

DEEP SPACE EXPLORER

You are thinking about exploring distant regions of our solar system. To do this, you will need to refuel your spacecraft while out in space. Ice mined from asteroids can be processed into fuel, which could be used to refuel your spacecraft for exploration and travel to the far reaches of space.



SPACE LAWYER

You are working on making laws that govern how asteroids can be mined. You are trying to answer questions like: who gets to own things in space, and who decides that? How are laws in space enforced? Your work makes sure that asteroids are mined responsibly, ethically, and equitably.



NASA'S GALILEO SPACECRAFT

took the first-ever close-up asteroid photos of



GASPRA

when it flew by in 1991.

CHALLENGE!

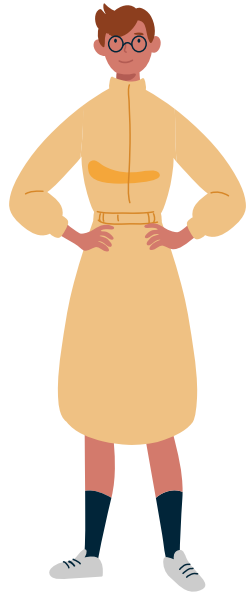
Design a machine that can mine and process ice into fuel for your spacecraft.



Even a house-sized asteroid could contain **METALS WORTH MILLIONS** of dollars.

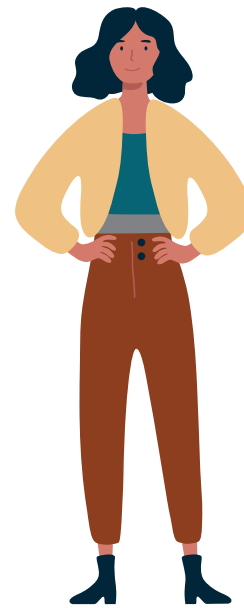
CHALLENGE!

Imagine some laws you could create to govern mining and ownership on asteroids. Draw what this looks like and how they are enforced.



MISSION CONTROL OPERATOR

You and your team are designing a way to mine a small and fast-moving asteroid. Your goal is to fly alongside or orbit the asteroid, so you don't change its path. Your mining machine will need to gather valuable minerals from above the surface of the asteroid.



SPACE HYDROLOGIST

You study water ice found in space and are part of a team planning a future mission to collect ice from asteroids. You will need remotely controlled lab equipment that can collect water ice samples, analyze it, and send the data back to Earth.



Scientists have counted about
800,000
ASTEROIDS
of the millions in our solar system.



CHALLENGE!

Design a machine that can orbit or fly above an asteroid and mine it without landing there.

CHALLENGE!

Imagine what the lab equipment could look like. How will it collect water ice? How will it analyze the water ice?



NASA spacecraft and telescopes have already detected
THE PRESENCE OF WATER
on some asteroids.



NASA ENGINEER

Your team is planning a future mission to the asteroid belt to drill into an asteroid and collect and analyze a sample of its core. As the chief engineer, you and your team need to design a device that you will remotely control from Earth.



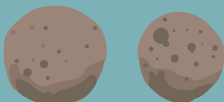
ASTRO-BIOLOGIST

You are interested in the search for signs of life in our solar system. But Earth contains a lot of life forms, and some of the smallest—*microorganisms*—can hitch a ride on spacecraft or just about anywhere.

Most asteroids are
IRREGULARLY SHAPED



Though a few are nearly
SPHERICAL



CHALLENGE!

Imagine what the drilling machine might look like. How will it collect the core sample? Where will the sample be stored?

CHALLENGE!

Design a mining machine that's unlikely to contaminate an asteroid with microorganisms from Earth.

In 2005, the Japanese spacecraft
HAYABUSA
landed on the asteroid **ITOKAWA**



Hayabusa collected
DUST SAMPLES
that it brought
back to Earth in 2010.

Design your own

ASTEROID MINING MACHINE

What materials will your machine look for?

What tools will it need?

