

# 2021 Moon To Mars Ice Prospecting Challenge

## Jackrabbit Automated Moon to Mars Extractor and Prospector (JAMMER)

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### INTRODUCTION

NASA has plans to set up a Moon base starting in the year 2024 and global interest in occupying Mars has increased exponentially. Water is essential for long-term off planet exploration and utilizing existing water resources reduces payload costs by millions. Besides providing drinking water for survival, water can be split into hydrogen (fuel) and oxygen for breathing. By tapping into newfound water resources on the Moon and Mars, long term stays outside earth becomes possible.



### SYSTEM GOALS

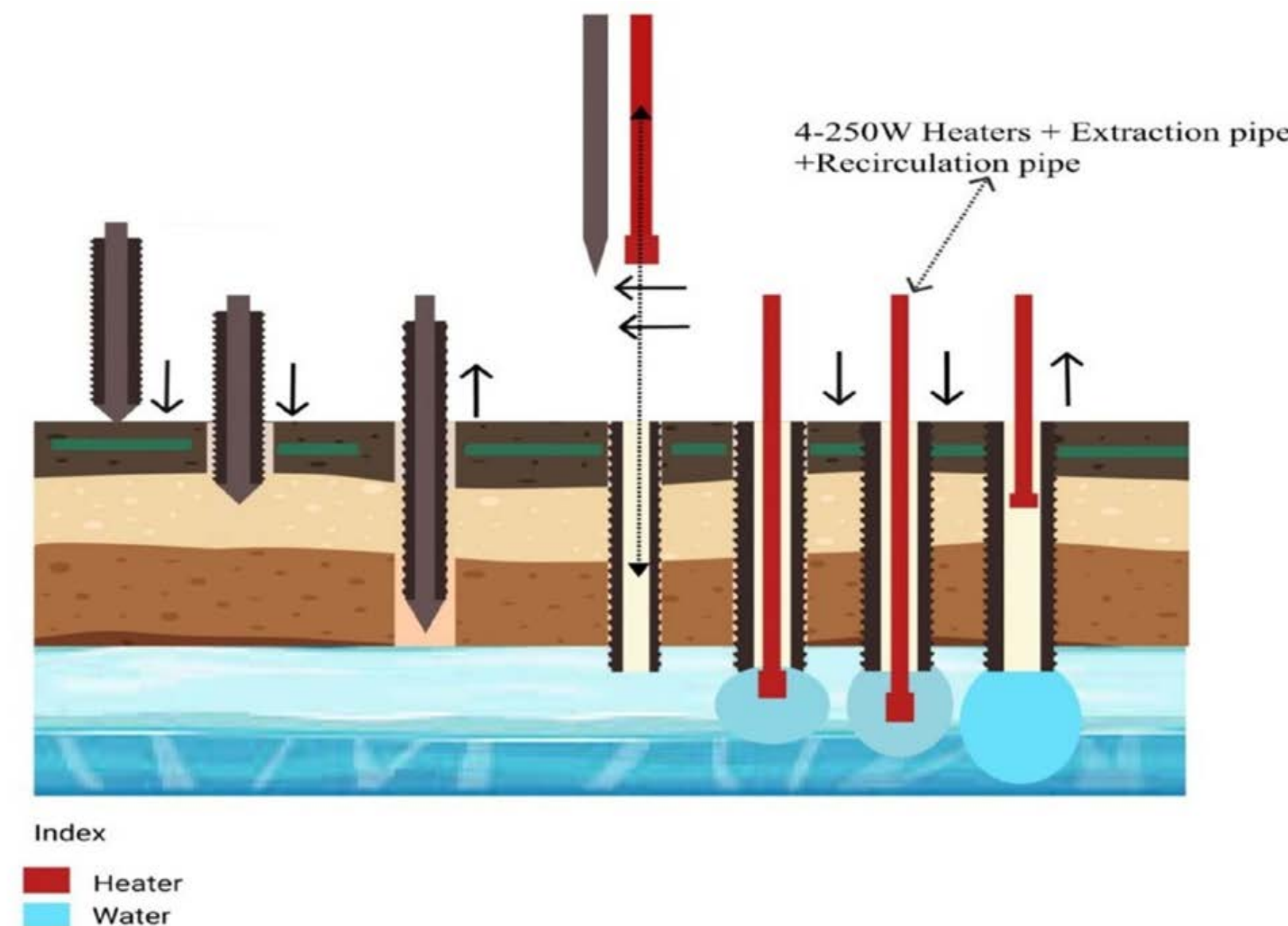
- Build a working prototype that can extract water from subsurface ice
- Drill through overburden layers and determine composition of the layer sand depths
- Use an innovate method for swirling water inside a Rodwell water mining system to promote faster melting and quicker water extraction
- Design a filtration system that requires few or no consumable parts. Filtered water should be free of major particulate matter
- System should be able to operate both hands-on and hands-off method
- Hands On: Changes can be made by physically touching the system
- Hands Off: Autonomous or remote-controlled. Control the system from 5 feet away and behind a wall

