

Jr Level 1 Push DX3 Build Guide

JrLevel1.com

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Rocketry Organization
O F C A L I F O R N I A



RocStock.org - ROC hosts monthly launches where Jr Level 1 Push participants will do their certification launches.

Introduction:

Transitioning from low-power rockets to mid and high-power rockets can be a bit confusing. Low-power kits typically have detailed instructions and include all components needed to build the rocket, but high-power kits will come with less guidance and require you to source some components.

People use a variety of techniques and methodologies when it comes to assembling their rockets. This guide aims to teach general ideas to help you make the leap from low power kits into the world of mid-high power.

For the Jr. Level 1 Push program, we selected the Madcow 2.6" DX3, as it's a flexible kit that includes all needed parts. Cardboard rockets can be built with easily accessible wood glue, no epoxy is needed. The payload section of the DX3 offers some flexibility once built for exploring dual deploy, or custom (non-deploy) electronics projects. The DX3 is not a difficult kit to build, but may require some new skills that are not needed for building smaller rockets. Nothing too exotic is needed, but before beginning, make sure you have:

- Wood Glue (see What Glue Should I Use? below)
- Fine sandpaper
- Masking tape/painters tape
- Hobby knife
- Ruler
- Pencil

Remember, there are many different methods that can be used to build a rocket like the DX3. This tutorial shows one way, using simple tools and wood glue. Look at the pictures and read the text for each step before proceeding. There are a number of steps that require the glue to set before going on to the next step, so give yourself time to complete the rocket.

FAQs:

What glue/adhesive should I use?

Different adhesives work well with different materials, so the decision of which to pick should be driven by the materials that a rocket is being built with. The cardboard and wood construction of the Madcow DX3 allows for the use of wood glue, which is very accessible and can be found at any hardware/home improvement store. Fiberglass and carbon fiber construction has become increasingly common in rocketry, but require epoxy adhesives. Epoxies are less accessible and require additional considerations over wood glue. Master the basic building techniques using cardboard/wood glue before learning the additional complexities of fiberglass/epoxy rockets. When done properly, the adhesive bonds will be stronger than the fins or body tube of the rocket.

Wood Glues - These are the 'yellow glues' that you find in hardware or hobby stores. They are similar to 'white glue' glue used in schools. Wood glues are specifically designed for wood and paper. They are inexpensive, safe to work with, don't require mixing of multiple components, easy to sand, and have a long working time for part alignment and positioning.

Epoxy Adhesives - Epoxy adhesives consist of two parts that must be mixed together in the proper ratio. They are thicker and don't shrink as much when they harden like the wood glues do. Epoxies are able to bond a wider range of materials than wood glues, but are harder to acquire, cost more, and require additional consideration to work with. Gloves should be worn when working with epoxy, chemicals in it can build up over time and cause allergic reactions. It is also much harder to remove epoxy from skin than wood glue.

Can I use super glue?

Super glue isn't a good choice for rockets like the DX3 as it doesn't stick well to porous surfaces. If you are in a hurry, use a fast curing epoxy.

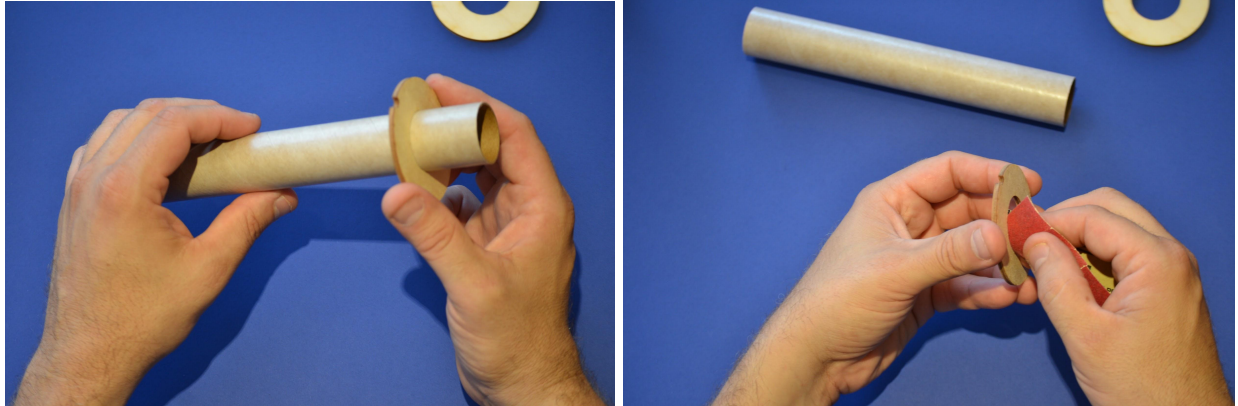
Most mid-power kits use phenolic paper for the body tube and wood for the fins. With these materials, either wood glue or epoxy can be used. For the purposes of this guide, wood glue is being used for the reasons discussed above. The general build techniques from this guide can still be followed when using epoxy, but the additional considerations will not be discussed from here.

