SLING SHOT ROCKETS

TIME	TASK	DESCRIPTION	NEEDS
5 min	**Introduction**	Review the big ideas of the lesson (Elasticity & Newtons 3rd Law)	- Use the kids phones to find videos about newton's 3rd
10 min	**Quick Read**	**Directions:** Take the next few moments to read a short excerpt about elasticity and newton's 3rd law. Be prepared to explain this.	- Make sure the reading is in the LP
10 min	**Writing It In Your Own Words**	**Directions:** Use the space below to answer to following questions: (1) What is elasticity? (2) What is Newton's 3rd law? (3) How do these thing explain how a slingshot works?	Make sure the reading is in the LP
25 min	**SlingShot Rocket Building**	Follow the directions to build your own rocket launcher.	- See materials
5 min	**Launch Competition**	We will have a slingshot rocket launching competition. Who can launch the rocket the furthest.	- Need chalk to mark distance
5 min	**Video Script Writing**	Write your script for your video recording.	- n/a
5 min	**Video Recording**	Record your video	

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Quick Read

Directions: Take the next few moments to read a short excerpt about elasticity and newton's 3rd law. Be prepared to explain this.

Slingshot physics involves the use of **stored elastic energy** to shoot a something at a high speed. This elastic energy comes from rubber bands which are specially made for slingshots. This energy is provided initially by the muscle energy of the slingshot operator. One of the goals of a slingshot is to fire the projectile at the greatest speed possible. To do this two basic physics conditions must be satisfied.

First, you must maximize your draw length, and second **you must maximize the draw force** you can personally exert over the draw length. In other words, the slingshot must be designed (for you) such that you are able to pull back on the projectile as far as you can and as hard as you can, before releasing it. This **maximizes the elastic energy stored** in the rubber bands **which translates into the maximum kinetic energy of the projectile** upon release, which results in the maximum release speed of the projectile. This in turn results in the greatest impact energy, and therefore damage inflicted on the target when it is struck by the projectile.

The figure below shows a conventional Y-shaped slingshot. The red dot represents the position at which the rubber bands start being pulled (drawn). At this point there is no tension in the rubber bands. Due to the slack in the rubber bands this start position lies ahead of the plane of the Y-shaped fork. The distance *d* represents the draw distance and the force *F* represents the draw force. Due to the slack in the rubber bands the distance *d* can be less than the maximum draw length of the person operating the slingshot. The red dot also represents the approximate release point of the projectile since it is the point at which the rubber bands no longer "pull" on the projectile. At this point the rubber bands have returned to their initial unstretched length and all their stored energy has (in theory) been given to the projectile. In reality though, a fraction of the energy is always lost through internal and external friction. Naturally we want to keep this fraction of energy loss as small as possible.

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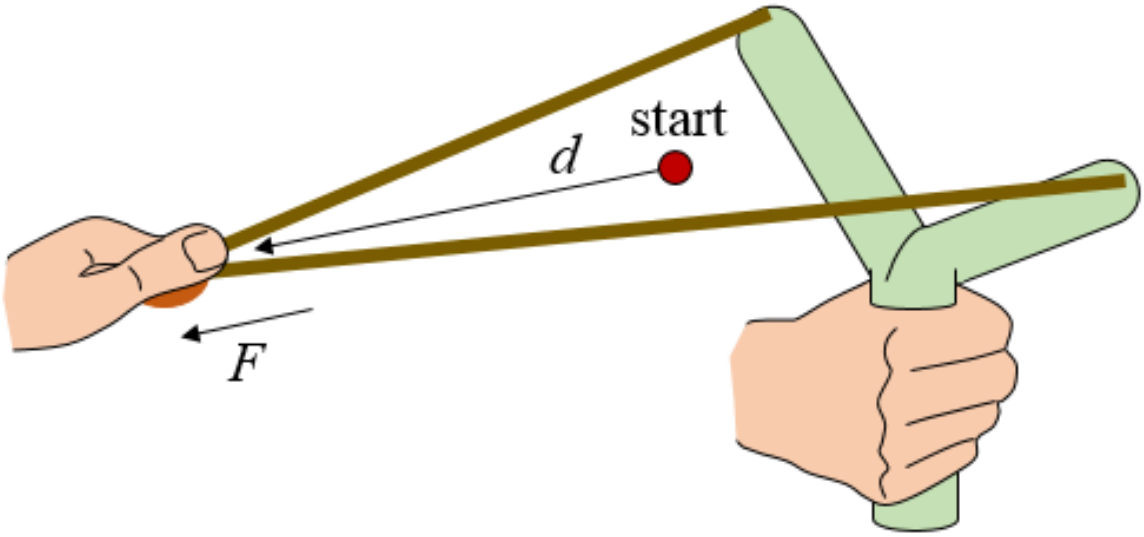

