TINKERBELL

Designed By:
David Boddington
TYPE AIRCRAFT
Micro Biplane
WINGSPAN
Top 22⅞"; Lower 19½"
WING CHORD
3½ Inches
TOTAL WING AREA
148 Sq. In.
WING LOCATION
Biplane
AIRFOIL
Clark Y
WING PLANFORM
Constant Chord
DIHEDRAL, EACH TIP
1⅛ Inches
OVERALL FUSELAGE LENGTH
16 Inches
RADIO COMPARTMENT SIZE
(L) 1¼" x (W) 1½" x (H) 5"
STABILIZER SPAN
9¾ Inches
STABILIZER CHORD
2⅞ Inches
STABILIZER AREA
28 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
2¾ Inches
VERTICAL FIN WIDTH (incl. rud.)
2¾ Inches
REC. ENGINE SIZE
Cox .020
FUEL TANK SIZE
Tank Mount
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
2
CONTROL FUNCTIONS
Rudder & Elevator
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa & Ply
Empennage	Balsa
Wt. Ready To Fly	7 Ozs.
Wing Loading	6.8 Oz./Sq. Ft.

Here's one to stop your fingers growing! A diminutive sports biplane with a sparkling performance and all of the enchantment of an aerial Leprechaun. You can build it in a week of nights, and the total airframe costs — assuming you haven't sufficient spare balsa in your "bits box" — will only be a few dollars. In fact, it is a fine way to employ all of these odd pieces of balsa and plywood that you never thought you would find a use for.

When I designed the "full-size" Tinker (all 46" span of it) some 20 years ago, I never anticipated that a kit for the aeroplane would still be available (Chart Hobbies) or that the plan would still be in the ASP Plans range (Bob Holman has ASP Plans, P.O. Box 741, San Bernardino, California 92402). However, it is a simple and cheerful low-tech model and appeals to the average club flier, it also has very pleasant flying characteristics and will take a fair amount of abuse. Although designed for .09 to .15 cu. in. engines, I have seen examples grossly overpowered with .29 and .35s — it also performs well on floats.

Perhaps it is a sign of old age creeping on, but I suddenly had a yen to create some of those earlier R/C days and decided to achieve this by designing a half size Tinker. In Britain I tend to be associated with large models and this design would perhaps persuade the "small minded" modelers that there are aeromodelers and aeromodelers — whether the models are large, small, R/C, U-control, or free flight should not matter.