Assembly

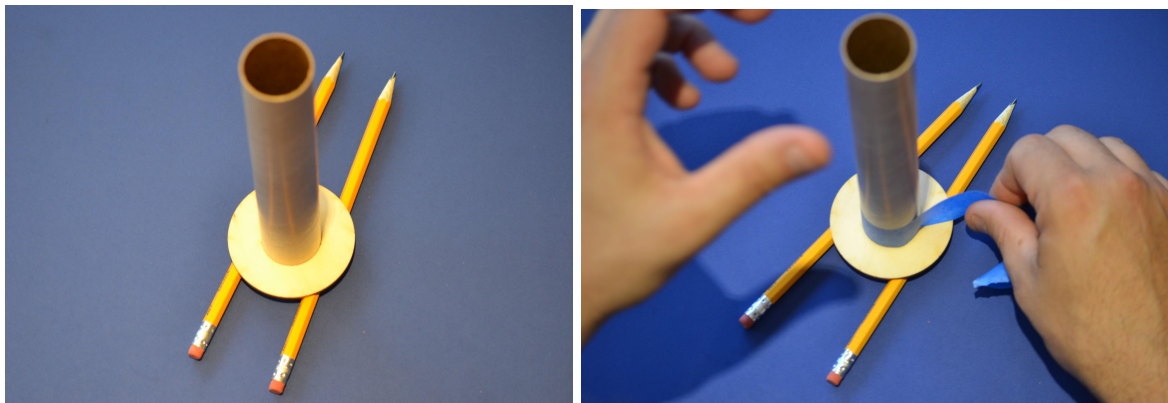
Note on Sanding:

Numerous steps in this guide instruct sanding the components to get a better bond. For the cardboard tubes, it is important to **ONLY** sand until the shine of the tube fades. Don't sand deep into the tube or get it fuzzy from sanding.

Part 1: Motor Mount



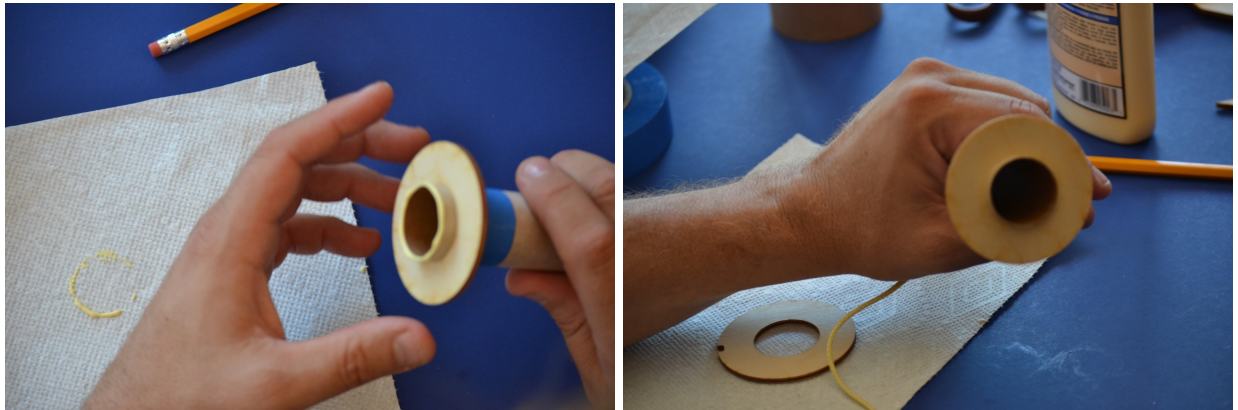
Test fit both centering rings on the motor mount tube. The rings should be fit snug and stay in place, but be able to be moved along the tube without damaging it. You may need to sand them to allow this. Lightly sand off the motor mount tube's shiny coating approximately $\frac{1}{2}$ inch from one end. Removing this coating allows the wood glue to seep into the cardboard, and creates more surface area for a better bond.



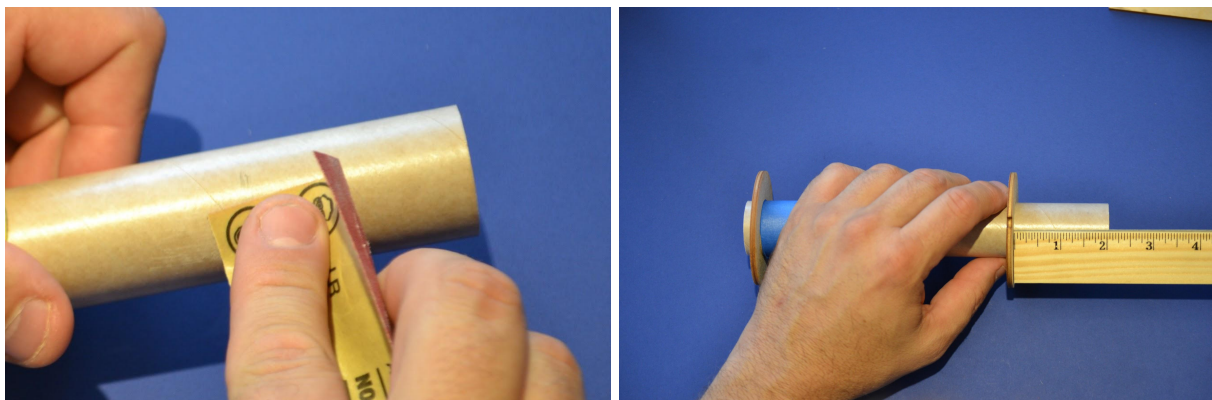
Place the motor mount tube between two pencils, and slide the **unnotched** centering ring down the motor mount until it rests on the pencils. Wrap some painters/masking tape above the ring to mark its position.



