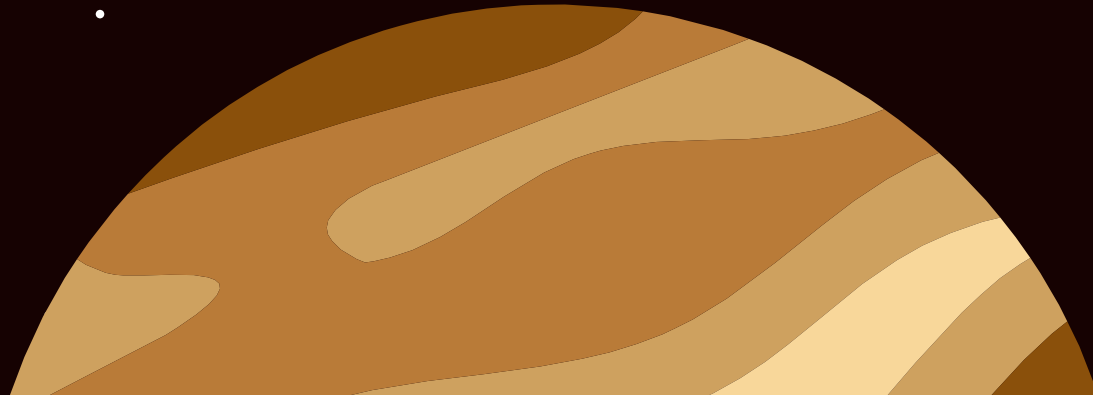


# A Wasteful idea



Team Kerbals



# Importance of water as a resource



- 1) **For drinking**
- 2) **For food production [1].**
  - Short term: 80% imported dried food, 20% food from hydroponics
  - Long term: Develop capabilities for large scale crop production
- 3) **For potential oxygen/fuel extraction [2]**
  - Extraction using electrocatalytic means
  - Hydrogen extracted used for fuels
- 4) **As reserve [3]**
  - About 1500 liters of reserve water will be stored in each life support unit
  - Consumed primarily at night and during periods of protracted low power availability, for example during dust storms.

# Problems with Securing water

## *Evaluation*

<u>Source [4, 5]</u>	<u>Evaluation</u>
Subsurface water	Small scale sustainability, also assuming if landing area has substantial subsurface water
Atmospheric water vapour	Given the thin atmosphere, there is little water available for extraction
Underground / Soil using MRWE [6]	Relatively efficient if available, but takes time to setup the system
Ice caps / glaciers	Power intensive

# OUR SOLUTION

Waste Water Recycle System



A System that is able to extract water from human feces through heating process and reutilise it

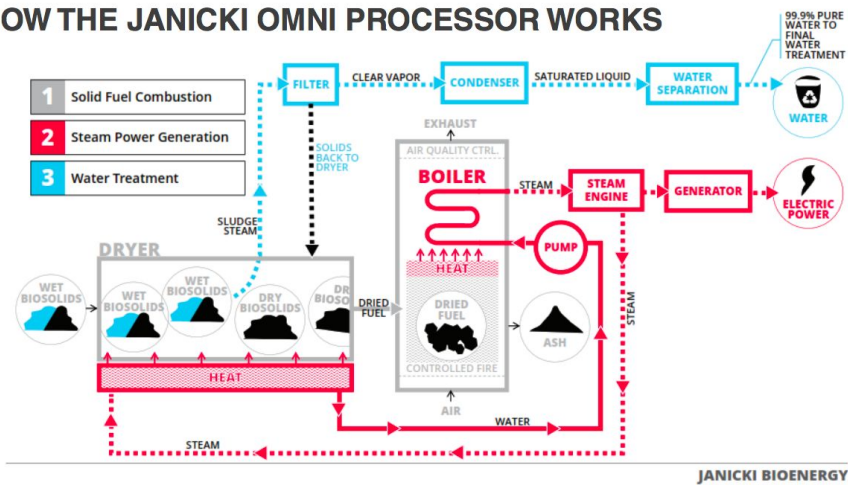
# Why Wastecs?



