

# 1935 TAYLOR CUB E-2

**T**hat free-flight scale is enjoying a resurgence of interest is undeniable. One need only measure the explosion of activity in P-Nut and Power and Rubber Scale and then count the increasing entries in local and regional contests to assess this phenomena. Models are being constructed of every conceivable prototype with the emphasis placed not so much on exact scale and intricate detail, as upon flying qualities.

Although some builders exhibit extraordinary skills in developing ultra-light — yet highly detailed models — the majority build to a certain scale that pleases them. The major emphasis is placed on the fun of creating and flying a model that is recognizable as a scale presentation of some specific prototype. To those R/C modelers to whom "Silhouette Scale" has appeal, we direct this article.

For several years many of us with an interest in the O.T. radio assist concept have speculated among ourselves about a Flying Scale event for old timers. We have wondered how well the S.A.M. rules could

be applied to models. What performance profile would the S.A.M. 225 in<sup>2</sup> per .10 cu. inches of displacement rule produce, and could scale models be built with thermaling ability?

Essentially, the concept would be free-flight scale models with R/C assist to simplify retrieval and prolong in-sight thermaling. The model's silhouette should be recognizable, but no major emphasis would be placed on super scale. Judging could be done using the existing Free-Flight Scale Rules, combining scale fidelity and judging with duration times. An even simpler approach could utilize the Mooney Pea-nut system as described in the AMA rule book. I am **not** attempting to delineate a set of rules for a new event. Rules could best be developed by sponsoring clubs after some experimentation, tempered with experience. I **am**, of course, interested in stimulating some participation in an area that promises a great deal of potential fun

and a challenging new dimension.

Several F.F. scale models were published or kitted in the pre-WW II era. As an example, Comet's "Curtis Robin," Cleveland's "Stinson Gull Wing" and "Rearwin Speedster," and numerous designs by Paul Lindberg. Several of these ancient designs are highly suitable to the "Silhouette Scale" concept, however, we have opted to design from scratch to better utilize modern techniques and materials. In keeping with the pre-WW II time span, a prototype full scale aircraft of that era has been chosen. Whether O.T. R/C assist scale subjects should be limited to a specific time frame is a moot point, although the choice is vast.

## THE PROTOTYPE

The E-2 Cub was chosen for several reasons: primarily because it has never been published in a large size, although several dozen variations of its younger sister the J-3 have. Secondly, the distinctive squared-off



**ABOVE: Dick Tichenor's Taylor E-2 Cub as photographed in 1940.**

**RIGHT: The thin guy with head in cockpit and playing with throttle is our Asst. Editor Dick Tichenor.**



**This new concept called "Silhouette Scale" could be an exciting new phase of R/C. Build the E-2 and give us your opinion.**

**By Doc Mathews**



**1935 TAYLOR CUB**  
Designed By: Doc Mathews

- TYPE AIRCRAFT**  
Silhouette Scale
- WINGSPAN**  
80"
- WING CHORD**  
11¾ Inches
- TOTAL WING AREA**  
930 Sq. In.
- WING LOCATION**  
Parasol
- AIRFOIL**  
Under Cambered
- WING PLANFORM**  
Constant Chord
- DIHEDRAL EACH TIP**  
2 Inches
- O.A. FUSELAGE LENGTH**  
48¾ Inches
- RADIO COMPARTMENT AREA**  
(L) 12" x (W)3½" x (H)4½"
- STABILIZER SPAN**  
25¾ Inches
- STABILIZER CHORD (incl. Elev.)**  
7½" (Avg.)
- STABILIZER AREA**  
200 Sq. In.
- STAB. AIRFOIL SECTION**  
Flat
- STABILIZER LOCATION**  
Top of Fuselage
- VERTICAL FIN HEIGHT**  
9 Inches
- VERTICAL FIN WIDTH (incl. rudder)**  
7" (Avg.)
- Rec. ENGINE SIZE**  
.30-.40 Glow, .25-.35 Diesel
- FUEL TANK SIZE**  
4-6 Ounce
- LANDING GEAR**  
Conventional
- REC. NO. OF CHANNELS**  
3
- CONTROL FUNCTIONS**  
Rud., Elev., Throt.
- BASIC MATERIALS USED IN CONSTRUCTION**
- |                        |                         |
|------------------------|-------------------------|
| Fuselage .....         | Balsa, Lite Ply, Spruce |
| Wing .....             | Balsa, Ply, Spruce      |
| Empennage .....        | Balsa                   |
| Wt. Ready To Fly ..... | 83 Oz.                  |
| Wing Loading .....     | 13 Oz./Sq. Ft.          |

look has a definite appeal to the eye. Thirdly, I was intrigued by the surprising discovery that the E-2 was **not** a cabin aircraft as I had thought for many years, but rather an open-sided parasol design. The latter fact gave an opportunity to try out a novel plug-in wing concept.

