National Aeronautics and Space Administration

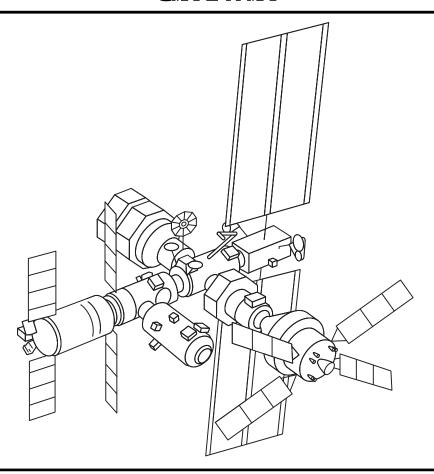


POWER & PROPULSTON ELEMENTS



THIS BOOK BELONGS TO:

GATEWAY

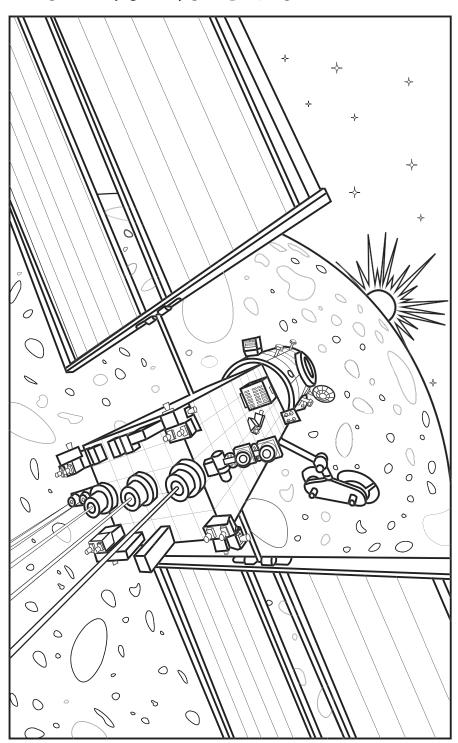


What is Gateway?

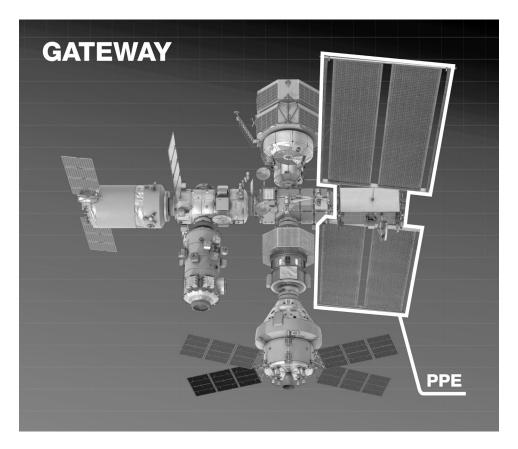
The <u>Artemis</u> Program will land the first woman and person of color on the Moon for scientific discovery and to enable human missions to Mars. An important part of Artemis is NASA's lunar-orbiting station called <u>Gateway</u>. Gateway is where astronauts from many countries will eat, sleep, rest, conduct science experiments, and get ready for their trips to the lunar surface.

The first two pieces of Gateway are the <u>Power and Propulsion</u> <u>Element</u>, or PPE, and the <u>Habitation and Logistics Outpost</u>, or HALO, where astronauts will live. PPE and HALO will launch together from Earth to lunar orbit.

POWER & PROPULSION ELEMENT



POWER & PROPULSION ELEMENT



Pictured: The Gateway space station with PPE highlighted (Credit: NASA)

What is the PPE?

The Power and Propulsion Element (PPE) is the powerhouse for the Gateway space station.

PPE will provide the lunar outpost with power to keep its computers running and to stay in its orbit around the Moon. PPE will also provide communications so that people on Earth can talk to astronauts on the surface of the Moon. It will also be a flying laboratory where computers and astronauts will conduct science experiments to better understand the solar system that we live in.

SPACE WORD SEARCH

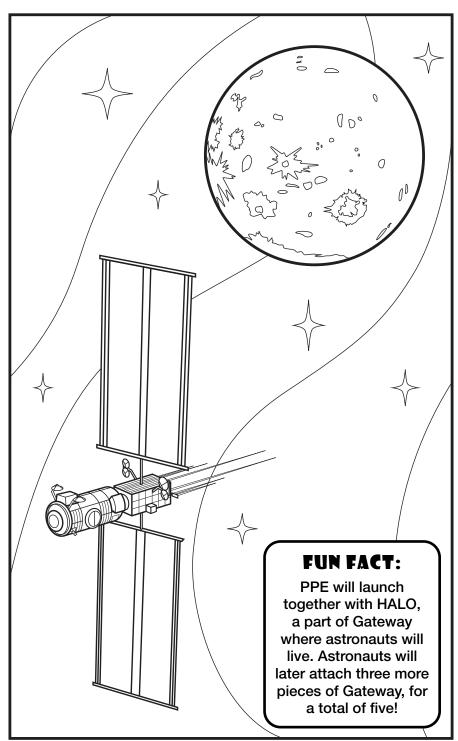
Can you find all the hidden space words?



