

Mid-power Executioner Clone

Assembly Instructions



Rocketry Works' mid power Executioner clone is made of heavy weight cardboard airframe tubes, and its 29mm motor mount is suitable for flights on E through G motors, reaching altitudes of 300 ft to 2,300 ft.

The 375 gram (13 ounce) dry weight of this rocket requires a 1/4 inch launch rod or a 1010 launch rail. The kit features a pre-slotted airframe tube, laser cut plywood centering rings and through-the-wall fins, and a 3D printed plastic 29mm motor retainer. A blow-molded nose cone caps a 12 inch payload bay, which connects to the airframe with 9 feet of 400 pound Kevlar shock cord. A 24 inch parachute affords a 17 ft/second descent rate. An optional motor block is included for Estes black powder 29mm motors that is not required for composite motors. Also included is a 24mm to 29mm motor adapter for flying 24mm motors in the 29mm motor mount.

What's in the Box

The Mid-power Executioner clone comes with a pre-slotted 2.16-inch diameter airframe tube, a 3D printed nose cone, laser cut plywood centering rings and through-the-wall fins. The 24mm motor mount includes a plastic motor retainer and an optional motor block for flying 24mm black powder motors like the C11-3 or D12-5 or E12-6. Recovery is handled by a 24 inch nylon parachute and 12 feet of 235-pound Kevlar shock cord .



- 66mm (BT-80) cardboard airframe tube, 18 inches long
- 66mm (BT-80) cardboard payload tube, 12 inches long
- 62mm (BT-80) cardboard tube coupler
- 1 laser cut 66mm (BT-80) laser cut plywood bulkhead
- 29mm motor tube, 6 inches long
- 3 laser cut plywood through-the-wall fins
- 3 laser cut plywood centering rings
- Blow molded nose one
- 24 inch nylon parachute
- 9 feet of 400 pound Kevlar shock cord
- 3D printed motor retainer
- Optional motor block
For flying black powder motors without a thrust ring like the Estes E12-6
- 3D printed 24-29mm motor adapter
For flying 24mm motors
- Two 3D printed 1/4 inch launch lugs
- Two 3D printed 1010 rail guides

Suggested Tools and Supplies

- A ruler or tape measure
- Wood glue or 5 minute epoxy
Do not use school glue; it takes a long time to set, which will be frustrating. If you use epoxy, use gloves, and a mixing cup and stir stick with a scale to measure the correct ratio of resin to hardener. When mixed properly, epoxy is a better choice, but wood glue is sufficient. Be sure to use gloves when working with epoxy.
- 150 grit sandpaper
- Hobby knife
- Pencil
- 1/4 inch launch rod or 1010 launch rail
Used for aligning launch lugs
- Scrap of wood to spread glue inside motor tube and airframe tube
A 1/2 inch or 3/4 inch wide scrap is useful for holding sufficient glue





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Notes Before you Start

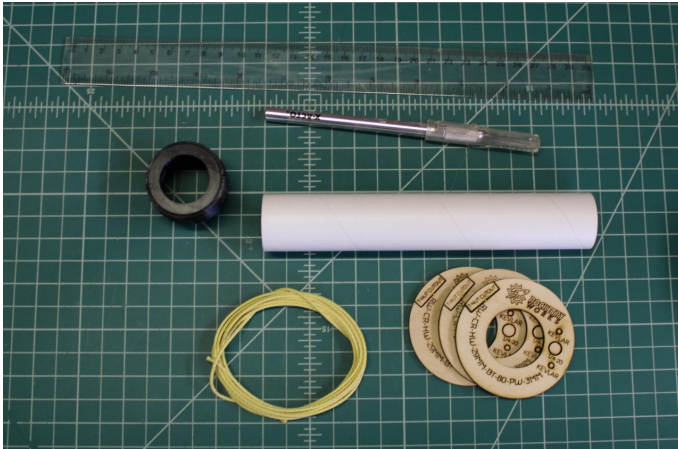
Read these instructions thoroughly before starting assembly, so you understand the full context of what you're doing. And while you are pre-reading, test fit parts without glue, so you are familiar with how things fit together. You may use either wood glue or 5 minute epoxy for this model. You'll see photos in this document using either adhesive. Be sure to use nitrile gloves when working with epoxy, but wood glue

