PEAK OF FLIGHT

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Apogee Components, Inc.
Your Source For Rocket Supplies That Will Take You To The "Peak-of-Flight"
3355 Fillmore Ridge Heights Colorado Springs, Colorado 80907-9024 USA
www.ApogeeRockets.com e-mail: orders@apogeerockets.com Phone: 719-535-9335 Fax: 719-534-9050

PEAK OF FLIGHT

Toughening Balsa Nose Cones

By Tim Van Milligan

I received a question recently from a customer about balsa nose cones. He wrote:

"I have built three Cosmodrome Black Brant II kits (https://www.apogeerockets.com/Rocket_Kits/Scale_Rockets/Black_Brant_II_2-6in) purchased from you at Apogee. I am very happy with all the kits so far. The smallest in my fleet is the 1:6 scale that comes with the balsa nose. I've reinforced the balsa using a sandable wood-filler compound diluted with water, polished to a glass smooth surface. The balsa nose can only take so many repairs and even meticulous airbrushing can only hide so many scars. What do you at Apogee use, or suggest for reinforcing the balsa nose cones?"

From my perspective, the customer is constructing and finishing his model the same way that I would. And to be honest, I have a lot of balsa nose cones that have dings in them too. Balsa, being a soft wood, is easily dented when it strikes something. And the larger the nose cone, it seems that the dents are bigger and more noticeable (**Figure 1**). It only makes sense, because the nose is heavier and therefore has more kinetic energy that has to be absorbed when it lands. Anything that touches it first, like a small rock or tree branch, is going to make an impression into the balsa.

The customer also mentions how he repairs the dings, and it is the same method that I use too. I also fill the ding with some sandable wood filler diluted with water. When it is dry, I sand it down and repaint.

For more serious repairs, such as a structural repair like when the tip is crushed, I replace the balsa with FixIt epoxy clay (https://www.apogeerockets.com/Building_Supplies/Epoxy_Clay/FIXIT_Epoxy_Clay) as shown in Peak-of-Flight Newsletter issue #129 (https://www.apogeerockets.com/education/downloads/Newsletter192.pdf)

Figure 1: Noticeable dings in a balsa nose cone on the Aerobee Hi kit.

Strengthening the Balsa

I wrote this back to the customer about his balsa nose cone issue: "If it is already painted, you can't do anything. A raw balsa wood nose can be painted with super glue to give the surface a harder shell. But it can still get dinged up."

I had thought that would have been the end of the questions, because I figured that this was pretty common information. But then I have to remember that we all in different stages of our rocketry endeavors, and have different levels of experience. So I got a lot of great questions back:

"Thank you for your reply, I sincerely appreciate your taking the time to help. I have a few quick questions in regards to the super glue. Fortunately I do have another unpainted balsa nose cone. What brand super glue has worked for you? How

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You can subscribe to receive this e-zine FREE at the Apogee Components website **www.ApogeeComponents.com**, or by clicking the link here Newsletter Sign-Up

Newsletter Staff
Writer: Tim Van Milligan
Layout/Cover Artist: Chris Duran
Proofreader: Michelle Mason

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well does the super glue sand? What grit Paper works best with the glue?...to achieve a glass smooth surface. How thick a coat do you suggest applying? One application or multiple? What type of paint adheres to and covers well to a super glue surface? (Oil paint, acrylics, etc.). Rust-Oleum primers and paints seem to work well on a variety of surfaces. I airbrush but in this case I plan on using a high quality spray paint. What do you personally recommend? Also, what do you use to fill the two grooves in the heavy paper body tubes? Is the super glue unnecessary for finishing the plywood fins? A stickler for fine finish and detail I've tried a couple things including the Elmer's I mentioned above, but I don't believe the wood filler is the way to go."

With so many great questions, I thought that this would probably make a good newsletter article in case other readers have the same question.

"What brand super glue?"

It isn't the brand so much, as it is the "viscosity." The idea behind applying superglue to the balsa is that it penetrates the surface fibers, and creates a tough eggshell like surface that is more resistant to dings and dents. Note that as I mentioned before, the balsa can still get dinged up. It just will be a little tougher than with ordinary wood filler applied to the surface.

Therefore, if you want a tougher surface, you want a glue that has some ability to penetrate the wood. That means it has to be thin. When you select super glue, look for the kind that is called "thin"(**Figure 2)**. If it comes in a squeeze tube, you've got the wrong kind. Most super glues have fillers in them to thicken them up so they don't run. The thickening agents make them weaker, but most people like them because they are less messy. No one likes gluing their fingers together.

