**Build the Tiger that's really a pussycat! — Gordon Whitehead is doing his best to get you schoolyard scalers flying .20 powered ships with his 47½" no-frills Tiger Moth.**

# D.H. 82a TIGER MOTH

## By Gordon Whitehead

The full size Tiger Moth was developed from the Gypsy Moth using a similar scientific approach to that which modelers use to evolve their designs. First off, the Gypsy top wing was moved forward to ease emergency exit from the front cockpit. So then the wings had to be swept back to keep their relationship with the C.G. The engine was inverted for better pilot vision and also to hide the pots. Now guess what! Well, the wing tips kept catching the ground. So the interplane struts were shortened, producing an instant cure, and also resulting in that unequal sweep back and dihedral.

And with her sort of homely appearance and gentle nature she became a lasting favorite right from her emergence in 1921.

Perhaps the most intriguing role the Tiggie played was that of "Queen Bee." The Queen Bee was a target drone for war-time naval anti-aircraft practice, and a few words will not go amiss just to show how things have progressed. Basically a standard Tiger Moth, the Queen Bee had a "wireless controlled automatic pilot" for guidance. The autopilot had a single gyroscope which controlled two compressed air valves about the pitch and yaw axes. The valves fed air to pistons on rudder and elevator, and there was no aileron control. The gyroscope was powered by compressed air and control was effected by disturbing the gyro, causing it to precess. The disturbing was actuated by radio. The ground control box had nine buttons each of which sent a code:

| | |
|---|---|
| –• | nav. lights on |
| –•• | nav. lights off |
| –••• | right turn |
| –•••• | straight ahead |
| –••••• | climb |
| –•••••• | level flight |
| –••••••• | glide |
| –•••••••• | dive |

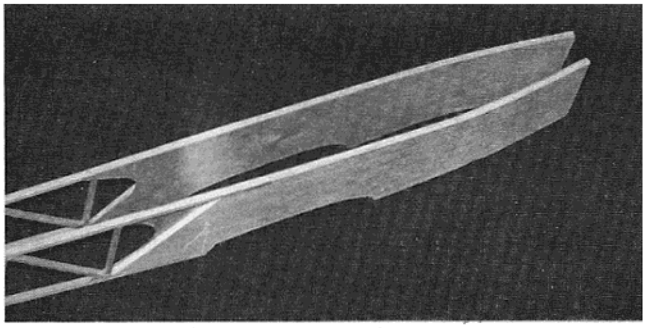
There was a stand-by telephone dial if the buttons failed (though no hand-set for shouting instructions!). The transmitter weighed half a ton, working on a frequency of 160-180 KHz, and you needed a cruiser to both carry it and the airborne package. A 4-tube receiver fed a decoder full of relays. Throttle and elevator were linked, so that "climb" increased throttle, while "glide" decreased revolutions. If the radio failed, or if the engine stopped, the ship went into a left glide. At a pre-set height, the Queen Bee would level off automatically and go straight ahead for landing, and she would also pull out of a dive at "altimeter height" and level off in a curise mode. The autopilot was taught to fly the ship by an intrepid aviator/radio boffin, who occupied the front cockpit for the first flights. A human buddy-box no less!

The bird was usually float-equipped, and was launched by catapult from a ship, with controls initially locked. During the landing phase, a 50' long trailing wire touched first, whereupon full up elevator "happened" and the engine stopped, allowing the machine to settle. A hidden feature was that if "glide" was selected when the bird was overhead, she would dive straight in. Some glitch, huh!

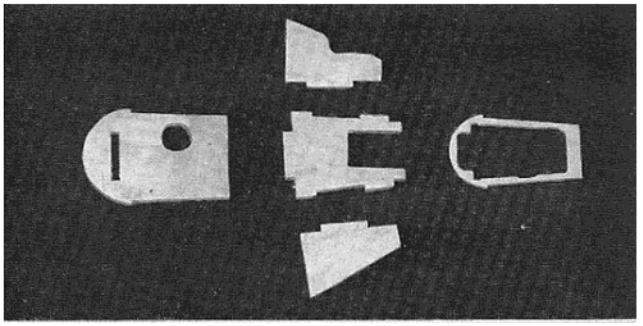
One float-equipped Tiger exists in England, with Edo seat boots from an Aeronca Sedan, and a Schneurle-ported .20 or .25 would easily allow you to successfully float-equip this model. Otherwise a good .20 will give a lively performance as she is now.

