

# PSYCHE'S JOURNEY TO A METAL WORLD





## **Psyche's Journey to a Metal World**



A project by NASA's Psyche Inspired Program

Text by Caralie Cedarleaf

Illustrations by Jeremy Seidner and Chris Vasquez

Story concept led by John Domenico

“Today’s the day! Today’s the day!” the Psyche robotic spacecraft thought to herself. After years and years of building and testing, she was finally ready to launch into outer space!

As Psyche sat lost in thought waiting for instructions from the control tower, a small, blue bird landed on her rocket.

“Why are you leaving Earth?” the bird chirped.

“I have an important job to do,” Psyche said, not knowing where the chirp had come from.

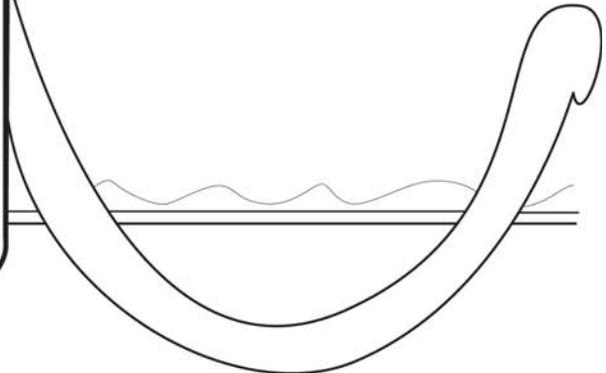
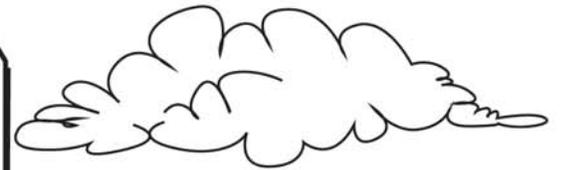
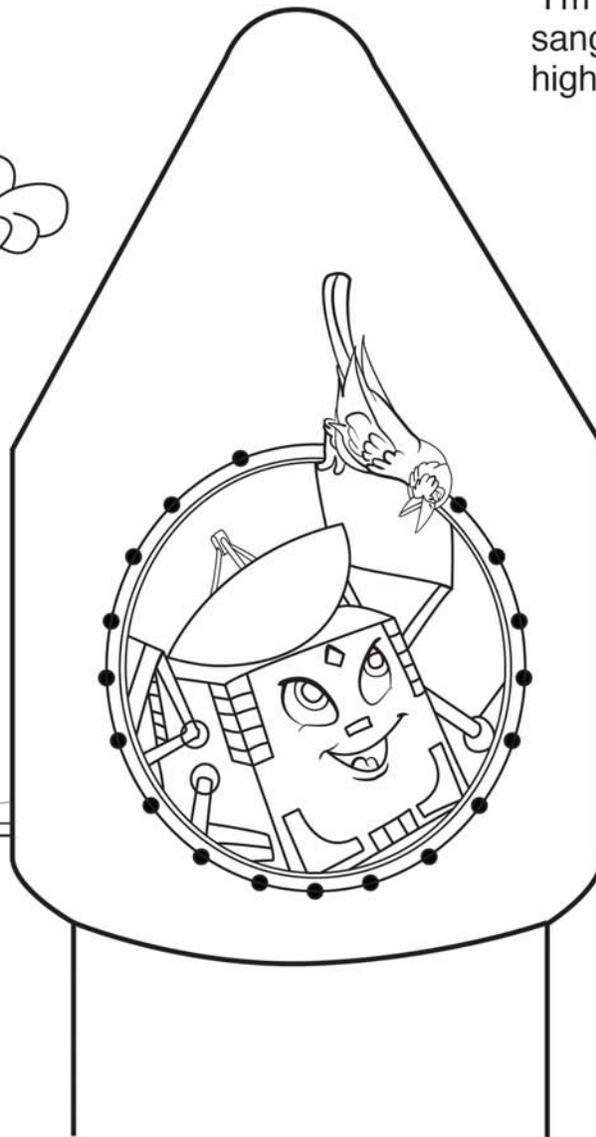
“What do you have to do?” the bird asked, jumping down from its perch and facing Psyche.

“I’m the first robotic spacecraft to visit a metal asteroid. All other missions have been to study planets or other objects made of rock or ice.”

The bird thought for a minute. “That is important. I bet you’ll learn a lot. But won’t you be lonely in space all by yourself?”

Psyche quickly realized she might be lonely during her voyage. “Well I might be lonely during my trip. But I’m hoping that I get along really well with the asteroid I will be visiting, which is also named Psyche, just like me.”

“I’m sure you will!” the bird sang reassuringly and flew high into the sky.



Psyche heard over the loudspeaker that she was ready to launch. She was nervous because her mission was so important for scientific research.

“10... 9... 8...” she heard an official-sounding voice through the launch pad speakers.

