Wildman Rocketry

Demon Sport Build Instructions

Congratulations on buying a Wildman kit! If this is your first time building with fiberglass, you'll be glad to have a resilient rocket that can take most of the usual abuse that we dole out at the field. Be sure to read through the instructions first so you'll know what to do. Bonding fiberglass requires bonding prep, and the order of the steps matters! You may not be able to do something once the next step is done, so be sure to follow the order of steps.

In the directions below, for some steps, there are different options available depending on the materials you have or personal preference. Pick one or read them all, any one of those methods will result in a solid build. There are other methods you can use, as well, we've summarized the most common.

In the parts list below, the Kit you've ordered should have the listed parts. In order to complete the build, you'll also need the "Necessary Parts." "Optional Parts" are recommended, but not necessary to complete your rocket. Then, we've included a list of some tools you'll want to have on-hand.

Parts list:

Kit:
- Nosecone
- Body Tube
- Tail cone
- Centering Ring
- Motor Mount Tube
- Aluminum motor retention system
- Fins

Necessary Parts:
- Kevlar shock cord
- Parachute
- Epoxy
- Rail Button
- 29mm motor casing

Optional Parts:
- Nomex® Chute-Protector
- Eyebolt/U-Bolt
- Stainless Steel Quicklinks
- CA (superglue)
- 2-Part Foam

Tools to have on-hand:
- Paper cups *(or other cups for mixing Epoxy)*
- Popsicle sticks
- Latex/Nitrile gloves
- Sandpaper *(60, 80, 120, 150 grit)*
- File
- Masking Tape
- Drill
- Dremel tool

STEP 1: PREPARE ALL PARTS

1) Wash all fiberglass

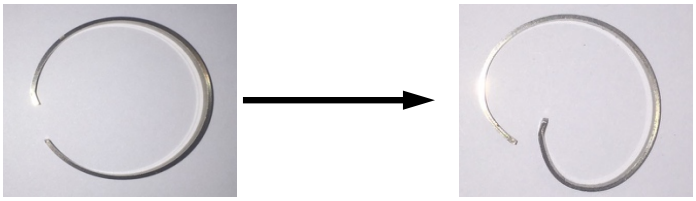
All fiberglass parts should be washed in a mild detergent, like dish soap. This will clean off all the mold-release agent and dust from the cuts. Simply fill a sink or bucket with soapy water and wash the parts like you would wash the dishes. Rinse with clean water and dry them off.

2) Sand Motor Mount tube

All fiberglass surfaces that will be bonded should be sanded using 60 or 80 grit sandpaper to create a rough surface area for the epoxy to adhere to. The entire motor mount tube should be sanded since the fins, harness, centering ring, motor retainer, and internal fillets will all be bonded to it. Sand it until it is scuffed well, but not so much that the fibers are torn.

3) Bend Motor Retain Clip

Prior to installing the motor retainer clip, bend the ends to ensure motor retention. Once bent, insert the clip into the motor retainer



4) Sand Centering Ring

The centering ring should be sanded on both sides since internal fillets, if carried out, will likely bond to it.

5) Notch Centering Ring

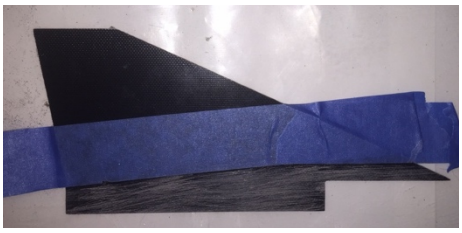
The Centering Ring will seat over the shock cord/harness, so you'll need to file a notch so that the Kevlar cord can fit under the CR and onto the motor mount tube.

Lay your Kevlar cord over the CR and mark where you need to file, and file notch just big enough for the Kevlar. Then, test fit the CR on the tube with the Kevlar to be sure the notch is big enough (cord should be able to move, but not loose).

If you're using a y-harness, file two notches. You can do them 180° apart, but you'll have to be careful to avoid interfering with fins later. You can also file notches 120° apart, leaving more room for fins later.