When pulling back on the **rubber bands the draw force *F*** increases as the draw distance *d* increases, just like when a spring is stretched. Ideally we want the maximum draw force (F_{max}) of the person operating the slingshot to be at the point at which his/her draw length is a maximum (d_{max}). This results in the maximum amount of energy stored in the rubber bands (provided by the slingshot operator), because you are generating a backwards force, you if you let go an opposite force will act on the slingshot. **Newton's 3rd law** states that for every force there is an equal and opposite force. So as you create a lot of force moving backwards you can expect a strong force forward.

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Write It in Your Own Words

Directions: Use the space below to answer to following questions:

(1) **What is elasticity?**

(2) What is Newton's 3rd law?

(3) **How do these thing explain how a slingshot works?**

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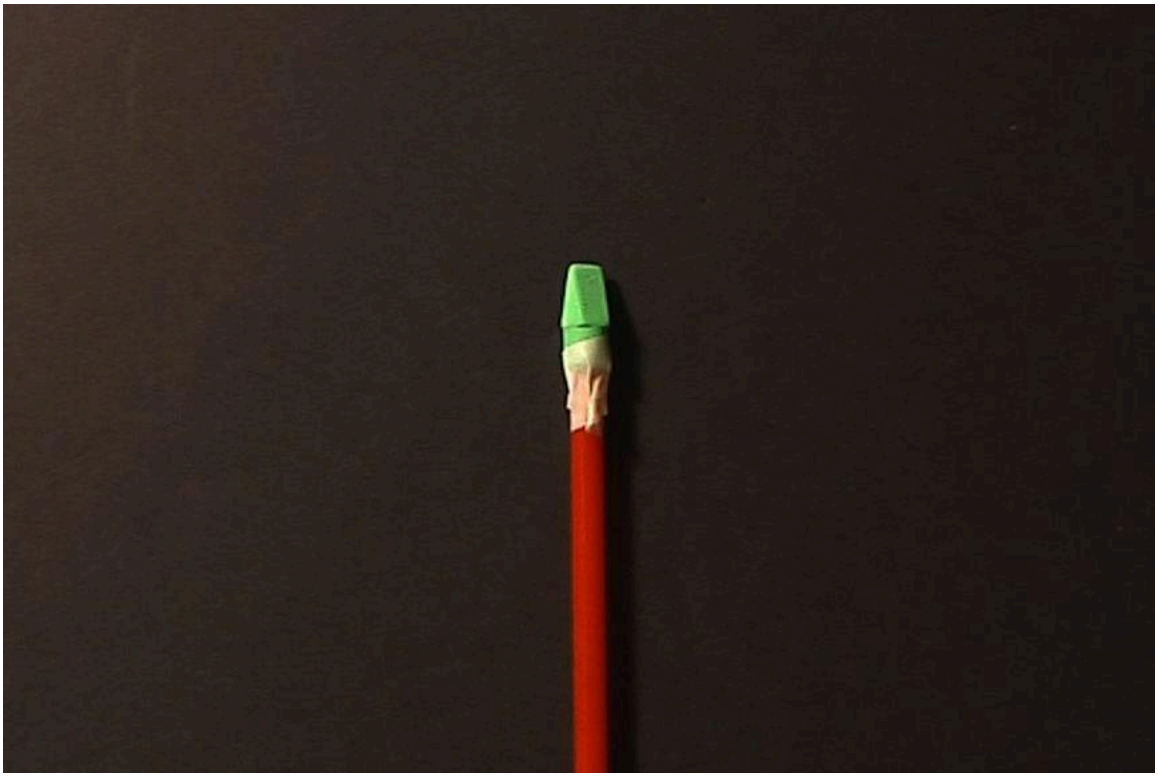
Build A Sling Shot Rocket