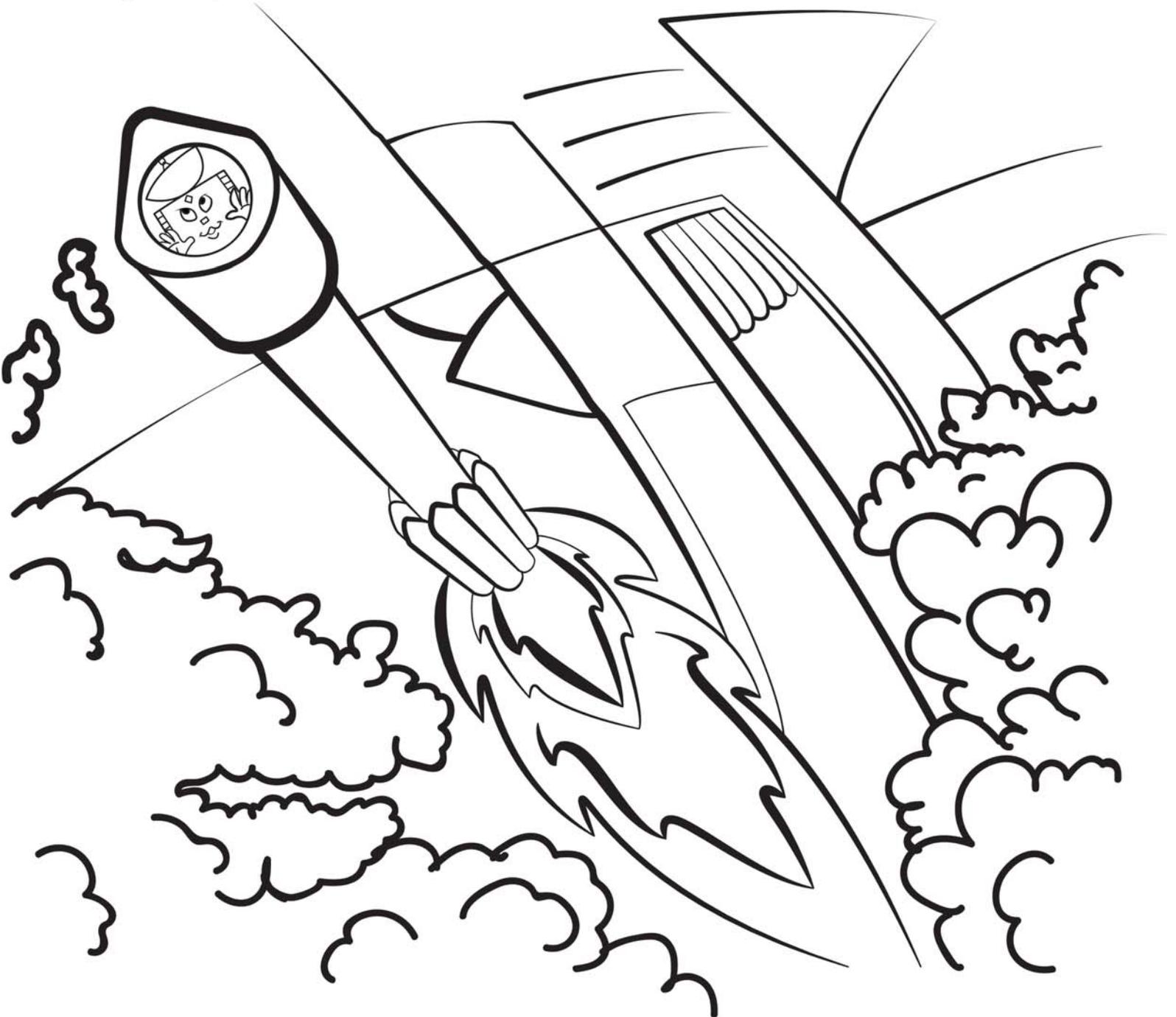
“7...6...5...4...”

“Here I go,” she thought and readied herself.

“3...2...1...”

Liftoff!

Her launch into space was incredible! It was so much faster than she had anticipated! There was a huge roar and lots of vibration, but she was prepared for that because of the “shake and bake” vibration testing she had done with her team of engineers. She was glad they had done lots of tests!



Outside Earth's atmosphere, Psyche could see a small meteoroid approaching.

"Helloooooo!!!!" The meteoroid called, hurtling toward her.

"Hi!" Psyche shouted back excitedly, thankful to make a new friend in space.

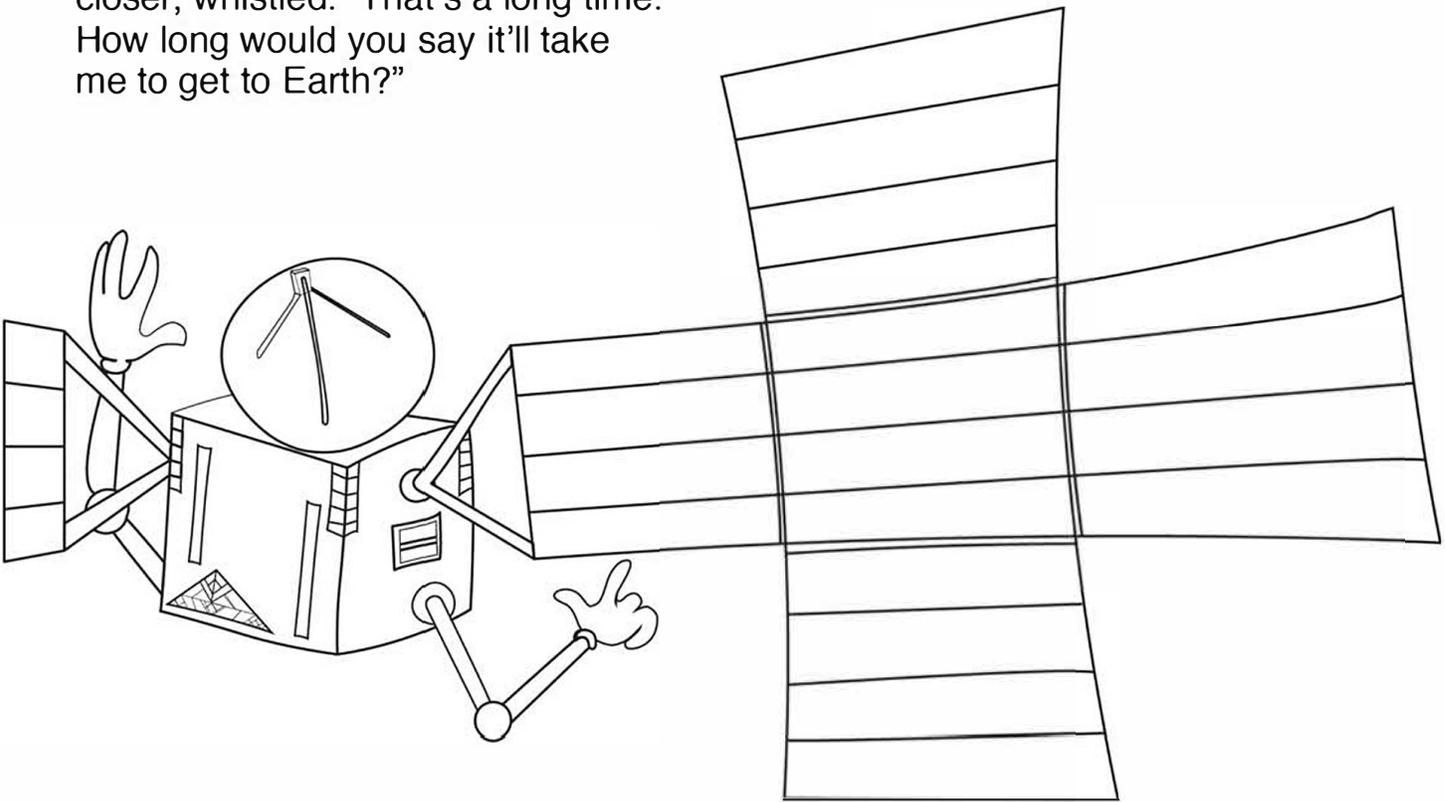
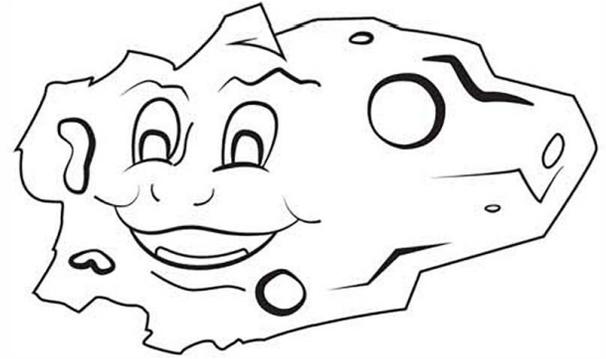
"What are you doing all the way out here?" the meteoroid asked Psyche.

