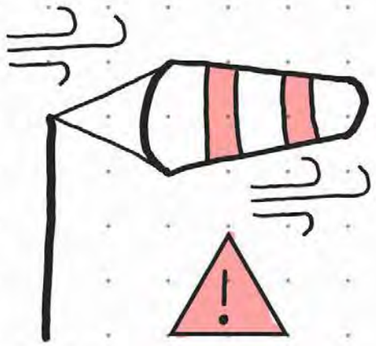
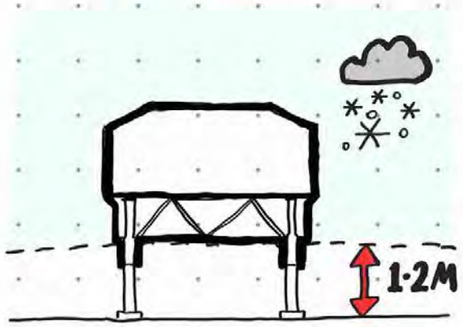




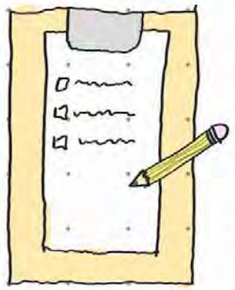

REUSING WATER
HYDROPONICS
VACUUM DRAINAGE
WATER USAGE TESTS
SNOW/SAND DRIFT TESTS
PLUGINS
REVIT MODEL
RESEARCH FOCUS OPTIONS
MATERIAL TESTS
MARTIAN SOIL SIMULANT
EXTERNAL ENVELOPE STUDY
HALLEY VI
VS
MARTIAN HOUSE
VS
PASSIVE HOUSE
GRP SKIN PANEL FILLED WITH PIR
INFLATABLE FORMWORK FILLED WITH MARTIAN SOIL
TYPICAL TIMBER FRAME STUD WALL FILLED WITH INSULATION AND CLAD
DETAILS
PANEL JOINT
WINDOW HEAD/CILL
KEY INTEREST

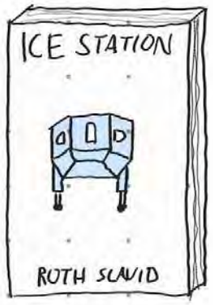

-10°C
-55°C

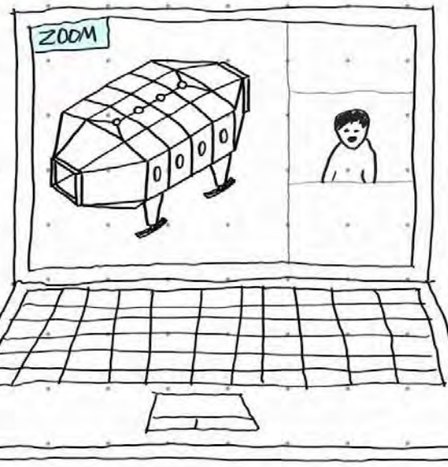


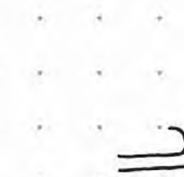

1-2M

TED



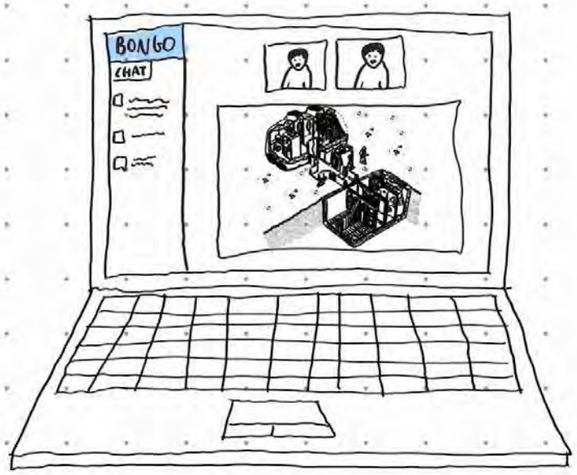

ICE STATION
ROTH SCAVID

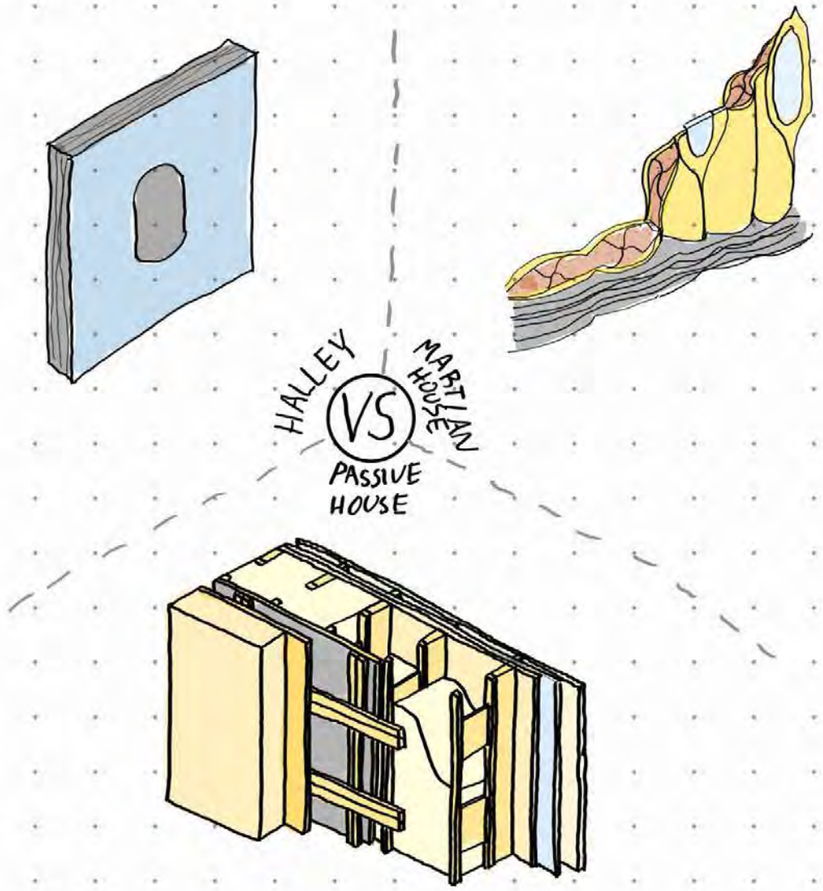

ZOOM




THE
CASE
FOR
MARS
BY
ROBERT ZUBRIN


NASA
APOLLO 11 MANUAL


BONGO
CHAT


HALLEY
VS
MARTIAN HOUSE
PASSIVE HOUSE

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