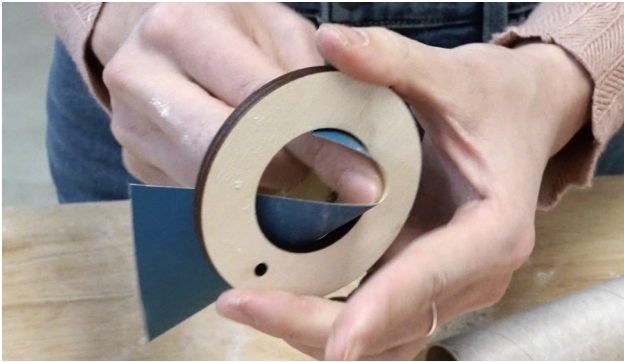**Miss Fire Assembly Instructions**

STEP 1:
Prepare Fin Assembly

Sand centering rings notches, inside the rings, and fins' leading and trailing edges. Gently sand the outside of the cardboard motor tube, just enough to scuff the waxy surface.

TIP: For the leading and trailing edges, I find it easiest to glue/tape your sand paper to a table and sand the fin against that, or glue/tape it to a sanding block (any flat rigid block, I've even used another fin for this), or carefully go with a good ol' belt or orbital sander if you have one.
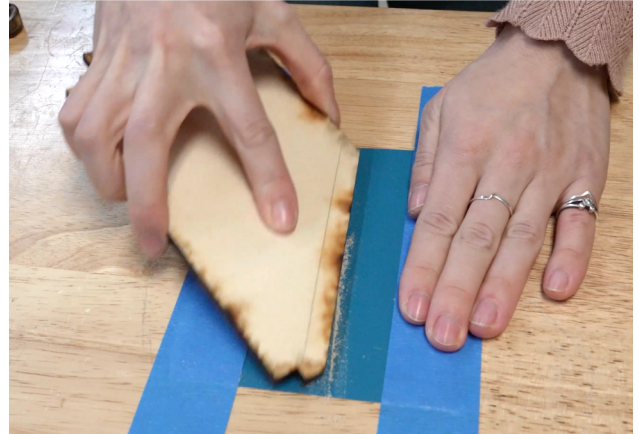

When working with epoxy, and any adhesive really, sanding laser cut edges thoroughly ensures better bond surfaces.

Tip: You can draw a line along the fin edge offset by about .5-.75" and then sand a filleted edge on the fin to that line.

Locate your motor retainer. The ridged side of the interior ring will be glued to the base of the motor tube. Separate the two pieces, and mask off the threads of the interior ring. Put the exterior ring somewhere safe where you will not lose it.
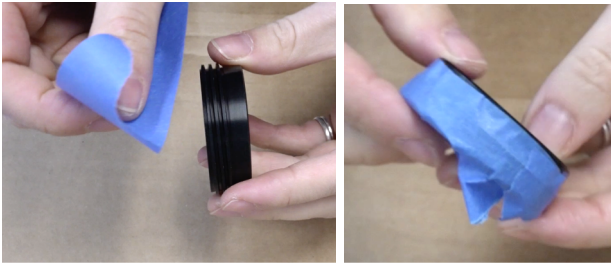
Next, assemble the forward centering ring (the ring with no notches and a small hole in it). Secure the eyebolt ensuring there is a washer on each side of the wood and the eyebolt runs tangent to the slope of the circle. If it protrudes past the outer diameter it will interfere with the body tube.
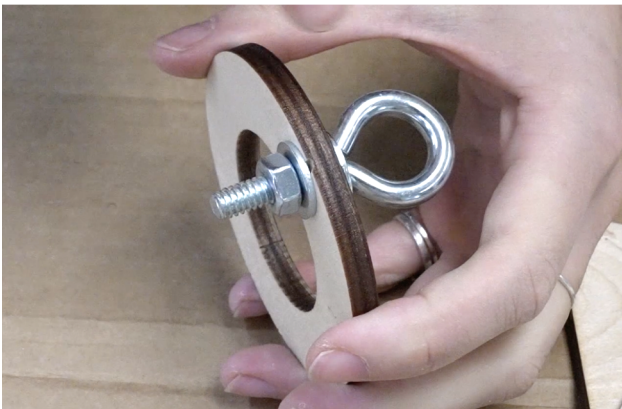
STEP 2:
Assemble Fin Can

Next you'll assemble the rocket's fin can. Begin by dry fitting the fin can and mark where the centering rings land on the motor tube, and trace where the fin lines align on the tube - then set the fins aside.

