GRADES 3-8 4-H

ROCKETS: DAY #1

Build and Launch Engine-Powered Rockets

Materials Needed: For the Instructor: Exacto or Carpet Knife
Rubber Band (Size 64, or similar), Grocery-store-style plastic bag, White or Wood Bottle Glue, Cardboard, Scissors, Copies of Shock Cord Mounts, Copies of fin placement diagrams, Hot Glue Guns and Glue, Masking Tape, 2.75" Engine Hook, Straw or Launch Lug, Estes A or B engine/motor, Estes Motor Igniter, Launch paper/wadding, Launch Pad and required batteries, NC-20 Nose Cone, BT-20 Body Tube (18 Inch—Will Make Two Rockets)

Procedure (Refer to attached photos.):

If you want to have the build completed in one day, pre-cut the fins and tubes as well as cut the small 1/8th-inch slots into each fuselage. Make sure that your hot glue is heated and ready to go.

Working with partners, Step #2 and Step #4 can be completed at the same time. However, you will want to wait until Steps 2 and 3 are completed before gluing the rubber band inside the rocket.

Step #1 (Body Tube and Engine Mount)

Cut BT-20 tube until 9-inches long. Use the other tube for another set of partners.

From the bottom of the cut tube, measure up 2.5 inches and cut a small slit (width-wise, not length).

Place engine hook (90-degree bend end) into the small slit. The odd-shaped bend should extend beyond the bottom of the rocket.

Use masking tape to go around the fuselage and hold the engine hook to the rocket. Do this in two places: one wrap should be directly over the slit and hook. The other wrap should be about 3/4ths of an inch from the end of the fuselage. Rub down any wrinkles in the tape.

Step #2 (The Fins)

Cut 3 to 4 fins out of cardboard. The simplest fin to cut is to simply to cut out a square and then cut the square diagonally. This will provide two fins. The square should be at least three inches (no more than four inches).

If you cut three fins, place them approximately 120-degrees from one another.If you are using 4 fins, place them approximately 90 degrees from one another. Use the "Fin Positioning Guide" by placing the fuselage in the middle and then marking where the bottom of each fin should attach to the rocket. Use the black lines for three fins and the white lines for four fins.

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ROCKETS

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Do not place a fin directly over the engine hook!
Attach fins so they will stick out below the rocket by at least half-a-inch. This allows the rocket to sit upright and leaves room for the engine and engine hook. Make sure that all fins are attached to the rocket facing the same way and are the same size!

Use hot glue (on its highest setting) in order to glue the fins to the fuselage.

Step #3 (Launch Lug)

From the top of the fuselage, measure down 1 1/2-inches and glue (white or yellow glue—not hot glue) your launch lug. This is simply a straw-like device that helps keep the rocket straight at launch. It should be mounted in such a way that the launch pad rod (going through the lug) will not be hampered by fins or other attachments. Make sure that glue does not block the lug/straw ends and it is mounted straight.

Step #4 (Recovery)

Cut out the "Shock Cord Mount" for a BT-20 rocket. Fold the paper into the three sections, with section one being the first fold and then unfold the mount. Cover the numbered side of the paper with glue. Cut the rubber band in one place, making it into a long elastic band. Place the band on the glue-covered paper (aligning the end of the band with the flat top of section #1). While keeping the band centered on the paper, fold the paper twice, wrapping the band inside. As glue and rubber do not stick well, students may need to hold this piece for a few minutes, so the paper does not open. Tie the other end of the rubber band to the nose cone ring. If the nose cone "plug" (bottom) is not secure, carefully glue it to the nose cone. Put the band and nose cone down and make a "streamer."
The streamer is simply a strip cut out of a trash bag. The perfect width is 2 inches, and length needs to be at least one-foot. As trash bags can be difficult to cut, some variation in size and rough cuts are fine. Once the streamer is cut, tie it onto the middle of the rubber band. A simple half-knot should work fine. Tell kids the knot is like the first part of tying shoes, with no bows.

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ROCKETS!

Complete and Launch

Simply make a loop around the band, and bring either end through the loop before tightening. Then, tighten without ripping the steamer. The streamer works best tied at one end, not the middle.

