CNY Rocket Team Challenge 2023
Junior Division
Estes Green Eggs
Building Instructions Addendum

The Green Eggs rocket may be built exactly as shown in the manufacturer's instructions included with the kit. Read the entire instructions for rocket assembly and this addendum before you begin rocket assembly. This addendum provides suggestions for several modifications that may strengthen your rocket at certain common points of failure and add reliability to your rocket's performance. One modification included in this addendum, drilling a pressure equalization hole for the altimeter, is REQUIRED for your CNY Rocket Team Challenge rocket. The other modifications are optional.

In the Rocket Team Challenge, you will be scored in 6 areas. Two scoring areas, *Flight Performance* and *Measured Apogee*, may be affected by your decisions on which modifications to make.

Fin Preparation – Consider adding paper skins to strengthen balsa fins. (Optional)

The Green Eggs rocket design incorporates through-the-wall attachment. This is a technique used in many larger model rockets to strengthen the fin/body tube connection. Tabs on the root edge of each fin are inserted through pre-cut slots in the body tube. The fin is glued to the engine tube and the body tube to create a strong joint. The fins are cut from a 3/32-inch-thick balsawood sheet. Balsa has the benefit of light weight but is not nearly as strong as other fin materials such as plywood or fiberglass. Though the fin may be securely glued to the rocket, it can easily break on landing, even if the parachute deploys properly.

The stock balsa fins can be strengthened by adding a paper skin to both sides of each fin. Videos showing the technique for adding the paper skin can be found at https://www.youtube.com/watch?v=wpqMfYrjDv8 or https://www.youtube.com/watch?v=JnYBSbYr8ZE.

Pros and cons of adding paper skins to strengthen fins:

Pros

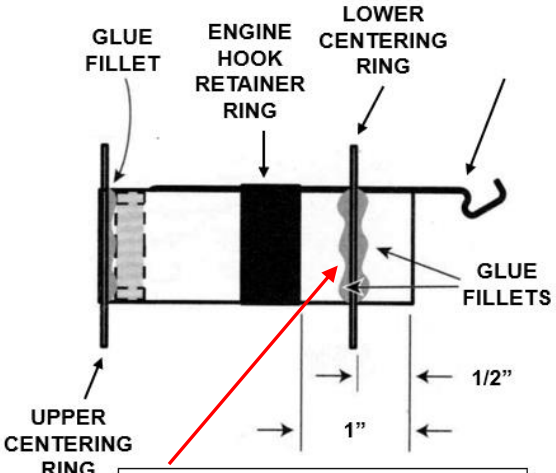
1. Reduces likelihood of breaking fins during flight or upon landing. Broken fins will result in lowered flight performance scores.
2. Creates smoother fin surface with lower drag compared to balsa fin surface without fillers applied to eliminate roughness caused by unfilled wood grain.

Cons

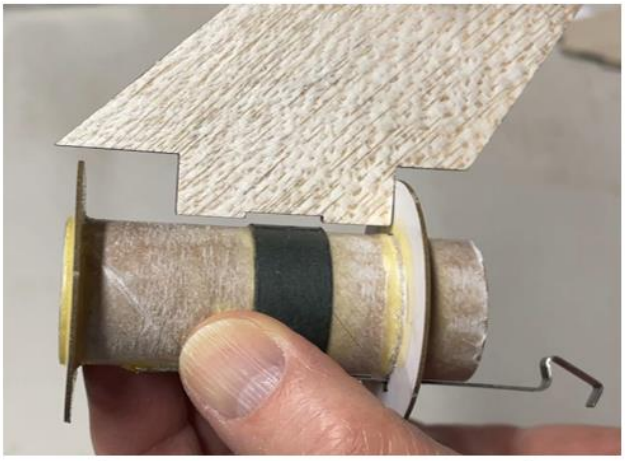
1. Increases building time and difficulty.
2. Slight increase in rocket weight.

Engine Mount Assembly – Pay close attention to spacing between engine hook retainer ring and lower centering ring.

If the lower centering ring is placed too close to the black engine hook retainer ring, the fin tab will not fit properly.



Use glue sparingly for fillet on top side of lower centering ring. A large fillet will interfere with the fin tab when the fin is attached in a later step.



Black engine hook retainer ring and lower centering ring must be properly positioned so that fin tab fits over retainer ring.

Fin Attachment

You may need to sand the pre-cut fin slots in the cardboard body tube to allow insertion of the fin tabs into the slots. The fins should fit snugly in the slots, but not so snug that you damage the cardboard tube when inserting the fins. The slots will definitely need to be sanded if you choose to cover the fin tabs with paper skins.