Note: the bottom edge of the fins should line up with the bottom of the motor tube.

Set your workspace to work with epoxy resin. Cover all surfaces you'd like to protect (I like to unfold the box the kit came in and build on top of that).

Miss Fire Assembly Instructions

Safety Alert!

Be sure you have the right PPE: **nitrile** gloves and working in a **well ventilated** area is a must. Ideally this is a space you can leave while the epoxy is curing. TotalBoat High Performance is low-VOC, but it is never a good idea to use epoxy in a shared airspace with your bedroom or living quarters. If you are in a closed garage, it is a good idea to wear a respirator. Some people will never develop a sensitivity to epoxy, and some people are hypersensitive and may develop an allergy on their first use. If you are prone to respiratory issues or allergy sensitivities, you should do your own research on epoxy safety before use.

It is time for the Thixo epoxy from TotalBoat! You can mix the Thixo epoxy on a piece of scrap cardboard or by using the mixing nozzle included in the kit. I prefer the mixing nozzle for this step, though if it is cold or you have a lower-power caulk gun it may be difficult to force the epoxy through the mixer.

In this case simply remove the nozzle and squirt ~2 pumps of epoxy onto a small piece of cardboard and mix with a popsicle stick.
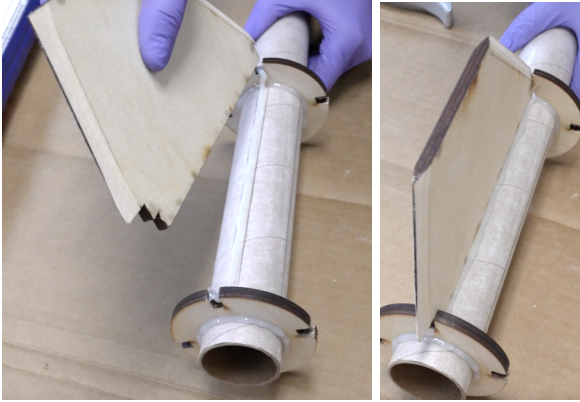

Begin by gluing the centering rings to the locations that you marked in the previous step. Check to make sure your notches align.

Once the centering ring is placed and secured with the adhesive, you're ready to glue the fins in place. Run a generous bead of epoxy down your marked lines. Firmly press the fin into place— squeeze out is a good sign.

Repeat for all 4 fins.

Using a popsicle stick, smooth your squeeze-out into an even fillet. You likely will need to add additional epoxy.


Before this epoxy cures, also use the Thixo epoxy to glue the aluminum motor retainer to the bottom of the motor tube. Be sure the threads of the motor retainer are masked off so you don't get epoxy in them.

Tip: Wiggle the motor retainer as you slide it onto the motor tube to further disperse epoxy into those ridges.

Place the fin assembly in an upright position to cure. Be sure to fillet all the centering rings. Double check that the fins are all neat and straight.
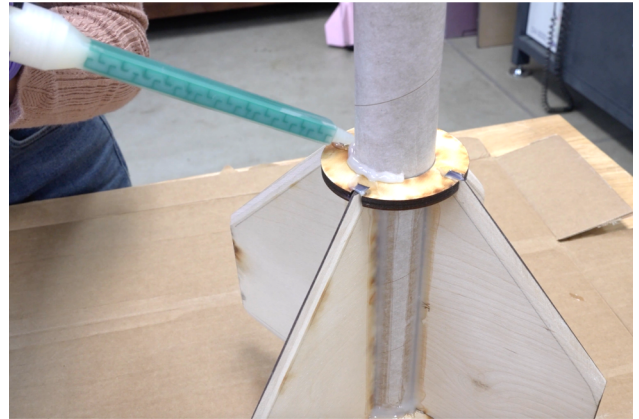
While the assembly is upright glue the forward (top) centering ring in place as well - be sure to apply epoxy over the eye bolt joint as well.

