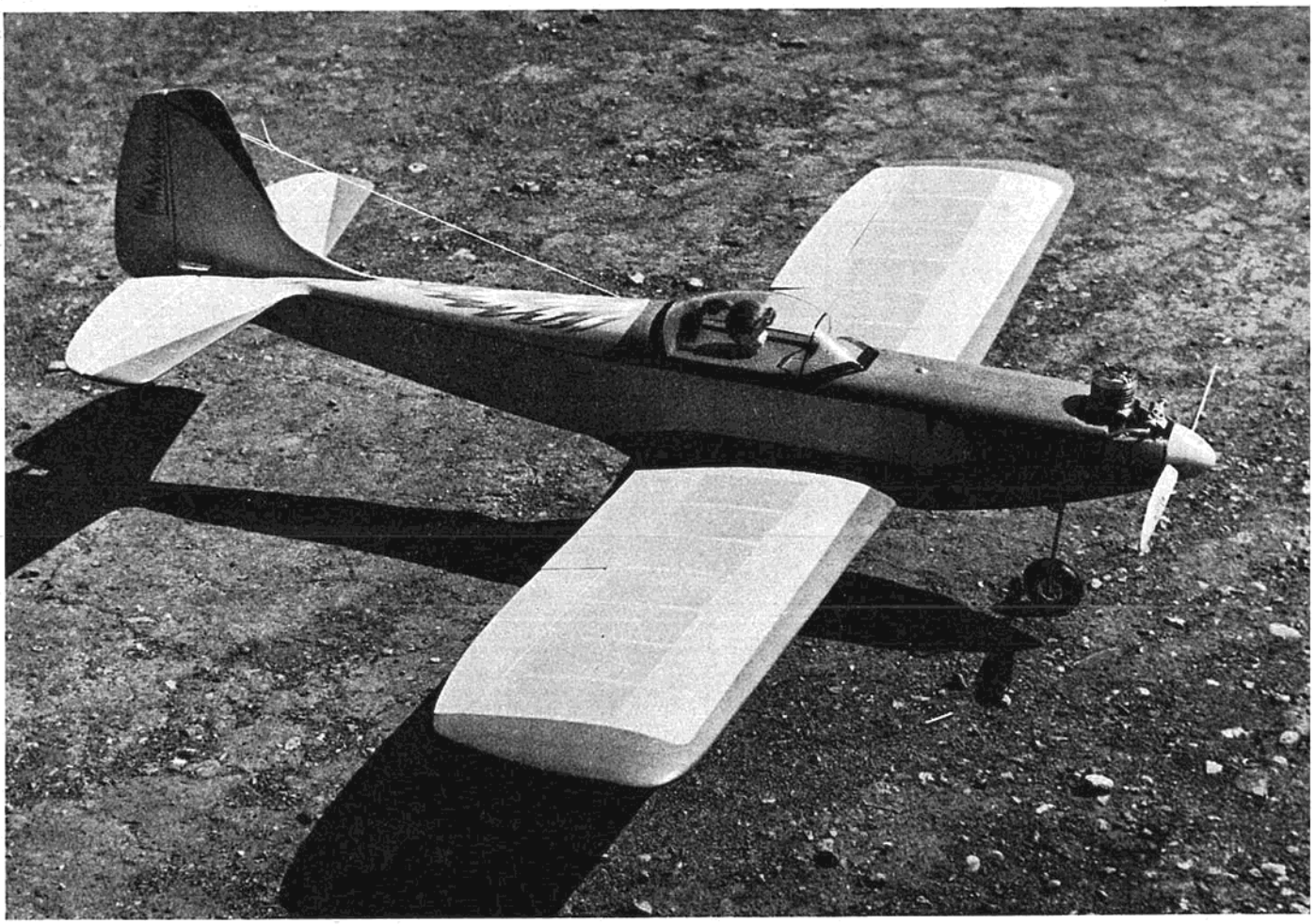
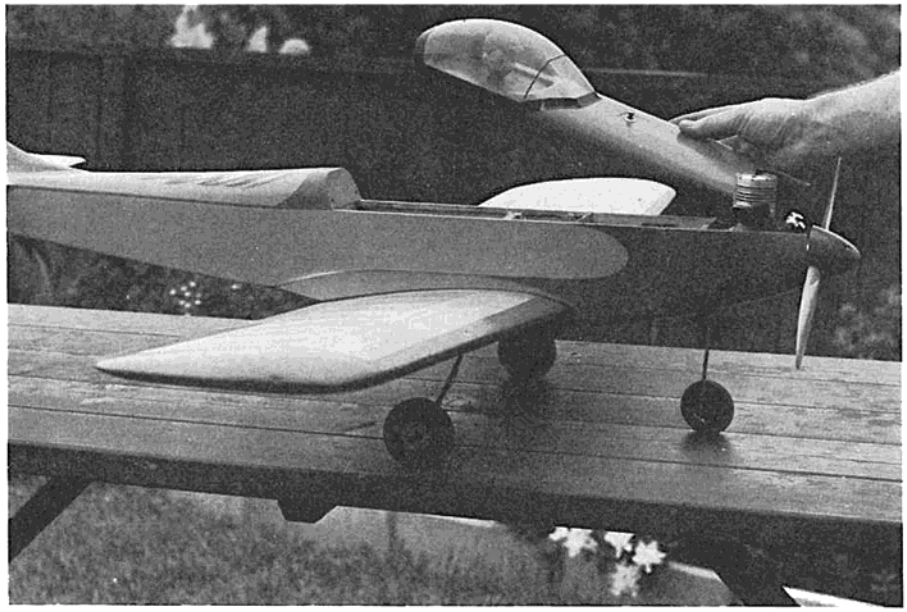


