PML G10 FINS FAQ

Fins

Material and Usage

- G10 is a highly compressed fiberglass laminate in a high-temp epoxy resin. It looks very similar to computer circuit board material. It is extremely tough, waterproof, and solvent-proof. It is very rigid, yet has just enough flex to keep it from snapping under most loads. When scuffed with sandpaper, epoxy bonds readily to it, and primers and paints adhere well to it too. Fins can be made much thinner (much less drag) when made of G10, and still be stronger than most other materials, especially wood. It is a very consistent material and does not have any of the hidden structural flaws that wood may have.
- PML was the first to use G10 fiberglass for fin material. G10 was exclusive to PML for many years, though now other manufacturers have recognized the benefits and offer it as well.
- G10 is used on <u>every</u> PML kit. Most other manufacturers use wood, especially in larger sizes.
- All PML kits except minimum diameter use through-the-wall-to-the-motor-mount fin mounting design for strength. Minimum diameter kits use dado slots in the body tube, with fiberglass reinforcing patches for the fin-to-tube joints. (**Dado** – A groove or "channel" that does not go all the way through a tube. Used in minimum-diameter kits for fin mounting; also used for some canard-type fins.)

Building/Construction

- G10 is sanded most easily using 80-120 grit cloth-backed aluminum oxide sandpaper.
- Scuff all areas where epoxy will be with 80-120 grit sandpaper. Use 220 or 320 on fin surfaces that will be painted.
- G-10 is extremely abrasive! Do not try to cut it with common shop tools, as it will damage or destroy most common blades very quickly. The cost of having PML make your G-10 fins for you on custom jobs is probably cheaper than buying the tools that will allow you to cut the G-10 yourself.
- Fins leading/trailing edges do not need to be shaped. Simply lightly sand the edges to remove any manufacturing burrs. If you do choose to shape the fin edges, protect your power tools from the abrasive sanding dust, and wear a dust mask!

Mounting

- Be sure to apply epoxy fillets to the fins at all three of the following areas: Motor Mount, inside airframe where fin passes through slot, outside airframe/fin joint.
- People have asked how to make internal fillets to the fins deep up into the airframe. One technique we've had luck with is to use a piece of 1/4", 3/8", or 1/2" dowel as appropriate. Mix your epoxy and "load up" the end of the dowel with a blob of epoxy,

then stick the dowel into the airframe and onto the fin joint you're working on. After depositing enough epoxy in this fashion, you can then pull the dowel toward you, making a fillet with the "fingertip-shaped" round profile of the dowel. It may be beneficial to use masking tape to cover the inside of the bottom of the airframe and the outside of the motor mount tubing while applying the epoxy inside. This will make it easy to peel off the tape to remove any epoxy drips that may get on the airframe and/or MMT and hinder you from installing the lower centering ring when your internal fillet work is done. Another easy and strong option is to use our Two-Part Expanding Foam available on the Adhesives page of the webstore. No internal fillets are needed! See the PDF on the Adhesives page for details on using the foam.

- Some customers are concerned that the small canard fins at the top of the Bullpuppy kit appear too long for the slot. This slight over-length is intentional. It would be difficult to fill in the slot and make it look good if the fin were too short, so we make them a touch long to ensure that will never happen. Go ahead and mount them, then when the epoxy has cured use sandpaper or a small file to knock them back flush with the top of the airframe.
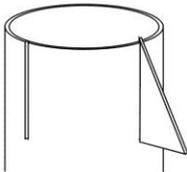
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- Customers sometimes ask: "Is it OK to put the launch lug in the corner of a fin root and the main body? The instructions say to put it in-between two fins, but it would produce less drag near a fin root and would be stronger also." This can be done if you're careful, but by putting the lug at the fin root, you limit the size of the fillet. If you make the fillet too big, the epoxy will block the ends of the lug. Also, it just makes it harder to sand that area of the rocket while painting.
- One customer asked: "…and the upper fins have some small amount of twist in them." All flat stock materials are warped to some degree (and I mean ALL except glass as in window pane and stone) and G-10 is no exception. At PML we know how to cut the sheet so as to minimize the warpage.

Fin Tolerances

- Variations in G-10 thickness: +0.012" / -0.003" (PML sends back to manufacturer any G-10 with greater variations.) A very small degree of warpage is common with G-10 (but nowhere near the degree of warpage in any wood product) and does not adversely affect the aerodynamics of the rocket.
- Fin dimension tolerance (stock and custom) ± 0.050. Matched fin sets accuracy ± 0.010 (FYI: a human hair is about 0.004).

Custom Fins

- You **MUST** use the custom fin template downloadable on either the Custom Work or Fins page of our website for a custom fin order. Be sure to fill it out completely to avoid delays.
- Minimum custom fin size is 2" by 1", maximum size is 48" by 36".

Kit Strengthening

As mentioned on the first page of the Motor Recommendations Chart on the Specs Page of the website, chart cells are highlighted for kit/motor combinations that require strengthening. We recommend the following changes for strengthening:

- Fully-glassed airframe, which requires phenolic as a starting point, not QT. **You must special-order your kit with phenolic as all kits 3.9" and under (except Nimbus) come standard with QT.**
- Thicker fins (0.063" should go to 0.093", 0.093" should go to 0.125")
- Fin-to-airframe joints should be glassed
- 30-minute epoxy should be used throughout the build.
- Some customers have asked if they can "double-up" or "sandwich" two pieces of G10 to create a super-thick fin for very high impulse flights. We don't recommend it; at high speed airflow can split them.