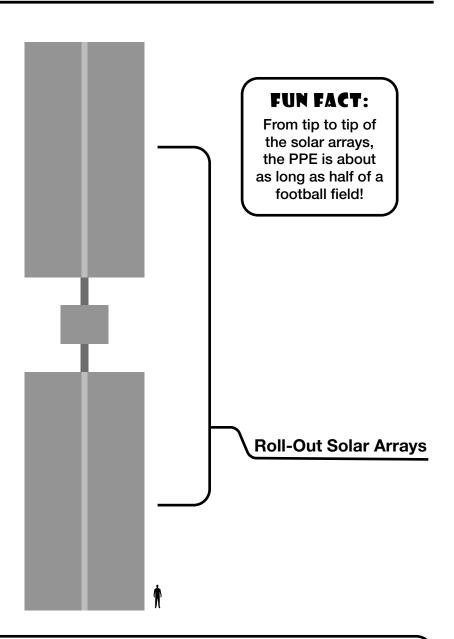
WORD BANK

Safety	Power	Propulsion	Orbit	Moon
Artemis	Sun	Earth	Spacecraft	Exploration
Engineer	Flight	Communication	Astronaut	Rocket
Innovation	Science	Technology	Universe	Discovery
	N	ASA Gate	wav	

GATEWAY & THE MOON



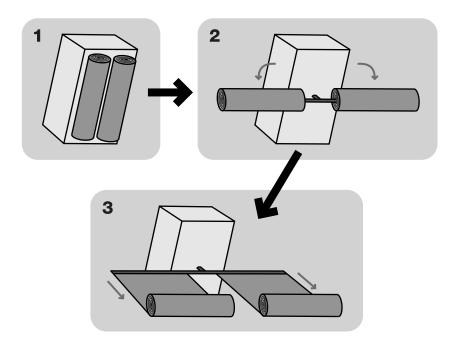
SOLAR POWER



How is the PPE powered?

Two large <u>roll-out solar arrays</u>, or ROSAs, will absorb the sun's energy to power Gateway.

ROLL-OUT SOLAR ARRAYS



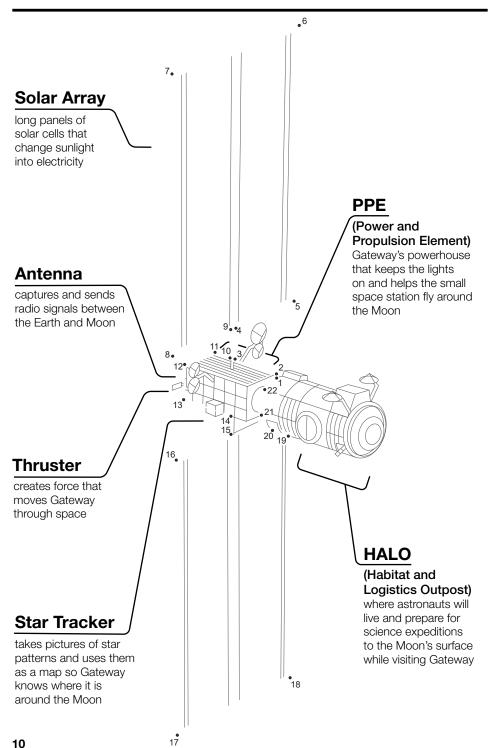
Pictured: They're called "roll-out solar arrays" because they roll themselves out, kind of like a rug!

What makes ROSAs different from solar panels on Earth?

You might already know about solar panels. Your own home may even have solar panels on the rooftop. They do the same thing as ROSAs, capturing solar energy and turning it into electricity. However, to be used in space, you need ROSAs because they are lightweight and can fit inside of a rocket for launch.

For the PPE, the flexible ROSAs are rolled up for launch and then rolled out once they're in space. ROSAs are already used on the International Space Station, and they may be used on future spacecraft to Mars and beyond!

CONNECT THE DOTS



SPACE WORD SCRAMBLE

Unscramble the letters to make space related words!

	GVRATYI	
	STOTAIN	
	SAEITLLET	
	MNOO	
	SAEPC	
	STASR	
	DTAA	
	LCHUNA	
	MSISINO	
	SOEFWTRA	
	ETHRA	
	RCEKTO	

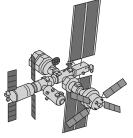
Write in the special shape letters to find the final word: What is the name of the space station that will orbit the Moon?