A candidate for 1968's winners circles, the Firefly performs every known maneuver. Designed for up to .49 engines and spanning a scant 52 inches, it is fully aerobatic on a good .35. With its twelve percent airfoil and a Merco .49 it climbs out like a scalded eagle! By George Harris.



FIREFLY

THE Firefly started out to be a protest against the increasing size of multi models and the rising cost of balsa. It was designed to be fully aerobatic with a .35 size mill and to hold full house proportional without squeezing. The first one built has been flown with a McCoy .35 and a Merco of the same caliber and will do the A.M.A. pattern with either. After the first flight the aileron link on the left side was adjusted one turn and no changes have been made since. Twelve flights were made the first day out without braking a prop, the only fault seeming to be insufficient rudder for consistent snap rolls.

A second model was built with a larger rudder, wing fillets and a few minor improvements in structure, including widening the fuselage to take three of the larger type servos side by side. The PCS gear was transferred from number one to number two, and, just for fun, a Merco .49 series 2 was dropped in behind the spinner to see if the beast would handle the power. When the loud lever was pushed forward the Firefly rolled almost six feet then climbed out like a scalded eagle! No trim changes seemed necessary so the first flight included multiple snap rolls in either direction from either side up. The plane will fly hands off in a straight line or will hold a gentle turn without sliding off. Loops have been started with one wing intentionally low and, using elevator only, the plane will finish the loop with the same wing low condition.

In spite of the stability the plane will do any maneuver possible with a model and is ideal for free style aerobatics.

A few of the design features should probably be explained. The ailerons look a bit strange from the tip end but this built in washout prevents tip stalling and makes the model very stable at low speeds, so tight turns can be made in the landing approach without dropping a wing. I used this method of getting washout on gliders many years ago and it is very effective. All the wing ribs are the same basic size and no special jigging is needed since all the washout is in the ailerons themselves. Because the model was intended to move around rapidly a 12% airfoil was used, but this seems to provide all the lift necessary, even in a slow glide. The control surfaces may look large to some people, but with proportional you don't have to use full control all the time yet it is there when you need it for the violent maneuvers. I used about 30 degrees up and 20 down on the elevators, 30 degrees each way on rudder, with 25 up and 15 down on ailerons. For reeds these should be reduced by almost half rather than cut down on the surface areas. I like lots of access without turning the model over and removing the wing, so the top hatch is removable in one lump from the spinner to the trailing edge of the wing and is held by a single Camlock. The wing fillets prevent buffeting in high speed maneuvers by eliminating vortex shedding at the junction of the wing and fuselage. If you don't believe in aerodynamics take my word for it, it works. I have watched various models through a small telescope and the tail buffeting can be seen by the light rippling on the surfaces, especially in tight turns. Try it sometime. The cockpit canopy was designed into the fuselage instead

Flying is simply a matter of winding it up and letting it go. Take it easy on the controls until you get the feel of it, then you can start tying knots in the exhaust trail.

of just being stuck on like a wart and a few curves were added here and there to get away from the basic box.

