PEAK OF FLIGHT NEWSLETTER

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MAKING DURABLE CURVED FINS

& TIM'S MESSY DESK

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PEAK OF FLIGHT

Making Durable Curved Fins

By Josh Frizzell

Applications for Scale Tube-Launched Military Rockets

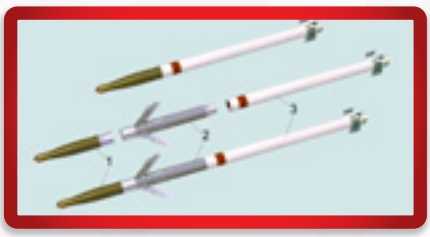
1 Introduction

Military rockets and missiles offer loads of opportunities for scale model rocket building. Many military rockets and missiles are launched from a tube that can be mounted on a vehicle or aircraft or even held by the user with a rocket or missile that can be fired from the user's shoulder. A design challenge for tube-launched weapons is that the fins that provide flight stability extend outward from the rocket's airframe and prevent the rocket from fitting neatly and compactly into the smallest tube possible.

Therefore, many tube-launched rockets have fins that fold in toward the airframe to give the packaged weapon a condensed configuration for storage and portability.

Some tube-launched rockets have flat, linear fins, like most model rocket designs, that fold in to fit the weapon into a launch tube and extend straight out from the rocket's body tube after launch. An example is the shoulder-fired Javelin anti-tank missile that has been highlighted extensively in world news in recent months.

Another design solution for a tube-launched rocket is to implement fins that have a curved shape that can conform to the curved outer diameter of the rocket's body tube while stowed in the launch tube and fold outward at launch. Examples include the Hydra 70 folding fin rocket or its precision-guided variants (for example, the Advanced Precision Kill Weapon System [APKWS]) used by the United States and allies.



Advanced Precision Kill Weapon System Source: Vslv - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=117883154

At 2.75 inches in diameter, the Hydra 70 (https://en.wikipedia.org/wiki/Hydra_70) could be a compelling full-scale model rocket project. However, larger folding-fin rockets exist and are in active military service. For instance, the rockets launched from platforms like the Guided Multiple Launch Rocket System (GMLRS) or the High-Mobility Rocket Artillery System (HIMARS) use such a fin design. These systems can deploy a variety of rocket configurations for various missions. Rocket variants include the M30, M31, inert training rounds, and others.

HIMARS ROCKET - SOURCE US ARMY

The HIMARS system, in particular, has also been the subject of many media headlines lately.

The curved fins on such rockets are not unlike tube fin designs seen on some model rockets (Figure 1), but fins on tube-launched rockets do not have the full circumference of the tube that comprises the fins like those found on tube fin model rockets.

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FIGURE 1: EXAMPLE ROCKET WITH TUBE FINS.

The lack of the full circumference of the tube that forms the curved fin on tube-launched rockets presents a challenge for the scale model rocket builder. Without its full circumference, a typical cardboard model rocket tube loses much of its rigidity. A partial circumference tube used as a fin on a model rocket would become unacceptably flimsy.

Fabricating the fins from another more rigid material, however, can result in curved fins with the strength and durability to be viable for model rocketry. In this article, I will describe a process that I used to create durable, rigid curved fins from fiberglass for use on a semi-scale M31 HIMARS rocket.

As *Peak of Flight Newsletter* author Tony Smith pointed out in his recent article on performing repairs on fiberglass rockets, many rocketeers shy away from fiberglass believing it is overly difficult, complex, or expensive. While I will agree that scratch building with fiberglass can be messy and comes with some nuances that must be done correctly, it should not be intimidating, and success can be achieved with minimal initial equipment, learning curve, or expense.

Since the fins described in this article are relatively small (with the rest of the project components comprised of parts that could be sourced off-the-shelf), they will require minimal cost and materials to get started and are therefore also a good way for someone to dip their toes in to fiberglass rocket scratch building. I'll include some intro pointers for getting started with fiberglass as we go along in this article. Additionally, the fins produced for this project have a relatively simple shape so the molds needed to create the fins can be made from simple, common materials.

2 Preparing a Mold

To create much of anything from fiberglass we will first need a mold. Fiberglass in its final form is a composite of fiberglass strands or cloth combined with a laminating epoxy. The epoxy in liquid form saturates the cloth, then

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cures to yield the hardened part in its final shape. Uncured fiberglass, composed of raw fiberglass cloth saturated with liquid laminating epoxy, has about as much structure as a wet rag. We will therefore need a means of keeping the fiberglass cloth in the desired shape while the epoxy cures.

For my airframe I used a 4-inch diameter upcycled cardboard shipping tube to create an approximately ½ semi-scale HIMARS rocket model. Of course, a purpose-made model rocket cardboard airframe tube (https://www.apogeerockets.com/Building_Supplies/Body_Tubes) would also work well, probably better.

FIGURE 2: PIECE OF AIRFRAME TUBE CUT TO CREATE THE CURVED SECTION OF THE FIN MOLDS.

