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from: engineeringadventures@mos.org
to: You
subject: Astronauts need your help!


10:15 AM

Hi engineers!

You did a great job testing materials to see how well they protect against space hazards! Now it's time to put together everything you've learned about materials engineering to design a model space glove.

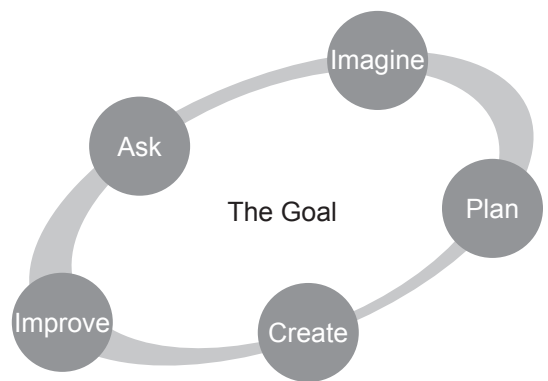
Maru told us about three space missions that could use your help. These missions will send astronauts to the Moon, asteroids, and Mars. It's your job to design a model space glove for one of these teams. We sent you some images so you can get an idea of how the gloves will be used and what these places are like. Which materials can you combine to protect from the hazards of your mission?

Since we can't test our gloves in space just yet, we've been using a simulation here at the testing site—a way to model the hazards the astronauts might face on their missions. We've sent you some stations so you can run a simulation on your model gloves.

You won't be surprised by three of the stations—they're the same tests you've been using all along. But don't forget, an astronaut will need to wear and use your glove, so we sent you a final station to see if your glove is strong enough to make it through the entire mission and is easy for the astronaut to use. The data you collect from all of these tests will help you *improve* your design later. We can't wait to see what you come up with!

Good luck!

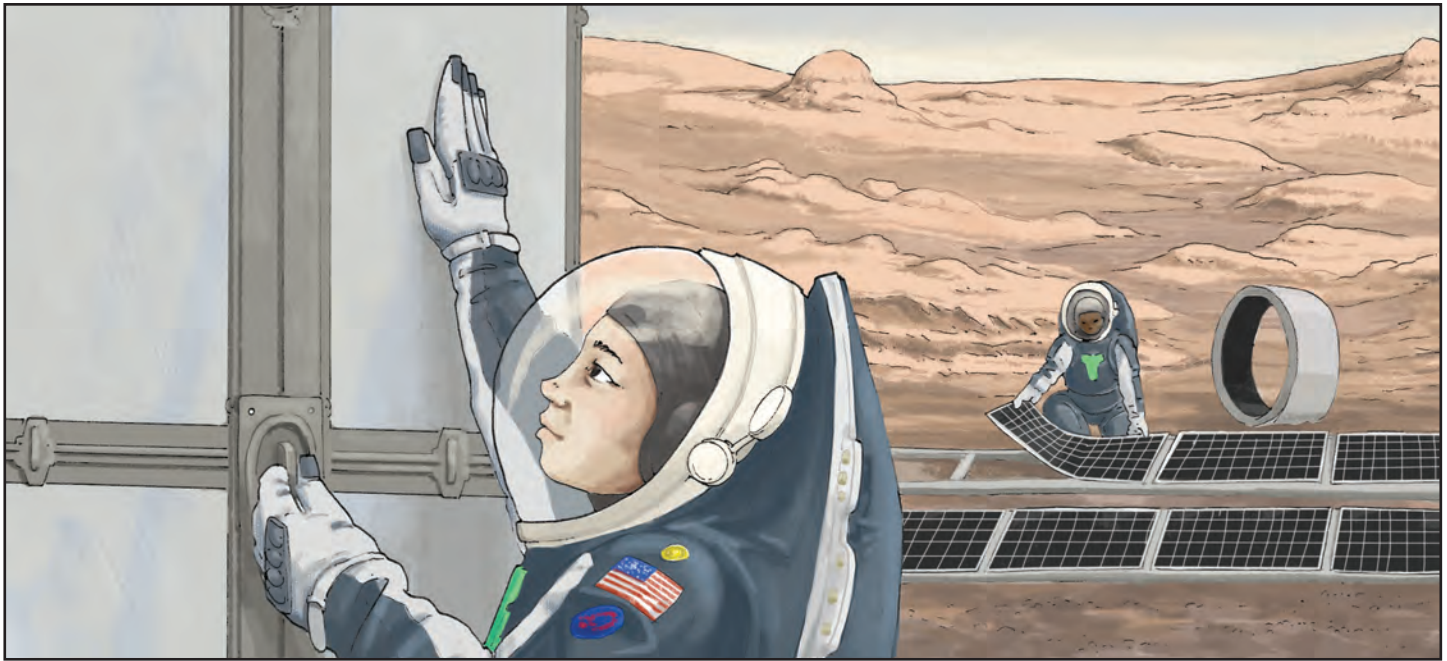
India





Mars

Build a habitat on the planet Mars.



