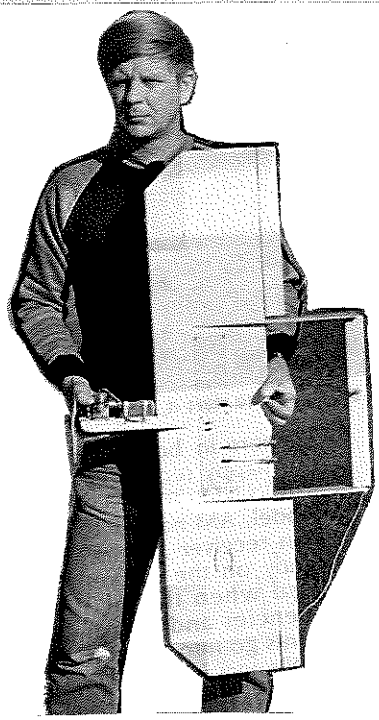
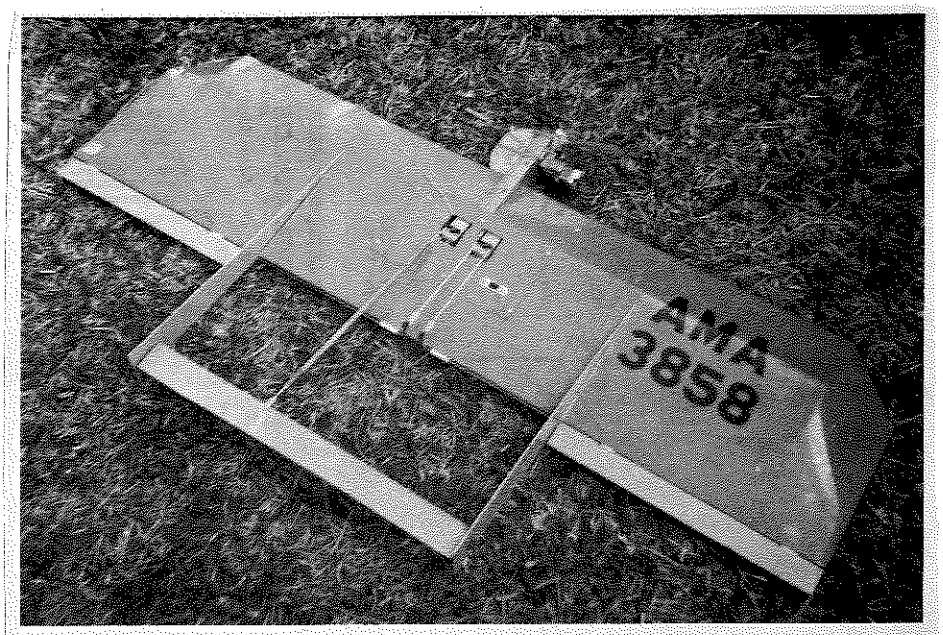
The Razorblade

By TIM FARR





The original (1971) *Razorblade* had full ailerons, short fuselage, and a tail-heavy condition which was hard to counter-balance. Later ships had tapered ailerons, longer nose.

• **COMBAT!** There has never been any endeavor created in the fertile mind of man that has not been contested at some time or another. Someone is always trying to be higher, wider, taller, stronger, faster, slower, or more of *something*, than anyone else. If you don't believe it, why not try a little experiment the next time you are out driving on the freeway. When you find yourself following another car for awhile that is traveling at the same speed you are, pull over to the left lane and slowly, but ever so slowly, increase your speed so that you just barely creep on by him. Nine times out of ten, if the difference between your speeds is slight enough, you will notice his speed increase just enough to prevent you from passing him without increasing your speed some more. If you do this, and then change lanes back in front of him, not long after that he will pass you again. Try it and see if I'm not right!

What's the point? Well, this model is the point, or at least one result of the point. Back around 1970, several club members and I used to find ourselves flying together at the same time, and started flying in formation with each other. Then, one of us would try to get on the other guys' tail. One thing led to another, and pretty soon we added crepe paper streamers, and it became full-scale combat!

About that same time, there was an article in one of the model magazines concerning R/C combat. I no longer remember who the author was, or which magazine the article appeared in, but the author proposed modifying C/L Combat planes for use with R/C and flying R/C Combat with them.

