About the Asteroid 16 Psyche

- Between Mars and Jupiter at approximately 2.5 to 3.3 AU from the Sun
- May be the core of an ancient planetesimal because it likely consists largely of metal
- Easy access to Psyche, compared to Earth's core, makes it very valuable to understanding planetary formation

Figure 5. *Graphic of 16 Psyche*

Orbit & Debris Simulations

- The particle spray and drone orbit were modeled to ensure collection of varying particle sizes and avoid collision with Psyche's surface

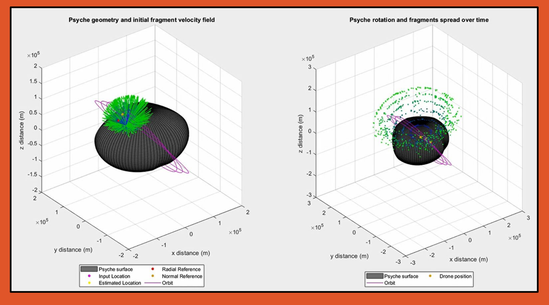


Figure 6. *MATLAB model of drone orbits and debris spray*

Oregon State University

NASA Psyche Sample Return

IMPACT-COLLECT-RETURN: Our project aims to retrieve samples from the asteroid 16 Psyche through three stages: Impact, Collection, and Return. We will deploy an impactor to Psyche's surface to scatter debris, which will be collected by a drone sent from a satellite orbiting Psyche. After collection, the drone will return to the satellite, which will then return to Earth. Our focus is on the collector mechanism within the drone for sample acquisition.

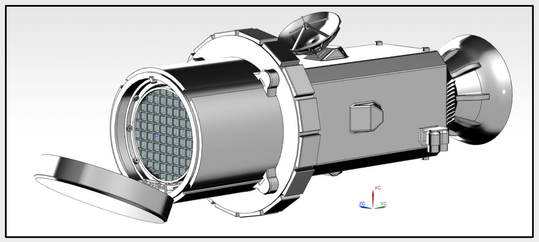


Figure 1. *NX model of complete drone*

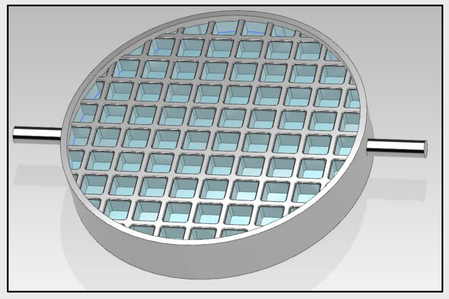


Figure 2. *NX model of disk concept*

Design Concepts

Drone:

- Design was inspired by NASA's Stardust mission that collected comet samples
- The front capsule will contain the collector and seal to prevent contamination

Double-Sided Titanium Disk:

- Both sides consist of a grid-like pattern holding Aerogel to secure particles
- Shallow and deep pockets ensure that samples of varying sizes are collected
- The disk will flip sides at high and low altitudes so the corresponding Aerogel sections are in contact with the debris

Disk Analyses

Constraints:

- **Thermal:** simulated expected temperatures of 75 K to 200 K showed no significant structural impact
- **Stress:** assuming worst case scenario of 1600 N at an angled impact against thin-walled segment

Side 1 - Small Aerogel Sections:

- Max stress of 387 MPa, well below the yield stress of titanium alloy
- Max deformation of 0.02 mm

Side 2 - Large Aerogel Sections:

- Max stress of 390 MPa, well below the yield stress of titanium alloy
- Max deformation of 0.027 mm

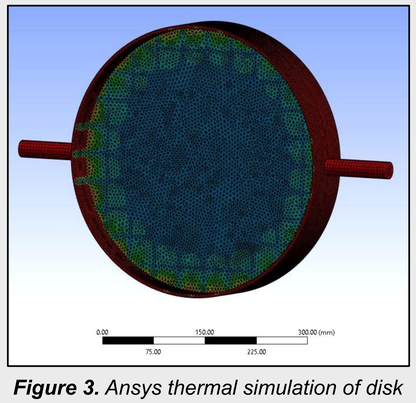


Figure 3. *Ansys thermal simulation of disk*

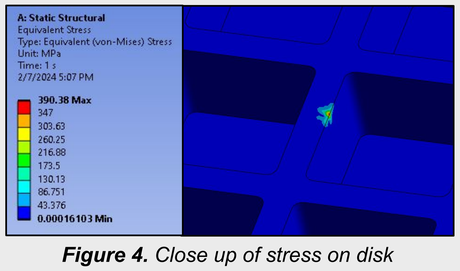
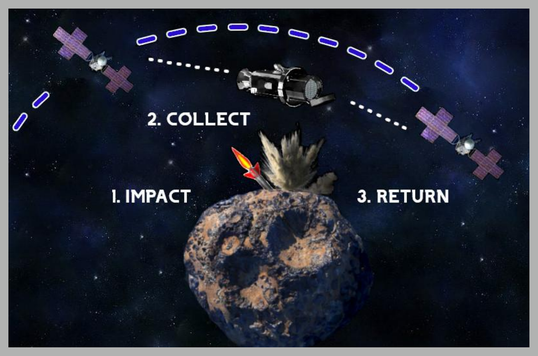


Figure 4. *Close up of stress on disk*

Sample Collection Process



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