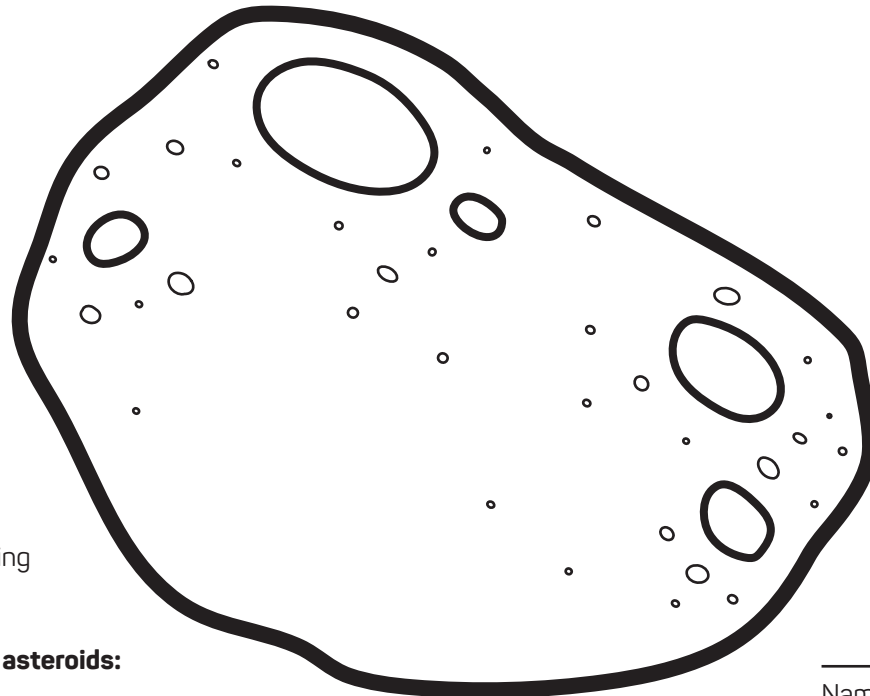
How does it get the power it needs to run?

How does your machine communicate back to Earth?

It's exciting to imagine what our lives might be like in the future—it's also important.

When you imagine your asteroid mining machine, you're doing a little bit of science. Well before scientists and engineers can start mining, they think up ideas for machines and consider how mining asteroids might change our future.

Learn more about how NASA is studying asteroids:
science.nasa.gov/solar-system



Name your asteroid mining machine:

Design your own

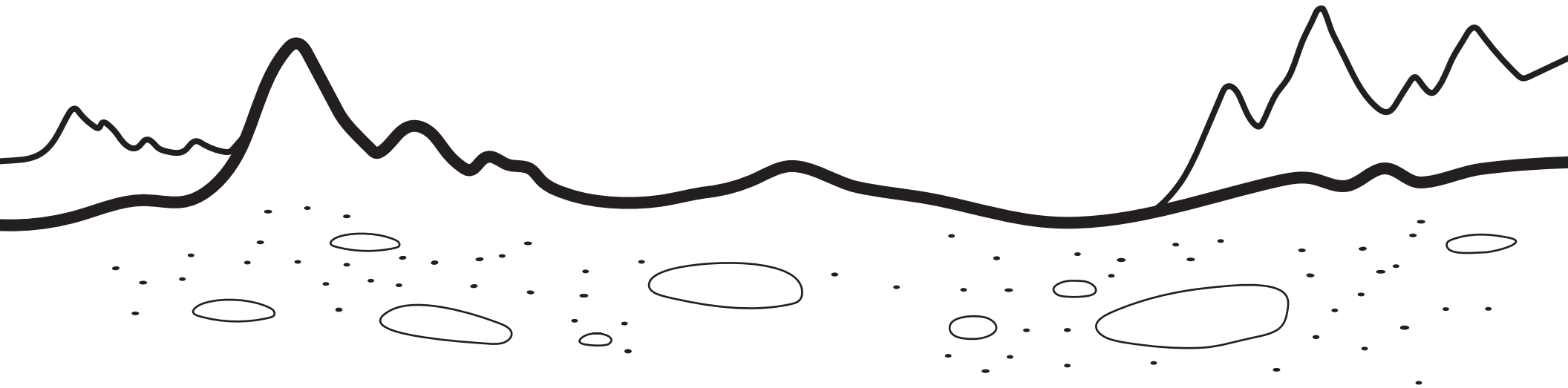
ASTEROID MINING MACHINE

What materials will your machine look for?

What tools will it need?

How does it get the power it needs to run?

How does your machine communicate back to Earth?



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