Gilbert and Gordon Taylor introduced the Arro-Wing "Chummy" in 1928. This 60 hp Anzani powered side-by-side two-place was so narrow that the pilot and passenger might have departed strangers but would return "Chummy" --- hence the name. Gordon

was not until 1933 that any sort of winter enclosure was made available. This winter unit consisted of a squarish left side window hinged at the top, and a split window/door on the right that is so typical of the J-3 Cub. Gene Chase of the E.A.A. Museum states that, to his knowledge, no E-2 was ever built with rear windows. "The Piper Cub Story" by Jim Triggs, shows a photo of an E-2 with a fully enclosed cabin, but Bill Knepp and Chase both feel this to be an owner modification.

Interestingly, the basic fuselage frame of

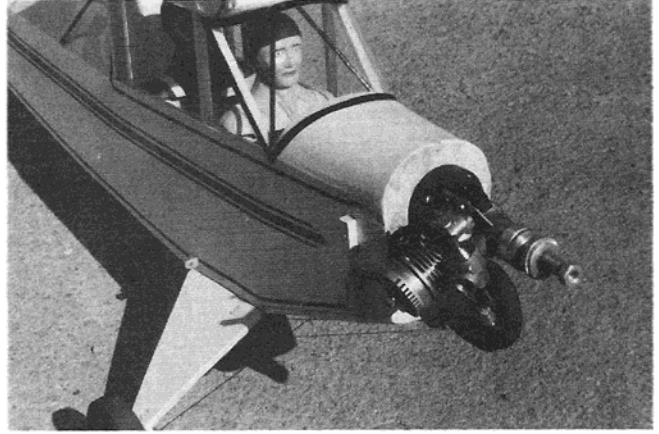
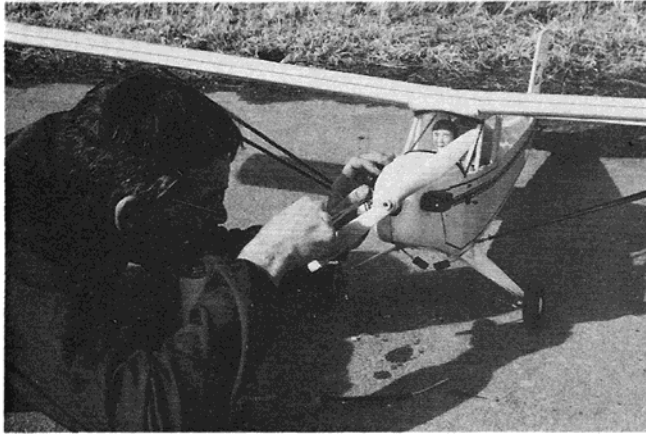
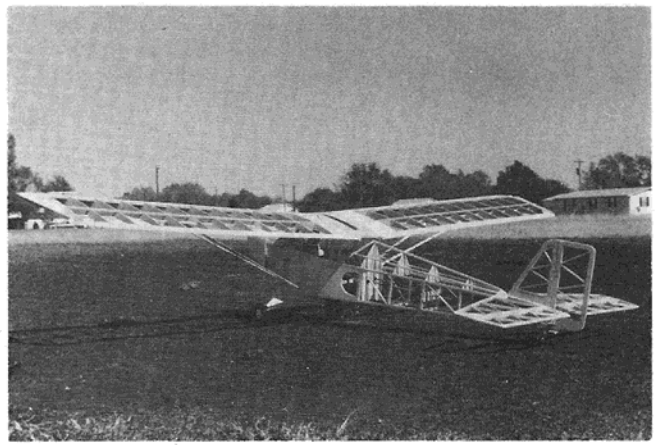


*Doc's daughter, Shelly Mathews Showing off dad's Taylor Cub.*

Taylor was tragically killed in a crash and only ten of the aircraft were sold. In 1929, W.T. "Bill" Piper arrived on the scene with an infusion of oil money, and an epic chapter of aviation history began to unfold.

The F-2 Cub was designed in 1931 by Walter Jameneau (the J in the early Piper model numbers —J-2, etc.) Powered with an unreliable Aero-Marine three cylinder radial, the F-2 quickly gave way to the Continental A-40 powered E-2. The E-2 Cub was sold without side windows and it

the E-2 is identical to that of the J-3, the changes lie in the turtledeck and enclosed cabin. Jameneau and Piper split with Taylor in 1937, taking with them the J-2 design (the E-2 with rounded surfaces and an enclosed cabin), and the "Cub" name and trademark. The Piper story is not within the scope of this brief history, but it is a most interesting one. Gilbert Taylor pursued the side-by-side seating concept of the original "Chummy" with an all-new Taylorcraft A of 1938. Nearly 7000 were eventually sold,



**TOP LEFT:** As realistic looking as the day the full size version rolled out of the factory, our E-2 is sure to bring back memories. **TOP RIGHT:** The X-rated (nude) version, prior to application of the covering. Plastic and fiberglass cowlings available, see text. **CENTER LEFT:** Eyeball to eyeball, our two pilots take care of all the minor details that are a necessity before the first "clear" is given. **CENTER RIGHT:** Dieselized Super Tigre as used in prototype model shown here. Pilots are Williams Bros. #185 2 5/8" sportsman. Note the prop extension shaft (available from Fox) and metal/plywood sandwich landing gear. **LEFT:** A very short roll and you're airborne. It's truly a fun to fly model.

plus an English series that became the Auster lightplanes. Taylorcraft contributed the L-2 observation aircraft to the war effort; it was a tandem seat modification of the T-Craft.

