PEAK OF FLIGHT NEWSLETTER

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CHROME PLATED FINS ADD DAZZLE & INCREASE VISIBILITY OF YOUR ROCKETS

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PEAK OF FLIGHT

Chrome Plated Fins

By Tim Van Milligan

How would you like a low weight way to add a chrome plated finish to your rocket's fins? It not only makes them look highly unique, but when the sun sparkles off them as they hang in the air, it makes the rocket a lot more visible as it drifts off in the distance.

In this article, I'll show you the method that I use on competition rockets to chrome plate a fin, so that it has low weight and stunning looks. It doesn't have to be competition for you, it can be used on any rocket of any size.

Background

I'll be honest with you… there are other ways to give your rocket a chrome-like finish (I know it really isn't "chrome," it is actually aluminum, but it looks so shiny that I will call it chrome in this article). Modelers have been using adhesive silver mylar for decades to make their rockets sparkle in the sun. Here at Apogee, we sell kits with silver decals, like on the Peregrine rocket kit (https://www.apogeerockets.com/Rocket-Kits/Skill-Level-3-Model-Rocket-Kits/Peregrine). This totally works and it gives the same effect as the method that I'll be describing in this article.

In my particular case, I wanted to get that same effect on a competition rocket, but where the final model weight is of critical importance. The disadvantage of the stickers is that the amount of additional mass it adds to a small rocket is more than I could tolerate. The carrier of the shiny aluminum is a sheet of plastic that adds weight. It is just a personal thing for me, in that I didn't want to add a lot of weight to the rocket. But if you feel that the extra thickness of aluminized mylar tape on your rocket is insignificant, then using that material would be perfectly fine. Go for it. And the extra advantage of the aluminized mylar tape is that it will add some strength to the rocket, because it adds a plastic skin to the fin as well.

To use this new method of chrome plating your fins, you will need to use the vacuum bagging technique that was discussed in *Peak-of-Flight* Newsletter #569 (https://www.apogeerockets.com/education/downloads/Newsletter569.pdf). The reason why is because it will give you the smoothest surface on the fin. When the fins are chromed, every little bump and valley will stand out visually. So you want to have the surface as smooth as possible.

In *Peak-of-Flight* Newsletter #569, I recommended sealing the surface of the fins with wood filler. We'll do the same thing here. You will fill and sand the fins as smoothly as you can.

The "chrome" will come from a special material called "Toner Reactive Foil." This is commonly used in the crafts industry to make personalized cards. The material is readily available in a rainbow of colors from a variety of online or offline retailers. I'm using silver in this article, but you could use red, blue, gold, glitter, or rainbow.

To find it, just go to any search engine or an online crafts dealer and search the words "toner reactive foil." There are a variety of companies that make it, so you can find the one that is cheapest for you.

FIGURE 1: REACTIVE FOIL

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What makes the reactive foil special is that it was designed to allow the metal finish to bond with toner from a laser-printer.

Toner is really just powdered plastic. This plastic is transferred to paper, and then bonded to the paper with heat. The heat actually melts the plastic as the method it uses to bond itself to the paper.

The way the reactive foil is meant to be used is that it is placed over the toner on the paper, and it is re-heated. What happens is that the plastic toner already on the paper melts a second time, and it grabs hold of the metallic finish. That's what bonds it to the paper as well.

The machine that is used to reheat the paper and fuse the metal to the paper looks very much like a paper laminating machine - it is just a heat roller system.

We're not going to use toner and heat to bond the metallic substance to the fin, but instead we're going to use epoxy.

Epoxy is just the bonding agent to permanently attach the metallic chrome to the fin.

If you look at the reactive foil, you'll notice that the two sides of the sheet have different appearances. One side is shiny and bright, while the other side looks dull and whitish. The shiny side is actually just the clear plastic carrier for the special metallic substance (the dull white) that is on the other side. Be careful not to scratch the dull side. It is fairly fragile, so handle the material carefully. If you scratch away the white stuff, you'll have a bare spot on the finished fin.