6) Sand Root Edge of fins

The "root edge" of the fin is the bottom edge of the fin that will bond to the motor mount. Sand it using 60 or 80 grit sandpaper, again, for bonding. This is also a good time to sand the bottom on both fin sides which will be bonded with the internal, if done, and external fillets. Tape can be applied at this step (keep close to ½" of the fin showing above the tab) to keep from sanding too much fin area during this process, and later can be used as a mask for external fillets.



7) Bevel fins (optional)

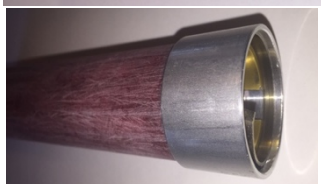
If you want to bevel the fins, now is the time to do so. Bevel the edges using whatever method you like, but sandpaper on a block works well to simply round the edges. If you use any sort of power tool, be careful not to take too much off the fins; be sure to leave a bit of "meat" in the middle for fin strength. Rounding or beveling the fins has a minor beneficial effect on the rocket's performance, but isn't critical at all to a build. You may also choose to bevel your fins for purely aesthetic reasons.

8) Dry-fit pieces, sand until fit

Test fit the pieces, and sand accordingly if things don't fit. A little tightness is okay as is a little looseness. The parts should fit so that you can move them around as you build, but not so loose that they will slip around once you've set the epoxy. Fins should fit snugly in their fin slots, be sure not to open the slots up too much. If you must sand the fin slots, just do so using a folded-over piece of sandpaper. Now is also the point when you'll want to make sure all your pieces are squared off. Sometimes the manufacturing process leaves little tabs on the tubes that you should square off, for example. After all this sanding, it's a good idea to wipe down all the parts with a damp cloth/paper towel to remove all the dust. Once the pieces all dry-fit together, you're ready to start building.

9) Install aluminum retainer

Obtain a 29mm motor casing with a rear closure; this will be used to set the retainer properly into the motor mount. Place the motor casing into the motor mount tube. Slide the retainer, with clip installed, onto the end of the loaded motor mount tube.



While holding the retainer in place, use a sharpie to draw a line on the motor tube where the retainer ends. Remove the retainer and the motor casing from the motor mount. Apply a thin coat of J/B weld, or other high-temperature resistant epoxy, to the end of the motor mount up to the sharpie line. Slide on the motor retainer ensuring no epoxy gets on the inside of the motor mount tube. Allow to dry.

10) Attach shock cord/y-harness

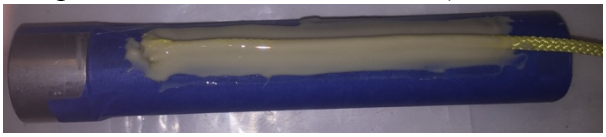
If you choose to do a y-harness, make a loop of Kevlar (be sure to use an extra piece Kevlar, otherwise your shock-cord may be too short) long enough to go on the motor mount, up to the top of the red airframe and back down, with a little extra. Cut off the Kevlar and tie a loop (overhand knot) at the top so that you have a loop at the top of the red airframe (when dry fit to the tail cone) and two Kevlar leads that reach down to be epoxied onto the motor mount. When attaching this to the motor mount later, be sure that the Kevlar leads are long enough to give 3 to 5 inches for attachment.

Use masking tape to set a boundary for the epoxy on the shock cord attachment point(s). This will prevent epoxy from running down the tube and interfering with fins later on. Mask off the forward end of the motor mount as well, to ensure that no epoxy interferes with the placement of the centering ring later on. Also, make sure that the attachment points chosen will not interfere with late fin placement!

Mix a batch of epoxy and lay some under the harness. Then, press the Kevlar into the epoxy, and put more epoxy over the top. The entire cord should be encased in epoxy.

After the epoxy sets up a little (and before it cures completely!), pull the tape off.

