Wildman Rocketry

Wildman Mini and Wildman Sport Build Instructions

Congratulations on buying a Wildman kit! You've just purchased one of the finest fiberglass rocketry kits on the market. Follow the build instructions below to make sure that your Wildman Rocket lasts flight after flight. Build it right, and you can be sure that the rocket will take any motor you can cram in the tailpipe.

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.

Your kit may vary slightly, depending on which kit you have purchased, but the build steps and methods should be the same. Enjoy the process, and we're always here if you need help! See you at the launch field!

Parts list:

Kit:	*Necessary Parts:*	*Optional Parts:*	*Tools to have on-hand:*
Nosecone	Kevlar shock cord	Motor Retainer	Cups for mixing Epoxy
Body Tube	Parachute	Nomex® Chute-Protector	Popsicle sticks
Centering Rings	Epoxy	Eyebolt/U-Bolt	Sandpaper
Motor Mount Tube	Rail Buttons	Stainless Steel Quicklinks	File
Fins		CA (superglue)	Masking Tape
		2-Part Foam	Drill
			Dremel tool

CONTENTS

STEP 1: PREPARE ALL PARTS

1.1: Wash all fiberglass

1.1a) 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.

1.1a →

1.2: Sand surfaces to be bonded

1.2a) 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.

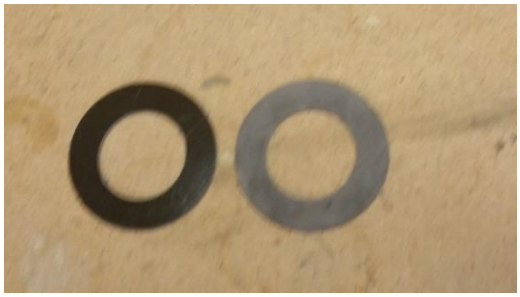
1.2b) The entire Motor Mount Tube (MMT) should be sanded since the fins, harness, centering rings, and internal fillets will all be bonded to it.

1.2b →

1.2c) The centering rings should be sanded on both sides since internal fillets will bond to them.

1.2d) 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 ½" or so on both sides of the fin which will be bonded with the internal and external fillets.

1.2c →



1.2d →

1.2D) BEVEL FINS (OPTIONAL)

If you've purchased a kit that does not have beveled fins and you want to bevel them, 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.

1.2e) Since the external fillets will adhere to the airframe around the fin slots, now is the best time to sand around them easily. Sand about ½" on each side of the fin slot both on the outside and on the inside of the airframe. Again, use 60 or 80 grit sandpaper as this is for bonding purposes.

1.2e →

1.2f) Be sure to sand inside the BT and around the inside of the BT where the Centering Rings will bond

1.2f →

1.3: Dry-Fit all parts

1.3a) Now that all the bonding surfaces have been sanded, it's time to get everything ready for the build. 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 them 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. 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.

1.4: Mark line for Rail buttons and Vent Hole

1.4a) Now that all parts are sanded and ready, it's a great time to mark a line that you will use as reference later for Rail Buttons and a Vent Hole. Using a piece of angle-iron or even just a door jamb, mark a line in between two fin slots from the tail end of the body tube to at least 2/3 of the way up (all the way works, too). A silver permanent marker works well for this.

1.4a →

STEP 2: MOTOR MOUNT

The Motor Mount Tube (MMT) acts as the attachment point for the y-harness, the attachment point for the fins, and the motor mount. Be sure to build it well! The y-harness method shown here has flown in rockets small, large, and massive, and it will hold up for flight after flight. The y-harness will be the attachment point for your recover harness. For injected internal fillets, it's important to get the centering rings attached properly so they act as dams for the injected epoxy mixture.

2.1: Mark MMT for Fins

2.1a) You'll need to mark the location of the fins so that when you attach the shock cord/harness, you don't interfere with the fins bonding to the motor mount. Dry-ft the motor mount into the aft of the airframe and use a marker, pencil, or other implement to mark a line through the fin slots. You can use a razor to score a light line if you wish, or pull the tip out of a marker. Whatever you can get in the slot is good.

2.1b) Be sure to mark where the top of the fins will be because this will be the location of the top centering ring. You'll want to place the top CR just above that mark so that the fins seat on the top CR.