Turning our attention to the model for an instant, she is to 13/96th scale, giving a size and wing area I've found, by experience, to be just right for a .20 powered light biplane type. Her performance is very scale-like (if rather too fast) and the full-size pilot's notes are a useful guide to handling this ship. More on flying later, so let's read some more about Tiger Moth exploits.

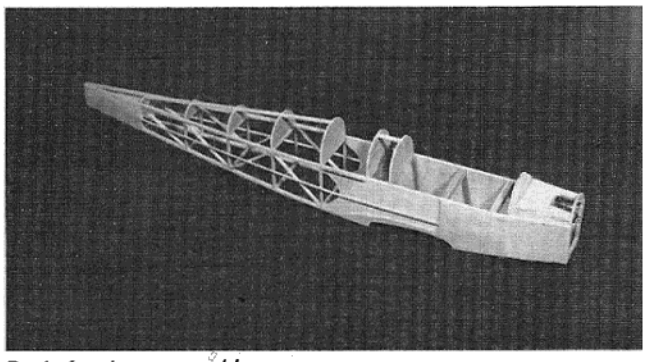
Between the wars, when the practice of aerial barnstorming reached epidemic proportions, Tigers formed the equipment



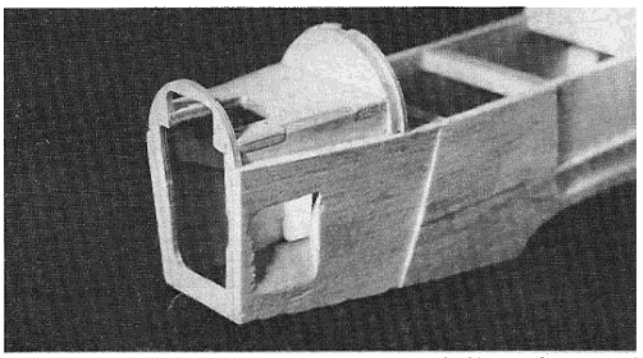
*Pre-formed fuselage sides with doublers affixed.*