This kit flies nicely on a variety of motors, from E impulse up to G impulse. But don't take this range as license to fly any motor you want. On the low end, an E9 motor will not lift this kit off the pad with sufficient velocity for stable flight. An E12 is capable, but an E20 or E30 perform well to around 600 or 700 ft. On the high end, G motors will boost this model to over 2000 ft, which will require a large flying field. The following motors perform nicely in simulations and in the field. Stick with these or similarly rated motors, and you'll be able to fly this kit many times. An Open Rocket computer model for this kit is available via the link at the bottom of the page.

Manufacturer & Motor	Predicted Altitude
Estes E12-4	350 ft (107 m)
Aerotech E20-4	600 ft (183 m)
Aerotech E30-4	740 ft (256 m)
Aerotech F44-4	780 ft (238 m)
Aerotech F30-6	900 ft (274 m)
Aerotech F67-6	1,200 ft (366 m)
Aerotech G80-7	2,300 ft (701 m)

Motor Mount Assembly

For this sub-assembly, you'll need:



- 29mm x 6 inch long motor tube
- 3 centering rings 29 mm - 66 mm
- Yellow Kevlar shock cord
- 3D printed motor retainer
- A hobby knife
- Wood glue or 5 minute epoxy

1. Start by poking the small hole cut outs on **one** of the centering rings using a hobby knife. This is now the forward centering ring. Leave the other centering ring as is.

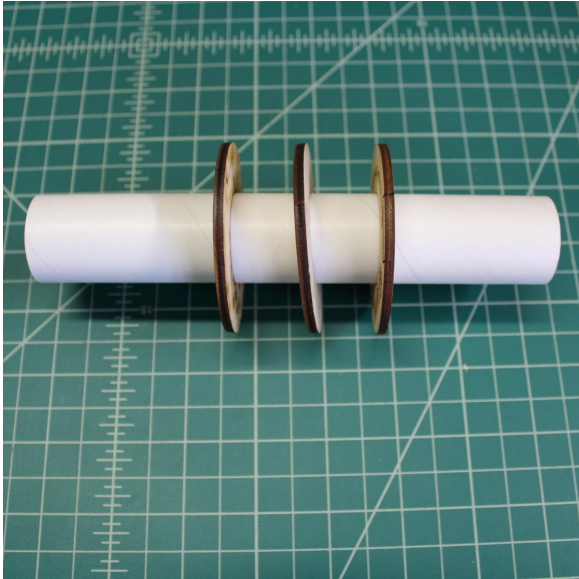




2. Smear glue into the unused cutouts--the T-nut cut out and the 1/4-20 bolt hole cutout on the forward centering ring.
Use your finger to smear glue into the unused cutout grooves.

3. Smear glue in all the cutouts on the other centering rings.
Smearing glue into the unused cutouts strengthens the centering rings and prevents ejection gasses from escaping out the back of the rocket.





4. Slide the 3 centering rings onto the motor tube, leaving them near the middle of the tube.
Do not glue them into place yet.
The centering rings will slide onto the tube easier if you insert the tube into the centering ring from the side with the engraving. The laser cutter leaves a slight bevel on the cut edge that helps the centering ring slide onto the tube.

5. Add a bead of glue $\frac{1}{2}$ inch from each end of the motor tube.





6. Slide each of the outside centering rings into the bead of glue.
Smear excess glue into the joint between the tube and the centering ring, making a fillet.
7. Glue the middle centering ring 2.5 inches from the aft centering ring, verifying that there is sufficient room to fit the fin tabs between the middle and aft centering rings.

