



# ANCHORNAUTS MICROGRAVITY TEAM

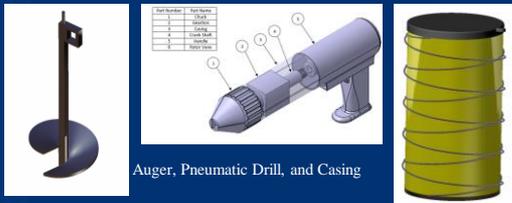
## ANCHORING DEVICE FOR REGOLITH DESIGN AND DEVELOPMENT

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### Abstract

This project will involve the design and development of an anchoring device for use on an asteroid surface. The system's purpose is to successfully anchor an astronaut to regolith in microgravity, allowing them to take samples and collect data from the environment. The overall design is centered around a drill, involving pneumatic technology and an auger-based design enclosed in a protective kevlar sheath. This device will be submerged within the neutral buoyancy pool at a temperature of +82° F (27.8° C) to +88° F (31.1° C). If the anchoring device is effective at keeping the diver secure while mining the asteroid simulants, the mission will be considered a success.



Auger, Pneumatic Drill, and Casing

### Objective

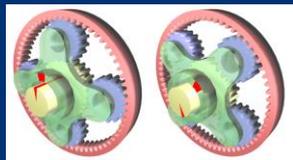
Designing an anchoring device will allow NASA to execute safe and secure asteroid mining. The design of the anchoring device will consist of a cased, pneumatic-powered auger. The pneumatic device will be modified in such a way that the auger blade will utilize maximum torque available while rotating at 40 rpm. Care will be taken to include an attachment point of one inch in diameter to the body of the device. This is to allow the astronaut to be tethered to the device. The auger will be surrounded by a tube that will compress against the regolith as it is drilled into the asteroid. This casing will protect the astronaut from the auger and contain any debris produced by the operation of the device. If the pneumatics fail there is a manual backup stored in the device as a precaution.



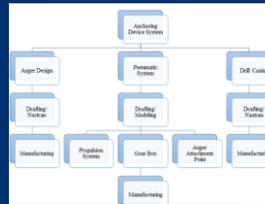
GEARBOX NEMA drawing showing required dimensions (Gearing Solutions)

### Design

The anchoring device was designed to include a simple auger protected by a casing and powered by a pneumatic drill. When the astronaut moves into position, the device is to activate the pneumatic drill that will drive the auger into the regolith of the asteroid simulant material. Once the auger has reached the maximum depth, it will detach from the pneumatic drill and remain in the regolith. The auger will have a tether point that will allow the astronaut to anchor themselves to the stationary auger. This will allow the astronaut to move around, while still being attached to the surface of the asteroid.



Planetary Gear Set (Cregar)



Experimental Procedure

### Testing

The anchoring device will be tested in various phases. During the construction phase, the auger will be tested in multiple mixtures containing sand, gravel, and water. The object is to find the correct size and type of auger with the capacity to withstand as much force as possible. Although the anchoring device must withstand a specific amount of force in testing and in the lab, it must be as lightweight as possible in reality. By the time the anchoring device arrives at the NBL (Neutral Buoyancy Laboratory), the best design factors have been established by the team. Once at NASA, the Microgravity team has the exciting opportunity of presenting the design to NASA engineers and testing it in the NBL.



NASA engineer review tool operation with divers



NASA Neutral Buoyancy Facility (Roth)

### Future Implication

Upon completion of this project, a better understanding of the difficulties of stability in a microgravity environment will be achieved allowing the advancement of asteroid mining. By testing the anchoring device NASA can determine the best strategy for safely securing their astronauts to asteroids. Developing a device that stabilizes astronauts while they asteroid mine will achieve maximum collection and safety. Asteroid drilling will become very popular for gathering rare minerals and space exploration in the coming decades. During this time safety precautions such as anchoring devices will be necessary.



Upcoming Space Industry (Spacevidcast)



Concept image of an astronaut retrieving an asteroid sample (NASA)

### Outreach

- South Daytona Elementary STEM Expo
- SWE's Introduce a Girl to Engineering
- Mainland High School Design Academy
- South Daytona Elementary Robotics Club
- Florida's Regional SeaPerch Competition



South Daytona elementary students playing with Boo Bubbles experiment.



Graduated team member Endi Leonardo leading an experiment for the Introducing a Girl to Engineering campus event

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