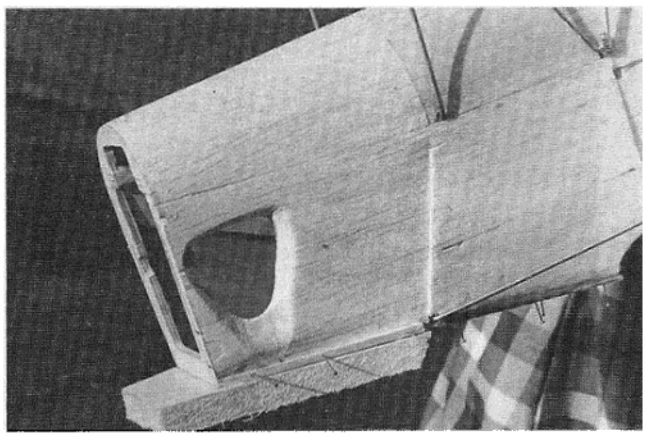
*Ply motor mount parts.*



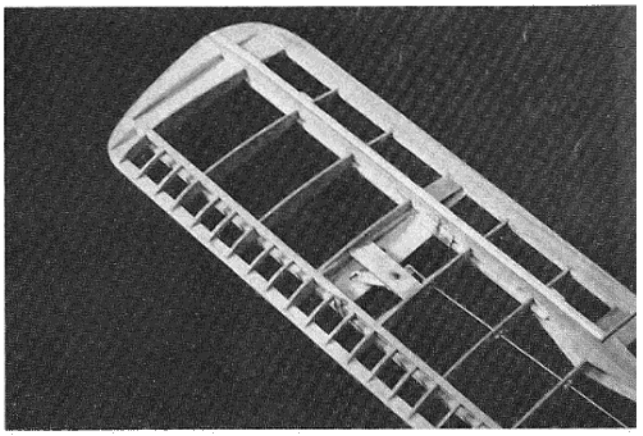
*Basic fuselage assembly.*



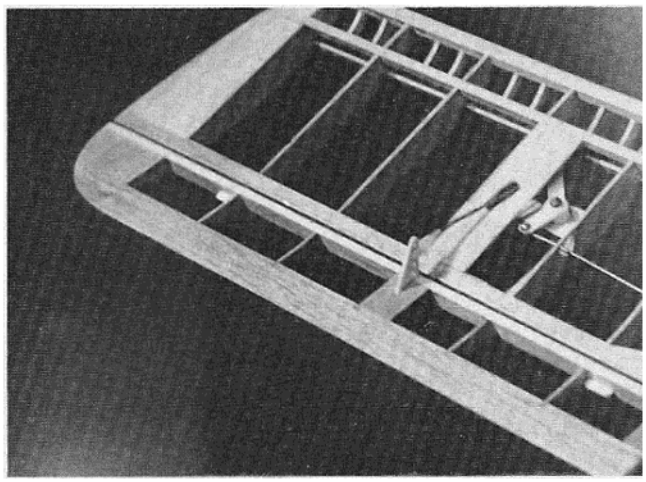
*Hole chamfered for screwdriver access and shows close-up of motor mount.*



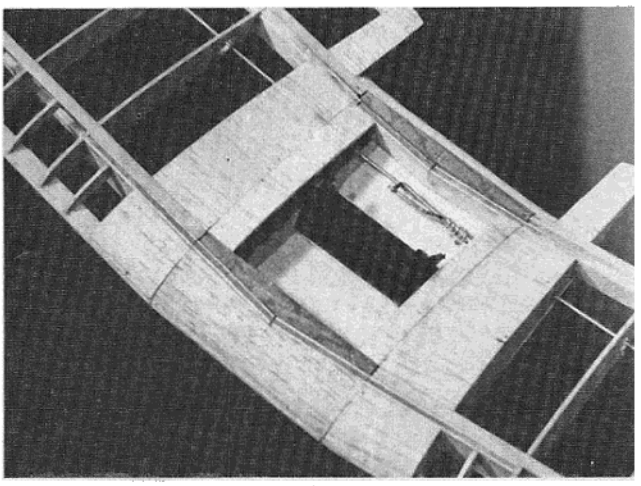
*Nose section sheeted with bottom block in place.*