"I'm on a mission to visit asteroid Psyche!"

"The speed you're going, that'll take you a few years."

Psyche nodded, "It'll take me almost six years to get there."

The meteoroid, getting closer and closer, whistled. "That's a long time. How long would you say it'll take me to get to Earth?"



Psyche remembered her home fondly. "Probably only a few minutes."

With that Psyche and the meteoroid passed one another. They each winked a knowing wink. The meteoroid had started somewhere far out in space and would end its journey on Earth. But Psyche had started her journey on Earth and hers was a journey to deep space that was only beginning.

Psyche headed out into the darkness of space. She noticed how far away everything was. But then she saw that she was approaching the Moon, who she recognized from her time on Earth.

“Hey little one,” the Moon’s voice boomed, “where are you headed off to?”

Psyche was so glad to see the Moon. “I’m on an important mission to the asteroid belt.”

“Well, do you have enough power to get all the way out there?”

“Indeed, I do!” Psyche beamed. “I use the Sun’s energy to make my thrusters work. It’s called solar-electric propulsion.”

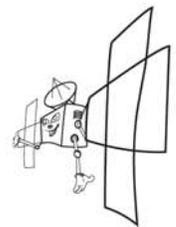
“You must have Hall effect thrusters. That reminds me of a story: Many Earth years ago, a small spacecraft came to visit me. I was honored, of course, and told the craft that I would be happy to oblige with any queries it might have for me. Humans have always been very interested in me, you know. In fact, I’m the only place besides Earth that people have ever visited. A few of them have even landed on my surface!”

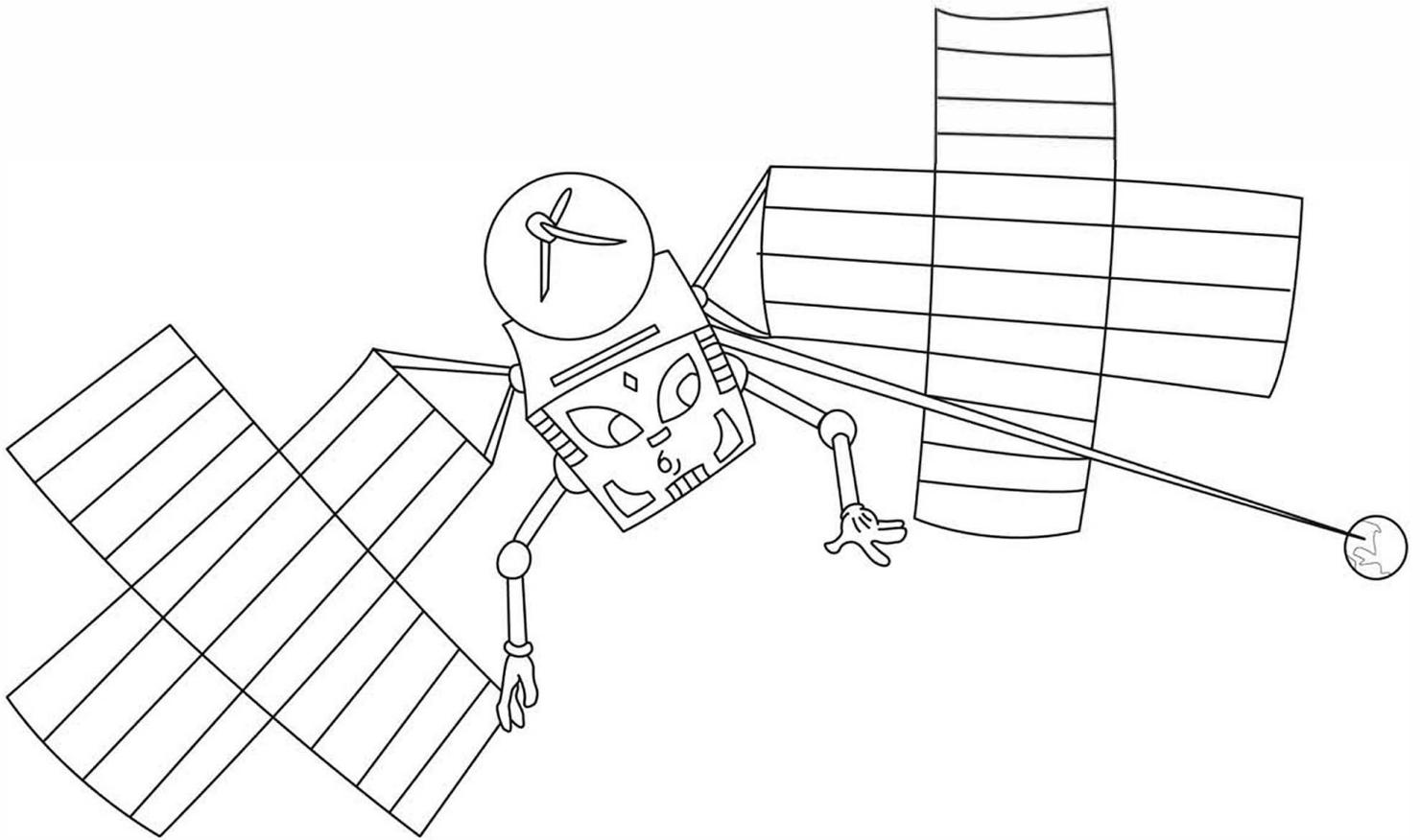
Psyche had been zipping past the Moon and was now a good distance away. She was getting worried that she would have to interrupt to say goodbye. But before she could say anything, the Moon kept on with his story.

“Now the craft was...”

And she couldn’t make out the Moon’s words anymore.

“I think he’s enjoying telling his story, even if I’m not there to hear it,” she thought.





Psyche watched as the Moon became just a spot in the distance.

“It’s going to be okay,” she told herself. “You have an important mission to do.”

“It’s a very important mission,” she said aloud. Startled by the sound of her own voice, she wondered how long it had been since she talked to the Moon.

Suddenly she heard something. She looked out as far into outer space as she could see, but no one was there. She heard it again.

“Psyche, this is Mission Control. Come in, Psyche.”

She realized that the Deep Space Optical Communications team was talking to her with a test of their laser communications technology!