8. Apply a bead of glue to all remaining joints between the motor tube and each centering ring.
Smear the glue into a fillet.





8. Apply a bead of glue around the aft end of the motor tube.

The aft end is the end with the centering ring with no holes punched out.

9. Apply glue to the inside of the motor retainer body--the smaller piece--sufficient to fill the small dimples inside the retainer body.

Note that one end of the retainer body features a lifted rim. Try not to get glue here, but if you do, it wipes off easily. The key is to get a generous, but not excessive coating of glue to fill the pores inside the motor retainer body.

10. With a rotating motion, slide the motor retainer body onto the aft end of the motor tube.

The twisting motion helps smear the glue between the motor tube and the motor retainer body, ensuring a solid fit.

11. Be sure to remove any excess glue from the inside of the motor tube.

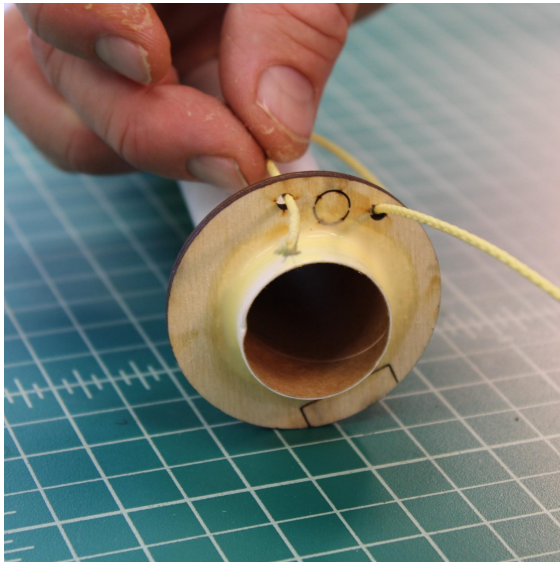
It's fine to have a thin smear of glue inside the motor tube; it can even lead to a stronger tube. But don't let any globs of glue dry there, because they can prevent the motor from fitting into the tube.

12. Carefully smear any excess glue on the outside of the motor tube into the tube, or onto the aft centering ring.

Be sure not to leave any glue in the threads of the motor adapter.

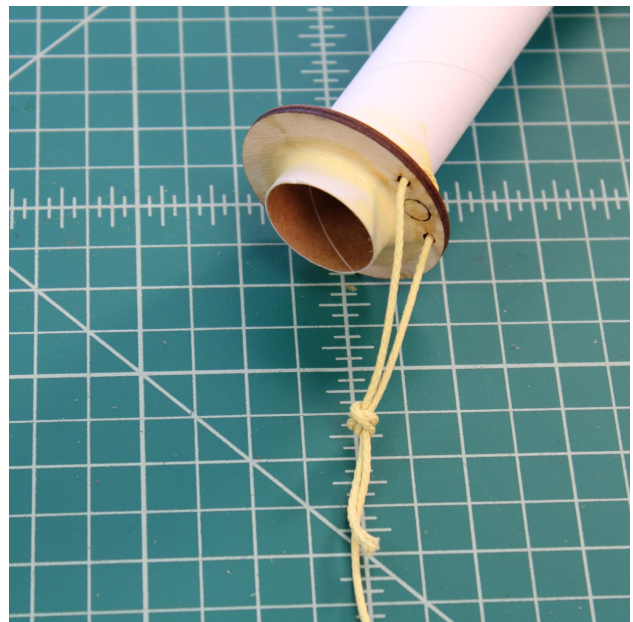


Attaching the Shock Cord to the Motor Mount



1. Turning to the forward end of the motor mount, insert one end of the shock cord through one of the holes in the centering ring from the exposed end of the motor mount.
2. Loop the end of the shock cord back through the other hole.
Pull enough shock cord through the centering ring that you can tie a double overhand knot in the shock cord.