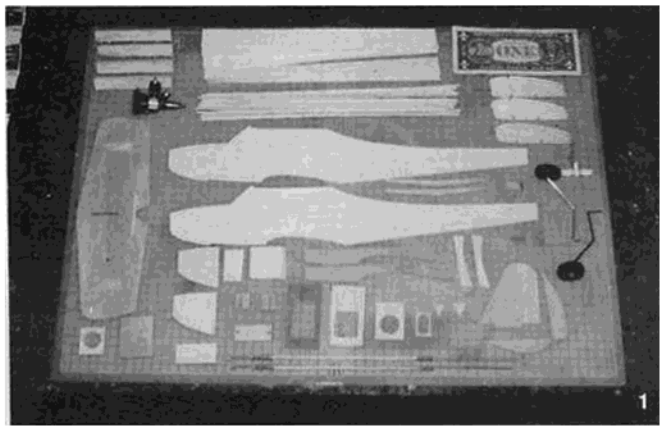
Sharpen The Scalpel

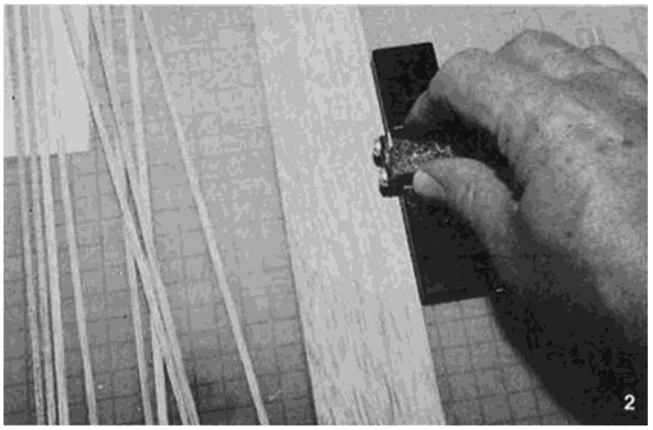
If it is sometime since you built a small, conventionally constructed model then prepare yourself for a slice of enjoyment. The essential smallness of the model and components make it fascinating, and the achievement in accurate cutting and assembly is most rewarding. With a couple of wing panels pinned to the board (the pins suddenly look huge), and the fuselage taking shape you can go to bed with a smile on your face. Naturally, with a model of such diminutive dimensions you will need to fit radio equipment of microsize. I used a British Fleet system with the receiver double banked, two microservos wired direct, a 50 mAh battery pack, mini-toggle switch and charging socket. No doubt a Cannon system or one of the other mini systems now on the market would suit just as well.

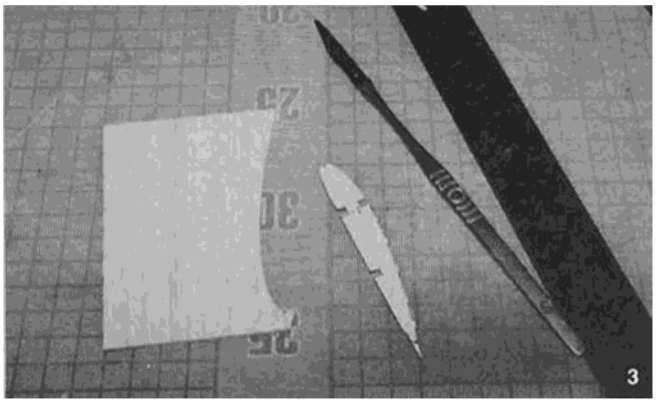
For power, the obvious choice is the Cox TD .020, a super little engine with good power output and easy handling characteristics. It is good to see that this engine has been joined again by the .010 version — another little gem.

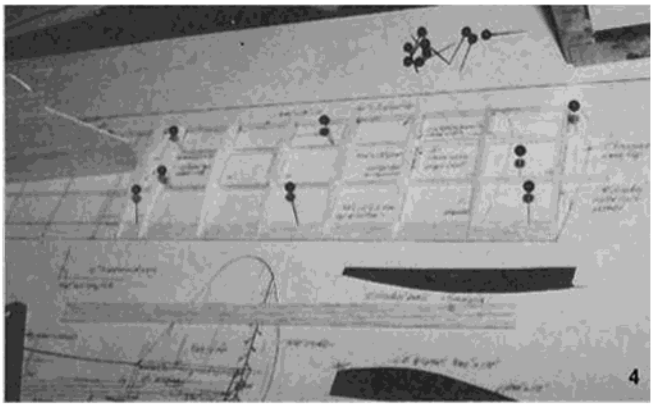
In these days of photo copiers you have the choice of copying the various components and gluing — 3M spray adhesive — to the wood for cutting out, or you can use one of the conventional means of transferring the pattern onto the material. For the wing ribs, I suggest you cut a 1/32" plywood template and cut around this for the numerous ribs. I did cut some of the ribs from 1/32" balsa but the weight saving is barely worth the effort.

Two things are important if you are going to finish up with a model that not only looks "dinky" but also flies well, and they are to select materials carefully and cut and glue accurately. Because the materials are small in dimensions there is a tendency to go for hard balsa, there is no need to, just keep to