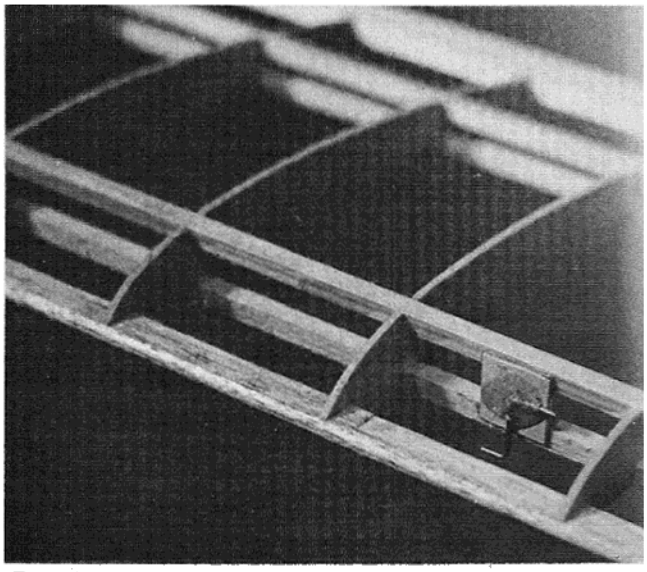
*Aileron hook-up – note riblets.*



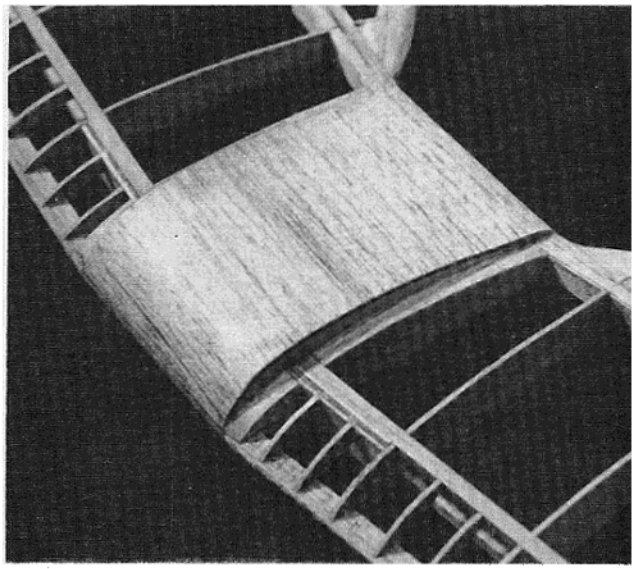
*Aileron and riblet detail.*



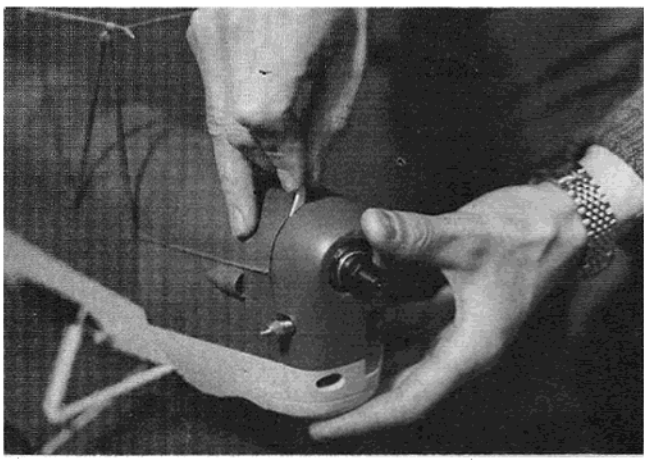
*Aileron hook-up at center section.*



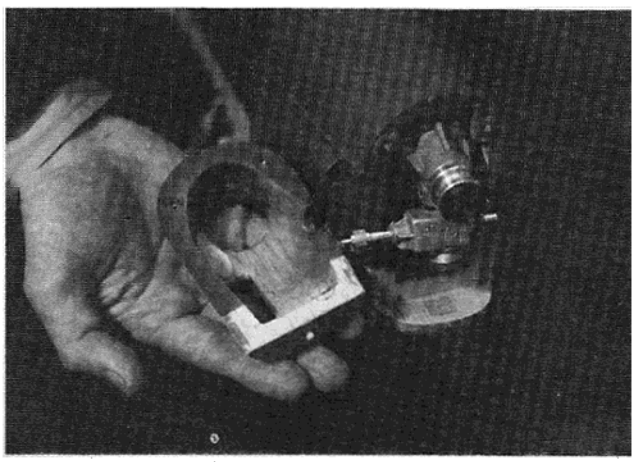
*Top wing strut hook.*



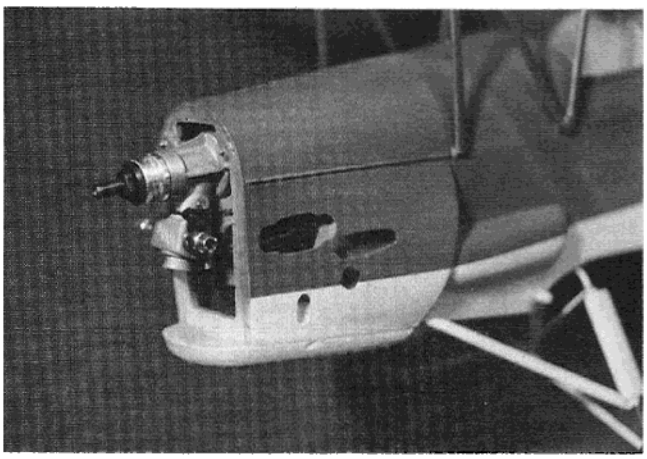
*Top wing center section.*



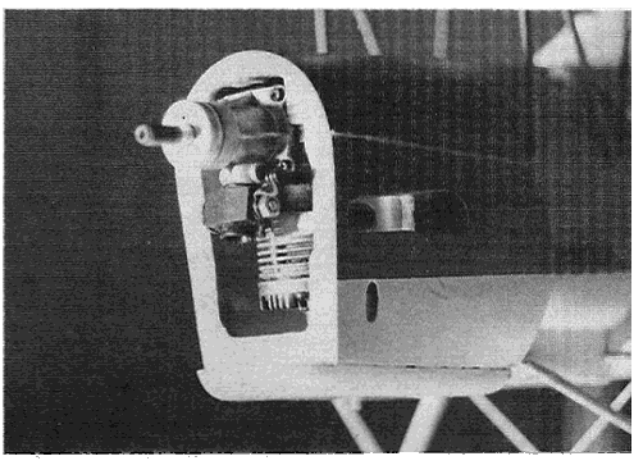
*Popping the cowling off with nylon thrust wedge.*