Set aside and let the epoxy set. (If using a y-harness, repeat for the second attachment)


11) Dry fit, but DO NOT attach centering ring

Dry fit the Centering Ring again over the epoxied motor mount to ensure the CR still fits. Make sure the notches you filed earlier are still deep enough to go over the shock cord. We're not going to attach the centering ring yet. We'll use that end of the tail cone to make our internal fillets, or fill with foam, later.

12) Prepare centering ring (Scotch Tape method/screws)

The CR will need to be put on the tail cone to aid in motor mount and fin placement. However, we'll need to be able to put it on and take it off. You can either:

a. Wrap a couple pieces of Scotch tape around it so you have something to tug on, or
b. Drive two screws partly into the ring to hold it with, and they can be removed later.

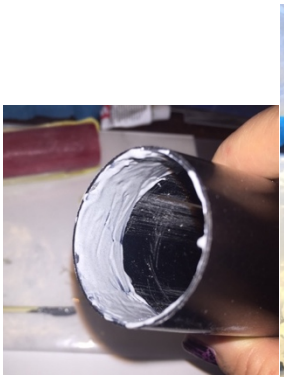
13) Sand Inside of Tail Cone

Sand the inside of the tail cone around fin slots and around the bottom, where the retainer will be epoxied in.

14) Attach Motor Mount

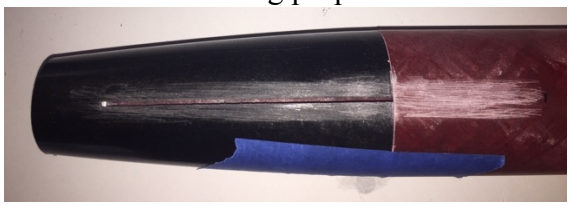
Stuff the shock cord into the top of the motor mount tube to keep it out of the way. Apply a one-inch ring of epoxy to the aft end of tail cone. Slide the motor mount, retainer side down, into the tail cone. Be sure to align the motor mount so that the shock cord is not in line with the fin slots so that the fins can seat directly and flatly on the motor mount tube. Remove excess epoxy from the bottom of the tail cone, where it engages the retainer.

Slide the taped Centering Ring onto the top of the motor mount and push into the tail cone. This will ensure that the motor mount placement is correct while the epoxy sets. Let dry.



15) Sand area around fin slots

The external fillets will adhere to both the airframe and tail cone. Now is the best time to sand around them easily. Tape the red airframe to the tail cone with masking tape. Insert the fins into the fin slots to use as a reference point. Mark on the airframe where the top of each fin reaches. Take out the fins. Sand about ¼ - ½" on each side of the fin slot on the tail cone and also on the airframe, up to ¼ - ½" above the reference mark. Again, use 60 or 80 grit sandpaper as this is for bonding purposes.



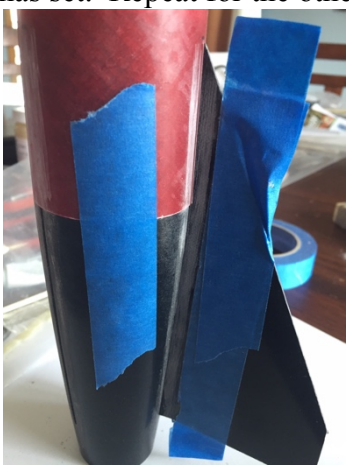
16) Attach fins through the tail cone to the motor mount tube

There's more than one way to attach the fins; some people do one at a time, some people do all three using a fin-alignment jig. **Note, if you're using 2-Part Foam for internal fillets, CA (superglue) or 5-minute epoxy will do fine to attach the fins to the motor mount since the foam will provide the most adhesion and strength.*

a. Epoxy method (such as RocketPoxy): First, mix a batch of epoxy, then "butter" the root edge of a fin. You can smear a bit on the sides of the fin at the root edge. This will be helpful in sealing the fin slot for internal fillets.

