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NEWSLETTER

Feature Article:

Another Method to Apply Paper Skins to Balsa Fins

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ISSUE 250 DECEMBER 15, 2009

Another Method Of Applying Paper Skins to Balsa Fins

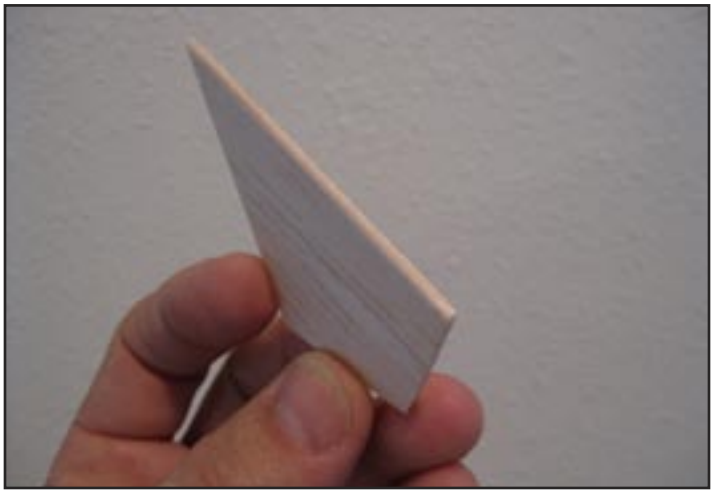
Written By Hans "Chris" Michielssen

After watching the Construction Video from August 4, 2008 (www.apogeerockets.com/Rocketry_Videos/Rocketry_Video_16.asp), I wanted to show how to get a smooth, rounded leading edge on a paper covered and reinforced balsa fin.

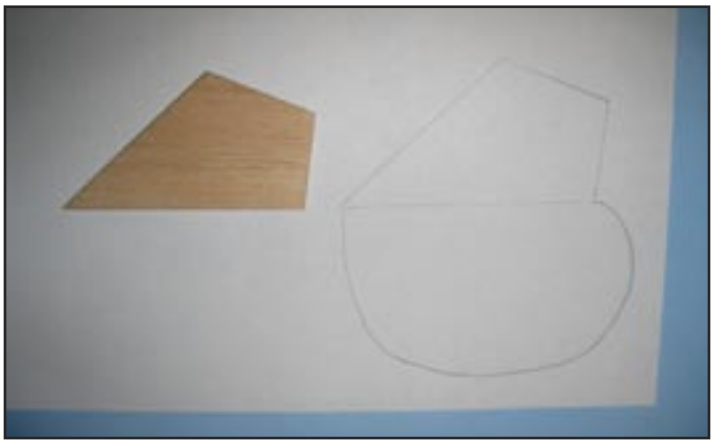
Normally, paper covering involves two separate pieces of paper, one glued or stuck to each side of the fin. Papering the leading edge like this might make it prone to peeling after a few flights. This method should alleviate the problem.

Papering a rounded leading edge is more aerodynamic and gives a more finished look to the fin.

Note by Tim Van Milligan: This method, because it uses spray adhesive to hold down the skin to the wood will not yield a fin that is as strong as the one shown in the video referenced above. The spray adhesive I've used in the past had a rubbery texture to it, so it can flex with the wood. While I have not tested it, my gut feeling is the edges might peel up if you don't tack them down with water-thin viscosity super-glue. But the big advantage of Chris' method is that it is a lot quicker to apply to the fins than what I showed in the video, and the fin is in no danger of warping due to the water in the glue.

