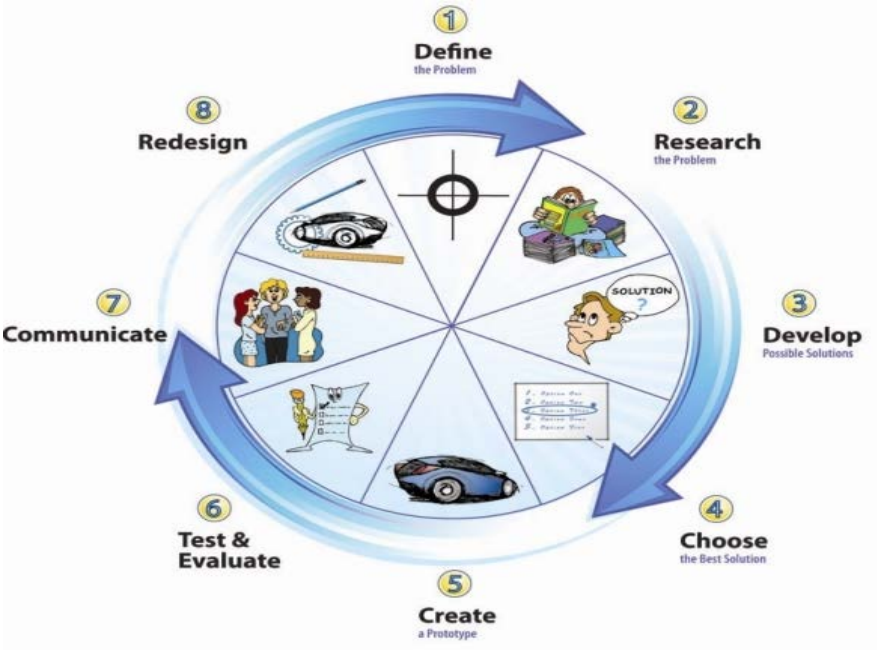
All Scientists, Engineers and Mathematicians Wanted!!

We need Scientists, Engineers and Mathematicians to help redesign a space lander for AFRL! The space lander is going to be carrying some special equipment to space. We need to ensure the safety of the tools and materials. The budget allowed for the mission is $10.00. Will your team be the ones who help the astronauts get what they need and ensure a successful landing?



1st Trial

2nd Trial

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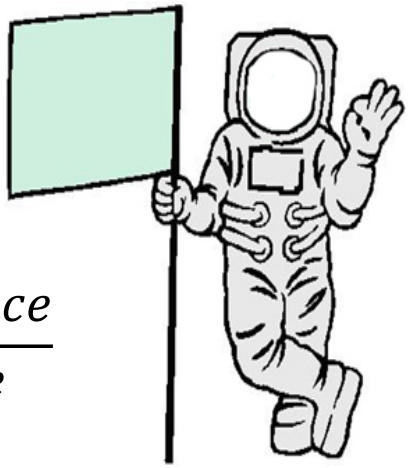
- Your team is allowed a budget of $10.00 to build your lander.
- The **mass** of the lander cannot exceed 150g.
- Must have 6 inch string from the top of lander (string will be free)
- All teams will receive 1 meter of tape and plastic cup for free.
- You must all agree on your design and materials.
- Your design must be drawn and labeled, then show to the instructor to get materials.

Lander Materials	Price
Peanut Bag	$2.00
Balloon	$0.50
Rubber Band	$1.50
Cotton Bag	$2.00
Popsicle Stick	$1.00
Styrofoam	$4.00
Egg seat	$4.00
Plastic Cup	$2.50
Plastic	$2.00
String	$1.00
Card Board	$1.00
Bubble Wrap	$1.00

Item	Cost	Quantity	Total
		Total Project Cost:	



Budget for Design	$10.00
Total Cost	
Amount left in account	

$$Velocity = \frac{Distance}{Time}$$

Velocity = _____ m ÷ _____ s

Velocity = _____m/s

Maximum Mass	150g
Total Mass	

Evaluate you design. Circle the condition of your lander and cargo after launch.

