



BOKKIE MK II

This low wing .20-.30 powered sport flier builds quick, flies great, and won't break the bank.

By Martin Irvine

Foreword

I think that most modellers would like to design their own aircraft. There is real satisfaction in seeing something unique flying for the first time, especially if it is your own and not just a run of the mill kit or plan that dozens of others have built. Most of us have a good idea of what we would want such a model to do, based upon others we have flown, but only a few have the

ABOUT THE AUTHOR

The author, age 34, has been building and flying model airplanes for 20 years, the last 17 off and on in radio. He is a special education teacher at a public school just outside his home city of Kingston, Ontario. He has been married for eight years and has two children, Michael (age 6) and Meghan (age 3). (It is rumoured that Michael's first word was "ser-vo," much to the horror of his mother.) He has held several executive positions in his club, the Kingston Radio Control Modellers, and is an active modeller, preferring scale aircraft, especially WW I biplanes.

confidence to start on a new design. For the rest of us there is an alternative; we can start with a good airplane and go from there.

Redesigning an already successful airplane offers many people a fairly safe way to end up with something that can stand out from the crowd but still be a sure flier.

The following is just one example of what can be done. I have gone into more detail than is strictly necessary so that anyone considering a similar project can follow the rationale for the





changes I made, and hopefully meet with as much success as I did. The basic aircraft is quite simple and the plan complete, and, therefore, needs little explanation, at least to those who should attempt it. If you are an "ARF" pilot, then perhaps you can get some help from another modeller!

CONSTRUCTION

Wing:

I force myself to build the wings first so I have them to set the wing saddle cut-out in the fuselage later. This is a fairly straightforward wing and the tapering platform is easier and less work than many people think. There are a few changes from the original drawing. The first one is the substitution of a 1/4" x 1/2" leading edge, bevelled after it is installed, but before the leading edge sheeting is glued on. This way the leading edge and the sheeting are tied together and so are stronger. I also feel that it is easier to get a reasonably accurate leading edge shape this way and it all but eliminates the possible joint gap. I added small 1/16" plywood landing gear doublers to W1 and W3 to help take my less than perfect "smash and go's," and wrote myself a note to add the 1/32" plywood wing bolt reinforcement after covering so that I wouldn't have to cover around it. This ply piece looks larger than is necessary but it ties the trailing edge together quite well at this point.

The ailerons were widened from a constant 1" to 1-3/16" from the base at W2 to W8, where they taper to the tip at W11. This was for appearance and to make sure that I had enough aileron for quick controls. The last thing that I did was to extend the tips back so as to enclose the ends of the ailerons. There isn't enough wing outboard of the aileron ends for this to be of aerodynamic benefit, but it avoids catching things in the hinge line at the

BOKKIE MK II

Designed By:
Martin Irvine

TYPE AIRCRAFT

Sport/Fun-Fly

WINGSPAN

44 1/2 Inches

WING CHORD

8 1/4 Inches (Avg.)

TOTAL WING AREA

348 Sq. In.

WING LOCATION

Low Wing

AIRFOIL

Symmetrical

WING PLANFORM

Double Tapered

DIHEDRAL EACH TIP

1 1/4 Inches

OVERALL FUSELAGE LENGTH

40 1/4 Inches

RADIO COMPARTMENT SIZE

(L) 9" x (W) 2 1/2" x (H) 1 1/4"

STABILIZER SPAN

17 1/4 Inches

STABILIZER CHORD (incl. elev.)

5 Inches (Avg.)

STABILIZER AREA

82 Sq. In.

STAB AIRFOIL SECTION

Flat

STABILIZER LOCATION

Top of Fuselage

VERTICAL FIN HEIGHT

6 Inches

VERTICAL FIN WIDTH (incl. rud.)

7 1/2 Inches

REC. ENGINE SIZE

.19-.28 2-stroke

FUEL TANK SIZE

4 Oz.

LANDING GEAR

Conventional

REC. NO. OF CHANNELS

4

CONTROL FUNCTIONS

Rud., Elev., Throt., Ail.