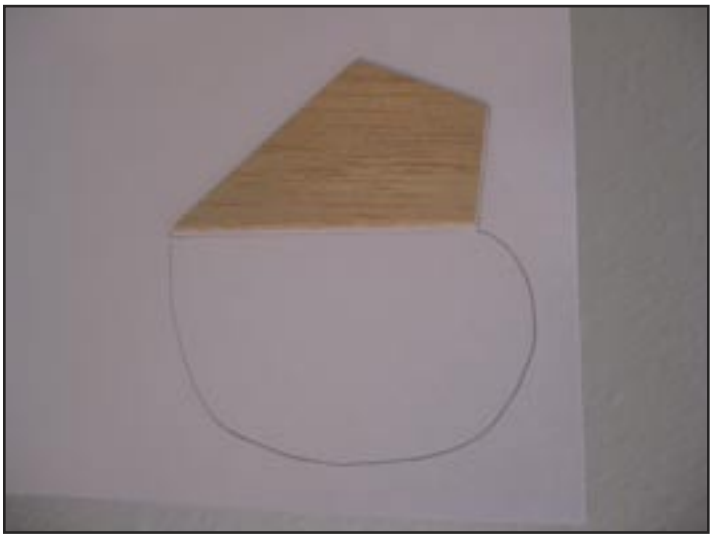


PICTURE 1: Sand a rounded edge on the leading edge of the balsa fin.



PICTURE 2: On lightweight paper, trace around the fin. Then flop the fin over its rounded leading edge on the leading edge line you've just drawn on the paper.

While holding the fin down on the leading edge line, draw a larger arc around the outside edge of the fin. You are making a larger side that will "Butterfly" over the rounded leading edge of the fin to be covered.



PICTURE 3: I sprayed the drawn fin area with spray adhesive. The fin was laid on the sprayed area, lining the rounded leading edge on the line where the paper will roll over the rounded edge.

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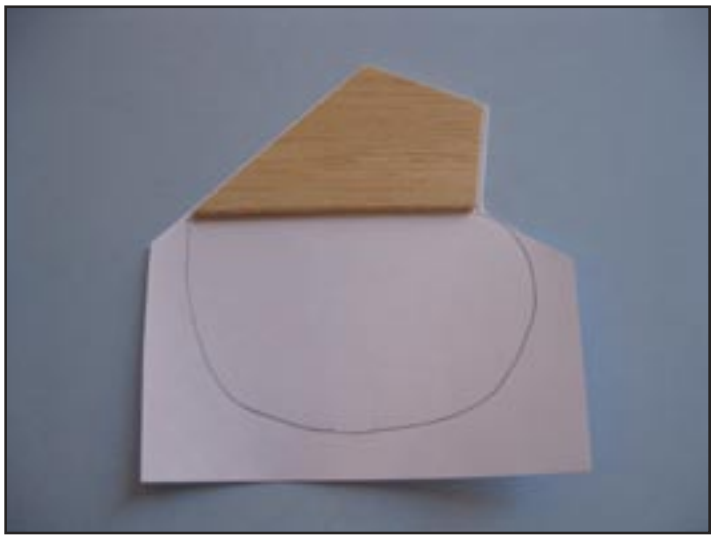
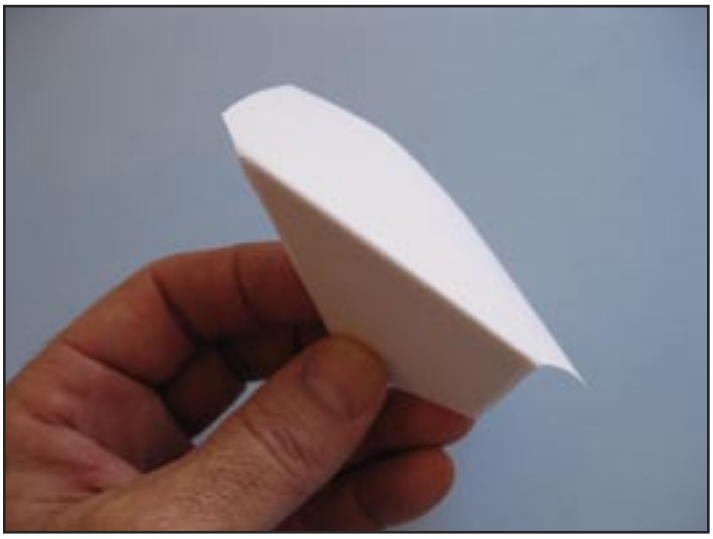
Applying Paper Skins to Balsa Fins



PICTURE 4: Trim the paper close to the balsa. You don't have to trim exactly to the wood yet. This simply removes excess paper and makes the next step "fold-over" easier.