- 1 – Cap eraser
- 1 – Standard paperclip
- 1 – 3” x 5” Index card
- 1 – Rubber band, #19
- 1 – Normal craft stick
- 1 – Drinking straw
- Masking Tape
- Ruler
- Pencil
- Needle Nose Pliers (optional)

Step 1: Make the Nosecone



Step 2: Add The Hook

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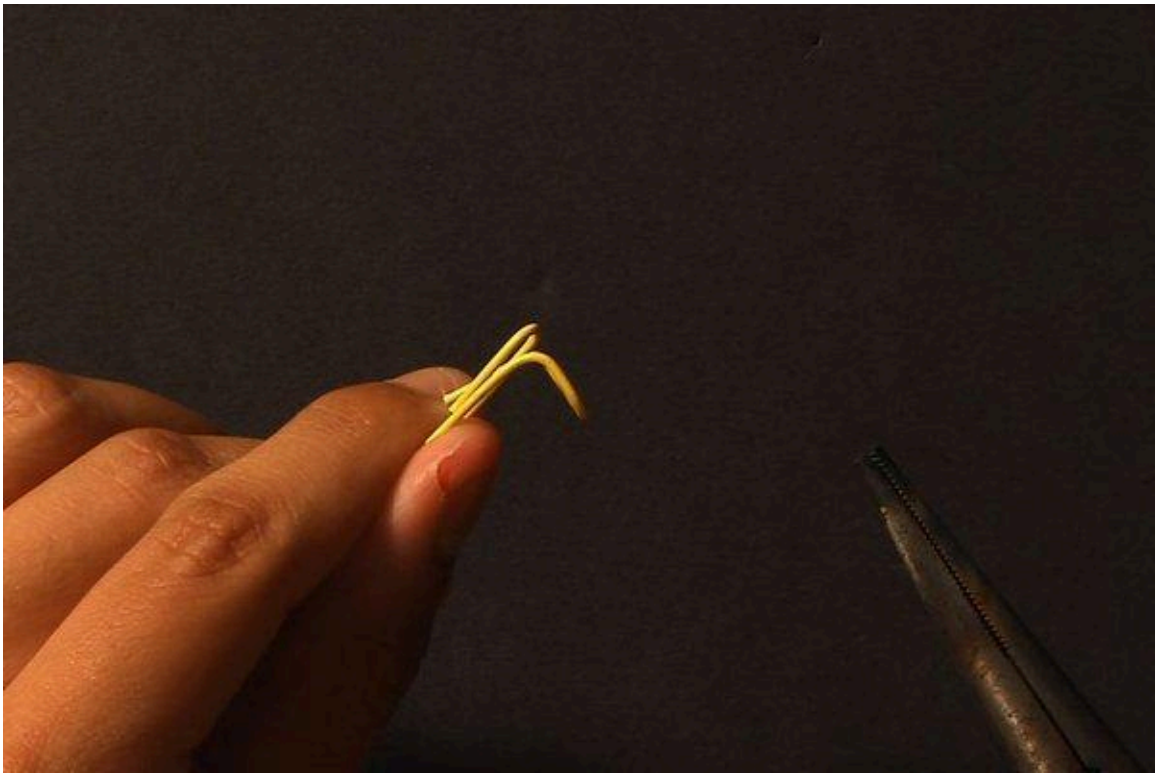