In order to keep the cost down, he proposed that engines be limited to inexpensive .15-size C/L engines with no throttles, and that the radios be inexpensive two-channel "glider" radios operating aileron and elevator surfaces only. Because there was to be no throttle, the fuel was to be limited to two ounces.

Needless to say, that article struck a very responsive chord in me, and I set out to find a suitable C/L Combat kit to modify. A preliminary study of all the C/L Combat kits available at the time quickly convinced me that there simply were none that were suitable for conversion to R/C.

Undaunted by this, I just sat down and proceeded to design my own concept of what a super-simple R/C Combat ship should look like. The layout was strictly contemporary C/L Combat: a wing, an engine pod with the engine right up against the leading edge; two thin plywood sheet tail booms glued to the wing; and a long, thin, all-flying stabilizer (or "stabilator") pivoting between the booms at the rear. Construction was somewhat more robust than was common practice with C/L ships of the era, however.

Being inveterately lazy, I designed the wing to use standard 36-inch lengths of wood, and to have a rather unusual, diamond-shaped airfoil which would allow me to cut the ribs out with an model knife and a straightedge. This also would allow me to build the wing pinned flat to the workbench so that there would be no possibility of warps. The wing was designed to be completely sheeted with 1/16 balsa for strength and durability, and the tail booms were to be made from 1/16 birch plywood. The stabilator was to be just a piece of 1-1/2 inch trailing edge stock (leftover from making the ailerons) with the thick edge razor-planed to a symmetrical airfoil shape.

When the "thing" was done, I stepped back and surveyed my masterpiece . . . and, quite frankly, was appalled at what I had done! Everything had seemed quite logical during that creative frenzy, but taken as a completed whole, the thing very obviously was a monster! Laying there on the workbench, it didn't even *look* like an airplane, but it did look like something very familiar. I couldn't put my finger on it . . . until I noticed an old single-edged razor blade laying on the bench next to it, and in one swift instant it was crystal clear: this was . . . the *Razorblade!!*

I was not about to subject myself to the unbridled derision of my fellow club members by taking it out to the club field in broad daylight . . . *not that crew!* So, it sat on the workbench for several weeks while I tried to decide: A) if I should ever actually attempt to fly it, and B) if so, how?

It would be comparatively easy to take it out to the field at a time when there was very little likelihood of anyone catching me (a technique I had employed on more than one occasion with other of my more exotic "masterpieces"), but this time there could be no secrecy . . . the darned thing had to be

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hand launched, and that necessitated the presence of at least one "witness."

Well, finally, I took the bull by the horns and just went out to the field with it. Braced for the worst, a "volunteer" was enlisted, the jeering crowd was moved back to a supposedly safe distance (a precaution that required surprisingly little urging!), and caution (followed shortly thereafter by the first *Razorblade*) was thrown to the wind!

I would really like to tell you that the ship flew right off the drawing board but sadly, it did not. The CG was positioned too far aft as a result of my following the C/L practice of placing the engine right up against the leading edge. At the same time, the stabilator travel was too great, which, combined with the CG position, produced a totally uncontrollable ship that quickly had the whole crowd scrambling for their very lives!

The robust construction vindicated my building technique, however, and saved the day. After wrapping a ton of solder around the engine and reducing the stabilator travel quite a bit, it did fly . . . well enough to assure me that I was on the right track. Thankfully, my limited success muted some of the more vocal critics . . . most of whom were at the back of the crowd, anyhow!

Back at the "Skunk Works", I lengthened the nose far enough to allow mounting of the two-ounce fuel tank between the engine and the leading edge of the wing. A muffler was added to the engine, as was a spinner, and the ship not only looked better, but the CG was in the right place without all that solder wrapped around the engine! This, then, was the winning combination. It not only looked good . . . but if flew beautifully!

In the ensuing months, I built several more copies of the *Razorblade*, each of which had the same terrific flight characteristics: unbelievably fast under power; fantastic maneuverability without being at all hard to control, yet, surprisingly, having a slow, floating glide that made landings an absolute breeze!