Your model space glove should:	Your model space glove cannot:
<ul style="list-style-type: none"> • protect from both dust and impact hazards. • allow you to open a jar and type on a calculator. • be removable. 	<ul style="list-style-type: none"> • use more than 3 materials. • use more than 3 feet of tape. • have any materials or parts fall off after testing.



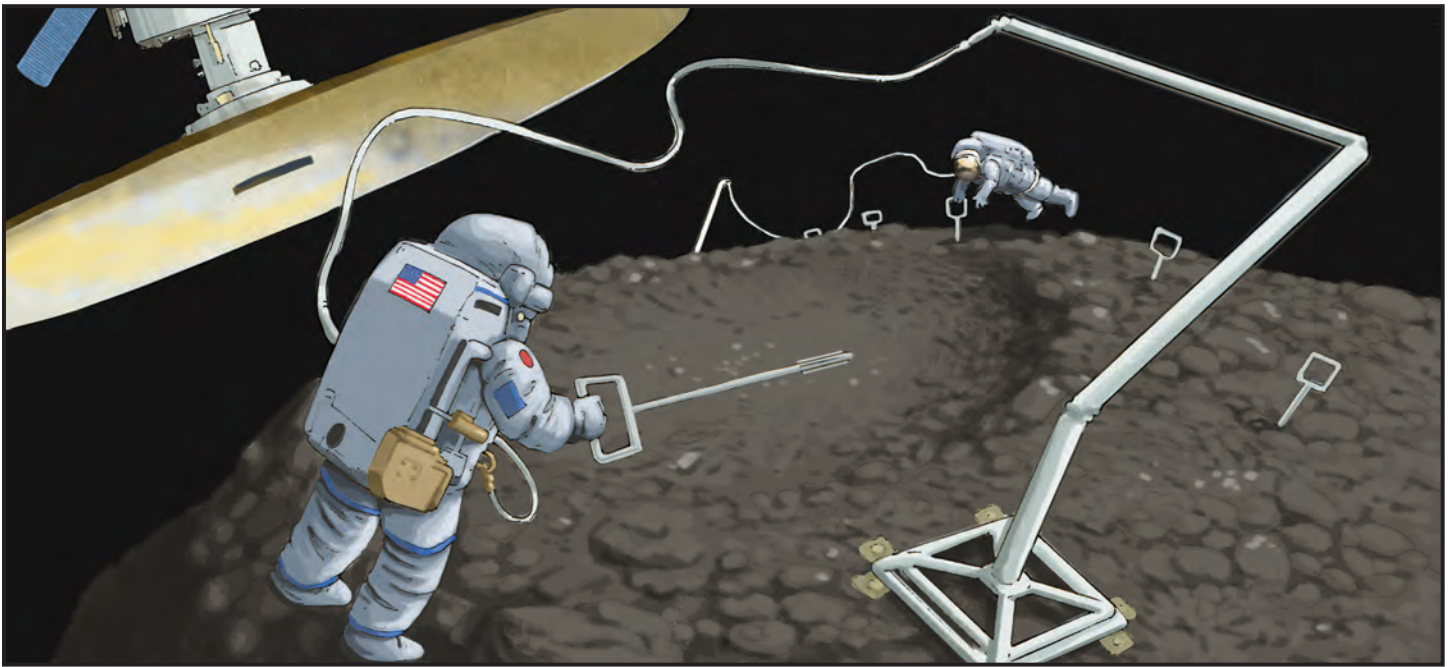
Did You Know?

Mars is the fourth planet from the Sun. There is so much rust in the rocks that Mars is nicknamed the “Red Planet.”



Asteroids

Mine asteroids for their minerals.



Your model space glove should:	Your model space glove cannot:
<ul style="list-style-type: none"> • protect from both cold and impact hazards. • allow you to open a jar and type on a calculator. • be removable. 	<ul style="list-style-type: none"> • use more than 3 materials. • use more than 3 feet of tape. • have any materials or parts fall off after testing.



Did You Know?

Asteroids are small, rocky objects that are sometimes called “minor planets.” Most asteroids in our solar system are found in the Asteroid Belt between Mars and Jupiter.



Did You Know?

Some asteroids are made of materials that have been around since the solar system formed 4.5 billion years ago.



Moon

Build a radio tower on the far side of Earth's moon.



