

Building a Better Profile

Part 9 - Flaps, Elevators, and Control System

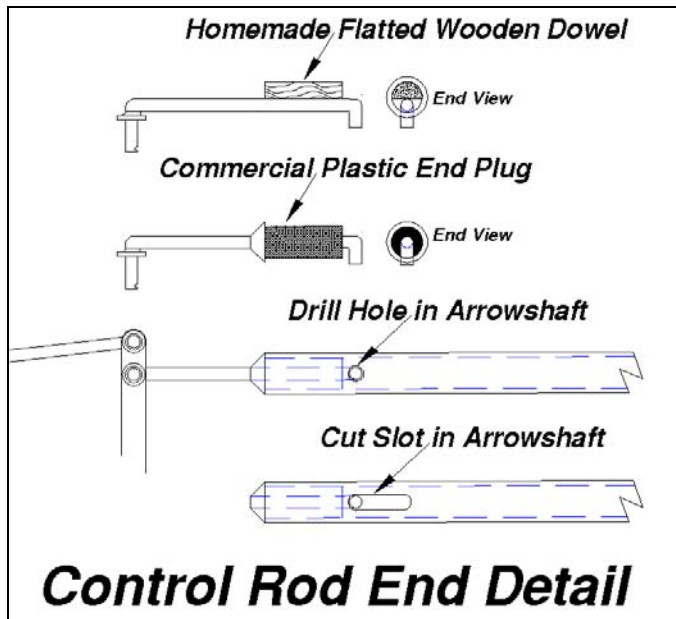


"Justice", Mo'Best profile with ST .51 power

Flap to Elevator Control Rod

Seeing as how we want to build a better profile ship, with a super smooth control system, I suggest that you NOT opt for a long piece of 3/32" wire for the flap to elevator control rod. Use a fiberglass or carbon fiber arrow shaft here.

The Dave Brown arrow shaft kit is long enough for two control rods on the average profile stunter. It also provides plastic "plugs" in different styles to attach the 3/32" control rod ends. If you use these, be very sure that the control rod and plastic plug are securely glued into place. I recommend roughing up plastic surfaces to provide a good mechanical joint for the glue, and use a strong epoxy glue.



It is also a good idea to drill the fiberglass rod and use a bend on the control rod wire end to secure it as shown here. For an adjustable end, make a slot in the fiberglass rod instead.

If you have access to a supply of fiberglass or aluminum arrow shafts, you can easily make a workable control rod end. Use a 1" section of wooden dowel with a flat sanded on it as a plug. Again, a "hook" is needed on the end of the control rod wire.

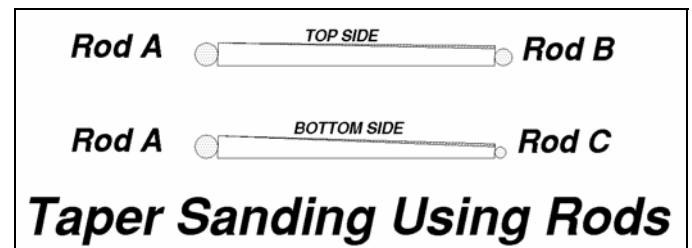
Finally, you might consider cutting one of the rod ends off and installing a brass tubing joint as already described. If you anticipate the need to make length adjustments on this rod during trimming, this joint would be come in handy. However, why not wait until the adjustment is actually needed? On a profile ship, this retro-work is easy: cut the rod with a Dremel tool cutoff wheel and install the joint.

Profit everything and take it all apart again for final assembly: remove hinges, control horns, and control rods. Your reward for all this pain and effort absolutely has to be a control system that is smooth as silk from the first flight, and doesn't have to "wear in". Superb quality in the control system will be evident by the feel of your ship on every single flight.

Tapering Flaps and Elevators

Flaps and elevators are often cut from sheet stock and sanded to a taper with a thinner trailing edge. Perimeter curvatures and differences between root and tip chord lengths tend to complicate the tapering work. Obviously, all tapers need to be accurate and symmetrical.

Many years ago in his *Model Aviation* column, Ted Fancher described a simple method for accurately sanding tapers in flaps and elevators. The idea is to use wire rods as guides for sanding.



