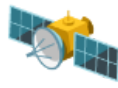


Space Trash



Design a shield to protect your
“spaceship” from space trash!



Space Trash



Learning Objectives/Key Messages

- Design and test a shield that will protect a spacecraft from space trash.
- Even if space trash is tiny, it can cause a lot of damage to spacecraft because it is traveling so fast.

Age/Ability:

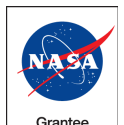
- 3-5 grade, adaptable for K-Adult
- Multimodal, accessible for all physical abilities

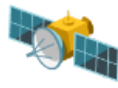
Materials Needed per Station:

- 1 aluminum tray
- Table salt or rice, $\frac{1}{8}$ tsp per trial
- 1 piece of dark-colored paper (to better see the salt or rice)
 - Optional: draw a bullseye on the dark-colored paper
- 10 washers
 - 1 alone
 - 2 taped together with masking tape
 - 3 taped together with masking tape
 - 4 taped together with masking tape
- 2 rulers
- *Impact Testing!* page (ideally laminated - use with dry erase markers)
- For (optional) Shield Design: an assortment of building materials such as:
 - cheesecloth
 - felt
 - craft foam
 - aluminum foil
 - index card
 - *Design It!* page (ideally laminated)
- Optional:
 - *Investigate It!* page
 - *Space Trash* Table Sign
 - Video or video clip about space trash
 - Electricity and equipment to run video
 - *Space Trash* Comic page



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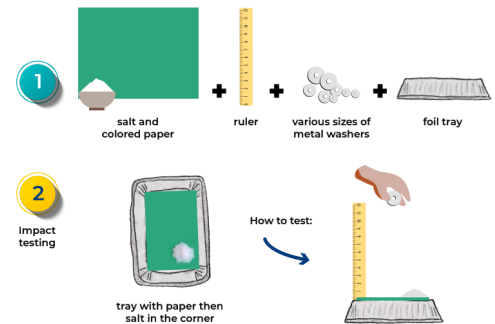


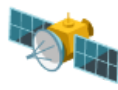
Space Trash



Impact Testing! (For Educators)

- Get a baseline!
- Ensure the spacecraft (aluminum pan) is upside down.
- Place the piece of dark-colored paper on the spacecraft.
- Sprinkle $\frac{1}{8}$ teaspoon of salt or rice on the edge of the colored paper (to better see the salt or rice which measures vibration).
- Measure one foot above the spacecraft and drop one, two, three, or four washers to represent space trash of different sizes.
- Measure two feet above the tray to represent space trash traveling at different speeds.
- Measure how much the energy of the space trash damaged the spacecraft in any of three ways:
 - A louder sound means more damage.
 - More vibrations in the tray mean more damage.
 - More movement of the salt or rice means more damage





Space Trash



Record Your Results (For Educators)

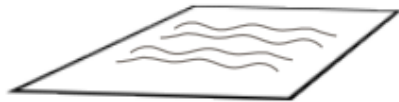
Use your own system, or use the *Investigate It!* sheet provided.



Record
your
results

On the *Investigate It!* page:

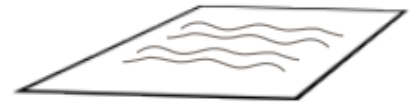
1. Write your predictions.



2. Test.



3. Record what happened.



Optional:

No pen? No problem! You can also have learners share their results:

- Tell someone
- Take a picture
- Other ideas of how to share

Space Trash

Investigate It!

Write your predictions below. Then test and write the results.

	A = A little damage	B = Some damage	C = A lot of damage
When...	I predict there will be... There is actually...		
1 washer is dropped			
2 washers are dropped			
3 washers are dropped			
4 washers are dropped			
the drop is 1 foot			
the drop is 2 feet			
<hr/>			
shield is cheesecloth			
shield is felt			
shield is foam			
shield is foil			
shield is an index card			



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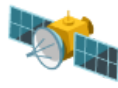
Reset

Clean up your area and throw away your trash
(This will vary depending on your setup)



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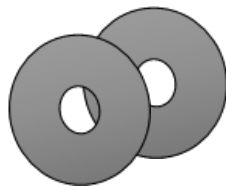


Design a Shield! (for Educators)

(Optional extension)

Use learners' engineering skills and their imagination to help solve a real-world problem:

Washers =
space trash

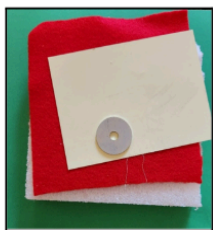


Aluminum tray =
the outside of the
spacecraft.