Payload Section Assembly - Consider adding a metal eyebolt for more secure shock cord and parachute attachment. (Optional)

The payload tube adapter has a plastic eyelet used to attach the shock cord and parachute. Plastic filling the center of the eyelet must be carefully removed with a hobby knife. The thin remaining eyelet loop is fragile and can be a point of failure during flight. If the plastic loop breaks the payload section will separate from the shock cord and parachute.

A more reliable attachment point can be made using a metal eyebolt. You were provided an eyebolt (#6-32 w/ ¾" shank), two #6 hex nuts, and two 9/16" O.D. #6 washers.

Screw the first nut all the way onto the eyebolt, then slide the first washer onto the eyebolt.

Insert the eyebolt into the hole in the payload tube adapter.

Place the second washer over the eyebolt inside the payload tube adapter.

Screw the top nut onto the eyebolt. This is most easily done by holding the nut using needle nose pliers.

On the inside of the payload tube adapter, cover the eyebolt threads, nut, and washer with 5-minute epoxy. Wear gloves while working with epoxy. Support the assembly in a vertical position until the glue is set.

Pros and cons of adding a metal eyebolt for shock cord and parachute attachment:

Pros

1. Eliminates possibility of failure due to breakage of thin plastic eyelet during flight.

Cons

1. Increases building time and difficulty.
2. Increases rocket weight.

Payload Section Assembly - Consider gluing payload tube to coupler rather than taped friction fit. (Optional)

The manufacturer's instructions suggest connecting the payload tube to the adapter by wrapping clear tape around the shoulder of the adapter. Sufficient tape must be used to create a very tight friction-fit between the tube and adapter to prevent separation during flight. If this connection separates during flight the payload will be lost.

An alternate approach is to glue the payload tube to the adapter using epoxy. The adapter shoulder and the inside of the payload tube should be sanded with 100 grit sandpaper to improve adhesion of the epoxy.

Sand the upper shoulder of the adapter (the part that will be inserted into the payload tube). Don't sand the lower shoulder (the part that goes into the cardboard body tube). This is a quick sanding, not intended to remove a lot of material. It is just to score the surface for better epoxy adhesion.

Sand the bottom ¾-inch of the end of the payload tube that will be glued to the adapter. Don't sand the other end of the tube. This is a quick sanding, not intended to remove a lot of material. It is just to score the surface for better epoxy adhesion.

Spread 5-minute epoxy in the bottom ¾ inch of the sanded end of the payload tube.

Insert the adapter into the payload tube, giving it a twist to spread the glue evenly. Support the assembly vertically until the epoxy has set.

Pros and cons of gluing the payload tube to the payload section adapter:

Pros

1. Significantly reduces the possibility of separation of the payload tube from the payload adapter during flight.

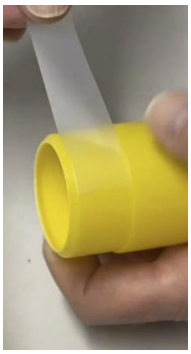
Cons

1. Increases building time and difficulty.
2. Decreases access to the payload compartment. Access is available from the top via nosecone removal, but not from the bottom of the payload tube.
3. Slightly increases rocket weight.

Payload Section Assembly - Consider adding a screw to secure the nosecone (Optional)

The manufacturer's instructions suggest connecting the nosecone to the payload tube by wrapping clear tape around the shoulder of the nosecone. Sufficient tape must be used to create a very tight friction-fit between the tube and nosecone to prevent separation during flight. If this connection separates during flight the nosecone and payload will be lost.

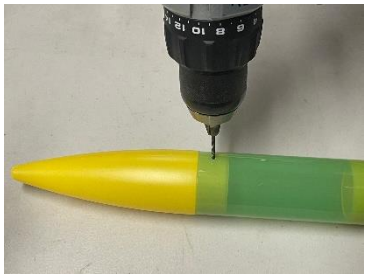
Nosecone loss can be prevented by fastening the nosecone with a screw. This can be done in conjunction with a tape wrap, which will prevent the nosecone from wobbling during flight.



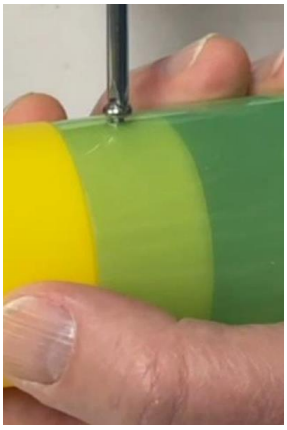
Wrap clear tape around the nosecone shoulder to provide a smooth fit with no wobble. Make sure the tape is wrapped smoothly with no wrinkles. If wrinkles are present, unwrap the tape and start over.

Place a mark on the tape 3/8 inch down from the top of the shoulder.

Insert the nosecone fully into the payload tube. Use a nail or screw to create an indentation in the payload tube at the 3/8-inch mark.



Drill a 3/32-inch hole through the payload tube and nosecone shoulder.