*Peg and dress snap fastening.*

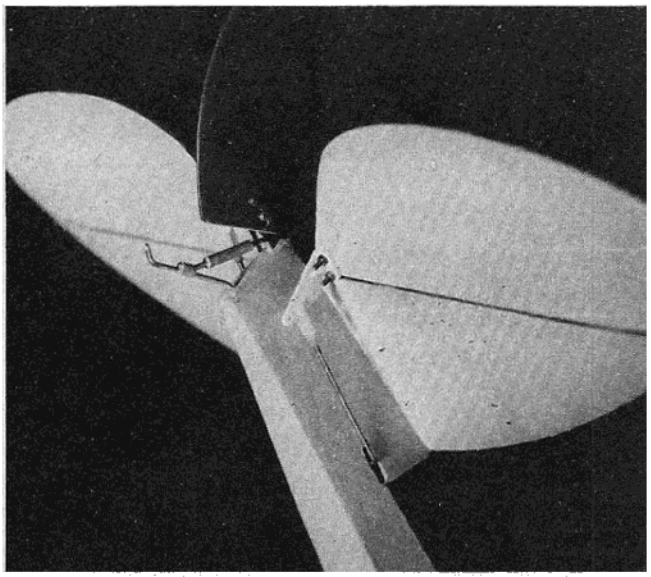


*Irvine .20. Top 3 holes are for OS type muffler and its pressure nipple. Bottom hole for screwdriver access. The big carb still fits inside!*

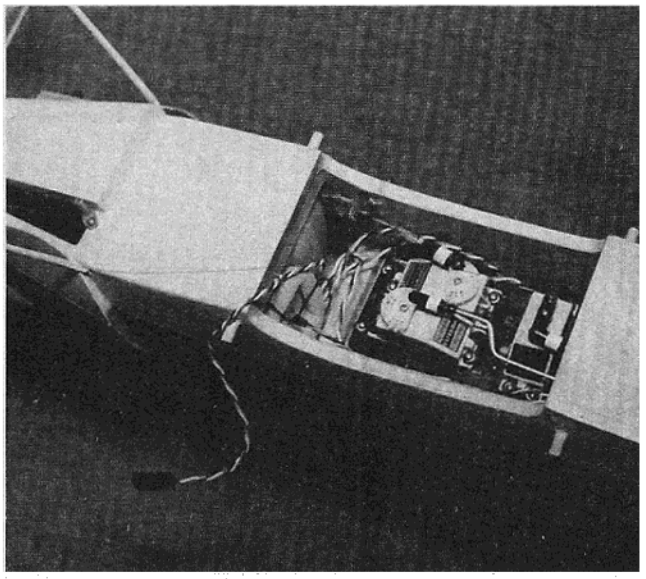


*HB .20 – Veco type muffler has single relief hole. Lower hole for screwdriver access. The small Perry fits easier!*

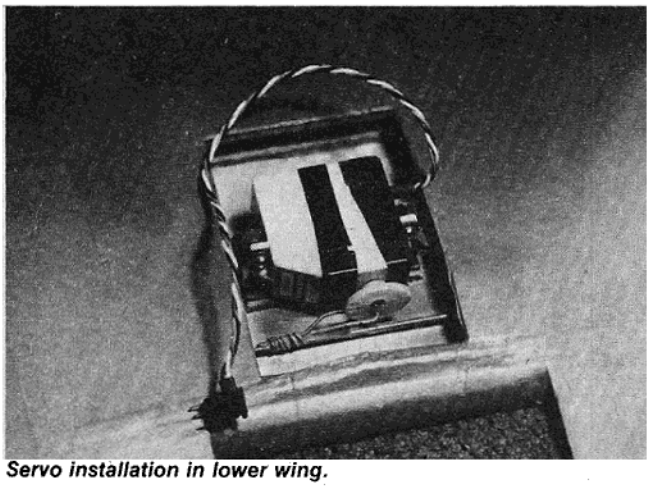
of several "flying circuses," and for a period of time, the Tiger held the World record for the greatest number of loops flown consecutively. One guy used to loop around a length of bunting held 13' off the ground — he also used to pick up handkerchiefs from from the ground with a 9" spike on the lower left wing tip; 800 times! The Tiger's aerobatic repertoire included loops, rolls, bunts, upward rolls, inverted falling leaves, inverted loops and inverted flights — though there just had to be modifications lurking in the ships capable of the upward and outside antics. For instance, the standard Tiger is forbidden to flick roll, though not our model. For a full description of the Tiger's history, try to get "The Tiger Moth Story," written by