3. Tie a double overhand knot into the shock cord.





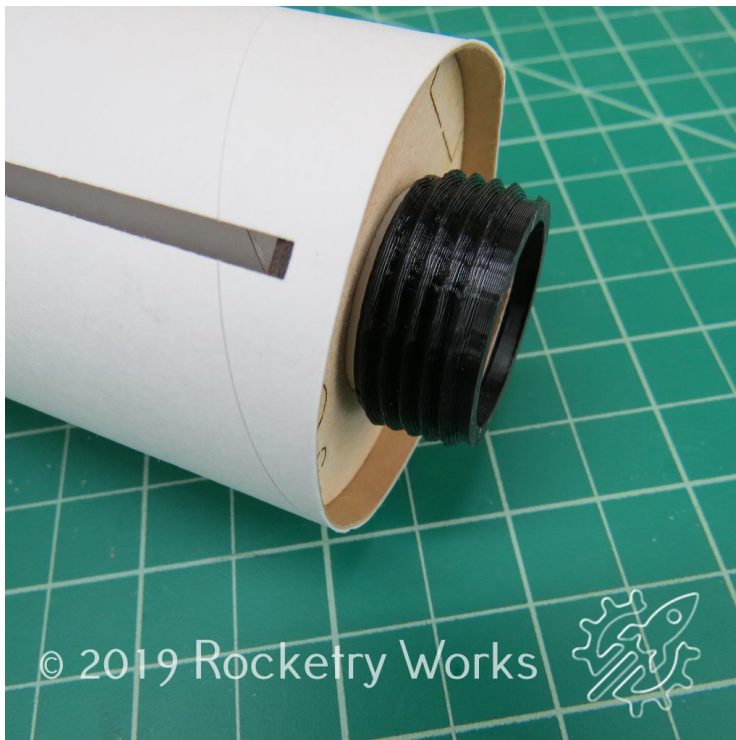
4. Wrap the loose end of the shock cord around your hand, and tuck the shock cord into the motor tube so it's out of the way.



5. When you're done, the motor mount should look like this.
6. Double-check to make sure you don't have any glue inside the motor tube. Glue that dries in here will prevent your motor from fitting inside the motor mount. Use a pencil or a stick to wipe away any excess glue.
7. Set the motor mount aside to dry on its side on the plastic bag.
Keep an eye out for drips for the first 10 or 15 minutes.

Mounting the Motor Mount in the Airframe

1. Mark your glue applicator stick 6 inches from the glue end.
This will allow you to apply a bead of glue inside the airframe tube just forward of the fin slots.
2. Apply a generous amount of glue to the glue applicator stick and lay a bead of glue around the inside of the airframe tube just forward of the fin slots.
3. Insert the motor mount, forward end first (the end with the shock cord), until the first two centering rings are inside the tube.
4. Apply a second bead of glue just inside the aft end of the airframe tube.
You'll need to work around the motor mount tube, which will be sticking out of the aft end of the rocket.
5. Insert the motor mount, twisting as you go, until the aft centering ring just shows in the aft end of the fin slots.



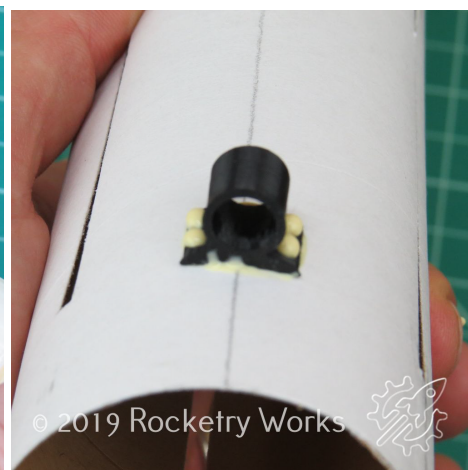
6. Be sure to double check your motor mount alignment so your centering rings are not blocking the fin slots.
You should be able to see both the middle and the aft centering rings at either end of the fin slots.
7. Allow the glue to dry with the rocket in the upright position.
Clean up any glue that drips out of the fin slots.