Use a gloved finger to clean up any epoxy that may have squeezed into the inside of the motor tube.

wait 3-4 hours

STEP 3:

Install Fin Can into Airframe Tube

Once all of the epoxy from the previous step is completely cured, you're able to install the fin assembly into the slotted airframe tube.

Trim the connecting flange on the bottom of the slots down all the way to the bottom of the tube. This is required to make sure the tube doesn't get squished in shipping.

Before moving on to the next epoxy step, mask off the motor retainer to protect it while you're applying adhesive to the rest of the exterior of the rocket. (It may still be masked from the previous step)


Mix a small amount of epoxy on a small piece of cardboard. (about half a pump of Thixo). For this step I prefer to remove the mixing nozzle and mix directly on the cardboard with a popsicle stick.

Using the mixing popsicle stick, glue along the outside of each of the centering rings and slide the airframe tube down over the fins.

Clamp the bottom of the airframe tube to the centering rings if they're splayed at all. Masking tape across the tube pulled tight will do. The key is to make sure the cardboard is pulled back against the lower centering ring and that it is well glued.
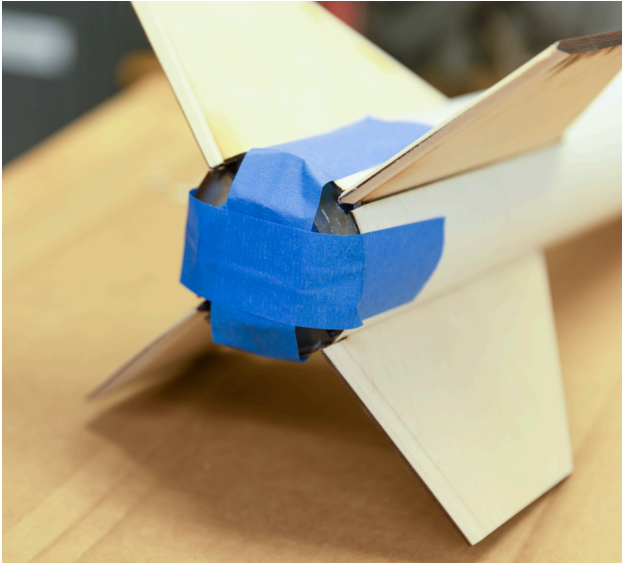
wait 3-4 hours

