

# SPACE WORKERS

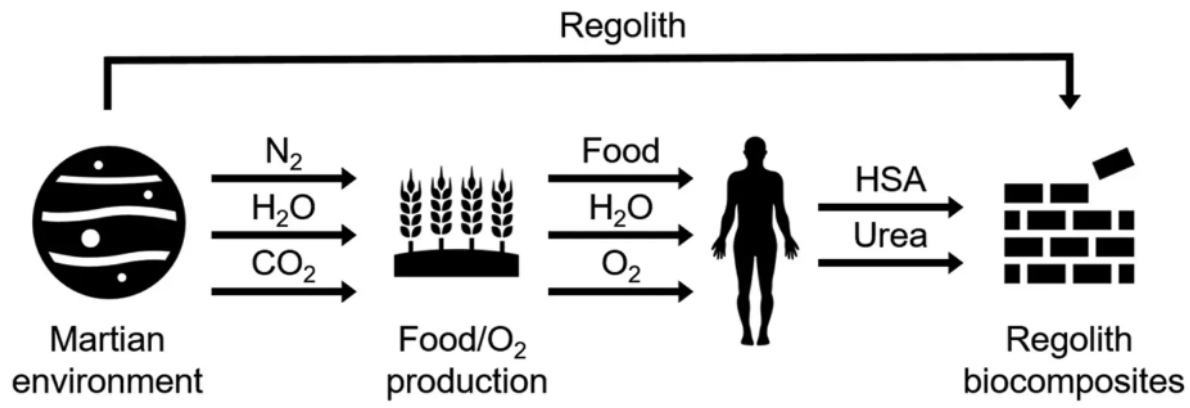
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## Martian Brick

A protein from human blood (human serum albumin) combined with urea (a compound from urine, sweat, or tears) could glue together simulated moon or Mars soil to produce a material stronger than ordinary concrete, which would be perfectly suited for construction work in extra-terrestrial environments. An estimate is done that over 500 kg of brick could be formed from the human waste of an astronaut over a 2-year mars mission.



The brick formed from this factory will be used to develop a habitat on Mars. First, the raw materials will be transformed into fine particles using a grinder. Then the mixer will mix the Martian fine particles, water, albumin, and some adhesives(polymers) into it. Now, this thick paste will be transferred to a 3d printer and the 3d printer will make brick. Then a person will carry this and send it to storage. The storage system will be open to sunlight and air where it will solidify and get hardened.

Raw materials: Martian soil, adhesives, water, human albumin

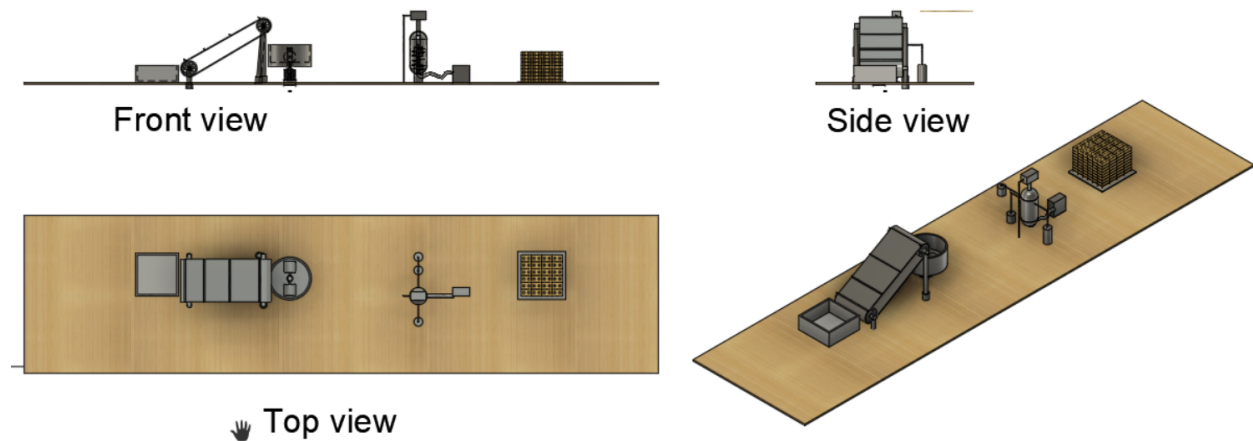
Martian soil will be over there itself and can be transported using industrial trucks manually.

Water will also be transported to the pipe(However studies have claimed that only human albumin is sufficient to provide a compressive strength of up to 25Mpa).

Adhesive(such as polymers): This would be required in significantly fewer amounts and can be transported from the earth.

- **Product layout: Mass flow production throughout the year**

## Space factory sketches



## Material handling system

- The martian rock, dust, or soil is transported to the raw material point via **industrial trucks**.
- **The Belt conveyor** will be used to carry the rock, dust, or soil to the grinder.
- Finally from the 3d printer, again the brick formed will be rolled on a **belt conveyor** and thereafter a worker will put the brick into the storage system.