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa & Ply
Empennage	Balsa
Wt. Ready To Fly ...	36-44 Oz. (2 1/4-2 3/4 Lbs.)
Wing Loading	15-18.5 Oz./Sq. Ft.

tips. My wing tips were made of 1/8" sheet for the outline and a bit of block. It is a little lighter than solid block. The plane should also roll better with less tip mass although I doubt that it is significant.

I included 1/16" shear webbing (vertical grain between the spars) even if not strictly necessary. Subsequent flying with and without webbing (two wings) has shown this to be true, but if you want more strength for negligible weight, include the webbing from the centre section out to W8 (web between the spars, with the grain vertical). This would be a particularly good idea if a Schnuerle ported .25 is going to be used.

Tail:

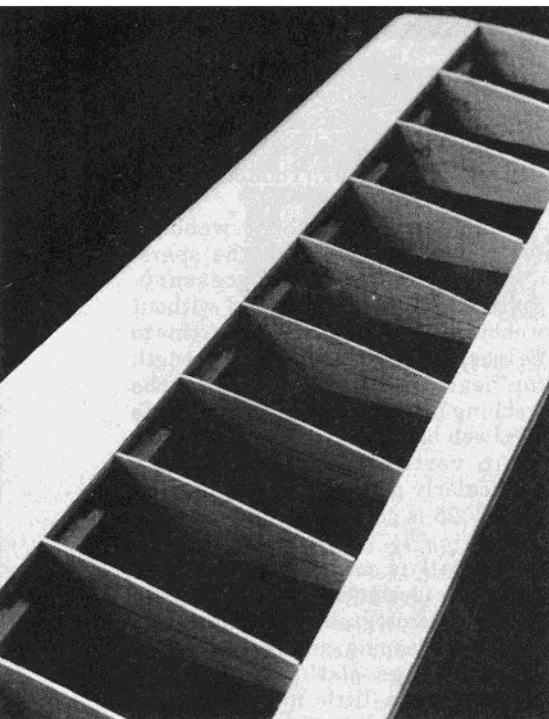
The tail is pretty much as was originally designed by Harry Allen, but I used crossgrain stabilizer tips to minimize warping, and I extended the trailing edge of the rudder and elevator for a little more response. This was a modification that we felt was beneficial. I built the tail skid shown on the original plan on the first aircraft I made but took it off after trying it and finding it hard on the rudder hinges. I replaced it with a swivelling tail wheel mounted in the fuselage. The method shown (using a drilled out dowel as a mount) seems to work very well, especially for an "after the fact" modification and so that's how I did it on the second Bokkie Mk II. Steering on the ground has been no problem unless the wind is strong, in which case your left thumb will get lots of exercise! If you feel the need for precise ground handling, put in a steerable wheel but attach it to the rudder with a rubber band or some other shock absorbing mount.

Fuselage:

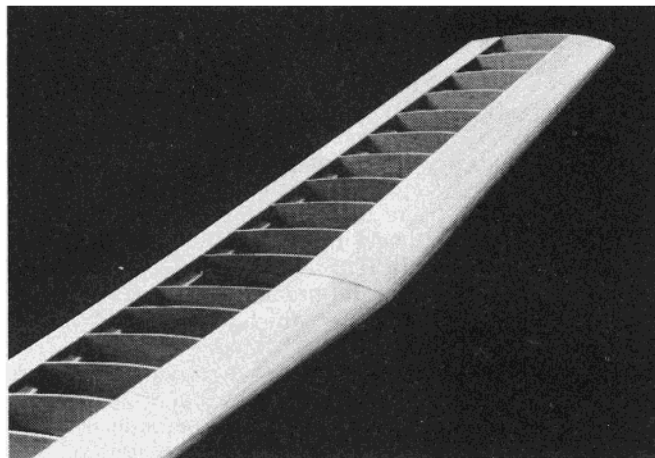
The fuselage saw a lot of change. The 1/8" sides were extended to the new spinner ring. Determine how long the sides should be for your engine,