*Tail hook-up plus skid.*



*Triple servo mounting – 2 servos forward to help C.G. position.*



*Servo installation in lower wing.*

*Just waiting on the ground crew.*

*Lift-off with HB .20 for power.*

*Flight performance is as beautiful as she looks here.*

Bramson and Birch, published by Cassell. There are about 42 Tiger Moths in the U.S., and a dozen in Canada so color research shouldn't be too difficult. Profile No. 132 is useful to modelers for decoration details, but for nothing else.

Let's build!

**Fuselage:**

The front fuselage sides are medium sheet. Build on the rear fuselage, framework, then soak the front sheet in boiling water and weight the frames down, jigging in the bend between F2/3 with packing. When dry, contact cement the ply doublers in place. You can set the bend accurately by rolling a bottle over the curved portion, varying the pressure you apply in

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**Designed By : Gordon E. Whitehead**

**TYPE AIRCRAFT**
Sport Scale
**WINGSPAN**
47½ Inches
**WING CHORD**
7 Inches
**TOTAL WING AREA**
631 Square Inches
**WING LOCATION**
Biplane
**AIRFOIL**
Flat Bottom
**WING PLANFORM**
Constant Chord - Swept

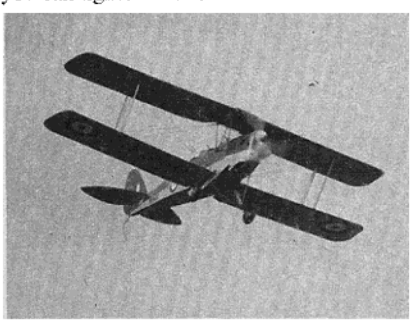
**DIHEDRAL, EACH TIP**
1" Top
1⅞" Bottom
**OVERALL FUSELAGE LENGTH**
39 Inches
**RADIO COMPARTMENT AREA**
(L)7" x (W)2½" x (H)2¾"
**STABILIZER SPAN**
16 Inches
**STABILIZER CHORD (incl. elev.)**
4½" Average
**STABILIZER AREA**
72 Square Inches
**STAB AIRFOIL SECTION**
Symmetrical
**STABILIZER LOCATION**
Top Of Fuselage
**VERTICAL FIN HEIGHT**
7¼ Inches

**VERTICAL FIN WIDTH (incl. rud.)**
7" Average
**REC. ENGINE SIZE**
.20-.25 Cu. In.
**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 and Ply
Wing ..... Balsa, Ply & Spruce
Empennage ..... Balsa
**Wt. Ready-To-Fly** ..... 66 Oz.
**Wing Loading** ..... 15 Oz./Sq. Ft.

order to adjust the curl. Now join the sides with the cabane mounts, F10, F5 and the front lower cross-brace. Then join the stern post and all all cross-braces, and the 3/16" sheet at the lower wing T.E. Epoxy F1 in place followed by M1 and F2. Cut the exhaust aperture to suit your motor, cut the left M2 to suit, then epoxy both M2's in place. These are slipped in place from the bottom side.

Engine mount nuts are soldered on to brass strip joiners, which are then epoxied to M1. Make up and fix the cabane in place, and bind the front L.G. legs in place on F2. Add the ply cockpit and tank compartment floors, followed by the top formers and 1/16" balsa decking. Stick on the 3/32" balsa side sheeting aft of C3, and over the tail bay, followed by the 3/32" square stringers. Sand the sheet panels to section. Now feed the engine through F1, bolt it in place, and chamfer away the cowl side below the exhaust outlet to allow a screwdriver to engage the mounting-bolt heads through the exhaust outlet aperture. Now buy a couple of spare identical screwdrivers, or put your existing one round your neck on a chain! Add the 1/8" cowl top sheet, followed by both C3's, both "S" spacers, and the 1/64" ply cowl side panel. Cut muffler clearance holes, and also the screwdriver access hole. Now check that you can tighten and loosen the exhaust-side



***You can almost hear the nostalgic crackle and pop of an idling Gypsy Major as she sails serenely by.***

mounting bolts through the designed route. Okay? Now you can add C2 without fear of having your engine locked permanently inside the cowling. Remove the motor, tack glue C1 in place and carve and sand it to shape. I cut out all the apertures before final shaping, and didn't fit the dress-snaps and dowel peg until after covering. An X-Acto router is sufficient to hollow the cowl.