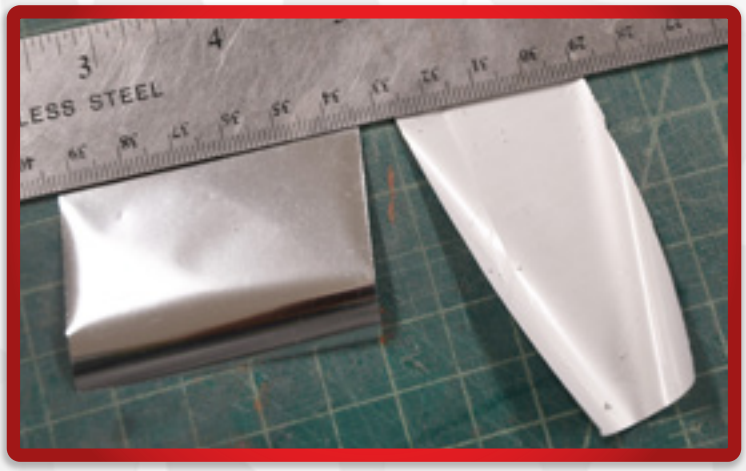

FIGURE 2: THE TWO SIDES OF THE TONER REACTIVE FOIL

At this point, your fins should be filled and sanded as smoothly as possible. Now cut the reactive foil into rectangles that are a bit larger than the size of the fin. Figure 3 and 4 show cutting the foil, and final rectangles.

FIGURE 3: CUTTING THE FOIL INTO RECTANGLES

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FIGURE 4: THE RECTANGLES FOR THE FINS

The one negative thing about the reactive foil is that it rolls up like shown in Figure 4. We need the material to stay flat, so we can apply epoxy to the dull side. Because it rolls up, we need a way to get it straight.

What I do is find a piece of scrap cardboard, spray some spray-adhesive on it, and tack the reactive foil sheets to it so they stay flat.

You can use any spray adhesive, but I typically buy mine at a local hardware or craft store.

FIGURE 5: FLATTEN OUT THE STRIPS BY TACKING THEM DOWN TO CARDBOARD.

FIGURE 6: SPRAY ADHESIVE CAN BE FOUND IN A CRAFT OR HARDWARE STORE.

To put the epoxy on, the trick is to put it on uniformly so that you don't have any waves in it. And it can be super thin, because it doesn't need much to adhere to the foil. For this task, I actually use and recommend a spray gun. I bought a cheapy plastic spray gun from Harbor Freight that I use, as shown in Figure 7.

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FIGURE 7: A CHEAP PLASTIC SPRAY GUN THAT WILL BE USED TO APPLY THE EPOXY.

I also have a regular small air brush, but I never use it for spraying epoxy. I don't want to clog that up. You'll notice in the one shown that the epoxy comes right out of the container and doesn't flow through the gun. It only has one small metal cap that it flows through, so it is pretty easy to clean up. You don't have much control over the gun, like the spray pattern or the flow rate. But that is ok. We only need to put down a thin mist of the epoxy.

The epoxy I use is a thin two part mix (see *Peak-of-Flight* Newsletter #569). But one thing that I do is really thin it out, so it is less viscous. For this I use 91% Isopropyl Alcohol (strong rubbing alcohol). I thin out the epoxy at least 50-50 so it is very runny. So if I mix up 5-grams of epoxy, I'll put in 5 grams of alcohol.

As soon as you spray out the mixture, it is so thin that the alcohol evaporates out in about 5 minutes. That leaves just epoxy on the surface of the reactive foil.

FIGURE 8: SPRAYING THE BACKS OF THE REACTIVE FOIL WITH THINNED OUT EPOXY.

The hard thing about spraying the foil is that the air from the gun wants to lift up the material and blow it off the cardboard. Work slowly to try to avoid this situation.