The rod method requires a flat work surface, flat sanding blocks, and three music wire rods (A, B, C) of different diameters. Rod A is for the leading edge, with a diameter the thickness of the sheet material, say 1/4". Rod B and Rod C are for the trailing edge: the diameter of Rod C is the desired thickness of the finished trailing edge, say 1/8". Rod B's diameter is midway between Rod A (1/4") and Rod C (1/8"), which is 3/16".



Tapering an elevator

Initially Rod A is butted against the leading edge, and Rod B against its trailing edge as sanding guides. The first sanding will taper one side by 1/16" (Rod A - Rod B diameters, 1/4" - 3/16" = 1/16").

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The part is then turned over, and Rod C replaces Rod B on the trailing edge. The second sanding tapers the other side by 1/16" (Rod B - Rod C diameters, 3/16" - 1/8" = 1/16").

The result is a perfectly symmetrical surface which tapers evenly to 1/8" on its trailing edge. (For 1/16" trailing edges, Rod C is 1/16" and Rod B is 5/32".)

Some prefer to tape the rods in place on the work surface, but it seems just about as easy to hold them in place by hand. With steel rods protecting the balsa surface most shaping can be done very efficiently with coarse (#100) sandpaper.

Cutting Hinge Slots

Nylon hinges are de rigueur for any modern stunter, and regular sized Klett hinges are a good choice for the Better Profile ship. An inexpensive Carl Goldberg hinge slotter tool works acceptably well. It includes clever little plastic ditties for marking centerlines on hinged surfaces and self-centering guides for the hinge slotter tool.

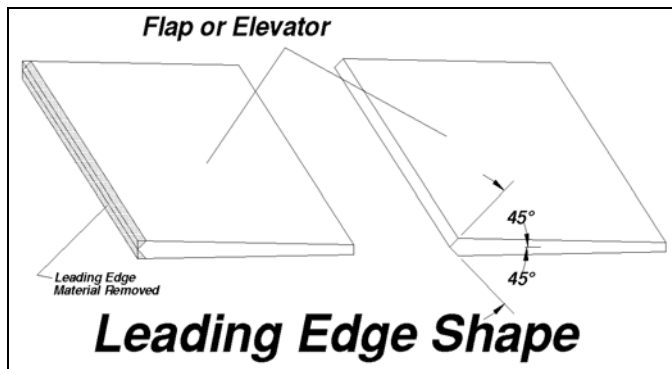
A "digger" blade is also included, but a broken hacksaw blade also serves very well for this particular task.

When locating flap hinge slots, pay close attention to wing rib positions to avoid damage. Hold the flaps and elevators in position and mark hinge locations of both surfaces at the same time. Cut flap and elevator hinge slots PRIOR to shaping their leading edges!

Shaping Leading Edges of Flaps and Elevators

After a flap or elevator is tapered and its leading edge has been slotted for hinges, the leading edge is ready for final shaping.

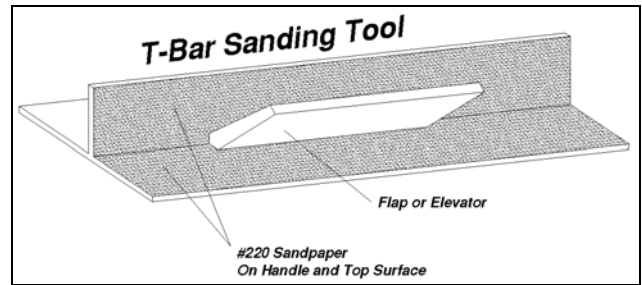
Common practice for stunter is to bevel the leading edge so that it comes to a point at its center, with 45-degree angles on both surfaces.



My method for shaping leading edges begins by marking it with three straight lines. For 1/4" sheet surfaces, first mark the center line of the leading edge.

