The DELTOID - a “1/4A” to “A” Rocket Glider

By Bruce Markielewski August 2002

The **Deltoid** design is based on the popular boost glider, the Edmonds “Deltie”. I chose to use the Deltie as a basis for a rocket glider because of the widespread familiarity of the model, its simplicity of construction, and its reliability of performance.

The design uses a pair of flaps behind the wings to transition between the boost and glide phases of the flight. The flaps change the wing cross section from a flat plate during boost to a somewhat chambered airfoil during glide to produce the necessary lift. A burn string holds the flaps flat during boost. The engine’s ejection charge breaks the burn string and allows the flaps to move down into their glide mode positions.

Most of the parts are made from 1/16″ balsa. I would recommend around 8 lb./cu. ft. density balsa. The wings and rudders are the nearly the same as those of the Deltie (except for no assembly tabs). I added significant dihedral to the design to compensate for the higher center of gravity of the model due to the engine/pod weight. The stabilizer is made from two pieces instead of the Deltie’s one.

I used 3/32″ spruce or basswood for the body and pod mount, although some dense balsa might work as well. Unlike the angled stabilizer on the Deltie, the Deltoid’s stabilizers remain flat to keep the boost straight. The angle of attack of the wing airfoil during glide is up slightly relative to the stabilizer angle, and this produces the proper glide orientation between the wings and the stabilizer. To make assembly easier, lay each wing/stabilizer pair in position using the body as a guide. Attach the rudder, angling it outward 3/8″ at the top. Then assemble two halves at the proper angle.

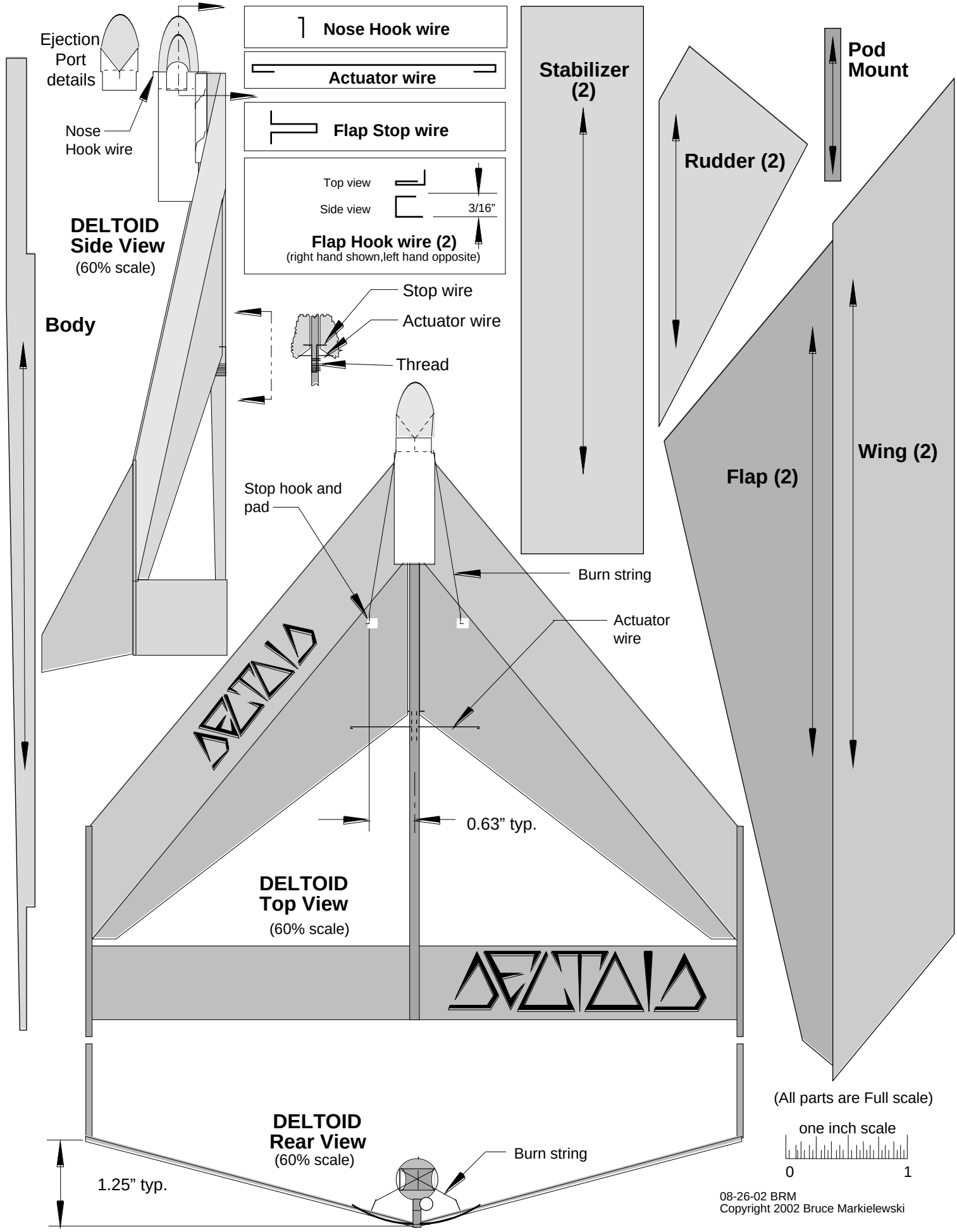
The flaps can be sanded to a sharp taper at the trailing edge for slightly better performance, but rounding the edge should work fine. If you taper the flaps, it helps to stiffen the trailing edge with CA. Also, by cutting out each wing/flap pair as a single piece before tapering will allow a perfectly matched hinge joint when separated. The flaps are attached to the rear of the wings with a 1/2″ wide tape (trim Monokote or similar material) hinge along the length of the joint, on the bottom side. A 0.020″ piano wire hook is mounted to the top of each flap as shown, and reinforced with a small piece of paper.