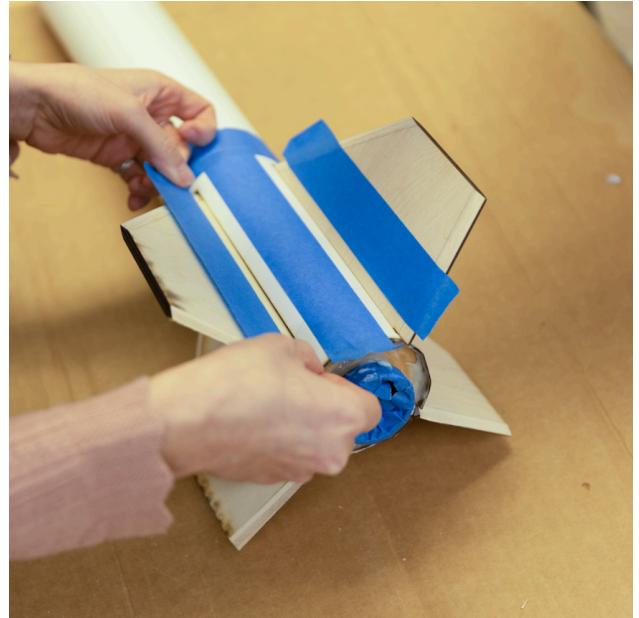**STEP 4:**
Fillet the Fins

Next, it's time to add filleted edges to the fins where they meet the airframe. Apply masking tape about a popsicle width away from each of the joints.
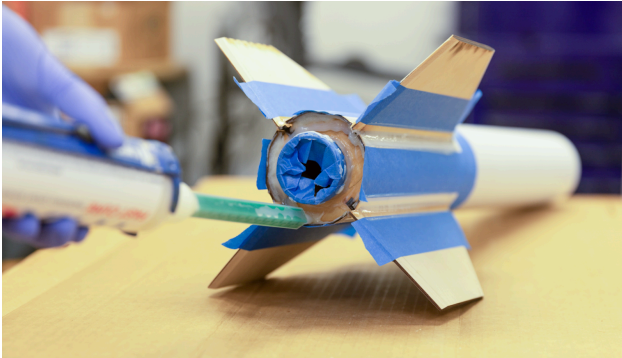

Run a bead of Epoxy around each of the fins, and before moving on to the next fin, use the rounded end of a popsicle stick to smooth those into a nice radius - using any excess to fill gaps.

Add a fillet around the bottom and top centering ring as well.

Before the epoxy cures, carefully peel up the masking tape to reveal a clean filleted edge that will need minimal sanding once the epoxy has completed setting.
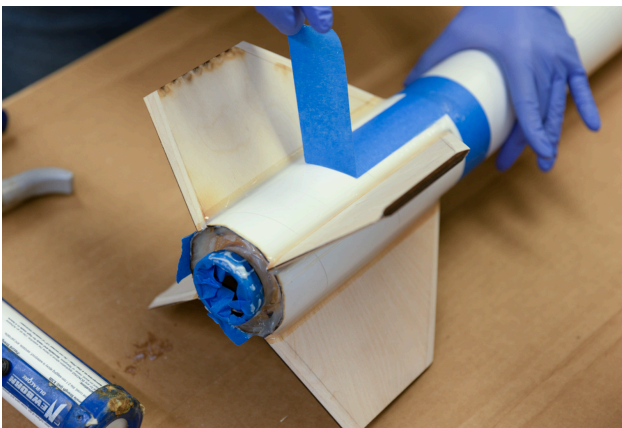
wait 3-4 hours

STEP 5:

Loop recovery cord through the eye bolt

Create a larks foot knot (girth hitch) through eyebolt with the parachute line.

Wrap line neatly up so it doesn't get glue on it, you can protect it from glue by placing it in a ziploc bag and taping it shut.

Once the cord is secured, tuck it into the top of the airframe tube.

STEP 6:
Assemble Main airframe

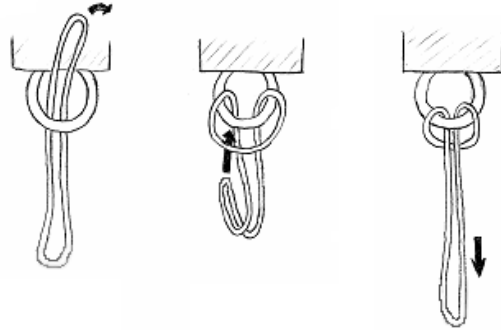It's now time to assemble the main airframe.

Begin by supergluing the coupler into the lower airframe with (TB product) and then act quickly to superglue the upper airframe piece onto the coupler.

💡 TIP: It is perfectly reasonable to separate at this joint as a payload section instead of deploying the nosecone at apogee. I do not recommend for beginner builders but if you need to fly your rocket in a suitcase to your launchsite this may be easier for transport, the instructions will not cover that though.

STEP 7:
Prep nosecone

Prepare the nosecone by drilling 2 large holes in the nosecone to loop your recovery cord onto for it later.

Find a good way to hang the nosecone vertically or place it in a cup or a vice or just a stable way to sit it pointy end down

STEP 8:

Prep for Fiberglassing

Next, prep your workbench and space for fiberglassing and resin mixing again.