The *Razorblade* had an unexpected drawback, however. All my former "buddies" refused to fly combat with me and my *Razorblade!* What was worse, I could never convince even one of them to build a *Razorblade* of their own so that we could enjoy some real combat practice.

One day my "helper" forgot to turn on the receiver before launching the ship, and I didn't notice it either. The technique was to launch it upward at a 45-degree angle, and let it go for a second or two in order to build up speed and a little altitude before starting to feed in any control. It "grooves" so smoothly right from the launch that I often let it climb a couple of hundred feet before touching the stick at all! I was doing that this day when I finally started to feed in a little turn . . . then a little more turn . . . and then a whole lot of turn . . . completely without visible result!

I was looking down at the transmitter, to see if I had forgotten to turn it on, when the awful truth finally dawned on me! I turned to my "helper" and asked him if he had turned on the receiver, to which he shrugged and replied, "No, didn't you?" I just handed him the transmitter, said "Here, you fly it," and walked away.

Well, when the ship finally arched slowly over and started to head downward, it was just a minute speck in the sky. To this day, I am still firmly convinced that just before it hit the ground, it may well have become the first model airplane ever to go supersonic!!

Eventually, I gave up trying to convince people that they really could fly a weird-looking R/C ship with no tail, no throttle, and no landing gear, and went on to other projects. A year later, employment considerations forced me to move away from the area. However, I still maintained my ties with the club, continued to receive the club newsletter, and attended club meetings whenever business travel "mysteriously" happened to put me in the area at just the right times.

Early in 1981, some ten years after the *Razorblade* first flew, one of the club newsletters made mention of the fact that some of the club members were into flying combat again and wondered if there were any ships that had been specifically designed for the purpose. The editor went on to make mention of the *"Razorblades"* which he had seen fly many years before, and asked if there was anyone in the club who could tell him where to obtain plans for the ship.

Obviously, my interest was rekindled, and I set out to look in my musty old files for whatever information and snapshots that I might have stored away. There were no plans for the ship . . . there never had been! The ship was so simple to build that I never bothered to draw them. I just built them from some dimensioned outline sketches that I had done on old notepaper.

Immediately, I sat down and drew up plans showing the construction details, parts list, etc., and mailed them off to the newsletter editor who passed them on to the interested parties. Several new ships were built from those plans, which, to my everlasting gratification, proved to be just as easy to build, and which flew with the same superior flight characteristics as the original ships had displayed over ten years before!

Now, if a combative spirit lurks deep down in your soul, and you are possessed of enough courage to brave the initial reaction at the club field, this little ship will certainly set you apart from the crowd! It is very quick and inexpensive to build, has unbelievable flight characteristics, and fits unobtrusively into the most compact of cars when it comes time to go to the airport! Go ahead and try it, you'll love it! And you can always say, "The devil made me do it!"

PARTS CONSTRUCTION

You may as well start by cutting all of the parts out at once: there aren't that many of them! Cut six full-ribs and two half-ribs from 1/8-inch sheet. It's easy because you can use a straightedge to guide your knife!

Next, the two wing tips and their four triangular tip braces are cut from 1/4-inch sheet. Again, you can cut them out with a straightedge to guide your knife.

Now cut the two tail booms and the hatch cover from 1/16 birch plywood. No need to saw them, as a sharp knife and a straightedge will do the trick here too. They will seem too flimsy at first, but don't be mislead into substituting something heavier. I guarantee you that they are strong enough for the job they have to do, and that's not the place to add extra weight . . . trust me!

Finally, cut the fuselage rib and fuselage side from the 1/2-inch sheet. That's it!! All the preshaped parts are done!

FUSELAGE

This will undoubtedly be the easiest R/C fuselage you have ever built! Epoxy the two 1/2-inch square hardwood motor mounts to the 1/2-inch fuselage rib. When the epoxy has set, drill four motor mount holes and mount your motor with T-nuts. Glue the two half-ribs to the sides of the fuselage rib and set this assembly aside until it is needed later.