“Thank goodness for lasers!” Psyche thought to herself. “I’m glad I get to help test this new way of communicating, because it will be very important for humans when they travel far from Earth.”

As Psyche continued on her journey, she hoped for more of the brief encounters in space that were making the journey so enjoyable. During one conversation with her team back on Earth, they informed her that soon she'd be meeting a Near-Earth Asteroid named Bennu, who had been visited by another NASA mission named OSIRIS-REx. She couldn't wait!

Eager for the opportunity to meet her first asteroid, she kept her eyes peeled and soon spotted Bennu in the distance.

"Bennu, it's a pleasure to finally meet you!" Psyche called out to him.

"The pleasure is all mine," he responded, calm and kind.

"Were you sent here by OSIRIS-REx?"

"Oh, I should have introduced myself properly. I'm Psyche, on my way to the asteroid belt, to study a metal asteroid also named Psyche." Psyche found herself with a renewed passion for the mission.

"Won't that be a rewarding journey!" Bennu responded thoughtfully.

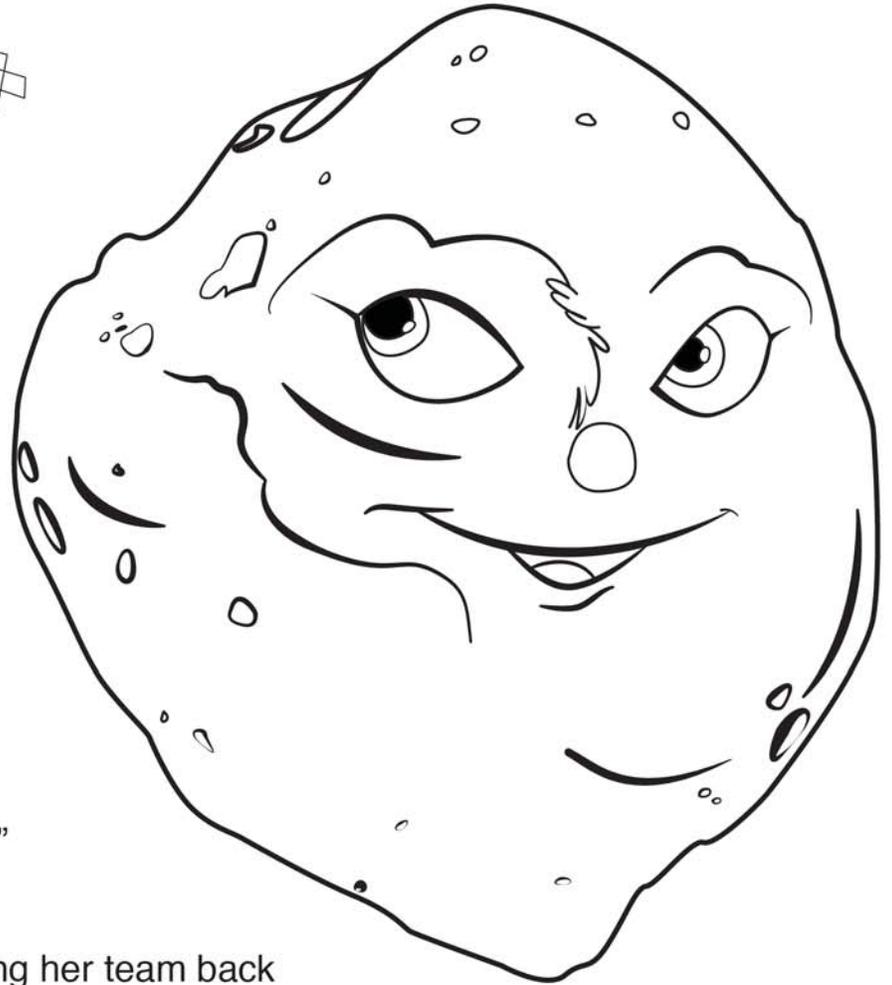
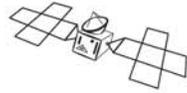
"I do believe it will be!" Remembering her team back home she said, "OSIRIS-REx and I share some of the same team members. They send their greetings."

Bennu smiled. Psyche thought that he might get lonely too, far away from the other asteroids, with very few visitors.

"Are you lonely out here by yourself, Bennu?" Psyche blurted out, realizing too late that it might not have been a polite question to ask.

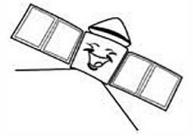
"On the contrary," Bennu answered, "I am very fortunate to be travelling on my own journey." He smiled a knowing smile.

Psyche left Bennu with his words repeating in her mind. She was also fortunate to be on her own journey, one unlike any other. Grateful to have met Bennu, Psyche continued on her way, reinvigorated and excited for the journey ahead.



Psyche then saw Mars in the distance. Dusty red in appearance, the surface of Mars looked desolate. As she approached, however, Psyche heard the sounds of a party.

Then she heard a voice, "Who's that? Are we expecting another visitor?"  
The Martian moon Phobos asked its companion moon, Deimos.



Psyche took the opportunity to introduce herself. "Hello, I'm Psyche. I'm an orbiter on my way to study asteroid Psyche."

She was closer now and could see that the other guests at the party were all the Mars spacecraft: The rovers and lots of Mars orbiters, including Odyssey, MRO, MAVEN, MOM, and Mars Express. All of them were there! Psyche was completely starstruck.

MAVEN spoke up and said, "Join us, traveler, you're most welcome!"

Before Psyche could respond, Mars called out to her.  
"Hey there, kiddo."

"Hi there!" She was glad to find out that Mars was kind.

"Are you curious about what I'm up to, too?"

"Yes of course," she responded, "but my mission is to travel deeper into space."

"Come on, stay a while," Deimos piped in.

"I'd love to, but I'm on a mission," Psyche replied.

"Where you off to?" Mars asked.