Figure 2: Look for the level of viscosity described on the bottle.

The thinner viscosity super glues are harder to find. You typically WON'T find them at a hardware store. I find them at my local hobby store only. Pick the bottle up, and slosh it around. If it has the consistency of water, then you have the right stuff. If is syrupy, then it is too thick to penetrate the surface of the balsa wood. Avoid it for this task. It may be OK for putting on fins, but not for sealing the fibers deep under the surface of the wood.

Just so you know, "wood hardener," which you can find at a hardware store, is superior to super glue for this task. It has a lot of solvents in it to thin it out, so it really penetrates deep into the fibers of the wood,

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toughening up the surface. Another advantage of wood hardener is that it cheaper than super glue. So if you're doing a large nose nose cone like on the Cosmodrome kits (https://www.apogeerockets.com/Cosmodrome_Rocketry), you might want to use wood hardener instead of water-thin super glue. The drawback is the solvents have to evaporate out, so you should use the wood hardener in a well ventilated area or outdoors.

The reason I recommended super glue is that many modelers already have it in their tool kit. And most balsa nose cones are generally small enough that super glue is just convenient and instant. When you put it on, it will harden in seconds. You can be sanding the surface almost as fast you put it on. Because the price of balsa wood continues to rise, most manufacturers of bigger kits have long since switched to alternate materials for making nose cones, like plastic or fiberglass.

The instant curing can be a drawback of using super glue. If there is moisture present in the wood (and there almost always is), the glue can flash cure. When it does, it leaves a bubbly white surface. Try to store your super glue in a cool place. Heat will accelerate the cure time. So if the glue starts out cool, you'll have a little bit of working time to get it onto the balsa and spread it around.

When I apply it, I use a super glue applicator tip (https://www.apogeerockets.com/Building_Supplies/Tools/Super_Glue_Applicator_Tips). The side of the thin tube is used to spread the glue around like a paint brush (**Figure 3**).

Figure 3: Using a super glue applicator tip helps to spread the glue around more evenly on the surface.

I start on the side of the nose cone instead of the tip. The reason is to see how much working time I have to work the glue around the surface. If you start at the tip, you have a harder time gauging how quickly the glue cures. The glue penetrates quicker on "end grain," which you'll see on both the tip and the base of the nose cone.

One thing that I try to avoid is leaving a puddle of glue on the surface of the wood. While this seems like a good idea,

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since it would leave a thicker shell on the wood, it can cause other issues. What happens is that the glue that penetrates deep into the wood starts to cure there first. When it does, it generates heat and those annoying tear-producing vapors (**Figure 4**). The heat released accelerates the cure of the glue on the surface, and the vapors mix in causing the surface glue to bubble up. Now you have a crusty white surface that takes a lot of effort to sand off.

Figure 4: Try and avoid putting on too much super glue because it will evaporate quickly and leave a white bubbly residue that is hard to remove.

There is a fine dividing line when applying the glue. You want to leave a little bit of glue on the surface so you can spread it around and so it can penetrate down into the wood, but not so much that it cures so quickly that it bubbles up. The super glue is expensive enough that you don't want to waste it by having to sand it all off.

Wiping it off

Once I can see how fast the super glue is curing, I'll try to time the application so I can put down as much as possible, work it around, and then wipe it off. Yep, I wipe it off. Again, this is to avoid having a puddle on the surface that will bubble over when the glue heats up and cures instantly. In actuality, I probably can get only an area of about two square inches done before I have to wipe off the excess before it cures. It all happens really fast.

I should also mention that another annoying thing often happens when applying super glue to the surface of balsa: you often get it on your skin. If you're smart, you'll wear plastic gloves. Not rubbery gloves -- get "plastic" gloves. The glue bonds to rubber or nitrile gloves like it does to skin. But super glue does not stick to "polyethene" plastic gloves. You may find them at gas stations, or in food preparation establishments. They are the cheap gloves that are meant to be used once and tossed away. If you can't find the plastic gloves, get a sandwich bag and use that as a finger cot to spread the glue around on the surface of the balsa wood. Another tip is to use the "Happy Hands" Cream (https://www.apogeerockets.com/Building_Supplies/Tools/Happy_Hands_Skin_Barrier_Cream). It is a cream that you apply to your hands to prevent the glue from sticking to skin. It is a lot easier to get off the glue later, trust me. I use it often myself.

Also, wear safety glasses, because it is easy to spatter the water-thin super glue. You don't want to get it in your eyes.

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"One Application or Multiple?"

Once the first layer of glue is on, any subsequent applications do not penetrate the fibers of the wood. It will only stay on the surface. You are building up the outer surface, but the inner wood doesn't get any harder.