Since the fins' curvature conforms to the body tube when they are folded up in their launch tube on the real rocket, pieces of the airframe itself make the perfect mold. To begin producing the mold, I cut a piece of my airframe tube to the desired root chord length of the fins, then cut the resulting piece of tube longitudinally into four equal sections (Figure 2). The resulting four pieces of airframe tube provided material for two sets of fins molds as described below.

Since the cardboard that makes up the curved part of the mold bends easily, I reinforced the curve of concave half of each mold set with ¼-inch thick plywood ribs to ensure that the mold would maintain the desired curvature once clamps were applied to cure the final fin part.

I began by tracing the inner diameter of the body tube onto a piece of plywood and using the cut body tube quarters to lay out the length of each rib (Figure 3).

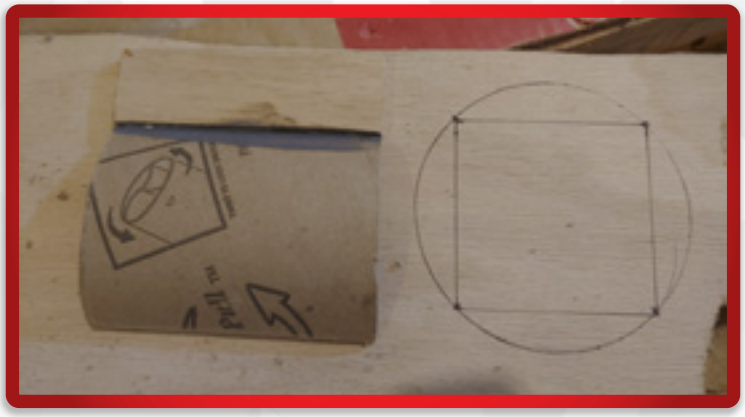

FIGURE 3: TRACING OUT PLYWOOD REINFORCEMENT RIBS BEFORE CUTTING.

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I then cut out each rib using a jigsaw. I also cut a small notch near the end of the flat side of each rib to make clamping easier during later steps. I affixed the ribs to the inner (concave) curved side of one curved cardboard piece per mold set using wood glue (Figure 4).

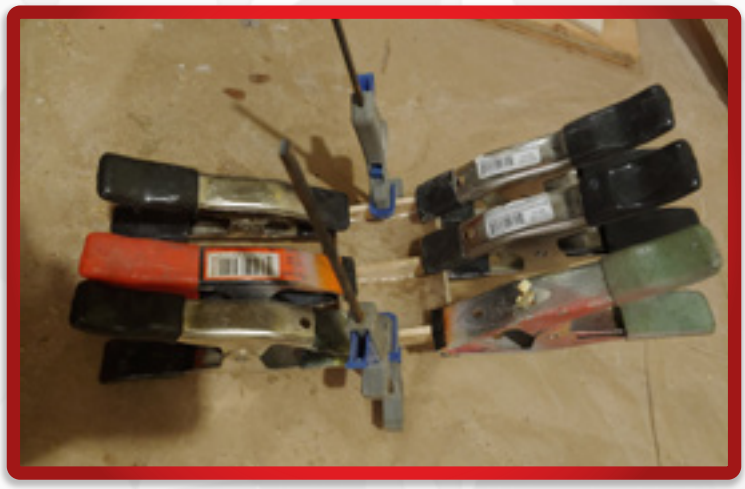

FIGURE 4: AFFIXING PLYWOOD RIBS TO THE CURVED SECTION OF THE MOLD.

The curved fin design presents another challenge when it comes time to mount the fins to the body tube. Since the fins do not join the airframe perpendicular to the body tube's surface like the more typical straight fins do, simply gluing the fin directly to the body tube's outer surface would likely result in an unacceptably weak joint. For this reason, I went with a through-the-wall fin tab design, with the fin tab and fin integrated as one single, solid piece for each fin.

To prepare the fin tab portion of the mold I calculated the distance from the outer diameter of my 38 millimeter (mm) motor mount tube and the inner diameter of my 4-inch airframe tube. Using this dimension and the root chord length of the fins, I cut a rectangular piece of ¼-inch plywood to serve as the fin tab part of the mold. Since the edge of the curved cardboard piece of the mold and the edge of the flat fin tab portion of the mold meet at approximately a 45-degree angle, I joined the two pieces with a viscous, slow-cure two-part epoxy (J.B. Weld) rather than trying to make the edges of the two parts butt up against each other. *{ed: The FixIt Epoxy clay would also work very well for this task - https://www.apogeerockets.com/Building-Supplies/Adhesives/FIXIT-Epoxy-Clay}*

I applied a generous bead of epoxy to both parts and joined them, laying on a piece of wax paper over a hard, flat surface so the part could be easily removed from the drying surface once the epoxy cured (Figure 5).

FIGURE 5: JOINING THE FIN TAB AND CURVED FIN SECTION OF THE MOLD WITH EPOXY.

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After the epoxy cured, I added additional epoxy to create a smooth filleted surface at the joint between the curved and flat surfaces. Additionally, I used thin cyanoacrylate (CA) glue to seal the edges of the mold (tube). The hard edges of the mold created by the cured CA glue will make trimming the partially cured fiberglass to shape easier in later steps.

