# Design: A Space Odyssey

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## Introduction

- A space rocket is a non-reusable launch vehicle used to send satellites and space shuttles into space.
- How a rocket performs in space depends on the design and shape of the body, nose cone, and fins, as well as the rocket diameter and speed.
- To design a rocket, you must know its requirements – what it needs to be able to perform or withstand.

## Experimental Design

- Validity of an experiment is directly affected by its creation and execution.
- Determines cause-and-effect relationships.
- Must identify known or expected variables and control outside variables, or risk having an experimental bias.

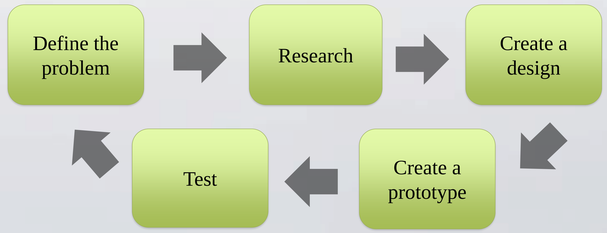


Figure 1: The Engineering Design Process.

## Methods

The engineering design process was followed as illustrated in Figure 1.

1. Researched current rocket designs and materials used by large corporations.
2. Sketched out multiple design ideas for the rocket body, nose cone, and fins.
   - Narrowed ideas down to six possible rocket designs.
3. Developed a computer model of the rockets on Solidworks.
   - Solid modeling was used because it shows the designed object as if it were a real manufactured product.
4. Chose individual sections of the rocket to apply load tests to. In this experiment, the body tube of the rocket was chosen for testing.

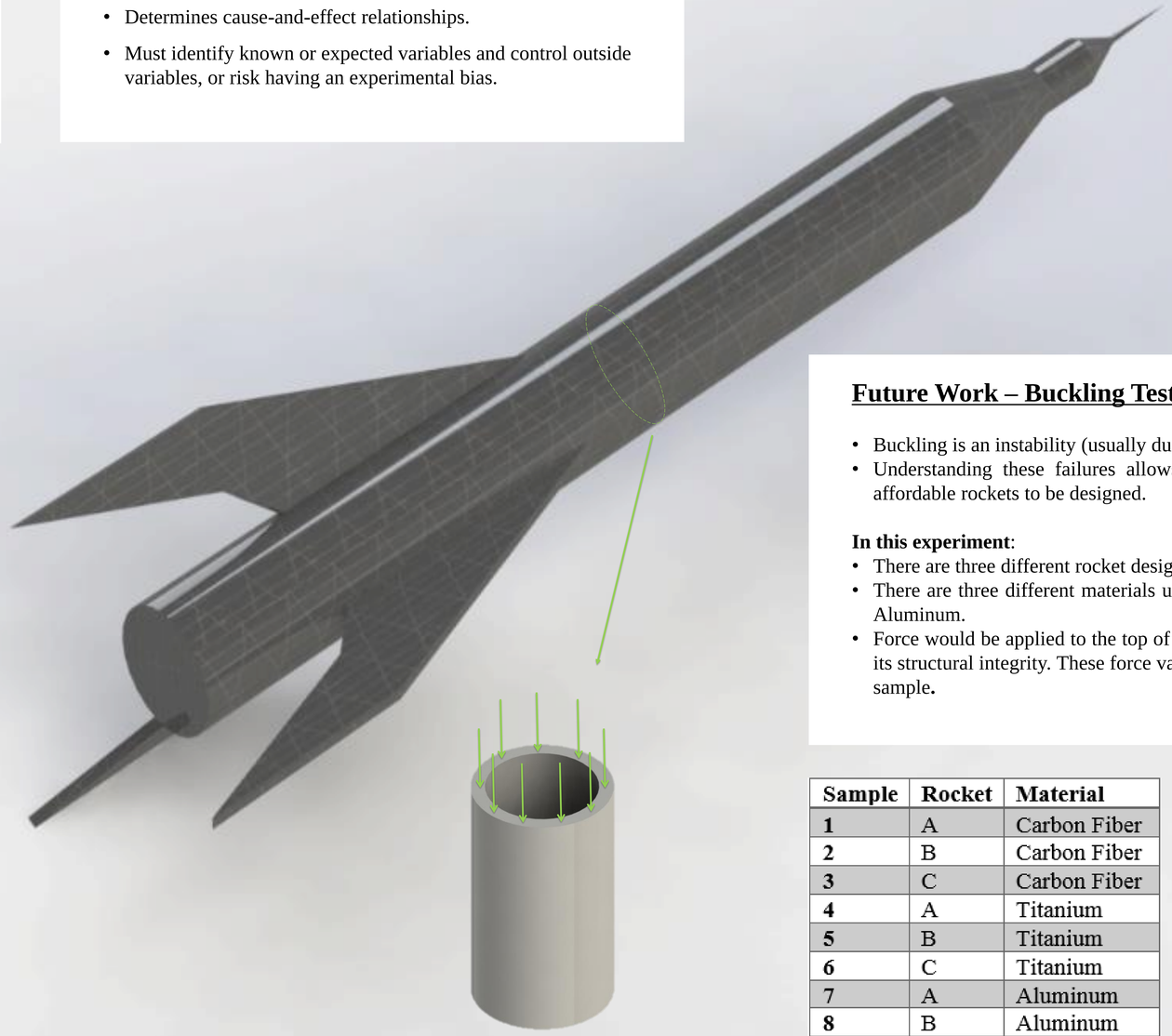

Figure 2: Shell buckling test being applied to a section of a the body tube of a rocket.

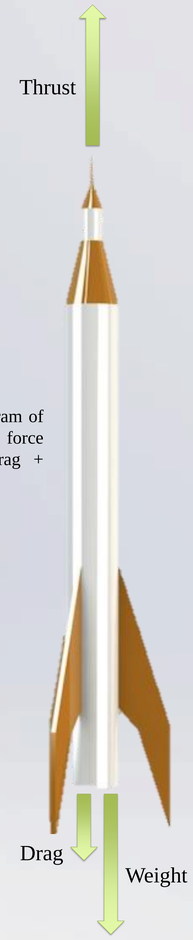


Figure 4: Free body diagram of a rocket. Resulting force upwards = thrust – (drag + weight).

## Future Work – Buckling Tests

- Buckling is an instability (usually due to a load) that leads to failure.
- Understanding these failures allows for lighter, thinner, and more affordable rockets to be designed.

**In this experiment**:

- There are three different rocket designs, labelled A, B, and C.
- There are three different materials used, Carbon Fiber, Titanium, and Aluminum.
- Force would be applied to the top of the rockets body tube to evaluate its structural integrity. These force values would stay constant for each sample**.**

| Sample | Rocket | Material |
|---|---|---|
| 1 | A | Carbon Fiber |
| 2 | B | Carbon Fiber |
| 3 | C | Carbon Fiber |
| 4 | A | Titanium |
| 5 | B | Titanium |
| 6 | C | Titanium |
| 7 | A | Aluminum |
| 8 | B | Aluminum |
| 9 | C | Aluminum |

Figure 3: Chart used to determine how many samples are needed.

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