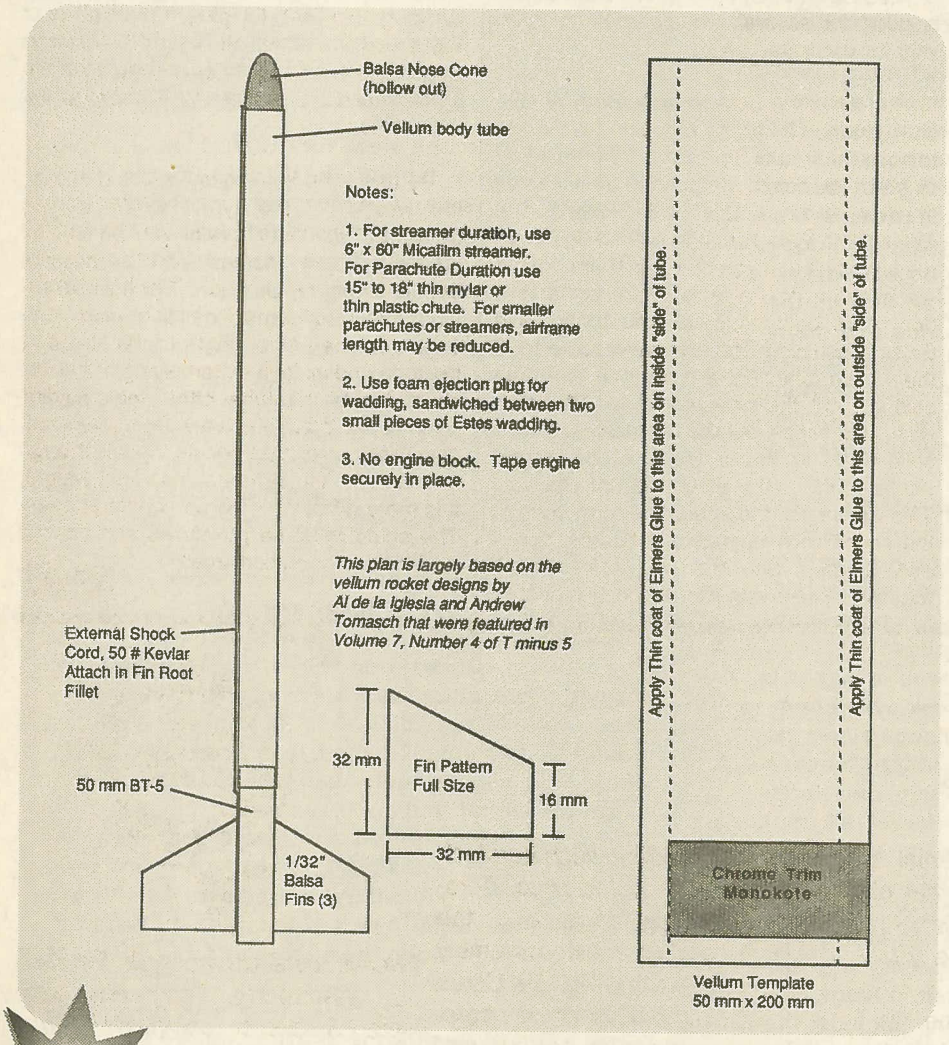
COMPETITION ROCKETRY

Vellum Airframe Rockets for Low Impulse Streamer and Parachute Duration

by **Dan Wolf**



During the 1980s, the seemingly simple Streamer Duration event saw lots of development activity. Most of this work was in the research of materials that would produce more drag than the commonly used crepe paper and mylar streamers. Now, most competitive SD birds use a streamer with a length to width ratio of 10:1, accordion folded for 1/2 to 2/3 of the length and made of tracing paper, Micafilm, or any other light weight material that will hold the pleats. With the streamer portion "solved", attention in recent years has focused on reducing the weight of the model. Models flown in FAI (International) SD and PD events are almost exclusively fiberglass airframes. Some modelers have built models from fiberglass for NAR competition that are straight BT-5 equivalents at far less weight than BT-5. The benefit of doing this seems to be questionable for a rocket that will probably only last 3 or 4 flights.