2.1a → 

2.1b → 

2.3: Prep Y-Harness

You can attach the single shock cord directly to the motor mount, or you can choose to make a "y-harness" that will be mounted on the motor mount, and a shock cord will attach to that.

2.3a) If you choose the 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 airframe and back down, with a little extra).

2.3b) Cut off the Kevlar and tie a loop (overhand knot) at the top so that you have a loop at the top of the airframe and two Kevlar leads that reach down to be epoxied onto the motor mount. When attaching this later, be sure that the loop is accessible at the top, either right at the top or protruding an inch or so.

2.3a→ 

2.3b → 

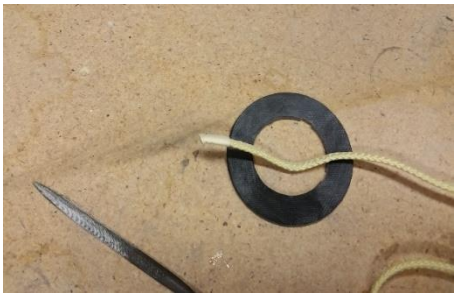
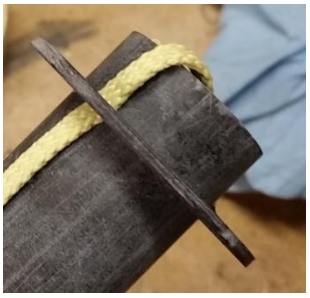
2.4: Notch top Centering Ring (CR)

The Top Centering Ring will seat over the harness, so you'll need to file notches so that the Kevlar strap can fit under the CR and onto the motor mount tube. You can do the notches 180° apart, but be careful to avoid interfering with fins later. You can also file notches 120° apart, leaving more room for fins.

2.4a) Lay the Kevlar strap over the CR and mark where you need to file

2.4b) File notches just big enough for the Kevlar.

2.4c) 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).

2.4a →  2.4b →  2.4c → 

2.5: Attach Top CR

With the Y-Harness looped through the Top CR, slide the Top CR into place.

2.5a) With the shock cord/harness in the notches (and extra stuffed into the MMT), place the top CR on the motor mount where it will go and use a drop or two of CA (superglue) to hold it in place (if you don't, the CR may move while epoxy sets in the next step)

2.5b) Once the CA dries, mix up a small batch of epoxy and epoxy the top CR in place by putting epoxy on the top of the ring against the Motor Mount Tube. Do not put epoxy on the under side as that would interfere with the fins later. Also, be careful not to get any epoxy on the shock cord; you'll want to be able to slide that around to the right length in the next step.

2.5c → Set the assembly aside until the epoxy is cured.

2.5a →  2.5b → 

2.6: Attach Y-Harness

2.6a) Make sure that the length of shock cord being mounted to the motor mount is long enough (3-5 inches). If using a y-harness, be sure that the knot at the top pulls evenly on both attachment points and reaches the top of the airframe so you have access to it later. Once the length is just right, tape the Kevlar strap in place using masking tape. You can do this on the top of the inside of the MMT to avoid any issues with the epoxy process in the next step.

2.6b) Use masking tape to set a boundary for the epoxy on the shock cord attachment point. This will prevent epoxy from running down the tube and interfering with fins later on.

2.6c) 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 below the top CR.

2.6b →  2.6c → 

2.6d) After the epoxy sets up a little (and before it cures completely!), pull the tape off.

2.6e) Set aside and let the epoxy set. (If using a y-harness, repeat for the second attachment)

2.6d → 

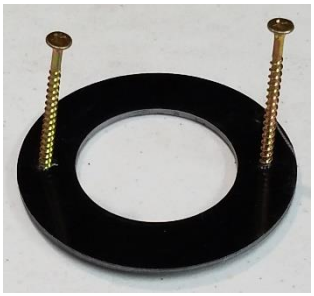
2.7: Aft Centering Ring

DO NOT attach bottom centering ring (Scotch Tape method/screws)

We're not going to attach the bottom centering ring yet. We'll use the aft-end of the rocket to make our internal fillets later. However, we'll need to be able to put it on, align the MMT, and remove it. You can either:

2.7a) Wrap a couple pieces of Scotch tape around it so you have something to tug on, or

2.7b) Drive two screws partly into the ring to hold it with, and they can be removed later.