The flaps are actuated using a 2″ piece of 0.015″ piano wire running through a small slot in the bottom of the body. The ends of the wire are bent over to prevent gouging the flaps. The ends of the wire should be higher than the center so that the tension on the wire presses down on the flaps. The flap stop wire is attached below the body by wrapping the joint with thread and coating with CA. The wire is positioned such that the flaps rest on the wire ends as shown. The flaps should be at about a 2-3 degree angle below the wing (the innermost point of the trailing edge would be about 0.08″ lower than the front edge).

The pod mount is attached to the body as shown. The pod is 1.75″ of BT-5 (13mm) tube. The nose cone is a BNC-5V or equivalent. The shoulder should be shortened to 1/4″ if it is longer. A piece of sandpaper wrapped around a 1/4″ dowel is used to sand the angled ejection ports. Once the nose is glued into the tube, the ports are extended into the tube to the shoulder of the nose cone. The surfaces of the ports exposed to the ejection charge should be coated with a thin layer of epoxy to prevent charring of the balsa. The Nose Hook wire is pressed into the top of the nose cone as shown and glued into place. The launch lug is 1.25″ long, and is sized for a 1/8″ launch rod.

The model can be flown on 1/4A3-3, 1/2A3-4, or A3-4 engines. The model should be trimmed with an empty engine casing in the pod. My model had the center of gravity (C/G) about 4.125″ from the rear of the model. I needed to add about 1.3 grams of weight to the rear of the model to balance it for a proper glide. The final weight was 9 grams.

Prepping the model for flight is easy. The engine is friction fit into the pod, and tape can be wrapped around the end of the pod and engine if necessary. The burn strings are two pieces of dental floss each about 8 inches long. A loop is tied into the end of each string. The loop is placed on the flap hook and the free end is passed through the ejection ports, over the top of the pod, and through the ports again. The string is pulled tight enough to lift the flaps into a flat position relative to the wings, and finally tied to the nose hook on the top of the pod. The normal igniter installation and launch procedures are recommended.



08-26-02 BRM

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Appendix B

DELTOID Model Photos

Image 1: Left side view of the model showing the ejection ports and actuation wire placement.

Image 2: Right side view of the model showing the ejection ports and elevator hook wire placement.

Image 3: Top view of the model showing the elevator actuation and stop wire placement.

Image 4: Bottom view of the model showing the elevator actuation and stop wire placement.

Image 5: Top view of the “Deltoid” prototype just before launch at NARAM 45.

Image 6: Bottom view of the “Deltoid” prototype just before launch at NARAM 45.

Image 7: Top view of a 50%“Deltoid” scale-up built by Russ Anthony.