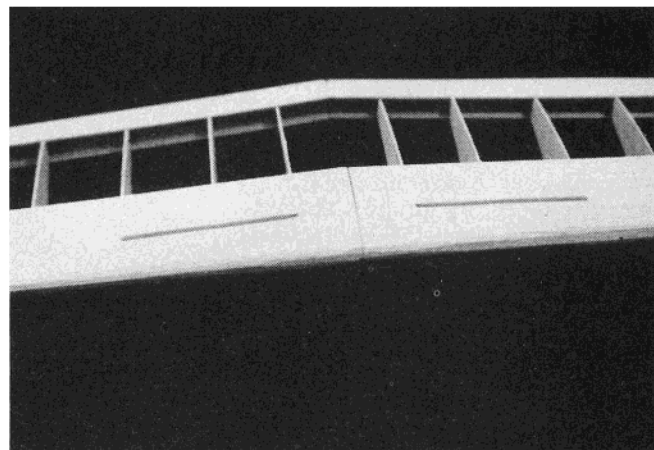
The first Bokkie Mk II.



Wing framing prior to tips and final sanding.



Wing framed up.



Underside of wing c/s. Note L.G. slots. L.E. has not been sanded to section.

they will be straight. The forward cowling top was done in a similar manner and covered with 3/32" sheet. A good way of doing this is to soak the sheet in household ammonia for 15 minutes and then use long strips of masking tape to hold it in position on the cowl. Leave it to dry overnight. You will be amazed at how pliable even stiff sheet can become.

The position of the 1/16" ply spinner ring was determined by the engine that I was using; in the first aircraft, an old loop scavenged Super Tigre .23, and a K&B .20 Sportster in the second. The engine was mounted and the spinner ring put over the forward crankcase, between the carb and the thrust washer. The prop and spinner (a Goldberg 2 1/4") were put on next. Then, using a 1/32" shim between the spinner and the ring, the ring was carefully glued to the fuselage sides. I wet the sides to help bend them into position. (This would all go faster with four hands but isn't too difficult to do with just two.) Add the 3/8" triangular stock and the 1/8" balsa doubler from F2 forward. Finally, the 3/16" cowling bottom is glued on and soft block is added to brace the ring and fill the gaps. This was all sanded to shape, blending the essentially square fuselage into the round spinner ring.

The aft decking has a 1/8" x 1/4" spine down the middle, and 1/8" square stringers on both sides. Once the bottom sheeting has been added, the 1/4" triangular stock is largely sanded away as the aft fuselage is shaped. This bottom sheet was changed from 3/32" to 1/16" sheet crossgrain as the triangular stock adds a fair bit of strength.

The tail wheel is a swivelling set-up using a 1/16" i.d. eyelet and brass tubing and 1/16" spring steel wire. The 1/16" wire is bent to shape, the eyelet is put on, and the brass tubing is carefully soldered to the end to keep

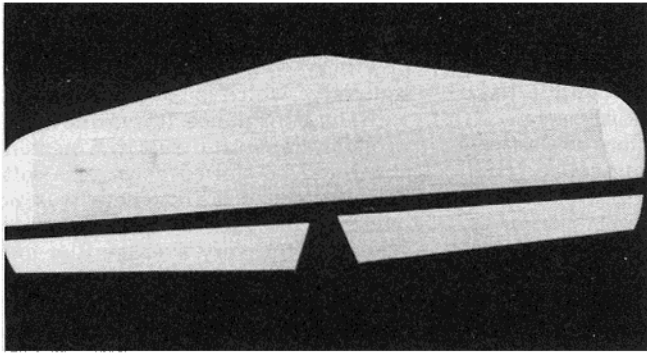
engine, consider shortening the nose a bit. My second Bokkie Mk II, with a K&B .20 Sportster, required the radio to be as far aft as possible and the 500 mA pack behind the canopy. The original's thick sheet top construction was discarded in favour of a built-up turtledeck. This necessitated the redesign of the bulkheads as well as the addition of a 1/8" x 1/4" balsa strip along the top edge of the sides to compensate somewhat for the lumber removed from the top deck. Also, 1/4" triangular stock was added along the lower rear edge of the sides to allow for some rounding off of the fuselage bottom.