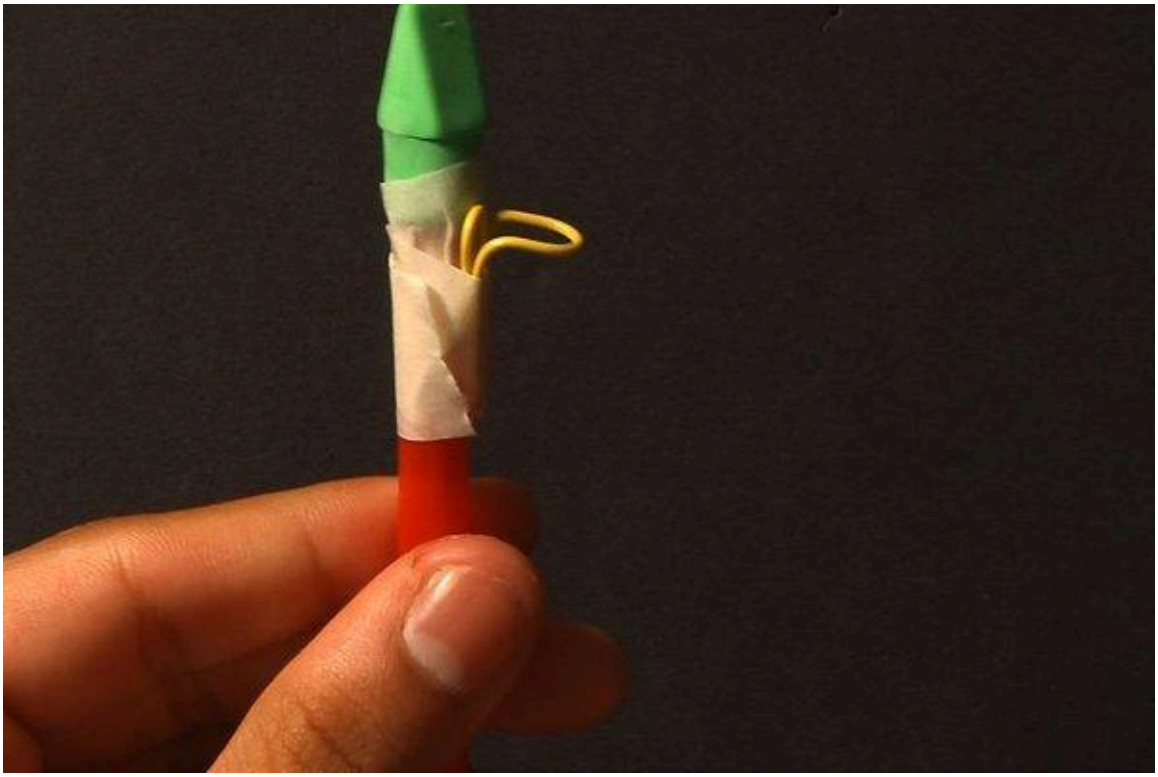

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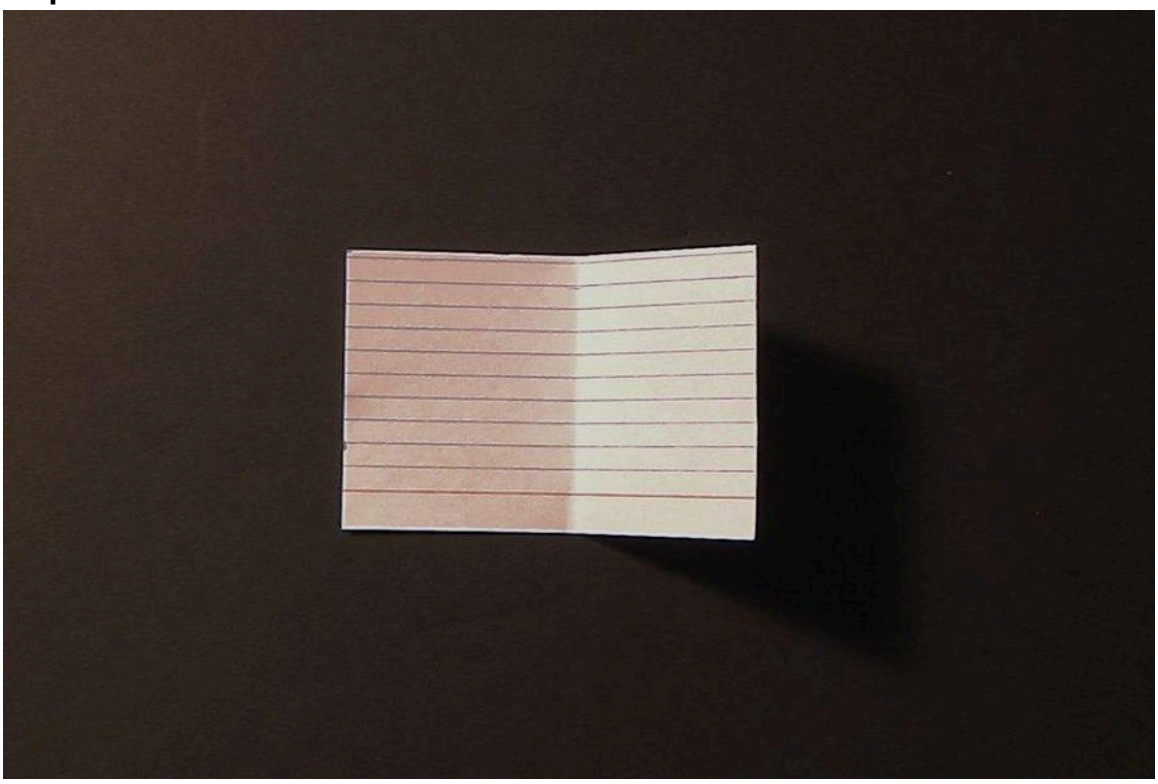
Use the needle nose pliers to bend down the tip of the larger end of the paper clip. You can also just