Next, slide the fin into the slot and press it down against the motor mount tube. Be sure it is completely in place against the airframe & the motor tube. If you're doing one fin at a time, let this set until the epoxy is completely cured. Using a fin alignment jig while the epoxy sets is important; you want to be sure that each fin stays aligned precisely and doesn't slide around later when you're attaching other fins. If you're doing all three fins, place the fins then slide your jig into place. Be sure the jig doesn't get epoxied to the airframe by excess epoxy!

b. CA method (or 5 min epoxy): First, add CA the root edge of a fin. Next, slide the fin into the slot and press it completely down against the airframe & motor mount tube. Hold in place for about one minute or until the CA has set. Repeat for the other fins.

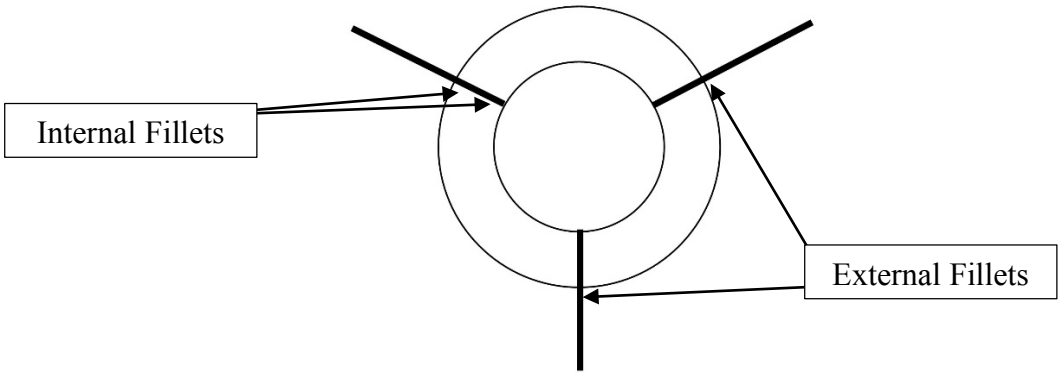




17) Remove airframe

At this point, remove the masking tape holding the airframe to the tail cone. Then remove the airframe from the tail cone.

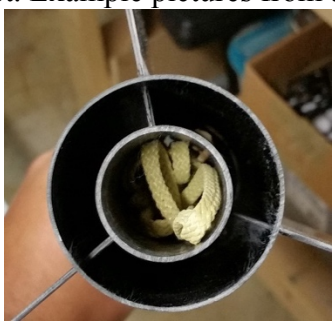

18) Internal Fillets

Each fin is bonded to the motor mount from the initial placement. Fillets provide extra strength, bonding the side of the fin to the airframe and motor mount. Internal Fillets bond the side of the fin to the inside of the airframe and the motor mount. Strictly speaking, internal fillets are not always necessary; however, including them provides superior strength so that your fins will stand up to the stresses of flight as well as potential hard landings. If you plan to use high power motors, internal fillets are always a good idea.



Epoxy Method: The standard method of doing internal fillets. This method involves pouring mixed epoxy to fillet the fin both at the motor mount and at the inside of the airframe. The amount of epoxy you'll use depends on the length of the fin root edge.