I had the height of the fuselage bulkheads from the new side view that I had drawn (the width remained the same), and so just redrew the new bulkheads over the old ones using a cheap French curve (no, not Fifi LaFlamme!). By doing them one on top of each other, I was able to make sure that the shapes were similar enough that the stringers would maintain a smooth line from one bulkhead to the other. (They have since been drawn

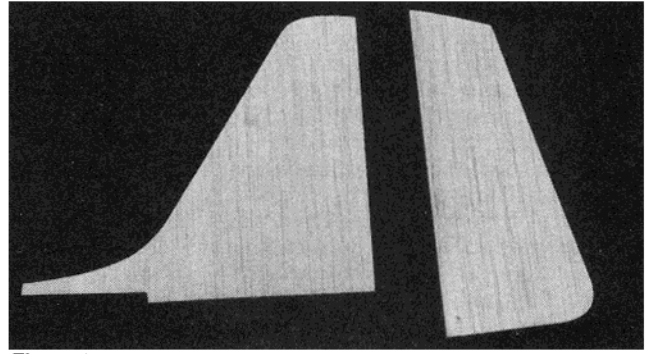
and then cut them a little too long so that you can sand them down for a perfect fit. If you are using a heavy

separately on the new plan.) The rear stringers are added after the bulkheads are in place in order that

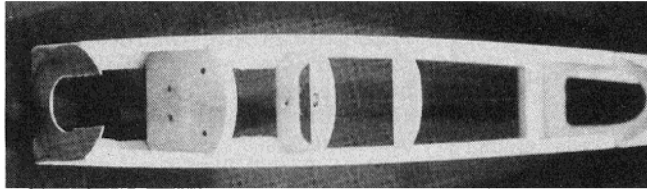
the wire on, but still free turning. This assembly is glued into a clearance hole in a 3/16" dowel (being careful not to



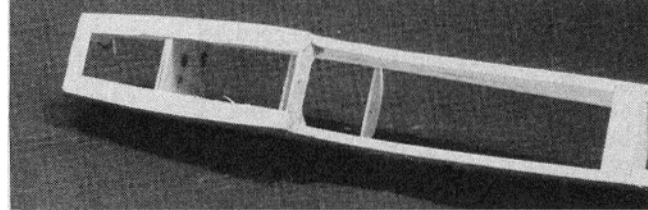
Stab and elevator parts.



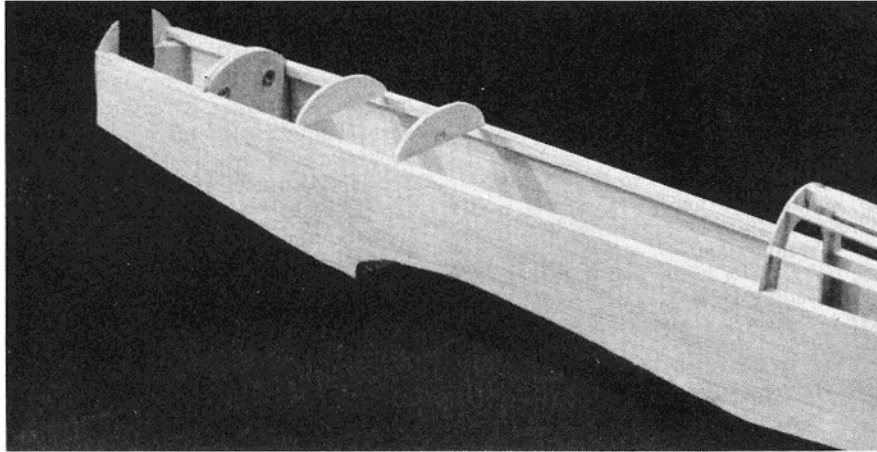
Fin parts.