Roll out the fiberglass (TB Product) onto a **clean**, large table. Cut a 10" wide section of fiberglass the length of the tube above the fins, so it's 10"x36" inches.
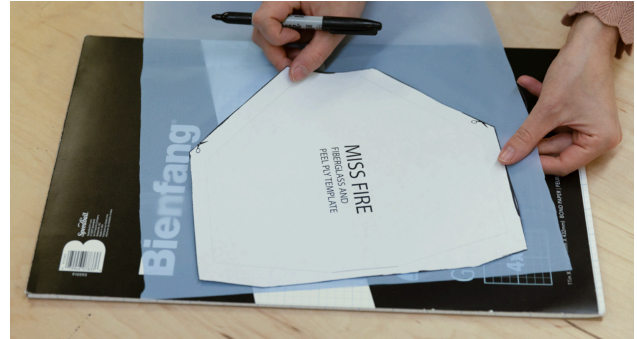

Neatly and gently fold that cut fiberglass back up and set aside for the time being. Don't crease the folds.

Either print this fin template or make your own by tracing the shape of the section from one fin to the next fin.

Trace that shape onto the fiberglass 4x and cut it out, then trace that shape onto the peel ply 4x and cut it out.

TIP: Sharpie bleeds through both fiberglass and peel ply so protect your table!

Prepare your area for fiberglassing:
- ☐ Lay down a project mat or tarp or trashbag to protect your worksurface. Keep handy things nearby: extra gloves, acetone for cleanup, a utility knife, scissors, shop rags.
- ☐ Make sure temperature of workspace is 65-85°F .
- ☐ Make sure area is well ventilated OR you have a respirator to wear (must be an organic vapor cartridge) (product links)

STEP 9:

Fiberglass Fins!

Sand down any remaining bumps in your fillets to smooth out any ridges left from the tape or smooth globs that may have cured where you didn't intend to.

Give the fins and body tube a light sanding and dry fit your fiberglass to make sure it sits nicely in the fin area.

TIP: If this is your first time fiberglassing, I recommend doing one tip-to-tip layup at a time. This means that this step will be repeated 4 times.

TIP: This is also a good time to find a way to prop your nosecone vertically so that you can pour any excess epoxy into the tip to add weight for stability. I find this kit flies best with ~80g of nose weight and epoxy is the easiest way to achieve this.

Mix up your **TotalBoat High Performance** epoxy and paint a thin coat of epoxy onto the fin area.

Carefully lay the fiberglass down and press it flat so it conforms to all the curves and surfaces. I find it easiest to start in the middle and work your way out to the fins.

Miss Fire Assembly Instructions

Slowly wet out the fiberglass with a brush, don't go too thick anywhere or the fiberglass will start bubbling and shifting around.


It's important to take your time! You have about 30 mins of working time on the epoxy so relax, go slow and be careful as you work.

Once the fiberglass is completely clear and the epoxy coat looks even, carefully lay the peel ply down over it and smooth it over the surface. I like to start from the middle and carefully work my way towards the end of the fins.

Be sure to smooth the surface of the peel-ply and gently squish all the bubbles out. The surface of your peel ply will be the surface of your epoxy, so the smoother you get it the less sanding you'll have to do!
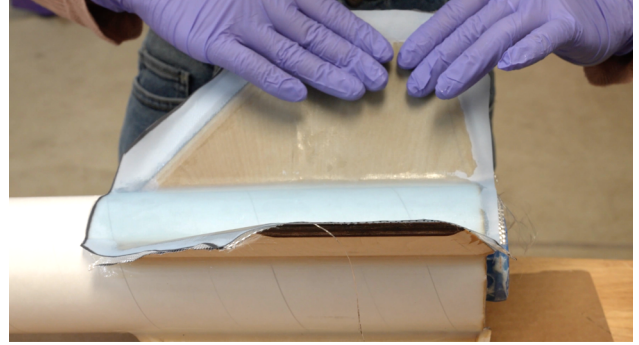
Now it's time to let it cure! Don't poke at it!