WING

This wing will probably be somewhat different in construction technique than any you have built previously, but construction is both easy and quick. First, lay two sheets of 1/16 balsa down on the workbench side-by-side. Hold the edges together very tightly and tape over the seam with a full-length piece of masking tape. Press the tape down firmly so as to assure complete adhesion of the tape to the balsa. Then, turn the two joined sheets over so that the tape is on the bottom. Bend the tape "hinge" so that the two sheets make a 90-degree angle with each other, and run a bead of aliphatic resin glue down the crack formed by the two sheets. Flatten the sheets out and pin them down to the workbench. A bead of glue will squeeze up where the sheet edges close on each other, but not to worry, we'll use it. Carefully place one of the 1/4 x 1/16 doubler strips over the joint and pin it in place. The glue that squeezed up will hold it.

Next, glue the 1/4-inch square trailing edge along the back edge of the sheet flush with the edge, and the 1/4-square spar along the other edge, but NOT flush with the edge as you did with the trailing edge. This one has to angle upward slightly, and only half of it is on the sheet. There should be 1/8 inch hanging over the edge.

Glue the fuselage rib onto the 1/16 sheets in the exact center, and make sure that it is aligned perfectly at right angles to them. Also, make sure that the engine exhaust points down. Then, glue three 1/8-inch wing ribs on each side of the fuselage rib, six inches apart. If you measured correctly, the last rib should be just at the edge of the 1/16 sheets at each end.

Next, glue the top 1/4 x 1/16 joining strip, the 1/4-square top spar, and the 1/4-square leading edge in their respective places. The 1/4-inch sheet wing tips can be glued and pinned in place, as can the top triangular tip braces. The trailing edges of the tips rest on the workbench, so they will automatically be squarely aligned with the rest of the wing. All of this can be done faster than it takes to tell it, and it is finally time to rest and wait for the glue to set. However, if you build with some of the more modern adhesives like Hot Stuff, Zap, Jet, etc., you may not get to take this rest.

When the glue has set, remove the pins that are inside of the wing, but leave those around the edges that hold the whole assembly to the workbench.

The next thing to glue in place is the top rear 1/16 sheet. This one is the last of the full-length sheets, and should cover only half of the 1/4 x 1/16 joining strip. The center sheets cover only the area from the wing tip to the 1/8-inch rib closest to the 1/2-inch fuselage rib, and should leave a 12-inch opening with the fuselage rib exposed in the center. The front sheets cover all the way from the tip to the fuselage rib, and rest on the half-ribs that are glued to the fuselage rib.

While you are waiting for these last glue joints to dry, fill in the time by gluing four 1/2-inch square hardwood pieces inside the corners of the opening in the top of the wing. Later, these pieces will be drilled in the center for the screws that will hold the 1/16 plywood hatch cover in place.

When the glue has set, remove the pins that hold the wing to the workbench and turn it over. The last sheets to go in place are the bottom leading edge sheets. The bottom triangular tip braces may be added at the same time. And last, but not least, the 1/2-inch thick fuselage side may be glued in place on the crankcase side of the fuselage. Be sure to carve it round to match your engine spinner before you do, however. This is about the only chance that you will have to do any carving on this ship! Oh, yes, now you can remove the masking tape from the original two sheets of balsa, too!

TAIL ASSEMBLY

Glue one of the 1/16 plywood tail booms to the trailing edge of the wing on each side of the hatch opening. They should be one inch from the edges of the hatch opening, which will place them 14 inches apart. Be sure that the glue does not fill in the holes at the trailing edge through which the aileron torque rod wires will pass.

The stabilator is made from a 14-inch piece of 3/8 x 1-1/2 trailing edge stock. Use your razor plane to round off the thick edge of the stock to a symmetrical, streamlined shape. Then, with a sharp knife and a straightedge, cut a 1/16 wide slot the full length of the stabilator, 1/2 inch from the leading edge. Epoxy a length of 1/16 music wire into the slot which protrudes about 1/2 inch from the stabilator at each end. The ends of this music wire are then placed through the small holes in the tail booms and secured in place with small wheel collars on the outer ends of the wire, outside of the tail booms. Leave enough play so that the stabilator may pivot freely without binding, but not enough to be sloppy. Drill the two mounting holes for a small nylon control horn in the stabilator, just to one side of the center, and mount the horn. This completes the tail assembly.