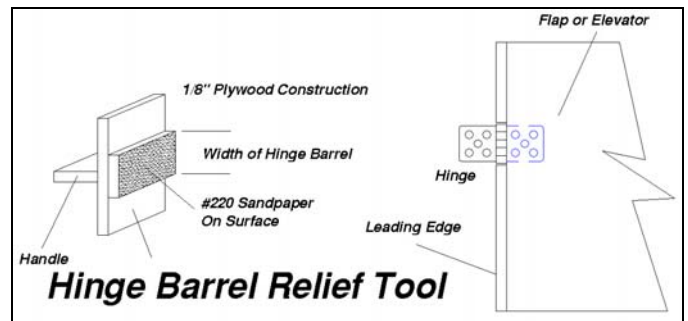
An easy way to do this is to butt an accurate 1/8" sheet surface against the 1/4" leading edge and draw along it. The other two lines are easily marked in a similar manner.

For accurate leading edge shaping I recommend gentle and careful sanding using a long T-bar and #220 sandpaper. For the final shaping, I get a perfect 90-degree corner with the T-bar and #320 sandpaper in the right angle corners of its "handle".



Hinge Barrel Reliefs

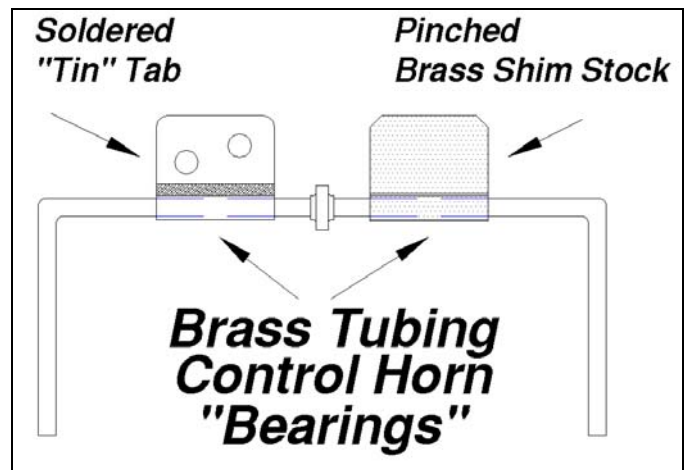
Contrary to popular belief, the barrels on hinges actually DO occupy physical space! Provision must be made somewhere on the hinge gap for them. Otherwise, hinge gaps cannot properly close, hinge barrels crush wood surfaces, or both: something has to give!



An easy way to avoid this problem is to sand a hinge-wide relief in the leading edges of flaps and elevators. A depth of perhaps 1/8" is adequate; a simple tool instantly cuts perfect reliefs.

Control Horn Installation

The heart of any stunter is its control system. Controls will never feel "like butter" unless all parts move freely in bearings. Bearings?



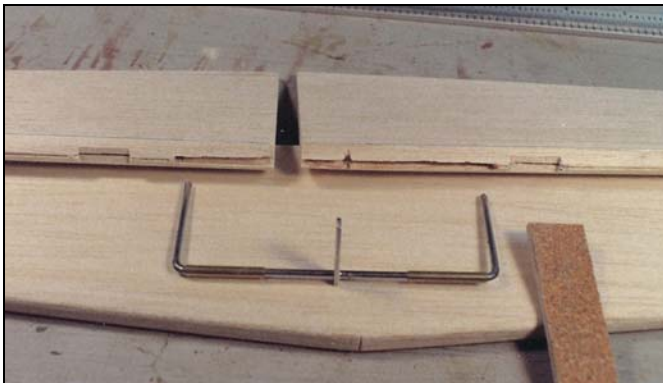
Well, maybe not roller bearings (although a few world class stunters have used them). But brass bushings are in order on any serious stunter and are easily constructed with ordinary brass tubing.

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Quality commercial metal control horns come equipped with bushings, both for the control wire and horn wire itself. Or you can add them yourself, using 1/8" long sections of 1/8" O.D. (3/32" I.D.) brass tubing, soldered into enlarged holes in the metal control arm. The effort will be well rewarded. Nylon is a good second choice for control horns. Metal horns without brass bushings are clearly the poorest choice!

Horn wire bushings should be properly attached to the trailing edge of the wing and stab. The brass tube could be glued to the wing trailing edge, but a better method uses strips of brass shim stock or soldered metal tabs. It may be necessary to cut temporary slots in the fuselage behind the hinge lines to allow installation. Also be sure to notch wing/stab trailing edges for control horn clearance.

