

Punisher – Build Instructions

Contents:

- 3" Hi Temp Von Karmon polycarbonate NC with phenolic tip [threaded for 1/4in eyebolt]
- 33"x3" thin wall spiral wound G-12 airframe
- 1" vent band
- 2 black anodized Aluminum bulk plates
- 6" coupler/av-bay
- 3 high performance super beveled 1/8in fins
- Thin wall 54mm motor mount
- 2 Centering Rings



Extra components you should have on-hand before building:

- rail buttons [1010]
- 3ft of Kevlar strap for Y-harness to motor mount
- 30 or 40 in Recon Recovery chute [soft or hard surface landings] or Top flight 45in chute
- 12in nomex chute protector.
- 1/4in kevlar shock cord (15ft [5yds] for main) (24ft [8yds] for apogee)
- Aero-Pac 54 motor retainer

Recovery Y-harness assembly.

- 1) Use approximately 3ft of Kevlar 1in. wide strap, glued to both sides of MM tube for recovery attachment point. Only need it long enough to just protrude out front end of tube. This doubles the strap width area where it hits top of tube and prevents zippers.
- 2) Lay across CR [centering ring] and mark for filing small notches so the CR's will go over Kevlar when installing on MM tube.
- 3) Tip: Using a silver sharpie for marking will simplify this for entire build.



- 4) File, dremel, or sand, small thin notches just deep enough for whatever size Kevlar you use....will provide clearance.



- 5) Sand entire MM tube and One side of each CR in preparation for glue.
- 6) Left/bottom end, may need a hard sanding for the motor retainer to fit.



Motor Retainer

- 1) Attach motor retention, by first test fitting and sanding.
- 2) Put thin layer of epoxy on both retainer & tube.
- 3) Use a twisting motion when installing.



- 4) Always wipe of any excess glue from interior with denatured alcohol, then drop a motor in, making sure of a good fit....before glue dries.
- 5) Set aside for epoxy to cure.



- 6) Before we forget [like I usually do] 2 must do's before going any further while glue cures:
 - a. 1st slide nose cone coupler/av-bay into fin slot end of airframe, and use the slots to mark for 3 equal points around the coupler. These will be transferred from coupler to vent band for altimeter breather hole & on NC for shear pin locations later.



- b. 2nd. Mark a straight line between 2 slots for mounting rail buttons later.

Fins

- 1) Sand inside edge of tube on slot end where CR will be glued.



- 2) Sand each side of all 3 slots approx. 3/4 in. out from slot. [for external fillet adhesion]
- 3) Wrap and tape sandpaper to dowel...PVC..etc to reach inside and sand area where forward CR will be glued



- 4) Sand and fit fins into each slot, sand slots also if needed.
- 5) Recommended to number fins and slots, as it will always go better when time to glue.
- 6) Sand up from root edge of fins approx. 1 1/2 in. for internal & external fillet adhesion.

...Now that epoxy on retainer has cured...

- 7) Slide CR without notches down flush with motor retainer. A drop or 2 of CA will hold it in place, just tack it on.
- 8) Place top CR on. Now a dry fit is in order...
- 9) Slide the assembly into airframe so you can mark MM tube through the slots. I find by pulling the tip out of the sharpie, it is now long enough & will reach down to motor tube and you can mark slot position onto it. Put your tip back on the sharpie, done.... or use whatever method you have to mark the tubes.
- 10) Remove assembly for next step.

- 11) Since I will be injecting the internal fillets, I need a tight fit between fin & MM tube as well as fin front and back edge with the CR's. I don't want epoxy leaking under fin or around the front/back between fin and CR edge. Soooo....
- 12) You must also be sure the Y-harness when glued on the MM tube does not interfere with the fin positions. Slide the notched CR over the Kevlar strap. By putting the excess strap inside the MM tube it will be out of the way, you can just fold over the ends leaving approx. 4in exposed. Use the slot lines to avoid getting the Kevlar in the fin positions.
- 13) Fit the numbered fins into corresponding numbered fin line/slot positions all 3 while pressing down on the CR to hold in place.
- 14) When satisfied a drop or 2 of CA will hold the CR in position.



- 15) Remove fins and place assembly back into airframe, insert fins through slots, making sure all fits well. If not adjust for correct fit. This is why you just tack stuff at first!
- 16) When happy with final fit remove fins & assembly to glue the strap on.
- 17) I put tape over the line to keep glue off.
- 18) Make sure you check both strap positions/sides so they do not interfere with fin placement.



- 19) Put a good dose of epoxy on MM tube press strap into it and cover/encapsulate strap with more epoxy.
- 20) Do both of course...



- 21) Add a fillet to top of top CR while your at it. The bottom CR and inside of the top CR will get plenty of epoxy on them during injection!
- 22) Set aside to fully cure.
- 23) After the MM assembly has cured, Insert into fin can, making sure # fins & #slots align. Check to see that Y-harness is clear of slots.

24) Butter, or thin coat the root edge of all 3 fins with epoxy, and place into slots.