In 1991, a new lightweight airframe came on the scene. Andrew Tomasch developed an all vellum airframe rocket to fly in FAI S3A (A parachute duration) and S6A (A streamer duration). Based on his work, Buzz Nau and Al de la Iglesia developed a vellum model they called the VDM-3, for the NAR "A" Streamer Duration event. Vellum is a type of drafting paper used for engineering drawings. It is actually a composite material, with cotton fibers impregnated in the paper. It is available in a wide variety of sizes at art and drafting supply stores. Al and Buzz blew away the competition using the VDM-3 at NARAM-33. Plans for both the VDM-3 and Andy's FAI model, the Paper Tiger II, appeared in Volume 7, Number 4, of T minus 5, published by HUVARS. This issue is an excellent reference for those seeking further information on vellum construction. Since that article appeared, myself and others have used vellum rockets based on the VDM-3 with various degrees of success. After the T minus 5 article was published, I built and flew VDM-3 type models in 1/4A PD (MR) at NYSPACE-92 with great success. I managed to easily "max" two flights, and missed a max on the third by only seconds when the chute didn't fully deploy. At other meets, I have had less success using Vellum, including a disaster at NARAM-35, when most of my flights were DQ'ed. Not all of these failures were due to the airframe failure but a significant percentage were. Even though the VDM-3 plan calls for a piece of chrome trim Monokote to be placed on the inside of the body tube, just above the engine, some models were still badly burned at this spot.

When writing up the NARAM 35 SD coverage for Sport Rocketry, I learned that others had had success using vellum. The "Hot and Cold" team took first place in Team Division using vellum. Team member Gary Miller told me that their models did not have a complete vellum airframe however. Gary said the bottom of the model was a short section of BT-5. It's then that I recalled seeing this idea at the end of Andy's article. Andy called out a 1.5" length of 13mm Apogee Blackshaft tubing but the idea is the same. Use just enough body tube to keep the end of the airframe from burning up, and make the rest of the model from vellum. I used this technique for 1/2A SD last fall at MARS-18 and it worked well. I believe that this hybrid airframe approach is the perfect compromise between weight and durability/reliability.

The body tube for this model is a 50 mm wide by 200 mm long piece of vellum. A template is shown in the plan. Once the vellum is cut out, a piece of chrome trim Monokote is placed on the shaded area.

When the tube is rolled up, the Monokote is on the inside and it helps protect that section of the body tube against heat. Now apply a light coat of Elmers glue along the edges, on the outside of the one edge, and the inside of the other, about 6mm wide. After the glue dries, the vellum is wrapped around a mandrel (a piece of BT-5 or Apogee PT-13) and taped in place. If you did this right, the Monokote is on the inside, and the two edges in the overlap area have the glue facing each other. There will be no Monokote in the glue area. Tape the vellum down with several small pieces of masking tape. Then take an iron set on a medium setting, and removing the piece of masking tape at the middle, iron the edge down. The heat from the iron will heat-seal the glue coated overlapping edges. After it cools, remove the next piece of tape and do the same thing. Continue this procedure until the entire tube has been ironed. Once cooled, remove the body tube from the form and glue it to a 50 mm piece of BT-5. There should be about 6 mm of overlap. I used white glue here, checking the alignment as it dried to insure that it was straight. The remainder of the assembly is fairly straightforward. Use an external shock cord mount by bonding a piece of 50 or 70 pound Kevlar in one of the fin root fillets. The Apogee "Lariat Loop" technique can also be used, but I've found that this can expose the shock cord to more stress and/or heat. With Kevlar, always examine it carefully for fraying before each flight, especially the 50 pound type. Look for Kevlar at your local fishing tackle shop (I found some in the sporting goods department of our local Walmart) under the brand name of Stren fishing line.