Forward fuselage — nose blocks visible. Holes drilled and engine mount blind nuts glued in. Hole for wing dowel evident in lower former.



Lower nose section. Note the triangular stock on lower forward edges. These will be rounded off once lower sheet is attached.



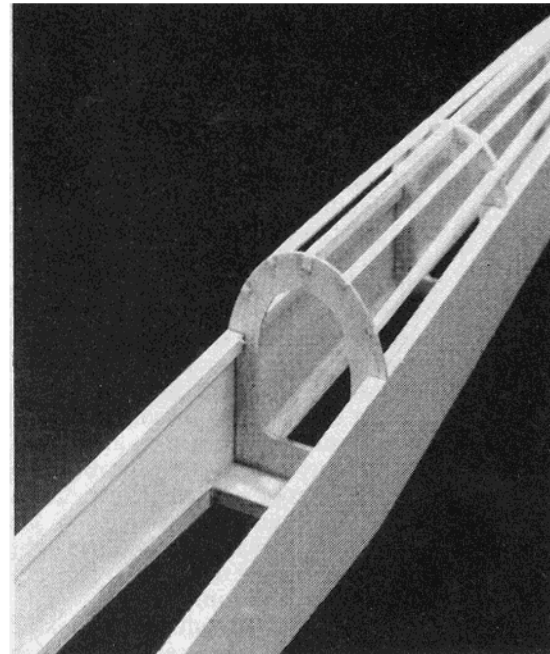
Forward fuselage prior to sheeting. Note triangular stock against the spinner ring. F3 and F4 will be cut away after sheeting to accommodate fuel tank.

get glue on the swivel) and, once dry, glued into a hole in the aft fuselage.

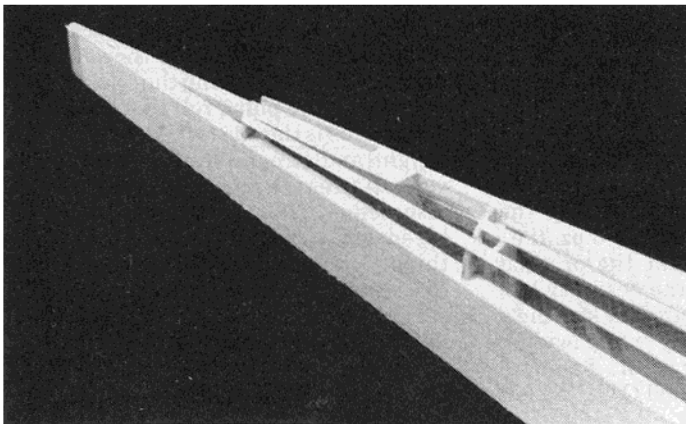
I added the 1/8" wing saddle doublers so that now there is a 1/4" width for the silicone wing seating sealant. The wing mounting block was also lowered so that it is flush with the wing. This way the wing shear bolt

might actually shear if necessary.

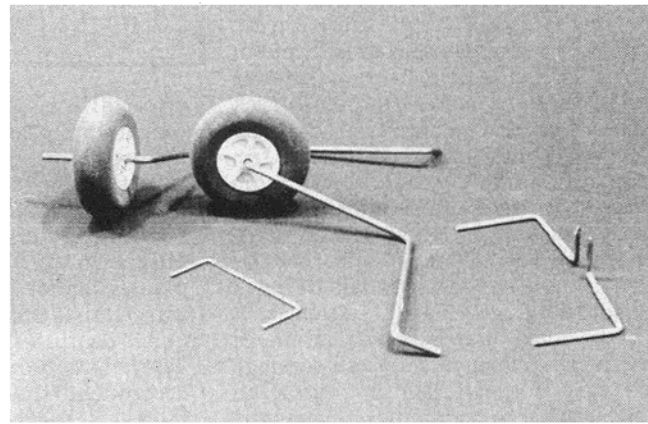
The canopy was molded using a block mold and sheet butyrate. The mold for the first Bokkie Mk II was from another airplane that fit adequately but one carved specifically for this aircraft was used on the second, and looks much better. Carve



Fuselage center. Stringers and longerons visible as is the wing saddle doubler and the wing bolt block.