2.7a →  2.7b → 

STEP 3: FINS

3:1: Insert motor mount

3.1a) The fins will be epoxied directly to the motor mount tube, so the first thing is to place the tube, with the bottom CR in place for proper fin placement. Stuff the shock cord into the top of the motor mount tube to keep it out of the way. 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.

3.1b) You'll also want to be sure that you leave enough motor mount tube on the aft end to accommodate a motor retainer if you have one. Once the fins have been attached, you will not be able to adjust the position of the motor mount tube.

3.1a →  3.1b → 

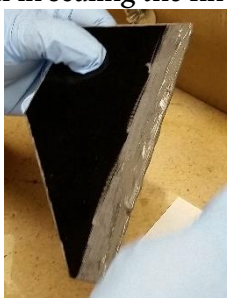
3.2: Prep Fins

3.2a) You should have already prepped the fins, but now is a good time to be sure enough surface area has been sanded for bonding. It's always easier to sand the fin when it's laying flat on a table... Be sure that the fin fits in the slot and that it seats all the way down on the motor mount tube.

3.3: Attach fins

3.3a) There's more than one way to attach the fins; some people do one at a time, some people do all fins at the same time 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*

3.3b) First, mix a batch of epoxy (JB Weld pictured) 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.

3.3b →   

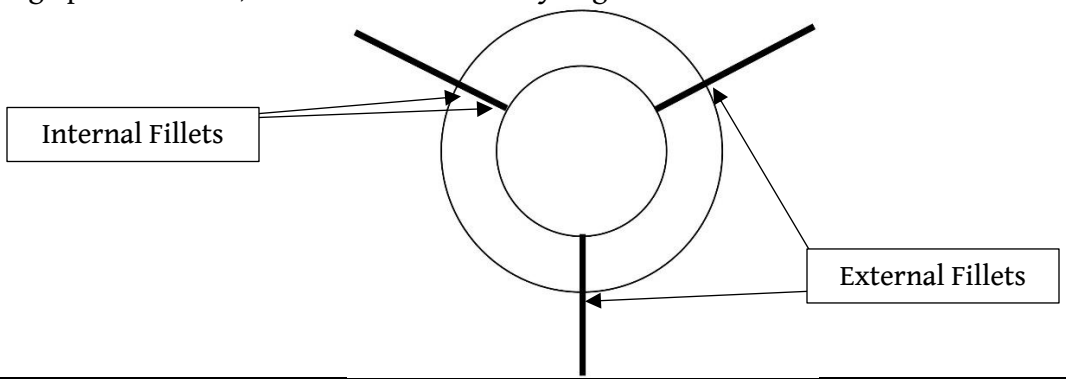
3.3c) Next, slide the fin into the slot and press it down against the motor mount tube. Be sure it is completely in place against the motor tube. If you're doing one fin at a time, let this set until the epoxy is completely cured. Using a fin alignment jig while the epoxy sets is important; you want to be sure that each fin stays aligned precisely and doesn't slide around later when you're attaching other fins.

3.3c → 

3.3d) 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!

STEP 4: 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.



Pour 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.

4.1a) First, pull the bottom centering ring out of the airframe so that you can access the space between the motor mount and airframe

4.1b) Next, get your rocket on a stand of some sort so that you're ready to pour epoxy as soon as it's mixed.

4.1c) Mix enough epoxy to pour (be sure to use an epoxy that flows well).

4.1d) Either pour carefully or use a syringe (ask at your local pharmacy for the ones they give away for kids medicine) to squirt the epoxy along the fin root. Tip the rocket forward so that the epoxy can flow evenly along the fillet.

4.1a →

4.1d →

4.1e) Set it aside for the epoxy to set, then rotate and do the next set.

4.1f) You can pour 2 fillets at a time, depending on your rocket. If you have 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.

4.1g) When pouring the internal fillets with the airframe, 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.

4.1h) 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 Airframe 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 airframe essentially become one unit.

4.1a) First, pull the bottom centering ring out of the airframe so that you can access the space between the motor mount and airframe.