### DESIGN OVERVIEW

- Aluminum extrusion frame
- Custom designed and manufactured removable interior carbide tipped drill bit
- 3D Printed aluminum heater core
- Recirculation of heated water via diaphragm pump to promote swirling and quick melting
- Digital core assed via vibration monitoring and weight on bit monitoring

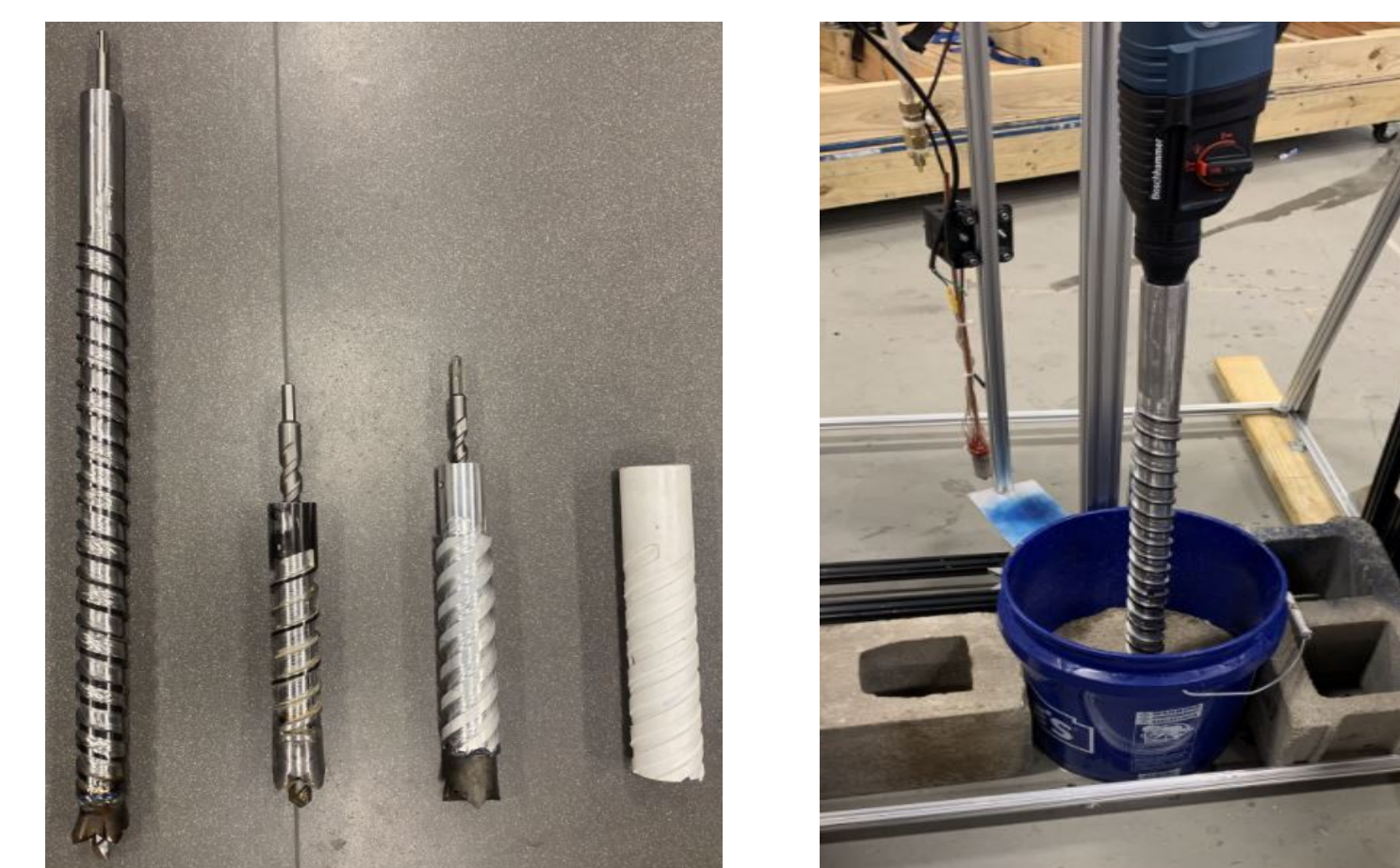
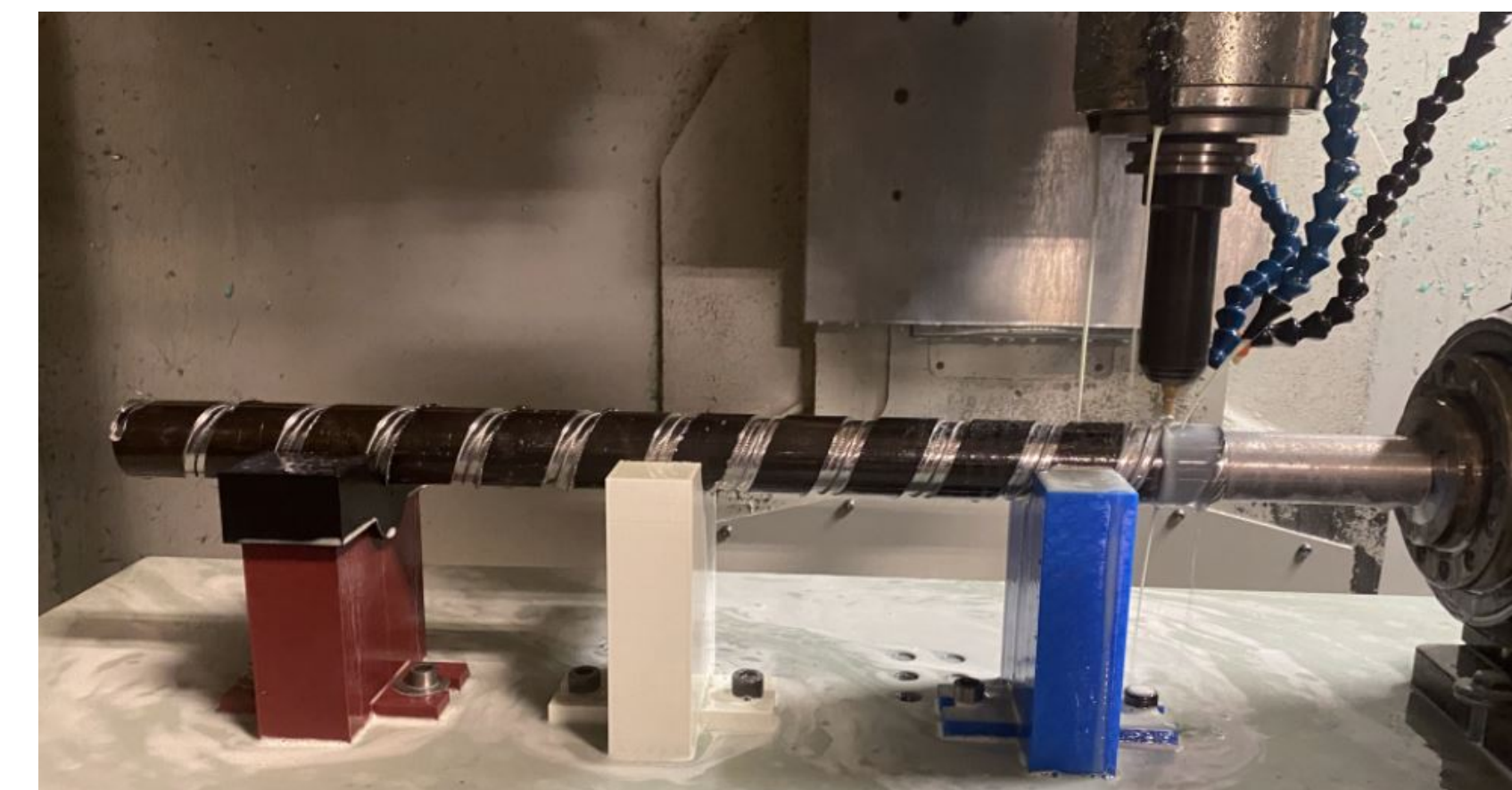
### OPERATIONAL OVERVIEW