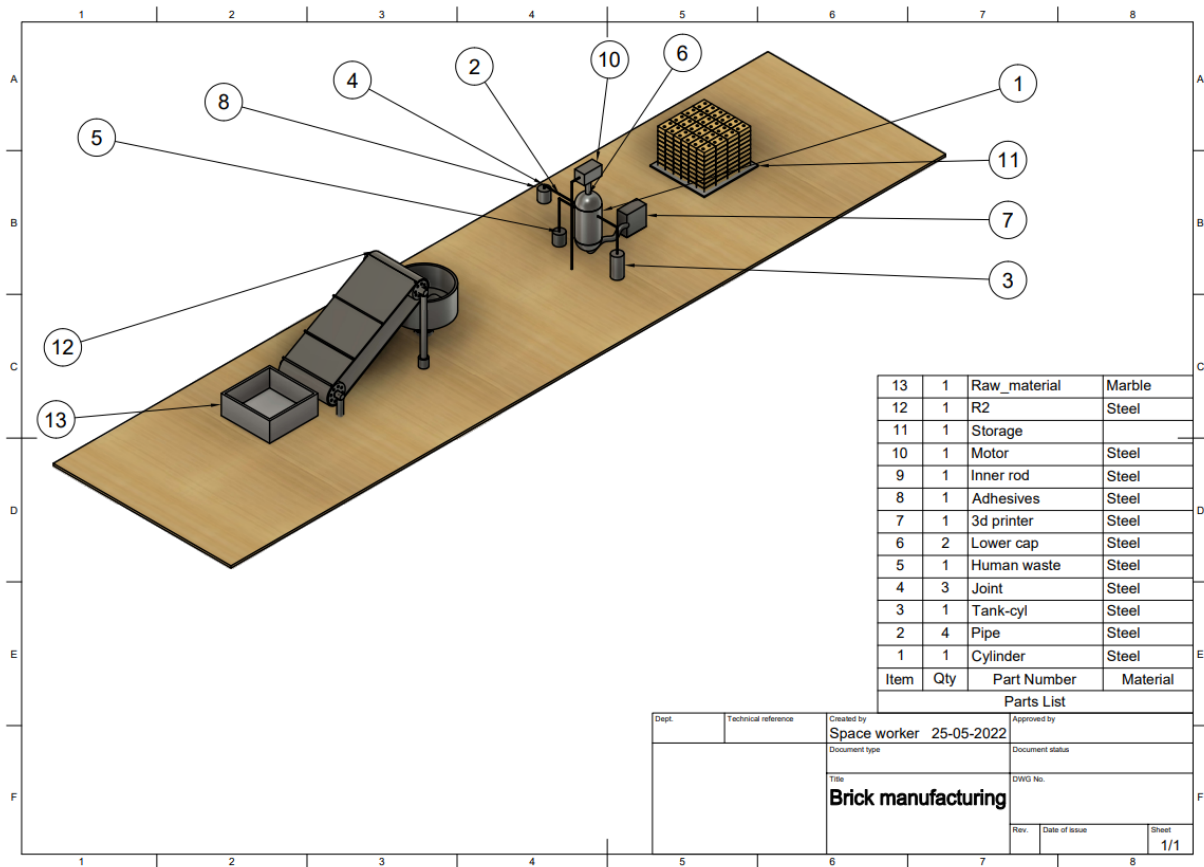
## Energy requirement

Energy will be required for running the motor and a grinder and this energy can be provided by solar energy.

## Human intervention

We already have very less human intervention but still, we can decrease the human intervention by having robots transfer the fine particles(from the grinder) to the mixer. And a robot to put the brick from the 3d printer to the storage system.

## Manufacturing process



## New technology/Teleoperation

In order to provide the appropriate amount of adhesive, water, and human albumin, we need to have a Programmable logic control(PLC).

A set-up for ladder logic programming would be done it would have multiple sensors and timers connected to it which would help in sending the appropriate amount of mixture data.

## Manufacturing metrics

**#We have a bit scaling factor in our project. Please assume all the millimeters into centimeters.**

### Raw material storage

Open cube of volume: 5290000 cm<sup>3</sup>

### Grinder

Cylinder of radius 125 cm and height 125 cm

So volume is 61,32,812.5 cm<sup>3</sup>

### Mixer

- Mixer  
Cylinder: Diameter = 100 cm, height = 150 cm and lower cap is hemisphere of radius 50 cm  
So total volume = 14,39,166.66 cm<sup>3</sup>
- Adhesive: Cylinder (radius = 25 cm; height = 50 cm; and volume = 98125 cm<sup>3</sup>)
- Water: Cylinder (radius = 25 cm; height = 100 cm; and volume = 196250 cm<sup>3</sup>)
- Albumin: Cylinder (radius = 25 cm; height = 50 cm; and volume = 98125 cm<sup>3</sup>)

### Storage

1 SKU - a square plate of side length 280 cm

1 SKU will have 216 bricks

### Brick

Length: 60 cm

Breadth: 40 cm

Height: 20 cm

Volume: 48000 cm<sup>3</sup>

Every cycle of raw material would get 100 L water, 50g adhesive, and 50mL human albumin (if available)

**For 1 cycle the total number of bricks produced is around 100 bricks.**

**And the net processing time for one cycle is 3 min and the total production is 175200 bricks per year.**

**And as this brick is used to have habitat over there, there won't be any selling factor. However, the cost of making this brick includes, transporting adhesive from the earth and the equipment set-up cost.**