4.1b) Stand your rocket vertically so you can pour the mixed foam.

4.1c) Mix enough foam for the entire aft-end. On a 54mm airframe with a 29mm mount, you'll need about 30ml total (10ml per space).

4.1d) 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.

4.1e) 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).

4.1f) Some foam will leak/expand out of little cracks/holes along the fin slots, and that's okay. It will also foam up out of the aft-end, and that's fine too. It's easily removed once it hardens, just do not touch it while it's expanding.

4.1g) 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 away.

4.1e →  4.1g → 

STEP 5 AFT CENTERING RING & MOTOR RETAINER

Now that your internal fillets are done, it's time to close up the aft-end of your rocket. First, you'll epoxy the aft centering ring in place, then, if you have one, you'll epoxy on the motor retainer. 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 aft centering ring until everything is ready for final placement. **If you're using a screw & washer-type motor retention, you'll need to attach your pem nuts or t-nuts to the aft centering ring prior to epoxying it in place**

5.1: Aft Centering Ring:

5.1a) Pull the tape off your aft centering ring (or remove screws).

5.1b) Be sure the sanded/scuffed side of the centering ring will go into the body tube (un-sanded side should face down)

5.1c) Mix a small batch of epoxy

5.1d) Smear the epoxy just on the inside of the body tube

5.1e) Slide the centering ring into place, twisting a bit as you go. This should pick up enough epoxy to form a bead above the ring and along the sides inside the rocket.

5.1d →  5.1e → 

5.2: Motor Retainers

The purpose of "Positive Motor Retention" (PMR) is to ensure that the motor stays in the motor mount and is not ejected when the ejection charge goes off. PMR is something on the aft end of the motor preventing it from sliding out. Friction fitting motors with masking tape is a tried and true method for most flights, but some clubs require a positive motor retention system. PMR is always a good idea anyway, and if you build it in place, then you know 100% that the motor is staying put in every flight. Screw and washer type retention has been used with complete success for many years and can be installed after you're done building, but can be cleaner and easier if you build it in as you go. Modern Screw-On retainers are a great alternative that yield a professional look. They work in two parts: one gets epoxied onto the aft-end of the motor mount, then a screw-on cap goes on over the motor to hold it in place.

SCREW & WASHER/MIRROR CLIP

5.2a) Prior to installing your aft centering ring, you need to install pem nuts or t-nuts (2 is plenty). Drill holes through the ring big enough for the screw and epoxy your pem nuts or t-nuts into place. Then install the aft centering ring as above.

5.2b) When you're ready to fly, place a washer or mirror clip on the screw, screw it down in place with a lip holding the motor in place.

5.2a →

5.2b →

SCREW-ON RETAINERS

5.2a) Once the aft centering ring is in place, be sure the bottom of the motor mount is plenty sanded/scuffed.

5.2b) Mix up a batch of epoxy (JB Weld® is strongly recommended in this application for its high heat resistance)

5.2c) Smear some epoxy on the motor mount tube and inside the motor retainer

5.2d) Slide the retainer in place, twisting as you go

5.2e) If any epoxy squeezes into the tube itself, be sure to wipe out the excess using a cloth dipped in denatured alcohol.

5.2f) Set the rocket aside and wait for the epoxy to cure.

5.2c →

5.2d →

STEP 6: 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.

6.1: Prep Fillet Area

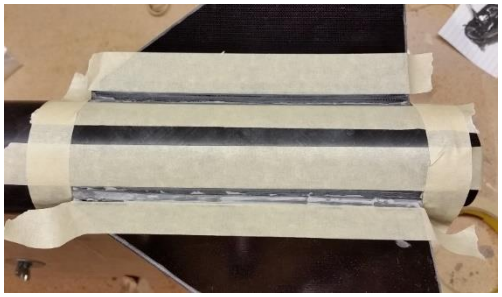
6.1a) First, sand the area to be bonded using 60 or 80 grit sandpaper. This is easily done by bending a piece of sandpaper (not folding), holding it in the corner and scuffing back and forth.

6.1b) Be sure to clean off all the dust. Using acetone on a cotton ball ensures that there is no leftover moisture when you pour the epoxy.