As an engineer-in-training, your learners' task is to design and test a shield that will protect their spacecraft from space trash!!

Materials + Imagination = Shield to protect the spacecraft from space trash.



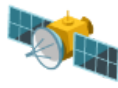
+



=



The learners may use any of the items provided, in any order.



Space Trash

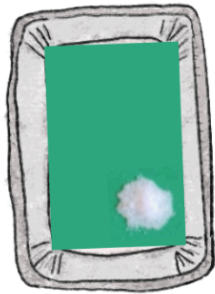


Add Your Shield! (and retest!) (For Educators)

- Test again with ***your learner's*** shield protecting the spacecraft
- Did it absorb some of the energy?
- Record the results



Impact testing



tray with paper then
salt in the corner

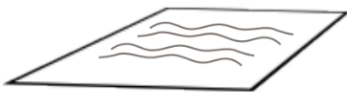
How to test:



Record
your
results

On the *Investigate It!* page:

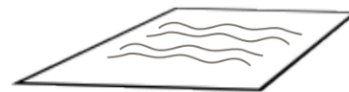
1. Write your predictions.



2. Test.



3. Record what happened.



Reset

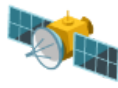


- Clean up your area and throw away your trash
(This will vary depending on your setup)



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Optional: Redesign and Retest!

(For Educators)

- Make a new shield, but with different materials
- You can choose how many options and trials offered



? What other materials can you use?



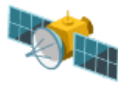
Reset 

- Clean up your area and throw away your trash
- (This will vary depending on your setup)

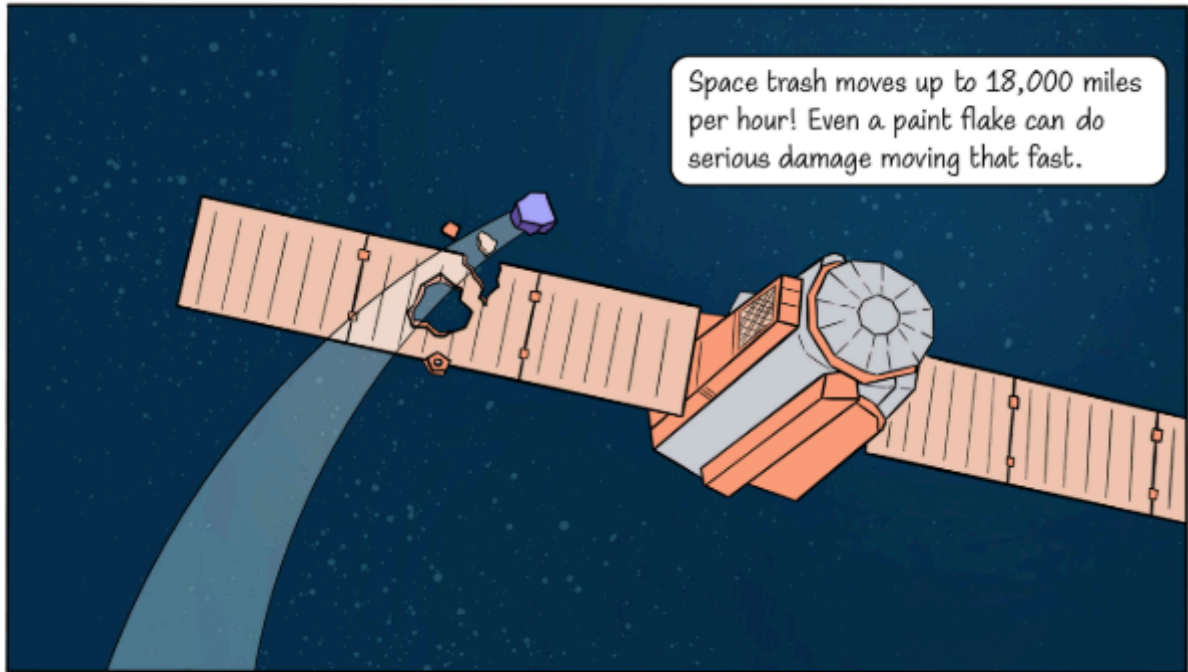


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