

# Lunar Resources Assessment Base Contract: Fenix

## TENDER DOCUMENT

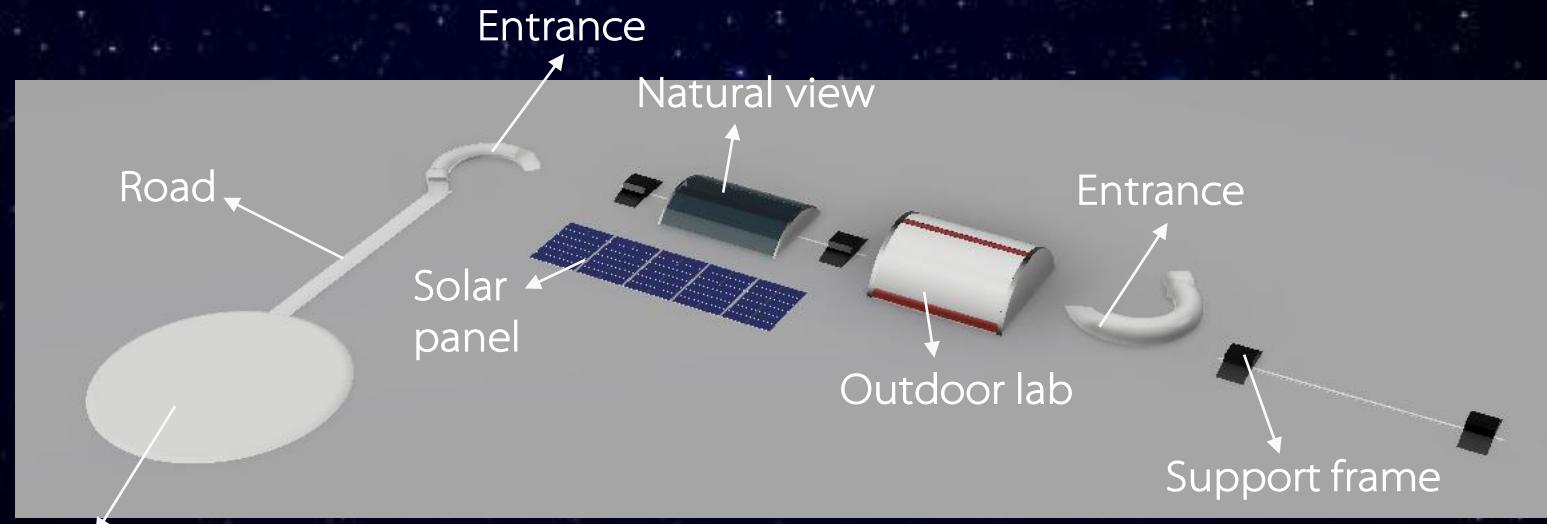
“Company B” BNDS Space Design Club

December 23th, 2028

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Runxin Yan, Yifei Li, Chuqiao Chen, Ziqian Zhao, Jiarui Wu,  
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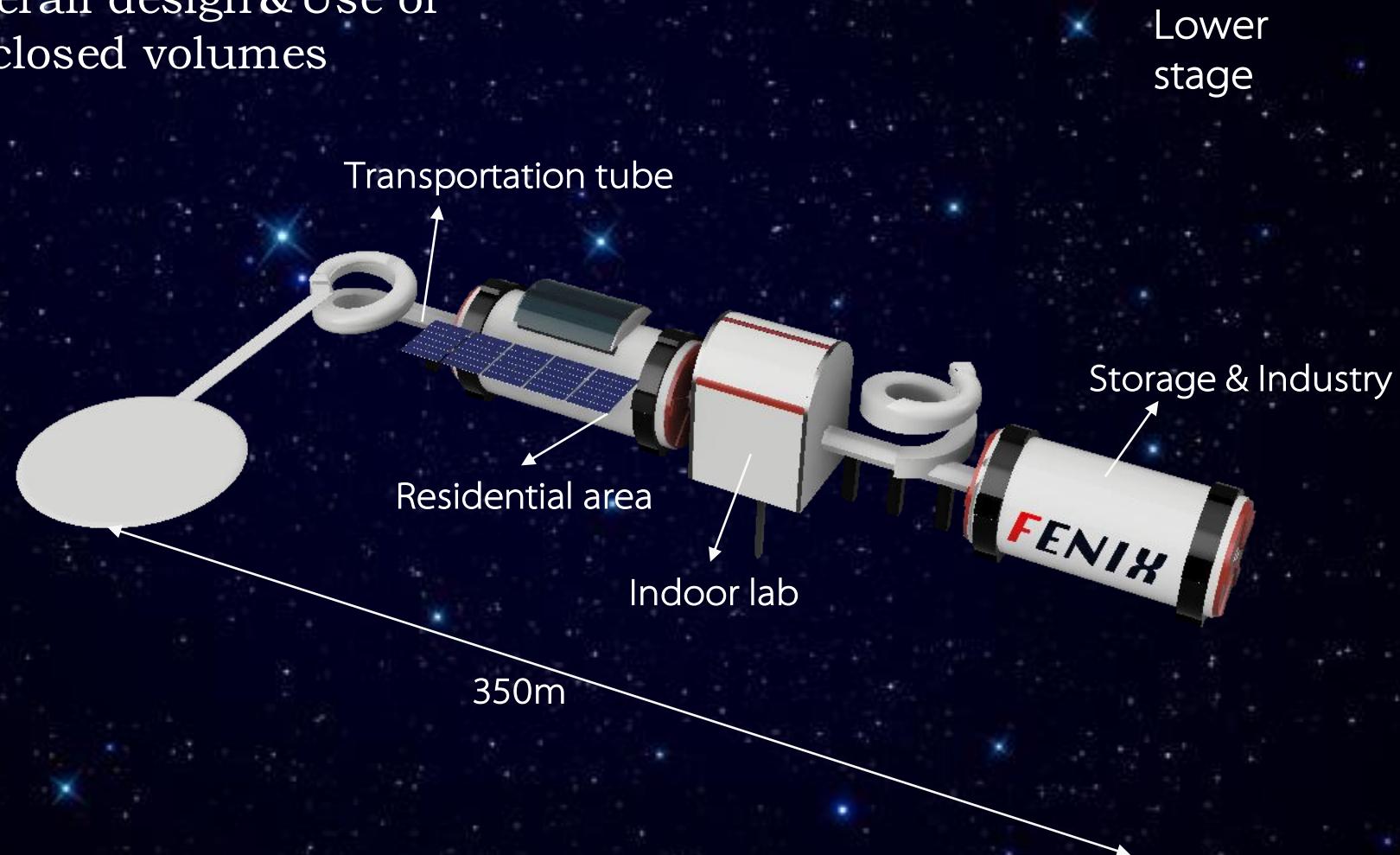
## 2.1 Overall design & Use of the enclosed volumes

Upper stage



Landing area  
for spacecraft

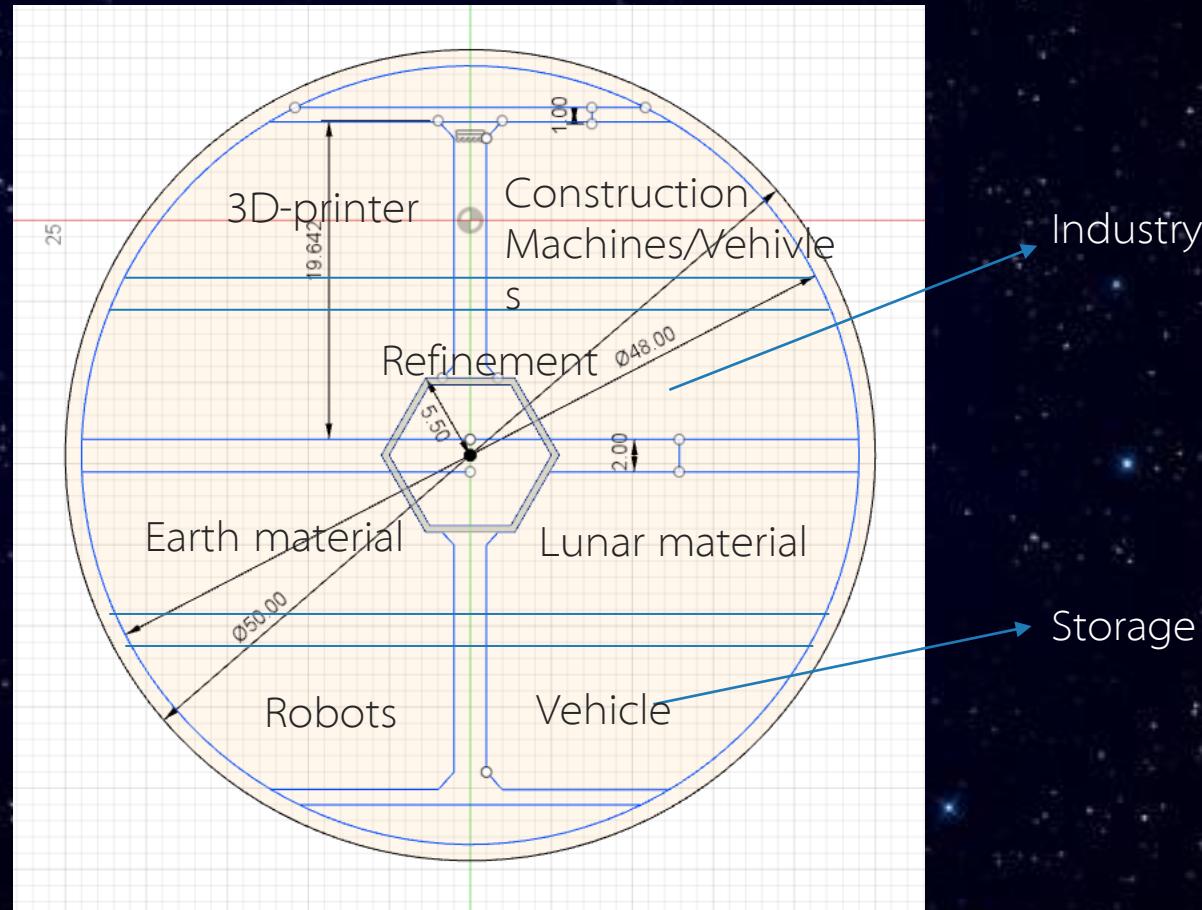
## 2.1 Overall design & Use of the enclosed volumes