Rear fuselage showing spine doublers forming slot for fin.



Wire parts. Landing gear wire, aileron torque rods, and elevator joiners. Note the Dave Brown wheels sanded to a round section.

the mold from balsa or softwood, to fit the opening. I carved the blank for the second canopy from basswood. If you use a bandsaw, sharp chisel, and coarse sandpaper, it will take less than an hour to get to the point where you can put a couple of coats of surfacing resin on it and wet sand to a smooth finish, ready for molding. Then add 1/8" sheet to the back and bottom. This will assure a good fit and allow a 1/8 overlap for gluing to the fuselage. For the molding, I took an 8" x 10" sheet of butyrate, tacked on a pair of 1/2" square balsa strips as handles down the long sides, and held it under the broiler in my stove until it was floppy. This doesn't take long, which is good, as it gets pretty hot in there if you don't use long balsa strips. Then, with the mold glued onto a dowel and clamped to a chair, I pushed the butyrate down over the mold, keeping it tight until it had cooled enough to hold its shape. The whole thing was done "quick and dirty" and one could take more time and do a better job. Of course if you can find a commercial canopy that will fit well enough, by all means use it. The thing to remember is that the making of an acceptable canopy is not that difficult and so it shouldn't scare you off any airplane.

On the second aircraft I lengthened the landing gear legs. At the original length, the airplane looked a little like some sort of rodent scurrying about the field. The lightweight Dave Brown wheels are perfect for this model so I used them on the second model. I used a sanding disc to round off the square edges. By holding the wheel on a spring steel axle at an angle against the spinning disc, the edges are sanded off as the tire rotates, ensuring a constant cross section. If you use a light touch, and take your time, it's easy. Ace and Sullivan also have light wheels available now.

Radio Installation:

Things are fairly snug in the Bokkie Mk II. Unless you are careful, you may get some interference between the aileron servo and the other components, so, be forewarned. Check to see that yours will fit before you cut wood, or you will hate yourself! I put in my RS with the LDR-2 servos (same as the D&R Bantams) and a 250 mA pack in my first, and a Futaba 107N Rx, 133 servos and a 500 mA pack (for balance) in the second. Total radio weight for the four channels is a little over 8 oz. for each flight pack. A super light radio could knock off another 3 or 4 oz. Later, when my small RS pack died, I squeezed in a 500 mA pack. It fit because that receiver is small. NyRods are a must as the aft fuselage is very narrow. The original plan shows a servo pod hanging below the wing, but I found it unnecessary.

Covering:

I covered my first Bokkie Mk II with silk and dope because I like silk and dope, but on the second I used MonoKote for speed of covering.

The colour scheme for the first was from a racing Mustang called "High Time II." The zebra stripes took awhile but I think that it was worth it. For the second, I used the "Bardahl Miss" checkers that I had used on an Andrews Trainermaster years ago, but in red and white rather than black

Bill of Materials

(All balsa is medium soft stock unless otherwise noted)

Sheet:

- (7) 1/16" x 3" x 36" — Leading and trailing edge sheeting, ribs, fuselage underside, and cockpit floor.
- (1) 3/32" x 3" x 36" — Top cowling and fuselage bulkheads.
- (3) 1/8" x 3" x 36" — Fuselage sides, doublers and wing tips.
- (2) 3/16" x 3" x 36" — Tail and nose underside (soft).
- (1) 3/8" x 3" x 36" — Ailerons and centre section trailing edge.