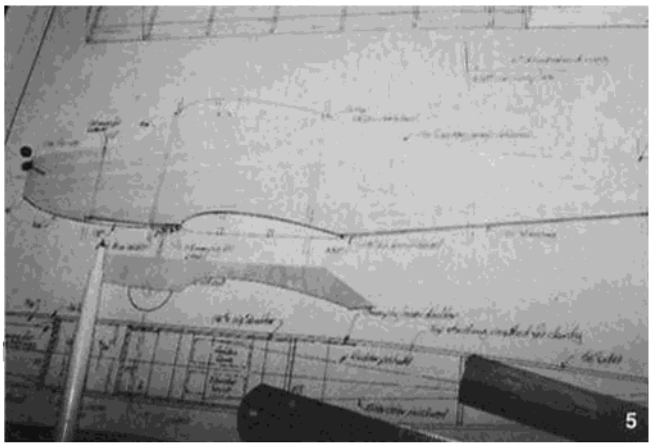


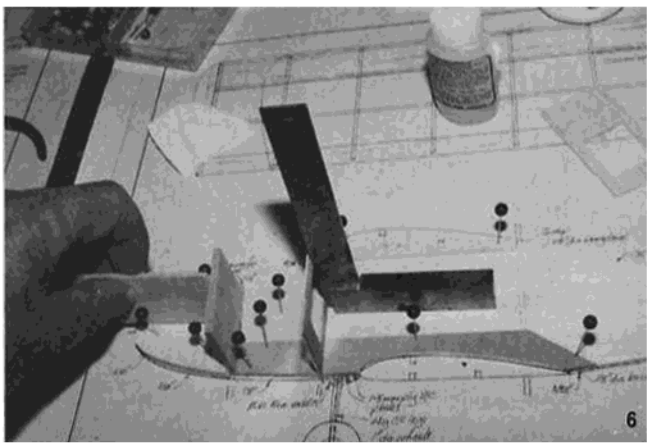


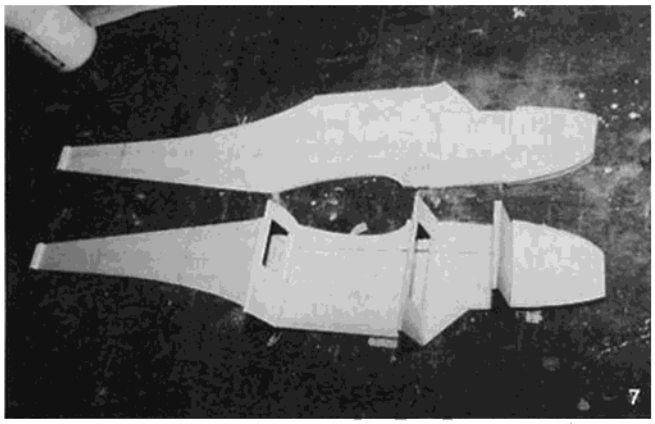


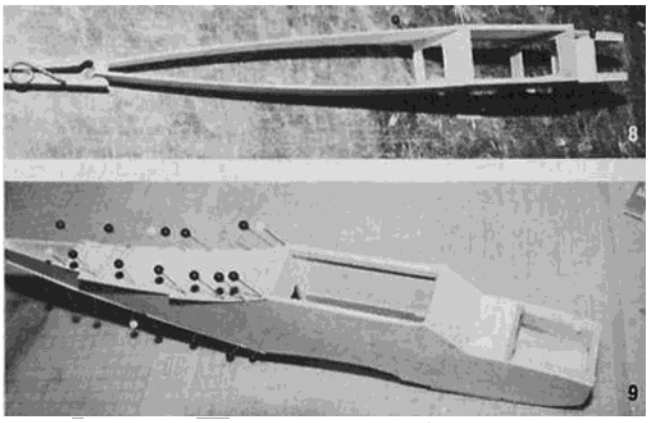


All parts cut and formed ready for assembly (1). Having a full kit of parts helps to speed assembly. Note the one dollar bill in right hand top corner to give scale. Wing spars were cut from 1/8" sheet with a balsa stripper (2). Thin plywood template for cutting wing ribs (3). Wing panels are constructed over the building board (4). Top trailing edge and spar are then glued in position followed by the leading edge strip and sheet.