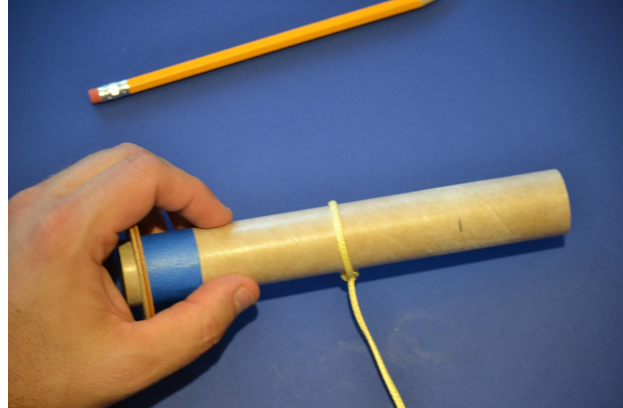
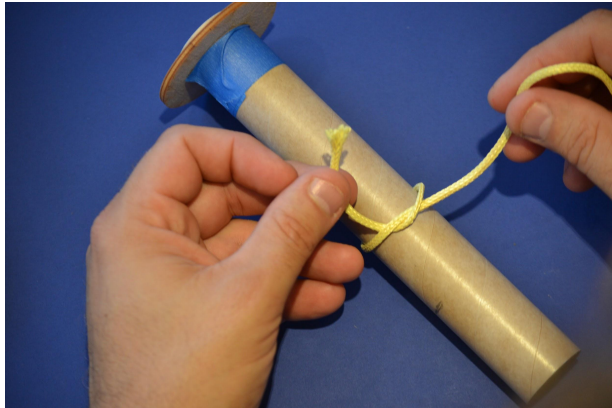
Remove the unnotched centering ring from the motor mount, and spread glue on the inside of the ring and the outside of the motor mount where the ring will go.



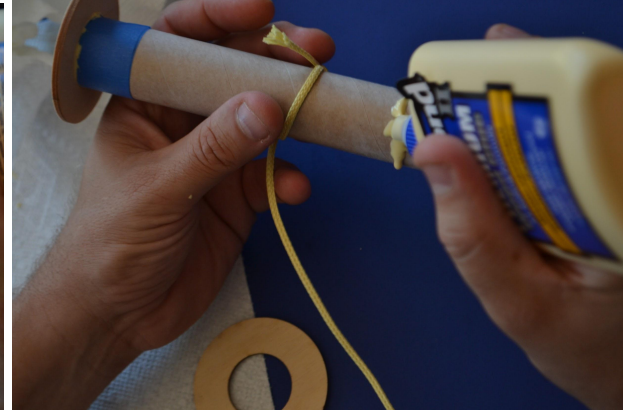
Twist on the centering ring until it reaches the tape, and clean any excess glue that has spread out. It is important to make sure there is no glue inside the motor mount. Allow the glue to set before moving on.



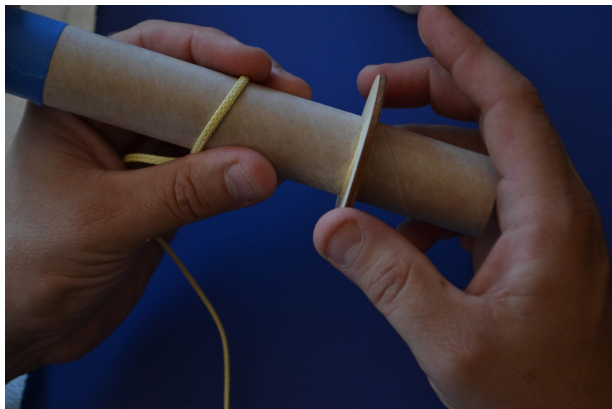
Lightly sand off the coating on the other end of the motor mount tube, approximately 2" from the end. Place the **notched** centering ring at 2 inches from the end, and mark with a pencil.



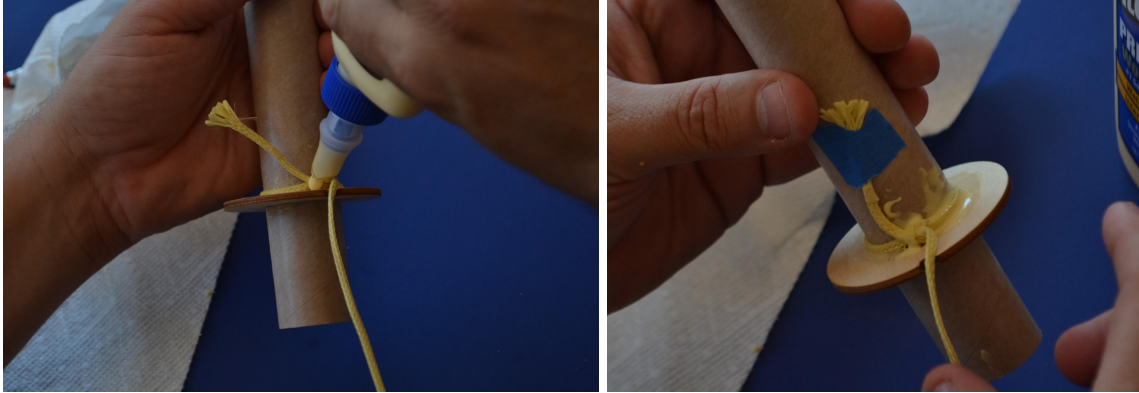
Tie one end of the kevlar cord snug to the motor mount tube between the already glued centering ring and the mark just made.



Spread glue to the inside of the centering ring and onto the motor mount tube at the mark.