With the general shape of the mold established, it was time to prepare the mold surface for laying up the fiberglass parts. The mold surface would need to be very smooth to result in a smooth surface in the finished part and to make sure the fully cured fins could be easily separated from the molds. At this stage, the mold had a number of imperfections to address, including a seam in the cardboard spiral wrap and a less than perfect epoxy joint between the fin and fin tab sections (Figure 6).

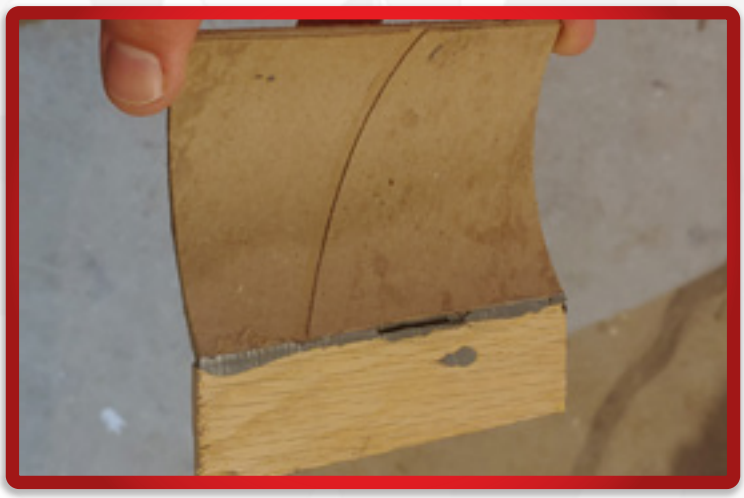

FIGURE 6: IMPERFECTIONS IN THE MOLD SURFACE, LATER ADDRESSED WITH ADDITIONAL EPOXY AND WOOD FILLER.

I added some additional J.B. Weld to smooth out the epoxy joint and filled the cardboard seam with wood filler. I then mixed a small batch of the laminating epoxy that I would later use to saturate the fiberglass used to create the fins. For this project I used Total Boat Traditional 5:1 resin with slow cure hardener laminating epoxy. I began the surface preparation by applying an even coat of laminating epoxy to cover the surfaces of the mold halves that would be in contact with the fins. After the laminating epoxy fully cured, I sanded the surface smooth using 220-grit sandpaper and removed the sanding dust using a damp shop towel.

A quick note on selecting laminating epoxy hardeners: a slow cure hardener will give more working time before the epoxy becomes too viscous to apply to the rocket. Furthermore, epoxies generally cure via an exothermic reaction (the epoxy releases heat as it cures), and the cure rate can be accelerated with the addition of heat. Therefore, a runaway reaction can occur in which epoxy gets dangerously hot and cures rather suddenly, especially with faster cure hardeners.

On the other hand, laminating epoxies require a minimum ambient temperature to cure properly, and faster cure hardeners are usually more forgiving in cooler ambient working temperatures than slower ones. In the winter, working in my basement can be rather chilly, necessitating the use of a faster hardener. If a faster hardener is used, mixing small batches (I generally don't mix more than about 150 grams total at a time) can help prevent runaway curing reactions, as can working from a wide, flat tray instead of a cylindrical cup to help the heat dissipate, combined with frequent stirring to help redistribute hot spots.

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Next, I applied multiple coats of Rustoleum automotive primer and sanded between coats with progressively finer sandpaper down to 600 grit until the surface was visibly smooth and wiped away the sanding dust (Figure 7).

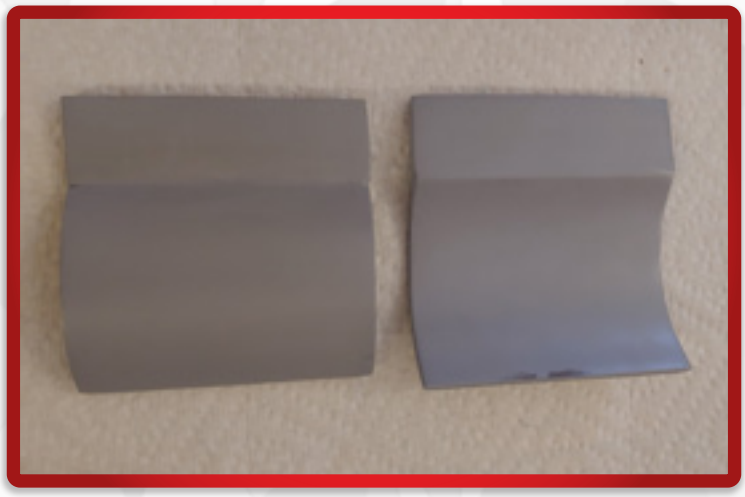

FIGURE 7: MOLD SURFACES AFTER APPLYING PRIMER & SANDING.

After the final sanding I prepared the mold surfaces for demolding after the epoxy cures. The importance of this step cannot be overstated. Insufficient surface preparation will cause the fiberglass part to be bonded to the mold, and the mold (and possibly the fiberglass part) will probably be destroyed in the demolding process in that case (don't ask me how I know).