## 2.2 Use & Size of the interior space

Storage &  
Industry

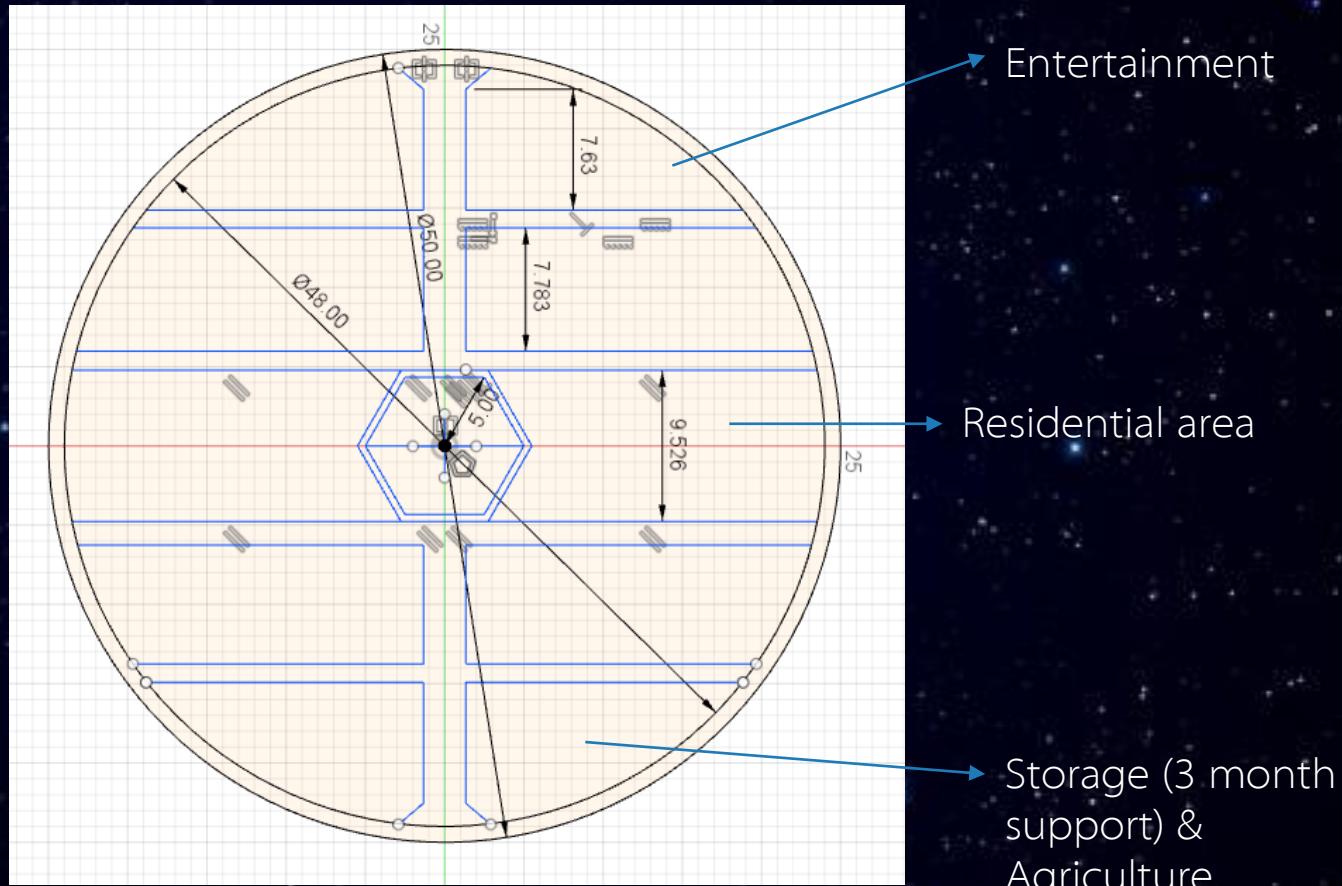
Length: 100m



## 2.2 Use & Size of the interior space

# Human Factor

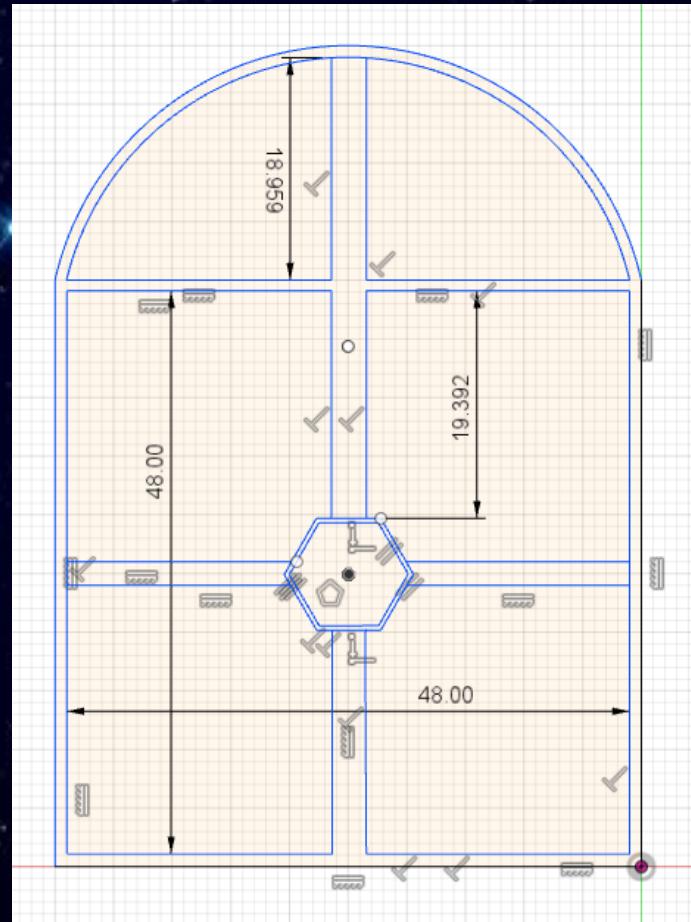
Length: 100m



## 2.2 Use & Size of the interior space

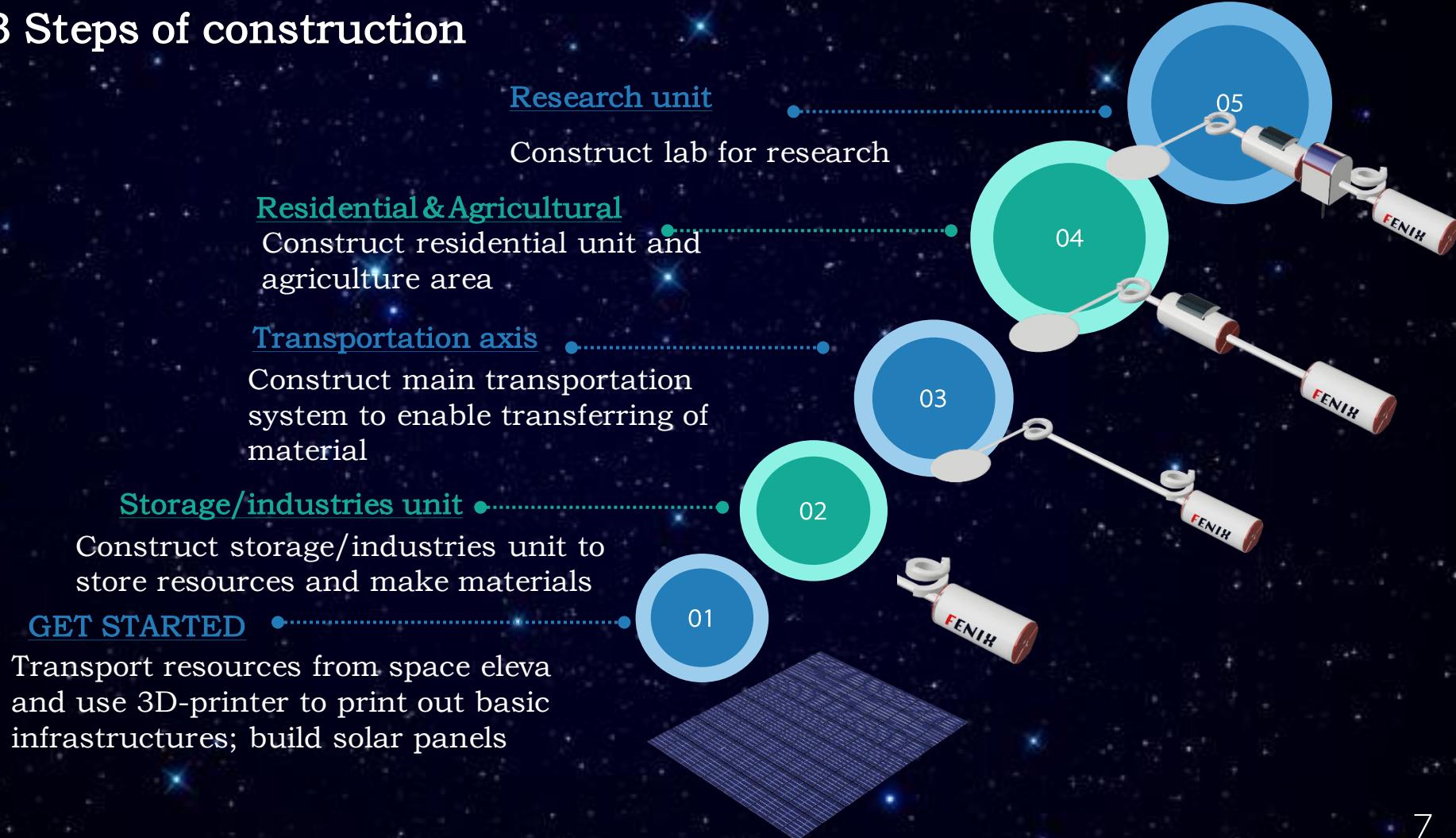
Lab

Length: 50m



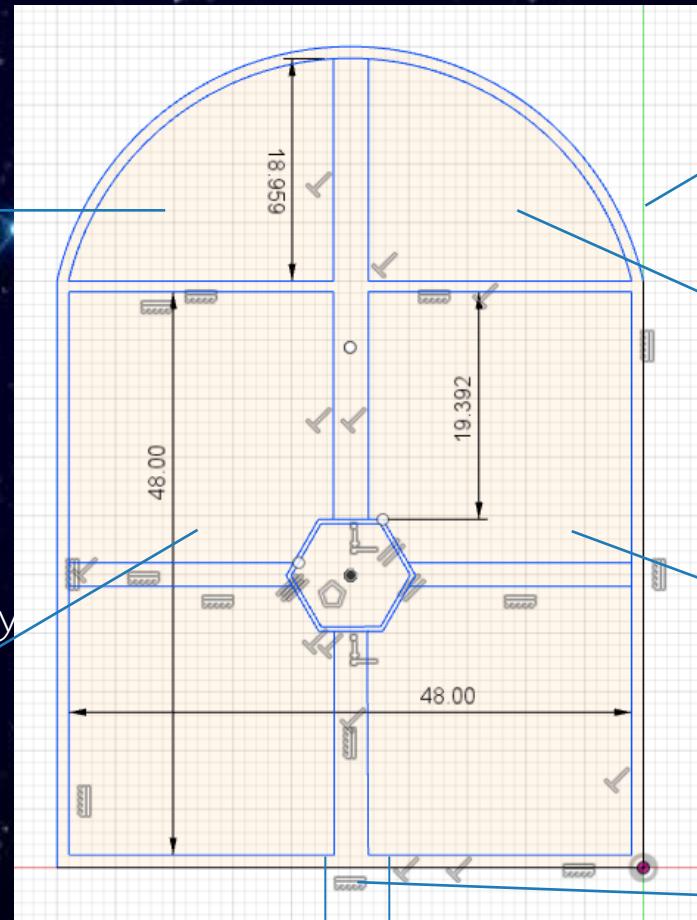
Details will be furthered in 2.4

## 2.3 Steps of construction



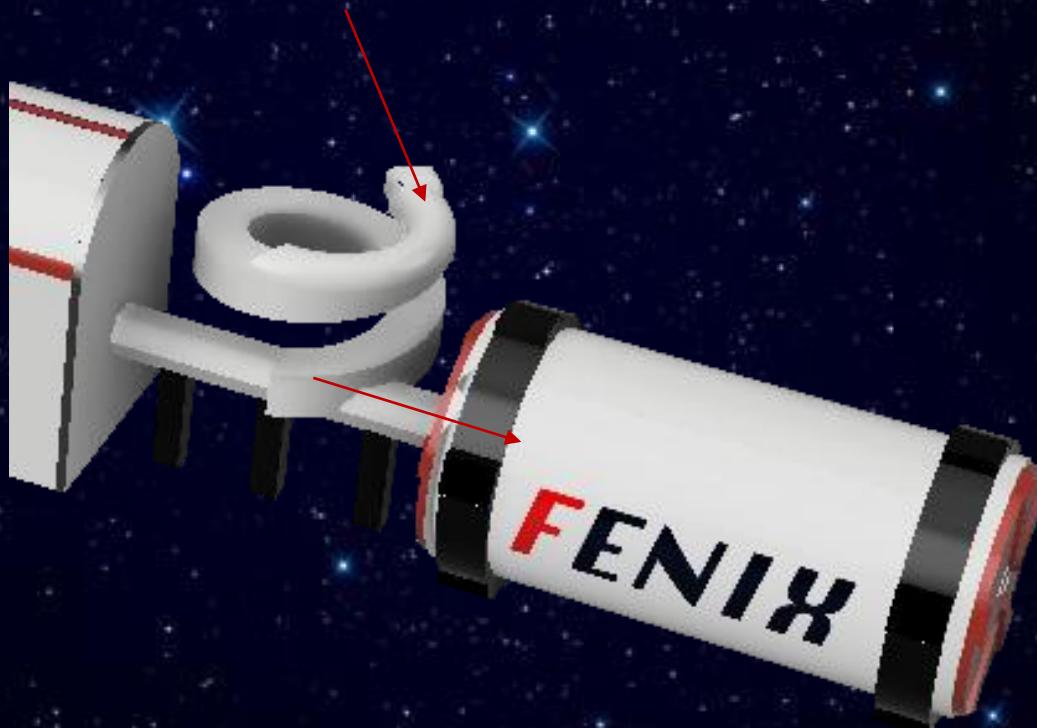
## 2.4. Laboratory facilities & Delivery of raw materials

