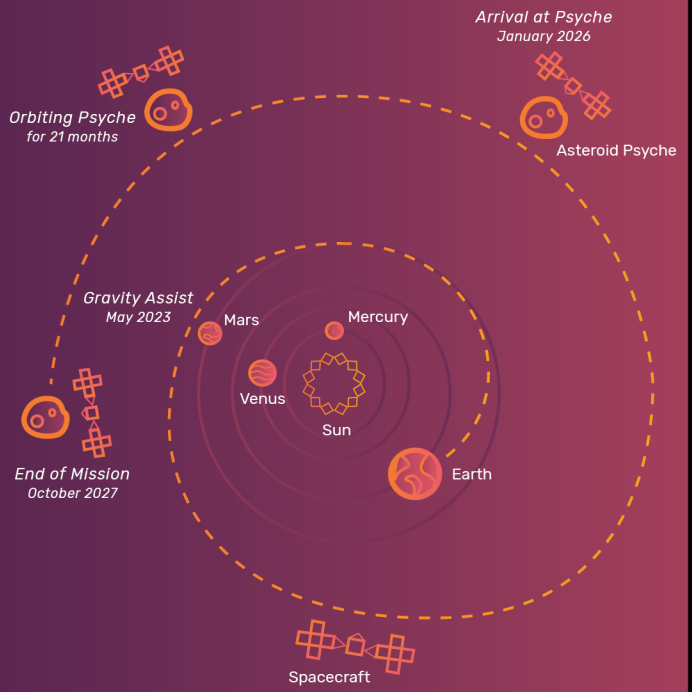
TRAJECTORY



Summer 2022 Launch

May 2023 Mars flyby & Gravity assist

January 2026 Arrival at Psyche

Orbit Psyche for *21 months*

- **Orbit A**: Characterization *(56 days, 41 orbits)*
- **Orbit B**: Topography *(76 days, 162 orbits)*
- **Orbit C**: Gravity science *(100 days, 369 orbits)*
- **Orbit D**: Elemental mapping *(100 days, 585 orbits)*

October 2027 Primary mission ends

MISSION OVERVIEW

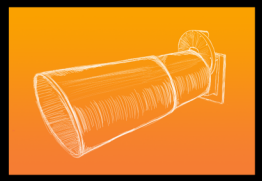
INSTRUMENTS USED

SPACECRAFT

uses solar-electric, low-thrust propulsion powered through cross-shaped solar panels

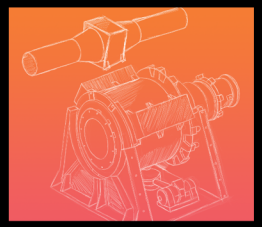
MULTISPECTRAL IMAGER

provides high-resolution images of geologic, compositional, and topographic data using filters to discriminate between Psyche's metallic and silicate constituents



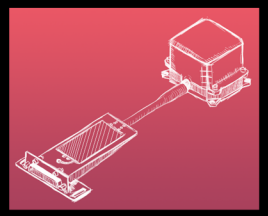
GAMMA RAY AND NEUTRON SPECTROMETER

detects, measures, and maps Psyche's elemental composition



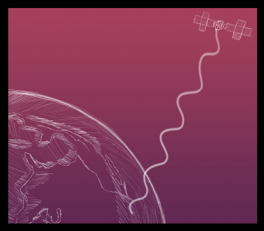
MAGNETOMETER

detects and measures the remanent magnetic field of the asteroid using high-sensitivity magnetic field sensors



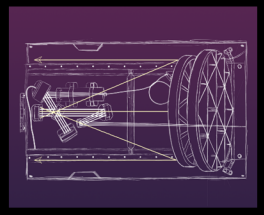
X-BAND RADIO TELECOMMUNICATIONS SYSTEM

measures Psyche's gravity field to high precision, and provides information on Psyche's interior structure when paired with topography from onboard imagery



DEEP SPACE OPTICAL COMMUNICATION

encodes data in photons, since using light instead of radio allows the spacecraft to communicate more data in a given amount of time



Psyche Inspired

psyche.asu.edu

Designed by: Carissa Tinoco

WHAT IS PSYCHE?

Psyche is...

• a **NASA space mission** led by **Arizona State University** to visit an asteroid that has never been explored before

• the **16th asteroid ever discovered**; discovered in 1852 by Italian astronomer Annibale de Gasparis

• named after the **Greek goddess of the soul**

• **one of 10 largest asteroids** in the asteroid belt orbiting the Sun

• hypothesized to have been a **protoplanet** that had separated internally into a rocky mantle and iron core, but **suffered violent impacts** that stripped away its mantle, **leaving only the metal core**

• **special** because it appears to be made almost entirely of **iron** and **nickel**

• our **window to understanding** how our **core** and the cores of the other **terrestrial planets came to be**

START 2015

PHASE A
Sep 2015 - Dec 2016

Concept Study
- Mission was selected by NASA
- Large team, led by Principal Investigator Dr. Lindy Elkins-Tanton, then worked on detailed concept study in order for it to be further considered for NASA's Discovery Program (a series of smaller lower-cost space missions that explore the Solar System)

PHASE B
Jan 2017 - May 2019

Preliminary Design of all Instruments & Spacecraft
- Design spacecraft & instruments that will be used to analyze asteroid
- Undergo project and flight system through Preliminary Design Review

PHASE C
May 2019 - Jan 2021

Final Design and Subsystem Fabrication, Assembly, & Test
- Build instruments: magnetometer, multispectral imager, gamma ray and neuron spectrometer
- Incorporate radio science with X-Band Radio Telecommunications System and new laser communication technology with Deep Space Optical Communication

PHASE D
Jan 2021 - Sep 2022

Instrument & Spacecraft Assembly & Test
- Integrate all spacecraft subsystems onto spacecraft bus
- Spacecraft undergoes testing in: vibration, environmental thermal-vacuum, electromagnetic interference and compatibility
- Ensure all aspects of mission are ready and fully operational through Operations Readiness Review
- Ship spacecraft to launch site since it is now fully assembled with solar panels

Mission Launch
- Re-check spacecraft before integrating it into launch vehicle
- Spacecraft will travel with low-thrust solar-electric propulsion
- Conduct Post-Launch Assessment

PHASE E
Oct 2022 - Oct 2027

Mars Gravity Assist
- Spacecraft will enter and leave Mars's gravitational field to increase speed, to set its trajectory to intersect with Psyche's orbit around the Sun, and to save propellant, time, and expense

Arrival at Psyche
- Before arriving at Psyche, spacecraft will spend 100 days in approach phase and measure asteroid's spin axis and rotation

Orbiting Psyche
- Orbit asteroid for 21 months
- Perform science operations from 4 different orbits (Orbits A-D), each successively closer to the asteroid
- Instruments send data back to Earth for analysis, during each orbit

PHASE F
Nov 2027 - Aug 2028

Mission Closeout
- Mission ends
- Space flight systems will be safely decommissioned

END 2028

TIMELINE
2015 - 2028