1. The inner and outer drill bit attached together will drill through the overburden layers and into the ice surface.
2. Vibration sensors, current monitoring, speed monitoring to determine the digital core.
3. After reaching the ice interface, the inner drill bit will retract, and the heater core will be inserted.
4. The heater core consists of extraction tube, recirculation tube and heater cartridges.
5. After the maximum amount of water has been extracted from the hole, the heater core will be removed and the inner drill bit reinserted to help remove the outer drill bit.
6. Extracted water passes through series of mesh filters and Sawyer drinking water filter to remove almost all particulate overview. The Sawyer filter can be backwashed to clean the filter.



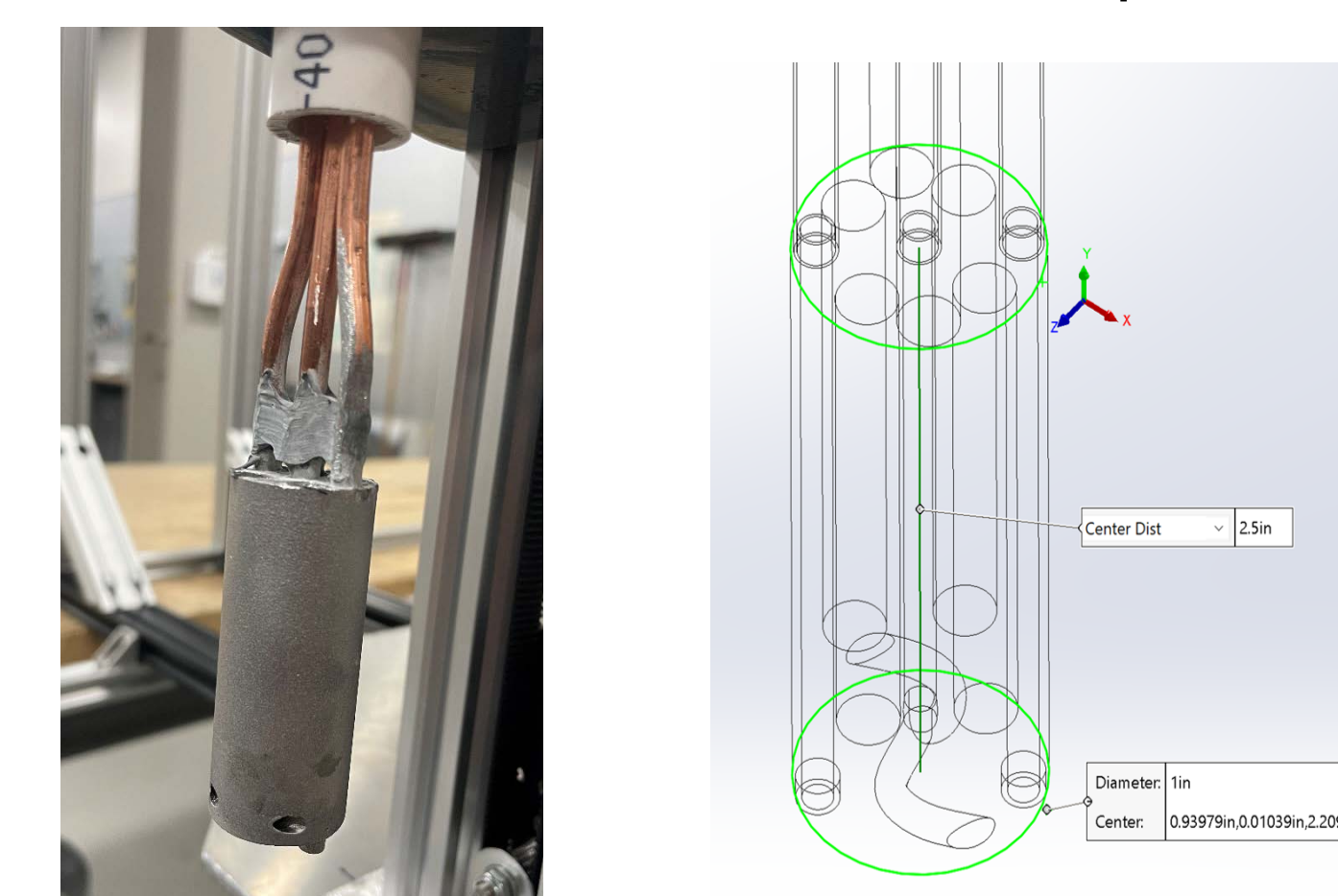
### DRILL

1. The hollow outer drill bit is manufactured using a 4<sup>th</sup> axis mill. Several versions were made using a variety of thread styles and two materials.
2. The interior bit is attached to an SDS extension for the Bosch Bulldog hammer drill.
3. A carbide tipped mountain climbing drill tip is attached to the end of the outer drill bit to do the majority of the heavy drilling through hard layers.



### EXTRACTION AND RECIRCULATION

A 3D printed aluminum heater core which houses four 250 W cartridge heaters, two extraction copper tubes and a copper recirculation tube will be attached to the vertical axis. The heater core fits into the hollow outer drill bit and recirculation promotes better melting and larger pool of water. Two solenoid valves will be used to alter between recirculation and filtration process.



### FILTER SYSTEM

What is continually pumped through the system to ensure swirling. Each time the water is removed, it is filtered through the mesh filters and filled into an intermediate tank for recirculation needs. After enough water has been collected, the water is allowed to pass through the valve to the Sawyer filter for final filtering. The water then moves into a 2<sup>nd</sup> intermediate holding tank to be used in case the Sawyer filter is clogged with tiny particulate. If the Sawyer filter needs to be backwashed, the backwash water will be pumped to a paper filter system to collect the small particulate before passing back to the 1<sup>st</sup> intermediate holding tank. When his intermediate holding tank fills, the water is then drained into the final collection reservoir.



### For more information, please contact

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