- Pressurized
  - Outdoor (affected by sunshine/wind)
  - No dust
- 
- Pressurized
  - Indoor (not affected by sunshine/wind)
  - No dust



- Non-pressurized
  - Outdoor (affected by sunshine/wind)
  - Dust
- 
- Non-pressurized
  - Outdoor (affected by sunshine/wind)
  - No dust
- 
- Non-pressurized
  - Indoor (not affected by sunshine/wind)
  - No dust
- Collect sample

## 2.4. Laboratory facilities & Delivery of raw materials



# 3.1

## SOURCE

### Material type

M5 fiber

3.1.3

For materials acquired  
on luna crest:



Raw materials will be  
transported by long  
distance vehicles to  
purity factory



Different type (metal,  
air,...) of materials will  
pack up and carried by  
long distance rovers to  
different base

Carbon

SSCs)

Hydrogen

nite

Nitrogen

SSSCs)

Iron

SSSCs)

Silicon

Si<sub>2</sub>O<sub>8</sub>) and Al<sub>2</sub>O<sub>2</sub>

Calcium

SSSCs)

Oxygen

SSSCs)

Titanium

For materials acquired by  
transporting from earth:



Transport to CASSSCs  
By space craft



Materials will be  
transported to Luna's  
arriving base by space  
craft from CASSSCs

Helium

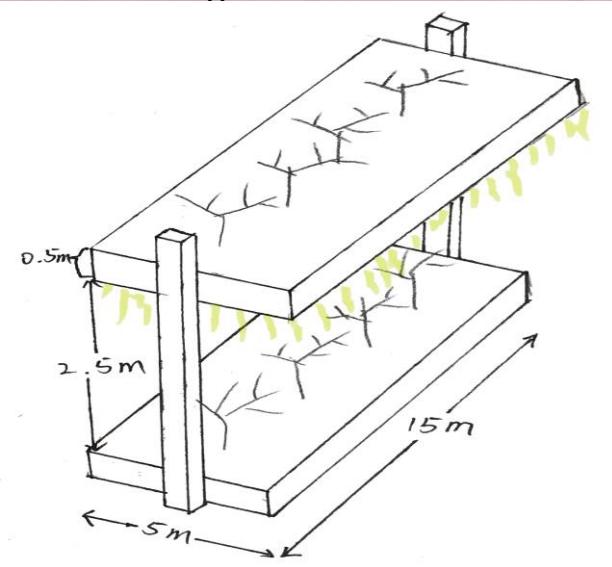
Long distance vehicles  
will transport materials to  
different base

Aluminum



## 3.2.1 FOOD PRODUCTION AND IMPORTING

Food will be obtained from *Icarus*, and by farming.



Reference: [https://www.baidu.com/link?url=2Z86GYJRxqV2Z2qAlZyKmXb3aSqUBoe8zzMHqRRe-zPVuTqTBca9\\_jhAW7BMzERcHV1PeqlbceUprkA7KiJzRzkjBlhVBUsQoavbBxrEnoG&wd=&eqid=826234a400059c5f00000035c1de40e](https://www.baidu.com/link?url=2Z86GYJRxqV2Z2qAlZyKmXb3aSqUBoe8zzMHqRRe-zPVuTqTBca9_jhAW7BMzERcHV1PeqlbceUprkA7KiJzRzkjBlhVBUsQoavbBxrEnoG&wd=&eqid=826234a400059c5f00000035c1de40e)

## 3.2.2 Electrical power

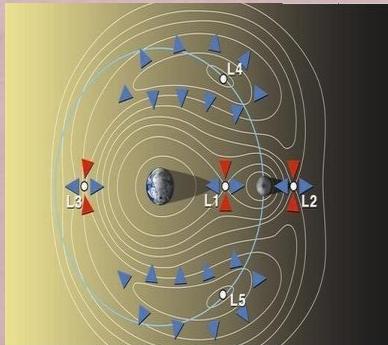
The energy will generate by solar mainly.

	power/kw
<b>Industry</b>	450,000
<b>Agriculture</b>	500
<b>Common facility</b>	1,000
<b>Lightning</b>	750
<b>Auto system</b>	32,000
<b>Transportation</b>	8,000
<b>Total</b>	492250

Finex need 3km<sup>3</sup> of panel.

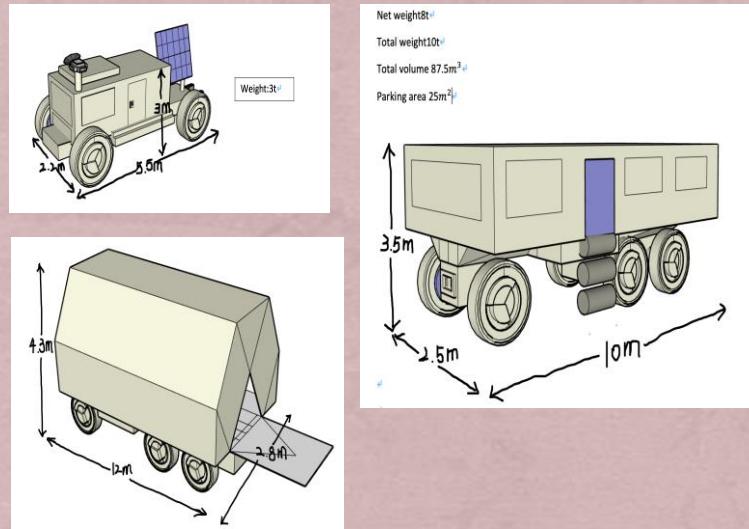
### 3.2.3 INTERNAL AND EXTERNAL COMMUNICATION SYSTEM

- + Internal communication system
- + External communication

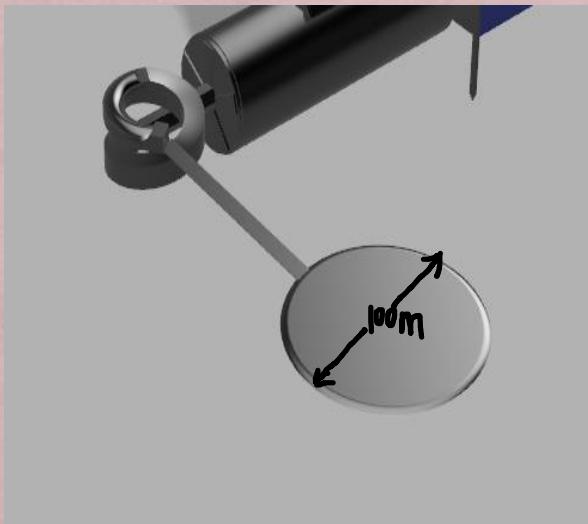


### 3.2.4 Transportation system between base facilities

- + Transportation part will be separated into two part.



## 3.2.5 LANDING AREA FOR SPACECRAFT



## 3.2.6 Atmosphere composition and pressure

	Percentage	Volume/m <sup>3</sup>
Nitrogen	78%	229,612
Oxygen	21%	61,819
CO <sub>2</sub>	0.5%	1,472
H <sub>2</sub> O	0.5%	1,472

- However, the farming part will increase the percentage of CO<sub>2</sub> appropriately. The variety of temperature will mainly caused by the change of humidity.

	Temperature	Humidity
Spring	20~24	40~50%
Summer	22~26	50~60%
Autumn	20~24	40~50%
Winter	16~20	30~40%

## 3.2.7 WATER MANAGEMENT

Sections	Water Required (m³/day)
Laboratory Area	$1.0 \times 10^3$
Residential Area	$1.2 \times 10^3$
Agricultural Activity	$1.5 \times 10^3$
Dock Area/Central Cylinder	$1.0 \times 10^3$
Total	$4.7 \times 10^3$

### COLLECTION

- Collect waste water from industrial and residential areas via pipeline

### FILTERING

- Remove large particles from water

### IRON CHLORIDE

- remove any solid impurities from water

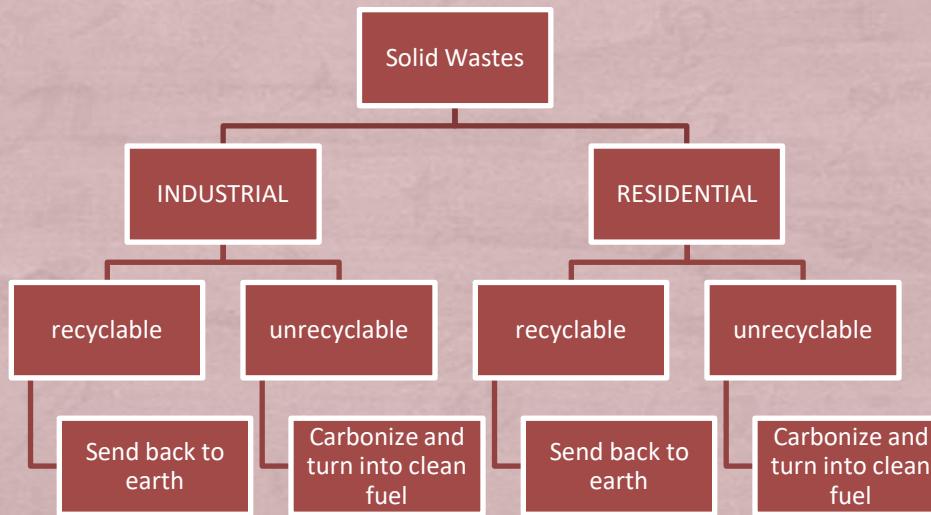
### CHEMICAL PROCESS

- Remove any soluble impurities from water

### REUSE

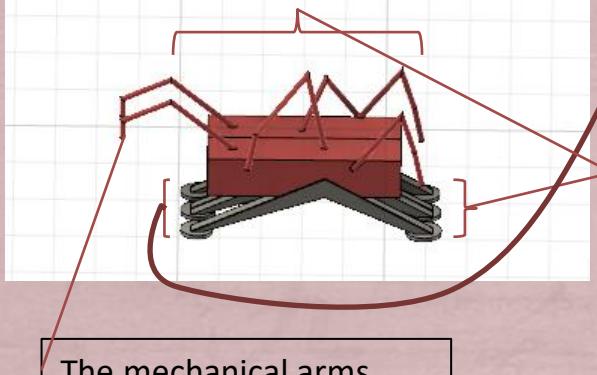
- Pump water back for use

### 3.2.8 WASTE MANAGEMENT



## 3.3 Machines

The installing robots



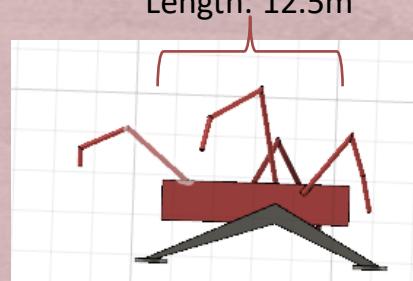
Sucking disc will  
on the  
mechanical  
arms

The details about the different types  
and their functions will be shown as  
automation department.