For this project, I applied five coats of Part-All #2 wax in accordance with the product's instructions followed by five coats of polyvinyl alcohol (PVA). The preferred method for applying PVA is spraying it on, but since I am not so equipped, I applied the PVA with a paper towel, spread it evenly and thinly, let it fully dry, and repeated for subsequent coats. Once the PVA had fully dried, the molds were ready to proceed with laying up the fiberglass fins. It is also important to treat the edges of the molds with wax and PVA for demolding. Some epoxy will inevitably be slopped onto the mold edges and, when cured, could make demolding difficult.

3 Fiberglass Fin Layup

With the mold complete, I prepared the materials needed for laying up the fins. For each fin I prepared eight layers of 6 ounce per square yard fiberglass fabric, cut to shape slightly larger than the dimensions of the combined fin and fin tab assemblies. All fabric should be cut out and all supplies ready to go before the next step of mixing laminating epoxy. Once the epoxy is mixed, the clock is ticking before the epoxy cures enough to be unworkable.

The fiberglass fabric can be easily cut using a decent pair of regular scissors. Notably, the eight layers of fabric that I used for my fins resulted in a final thickness of about 1 mm, which is rather thin. Although I was satisfied with the rigidity and strength for this project, more layers could be added for even greater thickness and rigidity. For reference, the fins included in high-power fiberglass rocket kits are often 3 mm thick or more.

A little trick for helping to cut straight lines in fiberglass fabric is to pull one strand from the fabric weave and remove it from the weave grid. Pulling on one strand with one hand while holding down the far edge of the fabric with the other hand will help this go smoothly (although it may

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be difficult or impossible with very large pieces of cloth). With the strand removed, the cutting edge in the fabric will be clear to see (Figure 8).

FIGURE 8: PREPARING FIBERGLASS CLOTH CUT TO SIZE & SHAPE.

I then mixed the laminating epoxy needed to saturate the fiberglass fabric. You'll want to wear skin protection (e.g., nitrile gloves) and safety glasses while mixing and working with laminating epoxy. Not only is it a sticky and slimy feeling, but some people report allergic reactions to epoxies.

Laminating epoxies are unforgiving of incorrect mix ratios, so I used a digital scale capable of measuring to the hundredth of a gram to measure out the epoxy resin and hardener components. Some epoxy systems (including those from Total Boat and West Systems) include volumetric metering pumps to precisely measure the epoxy components, but I prefer the simplicity of weighing the components into a cup on a tared scale. Note that, with some epoxy systems, the mix ratio can be slightly different depending on whether you are measuring by mass versus volume, so carefully read the measuring instructions for your epoxy.

It is also crucial to completely mix laminating epoxy, including mixing in any liquid that may be reluctantly hiding in the inside corners of the mixing cup, or risk being left with sticky, uncured areas in your final part. Using a stir stick and holding the mixing cup at various angles while paying particular attention to inside corners can help avoid pitfalls due to insufficient mixing. Unmixed resin or hardener can result in uncured spots in the final product that can be unpleasant, if not impossible, to repair.

From here forward I will be laying the mold half with the plywood ribs (inner curvature of the fin) on a flat surface during curing with the other half (outer curvature of the fin) on top, so I will refer to them as "lower mold half" and "upper mold half," respectively. I placed the lower mold half on a piece of wax paper to prevent slopping epoxy on my work surface but also provide a surface that would easily peel away from the epoxy once it had cured.

I began laying up the fins by using a chip brush (choose a brush that is expendable) to apply a generous coat of mixed epoxy to the lower mold half to cover the entire curved fin and flat fin tab surfaces. I then pressed the first layer of fiberglass cloth to the lower mold half and carefully brushed any air bubbles under the fabric out to the sides (Figure 9). I then added the next layer of fiberglass, pressing the fabric into place, working the fabric into the epoxy using a dabbing motion with the chip brush and

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adding additional epoxy to the fabric as needed to keep it saturated and working and air bubbles out to the edges of the mold.

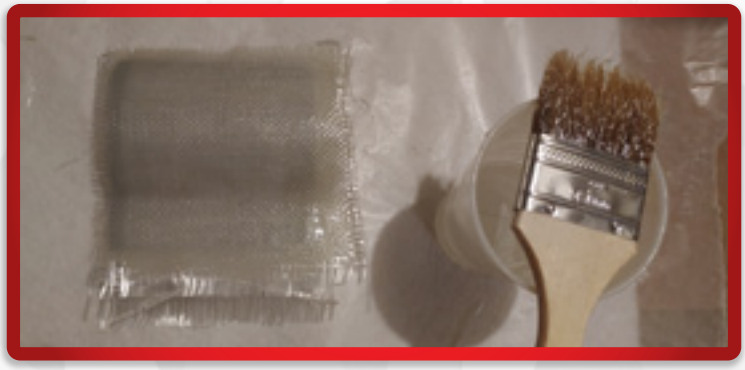

FIGURE 9: LAYING UP LAYERS OF FIBERGLASS CLOTH AND LAMINATING EPOXY.

With the eighth and final layer of fiberglass in place and enough epoxy applied to fully saturate all layers of fiberglass, I coated the upper mold half fin surface with a layer of epoxy and carefully placed the upper mold half on top of the fiberglass and clamped it in place to cure (Figure 10).