You can pour any excess epoxy into the nosecone for extra nosecone weight.

STEP 9.5:

Trim fiberglass

The easiest time to trim your fiberglass is when the epoxy is nearly cured but not completely cured, so it is still a little bit soft and flexible but not sticky. This is called the "green stage" and is generally 2-3 hours after mixing, though that is very temperature dependent. Colder temps mean a longer cure.

APPLICATION DATA:			
Hardener Selected:	**Slow**	**Medium**	**Fast**
Application Temperature/ Relative Humidity:	Minimum of 55°F, 0-90% RH	Minimum of 55°F, 0-90% RH	Minimum of 55°F, 0-90% RH
Application Film Thickness:	Thin film to 1/4" @ 77°F	Thin film to 1/8" @ 77°F	Thin film to 1/16" @ 77°F
Resin Density (@ 77°F) (ASTM D1475):	1.14 g/cm³	1.14 g/cm³	1.14 g/cm³
Hardener Density (@ 77°F) (ASTM D1475):	1.01 g/cm³	1.01 g/cm³	1.03 g/cm³
Resin Viscosity (@ 77°F) (ASTM D2196):	1000cP	1000cP	1000cP
Hardener Viscosity (@ 77°F) (ASTM D2196):	400cP	400cP	470cP
Mixed Viscosity (@ 77°F) (ASTM 2196):	600cP	600cP	650cP
Mix Ratio (By Weight):	100A:45B	100A:45B	100A:46B
Mix Ratio (By Volume):	2A:1B	2A:1B	2A:1B
Working Time (Varies by Mass of Mixed Epoxy):	20-45 minutes @ 77°F	10-30 minutes @ 77°F	5-15 minutes @ 77°F
Gel Time (150g mass @ 77°F) (ASTM 2471):	40 minutes	25 minutes	10 minutes
Tack-Free Time (Thin Film @ 77°F):	5 hours	3 hours	2 hours
Minimum Cure for Light Use (@ 77°F):	16 hours (thin film)	12 hours (thin film)	6 hours (thin film)
Clamp Time (Minimum, @ 77°F):	24 hours	16 hours	8 hours
Full Cure Time:	5-7 days @ 77°F	3-5 days @ 77°F	2-5 days @ 77°F
Shelf Life:	At least one year (under proper storage conditions)	At least one year (under proper storage conditions)	At least one year (under proper storage conditions)

Data table from the TotalBoat Technical Data Sheet (TDS). The kit comes with SLOW hardener.

Use a sharp utility knife to trim the fiberglass back to the edges of the fins.

Safety Alert

Always be sure to slice **away from you**. Box cutters cause the most frequent shop injuries!

💡 TIP: If you "missed the green window" you can soften the epoxy with a heat gun (or hair dryer on highest heat) and slice it easily.

STEP 9.75:
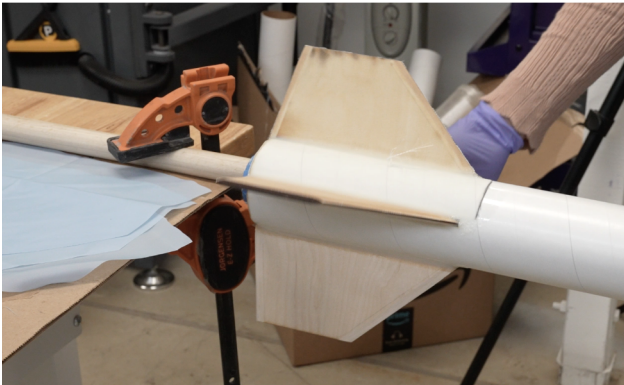
Repeat step 9 for all 4 fins

STEP 10:

Fiberglass overwrap the airframe

Find a good way to clamp your rocket down to a table - I like using a long dowel or broomstick clamped to a table, or balanced across 2 tables. Put a dropcloth/trash bag/cardboard on the floor (you have will drips).