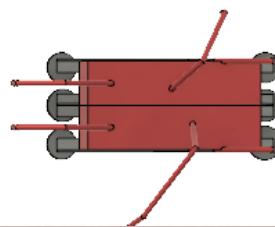
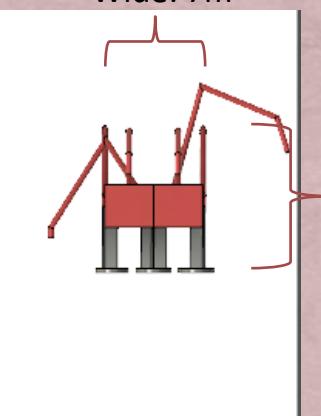
The mechanical arms

The graph is shown as a  
installing robot, which have 6  
sucking discs to fix itself on the  
inner surface, and 6 mechanical  
arms to fix the material pieces.

Length: 12.5m

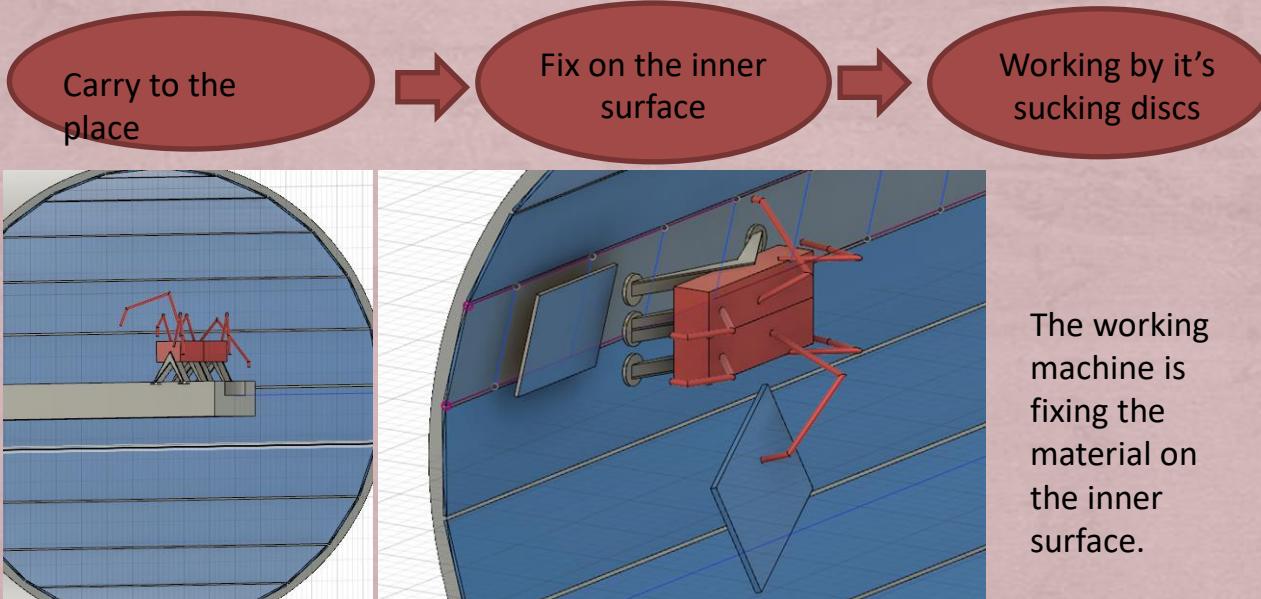


Wide: 7m



The step of installing:

- 1 Be carried to the inner places that will be fixed, constructed and reshaped, by the transportation vehicles on the control trail.
- 2 Be put on the interface of the tube by the mechanical arms and use 6 sucking discs fix itself on the surface stably.
- 3 Use 6 mechanical arms which have sucking discs on the end fix the materials.



The more detailed information of the vehicles as shown 3.2.4 transportation systems.

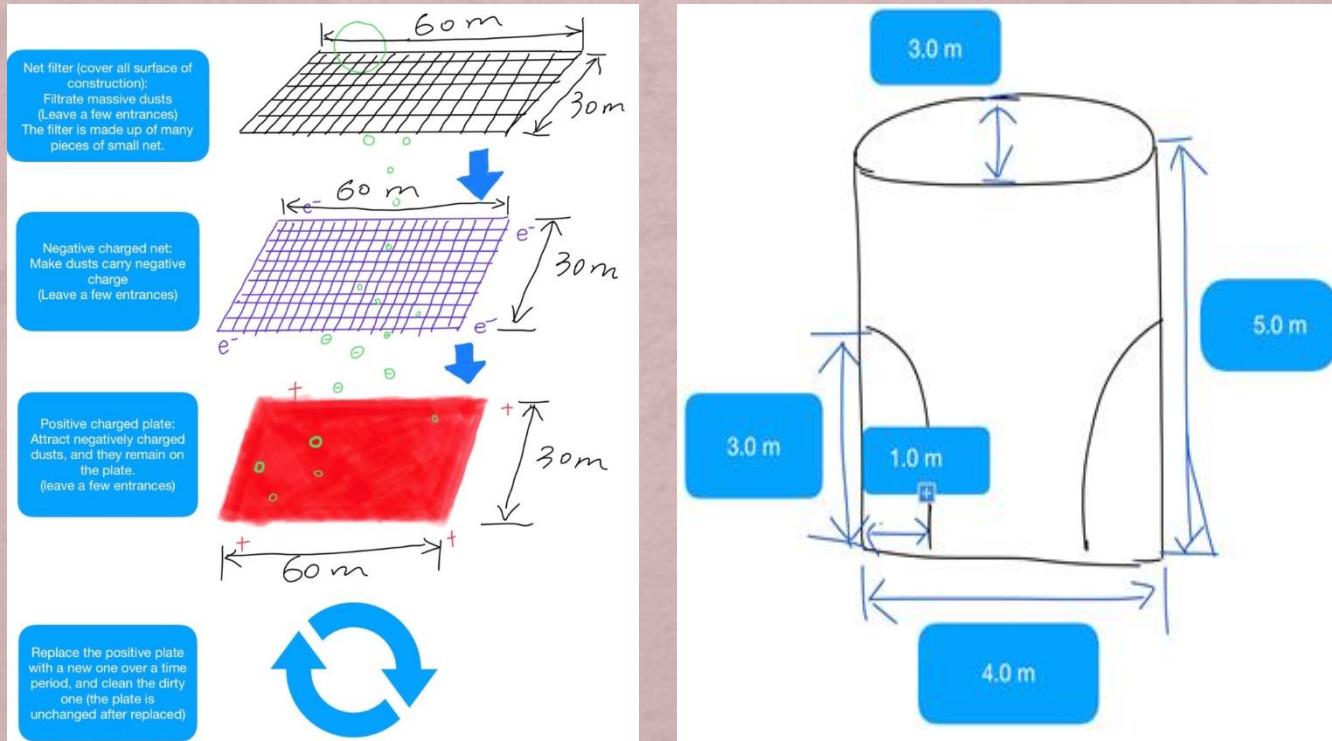
# 3.4

The diagram shows a long-distance vehicle with a rectangular cargo area. A vertical dimension line indicates a height of 4.3m. A horizontal dimension line indicates a width of 1.2m. A diagonal dimension line indicates a length of 2.8m. To the left of the vehicle, a blue rounded rectangle contains the text "Cargo robot". A large blue arrow points to the right, leading into a blue rounded rectangle containing the text: "Different type (metal, air...) of materials will pack up and carried by the long distance vehicles to different". Below the vehicle, a green background features a 3D model of a robotic arm or conveyor system with cylindrical components and a track.

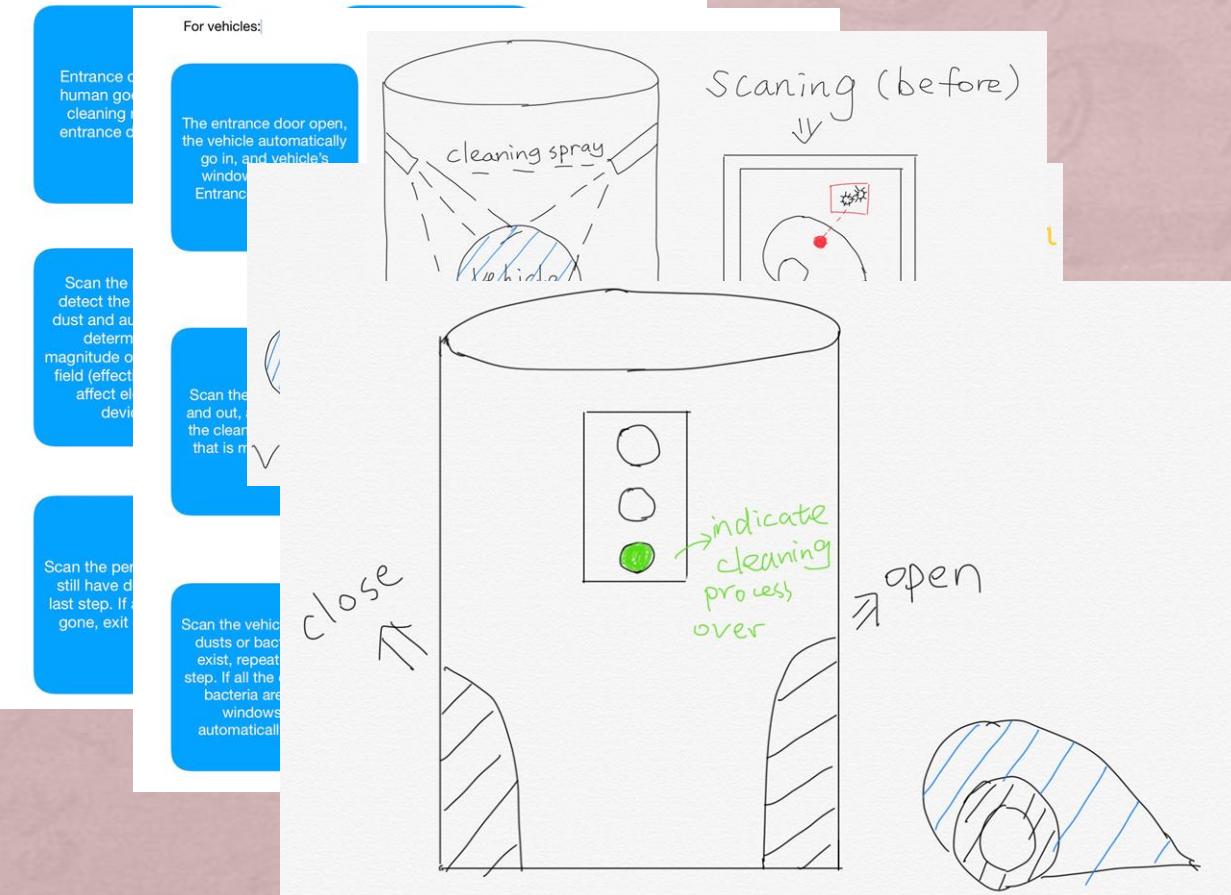
Length: 5m  
Wide: 3.5m  
Height: 4m  
Weight: 15ton  
Material: Titanium, Silicon

# 3.5

There are two component to prevent surface dust from getting into interior columns (referred to as “the inside” in chart). Four layers of net or plate will cover all surface area of construction, and a few entrances are left for transportation. Each entrance for transportation contains two part, one for human and one for vehicles. The size of the entrances is shown below.