Picture 5: Burnish the paper on flat side of the fin.

Take your time on the next step. Slowly roll the paper over the top of the rounded leading edge, being sure there aren't any creases or open spots. I run my index finger back and forth over the top.

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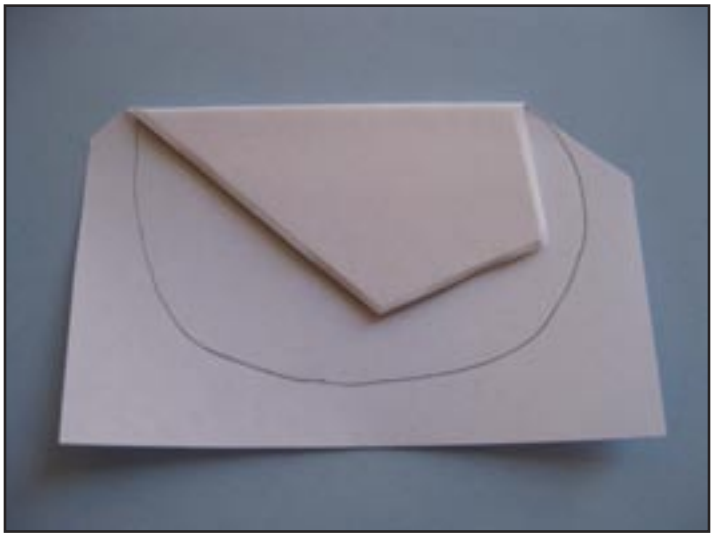
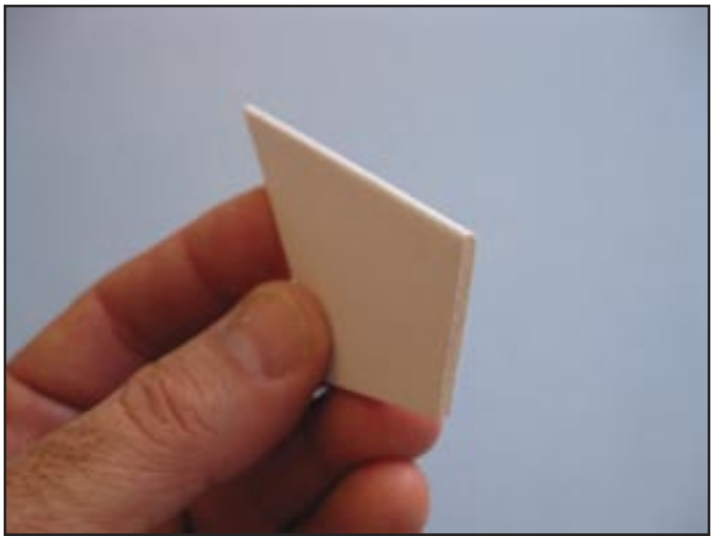
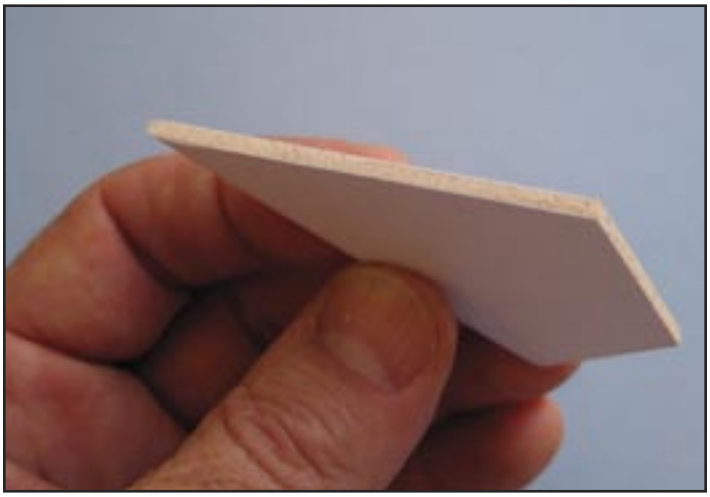
Applying Paper Skins to Balsa Fins