No real attempt was made to keep the model particularly light, because a fairly high wing loading and plenty of inertia will help the plane through multiple snaps, Lomcevaks and things, even in a stiff breeze. Weight of Firefly number two is a little over 4½ lb. and could go up to 5 without any problems. The first model is now flying with F&M 3+1 and makes the smoothest rolls you ever saw with the coupled ailerons and rudder.

Now you have been brainwashed, how about building it. Structure is very simple and there are few parts to cut out, all materials being stock sizes with no 48 inch or extra wide sheets required. A variety of available hardware can be used to suit your own taste.

WING.

Build the wing first because you will need it before you can finish the fuselage. All the ribs can be cut in a stack then the tail ends of the outer few can be cut off and the extra notches made as needed in certain ribs. Before starting assembly glue the ply nose ribs to the ribs R2 and R3 then trial fit the landing gear blocks and drill holes in the ribs for the leg retaining brackets. This is easier than trying to do it after the wing is built. Enlarge the holes in the balsa ribs so the nuts can seat down on the plywood. The slotted spar web may seem like work but it makes a very strong and light spar without having any breaks completely through spar or ribs and simplifies accurate assembly. Glue the bottom spar to the lower edge of the web and pin down flat on the plan, the rear spar will then need to be packed up ¼ inch with scraps. Fit and glue all ribs in place then add the leading edge, trailing edge and top spar strip, plus the dihedral braces. All top sheeting can now be added. When this is dry, prop up the tip rib 2 inches at the main spar and pack the rear spar ¼ inch above that. The other wing is then built in the same way. If you use a jig or dihedral board the whole thing will be put together at once, of course. When dry, turn the wing over and add the landing gear, then complete the bottom sheeting and install the aileron hookup. The sweep back of the landing gear does several things. It allows the gear to be secured in the high strength leading edge box but puts the wheels back behind the C.G. Also it lowers the plane and allows use of a commercial gear with only one small additional bend. The ailerons are built upside down on the plan, since the top surface is so near flat that the difference won't be noticed and it is easier to incorporate the washout this way. Aileron horns can be cut from nylon rudder horns and are raked forward to prevent reverse differential. The 60 degree bellcranks give just the right amount of differential between up and down motions. Note that when the ailerons are built they will belong to the opposite wing, when turned right side up. Confused — don't worry, they will only fit one way so Murphy's law does not apply. Tips are cut from soft block and can be hollowed if you are ambitious. The trailing edges of the tips are best shaped with the ailerons in place to match the weird washout contours.

FUSELAGE.

The sides are cut from standard 36 inch long sheet and the nose doublers will come out of the pieces left over at the tail end. The thin ply webs are ample, since they are not used for rigidity but for bursting strength, to stop the sides from splitting along the grain. I used contact cement for laminating because it is quick and won't cause warping. Complete the sides with webs, doublers, longerons, braces, motor mounts and the ¼ sheet wing saddles, which stiffen the sides and hold them straight when the rear ends are pulled together. This makes fitting the fillets easier. Install formers F1, F2, F3 and the wing tie down F4 with the hardwood block glued and screwed in place. The tail ends can then be pulled together and fastened. Rather than show complete formers for the rear fuselage, which probably wouldn't fit, I prefer to cut spacers to fit the natural curve of the sides. The bottom sheet can now be added and the top deck stuck on. Cut the plan view of the deck block first then there will be enough big pieces left to make the wing fillets. Don't forget to mount the nose gear while the front end is still open.

Now, fit the wing in place and drill through the holes in F2 to ensure accurate alignment of the leading edge dowels in the wing. Drill the hole for the wing tie down screw, then remove the wing and glue the leading edge dowels in place. The wing is now replaced and bolted down so that the fillets, lower nose block and leading edge fairing can be fitted closely. Complete the nose blocking and carve everything to shape. The top hatch is made by pinning the ¼" x ½" rails along the top of the fuselage sides and sticking the ½ inch sheet on top. This is carved to match the fuselage contours, after which the cockpit area can be cut to suit your taste. The front end of the hatch is cut to suit the particular noise maker being used. Dowels are added to the rear of the hatch and the Camlock, or a screw and nut plate, is installed on F2. Note that the bump on top of F2 acts as a locator to align the hatch.