I also spray the fins with epoxy at the same time as spraying the reactive foil. They are simply laid on the

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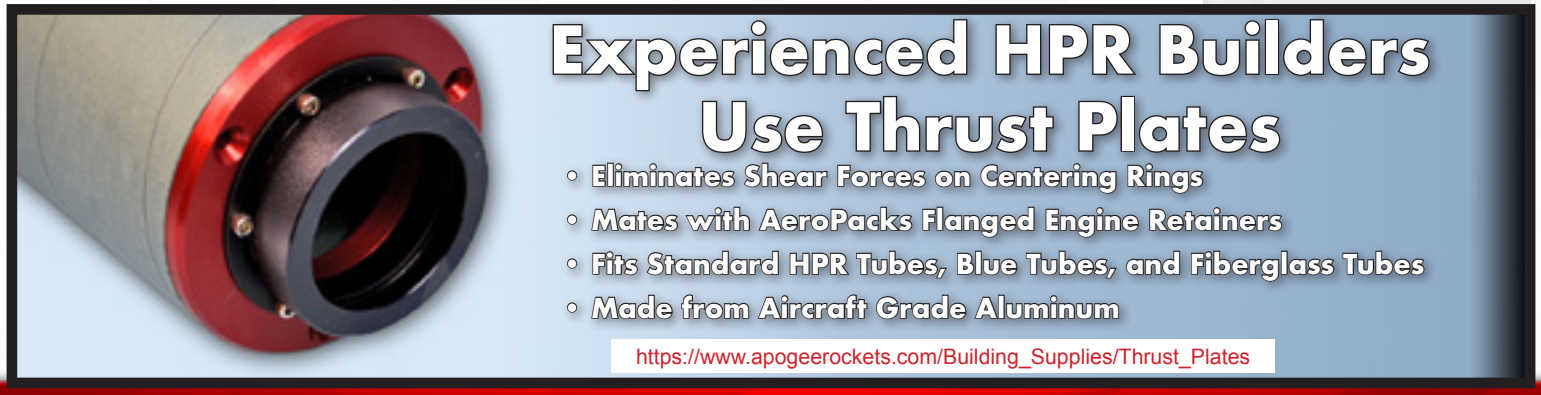

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cardboard and sprayed. I put a finger on the corner in order to hold them down while spraying them. Then rotate it around to spray the other corner that was previously under your finger.

When everything has been sprayed, inspect the surface of everything to look for bits of dust. This can be wiped off with your gloved finger. You want to avoid dust, as it leaves a raised particle that will cause problems later, as the plastic sheet can't be pulled down since there is no stretch in the plastic. It will be like a rock under a plastic tarp, and a small area around the base of the rock will be void of chrome.

Next, lay the fins on the reactive foil. Try to avoid touching the epoxy from this point on. Also, you only have one shot at positioning the fin on the foil. Hold the fin and hover it over the foil until you drop it down.

FIGURE 9: CAREFULLY LAY THE FIN ON THE FOIL

You can't shift the fin around on the foil, or you'll lift off the chrome from the plastic. In Figure 10, you can see a photo of what happens if you lift the plastic off the fin. It leaves behind a confetti like appearance of the foil. Basically, that piece of reactive foil is ruined. That is why I like to have a few extra sheets.

