

CHALLENGE 4

PAPER PLANE LAUNCHER - An Aerospace Engineering Challenge

Get a flying start to your day with this challenge: Try throwing a paper airplane by moving just your wrist (don't move your elbow or shoulder). It's hard, isn't it? How could you get a paper airplane to fly far if you can use only a short distance to launch it? Try this challenge to find out!

Objective :

Build a paper plane launcher using the concept of a catapult, like those used on real aircraft carriers. Unlike an aircraft carriers though, you won't need any compressed air or electromagnets.

In this challenge you will build one using a rubber band. The rubber band stores potential energy when it is stretched. When it is released, it gives kinetic energy (motion energy) to the paper airplane. Even over a short distance, this is much more effective than just using your wrist!

Successfully complete the challenge and your entry will be entered into a draw where at random you stand to win either RM25, RM50 or RM100 in credit.

Challenge Rules :

1. Create your own paper plane launcher using cardboard, building toys such as LEGO® or wood
2. Build or fold your paper plane and launch it using the paper plane launcher
 - Here are some ideas for different Paper Plan designs. (insert link to pdf for paper plane guides)
3. Measure the flight distance using a ruler or measuring tape and fill up the results sheet
4. Upload a video of you launching the plane using the launcher created on Facebook
5. Tag Engineering for Kids Malaysia

Additional Suggestions/Tips :

1. Make sure the clip is fastened at the tip of the plane



2. Make sure the launcher is stable when launching



Parent Guide

Science Concepts:

1. **Potential energy:** Defined as mechanical energy, stored energy, or energy caused by its position.
2. **Kinetic energy:** The energy that an object has because of its motion.
3. **Force?** Force is a push or pull acting upon an object as a result of its interaction with another object.
4. **Aerodynamics** is the way air moves around things. The rules of aerodynamics explain how an airplane is able to fly. Anything that moves through air reacts to aerodynamics. Aerodynamics even acts on cars, since air flows around cars as they move.

Learning Outcomes (Questions Parents can ask their Child)

1. Observation

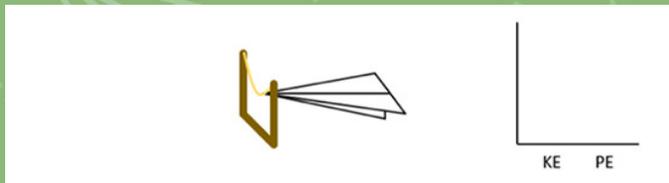
Compare the different methods of launching the paper plane and observe which gave the best outcome with the least effort

- First, try to throw your airplane only using your wrist. Keep your shoulder, elbow and forearm still.
- Then, try throwing your paper airplane using your entire arm
- Finally, try launching your airplane using the "launcher."

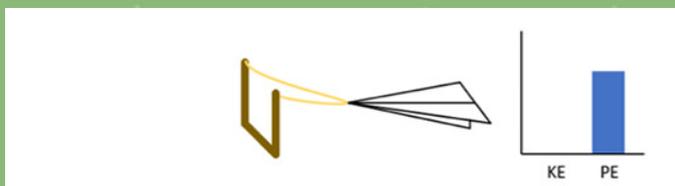
You probably found that it was very difficult to throw your paper airplane very far using only your wrist. Your wrist has a much smaller range of motion than your entire arm, and it's difficult to get the airplane going fast enough for a long flight. A rubber band, however, can store quite a bit of energy in a relatively small distance when it is stretched. A launcher built with a rubber band can get the paper airplane going fast over a much shorter distance, allowing you to launch it much farther than you can with just your wrist—possibly even farther than you could with your entire arm!

2. Comprehension

- Potential energy (PE)
- Kinetic energy (KE)



What happens when we pull back the rubber band? The stretched rubber band stores potential energy



What happens when we release the rubber band? The potential energy of the rubber band is converted to kinetic energy of the paper plane

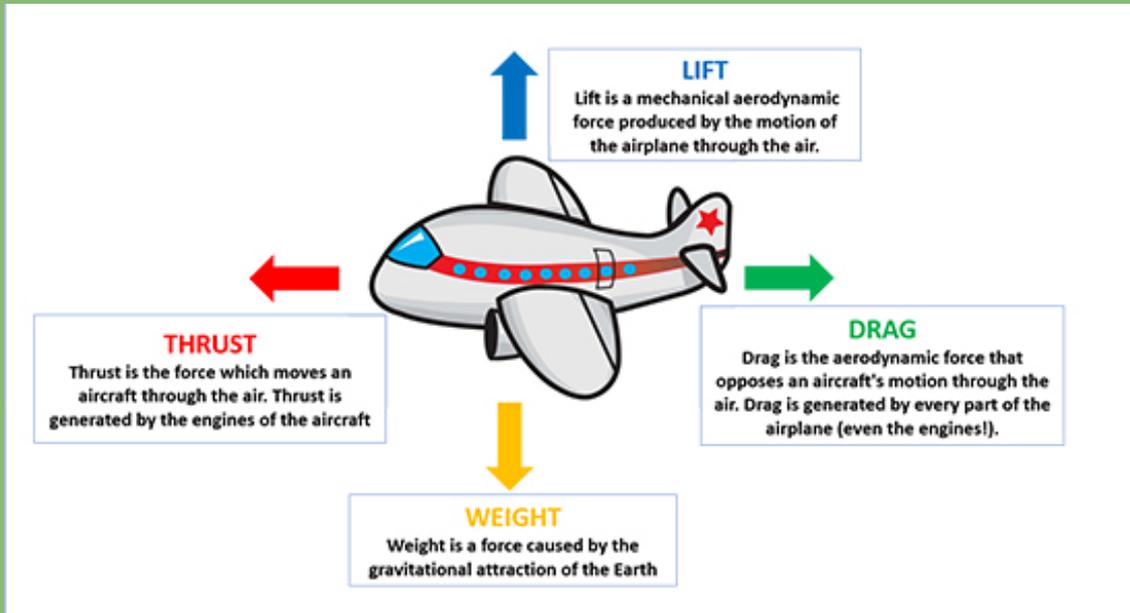


3. Evaluation

What forces are at play ?

Which rules of aerodynamics impacted the test flight and in what way ?

- Was the plane design a factor ?
- Did different materials (thickness of paper) affect the flight? Was weight a factor ?
- Did the Kinetic Energy from the rubber band force give enough thrust for flight ?



4. Testing

Measure the distances travelled by using:

- Rubber bands with different lengths and thicknesses, or several rubber bands at one go. Which ones launched the plan furthest? Which ones worked better than others? Why do you think that is?
- Did different paper plane design flies the further? Why?