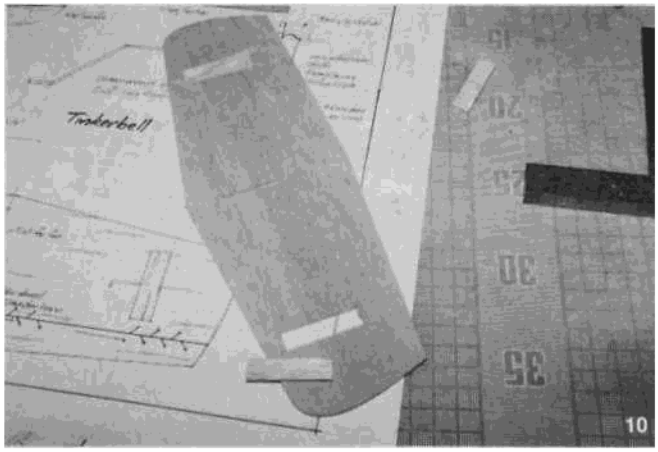


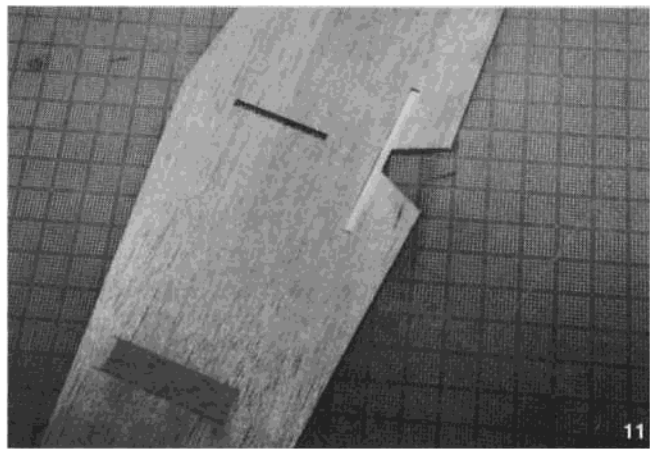




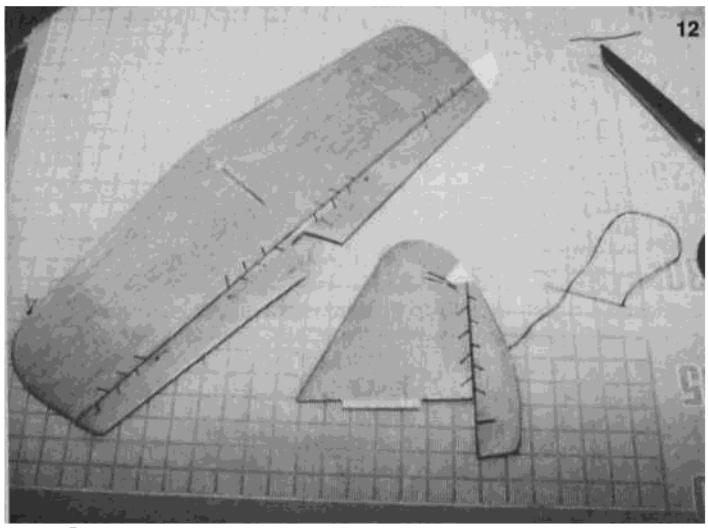


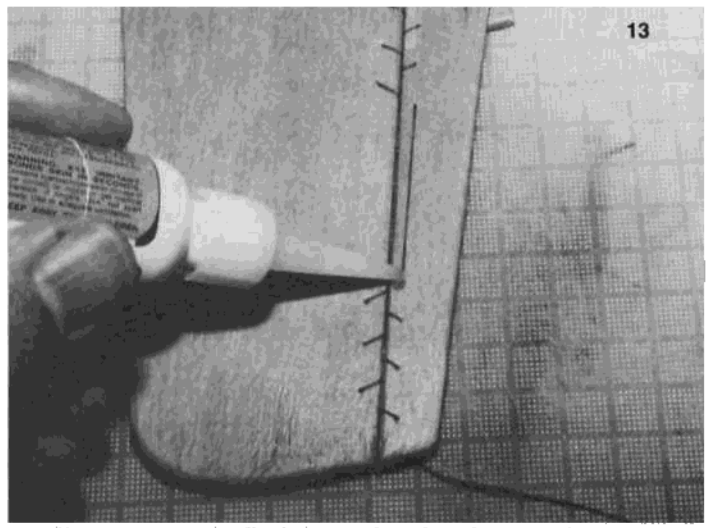
Mark out sheet sides for formers (5). Glue doublers to sides, followed by three formers to one side (6 & 7). Glue formers to second side, checking that all is "square" (8). Add top and lower sheeting and form grooves inside nose doublers to receive Cox TD 020 fuel tank (9).