By far, the easiest time to trim the fins to near final shape is at a partially cured stage where the epoxy has cured enough to maintain its shape but is not fully hardened. At this stage of curing, the fiberglass will have a stiff rubbery consistency and the edges of the part can be trimmed with a sharp razor knife. How long it takes to reach this stage of curing will depend on multiple factors such as which specific epoxy system you selected, which hardener speed you chose, and the ambient temperature where your part is curing.

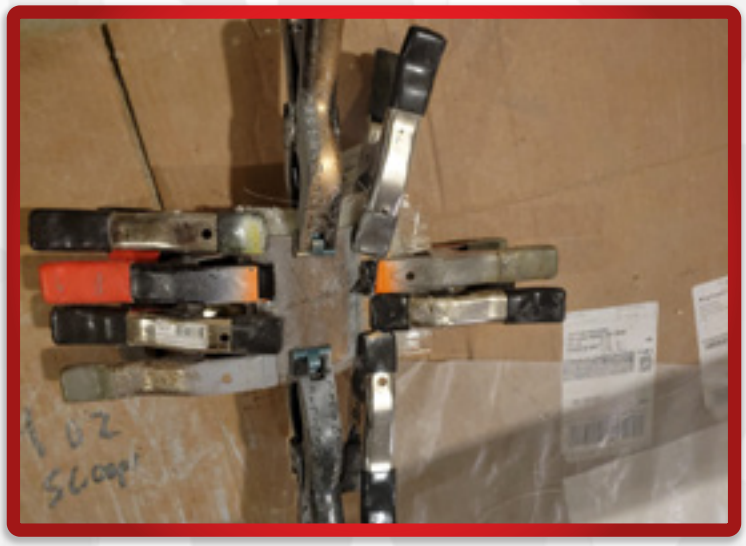

FIGURE 10: MOLDS CLAMPED TOGETHER FOR CURING.

In my case, the part was ready for trimming after about four hours. To trim the edges, I donned cut-resistant gloves (and always cut away from any part of your body in case the knife slips!) and removed clamps along one edge of the molds, trimmed the edge, and replaced the clamps before removing the next clamp and proceeding to trim the other edges. As noted above, the hard mold edge created by applying CA glue to the edges makes trimming the edge accurate without cutting into the mold. With the edges trimmed and the clamps re-applied, I set aside the fins to completely cure.

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4 Demolding and Fin Installation

After the parts had time to completely cure, I removed all clamps and carefully separated the mold halves from the cured fins. **Note that at this stage, the edges of the fiberglass fin might be sharp.** I touched up the edges with 220-grit sandpaper and a sanding block. Additionally, the fin surfaces come out quite glossy, so I sanded the curved surfaces that would be exposed on the outside of the rocket to help with paint adhesion (Figure 11).

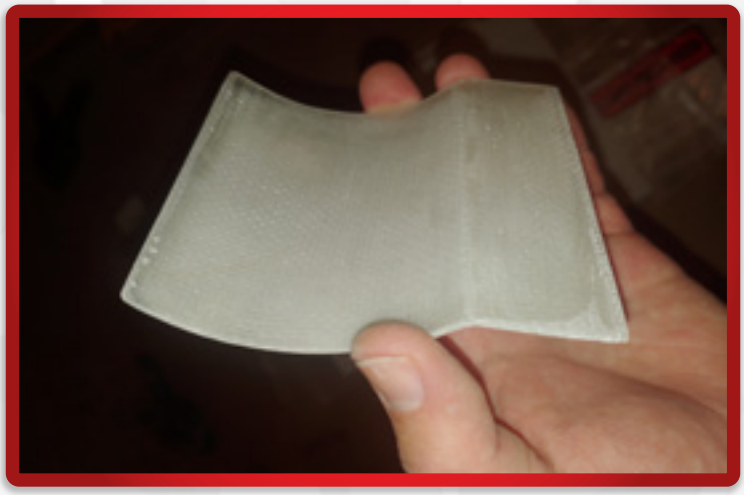

FIGURE 11: FIBERGLASS CURVED FIN AFTER DEMOLDING AND SANDING.

Crucially, sanding fiberglass will generate dust that you don't want to inhale. Wet sanding or respiratory protection is prudent. Once sanding is complete, the sanding dust or slurry can be scrubbed away with water and rinsed.

When working with epoxies, the cured part may exhibit an outer layer of what is known as amine blush. Amine blush can manifest as a waxy, slimy, or tacky outer layer of the part, even though the epoxy beneath the amine blush layer is properly cured. This is normal and easily remedied (assuming correct mixing ratio, thorough mixing, and appropriate ambient working temperature were all applied), although it must be properly dealt with to prevent paint adhesion problems. Since amine blush is water soluble, it can be scrubbed away with plain water and a dishwashing scratch pad. This is best done before any sanding is attempted, otherwise the amine blush layer can gum up your sandpaper.

FIGURE 12: ADDING FIBERGLASS TO THE AIRFRAME TUBE.