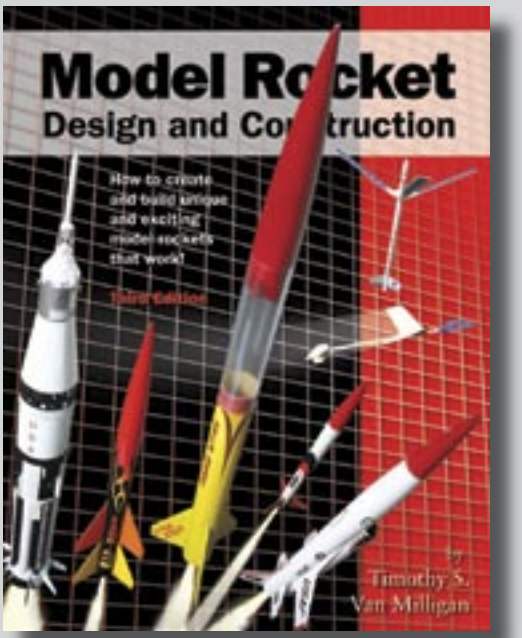
PICTURE 6: Lay the fin over the other side of the sticky paper. Burnish again to smooth it out.





PICTURES 7 (Top right) and 8 (Lower right): Sand the edges off with some 400 grit sandpaper on a sanding block. Check the edges after a while. You may have to close up a open area with some glue. Go lightly, it won't take much.

You'll still have to fill the open pores in the outside and trailing edges. But that is all that is to the process!



Model Rocket Design and Construction

By Timothy S. Van Milligan

New 3rd Edition Now Shipping!

This new 328 page guidebook for serious rocket designers contains the most up-to-date information on creating unique and exciting models that really work. With 566 illustrations and 175 photos, it is the ultimate resource if you want to make rockets that will push the edge of the performance envelope. Because of the number of pictures, it is also a great gift to give to beginners to start them on their rocketry future.

For more information, and to order this hefty book, visit the Apogee web site at: www.ApogeeRockets.com/design_book.asp

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Reader Questions, Comments, and Suggestions

Answers by Tim Van Milligan

Daniel Yaugo writes: *"I like all the videos you have on your website. Video #16 (www.ApogeeRockets.com/Rocketry_Videos/Rocketry_Video_16.asp) was very helpful. I've been skinning my fins ever since...I like that it cuts down on the rocket building process and I can't stand sanding. What I wanted to add to the process that works great for me is I use a Popsicle stick to squeegee off the excess glue. It gives you a very thin and very even coat of glue and the best part is that there's less of a mess, and it keeps the glue off your fingers. It works exceptionally well.*

My next step from there is I use a wooden dowel rod... maybe 1/2" diameter, and once I have the paper on the fins I roll the surface to make it extra smooth and get all the imperfections out, and then go over it with my fingers afterward."

Thanks for the suggestions. I'll pass them along to the other newsletter readers. I'm sure they'll find it useful too.

Steve Kristal writes: *"Just a quick note of congratulations on the TARC article in 249 (http://www.ApogeeRockets.com/Education/Downloads/Newsletter249.pdf). Superbly written!*

May I suggest you turn the article into a 'special edition' video talk. It would be an outstanding place to start for any TARC team.

Again, Tim, congratulations on the outstanding article."

Thank you, Steve, for those kind words. It means a lot to me to hear back from readers.

I have my own personal favorite article topics that almost seemed to write themselves. While this wasn't one of them, I felt it was important enough to press ahead and get it down on paper. I almost felt that I've written about this topic before, which is why it took me a bit longer to write than other articles. It also has a lot of back-links to previous articles, which is why it felt like Déjà vu. I don't like repeating myself. I get more energy when I get to write on a subject that I've never tackled before. For example, almost all the plans that have been printed each represented something new and unique. I'm jazzed about that kind of thing. The article about the Ares 1-X was also a recent favorite of mine. It was fun digging into the real flight data, since it reminded me of my days working on the Delta II rocket when I lived in Cape Canaveral, Florida. I also got a lot of nice comments about it from readers, and that gave me a boost too.