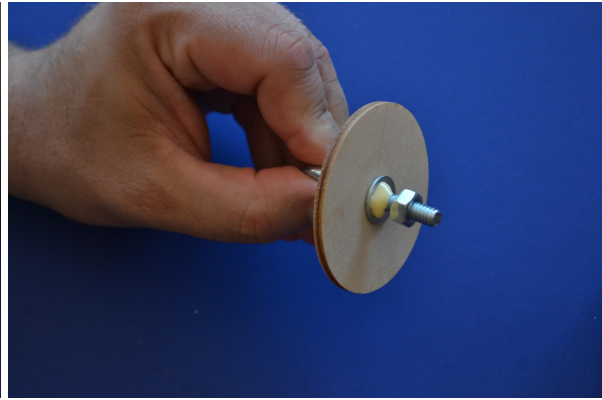
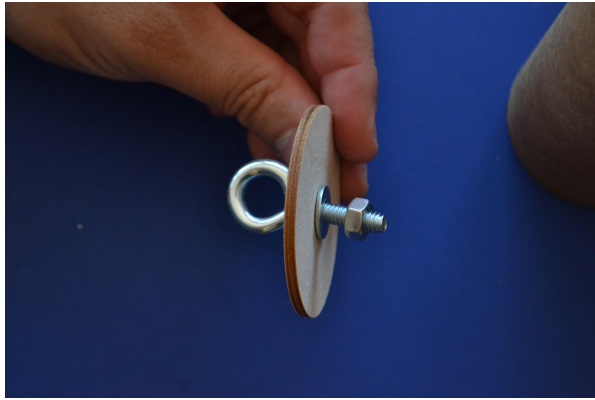


Twist on the centering ring to the mark and clean up any excess glue. Then slide the kevlar loop down until it is against the centering ring and the knot aligned with the notch in the centering ring. Position it so that the kevlar lines up with the notch in the centering ring (see below).



Use more glue to glue the kevlar loop to the motor mount tube and centering ring. Cut and tape down excess kevlar.

Part 2: Coupler



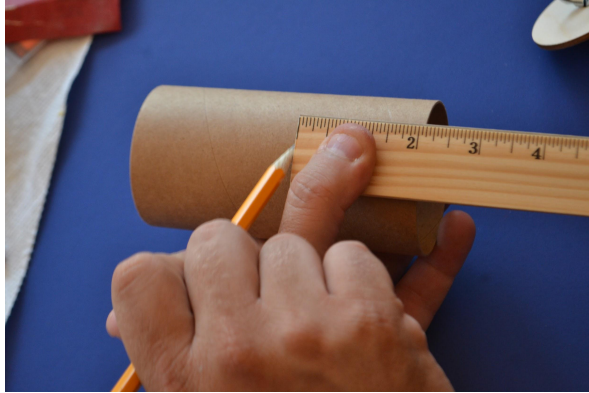
Assemble to bulkhead as shown: Eye bolt → bulkhead → washer → drop of glue → nut and tighten until snug.



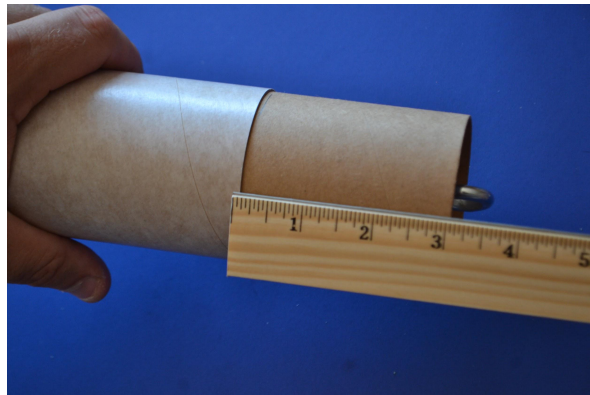
Glue the bulkhead into one end of the coupler by spreading glue on both surfaces and twisting into place. Position the bulkhead so that there is $\frac{1}{4}$ - $\frac{1}{8}$ of an inch of coupler exposed.



Add and spread glue to the corner of the bulkhead and the coupler. This fillet provides a better bond, especially helping when the shock cord will be tugging on the bulkhead in this direction in flight.



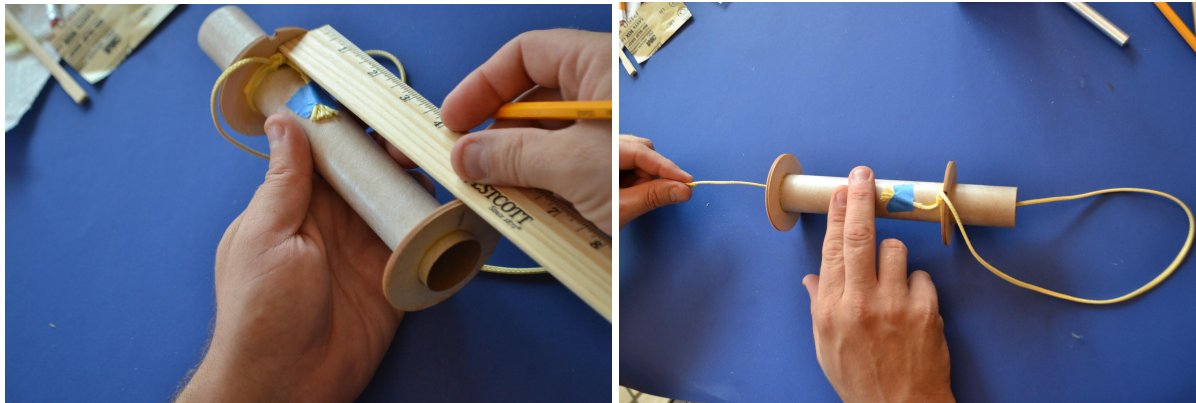
Measure and mark two inches from the end without the bulkhead and test fit the coupler in the forward body section (one without fin slots).