Before installing the fins, I pre-cut slots in the body tube using a razor knife and a piece of angle aluminum to maintain proper alignment. I laminated the outside of the airframe with fiberglass (optional, Figure 12) and trimmed the fiberglass from the fin slots, followed by installing the motor mount (centering rings were spaced such that they would join with the fore and aft edges of the fin tabs).

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I initially dry fit the aft centering ring to allow access to the inside of the fin can so internal epoxy fillets could be applied.

To install the first fin, I first applied a generous bead of epoxy to the fin tab edge that would be in contact with the motor mount tube and centering rings and placed the fin in position and checked for proper alignment (Figure 13). After the initial epoxy joint cured, I applied epoxy fillets along both sides of the fin joint outside the airframe as well as to the fin tab at the inner diameter of the airframe and at the joint between the fin tab and the motor mount tube. Once the internal fillets were in place, the aft centering ring could be permanently installed with epoxy. At this point, the build process is basically the same as for any other typical model rocket.

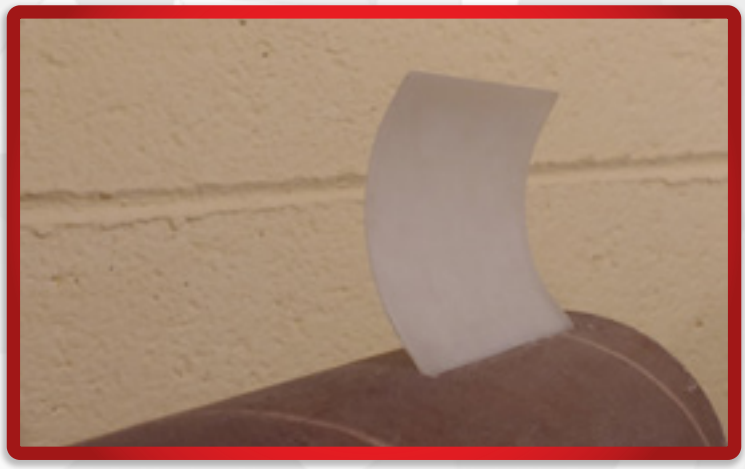

FIGURE 13: FIBERGLASS CURVED FIN INSTALLED ON THE AIR-FRAME BEFORE ADDING EPOXY FILLETS.

5 Conclusion

The ability to produce curved fins that are rigid and durable enough for flying model rockets opens doors to create some compelling military scale models and any number of other creative applications. The process described in this article can yield curved fiberglass that are strong and impact resistant. Since the fiberglass work to create the curved fins is relatively small and the remainder of the rocket could be built from off-the-shelf components, this could also be a perfect project for someone that wants to make an initial foray into scratch building with fiberglass. I look forward to flying my model HIMARS rocket and I hope this article will be fruitful for Peak of Flight readers!

About the Author:

Josh Frizzell has been building and flying rockets since his childhood in the 1980's. Josh is NAR Level 2 High Power Rocketry Certified and is also a NAR certified "Rocket Science Teacher."

Tim's Messy Desk

By Tim Van Milligan

What a busy year it has been. In November, I was looking back over the newsletters that we've put out since January, and I started counting up all the different items we've added to our product line so far in 2022. There were 23 different items we added from other manufacturers, including some significant rocket kits: NCR Corporal, Odd'l F-18, the Wildman Journey 75 and Darkstar Jr, three Quest models, and six different Estes kits. Plus there were new rocket motors, tools, adhesives, and rocketry accessories added too.

That's just products from other suppliers. We created or added a whole bunch of "Apogee" exclusive items too. There were six new Apogee kits: a BT-80 Ebay kit, and the Habu, Razzle Dazzle, Atomizer, Peregrine Jr, and Katana Jr.

There would have been more, but it was a busy year of releasing other big projects. At the beginning of the year,

we released the "Launch Visualizer" at RockSim.com — which took us two full years to create. On top of that, we did two significant updates to RockSim and RockSimPro. And in October, we finally got out the door a project that we were working on for about 5 years - the Experimental Gliding Parachute System.

There were a host of minor projects too, like the Vindicoat Aluminum Fasteners, the redesigned Strap-on Booster Pod Hooks, a new 24-inch diameter printed plastic parachute, and a host of T-shirts and stickers.

I'm very pleased with everything our team did here at Apogee, because the final product that you see is really just the tip of the iceberg when it comes to the amount of stuff we had to do behind the scenes to get it out the door. For example, when we create a new rocket kit, we have to write and illustrate the instruction sheets. That doesn't sound like much, until you actually compare an Apogee instruction

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sheet to a kit made by almost any other manufacturer. Ours are triple-checked for accuracy, and each assembly step has a detailed drawing that shows exactly how it gets put together. I personally think that each instruction sheet is a work of art, and should be collected as artwork. Of course, I'm biased. My point is that each one involves a huge investment of time for our staff.

Then before any product is released, we have to create a webpage for the item. Again, if you've compared an Apogee webpage for any rocket product to those other rocketry suppliers, you know how much information we pack into them. Even if the product isn't one created by Apogee, we devote the same amount of time building out the product information page for it, because we know that you and our other customers want in depth information so you can make an informed decision.