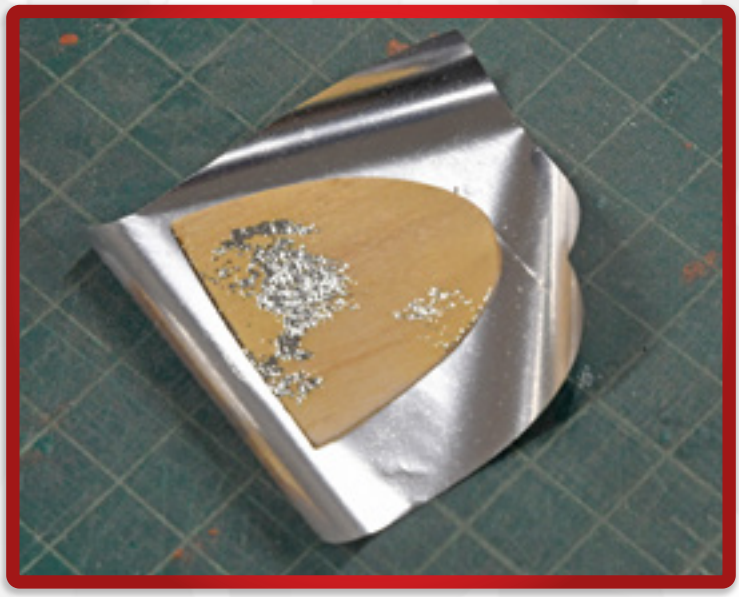

FIGURE 10: IF YOU PEEL UP THE FOIL TO REPOSITION, YOU'LL LEAVE A GLITTER ON THE SURFACE.

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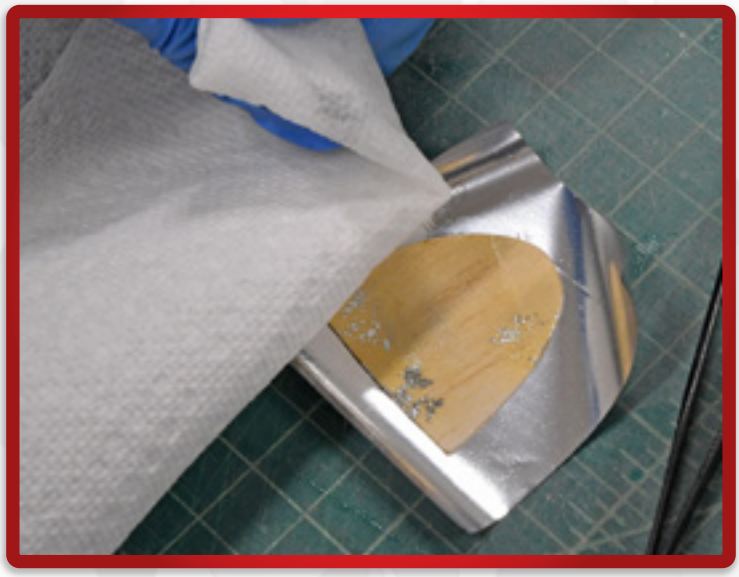

FIGURE 11: WIPE OFF THE GLITTER WITH ALCOHOL AND A PAPER TOWEL.

If you do ruin the foil, don't worry. The fin is still good. You can take a sheet of paper towel and some rubbing alcohol, and wipe off the confetti from the surface of the fin (Figure 11). Try not to remove too much of the epoxy, or you'll have to respray the fin.

It is a good thing to have a little extra epoxy in your spray gun so that you can account for this situation. I don't clean out the gun until after all the fins are in the vacuum bag.

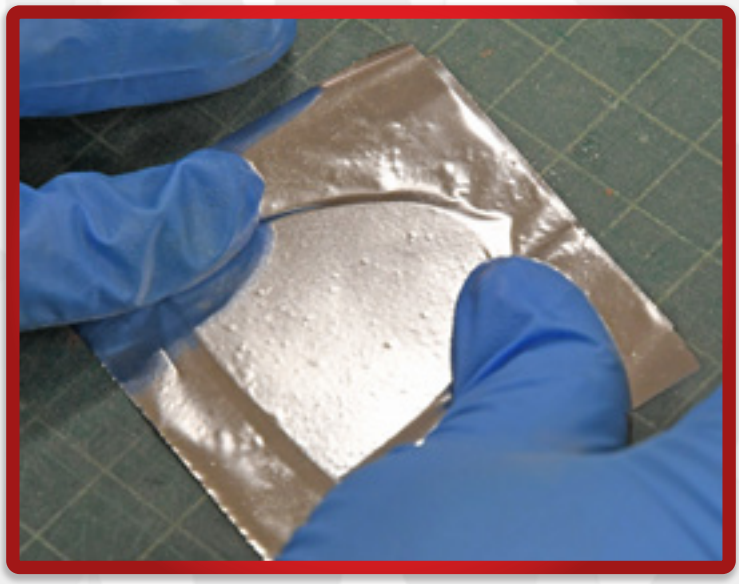

FIGURE 12: CAREFULLY PUSH THE AIR BUBBLES OFF THE FIN WITHOUT SLIDING THE FOIL AROUND.

