LAUNCHER

INITIAL IDEAS

Our first launcher idea was to use a simple concept of fulcrum where the weight will be placed on one side of the ramp and the device placed on the other side (Fig 1). We also thought of substituting the weight with a stomper (Fig 2)

Fig 1 – Fulcrum and weight-based launcher

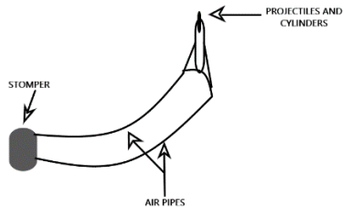
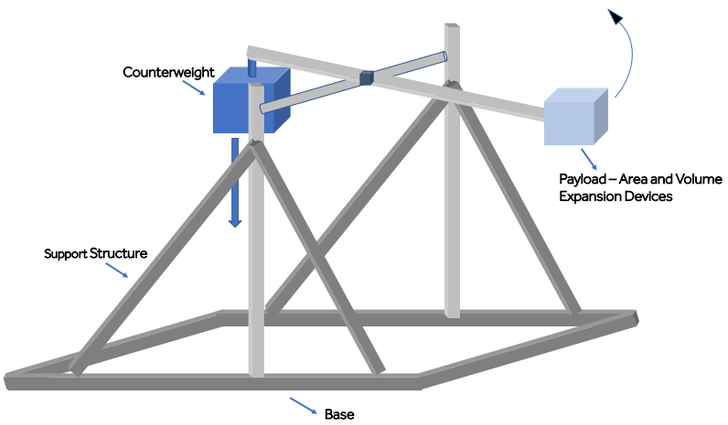


Fig 2 – A stomper-based launcher

However, both the design above did not provide the needed thrust for the device launching.

FIRST PROTOTYPE

Our next idea was a Trebuchet based design.



The physics behind a Trebuchet is based on converting the energy of a falling counterweight to launch a payload.

- The payload in our case are the 'area and volume expansion' devices. But to test our launcher, we used different objects to simulate the payload.
- The counterweight, and the payload are connected to the two ends of an 'arm,' which rests on a round wooden dowel (stick) that is supported on either side by a vertical support structure.
- The counterweight is much heavier than the payload. The 'arm' rests (pivots) on the round dowel in such a way that the length of the part of the arm that holds the counterweight is much shorter than the length of the arm that holds the payload.
- The length of the long arm (holding the payload) was approximately 3 times the length of the short arm (holding the counterweight).

Working mechanism: The long arm is brought down to keep the short arm (and the attached heavy counterweight) at a certain height. As the long arm is released, it results in the free-fall of the counterweight attached to the short arm. This free-fall makes the 'long arm' rotate, and as it reaches a certain angle, the payload is released.

Observation: While Trebuchet based design yielded better results than the fulcrum or stomper-based models, we were not able to get the needed accuracy to clear a height of 10 feet as well as go through the hula hoop.

SECOND PROTOTYPE

We used the structure that we built for Trebuchet and converted that into a **Slingshot** based design.

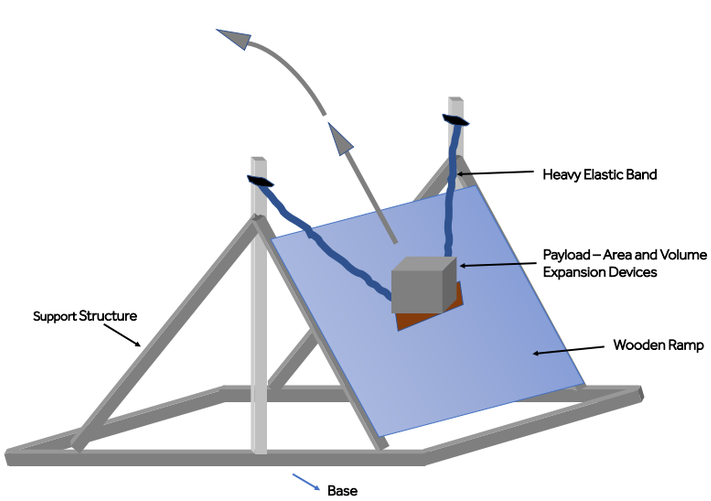
The physics behind a Slingshot is based on using the stored energy of an elastic to shoot a payload in a projectile motion.

- In our design, we used a heavy string that was attached on either side to the two ends of the support structure.
- The base on the string (to hold the payload) was prepared using multiple layers of tape.

Working mechanism: The string is pulled back using the holding base as far as possible, to maximize the initial energy that is exerted on the payload (i.e. expansion devices) when released. This allows the payload to achieve the required projectile trajectory.

Observation: We were able to gain enough thrust and clear enough height as well as trajectory. However, we were not able to get the consistent accuracy because of the angle of the launch and the pouch that we added to place the device was not holding the device consistently.

CHANGES TOWARDS FINAL WORKING LAUNCHER



The materials we used in order to build this device are following:

- Wooden Planks
- Wooden Ramp
- Elastic Exercise Band
- Screws

- Weights to make the base stable

To fix the accuracy of the launch and to have a stable base for the device, we added a ramp to the structure and added a wooden rectangular base where the device can be placed (instead of a pouch from previous design).

Launcher Specifications:

Weight – 4.5 lbs (excluding the stone weight)
Height – 2.5 feet
Width – 2 feet

Distance of device landing from the hula hoop pole after launch – 12.5 feet

COST FOR MATERIAL

LAUNCHER

Material	Store	Quantity	Price
Wooden Poles for the base (4x1 inch)	Home Depot	8	$16
Wooden plank for ramp	Scrap material	1	$0
Elastic Exercise band	Existing unused material	1	$0
Wooden plank for the launch base	Scrap material	1	$0
Screws (2inch)	Home Depot	40	$4
Weights to make the base stable (50 pounds)	Scrap Stone	2	$0
Total Launcher Cost			**20.00**