Why do I mention all of this extra work that we do for you?

I'm going to gripe a little bit. So please bear with me.

About three weeks ago, a visitor to our website asked us a question: "Do you price match against other websites?"

From my perspective, our prices are ridiculously low for the amount of investment we put into each product we sell. Add into that our devotion to customer service, such as daily updating our website inventory, answering the phone with a real person, or responding quickly to every email that we receive, and maintaining a massive inventory level, which allows us to offer the only same-day shipping guarantee in the industry. What we sell is more than just rocket supplies. We actually sell "success." When you come to Apogee for your rocketry project, it is our mission to see that you are successful. This is something that is easy to verify by looking at the over 1800 testimonials on our website (https://www.apogeerockets.com/Testimonials), and the 219 reviews on Google.

When "rocketry project success" is the basis for making a price comparison to other suppliers, I guarantee to you that our prices are the greatest value in the industry.

I know they don't measure up to our standards of customer service. If they did have the same level of service and dedication to your rocketry success, why would a visitor to our website even ask the question about us doing a price match?

That visitor wanted to buy from us, to get our high level of service. No doubt about that. If other suppliers had what we offered, we wouldn't have heard a peep out of the visitor, as they would have immediately left our site and got the products elsewhere.

Could we offer the same prices as other dealers? The answer is we would have to reduce our level of service to match what the other guys do.

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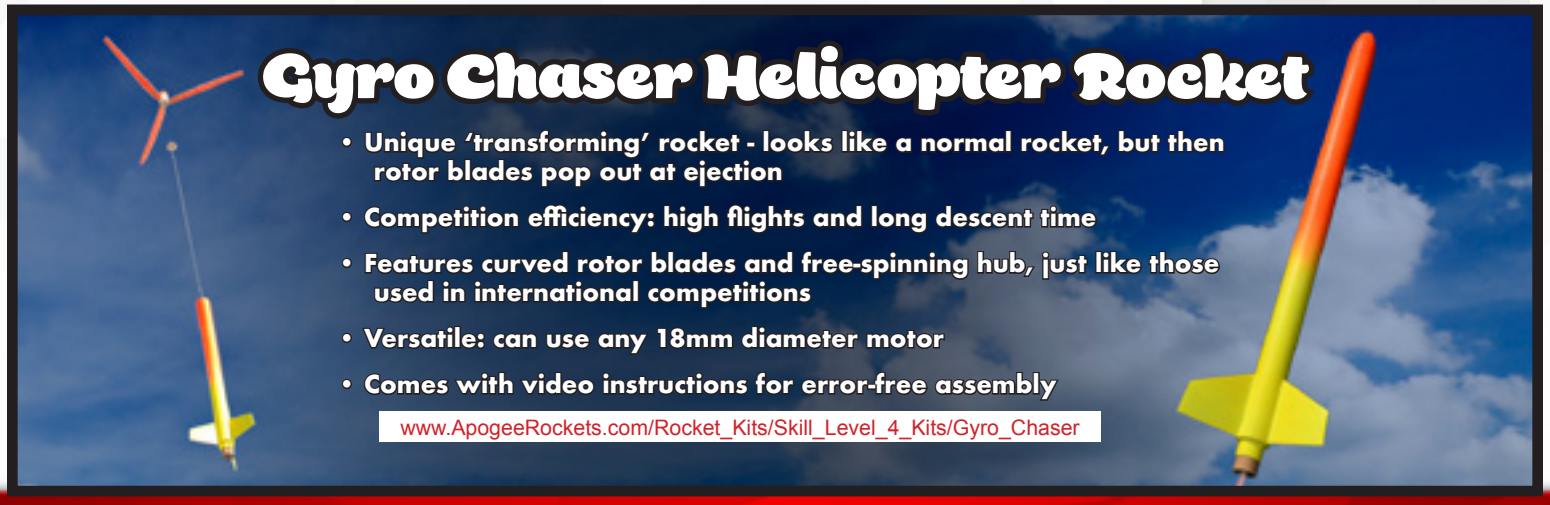

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Service is expensive. Good service is VERY expensive.

A long time ago, I had one person tell me that good service was "table stakes" - referring to the entry fee to just get into a card game to prove you are serious about getting into the game. I don't believe that for a second. If good service was table stakes, then why aren't other businesses offering it? They can't even define it. I painfully take the time to really define what it means to have a minimum level of good service that everyone gets, whether they buy from us or not. See it here: https://youtu.be/BgN50m6g9jY

We won't match prices until someone else matches our service. And at that point, we'll raise our prices to match what theirs are. I truly believe that there is no way that anyone could do what we do for our customers, at the prices we currently have.

Enough of my rant about service… I want this to be an optimistic article about what stuff is crossing my desk at the moment.

I'm currently preparing for next year, and what we hope to accomplish. Our goal is 12 new Apogee kits - one a month. And we've already started designing the first few. The January release is called the "Quick Draw." It has a western theme, which hasn't been done before as a model rocket kit as far as we know. What is cool about it is that it has interchangeable motor mounts. So you could fly it with a single motor, or a cluster of motors. It gives lots of options from a single model.