8. When the glue is dry, flip the airframe tube over and lay a fillet of glue at the joint between the aft centering ring and the aft end of the airframe tube.
 You can be generous here--it's even a good idea to coat the centering ring with glue; it will help keep the aft end of the rocket clean. Just don't get glue on the motor retainer.

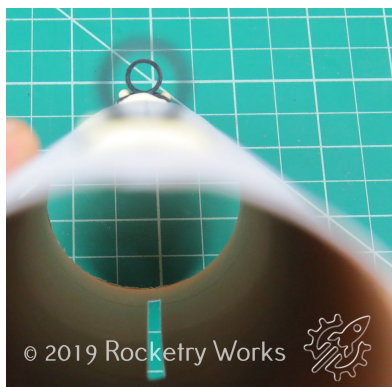
Positioning the Launch Lugs

Launch lugs guide the rocket until the rocket is going fast enough for the fins to guide the model. The kit comes with 2 3D printed launch lugs that you will position one at the aft end of the rocket, and the other at the center of gravity.

1. Using a door frame or a piece of angle iron, mark a line centered between 2 fins.
2. Apply adhesive to the curved foot of a launch lug, making sure to fill the 8 dimples in the bottom of the foot.
3. Place the launch lug on the launch lug line you drew in step 1, about an inch from the aft end of the tube--roughly at the aft end of the fin slots



4. Make sure the adhesive forms a cap on top of the launch lug foot. This is critical to securing the plastic foot to the airframe tube. If you don't see a cap like a mushroom from each of the 4 exposed holes, add a bit of adhesive to the top of the foot.



Repeat for the other launch lug, positioning it 8.5 inches from the aft end of the tube. Visually inspect the launch lugs to make sure they are aligned, and that they both have sufficient glue caps on top of the foot to secure the plastic to the airframe tube.

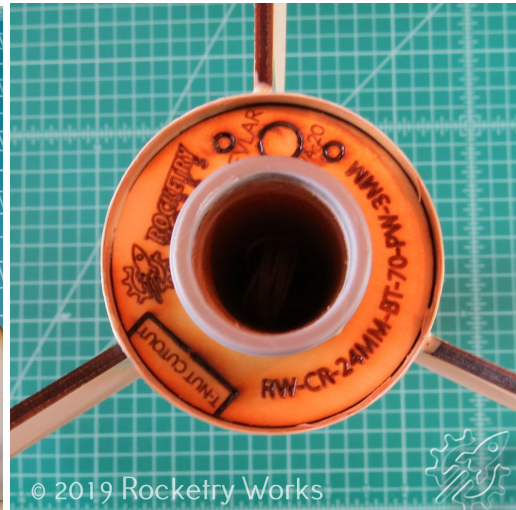
Attaching the Fins

The fins for this kit use a through-the-wall design that adds strength to the fins because the fins are glued to the motor tube, centering rings, and the airframe tube, creating a rigid structure that resists breakage.

1. Before you start gluing fins in place, it's a good idea to test fit the fins in the fin slots without glue.

You may have left a glob of glue on the motor tube that you may need to sand around, or you may need to sand the forward or the aft end of the fin tab to let it fit between the centering rings. Your fit should be snug, but you shouldn't have to force it.

2. Apply a generous bead of glue to the root edge of 1 fin.
Be sure to include glue on the forward and aft elbows.



3. Insert the fin into the fin slot until the fin tab touches the motor tube.
You may need to wiggle the fin slightly to get it through the slot.
4. Make sure the fin is inserted all the way against the motor tube and that the notches at the forward and aft ends of the fin tab sit flush against the airframe tube.
5. Make sure the fin sticks out straight from the tube, and is not at an odd angle.
6. Let the fins dry with the rocket upright on the forward end of the tube, with the fins in the air.