You should cover both sides of the fins at this point. Once all the fins have the reactive foil on them, and before you put them into the vacuum bag, you should try to smooth out any air bubbles (Figure 12). Just push the air bubbles out with the pads of your thumbs. Be careful not to slide the plastic around at all, or you will lift off the chrome.

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Next, you'll trim off most of the excess reactive foil from around the perimeter of the fin (Figure 13). This will make it easier to put the fins into the bag, because you may not have a lot of room to nest them. It also helps to pull a good vacuum on the fins so that the chrome is really pressed down to the fin's surface. Any air bubbles on the surface have less distance to travel to the edge of the foil to be sucked out.

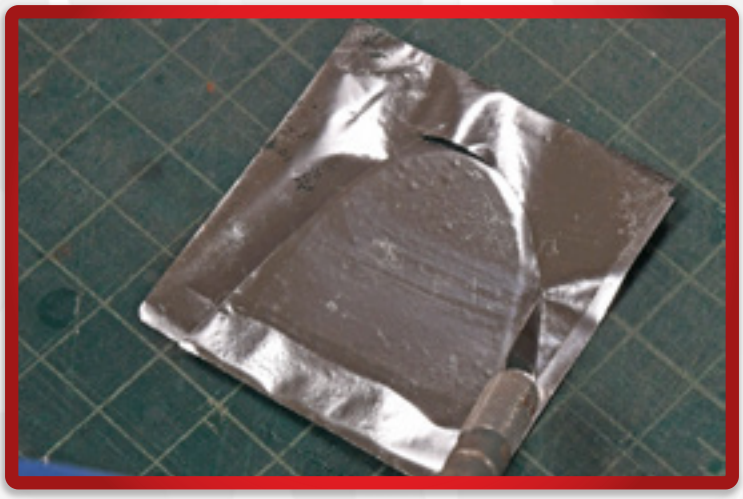

FIGURE 13: TRIM TO AROUND ⅛-INCH AROUND THE PERIMETER OF THE FIN WITH A HOBBY KNIFE

At this point, the fins can be put into the vacuum bag (Figure 14). The process of vacuum bagging was discussed in Peak-of-Flight Newsletter #569, so you can review that now. Remember, the purpose is to pull any air bubbles off the surface, in order to make the surface as smooth as possible. We're not sucking off excess epoxy in this process. We didn't put much on by spraying it, so there isn't much that would be sucked off.

FIGURE 14: THE FINS POSITIONED INSIDE THE VACUUM BAG.

As you turn on the vacuum, again use the pads of your thumbs to push off any air bubbles from the surface of the fins. Remember to do both sides, so flip the bag over in order to get the back side.

Also use your fingernail to trace the perimeter of the fin, which will stretch the plastic bag and really seal down the edges. Your fins are probably rounded off on the edges, and this will get as much of the chrome on the edges as possible. You probably won't get chrome all the way on the very tip of the edge, because the reactive foil doesn't have any stretch to conform to the curvature.