Coat the paper, attached to the end of the rubber band with glue on one side. Tell kids to push that paper down into the fuselage at least an inch. Once in the rocket, they will need to push the glued paper onto the wall of the fuselage in order to secure the recovery system. DO NOT PUT THE STREAMER INTO THE ROCKET—AS IT MAY GET STUCK TO WET GLUE!!!

Let everything dry overnight, and the rocket will be ready for final "rigging" by the next day.

Step #5: (Launch Day Preparation)

Follow the directions that came with the launch pad and/or engines. I recommend installing the igniter and plug into your engine and then installing your engine into the rocket. Remember, the end with the igniter sticks out of the bottom of the rocket. You will want to put a small piece of fire-resistant wadding into the fuselage from the top. You really only need about as much as an individual piece of toilet paper. Wad it up and push it down with a finger. Make sure that the rubber band is attached to the inside of the rocket, nose cone, and streamer. Roll the streamer and place it into the rocket, and follow with the nose cone. You are now ready to go outside and launch! Before placing rockets onto the pad, check that all fins and the launch lug are secure. Do not launch rockets with insecure parts.

SAFETY WARNING! Children have been known to ignite one of these rockets in their hands using a 9-volt battery. Keep your eyes open!

Step #6: (Launch) Review the Model Rocket Safety Code and make sure you comply with all suggestions. Follow the directions with your engines/launch pad. Make sure to have children stand back from the launch area and do a "count-down." The primary reason for the "count-down" is to provide situational awareness for participants. They need to watch the launch and recovery! Otherwise, they might not know that a rocket is about to land near/on them! Do not let children run after the rocket for recovery. They have been known to run into fast moving rockets with failed recovery systems. Sometimes, these rockets can punch a hole in the ground up to 3 inches deep, if the recovery system fails.

Step #7: Have Fun!

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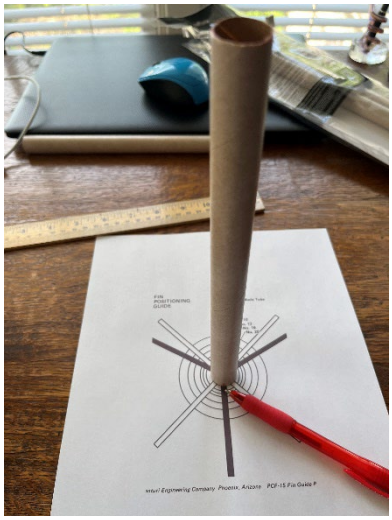
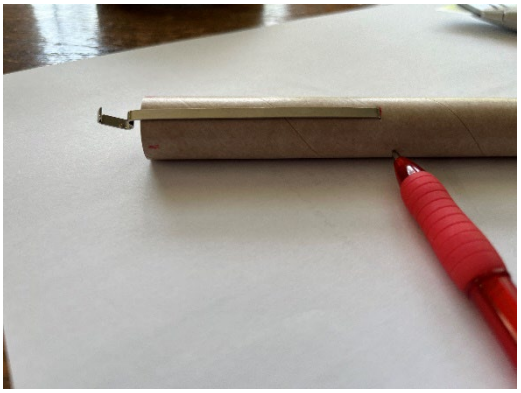
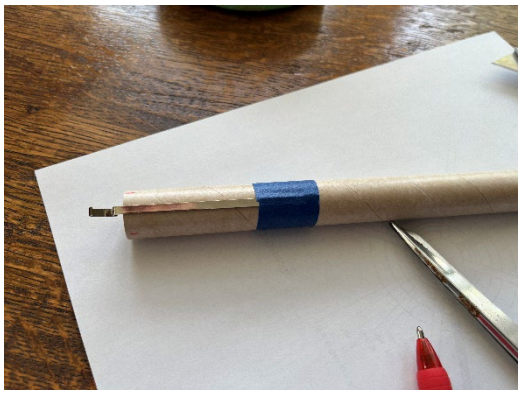
Rocket Build Photos

Step #1, Tube and Engine Mount: (Precut all pieces, if you want a one-day build.)