Applying Fillets

Fillets are a smooth bead of glue that spans the joint between the fin and the body tube. A good fillet maximizes surface area of the glue joint without adding excessive weight. More surface area means a stronger bond, and it has the added benefit of smoothing airflow at the joint.

1. Apply a bead of glue to the joint between the fin and the airframe.
2. Wipe the bead into the joint with your finger, creating a smooth fillet along the entire root edge of the fin.

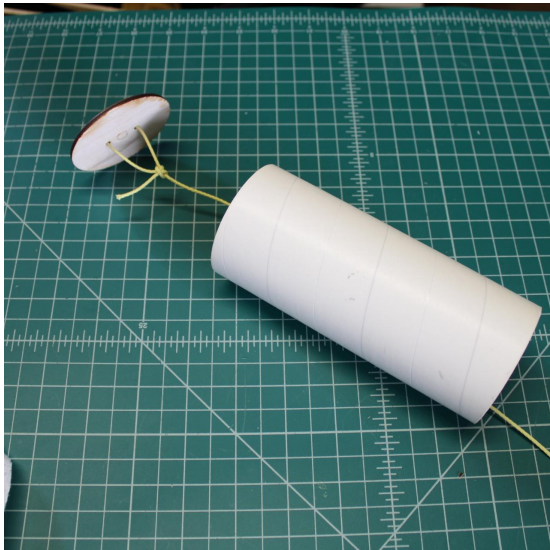
Apply 2 fillets at a time, on facing fins, so you can let the fillet dry while the rocket lays on its side with the fillets facing up. Gravity pulls the fillet into the joint, creating a smooth curved surface.

3. Repeat for the other 2 sides of the rocket once the fillets are dry.

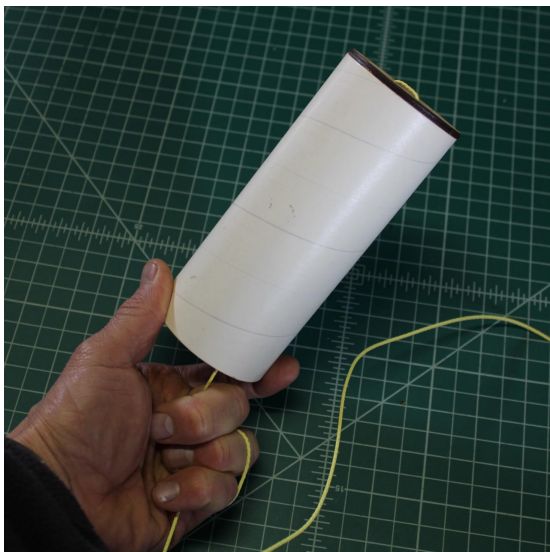


Assemble Payload Bay

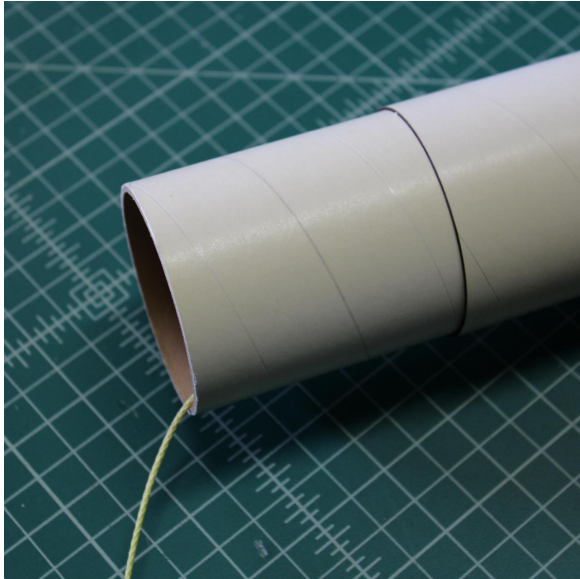
The payload bay bulkhead mounts to the forward end of the coupler tube, with the shock cord secured to it.