What I do after applying the first layer is to sand it off using some medium grit sandpaper (around 320 grit). This will take off the high points on the surface of the wood. You can then apply a second coat to fill in the lower valleys on the surface.

Or… You can just coat the outer surface with the wood filler prior to sanding. It will stick OK to the super glue that has not been sanded. There are a lot of nooks and crannies for the filler to get into and hold on to, like velcro. If you sand the super glue surface first, those nooks and crannies are removed and the wood filler doesn't get much to grip to. It may flake off later.

I've done both methods. They both work ok. The wood filler sands easier, so if you're doing a big nose cone, I'd probably recommend that first.

How well does the super glue sand? What grit Paper works best with the glue?

Super glue is hard like epoxy, so it takes some effort to sand it. As mentioned, I'll start with a medium grit (say 220 to 320) to take it down quickly, and then switch to a finer grit (400 grit) to make it smooth.

What type of paint adheres to and covers well to a super glue surface? (Oil paint, acrylics, etc.). What do you personally recommend?

Super glue is very paint tolerant. Everything sticks to it.

I don't have a favorite brand of paint or primer. I hate it all equally. And it is a pretty intense hatred too. I hate painting because I'm not a good painter. Having paint sticking to the surface isn't the problem for me. It is all the other paint problems like orange-peel, crazing, fish eyes, hazing, runs, drips, and errors that bite me every time. So I don't have a preference that I'd recommend. A good person to ask is someone like Chris Michielssen, who wrote sever-

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al articles for me on getting a smooth surface, like the previous issue at: https://www.apogeerockets.com/education/downloads/Newsletter421.pdf.

Filling Grooves In the Tubes

"Also, what do you use to fill the two grooves in the heavy paper body tubes?" This is a topic we've covered previously in this newsletter and in our Advanced Rocketry WorkShop videos. See Peak of Flight Newsletters:
#147 at: https://www.apogeerockets.com/education/downloads/Newsletter147.pdf
#241 at: https://www.apogeerockets.com/education/downloads/Newsletter241.pdf
Advanced Construction Video #43 at: https://www.apogeerockets.com/Advanced_Construction_Videos/Rocketry_Video_43
And finally, there is also our "How to build a rocket" video series that shows how to use wood filler to fill the spirals at: https://www.apogeerockets.com/How-To/Getting_Started_How_to_Build_a_Rocket

Plywood fins

"Is the super glue unnecessary for finishing the plywood fins?"

It is not needed on the surface of plywood fins. Since plywood is a dense wood, the super glue won't penetrate the surface and make the wood harder. The plywood is already 'strong enough.' However, I will seal the edges of the plywood with super glue. This is end grain, and the super glue will penetrate there and seal off the holes.
In this case, it isn't to get a stronger surface, it is to seal off the pinholes. I do the same for the edges of balsa fins too.

These tiny pinholes trap air bubbles that cause problems when you go to paint the rocket. What happens is the solvents in the paint go down into the holes and bubble up as the paint of the surface is just starting to get rubbery. So you have a small bubble magically appear on the edge of the fin. Once the paint is on, filling these tiny holes is very difficult. You can't just sand off the paint and re-apply it. The pinhole is still there and it will bubble up again when you put paint over it. You have to "seal" it first. Since the super glue is thin enough to get into the hole, it is what I recommend. But it has to be done before you put primer or paint on it.

Conclusion

In this article I tried to lay out the pros and cons of using super glue to seal balsa surfaces. If it is a larger surface area, I'd probably recommend wood hardener. If it is small, then super glue is quick and convenient.

About The Author:

Tim Van Milligan (a.k.a. "Mr. Rocket") is a real rocket scientist who likes helping out other rocketeers. He is an avid rocketry competitor, and is Level 3 high power certified. He is often asked what is the biggest rocket he's ever launched. His answer is that before he started writing articles and books about rocketry, he worked on the Delta II rocket that launched satellites into orbit. He has a B.S. in Aeronautical Engineering from Embry-Riddle Aeronautical University in Daytona Beach, Florida, and has worked toward a M.S. in Space Technology from the Florida Institute of Technology in Melbourne, Florida. Currently, he is the owner of Apogee Components (http://www.apogeerockets.com) and also the author of the books: "Model Rocket Design and Construction," "69 Simple Science Fair Projects with Model Rockets: Aeronautics" and publisher of the "Peak-of-Flight" newsletter, a FREE e-zine newsletter about model rockets. You can email him by using the contact form at: https://www.apogeerockets.com/Contact.

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