Mix up a larger quantity of **TotalBoat High Performance 2:1 epoxy** and paint a thin layer of epoxy on the tube all the way around.
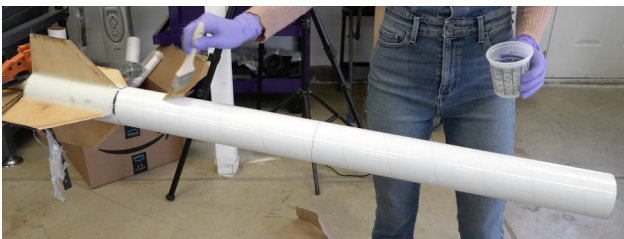
CAREFULLY lay the fiberglass on the tube, be sure that it is nice and straight. Wrap the fiberglass one way first, gently patting it down with your gloved hands, then the other way until the edges overlap.

Wet out the fiberglass using the chip brush.

💡 TIP: the cut edge of the fiberglass will fray and cause problems. That is a normal albeit frustrating part of the process. Refrain from pulling at the loose strands- it is better to cut them off if needed. (Your scissors can be washed with acetone to remove wet epoxy when you're done.) The best way to deal with this is to finish wetting out the rest of glass before getting to that edge, and then use a stippling motion on the raw edge instead of a brushing motion with your chip brush.

Pour any excess epoxy into the nosecone for additional weight

When the epoxy is green (or cured and heated a bit) trim the excess with a sharp boxcutter using the same method as the fins.

STEP 11:
Sand the airframe

It's time to sand the airframe smooooooooooth!

SAFETY ALERT
It is incredibly important that you wear the correct PPE during this step. It is critical to wear a mask rated N95 or N100- fiberglass and epoxy are extremely dangerous to breathe in. Protect your skin by wearing long sleeves and nitrile gloves - the sanded particulate can cause itchy irritation to the skin. I sometimes wear nitrile gloves under workgloves for extra protection. The best place to do this is outside or in a shop with proper dust collection. **DO NOT SAND IN YOUR HOUSE.**
Note to parents: children are frequently more sensitive to epoxy than adults. I recommend handling this step on your own.

I am wearing an N100 dust mask, nitrile gloves, and safety glasses.

Miss Fire Assembly Instructions

Sand sand sand! Make everything but especially the edges of the fiberglass smooth. Focus on the edges of the fiberglass first– make that seam on the tube overwrap smooth and the fins leading and trailing edges. Unsanded fiberglass edges can be very sharp and have the potential of cutting cloth or skin if left ignored.

For best results, wrap your sandpaper around a small sanding or wood block (or a dry old kitchen sponge).

If you have and want to use a power sander, I recommend a mouse sander.

Wipe with a wet shop rag (I use cut up old tshirts) as you go to check your progress.

Water is ok but isopropyl alcohol (IPA) is better. If you use water wait several hours before painting to ensure it is completely dry.

When you are done sanding and cleaning up the sanded rocket, and still wearing your PPE for sanding, it is a good idea to clean your work area thoroughly. If you used the cardboard box as your project mat, dispose of it alongside any other consumables covered in fiberglass/epoxy dust.

STEP 12:
Prep for paint

You're now ready to prep your rocket for its paint job!

Begin by thoroughly wiping down all the sanded surfaces with Isopropyl Alcohol (IPA), and wash the nosecone with warm water and Dawn dish soap to get the mold release off. (Paint has a hard time sticking to plastic nosecones)

Be sure motor retainer is still masked off for this part as you dont want any paint getting in the threads.

I like to use the kraft paper packing material the kit came packed with as my dropcloth for painting.

STEP 13:
Paint the rocket!

Paint to your heart's content! I am not going to tell you how to do this- have fun :)

Step 14:
Install Rail Buttons

The rail buttons are the two small black spool-shaped pieces of plastic. These are what holds your rocket on the 1010 launch rail prior to launch. Double check that your launch site has a 1010 rail- if it has something else you may need to order a different part. (1010 is the most common- it is unlikely a site wouldn't have one)

Fish the recovery line out from the rocket- it may get in the way of your measurement.