Survival (no damage)

Living….. with a cracked skull (shell cracked)

Unconscious with brain damage (any part of the inside leaking)

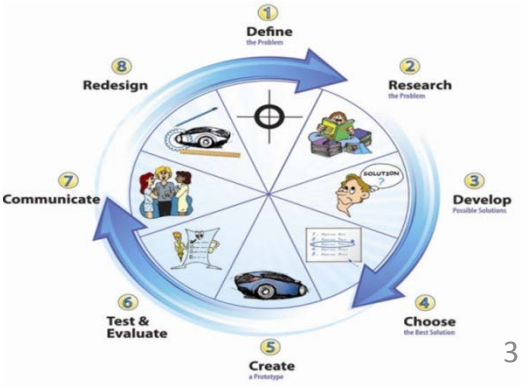
Totally scrambled (everything is broken)

1. Where did the cargo sustain damage?

2. What does this indicate about the flaws in your design?

3. How could your group modify your design to make it better?

4. How did your group work as a team? What was the most difficult part?



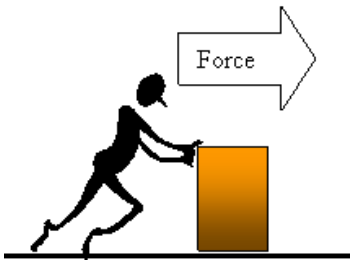
Math and Newton's 2nd Law of Motion

$F = ma$, or we can write it as $a = \frac{F}{m}$

where, F is the net force
m is the mass
a is the acceleration

In words Newton's 2nd Law states: The acceleration of an object is directly proportional to the net force applied to the object, and inversely proportional to the mass of the object.

Let's look at the math to see this. Fill in the missing values in the table. Since we are missing a, the acceleration, we will use the equation $a = \frac{F}{m}$ to do our calculations. For example, if F= 40N and m = 5 kg, then a = 40N ÷ 5kg = 8 m/s^2. Now you try:



F, Force	=	m, mass	x	a, acceleration
10 N	=	10 kg	x	m/s^2
20 N	=	10 kg	x	m/s^2
50 N	=	10 kg	x	m/s^2
100 N	=	10 kg	x	m/s^2

What happens to the acceleration when the Force increases?

What happens to the acceleration when the Force decreases?

Does this make sense from your observations of force and motion? Why or why not?

Is acceleration ***directly proportional*** or ***inversely proportional*** to force? (circle one)

Math and Newton's 2nd Law of Motion, continued

Next, let's change the object's mass. Fill in the missing values in the table. Since we are missing a, the acceleration, we will use the equation $a = \frac{F}{m}$ to do our calculations. For example, if F= 40N and m = 5 kg, then a = 40N ÷ 5kg = 8 m/s^2. Now you try:

F, Force	=	m, mass	x	a, acceleration
100 N	=	5 kg	x	m/s^2
100 N	=	10 kg	x	m/s^2
100 N	=	25 kg	x	m/s^2
100 N	=	50 kg	x	m/s^2

What happens to the acceleration when the mass increases?

What happens to the acceleration when the mass decreases?

Does this make sense from your observations of force and motion? Why or why not?

If you divide by a larger number what happens to the quotient?

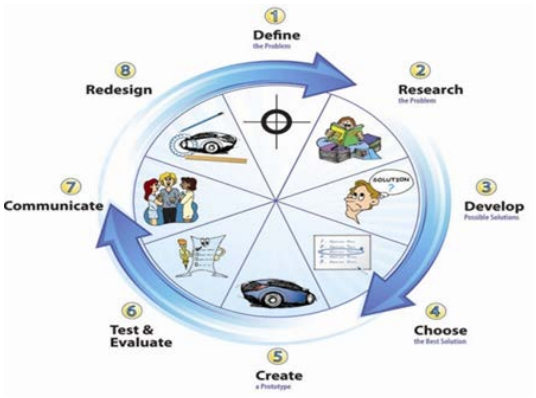
Is acceleration ***directly proportional*** or ***inversely proportional*** to mass? (circle one)

An Engineer's Conclusion

1. Refer back to your design, how does the 1st design compare with the 2nd design?

2. How are they different?

3. As an engineer, what is your next step, after completing these two tests? Describe what you will do and support your decision with evidence and the Engineering Design Process.



Closing the Conclusion of Design

1. How does the first design compare and contrast from the second design?

2. What needs to be communicated with other engineers? Why would you want to talk about this?

3. How can you apply this information learned to other designs for the future?

4. Write an argumentative paper proving your idea as an engineer. How could you convince other engineers that your design works or how it could improve?