6.1c) Tape off the area of the fillet. You can mark the lines of the fillet by rubbing the fillet tool (I used a popsicle stick) 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.

6.1a →

6.1c →



6.2: Make the Fillet

6.2a) 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.

6.2b) Using some sort of fillet tool, "Pull" the fillet into shape. You can use a popsicle stick for a small fillet, a tongue depressor for a larger fillet, or even a small piece of ½" PVC pipe. Starting from one end of the fin, pull straight along the fillet without stopping, allowing the excess epoxy to flow out onto the tape

6.2a →

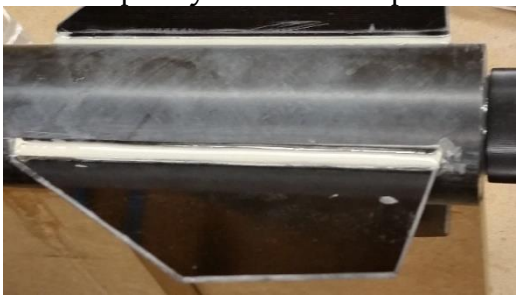
6.2b →

6.2c) 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.

6.2d) Set aside until the epoxy fillet cures completely. Rotate and repeat for each set of fins.

6.2c →

6.2d →



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. Or, you can let it set and sand it smooth in your paint preparation.

STEP 7: NOSECONE

Here again, there's a bunch of ways to mount a harness to the nosecone, and it all depends on what you want to do with your rocket. If you want a clean look using the provided bulkhead, mount an eyebolt or u-bolt on the bulkhead and mount the bulkhead to the nosecone. If you want to keep the nosecone empty so you can cram longer motors in the aft end and cram your 'chute in the nosecone, the Kevlar harness is a great way to go. If you plan on using the nosecone as an av-bay, you'll need a few extra parts, but it can be done pretty easily. **You'll want to be sure you don't need noseweight to properly balance your rocket before sealing up the nosecone in this step. Look in Step 8 for directions on how to do this**

7.1: Attach the Nosecone Coupler

If your kit comes with a nosecone that has a built-in should, skip to step 7.2. If you have a kit with a nosecone and NC coupler separate, the first step is to attach the coupler to the nosecone. You'll want to leave about 2" to 3" of coupler sticking out of the nosecone to use when inserting the NC into the body of the rocket.

7.1a) Measure your coupler in the nosecone, draw a line around the coupler to mark where the epoxy will go.

7.1b) Remove the coupler and scuff the inside of the nosecone and the outside of the coupler

7.1a →

7.1b →

7.1c) Spread epoxy on the inside of the nosecone.

7.1d) Insert the coupler up to your pre-marked line while twisting it to get maximum coverage. Once you've reached the line, continue twisting to insure maximum epoxy coverage.

7.1e) Set it aside to cure **be careful not to stand the nosecone on the coupler as it may slide while curing, leaving not enough coupler to use when assembling the rocket for flight.

7.2: NC Attachment Point

You'll need some way to attach the nosecone to the recovery harness in the rocket itself. Below, there are two methods for doing this. Read both options before deciding which one you will use.

KEVLAR HARNESS IN THE NOSECONE

The Kevlar harness is the simplest way to connect the nosecone to the shock cord. This method allows you to add noseweight later, if necessary, and it keeps the nosecone empty for longer, larger motors. Secure a loop of Kevlar into the tip of the nosecone, as per the directions below…

7.2a) Cut a length of ¼" Kevlar long enough to make a loop that reaches from the bottom to the top of the nosecone.

7.2b) Tie an overhand knot, slip a ¼-20 nut on the knot

7.2c) Drop the knot and nut into the tip of the of the nosecone

7.2d) Mix a small batch of the 2-part foam and pour it into the tip over the knot and nosecone. 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.

7.2e) Set aside to cure

Kevlar in the NC tip →

BULKHEAD AND EYEBOLT/U-BOLT IN THE NOSECONE

An Eyebolt or U-Bolt is a little beefier a connection, but it closes off the nosecone. That eliminates the possibility of stuffing a parachute or anything else into the nosecone if the need arises.

7.2a) Drill a hole or holes in the bulkhead for the eyebolt or u-bolt.