**Empennage:**

Butt-join 1/16" sheet, and cut to the outline of the complete horizontal surfaces. Mark all rib positions and pin it down. Soak 1/8" square balsa in water to make it pliable, and Zap it in place at the L.E. and T.E. Add the remaining ribs, spars, etc., for which white glue will suffice. When dry, turn it over and repeat the process. The vertical tail surfaces are made in like manner. Sand the ribs to section with a sanding block, then separate the moving surfaces and join the elevators with wire. Pin the tail surfaces together, and on to the rear seating, and admire your handiwork before bashing out the wings.

**Wings:**

Of fairly conventional lay out, the wings should pose no problems. I've labeled the dihedral measurements on the plans as follows: Upper wing 1" each tip and lower wing 1⅞" each tip. Braces B1-B4 are added to to their respective panels before joining the wings together to form the center sections. The ply and hardwood center section spars are best glued in place with epoxy. I fell out with Solarfilm hinges a while ago, and now find the type used here the best form of near-scale plain hinge.

Give the center section tank a couple of coats of dope to fill the grain. Now make the tank corrugations as follows. Cut an 8" x 5" rectangle of thin card and, with a ruler and a balsa knife, make 6" long slits in the card 1/16" apart. Remove alternate strips, and wrap the resulting grid over the tank fairing, securing the ends under the tank with Scotch tape. Five generous coats of sanding sealer (or dope and talc) will smooth out the grid into convincing corrugations without sandpapering. I didn't bother corrugating under the tank.

I don't know if the aileron differential really does very much at this scale, but I incorporated it using a 120° bellcrank, on the basis that the full-size airplane was so equipped. Before covering, add the interplane strut hooks and make the struts. However, don't solder the remaining L.G. parts in place yet so that you don't have it flopping about while covering and painting. Fit the tailskid.

**Covering and Finishing:**

I covered the wings, and the open areas of the fuselage with nylon. I then doped light tissue on the fuselage sheeted areas, sealing and sanding smooth. The oil tank and cowl scoop were then added, as were the cowl front fastenings. The tail surfaces were covered in heavy weight tissue and doped before gluing in place on the fuselage. The strut fairings and L.G. main legs were added at this stage as were the dummy slats.

The cellulose dope camouflage was applied by airbrush. I mixed the colors from normal primary colors. For roundels and under-wing lettering, I used a dope-loaded ruling pen held in a compass to mark the outlines, filling in the color areas by brush. Fuselage letters were transfers. The whole ship was then fuel proofed with egg shell polyurethane varnish.

**Radio Installation:**

The servos, mounted on a tray, can go at the rear of the equipment bay, to ease getting the receiver past the tank and battery pack for crystal changes. If using a 4 oz. square section tank, you will need a flat battery pack. If you only have a square pack or 500 mah button pack, you will have to use a 2 or 2½ oz. tank. The antenna passes down the inside of the fuselage exits through a hole in front of the tailpost, and is tied to the tail skid.

**Flying:**

Set up the control throws shown on the plan. She is slow on aileron, and needs all that elevator throw to hold the tail down when taxiing, and for spins. My ship carries 3 oz. of nose weight, and the HB .20 uses a 9/4 or 10/3½ T.F. wood prop, burning 5% nitro fuel drawn unpressurized from a 4 oz. tank. A friend built another version for his new Irvine Schneurle .20 and weights were about the same, though the performance of his Tiger was crisper due to the extra power.

**Take-off:**

Feed in full power, and hold full up elevator until she's rolling. Release the up, but control the rate at which the tail rises or she'll tip over on her nose. Slight right rudder is necessary for straight tracking and she answers the helm quickly when on the deck.

**Aerobatics:**

You'll find that as you vary the airspeed in level flight for different cruise speeds, you'll have to adjust the elevator trim setting. This is as you would expect with the free-flight type incidences, and is a feature of the full-size ship which uses adjustable spring loading to achieve the required control bias. Incidentally the slats were locked for taxiing and aerobatics, so our glued-shut ones are quite scale! Let's look at some speeds quoted from the Tiger Moth Handling Notes:

Cruising Speed, 85 mph; Red Line Speed, 170 mph; Powered Approach, 60 mph; Stalling Speed, 50 mph; Max. Level Speed, 105 mph;

Now as regards to aerobatics, entry speeds are quoted as follows:

Loop 120 mph; Slow Roll, 110 mph; Immelman, 135 mph; Inverted Glide, 80 mph.