AILERONS

The ailerons are made from the same 3/8 x 1-1/2 trailing edge stock that you used for the stabilator, and are mounted in a conventional manner. The music wire torque rods are epoxied to the individual ailerons, and are of unequal length. They should be mounted such that both wires terminate on the opposite side of the fuselage rib from the stabilator control horn. Be sure to place a molded nylon aileron bearing on the wires before the second bend is made, or it will be too late. You must use a bearing to support the torque rods at the inner ends, right next to the bend, or you will surely have aileron control problems! Attach a type of control horn to the wire that is secured in place with a wheel collar, and you will have an infinite range of aileron travel adjustment.

MISCELLANEOUS

The hatch cover is the last thing you will have to build. You previously glued four pieces of 1/2-inch square hardwood into the corners of the hatch opening. Now, drill a small pilot hole in the center of each of them. This hole will allow you to screw a No. 4, 1/2-inch sheet metal screw into the wood. You can also do the same on the centerline of the fuselage rib, a quarter-inch from the edges of the opening. These six small screws are used to secure the 1/16 plywood hatch cover in place.

You can mount your servos any way that you want, but I used nylon side mounts and secured them to the sides of the fuselage rib with double-sided foam tape after first coating the rib with five-minute epoxy (smeared on with my finger). The epoxy gives the rib a smooth, nonporous surface for the foam tape to get a secure grip on.

Cut a small rectangular hole in the hatch cover and secure your radio on-off switch to it so that the radio may be turned on and off from the outside. Cut holes as required in the hatch cover so that the aileron and stabilator pushrods may exit freely, but make them no larger than absolutely needed.

Wrap the battery pack with foam padding and stuff it into the leading edge cavity on one side of the fuselage rib. Do the same on the other side with the receiver.

Finish the ship with the covering of your choice. I used Monokote everywhere except the engine pod, which I coated with epoxy glue smeared on with my finger, followed by one coat of colored epoxy paint.

FLYING

This is the fun part, but in order for it to be fun, you should first take a few precautions. Check the CG: it should be at, or only slightly aft of the leading edge. There are several things that you can do to achieve this without just adding ballast weight somewhere. Use a spinner . . . the heaviest spinner you can find. There is nowhere that you can add weight that will have as much leverage as it does in front of the prop! Use a muffler. Again, use the heaviest muffler you can find for your particular engine. There are several good reasons for the muffler besides adding weight, although that is a prime consideration. Noise is a good reason to use a muffler. Many flying sites require it anyway, and I happen to dislike the sound of an unmuffled engine. It may not be required where you fly, but its use could save you the trouble of having to find a new flying site in the near future.

The muffler is also your landing gear. When you float it down to a smooth landing, it will skid on the muffler, and not on the engine directly. This saves having to dig the dirt out of your exhaust after each flight! The muffler also collects and directs the exhaust "goop" along the bottom of the wing, preventing the propwash from blowing it up and over the leading edge and back into the servos which are somewhat exposed.

Check the stabilator travel . . . start out with no more than 15 to 20 degrees at most. Remember, there is no horizontal stabilizer to smooth things out for you if you start having trouble keeping your thumb from quivering! When you have some time with the ship, you can adjust it up or down to suit your taste.

Now, finally, to the actual flying! Have your helper hold the ship with two hands, one on each side of the fuselage pod with his fingers curled down over the leading edge. Tell him to keep loose, however, because if he doesn't, he just might turn into an "orangutan," get excited, and crush the thing! You can both stand up at a comfortable height to start the engine. Be sure to check the controls before launching . . . remember what happened to me?

It doesn't take an Olympic hammer thrower to launch this ship. Exactly the opposite is true: easy does it. Have your helper angle the ship up at about 45 degrees, bend his elbows slightly so that he draws the ship in towards himself, then just straighten out his arms, smoothly chucking the ship away from himself and straightening out his hands at the same time. The ship will pull out of his hands smoothly and climb away with surprising speed! Nothing to it!!

Let the ship climb away for a second or two to pick up speed and altitude before you start to control it. It sounds real "spooky" at first, but after you have done it a time or two, it will seem as completely natural as taking off with a conventional ship.

Good luck, and please, write me a note and let me know how you like it! (**Model Builder** will forward all mail.) •