use your fingers in many cases. Tape the paper clip with the bent end sticking away the straw just behind the cap eraser.

Step 3: Add Fins



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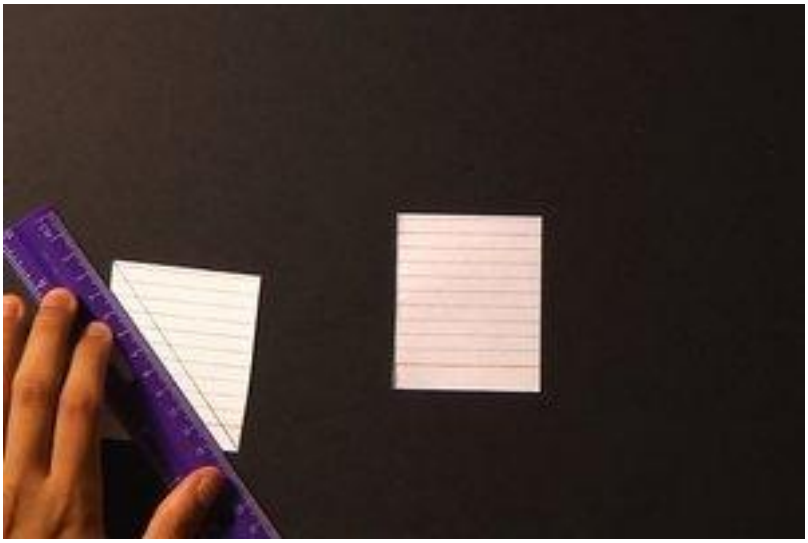