Once we designed the interchangeable motor mounts, we realized that they could be their own product as well. So you'll also see very shortly a set of interchangeable motor mounts that you can use in your own designs. We think you'll love that extra versatility that comes with being able to swap out different motor configurations in the same rocket. I don't want to reveal too much information about it quite yet, but you won't have to wait too much longer to find out the details.

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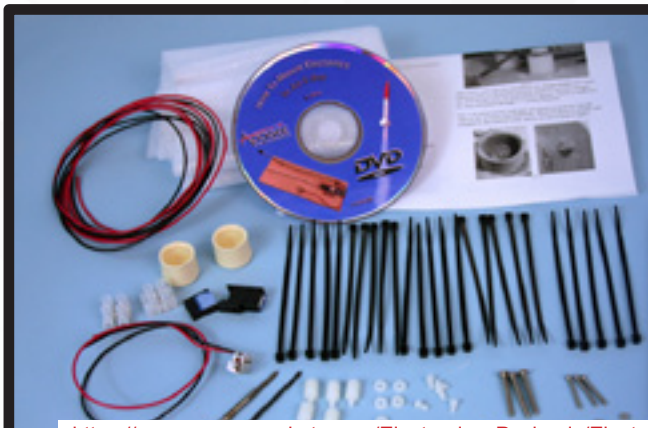

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Tim's Messy Desk

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We've already started the process for a new blow-molded nose cone tool for a BT-60 size tube. That specific size is one we don't currently have in our own inventory. So that will be coming in the first half of the year, along with several kits that will use it.

I'm also working on a new high power kit, specifically for people that want to go after a Level-2 certification. This kit will pay respects to a previous kit we had, but there will be several updates to it. I want to raise the quality level, so that it's easier to build and is more durable. Again… it is about "your" success, and these updates are aligned with that mission.

In addition to the 12 new Apogee kits, our goal is also to add at least 12 new non-Apogee products to our inventory. While no one matches our service, there are some pretty nifty products out in the market that we think we could enhance by selling them. We're totally open to your suggestions on which products from other manufacturers that would be better if they were sold by Apogee. Let us know what you'd like us to carry.

I've been kicking around an idea I had for a long while, and in the new year, we're going to try it out. The idea came from John Pursley, who was a fantastically talented scale modeler. He actually designed and built the molds that we use for the vacuum form wraps on the Saturn V and the Saturn 1b.

John once told me to invest a little bit every month in a good modeling tool. Over time, he told me, I'd have a collection of tools that would help me build better rockets too.

I personally took his advice, and my tool chest now has a lot of unique items that I've grown to find as being indispensable for the hobby (see my range-box video at: https://youtu.be/DyjzQRKVPTU).

Now I want you to have that little goal too. Collect one little inexpensive tool each month so that you can build better models. By better, I mean doing it faster, with more precision, and find it is less frustrating because you have a tool that seems magical.

The plan is to offer a "Tool of the Month." What I'm doing is sourcing some of my favorite useful (but inexpensive) tools, and we'll offer one per month at a discount price when your merchandise order during the month exceeds $100. You can buy them at full price if you wish, but I'd like to encourage people to stay active in rocketry by purchasing on a regular basis.

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Tim's Messy Desk

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My other motive for the discounted price is that I am investing in your skills. I once heard an expression that goes something like: there are only a few things we take with us into the future: our friends, our experiences, and the knowledge/skills we acquired. Once you have new knowledge or a skill, you never lose it. And its value increases over time.

For Apogee, if I can help you gain new knowledge or a new skill, I know you will use it in the future. I'm certain you'll use that skill to build more rockets, or use the knowledge to train future rocketeers. Either way, it sets up Apogee's future too. I'm in this for the long term (did I ever tell you my goal to live to 147 years old?).

The most difficult goal that I have for 2023 is to take time off. It is hard because I love working with our team, and with you. Coming to work every morning is enjoyable and what I look forward to. But my business coach keeps telling me that the reason Apogee isn't growing faster is that I'm working too much "in" the business, instead of working "on" the business. I've tried to work on the business while I'm in the office, but there are too many new opportunities that pop up on a daily basis. In order to shield myself from all these opportunities that cause me to lose focus, I have to get out of the office.

My coach wants me to have 90 straight days off. I don't know if I can do that. If I could, I don't know when I'd do it. But I'm writing it here so that I publicly make a commitment, and that you hold me accountable.

It is likely that customers won't know when I'm gone, because the team here knows how to run the company without me. They are well trained, and I mostly get in their way anyway. That's probably why my coach wants me to do this. Just think of what they might accomplish if I'm not underfoot.

But never fear: our same-day shipping guarantee will still be in effect. The new products will come out regularly, emails will be answered promptly, and the team will still be able to answer all your technical questions. If they get one that is really technical, and beyond them, I'll still be here for support (the internet means I'm always connected).

Being less distracted by so many available opportunities will allow me to focus on the few that are the most promising. And that is the intent. I'm not retiring–remember my goal to live to 147. I'm not even halfway there yet. I'm going to be around for a long time to come. Besides… I've got skills and knowledge of rocketry, and I plan to take them and my friends (you) into my future.

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