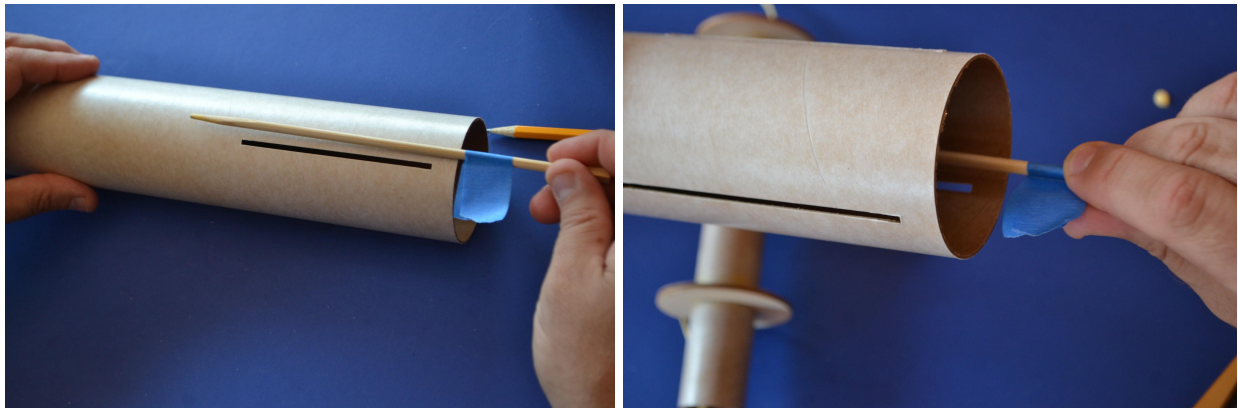
Apply glue to one end of the forward body tube (the one without fin slots), and spread it out before sliding in the coupler to your mark. There should still be about 3 inches of the coupler exposed. Clean any excess glue.

Part 3: Installing the Motor Mount

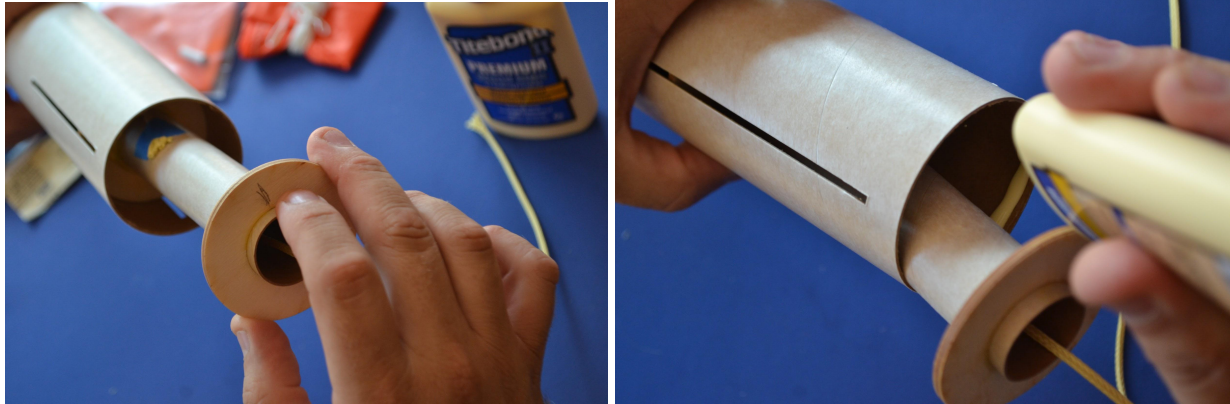
The glue from Part 1 must be set before starting this part.



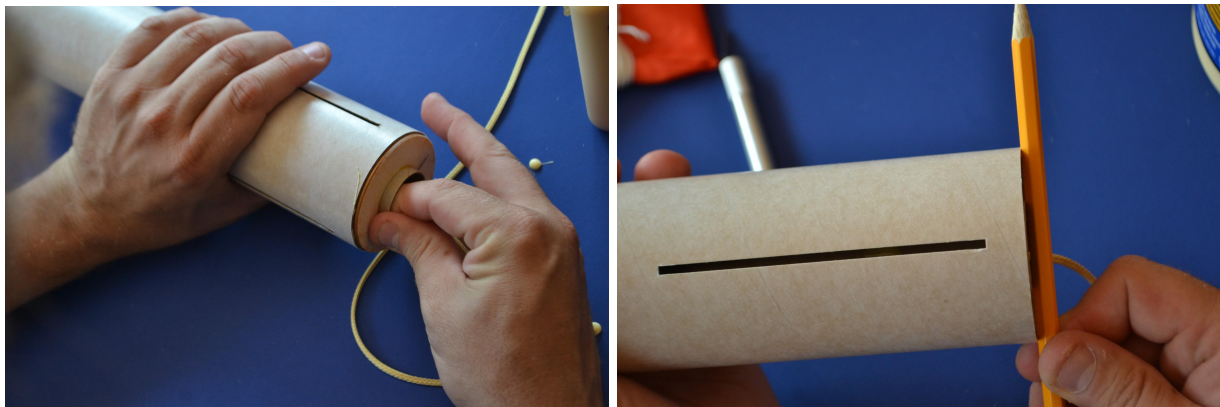
After the glue has set on the motor mount, remove the tape from the lower centering ring. Mark where the excess kevlar is on the flat side of the lower centering ring (left image). Push the kevlar through the motor mount tube and pull out the slack. Test fit the motor mount assembly in the body tube, and sand as needed, the motor mount should slide in snug.



