



# HEAT SINK

# STREAMERS

by Kevin Kuczek

The idea for heat sink streamers popped up around a year ago when I stumbled across a Slovakian FAI rocket competition website that mentioned a new streamer folding method that a number of eastern block countries, notably Poland, were using and having a lot of success with in the S6A FAI Streamer Duration event. The Poles, Czechs, Serbs, and Slovaks have all ended up in the winners circle at World Spacemodeling Championships and World Championships the past ten years more times than I can count and a few accounts indicated that this type of streamer was what was being used.

The writer described these streamers as having a very fine pitch of only 4-5mm and that they must have been pressed by machine vs. hand folding, since folding a 5" x 50" streamer with 4mm-wide folds would require around 300 folds! Unfortu-

nately, there was no discussion anywhere on how to actually make these fine-pitched streamers.

So, I sort of had an idea that the only way to get a fine and consistent pitch over the entire streamer would involve a mold and then clam shelling the streamer inside. But what could be used for the mold? I thought initially I would mill my own zig/zag pattern out of aluminum, but the more I thought about it, the more I knew I had seen such a zig/zag pattern before and somewhere in my house. Ah, the amp to my entertainment system. There, on top of the amp was a fine pitch corrugated heat sink. Yes, heat sinks!

I located a supplier and purchased half a dozen different sizes and started trying them out. Initially, I thought just laying a loose streamer and pressing between two heat sinks would work. But there was just

Photo 11. The completed 5" x 50" heat sink streamer after the roll is peeled apart.



Photo 2. Wooden jig used to roll the streamer in a 6" length.

## Directions

First roll up a 2-3 ft. wide section of 1/2 mil streamer material of the correct length for your streamer around a 1/2" diameter steel tube or similar tube. Tape the end down in a few places and slide the rolled Mylar tube off the steel tube mandrel. Mark the desired streamer widths (5" or whatever width you prefer) and then using a straight edge and roller cutter, cut the Mylar tube at streamer-width increments to give fast blank streamers. See photo 1.

Next, roll the streamer material around two 1/2" wood dowels that are spaced approximately 6 inches apart. I made a simple wooden jig to hold the two dowels. Carefully slide the streamer off the wood dowels. See photo 2.

With the end of the rolled streamer on the bottom, set the streamer squarely over the lower heat sink. See photo 3.

Next, start in the middle and press the streamer down into a groove using an ordinary credit card. Work upwards from the middle to the top of the heat sink using another credit card to walk the streamer into the next

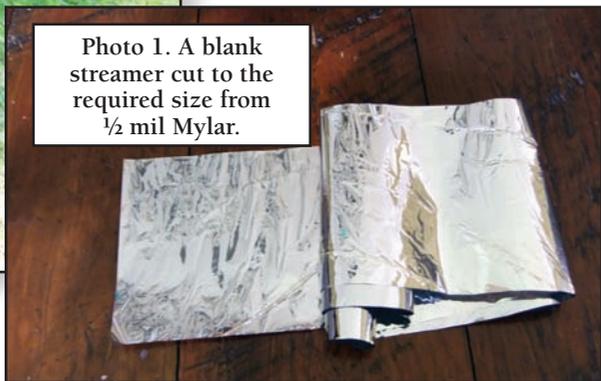


Photo 1. A blank streamer cut to the required size from 1/2 mil Mylar.

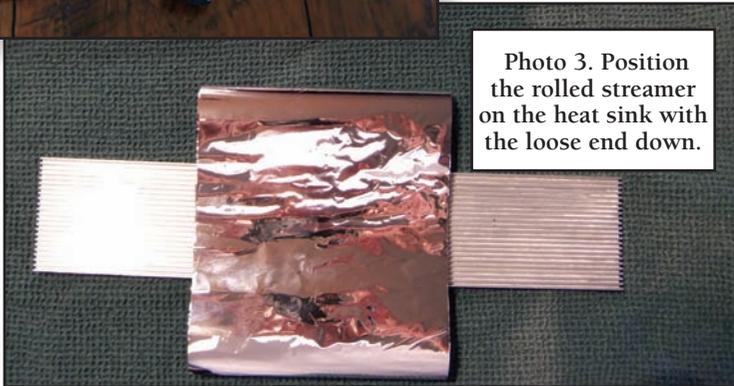


Photo 3. Position the rolled streamer on the heat sink with the loose end down.

enough friction to prevent this from happening. So, after a few other tries, I finally came up with the idea of walking the streamer into each groove on the heat sink using two credit cards.