Your model space glove should:	Your model space glove cannot:
<ul style="list-style-type: none"> • protect from both cold and dust hazards. • allow you to open a jar and type on a calculator. • be removable. 	<ul style="list-style-type: none"> • use more than 3 materials. • use more than 3 feet of tape. • have any materials or parts fall off after testing.



Did You Know?

We always see the same side of the Moon from Earth. This is called the “near side.” Sometimes the far side is called the “dark side,” but it actually gets the same amount of sunlight as the near side!



Which materials will you use to engineer your model space glove? Draw your ideas and label the features of your design.



PALM



BACK

Where will you place the materials?

- on the palm side of the glove
- on the back side of the glove
- inside the glove
- outside the glove

How will you use the materials?

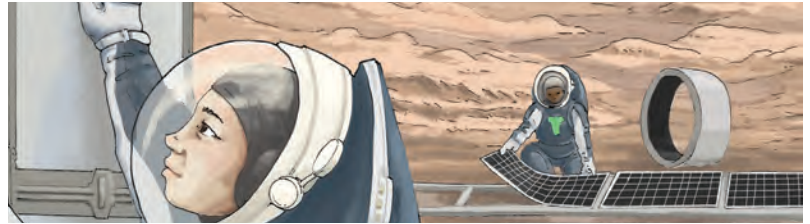
- layering
- combining materials

Why did you choose these materials?



Mars

How well did your glove perform in the tests below?



Dust: Circle how well your model space glove protects against dust.

Not Good 4+ areas	Good 2–3 areas	Great 0–1 area
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Impact: Record your results. Circle how well your model space glove protects against impact.

Test 1	Test 2	Test 3	Final

Not Good 11+ pieces	Good 8–10 pieces	Great 5–7 pieces
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Final Test:

Were you able to open the jar, remove the equation, and type it into the calculator?

Yes

No

Did your glove stay together after testing?

Yes

No



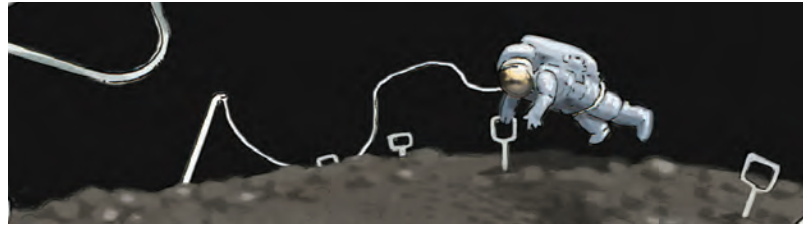
Did You Know?

Dust storms are very common on Mars. Sometimes there are storms so large they cover the entire planet!



Asteroids

How well did your glove perform in the tests below?



Impact: Record your results. Circle how well your model space glove protects against impact.

Test 1	Test 2	Test 3	Final

Not Good 11+ pieces	Good 8–10 pieces	Great 5–7 pieces
-------------------------------	----------------------------	----------------------------



Cold: Record your results. Circle how well your model space glove protects against the cold.

Starting Temperature	Temperature after 30 Seconds	Difference in Temperature

Not Good 7 °C or more	Good 3–6 °C	Great 0–2 °C
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Final Test:

Were you able to open the jar, remove the equation, and type it into the calculator?

Yes

No

Did your glove stay together after testing?

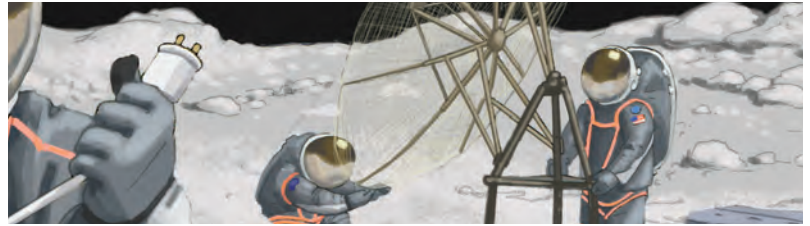
Yes

No



Moon

How well did your glove perform in the tests below?



Cold: Record your results. Circle how well your model space glove protects against the cold.

Starting Temperature	Temperature after 30 Seconds	Difference in Temperature

Not Good	Good	Great
7 °C or more	3–6 °C	0–2 °C

Dust: Circle how well your model space glove protects against dust.

Not Good	Good	Great
4+ areas	2–3 areas	0–1 area



Final Test:

Were you able to open the jar, remove the equation, and type it into the calculator?

Yes

No

Did your glove stay together after testing?

Yes

No



Did You Know?

Dust on the Moon comes from small materials from space hitting the Moon's surface.