Human and vehicle go in to two separate cleaning room.  
Human:



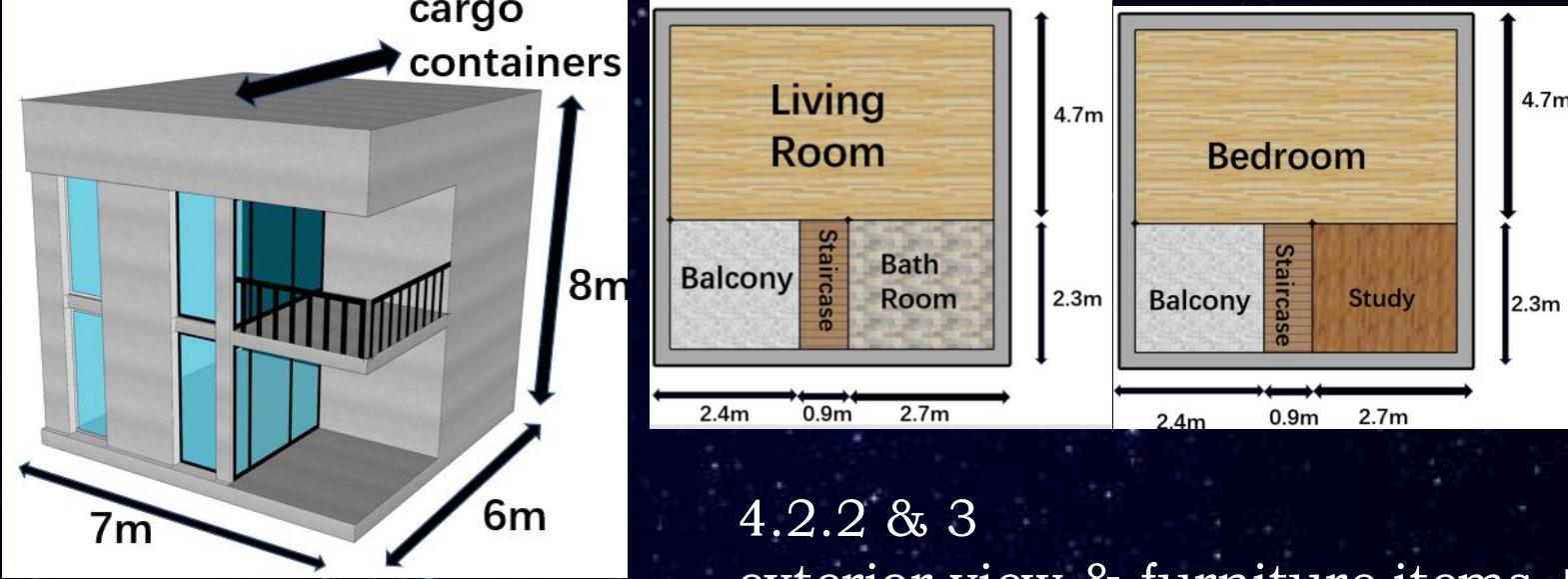
## 4.1.2 Maps of the community

48.1m

Term	Anticipated quantity/person/year	Total anticipated Quantity/year	Description	Source
Food	720.7452kg	216223.56kg	Grains, Meat Vegetable, Eggs, Fruit, Milk powder , etc.	Produce on Fenix and import from Icarus
Wash Supplies	20kg	6000kg	Tooth brush, soap, Comb Shampoo, etc.	Earth
Office Supplies	10kg	3000kg	Pens, Paper, Glue, etc.	Earth
Clothing	40kg	12000kg	Outer space suits, Inner space suit, Shirt, Trousers, Sweaters, etc.	Earth
Stationaries	300kg	90000kg	Furniture, Experimental Supplies, etc.	Earth & Produce on Fenix

100m

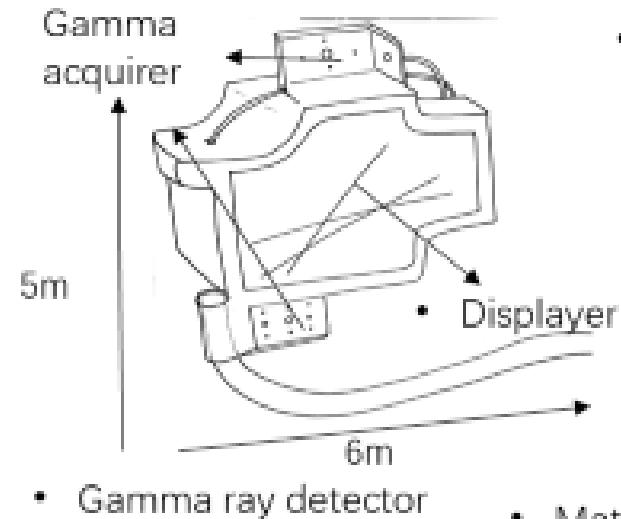
47m



#### 4.2.2 & 3 exterior view & furniture items + appliances

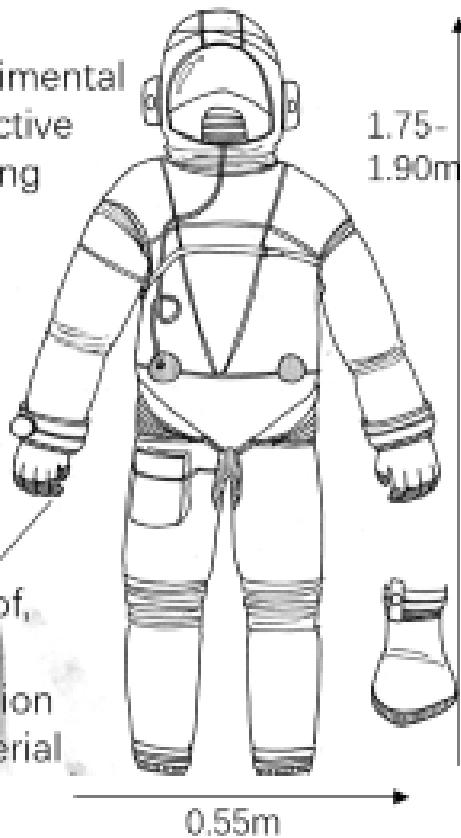
Type of Furniture	Sofa	Tv	Freezer	Bed	Chair
Number	300	300	300	300	300
Source(s)	aluminum	Mental & plastic	Mental & plastic	aluminum	aluminum
Manufacture	3Dprinter	Import from earth	Import from earth	3D printer	3Dprinter

#### 4.3.4 Design safety features in laboratory facilities



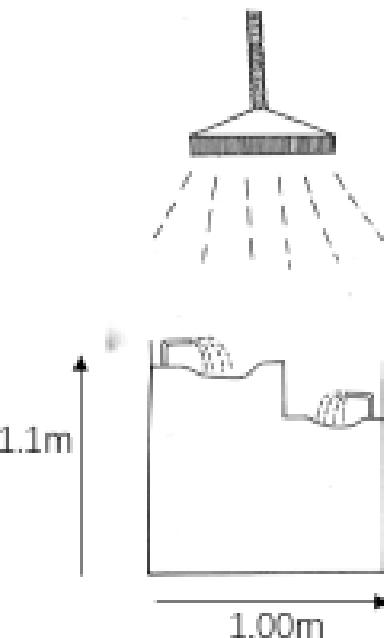
• Gamma ray detector

- Experimental protective clothing



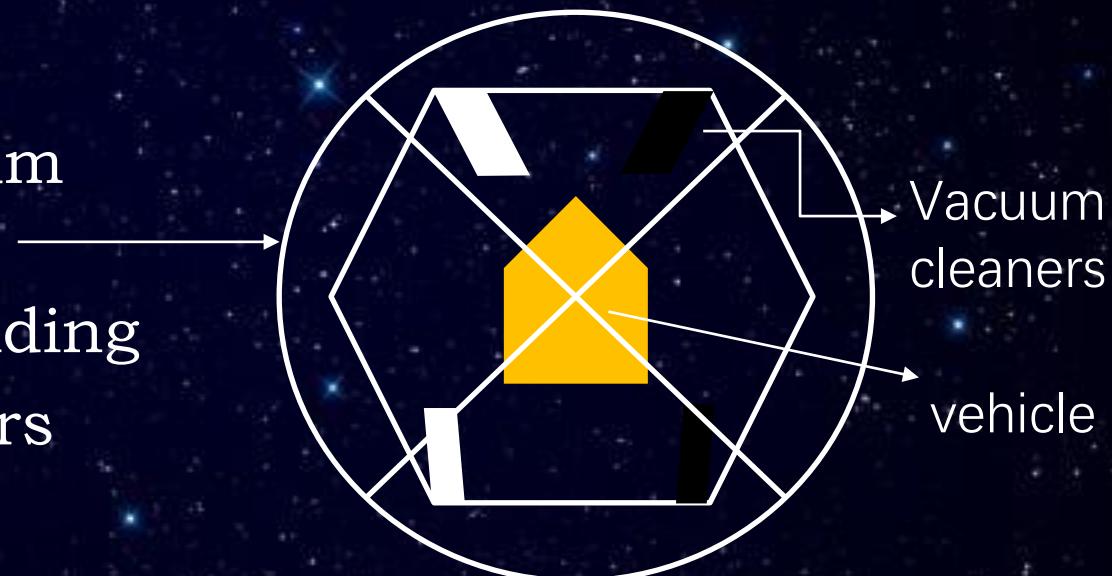
- Material: radiation proof, light weight
- Hands: corrosion resistant material

- Cleaning device (mainly for corroded clothes & things)