25) Align fins with your favorite method. I have visual jig I place tube on and align by sighting fins on lines jig.



26) To keep fins from slipping out of position, I apply 1 drop of CA to slot/fin joint, which locks it into position till epoxy cures.



27) Once the fins are cured..... Prepare for external fillets.

28) I use a 1in diameter section of PVC to smooth them, & also mark beforehand, where the tape will go to keep glue off tube.



29) Simply coat the edge with Sharpie then rub in V-groove to mark , carbon paper etc.



30) Then drill 1 hole centered on each side of fin, close to slot, for injecting epoxy. Close to fin so external fillet will cover hole & only large enough to fit whatever size syringe you are using into hole.

31) Tape to the lines previously drawn. You can see the tool fits right to the edge, so there will be no lip of glue when tape removed. If it does not, remove and re-tape to correct. I use size ...1in. tool, to get the correct fillet size....approx. 6% of the root length of fin.



32) Tape bottom fin joints to prevent glue leaking out if during injection of top fins a leak under fins occurs.



Proper amount of glue for injection of internal fillets is approx. 9ml per fin.

1 pump of West resin is 15ml.

1 pump of West hardener is 3ml.

So 1 pump of each works out perfect for this build18ml.... any more and glue will come out the injection hole or leak around front of fin/cr joint.

Add about a dime size of chopped carbon if you have it and mix till all the bundles break up. [or kevlar pulp, milled fiberglass]



33) I marked my syringe for 15ml and 7.5ml with sharpie [ahead of time by filling with water measured, and marking]

- 34) I cut tip at angle and to enlarge hole to make filling easier.
35) Inject half into each fin. Refill with remaining and inject half into each again.



- 36) Decided to go back basics with external fillets by using my original method....West epoxy with 406 filler [colloidal silica].
37) Use the same amount as in internal fillets 15ml resin & 3ml hardener [1 pump of each] and added 406 until consistency was stiff like peanut butter



- 38) I added some black tint that came with RocketPoxy....wow ...worked great. Black fillets. Painting them here, but I know it will work for future.



- 39) When pulling fillets smooth, decided to run fillet around rear of fin.
40) Pulled tape about 10 minutes after smoothing fillets



Airframe finishes:

- 1) Vent hole to relieve air pressure from airframe is place 11in. from top of tube, 1/8in. hole.
- 2) Place on rear, above the rail buttons to keep from interfering with vinyl.



- 3) 1010 rail-buttons installed by drilling 1/8 in. holes and self-tapping the screws into airframe.
- 4) Place button by rear fin & other a tad above front, to miss the CR.



Prepping to fly:

- 1) 25 ft of cord for fin can/apogee side....15ft of cord for main/nose cone side...all 1/4 in. tubular Kevlar.
- 2) One end tied to Y-harness in fin can...other end utilizes quick link for av-bay. Main tied to NC harness & quick link to av-bay.
- 3) Main [52in X-chute, Topflight a standard 45 would also work] is attaches via quick link, to loop tied in shockcord 2 ft from front. Folded burrito style in a 12in square nomex. I could not get a 40 in.Recon to fit, so went with above.
- 4) To insure main does NOT get stuck in NC, be sure to place all shock cord in FRONT of chute. This will help "pull" chute out of NC.
- 5) Insert the folded chute into NC with closed end facing ejection charge, thus preventing burns to chute. Insert shear pins & done.



WORD OF CAUTION:

There is a lip on inside of NC, be sure the cord, or edge of nomex does not get caught on this lip between it and coupler, if it does the coupler will not seat tight.

- 6) Highly recommended a 12-15in drogue is used for apogee! This will prevent the rocket from "streamlining" during descent from apogee & keep the main/NC above the fin can . The fin can is so

large in comparison to the payload [just NC] it "may" try to stabilize and come down ballistic dragging the NC at a very high rate of speed, with violent main deploy and very bad results! By using the small drogue, the fin can drops perfectly vertical below the NC/chute and will land much closer to the pad. A regular DD rocket, the payload tube/NC will create drag and keep a drogue less rocket from stabilizing during descent.

- 7) Fin can side has a 12in drogue wrapped burrito style in a 9x9 nomex attached 3 feet below the ac-bay/NC, leaving enough room between for my tracker to be taped to shock cord.
 - a. Word on that: Comm_Spec transmitter should have the battery taped in before closing the lid. One wrap will suffice & keep battery from losing contact in case of overzealous ejection charge.



- b. Transmitter has antenna coming out of box flush on one side. This side should be against shock cord when taping to it.
 - c. Wrap transmitter entirely to cord, but leave antenna wire free. I use electrical tape...NEVER.....NEVER...EVER use masking tape of ANY kind!



- 8) I fold and pack shock cord into fin can, followed by nomex/drogue with tracker in last. Last in.....first out. You will notice a jump in signal when apogee happens, a plus when flying high enough you cannot see the event. Rather than stuffing in tracker & antenna, I gently fold or loop the wire, so it is above everything with less chance of becoming tangled.



- 9) I used 1 gram BP in nose for main & 1.4 for apogee.