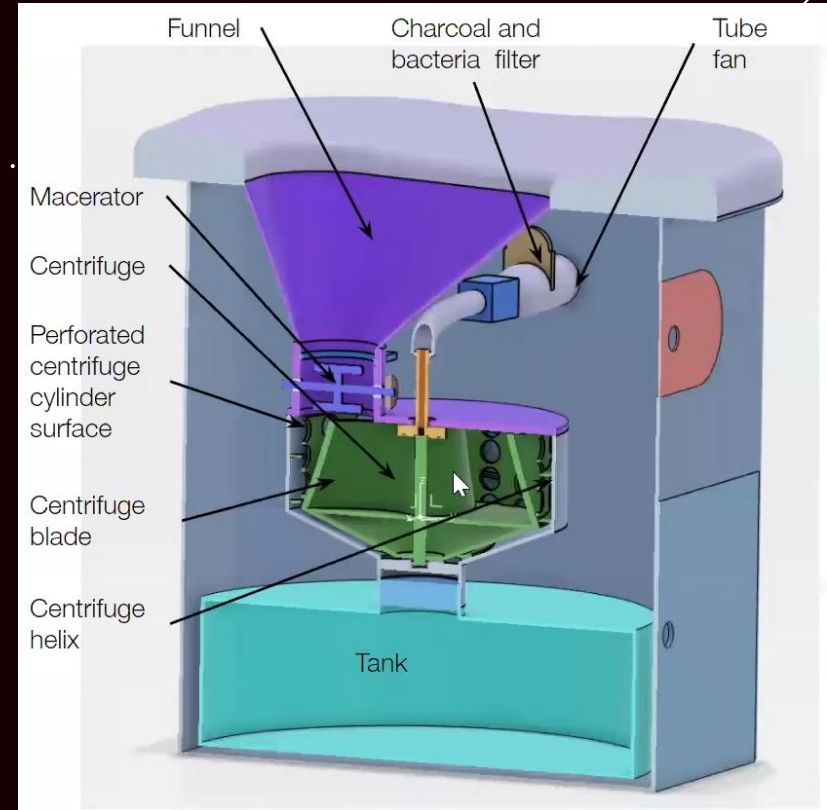
- Water is scarce
  - Unforeseen incidents that makes travelling outside the dome impossible (such as martian dust storm) [7]
  - Wastecs further closes the waste management loop
- Dried human waste is easier to manage, store or dispose
- NASA has yet to have a mechanism to extract water from solid waste [9]
- Human feces are 75% water, and we produce 250g of solid waste day
  - With 10 crew members, that's 170L of water in 3 months!

# Case Study

## HOW THE JANICKI OMNI PROCESSOR WORKS

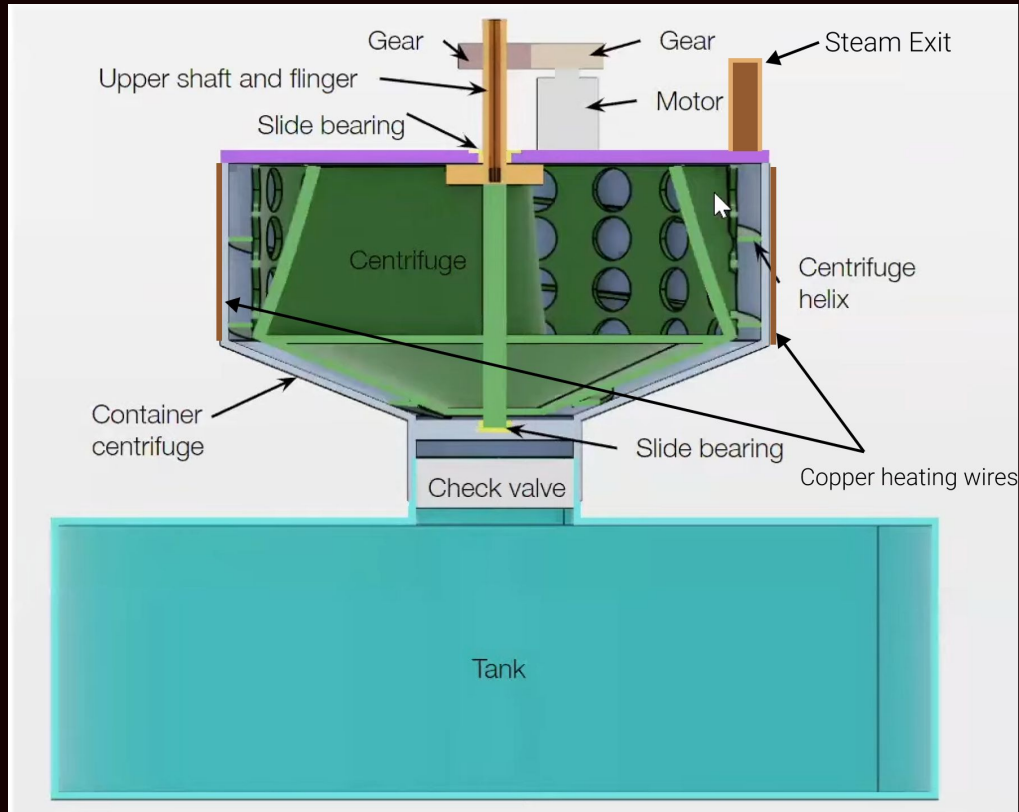


Janicki Omni Processor [8]



Centrifugal Lunar Toilet [9]

# How it works



Adapted from *Centrifugal Lunar Toilet, 2nd Runner up of NASA's Lunar Loo challenge*

# How it works

- Human feces ranges contains **55% - 75% water**. Much of the 25% to 45% that remains consists of gaseous methane—produced by bacterial breakdown—and a solid residue which, if dried and concentrated, has an energy content similar to that of coal [11]
- The treatment process involves boiling (or thermally drying) the sewage sludge, during which water vapour is boiled off and recovered.
- Water can be further treated with reverse osmosis to produce safe drinking water.



# Impact

Equivalent impact:

- Provide water for a hydroponics system of 90 plants [10]
- In a month, to provide water for 2 people for 23 days

# Future Works

1. Dried waste product can be used for biosolids
2. Water can be filtered to be drinkable water
3. Research can be extended to recycle other forms of waste that might contain water (wet tissue, food waste, etc)

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- [11] 'How Human Feces Can Be Worth \$9.5 Billion | Time'. <https://time.com/4098127/human-waste-energy-recycling/> (accessed Jul. 29, 2021).