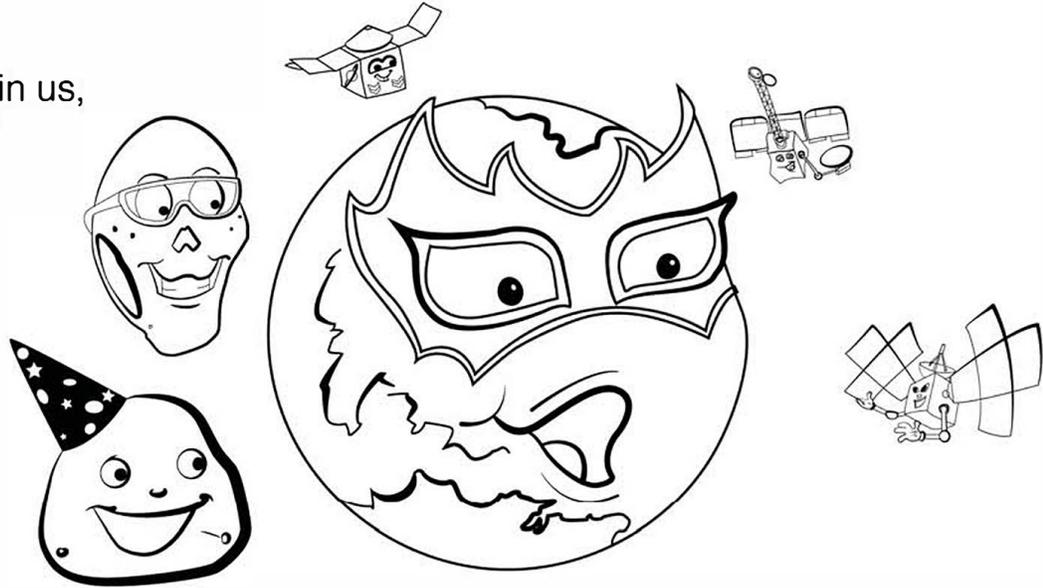
"The asteroid belt, to asteroid Psyche," she responded confidently.

"Whoa, that's quite a trip!" Mars responded. "Do you need some help getting there?"

"Yes, please!" Psyche remembered hearing in the meetings on Earth that her mission relied on a gravity assist from Mars.

"Here you go," said Mars, "I'm happy to have you use the effects of my movement and gravity to speed up your journey!"

"Goodbye, everyone! Thank youuuuuuu!" Psyche shot around Mars and realized it had been a few years since she left Earth. Psyche heard a chorus of "goodbyes" and "have funs" as she shot out toward the asteroid belt. She knew she wouldn't see Mars again.



Psyche had come a long way since she left her home planet, Earth. She could see that she was coming closer and closer to the asteroid belt, her destination on this long journey. She saw so many asteroids as she approached that she was unsure of how she would distinguish her asteroid from the others.

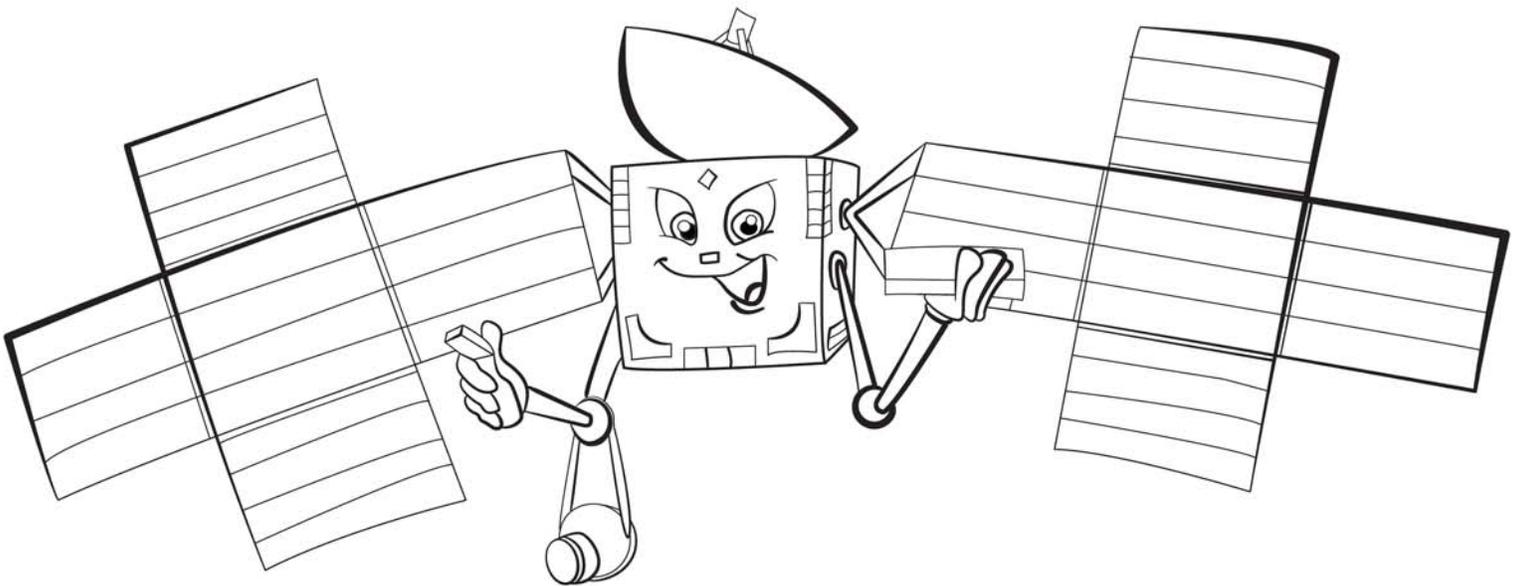
“Won’t you come and stay with me a while?” Psyche heard from somewhere nearby. Looking around she spotted the asteroid Vesta.

“Thank you, Vesta, but because the Dawn spacecraft was here to study you recently, I was sent to study a different asteroid, a metal one. The scientists working with me have given me instruments specially designed to study asteroid Psyche.

“How will they study it?”

“Well, I have three instruments, all with different jobs. My Multispectral Imager is a camera. It will take detailed pictures of asteroid Psyche and help figure out what the surface is made of. I have a magnetometer to see if asteroid Psyche has her own magnetic field. And I have an instrument called the Gamma Ray and Neutron Spectrometer, which is a very long name! We call it GRNS for short. GRNS will help find out what asteroid Psyche is made of.”

“Those do sound special,” Vesta responded. “I’ve been studied by imagers and a gamma ray and neutron spectrometer before, but I sure wish a magnetometer would visit me!”



“Maybe next time, Vesta!” said Psyche, “I need to continue on my journey so I can start figuring out what asteroid Psyche is like when I get there!”

“You’re on the right path. Say ‘hi’ to asteroid Psyche for me,” said Vesta.

Psyche smiled, realizing she’d be doing her research in no time. “I will, Vesta! Good-bye.”

