Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_\_\_

Mars Rover Engineering Journal

**Problem or need:** NASA is seeking for a solution to a collision that involves a moving object in a system. NASA needs a device that can safely deliver an astronaut, inside a cabin, to the surface of Mars.

**Supplies:**

* One golf ball--the “astronaut”
* One 3 oz cup--the “cabin”
* 8 straws
* 3 index cards
* 3 rubber bands

**Requirements/Constraints:**

* The astronaut must stay inside the cabin.
* The other materials are used to cushion the landing and keep the astronaut in the cabin.
* No items may be inside the cabin with the astronaut.
* The cabin may not have any type of lid, covering, or roof that intersects the vertical plane of the cup rim. (In other words, they cannot cut into the rim of the cup or stuff anything inside the cup that goes below the rim.)
* The astronaut may not be stuck to the cabin. Taping/gluing the astronaut into the cabin is not allowed.
* Your group may try out your design and redesign it as many times as you would like, but no changes can be made once official testing has started.
* After a 4 foot drop, the astronaut must still be in the cabin and the astronaut and cabin must be undamaged.
* Designs that survive a 4 foot drop will be dropped again from increasingly higher distances until the best design can be determined.

**Brainstorm:** Work with your group to design your lander. Remember, you need to keep in mind how Newton’s Third Law is affecting this system and your design must include solutions to lessen the impact of the collision.

|  |  |
| --- | --- |
| Draw arrows on the model to show the action/reaction forces that will be exerted in this system during the collision. | Draw what your lander will look like in the box below.  |
|  |  |
| **Prediction:** What height can this lander be dropped from and still safely land the astronaut? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Refining the Design:** On this page, record the results of your tests and the changes you make to your design. You may attach additional pages if necessary.

*Test 1*

*Drop your lander from 4 feet. Record your observations.*

* Did your lander survive the 4 foot drop? \_\_\_\_\_\_\_\_\_\_\_
* If yes, drop the lander from a greater height. How high were you able go? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Redesign: How can you make your lander better? Brainstorm and make some changes.*

|  |  |
| --- | --- |
| Changes that need to be made | Draw your new design |
|  |  |

*Test 2*

*Drop your lander from 4 feet or the highest height you have reached so far. Record your observations.*

* Did your lander survive the drop? \_\_\_\_\_\_\_\_\_\_\_
* If yes, drop the lander from a greater height. How high were you able go? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Redesign: How can you make your lander better? Brainstorm and make some changes.*

|  |  |
| --- | --- |
| Changes that need to be made | Draw your new design |
|  |  |

**Communicate the results:**

|  |  |
| --- | --- |
| How successful was your lander? What was the height of your official test? |  |
| Did you meet your prediction? Why or why not? |  |
| Draw a model of your lander and draw arrows to show the action/reaction forces exerted on your lander. |  |
| How did you use Newton’s Third Law to lessen the impact of the collision between the surface and the lander? |  |