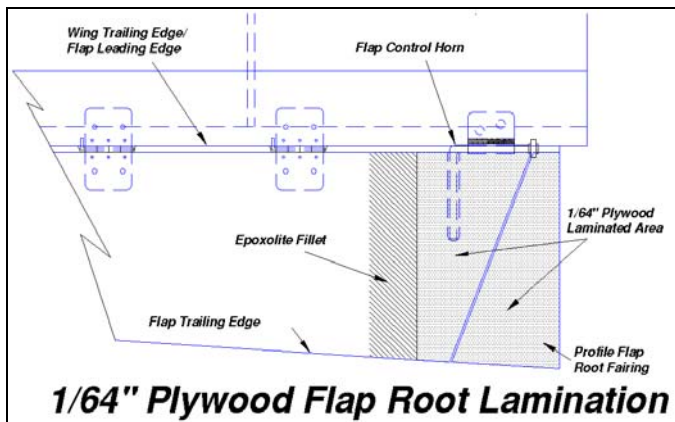


Control horn wire reliefs in elevators

That idea about hinge barrels occupying space extends equally to control horn wires! Flap and elevator leading edge areas in contact with horn wires must be properly relieved to fit.

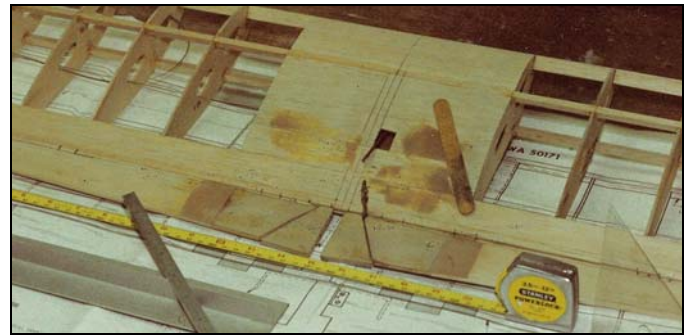
Laminating Flaps and Elevators

The task of drilling flaps and elevators for control horn wires is tedious at best. Modern ships with built-up fuselages typically use hardwood or plywood inserts in root ends of flaps and elevators to support control horn wires. Commercial "Lucky Boxes" (from RSM Distribution) are available for this purpose.



Where drilled flap or elevator methods are still used (as on profiles), it can be helped considerably by first laminating root areas with 1/64" plywood.

Use scissors to cut 1/64" plywood very slightly oversized and saturate the root area with thin CA to glue plywood sections in place. Use a single-edged razor blade to apply and flatten a wide, thin, tapered strip of Epoxolite along plywood edges. Use a T-bar to carefully sand the cured Epoxolite surface "flat", and sand exposed plywood edges straight and square. Properly done, laminated areas are easier to drill for control horn wire without puncturing the surface, plus strong enough to permit "tweaks" on [3/32"] horn wires. Careful filling work on edges makes laminations invisible on the finished ship.



1/64" plywood laminations on flaps, Epoxolite on edges

Wing and Stab Installation

After the control system has been fitted and tested is a good time to prefinish exposed areas of the wing and horizontal stab, BEFORE they are actually glued into the [prefinished] fuselage. I recommend the classical method of silkspan and clear dope, with sanding filler of talc in clear dope.

I personally recommend applying Monokote AFTER the wing is installed. If you do cover the wing in plastic in advance, be sure to remove a narrow strip where the fuselage glues to the wing.

Finally! Time to install the wing and stab in the fuselage! If you left the right side of the fuselage untapered, alignment of the stab and wing will be quite easy, using a right triangle (refer back to Part 3). Take your time, and check it several times. Tack glue the wing and stab in place with tiny dabs of thick CA and check final alignments. If needed, wedge small chips and slivers of balsa into the fuselage wing and stab cutouts to get a tight, accurate fit. Once everything is straight and tight, apply thin CA to penetrate the joints thoroughly.

No mention was of using epoxy to glue wing and stab joints on a profile fuselage. Fact is, I never use epoxy here! (Heresy!) Yet I never have any problems with these joints. All I do after the thin CA is add a little thick CA to fill any noticeable gaps. Then I use Epoxolite to add round, beautiful fillets around the joints..



"Dream Weaver", Mo'Best by Bill Huang

-Larry Cunningham