Using a long ruler or a dowel, measure the distance inside the rocket from the top edge to the forward centering ring. Mark that distance on the outside of the rocket.

Mark a spot to drill ⅛" aft from your line. This should be in the center of your centering ring, giving the screw something to bite into.

Mark another spot in the center of the aft centering ring.

Eyeball the two points to be centered down the centerline of the rocket, between two fins. I've tried several ways of measuring this and honestly- eyeballing it seems to work the best. Just take your time and close one eye; you'd be surprised how accurate the human eye can be!

Predrill the holes. If you don't hit the centering rings, figure out why you didn't and adjust accordingly.

Using a screwdriver, screw the rail buttons in.

**Step 15:**
Recovery system

Time to get your recovery system ready. Fish the line out from inside the rocket.

If you forgot Step 5, find someone with skinny long arms to loop the line through the eyebolt (I have done it a few times, but it sucks. Try not to forget that step)

On a table, unroll your parachute and fold it in half so each string is against another string. Take extra care that your lines remain untangled.

Fold in half again, again so that each pair of lines meets another pair. Repeat one last time- you should now have a wedge shape where lines meet in the center of the arc.
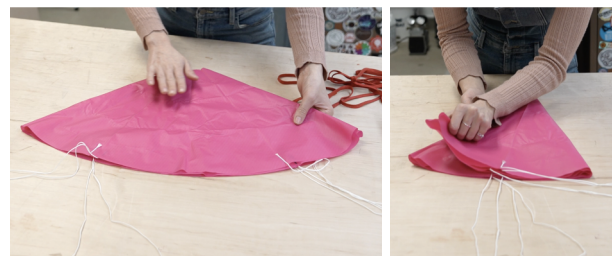
Miss Fire Assembly Instructions

Tidy your lines and tie an overhand knot on the bottom to form a loop.

Fold your parachute in half again, then again, and then z-fold it.

Run the recovery line through the parachute and the nomex octagon and then tie a knot in the recovery line.

This knot should **not** be in the middle. The parachute should be attached closer to the nosecone- if both lines are pulled tight (like in freefall) the nosecone and airframe should not hit each other).

Place the folded parachute in the center of the orange nomex and z-fold the lines on top of it.

Wrap the parachute into the fire-resistant nomex like a burrito. It is important to protect the parachute and lines from the black powder ejection charge that will blast the nosecone off and parachute out.

Load the burrito into the rocket- slide it to the bottom. We want it to protect the recovery line as much as possible too.
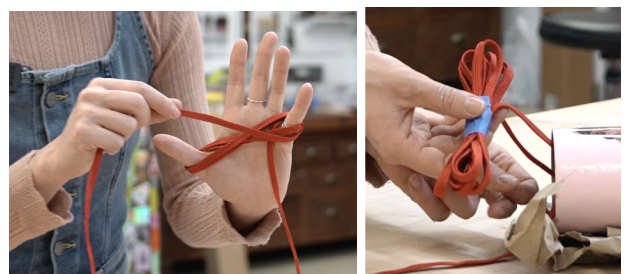
Wrap the rest of the recovery line in neat figure-8s around your pinky and thumb. Masking tape the bundle and slide into the rocket. The figure-8s will prevent tangling.

Miss Fire Assembly Instructions

Attach the other end of the line to the nosecone by poking the loop through one hole, and fishing it out the other. Quicklink the loop to the line and pull it tight, forming a modified girth hitch/larksfoot.

Figure-8 the rest of your recovery line and slide it into the rocket, and then slide the nosecone into place.

Congratulations! You have completed your Miss Fire rocket kit!

STEP 15:
LAUNCH DAY!!!!!

Pack yo' vehicle, grab your rocket and your motor, and head out to the launch site! Don't forget to bring comfy shoes, sunscreen, and plenty of water- rocket launches are frequently hot and may involve a lot of hiking.

You will need to load your motor at the launch site- if you have not done this before please find a mentor to help you in person.