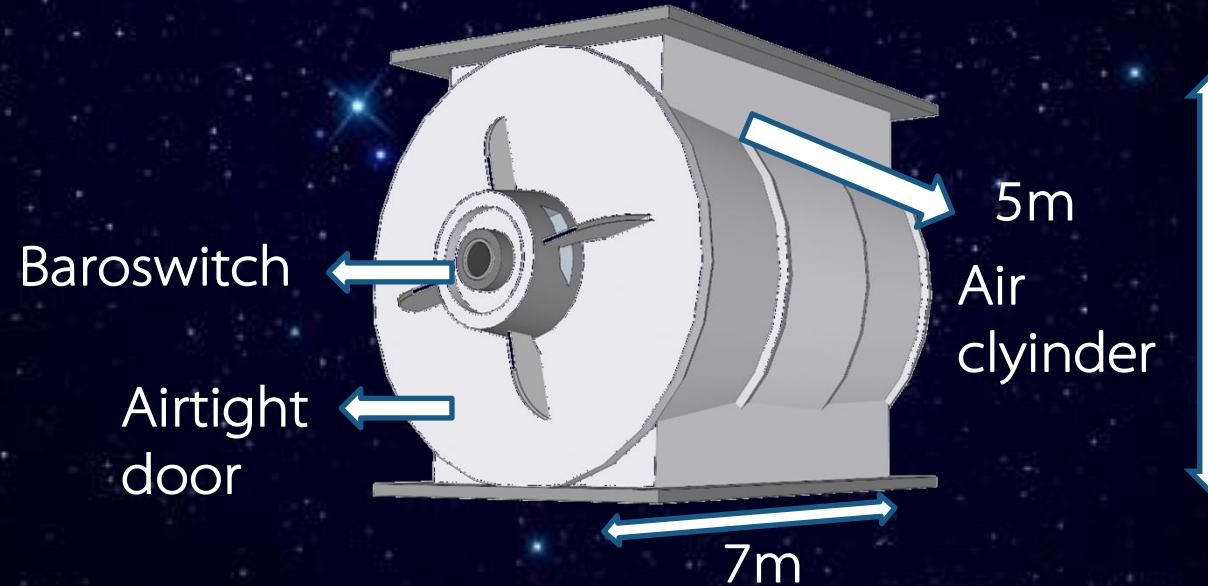


#### 4.3.5 methods prevent dusts into houses

1. Airlock
2. Giant vacuum cleaner
3. Electric shielding
4. Doubled doors

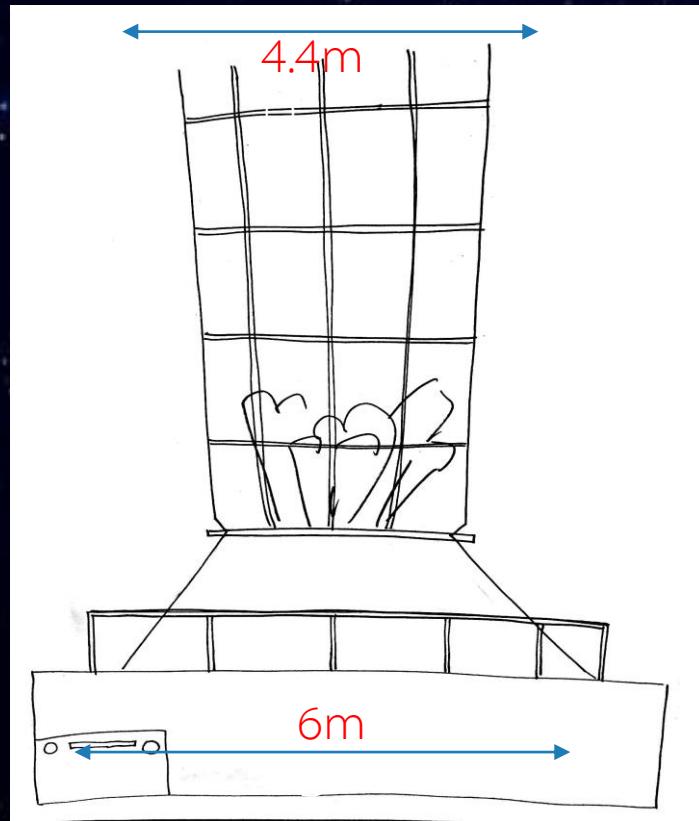


## 4.3.6 pressurized facilities (airlock)

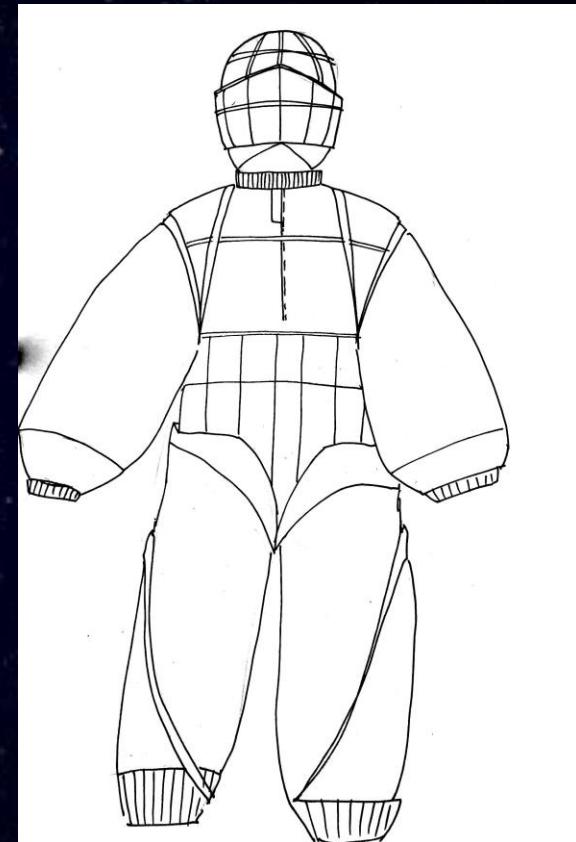


<https://www.praterindustries.com/products/rotary-airlock-valves/>

## 4.4 Entertainment



- protective clothing
  - Soft & thick
  - Mitigation of impact
- Machine



#### 4.5.1

Type  
of  
job

Doc

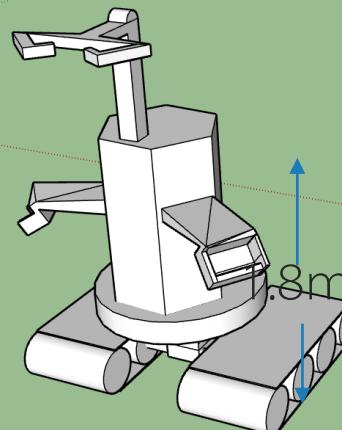
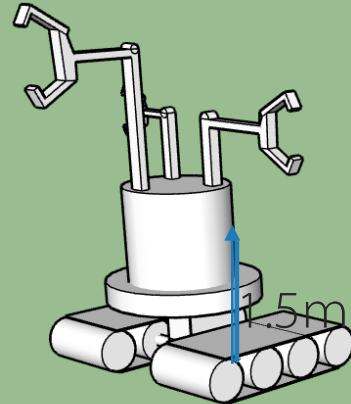
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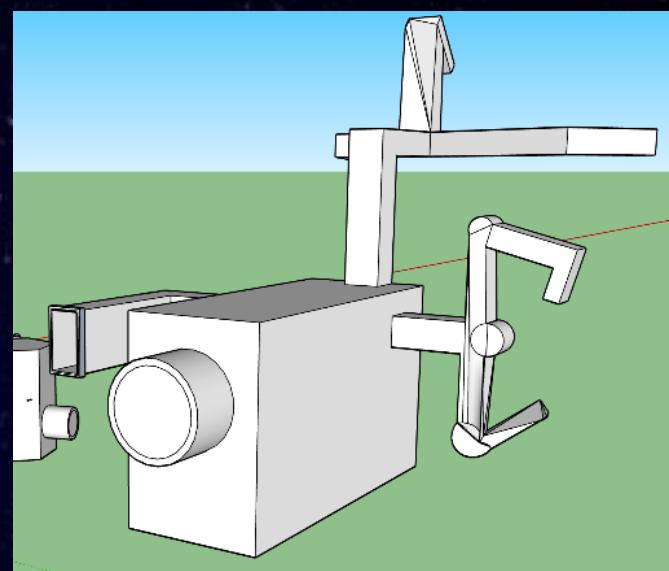
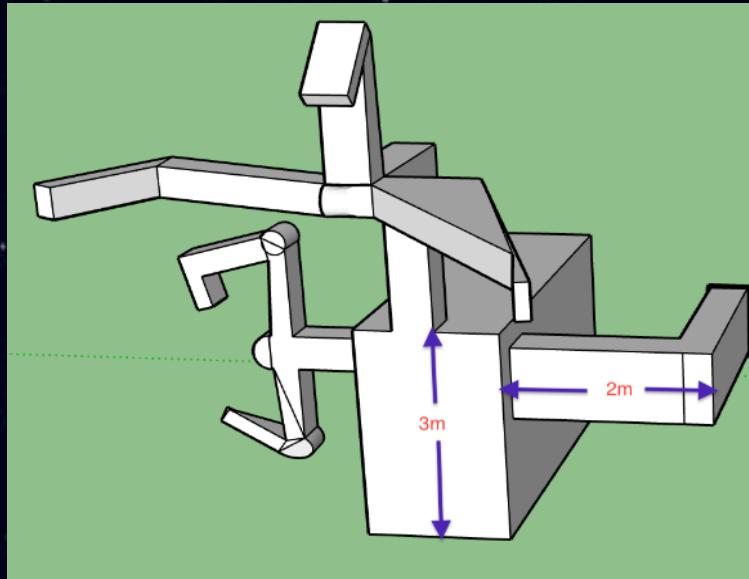
Working schedules

Time\Types of jobs	Doctors	Cooks	Researcheres		
			Agricultural	Laboratory	Management
7:00	at rest except in emergency situation	prepare breakfasts	at rest except in emergency situation		
8:00			breakfast time		
9:00					
10:00	start to cure patients	at rest except in emergency situation	Real-time monitoring of the climate environment, soil conditions	do researches on lunar rocks; analyze lunar soil	Protect common transportation
11:00		prepare lunch	Receive,collect and analyze data	collect data	
12:00:00-13:00			lunch time and free time		
14:00			Receive,collect and analyze data		
15:00			Real-time monitoring of the climate environment, soil conditions	observe lunar motion;observe earth motion;Do researches on metallic materials	Communication with earth to report whether the base works well
16:00	start to cure patients	at rest except in emergency situation			
17:00		prepare dinner	collect and transport back		
18:00			dinner time		
19:00			Check and repair agricultural machines	analyze data and make conclusion	check and report whether the base works well
20:00					
21:00			report date back to management		
22:00:00-23:00			free time(entertainment)		

5.1



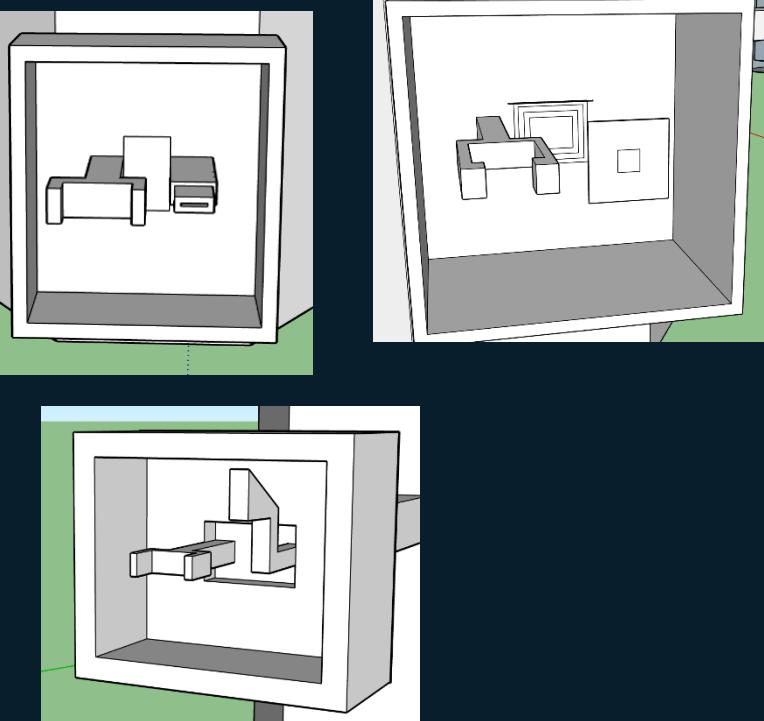
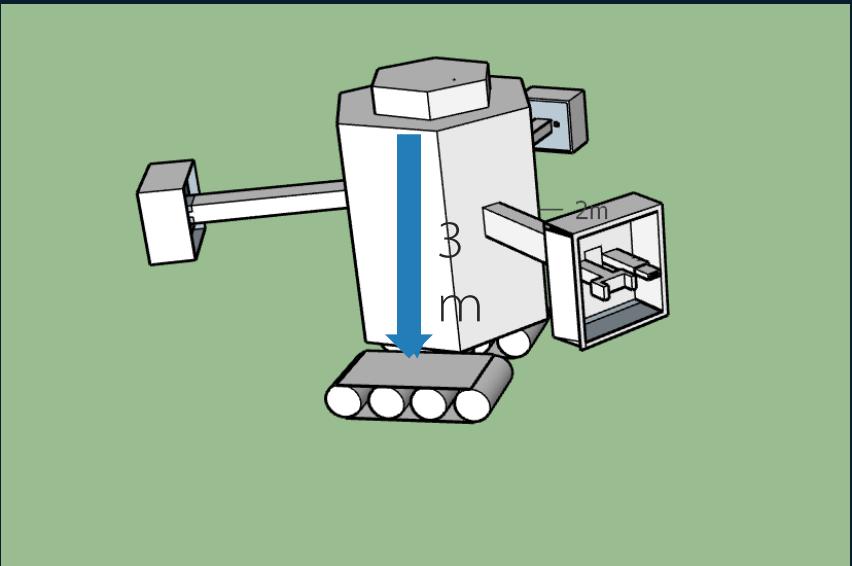
interior construction.  
travel on the moving wheels on the pathway.  
Black : twist and drag  
White: take the waste together  
pull and hold.  
ten groups of them, each group have 5  
Black and 5 White.



exterior construction  
Potter.  
thrusters  
pulling and taking up  
receive the instruction and control the direction.