Mark a pencil or skewer with tape so that the end of it is just past the fin slots on the body tube. Using the tape as a measurement for how deep to go, place a bead of glue on the end of the skewer and spread it in the body tube above the fin slots. Clean any excess glue that is in the fin slots.



Slide in the motor mount tube until just the lower centering ring is sticking out. Spread glue in the body tube below the fin slots. Keep the glue off of the motor mount. Align the mark on the lower centering ring between two fin slots.



Slide in the motor mount so that the end of the motor mount tube is flush with the body tube. Allow the glue to set. You can also add a fillet here, as done with the coupler section.

Part 4: Fins



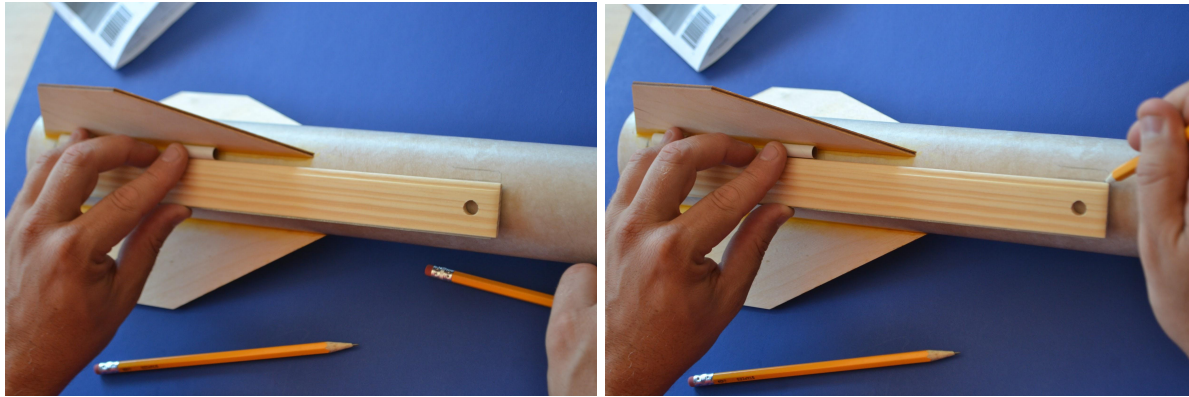
Test fit each fin in the body tube slots, and sand as needed, the fins should slide in snugly. Lightly sand the edge of each fin and the body tube above each fin slot. Again you are only looking to remove the shine from the cardboard tube.



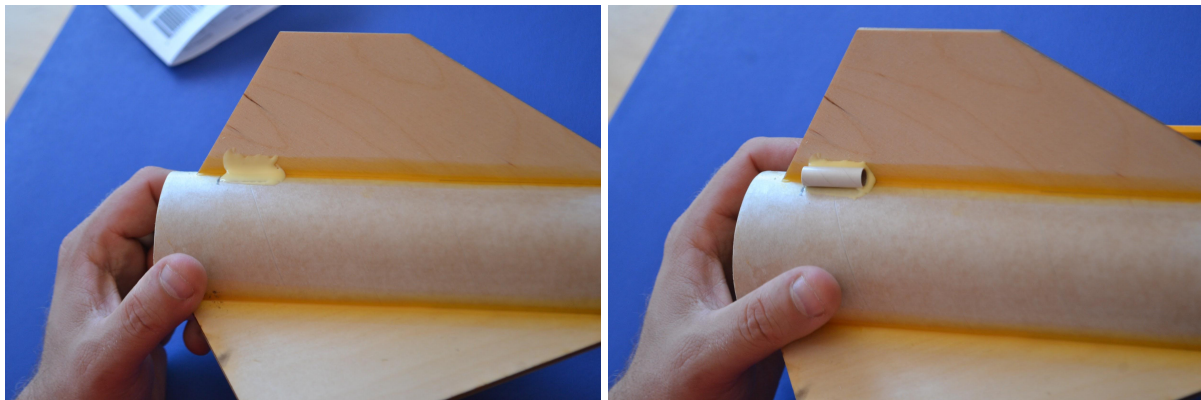
Spread glue on the edge of a fin, then insert it into the fin slot, ensuring that it is against the motor mount. Add and spread glue in the corner of the fin and the body tube to make a smooth fillet. It is recommended to do a single fin at a time, allowing the glue to set before continuing. Tape can be used to hold the fin's alignment while the glue sets. Repeat for each fin. After the glue has set, add additional thin layers of glue in the corners to build up the fillets. Wait for all the glue to set before continuing to Part 5.