As you will see, a gentle dive is required for a loop or roll, and a fairly steep dive needed for a roll-off-the-top. The model behaves in much the same way. Rolls need stacks of top rudder and elevator to maintain constant height but, when emerging from the roll with pro-roll rudder in force, reduce the amount of aileron deflection, otherwise the roll will speed up. She will roll on aileron alone but, for safety, stick the nose up 15% to 20% before entry. Barrel rolls need coordinated application of up elevator followed by aileron and rudder deflections. When looping, be sure you have a good entry speed. If you go in with insufficient speed to get further than "11 o'clock," she'll come to a halt and hang there inverted. She'll be hovering in an inverted nose-high attitude and aileron and elevators will be ineffective because of the lack of airflow. She'll then fall inverted for about 5' before the nose begins to drop, with airspeed building up enough to get control. Learn to recognize this flight (?) condition for what it is, and to take the simple corrective action which is to chop the throttle to idle as soon as she appears to "hang up." It is engine down thrust which is holding her nose up inverted, and removing the power allows the nose to drop instantly. Don't worry about it — many other low powered ships will probably behave similarly, and I'll wager that all Tiger Moths will do it. However, just make sure you have a good head of steam on entry into loops from ground level! If your idea of a loop is full power to the top and exit at idle, you will automatically avoid the condition, as you will if you never attempt loops!

Spins are really quite slow, and can be done to left or right without employing aileron deflection. You can flatten the spin as follows: Enter a left spin, then slowly apply full right aileron. The spin will slow and flatten slightly. Now advance the throttle to full, whereupon the spin rate will increase momentarily and she'll flatten some more. Finally, smoothly apply full down elevator. The spin will really flatten now, but not enough to go nose-up. On throttling back and releasing the sticks she will rotate about three more times before coming out. To speed up the exit slap in full right rudder after releasing the sticks. Needless to say, start this at a good height — and practice the control sequence in the shop first! If you feed the down elevator in too quickly or don't have full throttle, or if you try to flat spin to the right, she'll flick into an inverted spin as soon as you enter down elevator, because of propeller effects (or the lack of them).

She'll flick roll nicely, and quite slowly so that you can pick her out in any attitude you want. Stall turns are sheer music as are the aforementioned barrel rolls, for which a good entry speed is needed or she'll get "hung up" as in a loop. I can't do a convincing inverted falling-leaf as there isn't enough elevator power to stall her inverted. However, an upright one is just about possible provided you offset rudder trim slightly right to help keep it symmetrical. Unlike my Auro 504K she speeds up on the way down, evenutally overtaking you and flicking all the way round in a spin.

For an Immelman, start rolling fairly early after getting inverted, using full pro-roll rudder to hold the nose up, releasing the rudder smoothly in the last quarter of the roll to erect flight.

**Landings:**

You'll love spending all day just doing touch and go's, and the landing phase is something to be savored whether you do a square pattern or a curved approach. Throttle back to idle and trim for a gentle glide. Take your time now! She glides real slow and looks truly majestic planing down with the motor pop popping realistically. At about 4' altitude you can begin leveling out, and at 1' begin pulling back on the elevator stick at such a rate that she rotates without ballooning, using induced drag to kill the speed. She'll settle in a nose-high attitude and if your luck is in she'll 3-point. On gusty windy days, with engine at idle, dive at the strip and lay her on with a 2-point, keeping tail up as long as possible, as the previous elegant technique lets her get blown all over the place.

**Epilogue:**

Well boys, I think I've covered most of the main points to enable you to get a thrill out of flying my latest little number but there are a couple more things. The muffler extension is stuck on to the muffler with silicone rubber sealant, and is directed on to the bottom wing to make the exhaust oil stick to that surface and not cover the rest of the ship, especially the pilots and cockpit. It has worked extremely well for me. Second, the rigging is made up of double strands of elastic thread, to help make the "wires" look more substantial. That works as well.

In fact, it all works! Build one!

**From RCModeler Mar. 1980**