Cut tailplane and elevator as one (10) and glue anti-warp inserts in position. Fit the elevator joiner, cut out center elevator area, round off the edges and sand smooth and then remove the elevators from the tailplane (11).





Old fashioned thread hinges are used on the "Tinkerbell" because they are easy to fit, inexpensive, free in operation and lightweight (12) — need any more reasons! Secure thread by a tiny dab of cyano (13).

the grades you would use in a larger model. This chapter heading, "Sharpen the Scalpel" is no joke, you must keep an oil stone handy. (What! you use a new blade each time — shame on you, a couple of strokes on the stone and the edge is perfect again.)

I like to cut **all** the parts first and form the metal parts, I also want to know exactly where the radio, pushrods, and horns are to be positioned before commencing construction. Then I can really enjoy the building without worrying whether everything will fit into the fuselage. For instance, it is sometimes necessary to build-in the pushrods before top and bottom sheeting is applied — no good waiting to find this out when the fuselage has been completed.

Wings

Upper and lower wings are constructed in two sections and joined with dihedral braces, the lower wing has a shorter span. Interplane struts are optional, they should be constructed after the model is completed and the gap between the wings measured (same for both sides!). Protect the drawing and pin down the bottom trailing edge, rear spar, and lower main spar. Glue ribs in position, remembering to angle the root rib to the dihedral angle. Follow the ribs with the top spar, top trailing edge sheet, and leading edge. I use a mixture of white PVA glue (leaving the structure overnight to set properly) and a cyano where instant set is required. Attach the leading edge sheet the full length of the top spar, leave to dry and then curve around the ribs and attach to the leading edge. Remove from the board, add the center section sheet and 1/2" triangular wingtips, round off the leading edge and sand lightly overall. Wing panels are joined by cutting slots for the dihedral braces, gluing the latter in position (slow glue) and propping up the wingtips to the correct amount of dihedral. Add the strut fittings if these are to be used.

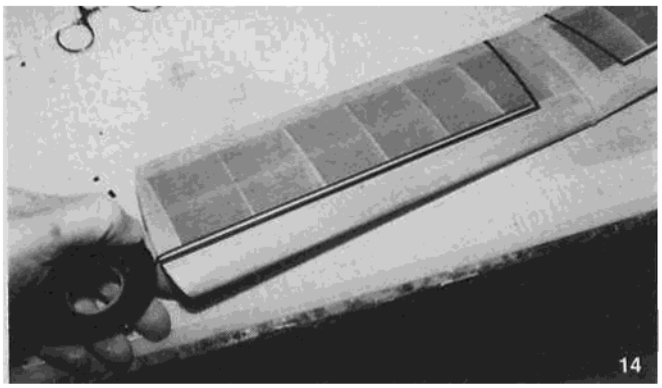
Tail Surfaces

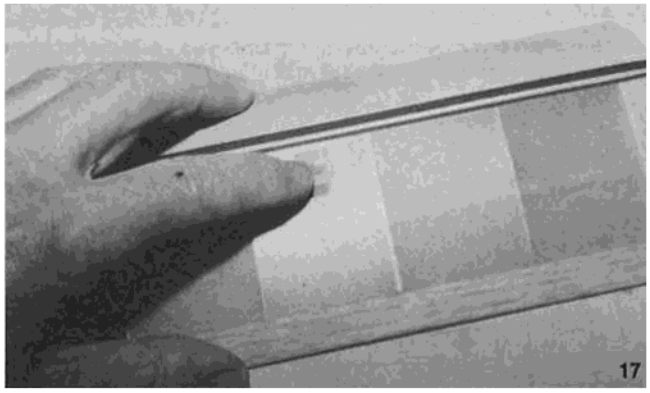
Simple sheet surfaces, they just need the edges rounded off — do select straight grained, light, and firm sheet balsa. Do not omit the tail plane stiffeners, these are useful anti-warp devices. Cut the tail plane and elevators as one piece, sand and round off edges, glue the 1/8" diameter dowel elevator joiner in position (to elevators only) sand the dowel slightly flat and **then** cut away elevators. In this way you will ensure matching elevators and no overlaps at the tips.