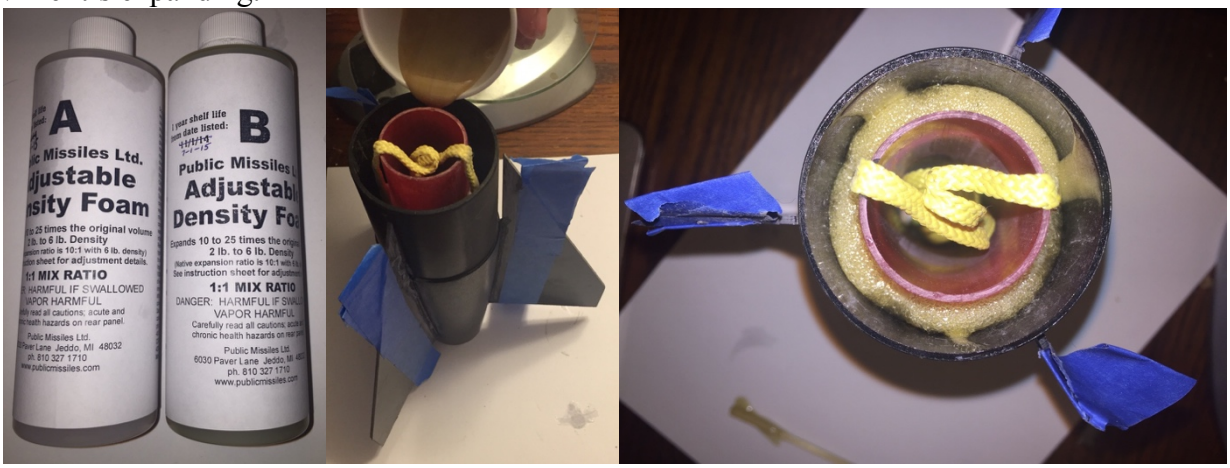
1) First, pull the centering ring out of the tail cone so that you can access the space between the motor mount and tail cone
2) Next, get your tail cone on a stand of some sort so that you're ready to pour epoxy as soon as it's mixed.
3) Mix enough epoxy to pour (be sure to use an epoxy that flows well).
4) Either pour carefully or use a syringe (ask at your local pharmacy for the ones they give away for kid's medicine) to squirt the epoxy along the fin root. Tip the rocket forward so that the epoxy can flow evenly along the fillet. Example pictures from another rocket shown below.



5) Set it aside for the epoxy to set, then rotate and do the next set.
6) You can pour 2 fillets at a time, depending on your rocket. With 3 fins, as in the diagram above, you can pour the "top" two fillets at the same time at the fin and motor mount, rotate 120° and do the next two, then repeat a 3rd time.
7) When pouring the internal fillets with the tail cone, tape along the fins on the outside so epoxy doesn't leak through. Rotate 60° so a fin is straight up, do the two internal fillets at the fin/airframe, and repeat for each set of fins.
8) Once all the internal fillets have been made, you're ready to move on to the External fillets.

Foam Method: Use 2-Part Foam to completely fill the space between the tail cone and the Motor Mount. If you choose this method, be sure to use the 2-Part Foam for rockets as other brands of expanding foam will not adhere or expand properly. The benefit of the 2-part foam is that it completely bonds the fins to the inside of the airframe. It also forms a complete, solid aft-end for your rocket. The fins, motor mount, and tail cone essentially become one unit. If you're doing the foam method, you may want to consider lining your fins/fin slots with CA first. This will prevent foam expanding out along the fin slots.

1) First, pull the centering ring out of the tail cone so that you can access the space between the motor mount and tail cone.
2) Stand your rocket vertically so you can pour the mixed foam.
3) Mix enough foam for the entire tail cone. One ounce seems to suffice.
4) As soon as the foam is mixed well, pour 1/3 of it in each space (1/4 if you have 4 fins). Remember, once the two parts of the foam are mixed, you've only got about 45-60 seconds before it starts foaming up.
5) Allow the foam to expand completely AND harden (about 20-30 minutes). Do not touch the foam while it expands (it's incredibly sticky and you could interfere with proper expansion).
6) Some foam could leak/expand out of little cracks/holes along the fin slots, and that's okay. It could also foam up out of the front end, and that's fine too. It's easily removed once it hardens, just do not touch it while it's expanding.



7) Once the foam is fully expanded and hardened, simply cut off the excess with a knife, razor, or saw blade. Any remaining foam can easily be sanded or dremeled away.