The other unique feature about these streamers is that they use 1/2 mil Mylar and not the more typical and thicker 1 mil Mylar. This makes them lighter and perfect for streamer duration where one is scraping to save every gram. The whip is pretty fantastic also with average durations being two minutes using A motors and 40mm diameter FAI-style (read large big Bertha size) models. The streamers seem quite responsive in even light thermal conditions with the whipping action becoming more violent.

What follows is a step-by-step procedure for heat shrink streamer making.





# Upgrade Your Scale Fleet

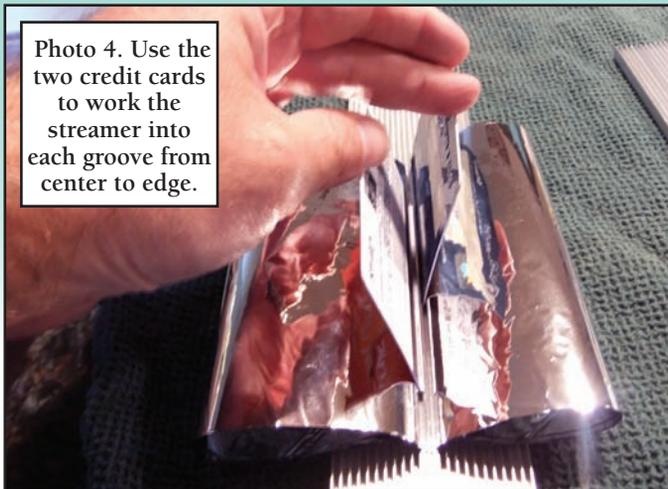
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**Photo 4.** Use the two credit cards to work the streamer into each groove from center to edge.



groove above, always keeping the first credit card in place to hold the streamer in the previous groove. Once you've reached the top, turn the heat sink around and work the remaining half of the streamer into the heat sink using the two credit cards. See photo 4.

Once the streamer is in the lower heat sink (see photo 5), carefully place the upper heat sink on top and clamp in place using C-clamps. Offset the heat sinks by approximately 1/2" so that you can easily pry them apart later. Bake the assembly in the oven for one hour at 200°F. See photo 6.

Allow the assembly to cool, then remove the streamer from the heat sinks. You should have something that looks like that in photo 7. Note that at this point the folds are kind of rounded at the ends and not crisp. This will be corrected in the next step.

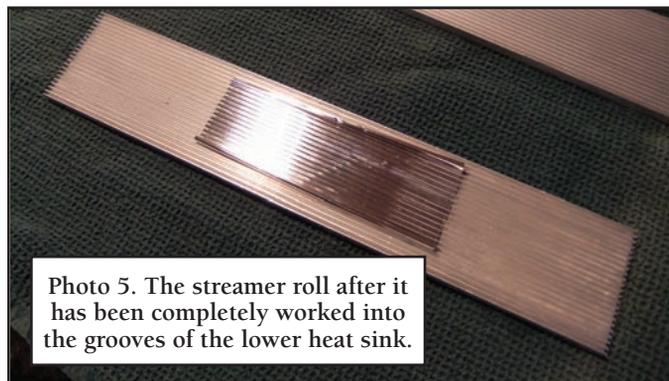
Using the two steel angle brackets with a flat center press,

clamp the streamer down between the two angle brackets using the flat center steel bar stock. Bake in the oven again for one hour at 200°F. See photos 8 and 9.

What results is a compact 5" x 50" long streamer that is compressed to only one-quarter-inch in size! Peel the streamer carefully apart to reveal the Heat Sink Streamer. See photos 10 and 11.