Fuselage

Cut the 1/16" fuselage sides from equal quality balsa stock and add the nose and wing seating doublers. Use the formers as temporary positioners for spacing the doublers and undercarriage plates. Glue formers F1, F2, F3, and the nose block in position, all but F1 (slanted to give right side thrust and predrilled for engine fixing screws) should be square. Predrill the servo bearers for servos, those shown on the drawing are the standard microservos used by many radio manufacturers. Glue the bearers at the correct spacing and for fitting the servos from the top or bottom (with permanently wired servos it is easier to fit the servos from above). Chamfer the 3/32" x 1/4" stern posts and glue to the rear of the fuselage, add formers F4 and F5 and join stern posts. Check for equal curvature of sides.

Top and lower sheeting can now be added, the nose is rounded off but the rear fuselage corners are only lightly sanded. Do not fit the 1/16" tail plane seating at this stage, the pushrods are fed in through this opening, after covering and prior to final assembly. The undercarriage is a normal torsion type with the top end housing into the 1/16" ply plates glued to the fuselage.





Decorative trim was from two thicknesses of black chart tape available from artists' stores (14). Fuelproof afterwards. Name was applied by Lettraset, pre-release letter by rubbing onto backing sheet (15). Transfer to wing and lightly press into place (16 & 17).

Undercarriage legs are retained by nylon mini-saddles, filed out to take two widths of music wire.

To fit the Cox .020 engine from above, you will have to cut away the 3/16'' nose doublers at the position of the fuel tank (easier to do before fitting the sides) and small notches for the mounting flange. This is also the time to cut away the top of the nose block and file a groove for the needle valve (extend with a piece of fuel tubing).

Radio Installation and Linkages

One advantage of this biplane is the access to the radio area from both wing seating areas. Fit the battery and receiver, if it will fit, between F1 and F2 and the switch in the side of the fuselage. Pushrods are from 1/8'' diameter dowel with 1/32'' music wire at each end. If the wires are bent and the plywood horns located as shown, the pushrods will clear each other and will be straight. I didn't use any adjusters, the trims on the transmitter should suffice if the model is built true.

Modernists may shudder at the use of thread hinges for the control surfaces, but these remain one of the most free moving and lightweight types you can have and are particularly suitable for a small model such as ''Tinkerbell!'' Please note that I have used a contrasting color thread not because it looks nice, but so that it shows up in the constructional photographs — you should use a color to match the finish.

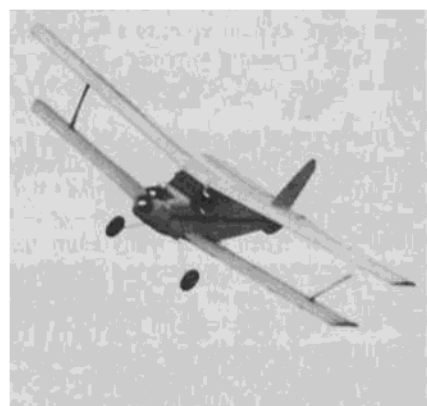
Finishing

Tissue and dope would have been the order of the day for this model a few years ago (and may still be used for traditionalists), but plastic film is the more obvious alternative now. I used Solarfilm ''Litespan'' which has the appearance of tissue but is airtight and fuelproof (weight only 1 oz. per sq. yard). It does not have an adhesive backing, Balsaloc is applied to the airframe, allowed to dry and then the film is ironed on in the usual manner. Decoration was in the form of trim tapes, dry film lettering and decals. When applying dry film (Letraset) letters or numbers to a light airframe always use the prerelease method so that you do not have to press hard onto the framework. Also, if you are intending to fuelproof the model the Letraset should be given a coat of spray protective coating before proofing. Some of the fuelproofers will attack the dry-film. I gave the model one coat of matt, two part, proofer to seal the edges and bring everything to an equal — nongloss finish.