HINT:

Want some clues? Look at the pictures on this page!



GATEWAY'S POLAR ORBIT

Gateway will take one week to fly around the Moon in what is known as a "polar orbit," because Gateway will travel over both the Moon's North and South Poles.

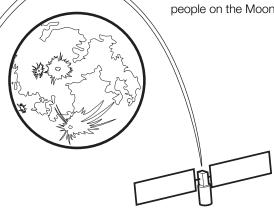
Why was it chosen?

ACCESS

Gateway's orbit is easy to access from Earth by many types of spacecraft, and will allow astronauts to land on every part of the lunar surface.

COMMUNICATIONS

The orbit allows people on Earth to talk to people on the Moon!



SCIENCE

Gives scientists and astronauts a great view of the Earth, Moon, sun, and deep space so we can study them all from the same orbit.

STABILITY

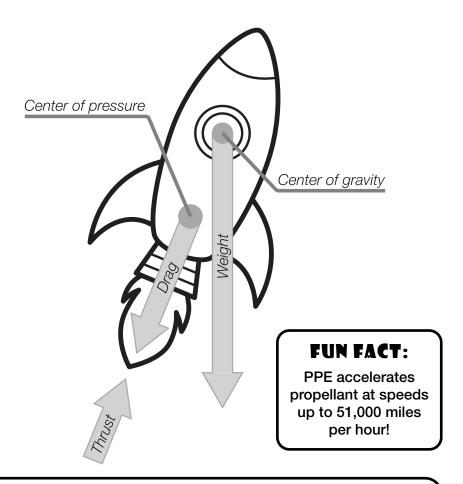
Gateway's polar orbit is balanced between the gravity of the Earth and Moon, making it easy to fly with less energy!

MARS AND BEYOND!

Gateway could be a place to prepare for human missions to Mars and beyond!

PROPULSION

Forces Acting on a Rocket

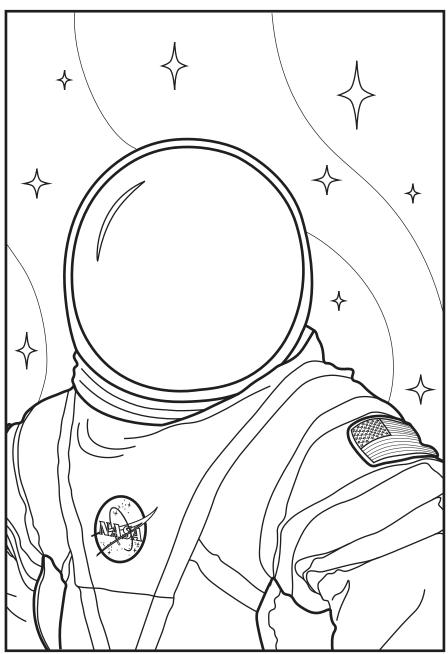


How does the PPE move Gateway?

PPE stands for <u>Power and Propulsion Element</u>. <u>Propulsion</u> means to push forward, or drive an object forward. As Gateway's propulsion system, the PPE's job is to produce <u>thrust</u>, or the force that moves things through space. This thrust is generated when PPE combines the Sun's energy collected by the solar arrays with a xenon plasma, creating an electric propulsion that produces the thrust to propel the spacecraft.

A NEW GENERATION OF ASTRONAUTS

Gateway will support long-term science and human exploration on and around the Moon. Can you draw yourself as an astronaut on a lunar mission?



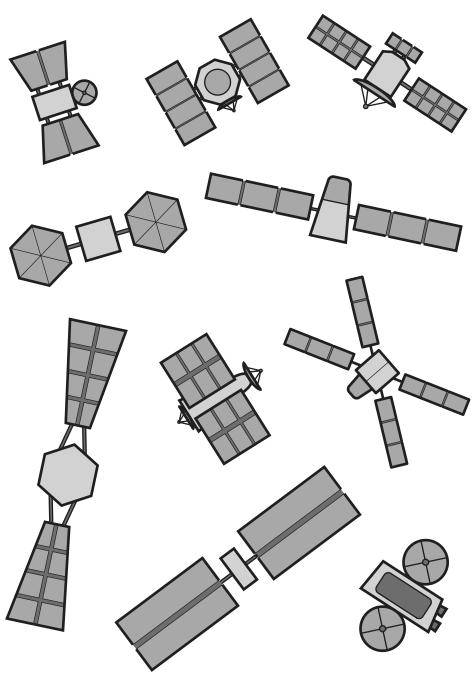
YOUR LUNAR MISSION STORY

Fill in the words to make your own story!