40

5.2

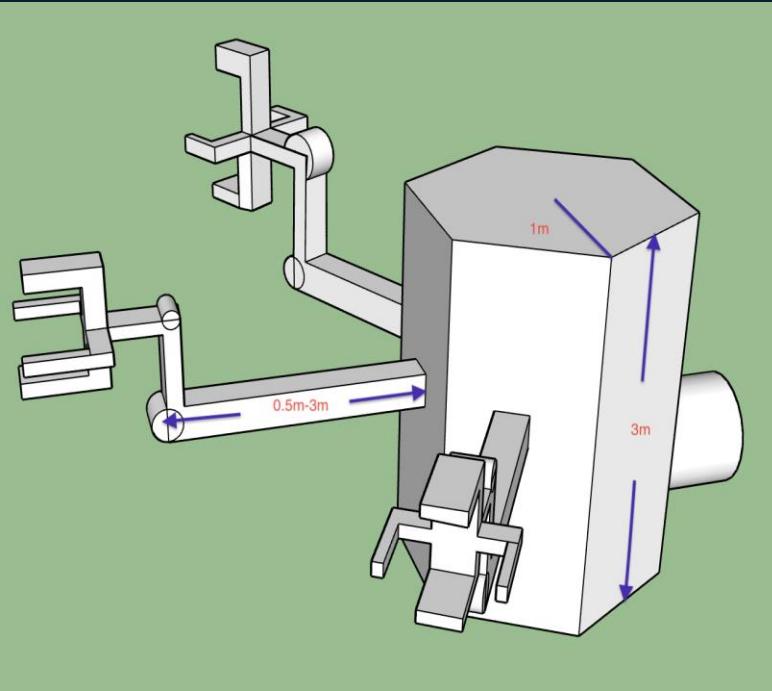


interior maintenance and repairing FCB.  
on the pathway

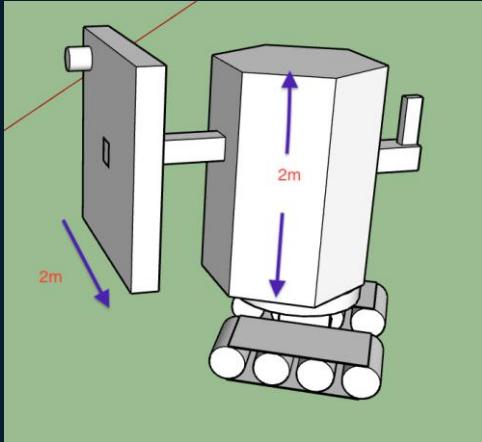
stretch out and draw back

cover the broken part

the robot hand, rubber gun, embossed plate and  
cutting disk receiver

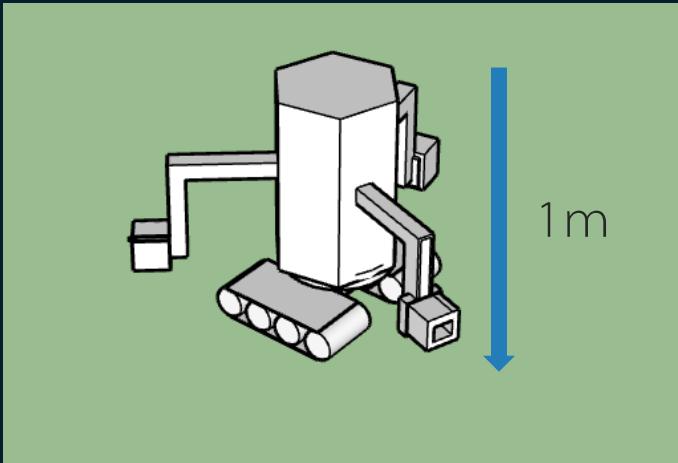


Exterior maintenance and repairing  
Spider  
Thrusters  
stretch out and draw back  
hold together and rotate  
pull out the damaged part  
put on the new parts



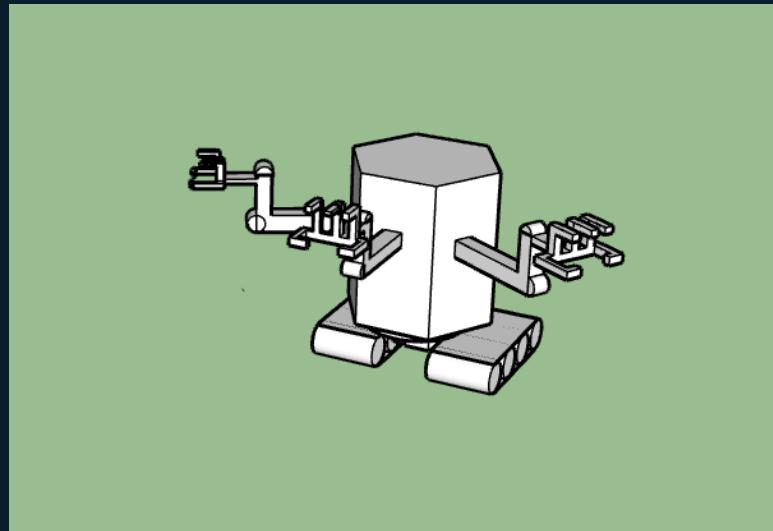
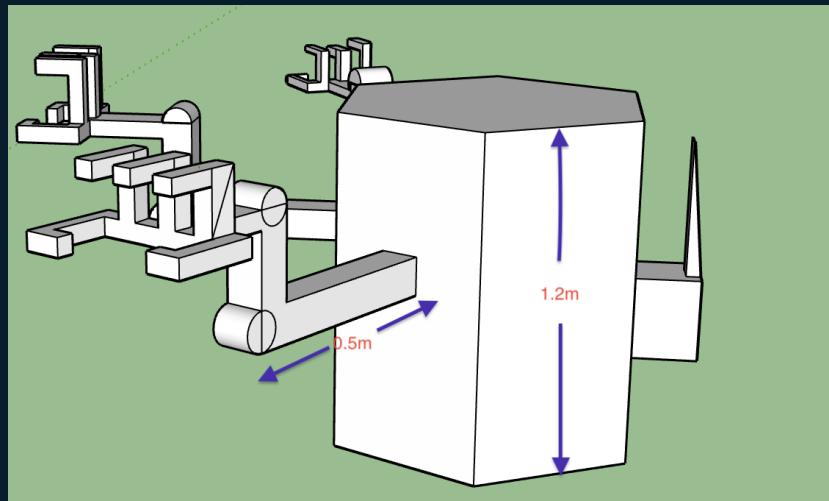
security 360  
can go everywhere  
contact with the watch  
check the metal things  
Record information  
pop out to protect  
the alarm system  
300

5.3



cleaning  
Elephant  
can go everywhere  
dust collection  
turn to every direction.  
300

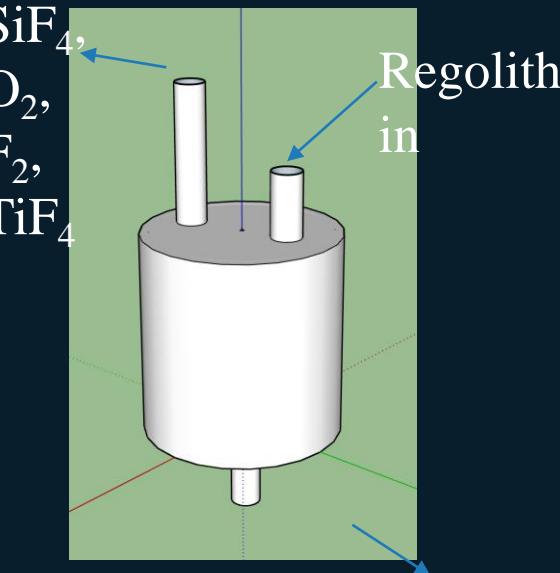
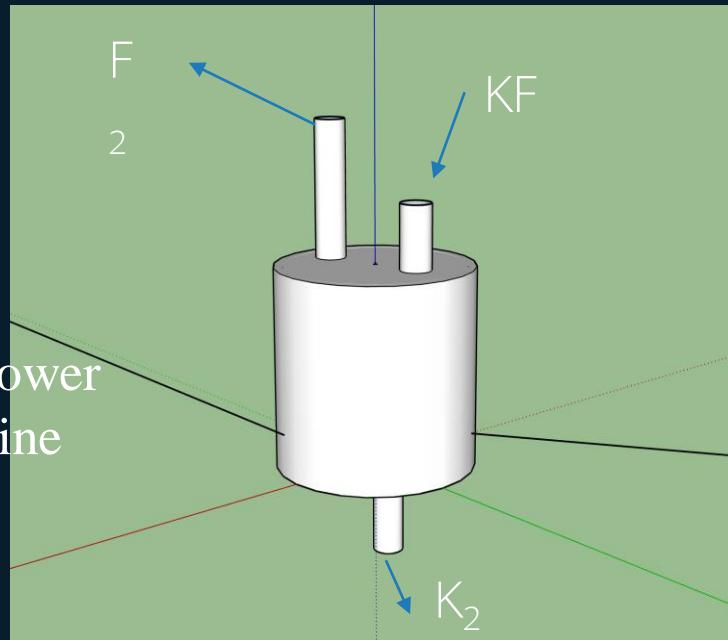
daily tasks Thomas  
can go everywhere  
hold many things  
Convenience and improve productivity  
Receiver  
300



## 5.4

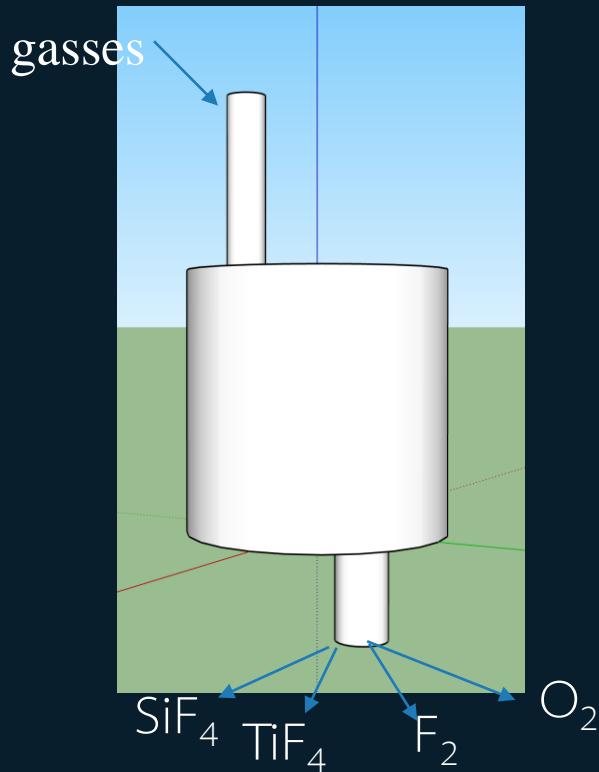
First, Electrolyzed KF that came from earth to  $K_2(g)$  and  $F_2(s)$  at 676 °C.