Deltoid Images

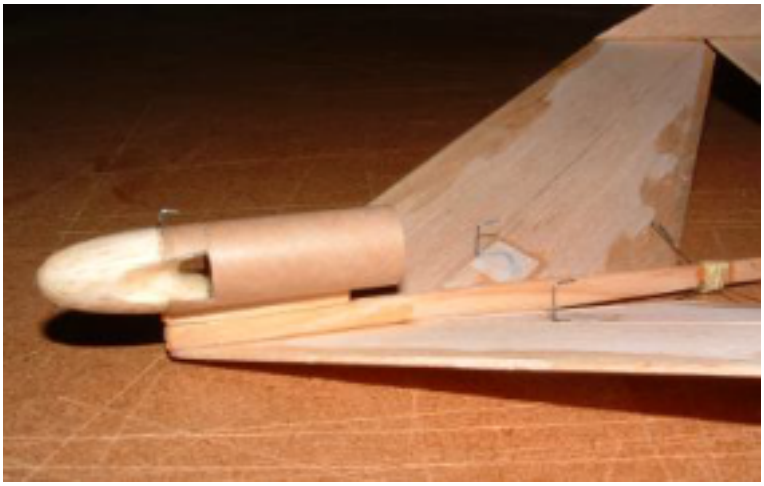

Image 1

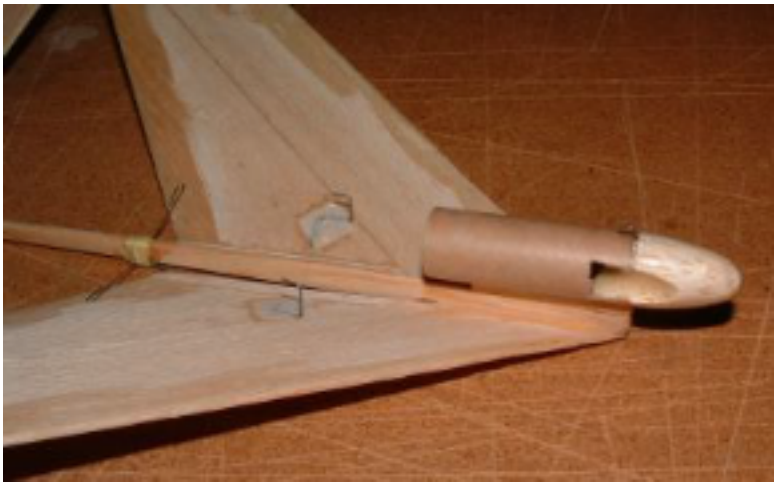

Image 2

Image 3

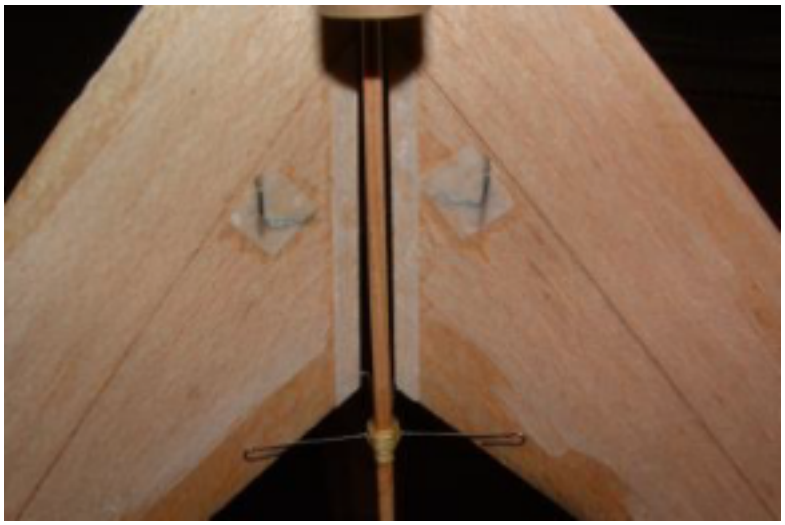

Image 4

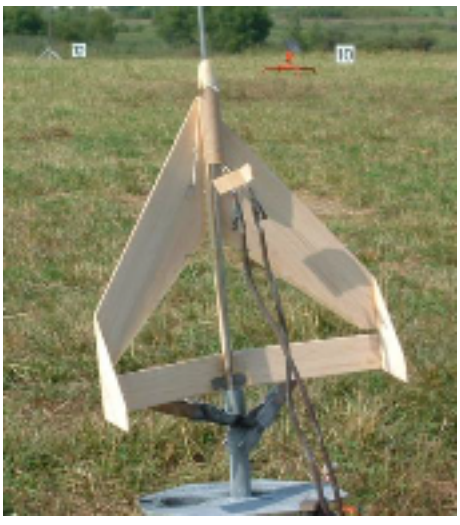

Image 5

Image 6

Image 7