I'm glad you found it useful. I suspected that many

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Reader Questions, Comments & Suggestions

TARC teams have similar issues in getting a good starting point. And thanks for the idea for the video. I'll give it some thought.

Comments About the Aries 1-X Article

Scott A. Stephenson wrote: *"I just finished reading your article (http://www.ApogeeRockets.com/Education/Downloads/Newsletter248.pdf) on the Aries 1-X test launch. What a great article. Packed full of techno-geek information that us rocketeers just absorb like a sponge! I then went to YouTube and watched the launch video from NASA television. Awesome! To read about the systems and the rocket and then to see it in action is fantastic! Brilliant timing for the article!*

I am really interested in being able to better read the flight data graphs you included. I would like to know what the scale and tick marks are on both of the axis. I presume the X-Axis is T (Time) in seconds on all three charts, is that correct? But what is the scale? The Rock and Tilt position charts, the Y-Axis is degrees? Do you have a clearer image? Or is it purposely fuzzy because of security issues?

Again, just a fantastic presentation of the data and reference to your collogues in the NASA program!"

Thank you Scott for the warm words of praise about the Ares article. It was a fun one to write.

I'm pretty sure that chamber pressure is in PSI, and that the actuator positions are in degrees. It makes sense that way.

The images are fuzzy in the article because I reduce their quality to decrease the overall size of the newsletter PDF. That was a particularly big newsletter at 1.7 MB. Normally, I try to keep them below 1 MB to reduce the stress on our web server. This newsletter goes out to over 18,000 people, which means a lot of data is being transferred on each newsletter issue.

There is actually a high resolution version of each newsletter too, but that only goes out to our VIP customers. You get to be a VIP after your 6th order of products from our web store (http://www.apogeerockets.com/Frequent_flyer.asp).

Mark Swierczek writes: *"I enjoyed the article about rocket stability in your recent newsletter; however, balancing a pencil on your finger while walking up stairs is not a proper analogy for the thrust forces acting on a rocket. The reason is that when you walk up the stairs, your finger moves upward regardless of which way the pencil is pointed, whereas in a rocket, the engine remains oriented along*

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Reader Questions, Comments & Suggestions

the body axis of the rocket even as the rocket turns.

The flawed pencil analogy is what leads people to believe that putting the engine near the front of a rocket is inherently more stable, due to the so-called "pendulum effect". In fact, there is no such thing...the stability of the rocket is unaffected by the longitudinal point of thrust application, due to the principle of vector superposition.

Interestingly, even the great Robert Goddard was initially fooled by this, which is why he put the nozzle near the top of his early rockets. He soon realized, however, that if he didn't get the location of the CP and CG right, his "nose drag" rockets were just as unstable as any other!

Thanks for the comments Mark. I still think my analogy of balancing the pencil on your finger is a good one. But I see your point too.

Rocket Motor Ejection Charges

Cal Wendlandt asks: *"The single use rocket motors you have listed (www.ApogeeRockets.com/rocket_motors.asp), can they be gotten without a recovery charge so a person can use your electronic dual deployment?*

Sorry. That is the way they come from the manufacturers.

This is a common question, and the solution is pretty simple. You can cut a hole in the side of the rocket and vent the ejection gases out. We do this all the time, like in the Texas Twister rocket kit (www.ApogeeRockets.com/texas_twister.asp), and in "rocket-glider" engine pods (see Figure 1).

Figure 1: Rocket glider with vent holes in front of the motor to allow the exhaust gases out of the tube.

If this is a big rocket project that you are working on, you can use the ejection charge from the motor as a redundant back-up to kick out the small chute at the apogee point. Obviously, the drouge chute would have to be towards the bottom of the rocket as shown in Figure 2. If you do it this way, just select a long delay for the motors so it would be on a downward trajectory when it pops. So if the drouge chute were already deployed, the motor ejection charge would go off in the empty tube and just vent out

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Reader Questions, Comments & Suggestions