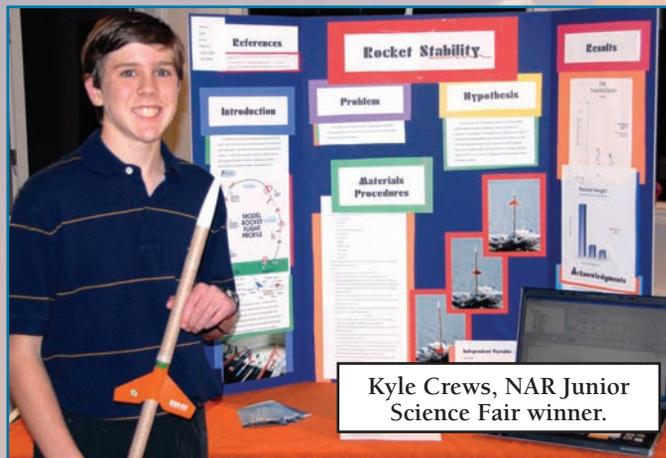
## Notes

I've found that the optimum attachment point is in the center of the end of the streamer that rolls off opposite the end that is first peeled from the pressed streamer. Use a small diameter carbon rod taped in place along the edge to stiffen. The wagging end of the streamer also seems to whip the most when the upper third and inside third (of the width) of the folds are further reinforced and



**Photo 5.** The streamer roll after it has been completely worked into the grooves of the lower heat sink.

# NAR JUNIOR MEMBER SCIENCE FAIR CONTEST



**Kyle Crews, NAR Junior Science Fair winner.**

## NAR Junior members:

*Have you done a science fair project that involves model rocketry? If so, you can enter your project into the NAR Junior Member Science Fair Contest. Up to six winners will receive free NAR membership renewals including First Class delivery of Sport Rocketry magazine! If you don't have a science fair project involving model rocketry, start thinking ahead to next year, because the NAR will run this same contest next year.*

### CONTEST RULES:

1. The contest is open to NAR Junior members.
2. Any science fair project involving model rocketry or high power rocketry is eligible to enter. The project can be a study of some aspect of rocketry, or it can be a project that utilizes rockets as a testing or data collection tool. Projects entered in a previous year's contest are not eligible for entry in this year's contest.
3. Submissions should include photocopies and/or photographs of your science fair report and display graphics. Include whatever material you feel will help the judges to better evaluate your project. You may also submit files on CD or DVD disc. A photograph of your self by your science fair display or conducting your rocketry project would be appreciated, but is not required.
4. Entries will be judged on Research Value and Originality, Scientific Thought and Engineering Goals, Organization and Thoroughness, Effort, and Clarity.
5. Membership renewals won in the contest are not transferable to other persons.
6. All Junior members who enter the contest will be listed in Sport Rocketry magazine.
7. You retain any copyright and commercial rights to your projects. You grant the NAR the right to publish your project in any of its publications. The entry materials become the property of the NAR and cannot be returned.
8. Deadline for entry (by postmark) is June 30, 2011. (We will run the contest again next year, so start thinking ahead!)
9. Send submissions to: Thomas Beach, Science Fair Contest, 432 Pruitt Avenue, Los Alamos, NM 87544. Be sure to include your name, NAR number, address, phone number, and email address (if applicable).

creased by hand. When this is done, the streamer curves towards the creased side and fans out at the wagging end.

Another note: The particular heat sink I ended up using gave folds that would not



Photo 7. The streamer roll after baking in the oven and removal from the heat sinks. Notice that the folds are rounded, and not yet sharp.

fold or crease up on themselves when deployed. Larger pitches than 4-5mm with 1/2 mil Mylar want to crease due to the deployment forces, and when this happens the streamer tended to streamline in.

Finally, at the 2010 World Championships I was able to discuss my streamer folding with the Polish team—sort of. Though they wouldn't show me one of theirs, they looked at mine and said, "Yes, yes, yes." They also seemed to indicate that the 10:1 ratio should be longer, but I cannot confirm this.

Certainly, there are probably variations of the technique that I hope people will try after seeing this technique.

## Materials

- (2) 12" lengths of aluminum heat sink material available from [www.mmmetals.com](http://www.mmmetals.com), item number MM26600. The minimum order from them as I recall was \$100, so you might get a group order together to help spread the costs out.
- (2) 12" long pieces of 1-1/2" wide x 3/16" thick steel angle stock from The Home Depot.
- (1) 12" long piece of 1-1/2" wide x 3/16" thick steel bar stock from The Home Depot.
- (4) Small C-clamps
- (1) Large C-clamp
- (2) Credit cards or similar



Photo 6. Clamp the two pieces of heat sink together with clamps, and bake for one hour at 200°F.