By using widely spaced motor mounts and an insert plate different engines can be installed and there is plenty of room for a large tank to feed a thirsty mill. Regular 8 oz. tanks will fit, or even the rectangular Taurus tank if the neck is cut off and a rubber stopper from a Pylon tank is installed.

TAIL SURFACES.

Structure is very simple and can be built over the bottom sheet laid on the plan. Leave the leading edge of the tailplane center section square to take the fillet piece, which is shaped after attaching to the fuselage. Key the fin into the notches and add the small fairing pieces to hide the lousy fit. The bevelled edges of the control surfaces are like I used way back in the old control line days and make a nice neat fit for tape, nylon, or metal hinges. It must be a good arrangement, it showed up in a recent R.C.M. article. A commercial elevator horn can be used and moved off center to put the horn at one side of the fuselage.

FINISHING.

I used silk on the wings and lightweight silkspan on the rest. If you sheet the wing all over you can use paper on everything,

The author's 7-year-old daughter, Wendy, with Firefly $2.

or just slop paint on the bare wood. Since my planes are built to fly and not for exhibition (that should get some comments about lazy characters), I wouldn't attempt to lecture on how to get a super finish. Just use your favorite method and nice bright colors.

There is room inside for any of the name brands of proportional gear, so no particular type has been shown. (I probably wouldn't get a kick-back anyhow!) The servo rails or platform can rest right on top of the ¼" sheet wing saddles, which will leave plenty of clearance for the aileron servo. Due to the thin wing the aileron servo may stick up above the top surface of the airfoil, but since the wing is bolted on, only total disintegration will knock it loose.

Flying is simply a matter of winding it up and letting it go. No nasty habits have shown up so far, but take it easy on the controls until you get the feel of it, then you can start tying knots in the exhaust trail. If you have flown multi more than a couple of week ends there should be no trouble. The model is very forgiving and quite rugged. At our local field we have what seems to be a strange type of interference limited to a small area which is deadly to fly through at certain times. Number one model with the F&M gear went through the bad spot at about 50 feet after take-off and proceeded to crash in neutral when a strong case of fail safe set in. It came down almost level but quite hard and only a broken prop resulted. Full up transmitter had no effect at all, but everything worked fine back at the pits.

Well, if you read only the important parts of this you should have the model finished by now.

Build two, they are small.

LIST OF MATERIALS:

SHEET BALSA:

8 of 1/16 x 3 x 36 Wing sheeting.
2 of 1/16 x 4 x 36 Tail sheeting.
3 of 3/32 x 4 x 36 Ribs, fuselage bottom.
3 of 1/8 x 4 x 36 Fuselage sides & formers, wing spars.
1 of ¼ x 4 x 36 Wing platforms, center rib, tail tips.
1 of 3/8 x 4 x 36 Elevators, rudder, stab. fillet, nose sides.
1 of ½ x 4 x36 Hatch, fill blocks.

STRIP BALSA:

10 of 1/8 x ¼ x 36 Spars, longerons, tail diagonals.
4 of ¼ x ½ x 36 Tail outlines, hatch rails.
2 of ¾ x ¾ x 36 Shaped L.E. stock.
1 of 3/16 x ¾ x 36 T.E. stock.

BLOCK BALSA:

1 of 1 x 4 x 36 Top deck, nose, fillets.
2 of 1½ x 2 x 12 Wing tips.

PLYWOOD:

1 of 3/16 x 6 x 12 Firewall & motor plate.
1 of 1/8 x 12 x 24 Formers, dihedral braces.
1 of 3/32 x 4 x 12 Ribs, bellcrank platforms.
1 of 1/32 x 12 x 24 Fuselage webs.

MISCELLANEOUS

Pair of 3/8 x ¾ x 9 maple motor mounts, 3 inches of 1/8 dowel, 3 inches of 3/16 dowel, Top Flite Taurus main landing gear set, nose gear and other hardware to suit.