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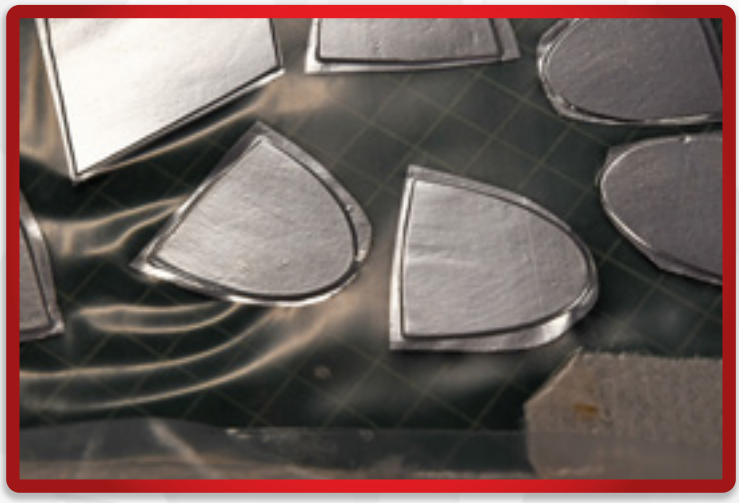

FIGURE 15: WITH A VACUUM APPLIED, PRESS OUT ANY AIR BUBBLES.

I usually put a heavy flat weight on the fins, which is used to keep the fins straight and flat while the epoxy cures.

Now just wait for the epoxy to cure. I usually leave it in the bag overnight.

This is the fun part, opening up the bag and pulling out the fins.

The plastic sides are sort of bonded to each other, so separating the film from the fin can be tricky. What I do is to tap on the edge with my finger (Figure 16). What this does is to separate the chrome from the plastic film. Once it is separated, you can pull the film off of the fin.

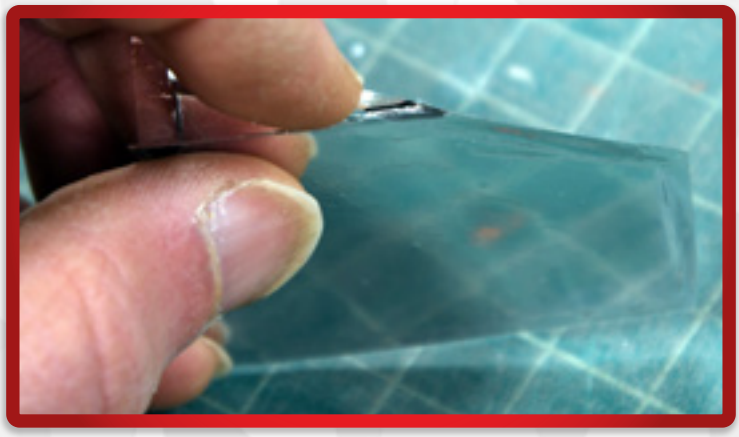

FIGURE 16: SPLIT THE FILM ON THE EDGE BY TAPPING WITH YOUR FINGER.

FIGURE 17: REMOVE THE PLASTIC SHEET. IT SHOULD BE TOTALLY CLEAR IF EVERYTHING ADHERED TO THE FIN.

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Figure 17 shows the film removed from the fin. You can see that the plastic is totally transparent where the foil used to be. What you want is a totally clear window, which means the chrome is stuck to the fin.

FIGURE 18: DEMONSTRATION OF HOW THIN THE SILVER LAYER REALLY IS.

You're probably wondering how thick the chrome is. You might be thinking that you can sand the fin after the chrome has been applied. In Figure 18, I put epoxy on the chrome and let it cure. Then I crinkled the plastic, and the chrome flaked off and looks like confetti. It is very very thin. If you hit the fin with even some very fine sandpaper, you will scratch it all off and get down to epoxy and bare fin. As long as you don't scratch it (like paint), it is durable enough for everyday handling.

Figure 19 shows a completed fin. You can see a mirror-like reflection on the surface of the fin. But since the fin isn't totally smooth, you can notice a little texture of the balsa wood. This is why you have to try to make sure the fin is extremely smooth before you attempt to put the chrome finish on.