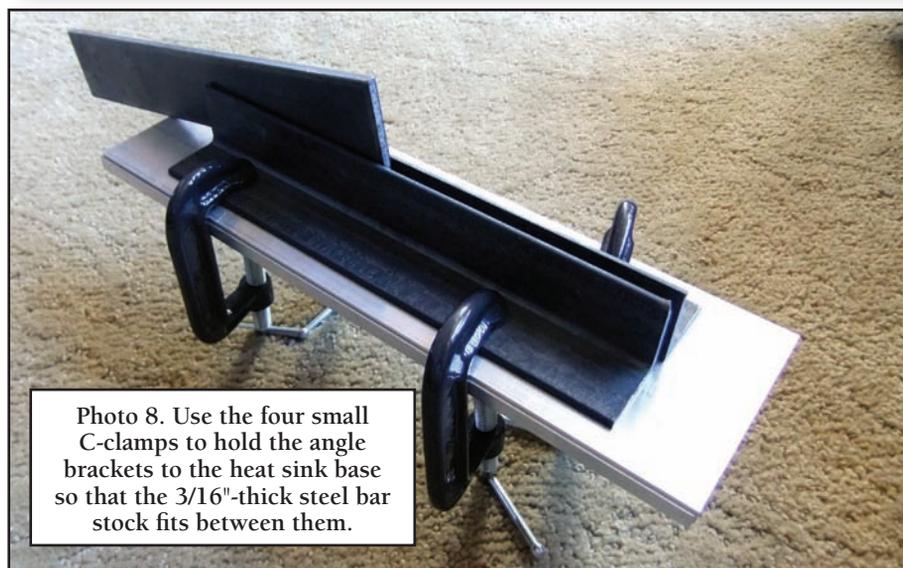


Photo 8. Use the four small C-clamps to hold the angle brackets to the heat sink base so that the 3/16"-thick steel bar stock fits between them.

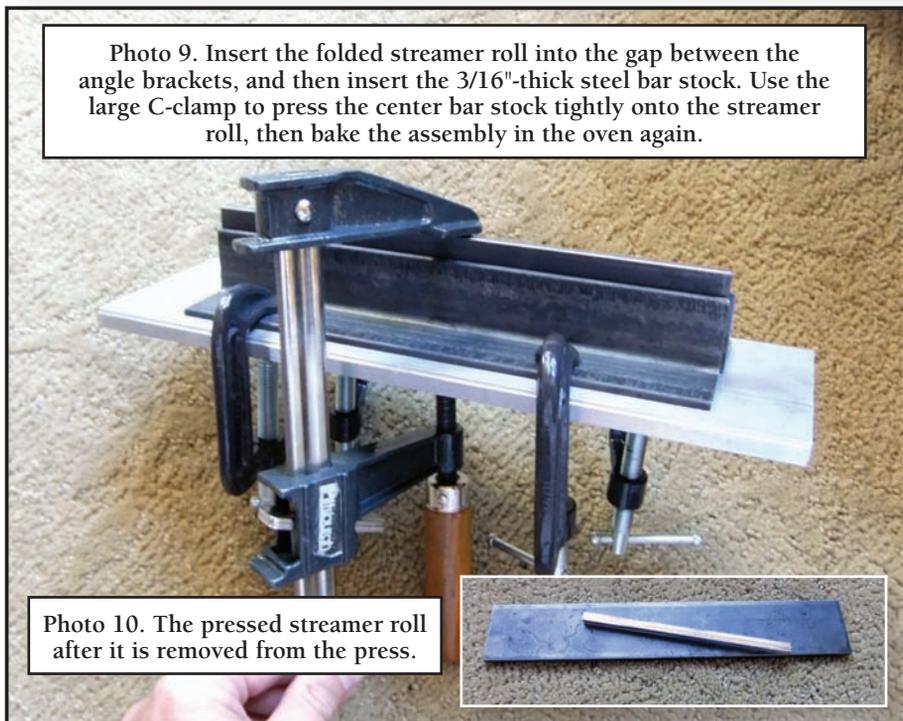


Photo 9. Insert the folded streamer roll into the gap between the angle brackets, and then insert the 3/16"-thick steel bar stock. Use the large C-clamp to press the center bar stock tightly onto the streamer roll, then bake the assembly in the oven again.

Photo 10. The pressed streamer roll after it is removed from the press.