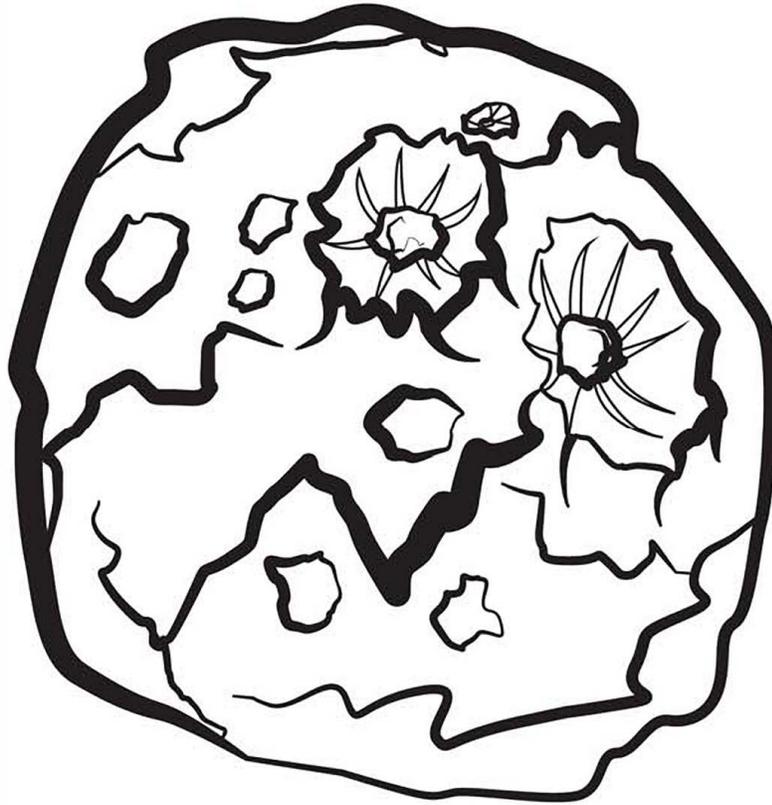
Psyche made her way past many asteroids of all sorts of shapes and sizes. And then she saw an asteroid unlike the rest she had passed—this one was a large metal asteroid. She could tell immediately that she had arrived at her new home in space. Psyche cleared her throat and introduced herself.

“Hello, I’m Psyche, a robotic spacecraft from Earth. And you must be asteroid Psyche. I’ve been sent here on a mission to study you.”

“It’s lovely to meet you, Psyche. I am indeed asteroid Psyche. How could you tell?”

“Your metallic surface is unlike the rest of the worlds I met on my way here,” Psyche said, completely mesmerized.

“How long did you travel to meet me?”



“It took me almost six years! That reminds me, I’d better let my team back home know I’m here.”

Using her X-band radio communications system, Psyche sent a message to her team back on Earth. She could only imagine how happy everyone would be when they received the message through the big dishes of the Deep Space Network.

Asteroid Psyche was honored to have a visitor. “I’m happy to help you with your research in any way I can.”

“In that case,” the robotic spacecraft answered, “I’ll get started!”

Psyche was so happy to finally start working with her special instruments. And she was incredibly grateful to have a new friend in asteroid Psyche.

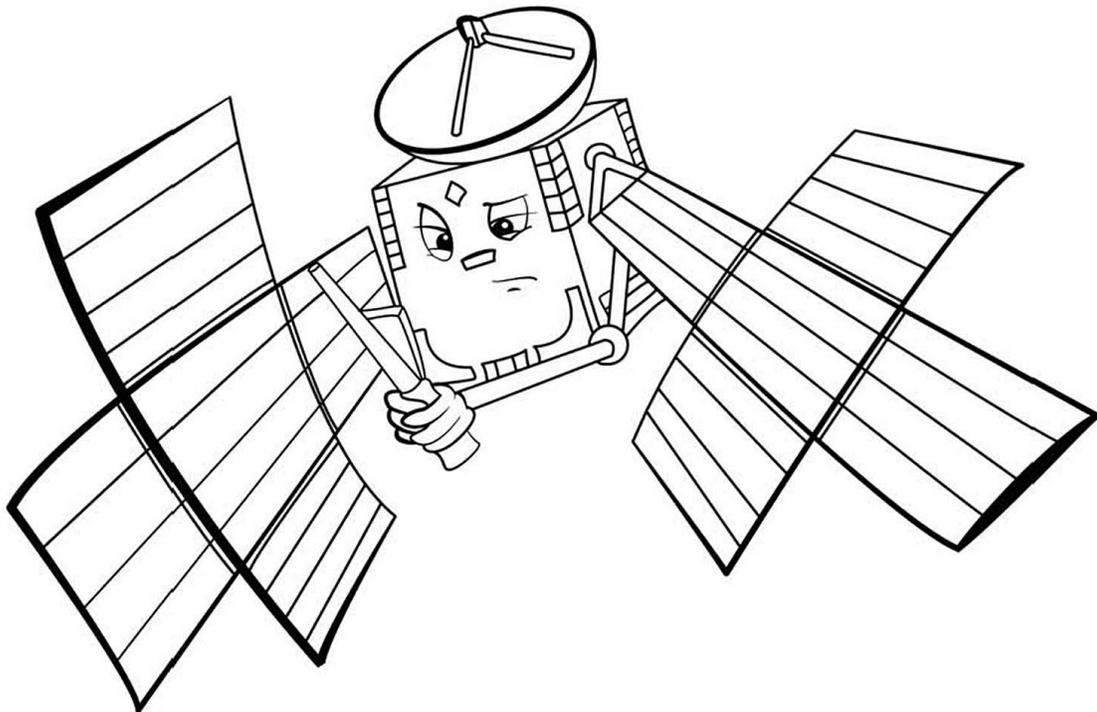
After checking to make sure all her instruments were ready to go, Psyche entered into her first orbit.

“What are you doing?” the asteroid asked.