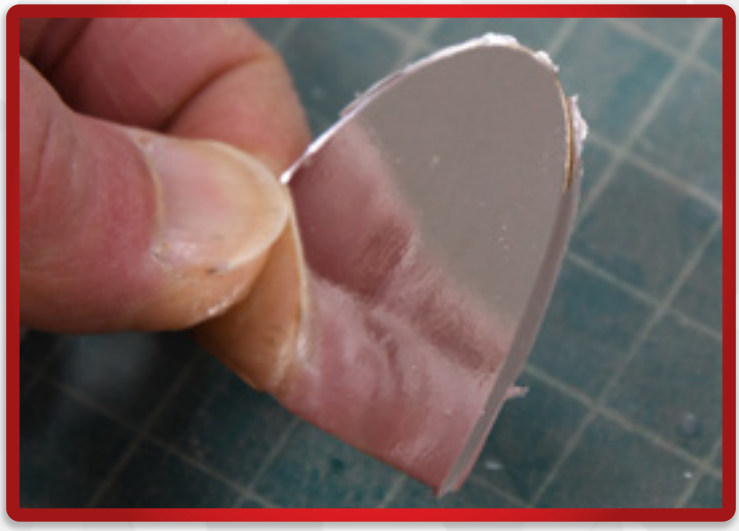

FIGURE 19: A COMPLETED FIN IS HIGHLY REFLECTIVE.

You'll also notice that there is a little bit of flash on the edge where a small amount of epoxy did ooze off. It won't be much. It is so thin, you can easily wipe it off with your finger. But you may need to sand it off just to make sure the fin edge is smooth and doesn't feel like a serrated knife.

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If you don't get all the air bubbles out, or there wasn't enough epoxy in the process, you'll get something that looks like Figure 20. This is where the chrome didn't adhere to the surface of the fin. The fin will still be smooth, but it won't look cosmetically pleasing like the rest of your fins.

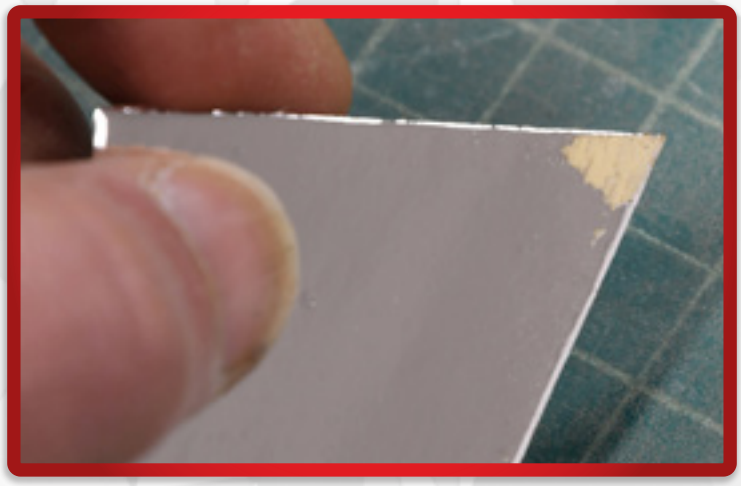

FIGURE 20: YOU'LL GET GAPS IN THE CHROME FINISH IF THERE ARE ANY AIR BUBBLES UNDER THE FILM.

Have You Tried…?

Whenever I seem to write an article like this that describes my attempts at a new process, someone always asks a question that begins with the phrase: "Have you tried…"

The answer is: no.

I haven't tried anything else besides the application of the reactive foil to flat fins. I have not tried tubes, nor have I tried repairing gaps in the foil, like was shown in Figure 20.

But I have tried putting on the reactive foil without vacuum bagging -- using just weights to press everything down. That doesn't work well, because any valleys in the fins (like along the wood grain) will trap air bubbles. And when you have air bubbles, the foil isn't pressed well to the surface and the chrome finish doesn't adhere. The appearance of the final fin isn't uniform and the wood shows through.

The plastic used in the reactive foil is not stretchy, and I think that is one of its limitations. It won't go around a compound curve very well, like over the edge of a fin that have been rounded off. It seems to like flat surfaces. I suppose you could put it on a tube, but I do not know what the overlap will look like.