The fluorine reacted with heated lunar regolith to form  $SiF_4$ , oxygen, and metal fluorides at a temper-ature of 500 °C

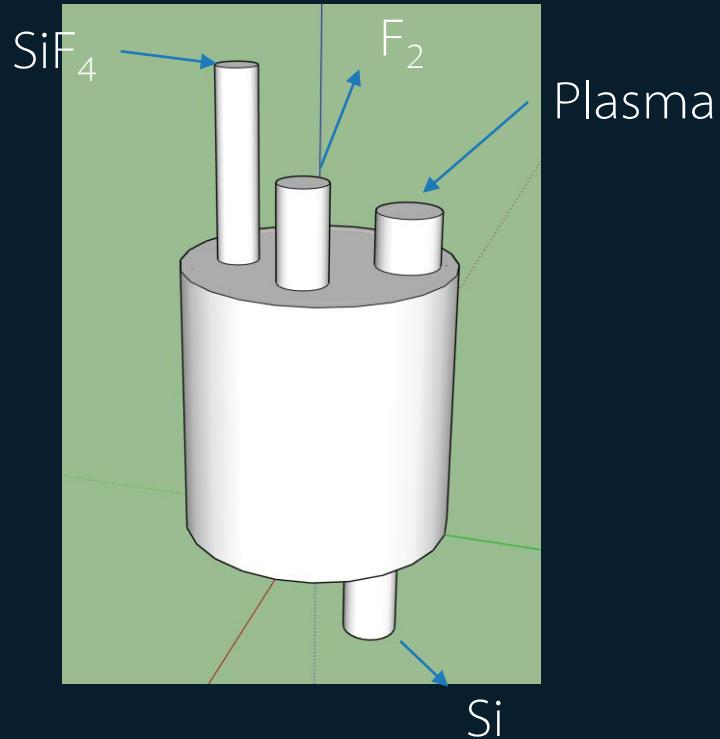


# Refining

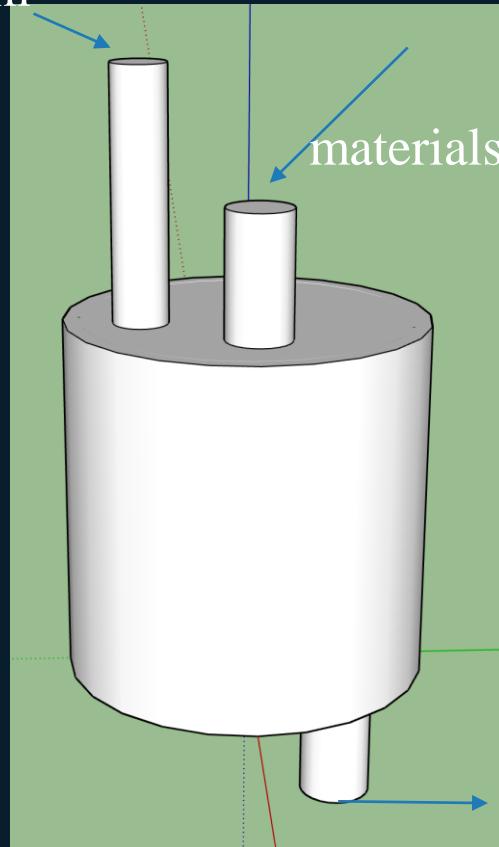
Third, all the gases came out from second step will be separated in the condenser in a temperature of 95°C. During this process, O<sub>2</sub> can be collect.



SiF<sub>4</sub> then react with plasma at 300°C to form Si and F<sub>2</sub>. The F<sub>2</sub> will be collect to use in the next reaction, and the Si can also be collect.



Potassium materials



- The last step is add potassium to the other material such as  $\text{TiF}_4$  and  $\text{AlF}_3$ . Then the Al, Ti and Fe can be collect and the K can be saved to use in the next reaction.

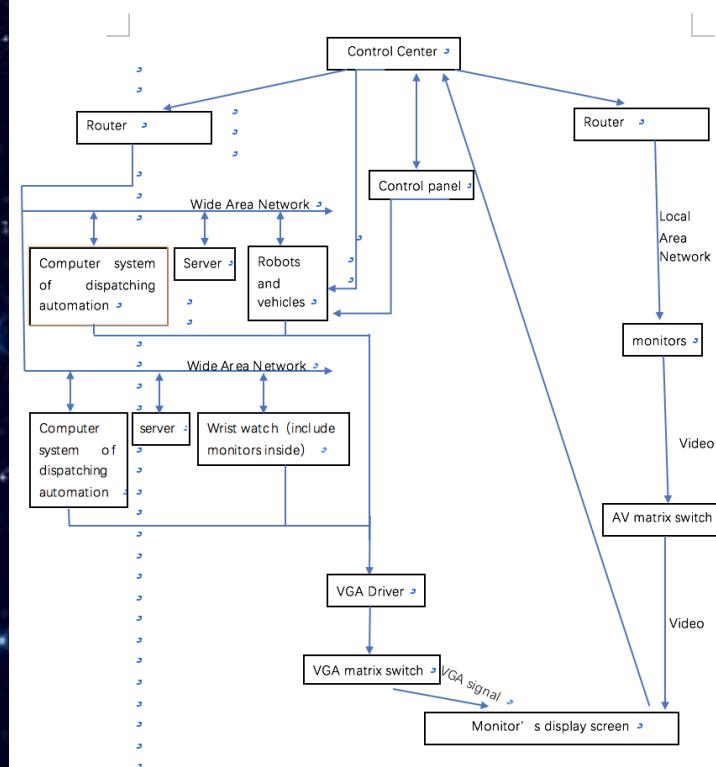
Metals and fluoride salts with K

## 5.5

# Base Functions of Control Center

Sending internet to routers	This is achieved depends on the development of the Al twisted cable. This cable has been proved to have the best transmission capability (high bandwidth, less affected from interference and need relatively less often repetition) with a relatively low cost. The Al can be purified from the alloy Al <sub>2</sub> O <sub>3</sub> on the earth and the cable may be produced by the 3D printer. The Internet signal can be transported through the shell to the routers quickly and efficiently.
Controlling the robots and vehicles	Once the monitors notice any or emergency situations or there is any request, the Control Center needs to command repairing robots and maybe vehicle to provide necessary materials. To achieve that, we give each robot and vehicles a unique address. To control them, the Control Center needs to send the command to the specific address through our online mail system (which transmits message between two or more terminals through Internet).
Commuting with the control panel (operating by stuffs)	The Control Center needs to be controlled by the faculties in specific situations, e.g. a crack in inferior circuit. The circuit of Control Center then is designed connected with a control panel and may follow its instruction. The Control Center may also report, if any, electronic problems to the panel also through the connected circuit, by lighting a specific light.
Commuting with the monitors	Monitors record every activity happened in the tube and in the mine, if there is any unusual situation, it will send message to the Control Center. Control Center then is designed to connect with the monitors through infrared wave (send by the monitors).

- Router
- Computer system of dispatching automation
- Server
- VGA matrix switch
- AV matrix switch



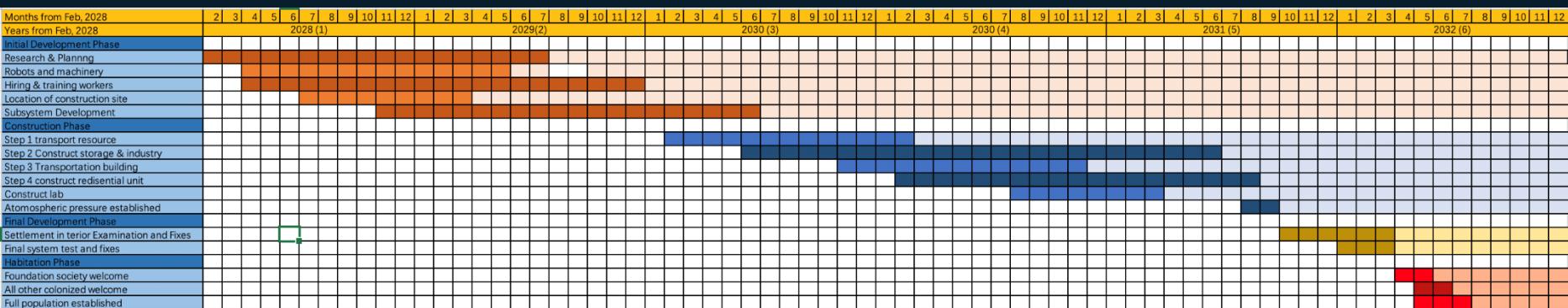
- Router : a device that acts as a node on the Internet
- Computer system of dispatching automation : a device used to strengthen the safety monitoring of the power system through operation. After any local failure, it can quickly notice and solve the problem and return to normal.
- Server : a device used to ensure the personal terminal's privacy, reliability and safety.
- VGA matrix switch: a device used to combine two or more analog signals and output to one device
- AV matrix switch: a device used to combine two or more video signal and output to one device.



- Example of display requires for base operations monitoring
- Functions of the wrist watch
  - Connect with other occupants
  - Health check
  - Map (send to surrounding environment images to the watch as well as the Control Center)
  - Helps (connections with staffs)
  - Online payment

6 schedule and cost

## 6.1 construction schedule



## 6.2 cost

# Construction cost: Phases

PHASE2:residential area					
Main parts		Material/dev ice	Quantity	Unit cost (include transportation)	Total cost
Exterior structure	Construction material	Aluminium alloy	100t	\$30million	3billion
Interior structure	houses	Houses(single)	100		
		Houses(double)	100		
		Total cost:5.5billion			

Industrail machine	5 billion	
Solar panel	5 billion	
Food	3 million	
communication	2.5 million	
transportation	93 million	
	4 million	
	80 million	
	20 million	
	120 million	
	7.27B	total 7.27B

Total cost: 16.95B USD

Devices	Quantity	Unit cost	Total cost
Interior space suit	300	10000	3000000
Exterior space suit	60	5000000	300000000
Wind tunnel for entertainment	4	20000	80000
Aluminum for furniture	19500kg	0.225\$ / kg	4387.5
Display screen in house	300	2000	600000
Gamma acquirer	5	1000000	5000000
Pressurized Facilities	6	10000000	60000000
Aluminum for house	2017052.002kg	0.225\$ / kg	453836.7
Experimental needs			2000000000

Automation cost list

0.132B USD

Material <sup>(v)</sup>	Source <sup>(v)</sup>	Amount <sup>(v)</sup>	Price <sup>(v)</sup>
Networking system <sup>(v)</sup>	- <sup>(v)</sup>	1 <sup>(v)</sup>	\$100,000,000 <sup>(v)</sup>
Communication and Online Payment Applications <sup>(v)</sup>	- <sup>(v)</sup>	1 <sup>(v)</sup>	\$200,000 <sup>(v)</sup>
Aluminum twisted cable	Moon <sup>(v)</sup>	10,000km <sup>(v)</sup>	\$6,000,000 <sup>(v)</sup>
Inner construction <sup>(v)</sup>	Earth & Moon <sup>(v)</sup>	50 <sup>(v)</sup>	\$4,000,000 <sup>(v)</sup>
Outer construction <sup>(v)</sup>	Earth & Moon <sup>(v)</sup>	40 <sup>(v)</sup>	\$4,000,000 <sup>(v)</sup>
Dust catcher <sup>(v)</sup>	Earth & Moon <sup>(v)</sup>	30 <sup>(v)</sup>	\$30,000 <sup>(v)</sup>
Repair robots <sup>(v)</sup>	Earth & Moon <sup>(v)</sup>	30 <sup>(v)</sup>	\$300,000 <sup>(v)</sup>
Safety & Service robots <sup>(v)</sup>	Earth & Moon <sup>(v)</sup>	One per one house <sup>(v)</sup>	\$18,000,000 <sup>(v)</sup>
Total <sup>(v)</sup>	v	v	\$132,530,000 <sup>(v)</sup>

THANK YOU