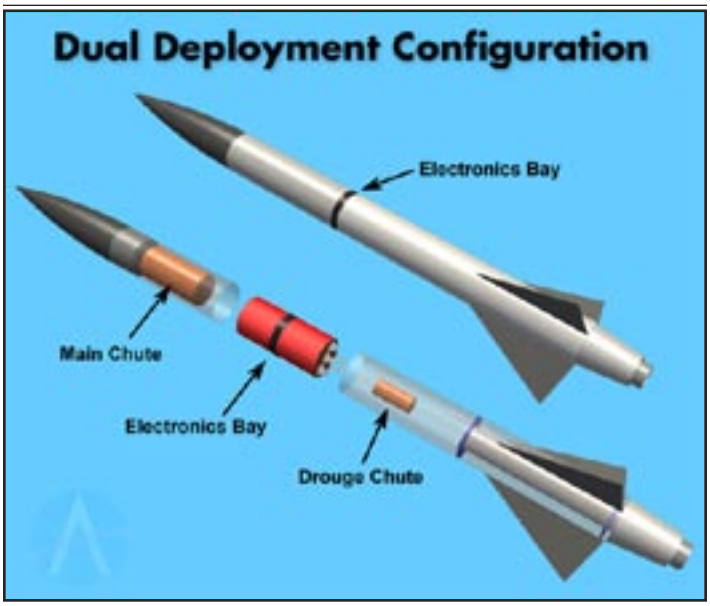

Figure 2: Dual-deployment configuration where the motor ejection can offer redundant drouge chute ejection.

to the atmosphere. If for some reason the pilot chute didn't come out from the electronics, the motor's ejection charge would kick it out of the rocket. That redundancy could be a life-saver.

Bill Mott asks: *"How do you use RockSim to determine Mach Delay settings on an altimeter?"*

This is a good question. For readers that are unfamiliar with term "Mach delay," what does it mean?

The mach delay setting is used to prevent premature deployment of the drogue parachute as the rocket makes the transition between subsonic flight and supersonic flight. During this period the pressure surrounding the rocket suddenly increases—which could be interpreted as a decrease in altitude. This condition would cause the altimeter to think the rocket has gone past apogee, and it would fire off the ejection charge to deploy the drogue chute.

"Mach delay" forces the altimeter to prevent firing the deployment charge for a predetermined amount of time (that time period where the rocket is travelling at supersonic speeds). After the time period has expired, the device will go back to normal operation and sample the air to determine the altitude of the rocket.

How to do it in RockSim? Step 1: Set your user preferences to display velocity as a Mach number.

Step 2: Run your simulation.

Step 3: Have RockSim graph out the velocity versus time curve. The graph will show you the velocity of the rocket versus Mach number (see Figure 3).

From this plot, find when the rocket drops below Mach 1. This is the minimum time you'll need for your Mach delay. Just to be safe, I'd set it for one-half second after this, just in case your rocket chuffs on the pad and doesn't lift off on at the instant the timer starts counting.

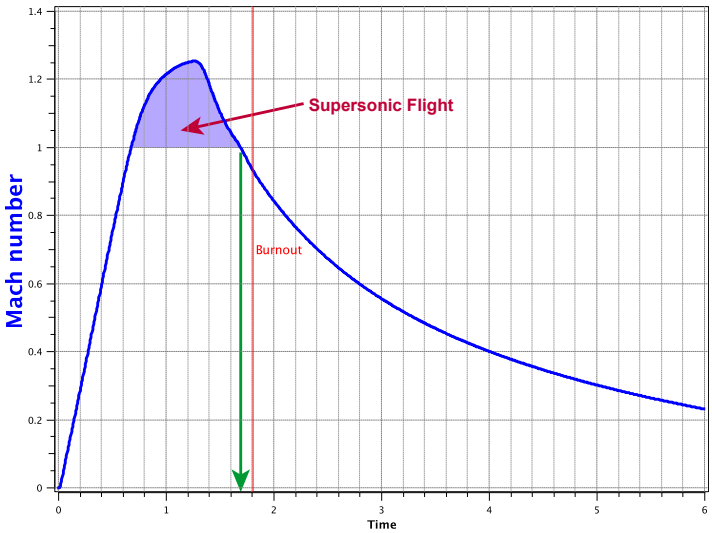

Figure 3: From the plots in RockSim, you can see where on the timeline the rocket is going supersonic.