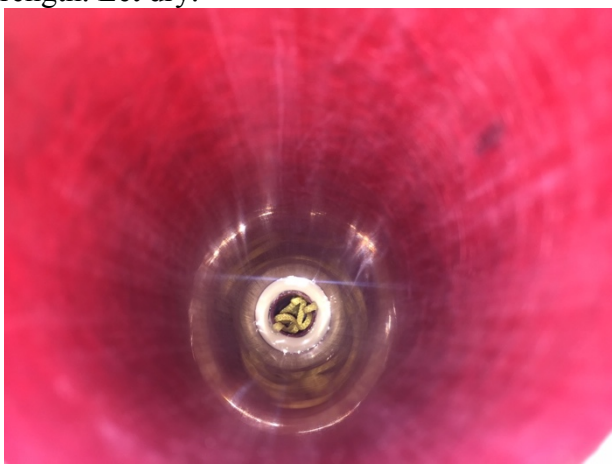
19) Attach Centering Ring

Now that your internal fillets are done, it's time to close up the tail cone. You'll epoxy the centering ring in place. If you've foamed the rocket, you'll need to first sand down the foam to a point where you can get the centering ring on all the way to where you want it. This may take a little trial and error, so be sure to leave the tape/screws in the centering ring until everything is ready for final placement.

a. Pull the tape off your centering ring (or remove screws)
b. Mix a small batch of epoxy
c. Smear the epoxy on the inside of the tail cone and on the outside of the motor mount. Do not get any on the inside of the motor mount; this will keep motor casings from fitting easily.

d. Slide the centering ring into place. Let dry.


20) Attach airframe
   a. Mix a small batch of epoxy
   b. Smear a thin layer of epoxy in a 2" ring on the inside of the airframe.
   c. Slide/twist the airframe down over the tail cone making sure to line up the sanded areas of the airframe with the fins on the tail cone. As the airframe goes down, a ring of epoxy will be formed on top of the centering ring. This will leave a nice fillet between the centering ring and the tail cone for added strength. Let dry.



21) External fillets

External fillets provide extra strength to the fins at the airframe. If you've used 2-part foam internally, external fillets are more aesthetic than necessary. Your choice of epoxy is important. If you're using a thin, runny epoxy, you'll want to consider fillers like silica or micro-balloons. The best consistency for an external fillet is that of a thick peanut-butter. That way the fillet will hold its shape as it cures. Also, if your epoxy is not black, and you want to avoid painting your tail cone, you will want to use a compatible pigment to dye your epoxy.

   a. Tape off the area of the fillet. You can mark the lines of the fillet by rubbing the fillet tool (e.g. popsicle stick or ½" PVC) along the airframe. If you color it heavily with a marker beforehand, it should leave enough of a line to see where the fillet will be.



b. Mix a batch of epoxy and pour it into the fillet area. Let it settle. Depending on the type of epoxy you use, you'll want to let it set up a bit before you "pull" (shape) the fillet. I used RocketPoxy and let it set for 30 minutes.

c. Using some sort of fillet tool, "Pull" the fillet into shape. You can use the same piece of ½" PVC you used to draw a line for taping, a popsicle stick for a small fillet, or even a tongue depressor for a larger fillet. Starting from one end of the fin, pull straight along the fillet without stopping, allowing the excess epoxy to flow out onto the tape.

d. As soon as you've pulled the fillet into shape, you'll need to pull the tape off right away. Be sure to pull the tape at a sharp angle so as not to leave drips.
    i. If your tape was too close to the fillet, and you've got a ridge that you want to smooth out, you can use a gloved finger dipped in denatured alcohol to smooth out the edge. Alternatively, you can let it set and sand it smooth at the time of paint preparation.

e. Set aside until the epoxy fillet cures completely. Rotate and repeat for each set of fins.

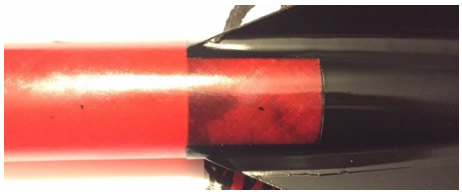
22) Mark for Rail buttons and Vent Hole

Rail buttons are necessary to keep your rocket held on the launch rail. You can also use rail guides which are slightly different but serve the same purpose. Using a piece of angle-iron or even just a door jamb, make the marks halfway between two fins. These marks should be located on the airframe, not on the tail cone, due to the curvature of the tail cone.