Will other adhesives work? Again, I haven't tried them. I've only used thinned out epoxy. Nor have I tried various manufacturers of toner reactive foil.

All I can suggest is to give it a try. The foil isn't too expensive, so playing around isn't too costly. Don't be afraid to experiment.

To answer all your other questions… "no, I haven't tried it." But that doesn't mean it won't work for you. Go for it!

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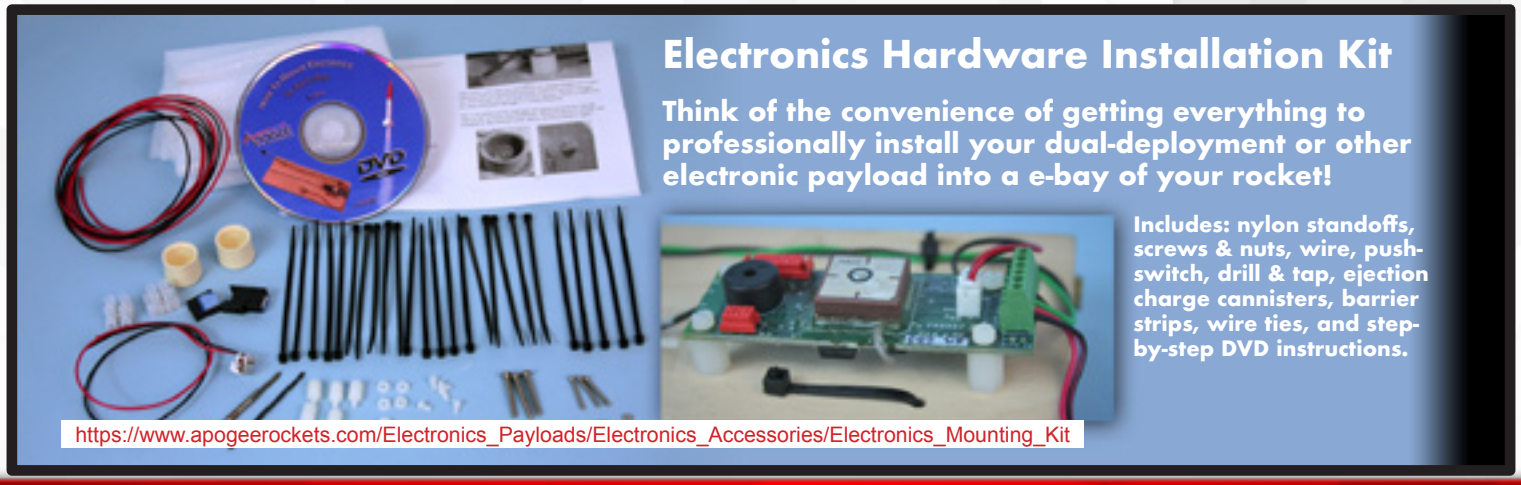

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Conclusion

The method described here to make chrome plated fins is a little more involved that just putting on an aluminized shiny decal. But I think that you'll find it looks a bit better. And it is definitely lighter weight.

Additional Resources

Here are a couple of previous newsletters that talked about how to make lightweight fins:

Peak-of-Flight Newsletter #440 (https://www.apogeerockets.com/education/downloads/Newsletter440.pdf) - Shows how to make a foam-core fin using expanding urethane foam and a two-part mold

Peak-of-Flight Newsletter #509 (https://www.apogeerockets.com/Peak-of-Flight/Newsletter509) - Shows how to flatten and press on skins to fins using a tool made from cutting boards.

Peak-of-Flight Newsletter #569 (https://www.apogeerockets.com/Peak-of-Flight/Newsletter569) - Shows the process of vacuum bagging fins.

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 an 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 ezine newsletter about model rockets. You can email him by using the contact form at https://www.apogeerockets.com/Contact.