

March 3, 2020

NAU Psyche Sampling Team

NASA Psyche Exploration Mission

Andrew Acosta
Sultan Almarzouqi
Samuel Armstrong
Karissa Barroso
Scott Sprauer





Project Description

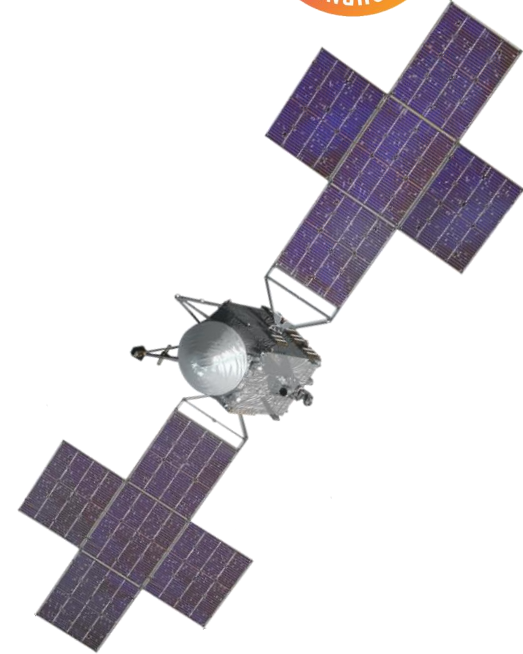
Purpose of the Mission

Psyche Mission Launch 2022 Arrive 2026:

- Map and study Psyche
- Located in the asteroid belt (~3.5 AU from Earth)

Psyche Sampling System:

- Client is Dr. Bowman
- Sponsored by NASA
- Sampling system to determine Psyche makeup
- Better understand planetary core formation





Design Description

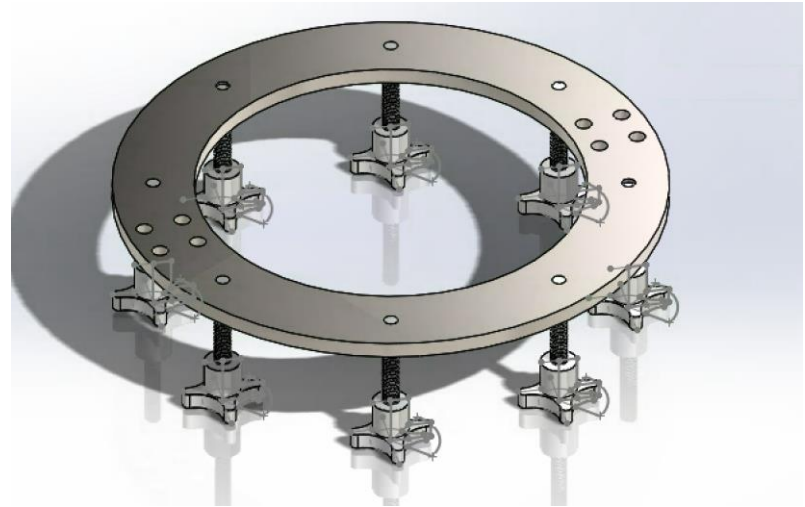
Current System Operation

Tower:

- To be made out of Tetrix Robotic parts
 - Connectability
 - Changeability
- Supportive of the weight in the drilling subsystem

Base:

- To be made out of Aluminum
- Eight tapped holes equally spaced for insertable iron screws





Current System State

Arduino & Electrical Control

Completed By Scott & Karissa

Adjustments to:

- Arduino Programming
- Power & Direction Motor/Drill Controls
- RPM Tracking and Distance Sensors
- Utilizing Torque & Servo Motors

Improvements to ERs/CRs relating to:

- Power Source

Before



After





Current System State

Main Frame Tower

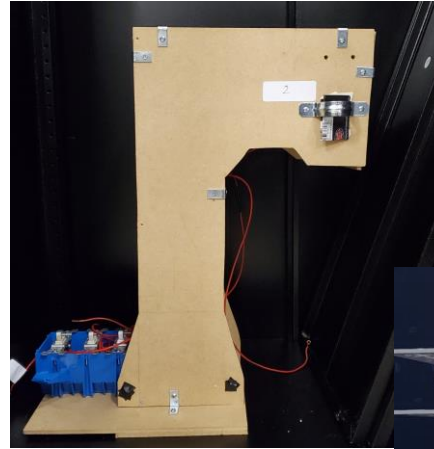
Completed By Sultan, Sam & Andrew

Adjustments to:

- Main Body Tetrix Structure
- Linear Actuator
- MagBase Design

Improvements to ERs/CRs relating to:

- Stability
- Weight Distribution
- Vertical Movement
- Electronics Visibility



Before



After



Current System State

What else needs to be done?