Part 5: Launch Lugs

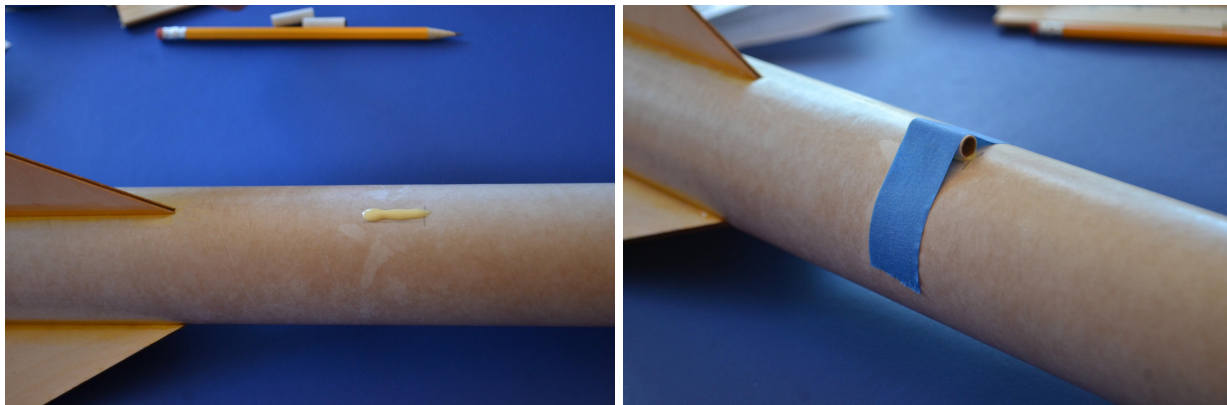
The glue from Part 4 must be set before starting this part.



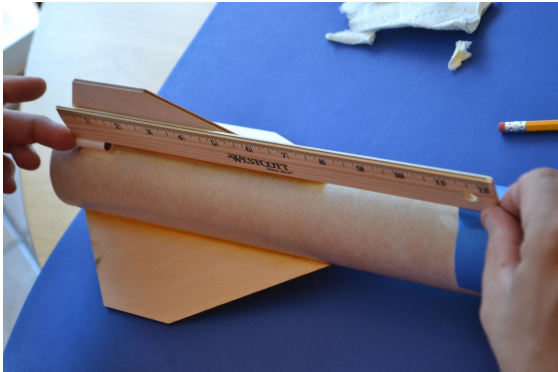
Place one launch lug against a fin and use a flat edge against the launch lug to make a mark about 13.5 inches from the end of the rocket.



Glue one launch lug in the corner of the fin and the body tube. Be sure to clean any excess glue blocking either end of the launch lug.

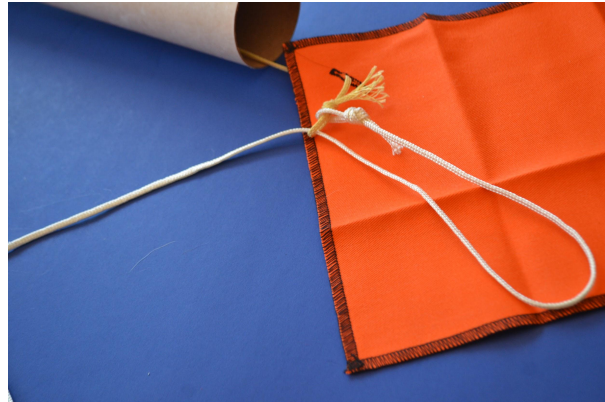


Using the mark made earlier, glue on the other launch lug, and use tape to hold it while the glue dries.

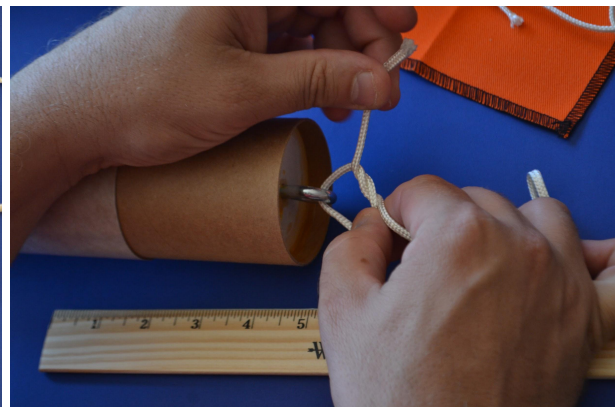
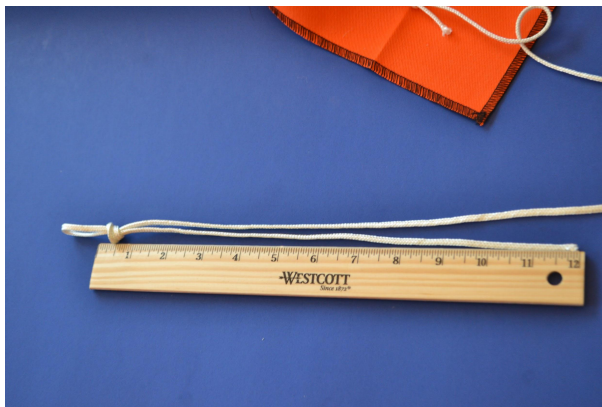


Before the glue sets, double check that both launch lugs are aligned.