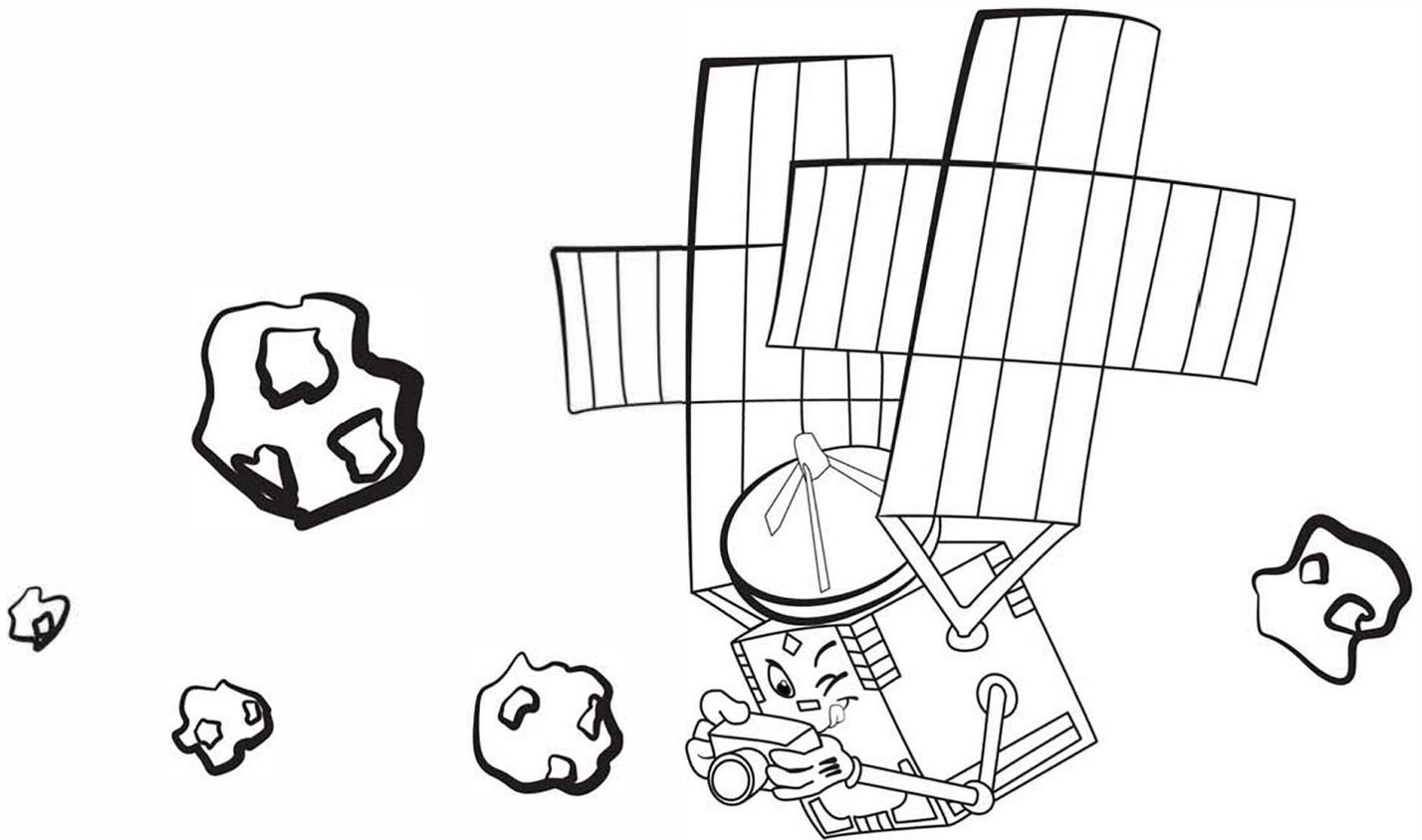
Psyche explained that she was entering into a path called Orbit A. “It’s the farthest from you that I’ll ever orbit. But Orbit A is important because it allows me to do “characterization,” which basically means figuring out what you’re like. I’m helping my scientists figure out your shape and whether you have a magnetic field.

“Do whatever you have to do,” the asteroid responded happily, “I’ll stay as still as I can.”

The two laughed together. They both knew that asteroid Psyche would still be rotating on her own axis and would still be hurtling through space in her own orbit around the sun, so she wasn’t exactly going to be “still.”



Nearing the end of her last orbit in Orbit A, Psyche used her thrusters to slow down and move closer toward asteroid Psyche.



“What are you doing?” the asteroid asked.

Psyche explained, “I’m entering into Orbit B for the first time. My team calls it ‘Orbit B1’. I’m going to start studying your topography, which means learning what your surface is like and creating maps for my scientists to study. I’ll be using my Multispectral Imager, otherwise known as my camera, to help me a lot.

Finishing Orbit B1, Psyche used her thrusters to slow down again and drew even closer to the asteroid.

“What are you doing?” asteroid Psyche asked again.

“I’m about to begin Orbit D. This is my closest orbit and will allow me to do elemental mapping, which means figuring out what kinds of materials make up your surface.”

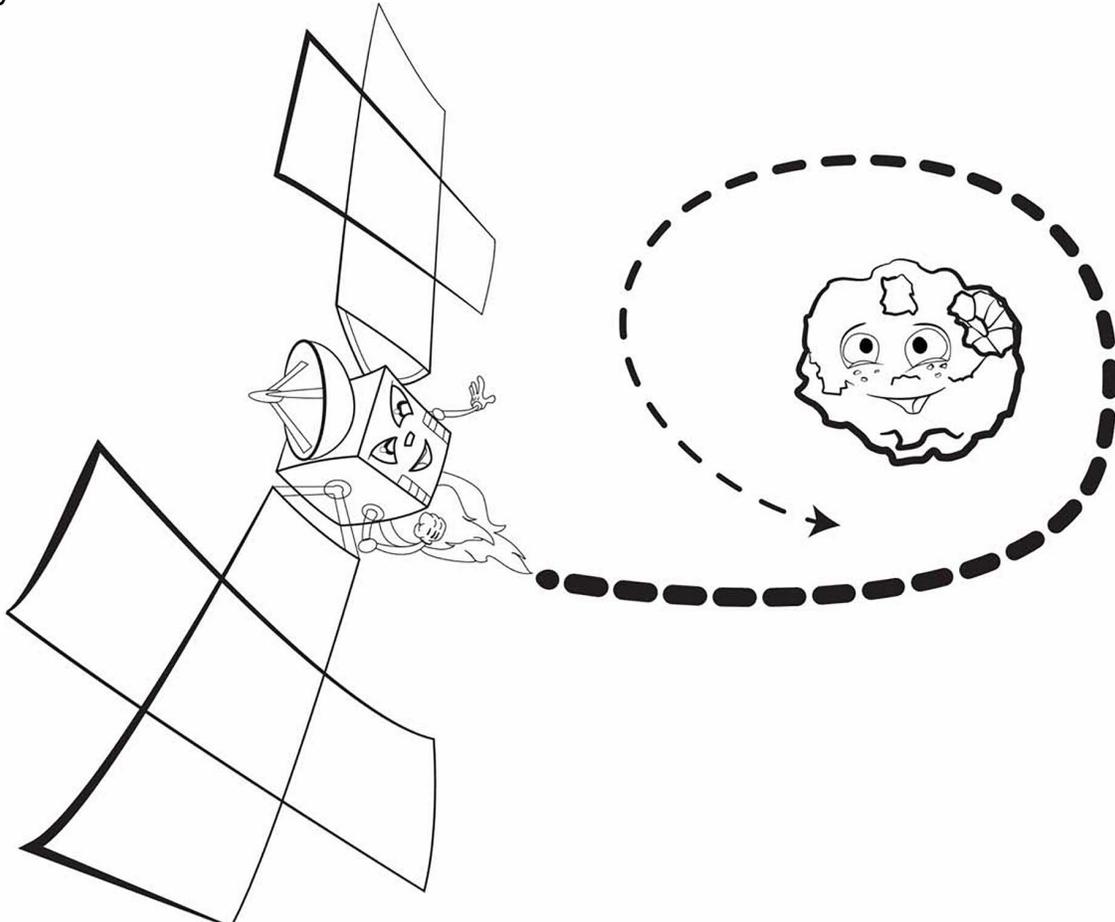
Asteroid Psyche nodded knowingly and was excited to see the Psyche spacecraft up close.