1. Knock out the 2 small perforations in the bulkhead with a hobby knife.
2. Shake the airframe gently forward end down to dislodge the shock cord from the motor tube, until it falls out the forward end of the body tube.
3. Thread the loose end of the shock cord through the coupler tube.
4. Thread the loose end of the shock cord through the 2 holes in the bulkhead—up through one, and down through the other.
5. Tie a double overhand knot in the shock cord to secure it to the bulkhead.

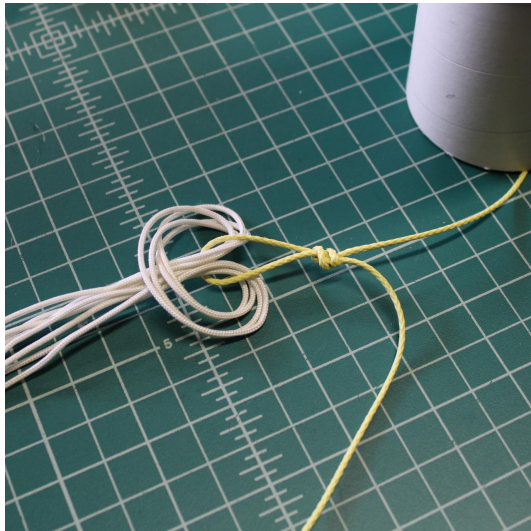


6. Mark the coupler tube in the middle of the tube; this is how far you'll insert the coupler tube into the payload tube.
7. Apply a bead of adhesive 1 inch inside one end of the payload tube, all the way around the tube.
8. Use the shock cord to pull the bulkhead securely against the end of the coupler tube.



9. Insert the coupler tube bulkhead end first into the payload bay until half the coupler is inside the payload tube.
Use a steady, smooth motion, twisting the coupler slightly as you go. You should see a bead of glue in front of the bulkhead.

Attach the Parachute



1. Loop the shock cord 3 -6 inches from the payload bay.
2. Bundle the parachute shroud lines so they form 3 superimposed loops, acting like a single loop.
3. Pass the shroud line loop through the shock cord loop.
4. Pass the parachute through the shroud line loop, and snug the shroud lines onto the shock cord loop.



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Decorate Your Rocket!

This is your rocket, so you can decorate it any way you want! Pencils, pens, markers, stickers, or paint all stick well to the white tubes. But you should write your name or initials somewhere on the rocket.

Prepare for Flight

1. Insert 10 or 12 squares of recovery wadding, or about 3 inches of dog barf wadding into the forward end of the body tube, leaving the wadding loosely packed, so it takes up the full width of the tube without packing tightly.
2. Fold the parachute into a pie shape, then fold the shroud lines into the middle. Fold the parachute around the shroud lines to keep them from tangling.
3. Insert the shock cord and parachute into the body tube, making sure that they slide freely inside the tube.
4. Insert the nose cone shoulder into the body tube, making sure that the nose cone rotates freely and that neither the shock cord nor shroud lines are pinched between the nose cone and the body tube.
5. Being careful not to let the nose cone fall out of the front end of the rocket, turn the rocket nose end down, with the motor mount pointing up.
6. Insert the motor into the motor mount with the nozzle end facing up, away from the rocket. Use the included 3D printed motor adapter to fly an 18mm motor in the 24mm motor tube. This adapter works with all known 18mm motor types, including Estes black powder motors and Aerotech composite motors.
7. Screw the motor retainer cap onto the motor retainer body, securing the motor in the motor mount.
8. Insert an igniter, tip down, into the motor nozzle, and insert the plastic cap or use tape to secure the igniter in the nozzle.
9. Follow the launch safety procedures outlined in the Model Rocketry Safety Code to launch your rocket.
<https://www.nar.org/safety-information/model-rocket-safety-code/>