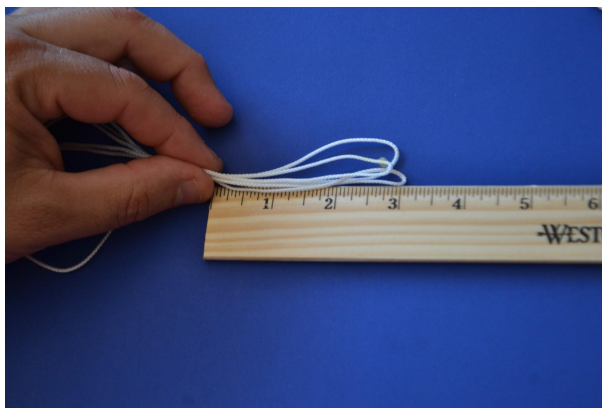
Part 6: Parachute



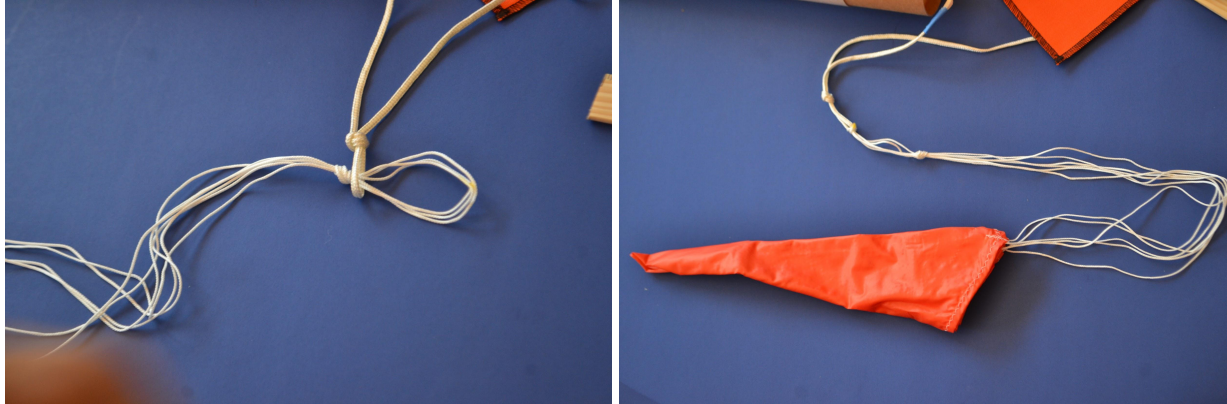
Thread the kevlar shock cord through the nomex blast protector and tie a loop. Tie a loop at one end of the nylon shock cord and tie the two together.



Tie a loop one foot from the other end of the nylon shock cord. Then tie the shorter end to the coupler.



Untangle the parachute cords and tie a single overhand knot approximately three inches from the end of the cords.



Pull the end of the parachute cord through the loop in the nylon shock cord, then thread the parachute through the loop in the parachute cords to tie it to the nylon shock cord.

Part 7: Motor Retention

High power motors have a thrust ring that is on the motor, transferring the thrust to the rocket and preventing the motor from going too far (or straight through) the rocket. This serves the same purpose as the motor blocks at the top of motor mounts in low-power rockets, but allows for motors of different lengths to be used. However, something is still needed to keep the motor from ejecting out the back of the rocket when the ejection charge fires. Low-power rockets usually use a clip style retainer for this purpose.

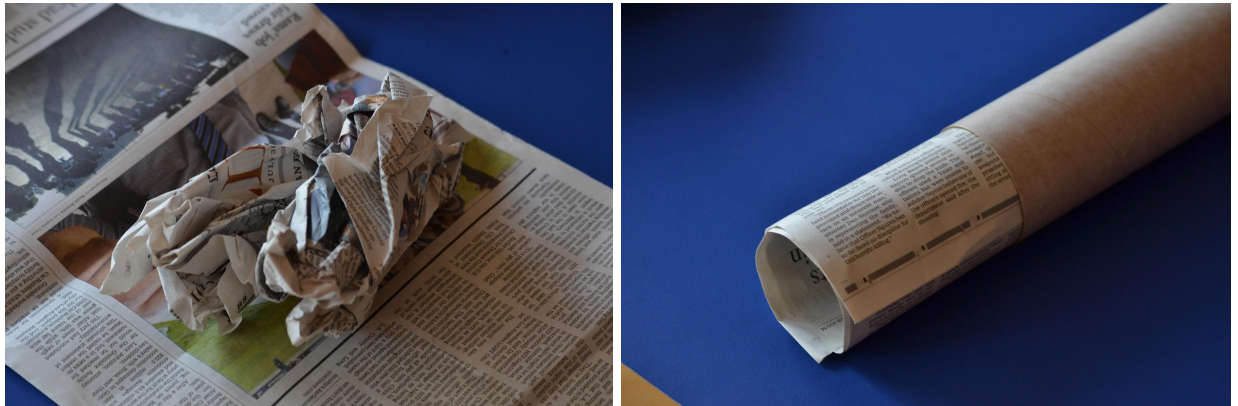
There are many methods that are used for retaining high-power motors, but for the Jr. Level 1 DX3 build, Madcow Rocketry includes a motor retainer that consists of a metal plate held in place by two screws that attach to the rear centering rings. The retainer comes with instructions on how to install it.

Part 8: Paint Prep

While this part is optional, painting will make it easier to distinguish your rocket. Especially if not painting, it is a good idea to write your name and a phone number on your rocket.



Wrap the forward section coupler in newspaper, then wrap the newspaper with tape to avoid damaging the coupler.



Crumple up newspaper and wrap it in more newspaper. Slide the newspaper into the lower section body tube. The newspaper should be snug and stay in place.



Tightly roll up newspaper and slide it into the launch lugs. Lightly sand the shiny coating off of the body tube to make paint adhere better. If painting the nose cone, lightly sand and use a paint that will adhere to plastic.

Similarly block the motor mount with newspaper if painting the bottom.



Paint. Clean any paint that is blocking the launch lugs, is on the coupler, or is inside the body tube.

Part 9: Launch + Certification

The NAR Jr Level 1 certification requires the certifier to take a written test and successfully build and fly a rocket using a Level 1 high-power motor. Coordinate with your local club to ensure someone can administer your test and observe your flight. If you have filled out the webform on the JrLevel1.com website and are flying at ROC, please reach out a few weeks prior to the launch you plan on attending.