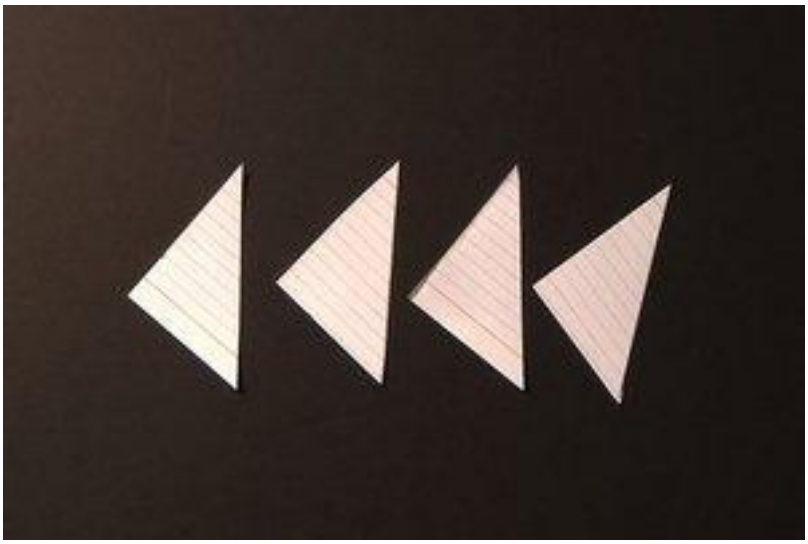

Fold the index card in half. Make a crease and unfold. Cut along the crease. Use the ruler to draw a diagonal line across both pieces of index card. Cut along the lines so you have four triangles. These are the fins of the rocket. Place a piece of tape on either side of the longer, straight edge of one of the triangles. Stick it to the opposite end of the straw from the cap eraser, about an inch from the tip. Repeat steps for the other triangles so they are evenly spaced around the straw

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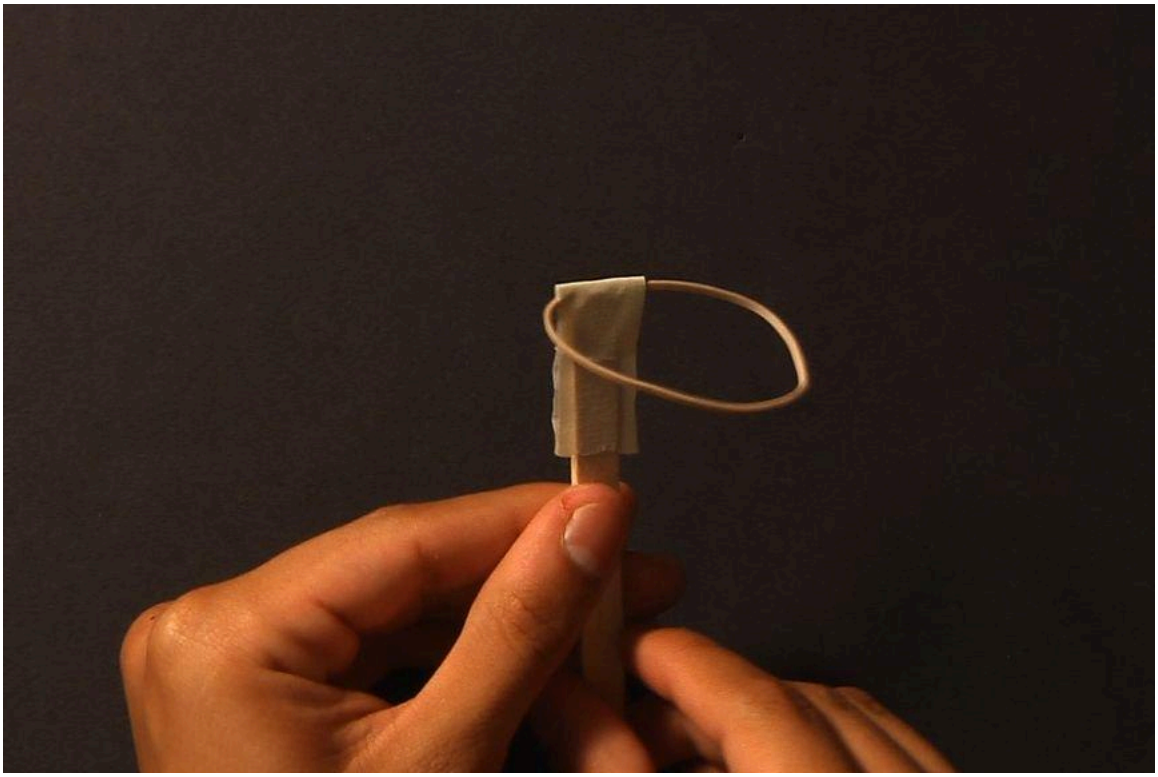
Step 4: Make The Slingshot Launcher

Tape the rubber band to one tip of the craft stick using two pieces of tape, one on top of the other.