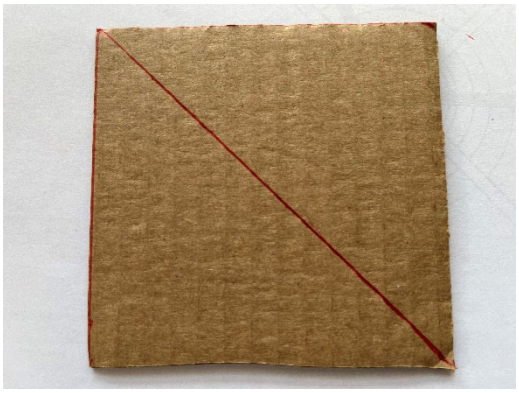


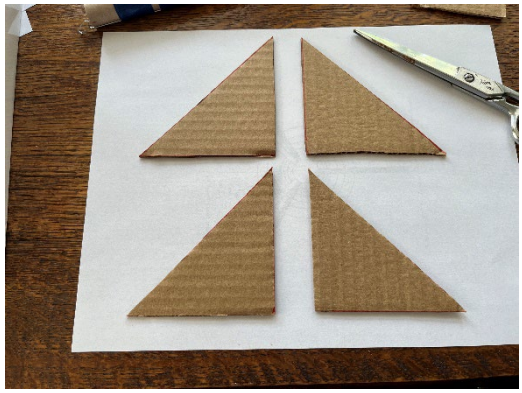


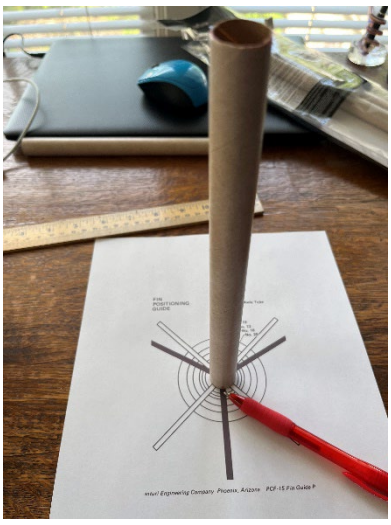


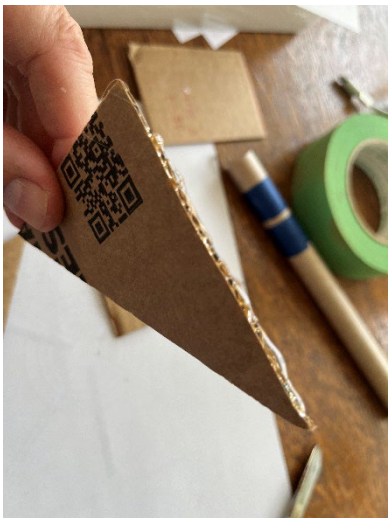
Step #2, Fins:

Hint: Working with partners, Step #2 and Step #4 can be completed at the same time. However, you will want to wait until Steps 2 and 3 are completed before gluing the rubber band inside the rocket.





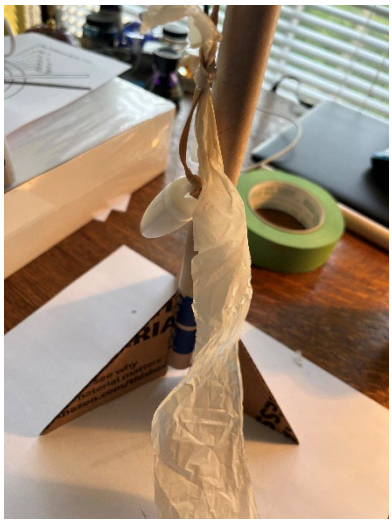




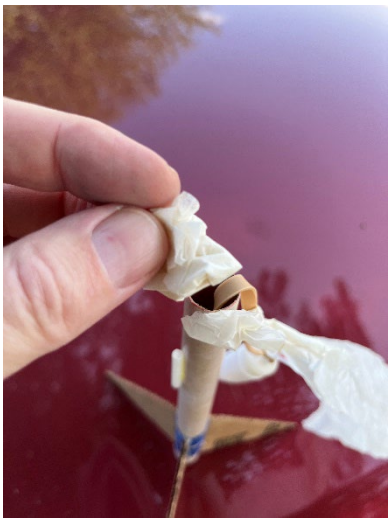
Step 3 (Launch Lug):

Step #5 (Recovery System)

Step #5 (Continued):



Step #6 (Launch Preparation):



Make sure to use fresh batteries and that your clips do not touch each other or any metal launch pad components. Don't twist the igniter wires!