Upcoming:

- Sample Caching System
- Finalizing Coring Bit
- Integrating Subsystems
- MagBase Wire Coiling
- Final Product Testing

Improvements to ERs/CRs relating to:

- Drill Capabilities on Various Materials
- Full System Functionality
- Operating & Effective Sample Caching



Current System State

Up-to-Date Bill of Materials

Budget Tracking:

- Under Budget
- Spent Total of \$750.62
- Still have to buy:
 - Manufacturing for Caching System
 - Bigger Battery Source
 - Diamond Coring Bit (Potentially)
 - Final Fasteners

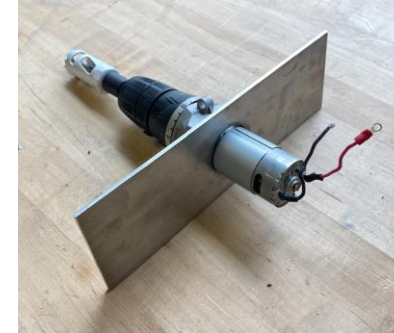
Current Running Bill of Materials can be seen in Appendix A



Implementation Plan

Manufacturing Plan:

- Machine the Drill plate
 - Will hold the drill and move accordingly
- Machine the Drill Magnetic base
 - Will create a magnetic force to stabilize sampling system
 - Will hold all the parts together



Designing the Final Product:

- Karissa and Scott - Finishing the arduino set up
- Andrew - Finishing up the magnetic base
- Sultan and Sam - Finishing the lift system for the Drill
- Team - Completing the caching subsystem





Final Product Testing

Planned Testing Procedure

Test Plan:

- Drill and sample multiple materials/terrain
- Ability to cache and store samples
- Drilling capabilities
- Stability of magnetic base

Testing Setup:

- Equipment sent from Dr. Bowman
- All parts can be sourced from Home Depot
- Full supplies will be sent by Dr. Bowman
- All supplies not yet known

Thank You!



Questions?





DISCLAIMER

This work was created in partial fulfillment of Northern Arizona University's Capstone Course "ME 486C". The work is a result of the Psyche Student Collaborations component of NASA's Psyche Mission (<https://psyche.asu.edu>). "Psyche: A Journey to a Metal World" [Contract number NNM16AA09C] is part of the NASA Discovery Program mission to solar system targets. Trade names and trademarks of ASU and NASA are used in this work for identification only. Their usage does not constitute an official endorsement, either expressed or implied, by Arizona State University or National Aeronautics and Space Administration. The content is solely the responsibility of the authors and does not necessarily represent the official views of ASU or NASA.



Appendix A: Current Bill of Materials



Bill of Materials			
Part Name	Part Quantity	Part Price	Part Description
Tetrix box	1	Provided by Dr. Trevas	Used the Tetrix box to create the tower
Drill motor	1	Used from old drill	The main that would be the main component and drills through the materials
MagBase Coiling Wire	1	Provided by Dr. Trevas	Coils around the MagBase to activate a downward directed force.
Arduino kit	1	\$71.80	The Arduino kit will help in controlling all the electronic parts in the sampling system
Easy-Access Base-Mounted Shaft Support	3	\$13.38	The supports keep the ends of the rods from wandering and create a more accurate motion.
External-Thread Ball Nut	1	\$63.46	The balls screw nut uses ball bearings to thread onto the ball screw, reducing friction.

Continued on Next Slide...



Appendix A: Current Bill of Materials Cont.

Bill of Materials

Part Name	Part Quantity	Part Price	Part Description
Mounted Linear Sleeve Bearing	1	\$53.31	The linear bearing moves frictionlessly along the steel shaft .
Ball Screw	1	\$44.31	The ball screw translates the rotational motion of the motor to vertical motion to raise and lower the drill assembly.
Linear Motion Shaft	1	\$16.95	The linear motion shaft provides support to the drill assembly, removing the need for a second ball screw.
Iron Four Arm Knob	8	\$11.67	These are the screws that will be attached to the base and wrapped with magnet wire.
Servo Motor	1	\$31.99	The servos motors will be used to actuate the caching arm, and the sample remover.
Clamping Beam Coupling	1	\$8.36	This coupler will connect the motor to the ball-screw.
Base	1	\$398.74	The base will support the tower and magnetic feet.
Total Price		\$750.62	