7.2b) Place your eyebolt/u-bolt into the bulkhead and tighten with a locking nut. If you want, feel free to put some epoxy on the thread above the nut to be sure it won't ever come undone (though a locking nut is really plenty safe)

7.2c) Sand/scuff the top of the bulkhead along the edges for bonding to the nosecone. Also sand/scuff the inside edges of the nosecone for bonding.

7.2d) Mix a batch of epoxy and smear it around the inside edge of the nosecone.

7.2e) Place the bulkhead into the nosecone and twist to be sure that epoxy spreads around the entire edge of the bulkhead.

7.2f) Set aside to cure. I set mine on paper cups so that the bulkhead stayed in place while the epoxy cured.

7.2c → 

7.2d → 

7.2e → 

STEP 8: AIRFRAME FINISHES

8.1: Rail Buttons

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.

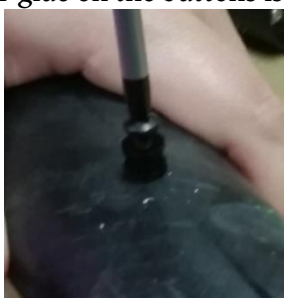
8.1a) Locate the line down the center of the airframe that you marked back in Step 1.

8.1b) Locate the two places where you will place your rail buttons. The aft rail button should be located just above the aft centering ring. Forward rail button placement depends on your specific kit. You'll want to place it far enough forward that it holds the rocket securely straight. Anywhere from 5 to 8 inches ahead of the aft is enough and probably just right. Depending on your kit, it might be a good idea to place the forward rail button at the CP (See balancing, below) as an easy reminder of where the CP is.

8.1c) 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.

8.1d) Screw the buttons into the holes, allow them to self-tap the holes. You'll be removing the buttons for paint, so do not epoxy or glue them in. Even after paint, epoxy or glue on the buttons is not necessary for rail buttons.

8.1c → 

8.1d → 

8.2: Vent Hole

A vent hole is necessary to prevent air-pressured induced separation of the nosecone. If the internal air pressure of the airframe is at ground level then launched rapidly into the air, the difference in air pressure could be enough to eject the nosecone at a less than opportune moment...

8.1a) Along the same line as your rail buttons, measure halfway up the airframe from the top centering ring to the nosecone.

8.1b) Drill a hole through the airframe. 1/8" is plenty for a 54mm airframe and smaller.

8.3: Balancing the rocket properly

In order to stay stable in flight, a rocket needs to have a proper balance between the Center of Pressure (CP) and Center of Gravity (CG). When fully loaded as it will be in flight, the rocket's CG should be 1 Caliber in front of the CP. 1 Caliber is one Body Tube width. For example, if the body tube of your rocket is 2.1" wide, then the CG should be 2.1" forward of the CP when the rocket is fully loaded.

8.3a) Locate the Center of Pressure of your rocket design. This can be done with a rocket simulation software. OpenRocket is a free simulation software using Flash and can help you locate the CP of your rocket.

8.3b) Load your rocket with all the parts as it will be when in flight. If you have the largest motor you'll plan on flying, load it as well. If not, find the weight of that motor using the manufacturer's website and load an equal amount of weight in the motor mount (BBs in a baggie or sock works just fine).

8.3c) Find the Center of Gravity of your fully loaded rocket by finding its balance point.

8.3d) If the CG is at least 1 caliber forward of the CP, you're good to go. If not, add weight to the nosecone until you find how much you'll need to make the rocket stable.

8.3e) **Before securing the noseweight, be sure you know how you want to do the nosecone in the next step** Once you've found how much weight you'll need, find a way to secure it in the nosecone. Often, rocketeers use lead BBs mixed with epoxy and poured into the tip of the nosecone. You can also use 2-part foam poured over the BBs.

STEP 9: PAINT

Painting fiberglass rockets is not as necessary as it is with cardboard or paper tubes. Fiberglass doesn't need to be sealed, though paint is always a nice touch. One option is to simply apply decals to the fiberglass tube. Many rocketeers simply clear-coat their rockets for a little shine. We'll not delve into the finer details of how to paint a rocket here; there are as many ideas as there are stars in the sky... But, a few tips are important to keep in mind when painting your fiberglass rocket.