The whole process of making body tubes from vellum is fairly quick and easy once you've done one or two. I usually build four or five at a time. One piece of vellum paper is good for several models, making them very inexpensive.

Reducing the airframe weight is of little consequence if careful attention isn't made to keep the rest of the model light too. Most plastic nose cones are just too heavy, even the Apogee ones. Use balsa instead. The Estes BNC-5V balsa cone has always been my favorite, but if you can't get them, try the Apogee 14mm balsa cone, and sand it down. The best choice is probably to have Balsa Machining Service make some to fit the vellum tube. For the ultimate in weight savings, cut the nose cone in half length wise, and hollow out the two halves. While split open, cyano a piece of 50 pound Kevlar in the hollowed out part of one half. This will be used to attach the nose cone to the shock cord instead of a heavier screw eye. Then cyano the two halves back together. Finish with thin cyano or a coat or two of clear dope. Make the fins from 1/32" balsa, and finish with a coat of clear dope. No engine block is used, to further reduce weight. Make sure the engine is taped in securely though.

The wadding is a foam ejection plug. I use a piece of brass tubing with an ID of 15/32" to cut the plugs. I sharpened one end of the tubing. I push and twist it through a 1" thick piece of dense styrofoam. I use a dowel that fits inside the cutting tube to push out the ejection plug. Even with the plug, a small piece of Estes wadding above and below the ejection plug, helps to seal the plug, making it act like a piston and preventing any damage to the recovery system.

By using the techniques outlined above, the weight of the typical 1/2A and A Streamer/Parachute model can be cut by 30-50%. These models lend themselves best to Streamer Duration. The rigid accordion folded streamer, ejection plug, and engine fill the entire length of the inside of the tube and make it extremely rigid. A parachute inside the tube offers less rigidity. Even so, no problems have been observed. One problem with parachute models though is that since the airframe is so light weight, it is more difficult for the parachute to open. The chute must be powdered and packed well for it to open consistently.

S/R

AEROTECH, INC.

ARREAUX

by **Jon Barton**

PRODUCT S/R REVIEW

I must admit I'm partial to Aerotech kits. As a forty year old professional, who but for this hobby would be considered sane (or at least lucid) by his peers, I have come to the conclusion the kits I built in my youth are somehow too tame now. Possessing neither the skill nor the money to plunge head first into high power rocketry, I find composite E, F and G powered vehicles adult enough to avoid allegations of child's play from associates while providing an affirming experience. The Aerotech Arreaux is a winner on all counts. As an introduction to mid power, the Arreaux familiarizes the builder to such advanced assembly techniques as through the wall fin mounting, CA adhesives, nylon parachutes and heavy duty components. In addition such Aerotech trademarks as fin-loc rings, Aerofibre centering rings and the labyrinth cooling mesh assembly make building this kit literally a snap. First time builders will appreciate the ease of assembly and excellent documentation that comes with the kit. More experienced builders will appreciate the 3000' + altitude, generous payload capacity and customizing possibilities. The 109 cm length and 4.7 cm diameter airframe weighs in at 340 grams minus the 29 mm engine. To further reduce weight and drag, ours was finished in a fabric "shrink wrap" material. The plastic ogive nose cone and four trapezoidal fins were finished with a chrome under coat and clear lacquer finish coat producing the look of substantial heavy metal components. Finally,

Aerotech's no nonsense graphic decals complete a truly handsome design. If you're not a kid anymore and are looking for a kit that offers a little more than perhaps you were used to, this is your kit.

Arreaux...
Length...43"
Diameter...1.9"
Weight...12oz
Fins...4-trapezoidal with modified double wedge airfoil
Stages...1
Motor Mount...29mm (includes 24 mm adaptor)
Recovery System...Parachute
Retail Price. .$45.95
Manufacturer: Aerotech, Inc.
1955 S. Palm St., Suite 15
Las Vegas, NV 89104