As Psyche finished Orbit D, she moved outward again.

“What are you doing now?” the asteroid asked, confident she knew the answer.

“I’m moving further away from you for Orbit C, which will allow me to do gravity science. By using the Deep Space Network on Earth to keep track of small changes in where I am and how fast I’m going, my scientists will study your gravity field and learn more about what your insides are like!”

Psyche was very dedicated to her work. She studied the asteroid and reported back to her team in Mission Control. And while she worked, she and asteroid Psyche had interesting conversations. She got to know her namesake very well, gaining insight into how the asteroid arrived here in the asteroid belt and why she had decided to make it her home.



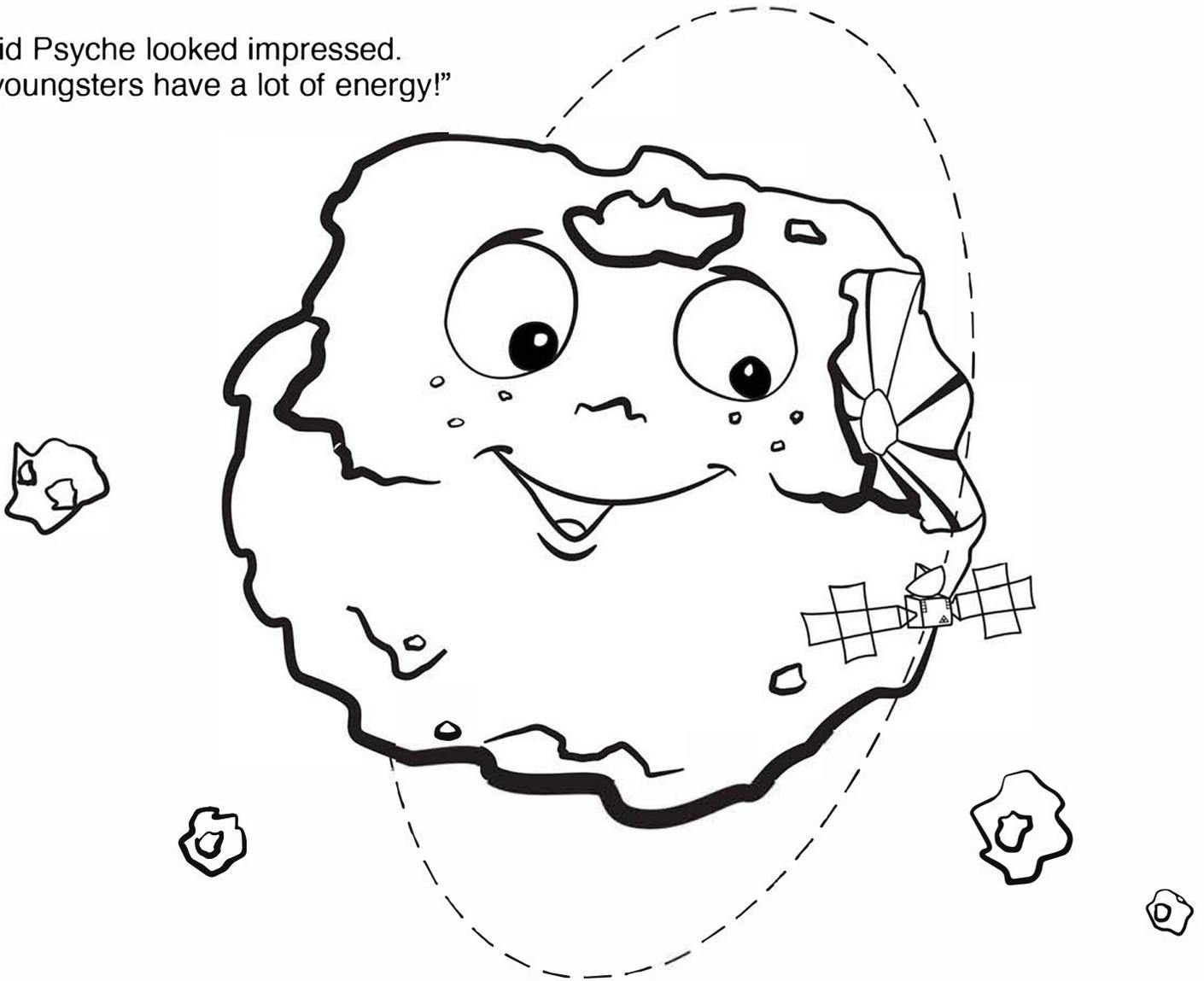
Psyche finished Orbit C and used her thrusters to go slightly higher again.

“Where are you off to now?” the asteroid asked.

“I’m headed back to Orbit B”, Psyche explained, “but this time my team calls it Orbit B2. I need to collect more images.”

Asteroid Psyche looked impressed.

“You youngsters have a lot of energy!”



The spacecraft thought about that remark. She remembered when she was getting prepared for her journey, and all the knowledge that scientists and engineers had shared with her.

She began to tell asteroid Psyche about her Hall effect thrusters and the gravity boost given to her by Mars. She told the asteroid everything she had learned so far and what it all would mean for the researchers back home on Earth. She explained that her studies of asteroid Psyche would give the people on Earth so much understanding about their own home and probably even the whole solar system.

Asteroid Psyche was very pleased that she could help unlock so many scientific mysteries for the people studying Earth and space.

As she finished her final orbit, Psyche began descending toward the asteroid.

“What are you doing now?” the asteroid asked her. “Orbit E?”

Psyche laughed. “I’d love to continue my studies, but my work is finished,” she responded. “And now that I’ve sent back so much insightful information, the researchers back home can continue to study you. But we have to finish this mission in order for other important space research to continue elsewhere in the solar system.”

“Where will you go?” the asteroid asked the robotic spacecraft.

Psyche remembered everyone she had ever met, from the wonderful people on Earth to the planets and other planetary bodies and even the other spacecraft she had met in space. She remembered her first encounter in space, with a meteoroid about to end its journey on Earth. She realized that her story had begun on Earth and she would be happy to live out the rest of her days here in space with asteroid Psyche.

“I think I’ll just stay here with you,” Psyche answered, descending towards the surface of her namesake, the subject of her study, and her newest friend, asteroid Psyche.