23) Rail buttons

a. The aft rail button should be located just above, where the airframe meets the tail cone. The forward rail button can be located at the Center of Pressure (CP), which is at about 21" from the

top of the nose cone. This will serve as an easy reminder of where the CP is located on the rocket.



b. Drill holes using a 1/8” bit for standard 1010 rail buttons (which use 8-32 screws). Placing masking tape over the spot to be drilled keeps the holes a little cleaner.
c. Add a little epoxy to the bottom of the rail button screws. Screw the rail buttons into their respective holes, allowing them to self-tap the holes. Allow to dry.



24) Vent Hole

A vent hole is necessary to prevent air-pressure induced separation of the nosecone.

a. Along the same line as your rail buttons, measure halfway between the top of the tail cone and the nosecone.
b. Drill a hole through the airframe. 1/8” is plenty for a 54mm airframe and smaller.

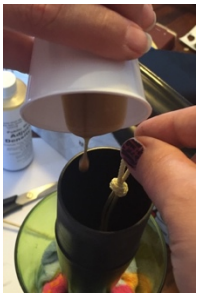
25) Completing the nosecone

The Kevlar harness is the simplest way to connect the nosecone to the shock cord. Two different options are available for the harness attachment.

a. Make a small y-harness using about 12” of ¼” Kevlar (same as the shock cord).
b. Fold it in half, tie a loop in the middle
c. Sand the surfaces you’ll be bonding the harness to
d. Epoxy the two ends of the harness 180° apart on the inside of the nosecone.
e. Set aside to cure

Another option for the Kevlar harness is to secure a loop of Kevlar into the tip of the nosecone.

a. Cut a length of ¼” Kevlar long enough to make a loop that reaches from the bottom to the top of the nosecone (approximately 26”).
b. Tie an overhand knot with both ends of the Kevlar; slip a ¼-20 nut on top of the knot
c. Drop the knot and nut into the tip of the of the nosecone
d. Mix a small batch of the 2-part foam and pour it into the tip over the knot and nut. If you don’t have 2-part foam, you can use whatever epoxy you have on-hand, but you’ll want to be sure to sand the inside tip of the nosecone and prep for bonding.
e. Set aside to cure




26) Release airframe's shock cord/y-harness

Pull shock cord/y-harness through the top of the airframe. Cover the shock cord that could potentially make contact with the top of the airframe with electrical tape or duct tape to protect from fraying.

27) Cut approximately 10 feet of ¼" Kevlar to serve as the shock cord that connects the nose cone to the airframe.
28) Tie loops with a bowline knot at both ends of the shock cord
29) Attach shockcord to nosecone's y-harness using 1/8" quick links
30) Attach Nomex (optional)

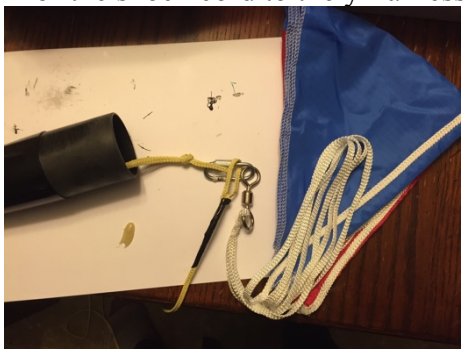
If you're using a Nomex chute protector, attach it to the 1/8" quick link at the top of the airframe. If you're not using Nomex, be sure to use plenty recovery wadding (commonly known as "Dog Barf" …fireproof blow-in insulation that is available at hardware stores in bales) to protect your parachute and shock cord.

31) Attach parachute

The parachute can be attached using a swivel or a quick link near the nosecone. Having the nomex at the other end of the shock cord ensure that the parachute doesn't get tangled in the shroud lines while coming down.

a. Attach the swivel about 1 foot down from the nosecone using a bowline knot or
b. Attach the parachute to the nosecone using the same 1/8" quick link as used to attach the nosecone to the shock cord

32) Attach the bottom of the shock cord to the y-harness extending from the airframe using a 1/8" quick link




33) Spray Paint with clear coat or apply a finishing agent to give the rocket shine