Insert a #4 x 3/8" (provided by the MOST) pan-head sheet metal screw to secure the nosecone to the payload tube. Do not over-tighten the screw. Stop turning when the head reaches the payload tube to avoid stripping the threads in the plastic parts.

Pros and cons of installing a nosecone attachment screw:

Pros

1. Significantly reduces the possibility of separation of the nosecone from the payload tube during flight.

Cons

1. Increases building time and difficulty.
2. Creates additional drag which will impact rocket altitude.

Payload Section Assembly - Drill pressure equalization hole for altimeter. THIS STEP IS MANDATORY.

At the Central New York Rocket Team Challenge, an altimeter will be inserted in the nosecone of your rocket. The altimeter works by measuring the barometric pressure change that occurs as your rocket rises from the launch pad to apogee. A pressure equalization hole is drilled through the shoulder of the nosecone to assure that the pressure measured by the altimeter is the same as the atmospheric pressure outside of the rocket.

Place a mark on the tape 1/2 inch down from the top of the shoulder on the opposite side of the nosecone from the screw.

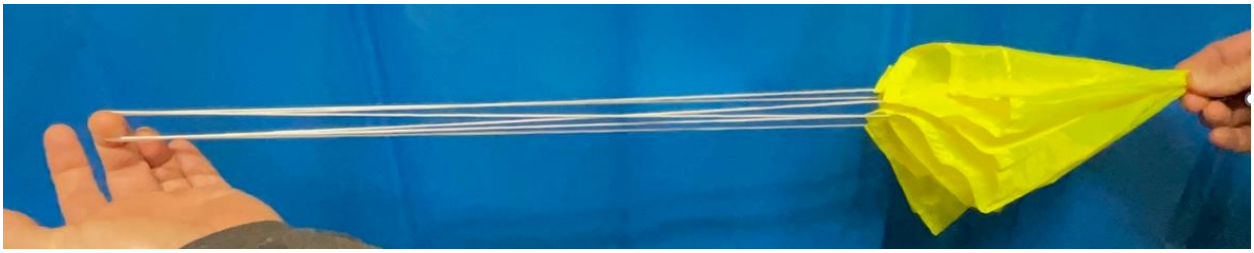
Insert the nosecone fully into the payload tube and install the retainer screw to assure proper alignment. Use a nail or screw to create an indentation in the payload tube at the ½-inch mark.

Drill a 3/32-inch hole through the payload tube and nosecone shoulder at the ½-inch mark. The pressure equalization hole should be smooth-edged to reduce turbulence. If excess plastic from drilling remains attached to the payload tube or nosecone shoulder, carefully remove the excess material with a sharp hobby knife.

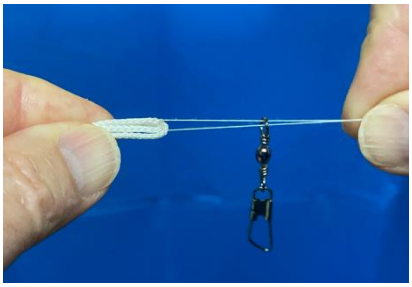
Parachute

The manufacturer provides an 18-inch plastic parachute with the Green Eggs rocket kit. As an alternative, you may substitute a different parachute of your own choosing. We are providing an alternate 18-inch nylon parachute which offers advantages of opening more reliably and less likelihood of tearing than the factory-supplied chute. We have also provided a snap swivel to attach the chute to the rocket. The swivel makes it easier to replace the parachute and reduces twisting of the shock cord and parachute shroud lines.

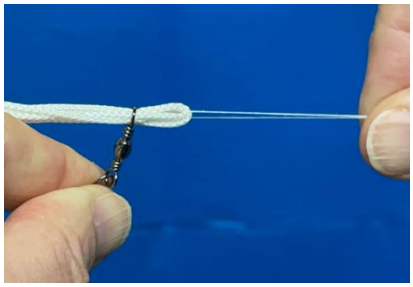
To attach the parachute to the snap swivel, unfold the chute and untangle the shroud lines. Bring all shroud lines together over one finger. Pull gently on the center of the parachute and hold the three shroud line loops together.



Hold the three loops together.



Feed the shroud lines through the snap swivel eyelet. It may be difficult to fit the shroud lines of the nylon chute through the eyelet. Use a thread to pull the shroud lines through the eyelet.



Pull the shroud line loop through the eyelet to enlarge the loop. Pass the entire chute through the shroud line loops and pull the lines tight.

Velcro

Velcro will be inserted in the nosecone on contest day for altimeter attachment.

Egg Protection

You must provide your own materials for protecting the egg during your flight. Your egg protection material may not extend above the bottom of the nosecone shoulder. The pressure equalization hole must remain unobstructed for proper altimeter operation.