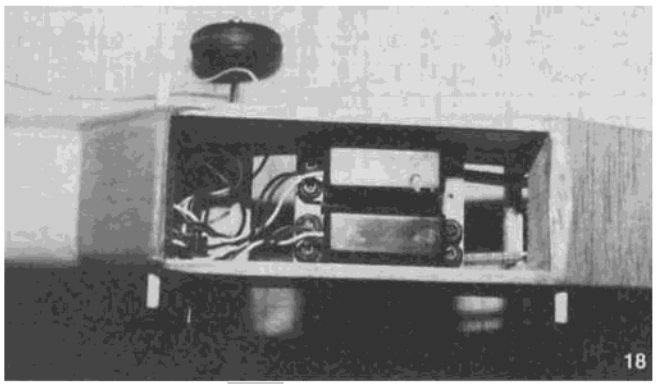
Check and Chuck

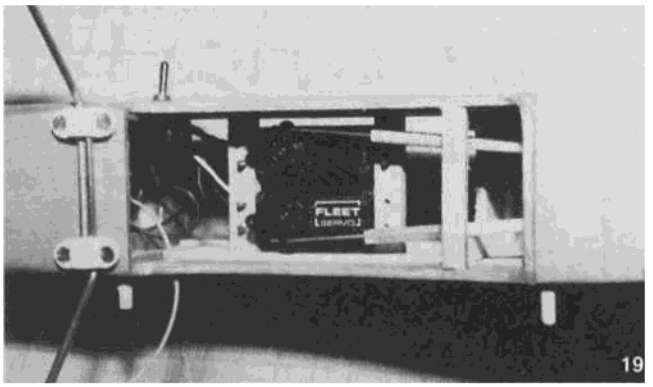
At a total weight still not exceeding 200 grams (7 ozs.) the wing loading is less than 8 oz. per sq. ft., so things looked good. Balance was a ''tad'' in front of the suggested location — something I could live with, the reverse (tail-heavy) is **never** acceptable. Control movements were a case of ''try-it-and-see,'' these small models tend to need far less movement than you would think.

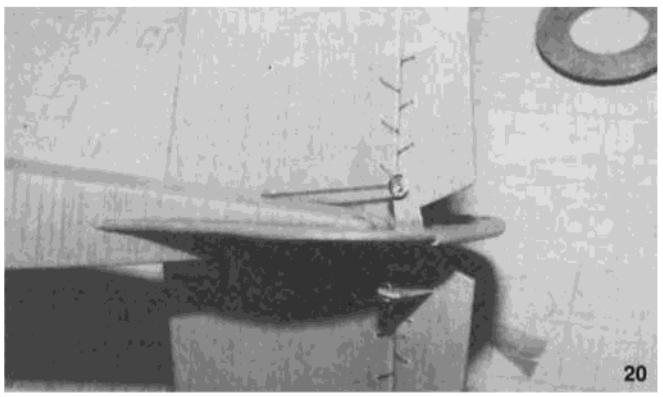
A nice bright winter's day came along, I persuaded a modeling friend that it was bad for your health to be stuck in an office and off we went to the flying field. First flights of any new design involve a mixture of apprehension and excitement. With the ''Tinkerbell'' I was slightly doubtful whether the Cox .020 would have enough power to take the model safely aloft. The absolute opposite was true, as the model went scorching skywards at a considerable rate of knots, power there was in plenty. A corkscrew left hand climbing turn was only

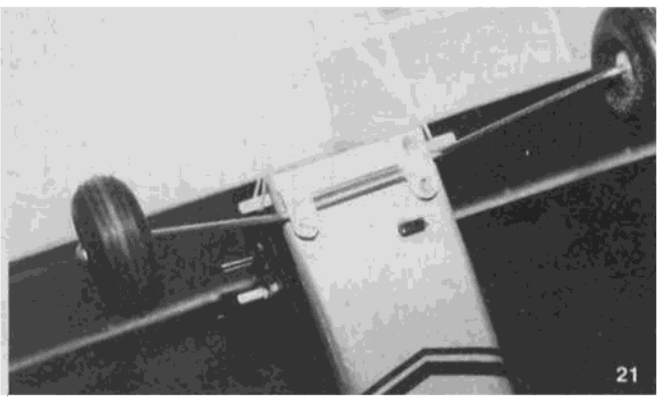


just held with full right hand rudder and at a safe height I fed in a little down elevator and this restored some of the right hand turn. Even so, there was nowhere near as much right turn as might be expected. The lack of right rudder was traced to the rudder servo. For a previous, even smaller model, one set of lugs had been removed and this was allowing the servo to move upwards, effectively pulling on left rudder! A piece of balsa glued across the servo cured this problem. From thereon, it was just a bundle









Micro servos are fixed from top of fuselage (18) and the pushrods connected from below (19). Elevator and rudder horns are from 1/32" ply, or Plasticard (20). Undercarriage is held in place with mini double saddle clamps (21). Note the miniature charging socket and the toggle switch on the fuselage side.

of fun, loops are round a dime, barrel rolls (in this case to the left) were very nimble and "Tinkerbell" was very responsive to all movements.