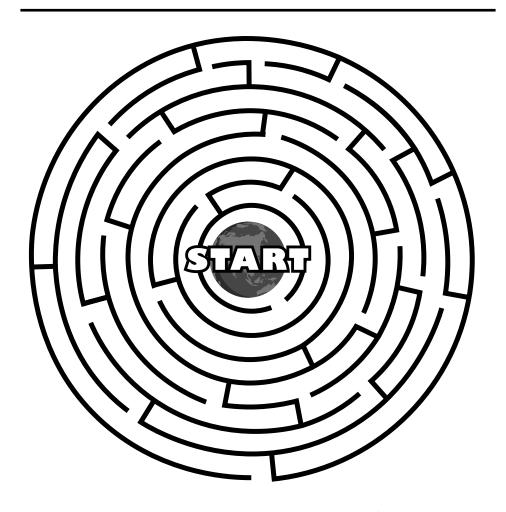
In the future year $\underline{\hspace{1cm}}_{year}$, y	ou'll be invited by NASA to
embark on a mission into space	e! You'll travel to the lunar
space station with a team of	astronauts for the
mission, and step for	oot on the Moon! They picked
name you because you're really good	l at On this mission,
you'll study, and se	and information back to your
team on Earth at	
You'll get to the lunar space sta	ation by riding on the
rocket. It will be pov	wered by and hour! Your crew is coming with
name travels at miles per	hour! Your crew is coming with
number number	noar. Tour orew to contain with
you, including your best friend	To keep yourself
entertained, you'll pack	and play with
entertained, you'll pack	to remember Earth while
you're away. While in space, yo	ou'll see!
\	plural noun
You'll live in space for	months. You'll wear a
spacesuit that looks	s , and bring 人
color	adjective
spacesuit that looks color and to e food drink visit the Moon's surface, you'll	stay there for
and travel using a	Your studies on
will benefit and help	
travel to!	

PICK OUT THE PPE

Can you find the PPE? It has a rectangular body and two large rectangular solar arrays.



POWER & PROPULSION ELEMENT MAZE



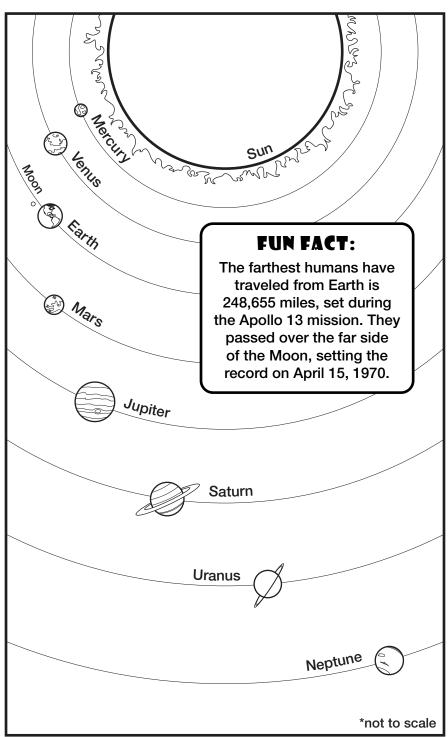
FUN FACT:

PPE provides
Gateway with power,
communications,
and steering for deep
space travels!

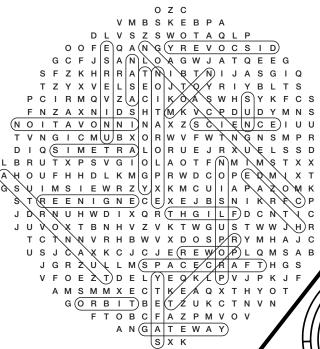




OUR SOLAR SYSTEM



ANSWER KEY



Page 11

HINT: Want some clues? Look at the pictures!

GVRATYI

STATION

SAEITLLET

MNOO

SAEPC

SPACE

STARS

DTAA <u>D A T A</u>

LCHUNA LAUNCH
MSISINO MISSION

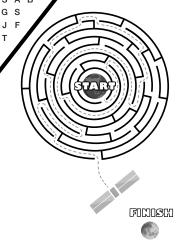
SOEFWTRA SOFTWARE

ETHRA EARTH

RCEKTO ROCKET

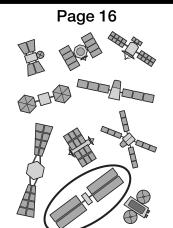
Write in the special shape letters to find the final word: What is the name of the space station that will orbit the Moon?





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National Aeronautics and Space Administration

Glenn Research Center 21000 Brookpark Road Cleveland, Ohio 44135 www.nasa.gov/glenn

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