Strip:

- (3) 1/8" sq. x 36" — Stringers.
- (3) 1/8" x 1/4" x 36" — Top longerons, spine and cross braces.
- (4) 3/16" sq. x 36" (or two 48" lengths) — Main spars (hard).
- (2) 1/4" x 5/16" x 36" (or one 48" length) — Trailing edge.
- (2) 1/4" x 1/2" x 36" (or one 48" length) — Leading edge.
- (1) 1/4" Triang. x 36" — Rear fuselage corners.
- (1) 3/8" Triang. x 18" — Nose corners and ring bracing.

Plywood:

- 1/16" x 5" x 7" — Dihedral braces, landing gear reinf., spinner ring.
- 3/32" x 3 1/2" x 4" — F3 and F2
- 3/16" x 2 1/2" x 3" F1

Wire, Tubing, Dowel:

- 3/32" dia. x 24" — Landing gear and strip aileron torque rods.
- 1/16" dia. x 2" — Tailwheel wire.
- 1/16" i.d. x 1" — Brass tubing.
- 3/32" i.d. x 4" — Brass tubing.
- 1/16" i.d., eyelet.
- 3/16" dia. x 2" dowel — Tail wheel mount.
- 1/4" dia. x 1" dowel — Wing dowel.

and yellow. Again, it was time consuming but worth it.

Flying:

By the time the last dope was on, my first Bokkie Mk II was tipping the scales at 2 3/4 ozs. This was 8 oz. (i.e., nearly 25%) over what the original plan called for, and the designer had warned that overweight Bokkies die a quick death. Still, my wing loading was about 18 oz. per sq. ft., balanced according to the original C.G., so I felt fairly confident. I was not disappointed. It flew virtually off the

board, the transmitter trims being quite sufficient on its test flights. It flew very well, being quick but not squirrely, which is too often the case with small airplanes. It was fine in the wind (an important trait in Kingston) and could be slowed down to a soft, straight ahead stall. There was no tendency towards high or low speed snaps. I am a very average flier and had no trouble with this airplane. In fact, I often landed the airplane deadstick because I forgot about my fuel level. That is an indicator of how pleasant it was to land. The second retains these good characteristics with more speed and faster ailerons. The K&B .20 idles better than does the S.T. .23, and is so much quieter (I can hardly complain; I bought the Super Tigre in 1973 and it has served in five or six models!).

The S.T. .23 is lots of power for sport flying, so an older O.S. .25 or Veco .19 would be fine, especially if you keep the weight down. These engines are lighter than the more powerful .25's now available so they help with the weight. The K&B .20 is another good choice — reasonably powerful, quiet, and inexpensive. (Of course if you want something that can go like a rocket at full throttle, use a Schnuerle ported .25 but be ready for it!) Use a small radio, a light covering and wheels, and select your wood with a little care. I got six to eight flights out of a 250 mA pack because of the small flight loads, but have yet to find out if I can get 15 flights out of the 500 mA pack. I got my second Bokkie Mk II down to 2 1/2 lbs., even with a heavier engine and battery pack. I'd like to try one with a Schnuerle ported .25 sometime, as the extra power would be fun.

The Bokkie Mk II is a small, light, attractive airplane that flies very much like larger models. It is quick to build and can be taken in any car in one piece. It tracks well through most maneuvers, rolling ones being slightly better than looping ones, as you would expect with a tapered wing. Actually, rolls are the reason to make sure you have lots of aileron throw; not because it's insensitive but because they are so nice. If you like bringing the stick over and seeing the plane roll like it's on a string, this is the one for you. The light weight and streamlining means that you can stretch a glide if need be, but it also means that it takes a bit of room to bleed off excess airspeed. The one thing that I would like to try with it (besides a .25 Schnuerle) would be two servos on the ailerons and mixed flap/ailerons so that it could be slowed down quicker on approaches. Until I have one of these fancy transmitters I'll just have to have a ball with one of the best small airplanes around. □