9.1: Remove Rail Buttons

Since you've simply threaded the rail buttons directly into the airframe, they should be easy to remove. While you're painting, some paint will get into those holes, and that's fine. After painting, simply screw the buttons back into the holes, and let them self-thread the painted holes. You'll find that the painted hole will "grab" the screw quite tightly.

9.2: Mark CP location

Find the Center of Pressure on your rocket using simulator software or the appropriate formulas. In your paint scheme, you'll want to include something that clearly marks the CP or the minimum CG location. That way, no matter what motor you use or what other gadgets you end up adding, you'll always know, on-site, whether your rocket will be stable.

9.3: Paint

Painting fiberglass is really simple. Before you start painting, a light sanding will help the primer and/or paint adhere better. Use 400 grit or higher sandpaper, and lightly sand the entire surface to be painted. Then, before painting, be sure to clean off all the dust using a slightly damp rag or paper towel. Using acetone for this ensures that any residue or oils will also be removed for the best possible finish.

Another option is to just use Enamel Gloss Clear Coat paint on the bare fiberglass tubes; it really brings out the shine/candy-apple color of the red tubing. If you want to even out the black for this option, you can just use some black primer before using clear coat over the whole thing. Just a basic enamel flat black primer, wait 30 minutes, then shoot the clear coat, and BAM, done.

STEP 10: PREP FOR FLIGHT

10.1: Attach shockcord to y-harness

If you've used a y-harness, you'll need to attach the shockcord to it now. I use a bowline knot to create a loop-to-loop connection. Then, just for added security, I wrap duct tape around the connection. The duct tape ensures that the loops don't come undone (they really won't anyway), but also to protects the shockcord as it rubs against the top of the airframe while descending on the parachute. In normal flights, the shockcord will rub on the airframe, and over enough time will fray enough to be cut. Using duct tape prevents this and you can replace the duct tape when it starts to get too worn.

10.2: Attach Nomex

If you're using a Nomex chute protector, tie it a couple feet down from where your parachute will be attached. I simply thread it on the shockcord and tie an overhand knot. Nothing fancy needed. Tying it a couple feet down from the parachute ensures that it doesn't get tangled in the shroud lines while coming down. 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.

10.3: Attach parachute

My favorite method of attaching the parachute is to use a swivel. I attach the swivel about 1 foot down from the nosecone using a bowline knot. Many people simply attach the parachute to the nosecone using a quicklink, making it easy to exchange parachutes between rockets.

10.4: Attach shockcord to nosecone

You can attach the shockcord to the nosecone using the same bowline knot used to attach it to the y-harness, or simply tie a bowline knot and leave a small loop. Then, attach the parachute to the nosecone using a quicklink. This has the benefit of allowing you to attach the parachute to the same quicklink, if you choose.

10.5: Burrito wrap parachute

If you're using a Nomex chute protector, you'll want to wrap the parachute in a "burrito" before placing it in the airframe. First, fold and roll the parachute properly. Next, place the rolled chute at the "top" corner of the Nomex. Then, roll the Nomex over. Then fold in the sides. Finally, finish rolling the burrito, and you'll have a nice little bundle.

10.6: Z-wrap extra shock cord

For all extra shock cord, z-fold it by going back and forth in one hand. DO NOT wrap it around your hand as this will increase the chances that the shockcord will knot in deployment and prevent a clean recovery deployment.

10.7: Nosecone on body tube

Load your shockcord and parachute into the airframe, and now you're ready to place the nosecone. Your nosecone should be on tight enough so that when you hold the rocket by the nosecone, the body tube does not slide off, but not so tight that the ejection charge won't separate. A good test is to hold the rocket by the nosecone and shake it. If the body tube separates with some vigorous shaking, you're good to fly. If not, it may be too tight. You can use masking tape to get the fit just right. If needed, wrap a piece all the way around the nosecone shoulder. Or, just add a small strip vertically on the nosecone shoulder and test. If you need more, add another strip just to the side of the first one and test again. Keep repeating until you have the right tightness. When you bring your rocket to the RSO, you can ask him or her to double check the fit.

10.8: Insert motor

Your rocket is ready... If you've built it well, go Wild and stuff the biggest motor you can and watch it fly!

10.9: FLY!