The glide was amazing on this near windless day, I turned way downwind cursing that I would not make it back to the strip. In fact, I was going to overshoot, the glide is both gentle and shallow, and it was necessary to "S" off some height.

With all this power available, I suggest the old trick of making the test flights with the propeller on backwards to limit the thrust. Once trimmed out, and you have the feel of the model, change the prop around and prepare to have a ball. Because the model is small don't let it wander too far, a yellow or orange color is good for visibility. With the control surface movements stated she is really aerobatic.

Conclusion

Well, that seems a lot of words for such a small model, but I hope it makes you want to build the "Tinkerbell" and also makes it easier for the building. Incidentally, the name "Tinkerbell" comes from the character in the famous J.M. Barrie "Peter Pan" play — it was an absolute natural with the original model being called the "Tinker." If life is a bit jaded have a go with this model, it acts as a great "pick me up."

One final thought, I suppose aeromodelers are as perverse as any of their fellow humans. When radio equipment was heavy and bulky, in the early days of R/C, we tried to shoe-horn it into small models and experiment with all types of ways to build ever smaller models. When genuinely small R/C equipment became available what did we do? Build giant models, of course!

P.S.: You may notice on some of the photographs the national American flag with the stars in the wrong position, i.e., at the rear of the flag. The flag symbols are "paired" on the AMA decals and if you put them on the wrong side of the fuselage the flag is facing the wrong way. I got so confused I even put them upside down as well!

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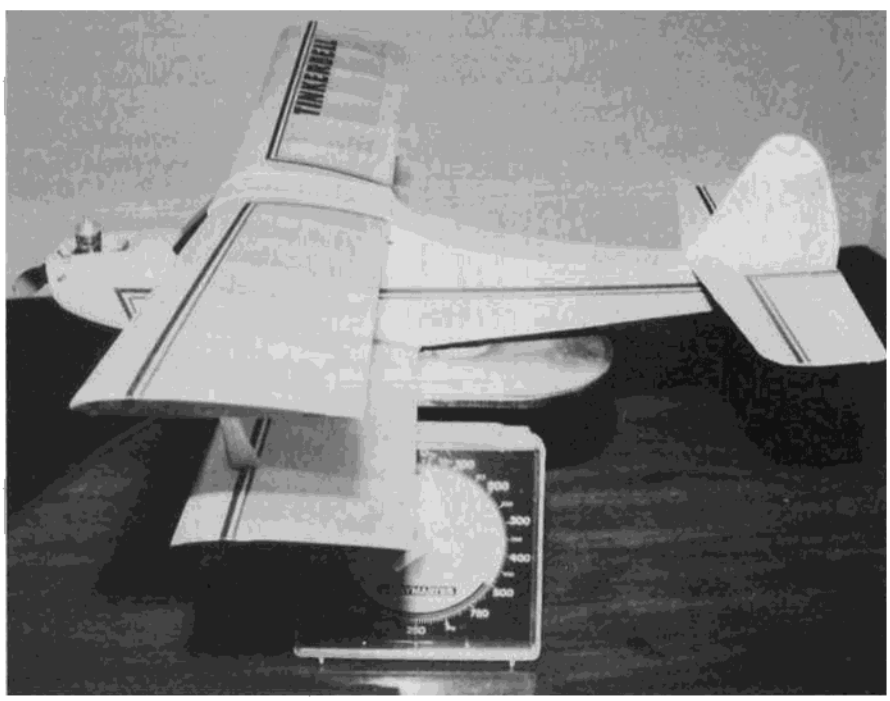

Weighing only 100 grams uncovered and 200 grams (7 ozs.) complete, the Tinkerbell has a light wing loading and fine flight performance.