STEP 5: To Launch Your Rocket

To launch, hold the rocket by the straw below the fins. Hook the rubber band with the paper clip and pull back. AIM AWAY FROM PEOPLE. As you let go of the rocket, flick the craft stick forward.

The energy the rocket needs for flight comes from the rubber band. Rubber bands are elastic, meaning that, when stretched, they return to their original shape. When you stretch the rubber band, there is a lot of energy stored in the rubber band. When you let go of the rocket, the rubber band returns to its original shape, pulling the rocket with it. This transforms the stored energy into the rocket's motion.

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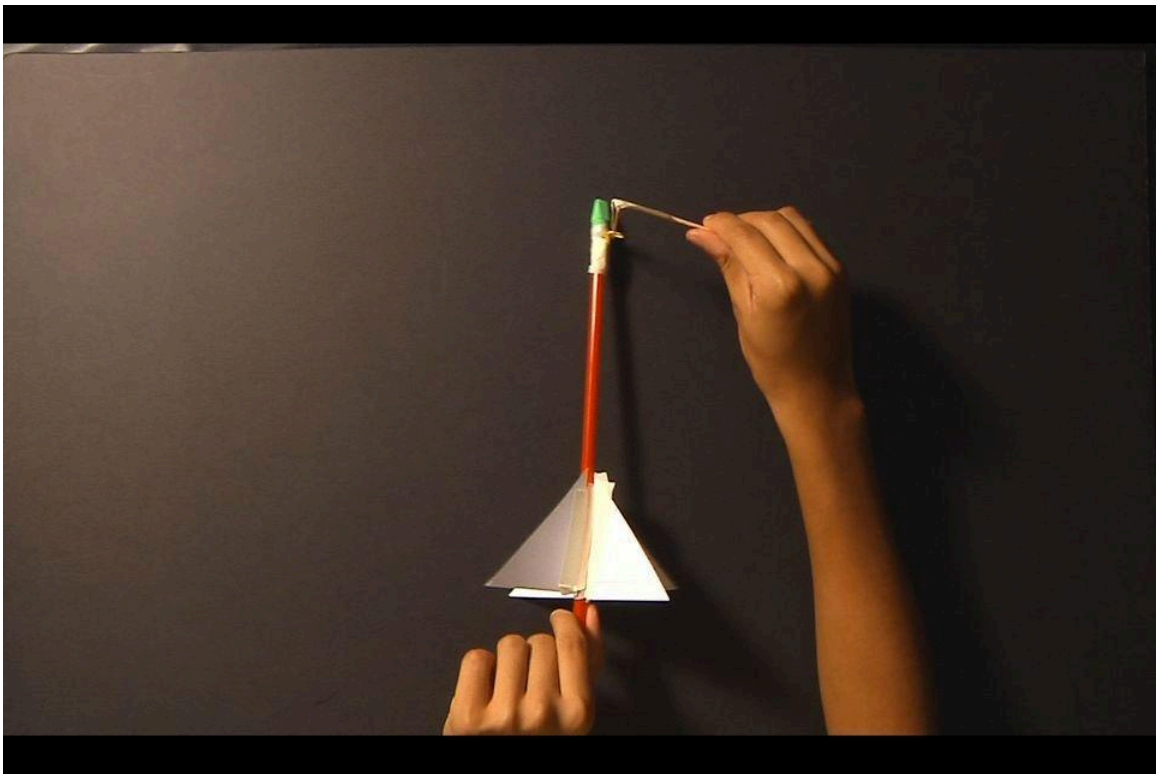
To change this up, try using other shapes for the fins. Or, change the number, location, or even the angles of the fins. OR, try different rubber bands. The engineering/tinkering options are tremendous. Have fun!



Launch Competition

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Video Script Writing

https://www.instructables.com/id/Rubberband-Slingshot-Rocket/

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