And so we see the original "Cub" was a Taylor Aircraft Co. product, an open cabin parasol, and a strikingly different airplane than the one we tend to think of when the name "Cub" is used.

#### General Construction Notes

Essentially this model was designed to be constructed using power F.F. Scale techniques. A quick study of the drawings will reveal what amounts to an oversized free-flight scale model with radio control added. Although much lighter and of less complexity than more usual R/C designs, the model is adequately strong and well stressed in the high force areas. Plug-in wings were selected to best develop a strong

parasol mount without resorting to heavy structures or difficult wire bending. Our European cousins have preferred plug-in wing panels for many years; now that our American autos are also shrinking, we, too, will likely be using this technique more frequently.

The use of laminated 1/8" light (poplar) ply is novel, but highly effective. A sheet is cut into four 6" x 18" pieces (buy a 12 x 48 to allow for wing saddles, formers, etc.) and laminated using 5-minute epoxy spread very thin with a scrap-wood "trowel." The resultant ply is approximately one half the weight of conventional 5-ply 1/4" stock, while exhibiting nearly equal strength.

The wing pins are 3/16" brass tube roughened with coarse sandpaper then epoxied into boxes built up around the spars. While 3/16" dowel could be used,

the brass tube is much stronger and resistant to abrasion, while weighing approximately the same. The wing struts are, of course, functional on this model and should be assembled with epoxy as the adhesive on all parts. Note the right angle bend on the wire inside the struts. Do **not** substitute balsa for spruce! The clevis-horn-keeper connections have proven to be simple to fabricate and use.

Field assembly involves plugging in the wing panels, latching the wire and keeper into the bracket, and installing the elastic bands onto the wire hooks (the skylight even prevents head stands). An added convenience is the ability to adjust wash-in or wash-out and dihedral angles by turning the clevis. This model is **not** stressed for inverted flight or abrupt aerobatics. It is intended for slow, majestic flight, power on

or off.

The undercarriage is also unconventional, but we have yet to damage these pop riveted ply-metal sandwich units on the several aircraft incorporating them. We feel this technique is superior to the more ordinary wire units. The unit is a stock Sig Catalog item as is the plastic cowl. For those who are interested in a more durable fiberglass cowl, an excellent one is available from Fiberglass Master, P.O. Box 134M, Bayshore, New York 11706.

An extension shaft is used to more effectively place the carb, and to avoid cutting the cowl front so severely. If an inverted engine is used, no extension shaft will be needed, but engine starting may become more difficult.

Part patterns can be developed by tracing over the plans with carbon paper between the wood and plan. Another technique involves a "Thermofax" type copy stuck onto the wood with 3M "Sprayment." The part is cut to shape; then the pattern peeled off. Be sure to drill all required holes as the parts are being cut. Essentially, develop a fully cut-out "kit" of parts before beginning assembly.

### Wing

(1) Develop a master wing rib pattern of ply or metal using one of the previously described techniques. Stack cut the ribs from "C" grain balsa (the speckled kind). The center section ribs are trimmed for the sheeting using the master rib lowered 3/32" etc., as a cutting guide.

(2) Notch the pre-formed L.E. and T.E. stock using the plan as a marking guide. We find the notches easier to cut if the blade is reversed in the jigsaw; the marks are much easier to see.

(3) Pin the T.E. to the plan; position the bottom front spar using several ribs as a jig. Shim the T.E. up 3/16" at the point shown to create some built-in wash-out.

(4) Glue the ribs into place on the spar and the T.E. Use the jig to angle the center ribs. Adding the bottom spar after removing the panel from the board avoids any need for shimming.

(5) Add the L.E. and the top spars. True the edges of a piece of 3" x 3/32" flexible balsa and add the leading edge sheeting.

(6) Cut out and position the tip, then add fillers of scrap balsa.

(7) Remove the wing from the board and add the bottom rear spar. Block up the wing tip to dihedral height and sand the center rib bevel using the table edge sanding block technique.

(8) Cut the 3/16" brass tubes to length, roughen with coarse sandpaper in the areas to be epoxied.

(9) Cut out and drill the 1/8" light ply end rib, epoxy it to the face of the beveled rib while adding the tubes and scrap balsa fillers. Cut and epoxy the ply box faces holding everything in position with clothespins used as clamps.

(10) Plank the center section with 3/32" medium balsa.

(11) Epoxy the ply horn mounts to the wing bottom.

(12) Sand and contour the wing panel.

(13) Optional vertical grain sheer webs can be glued to the rear faces of the front spars for additional torsional strength.

### Empennage

Build directly over the plans, leaving the outline contour to be cut after the wire joiner and hinges are installed. Note the slot in the stab for the fin which is, in turn, notched front and rear to fit into the slot. This method is vastly superior to a butt joint from a strength and alignment standpoint.

Install the hinges and horns temporarily for the control system installation step. Hinges are permanently installed after covering. Many hinge techniques are suitable but we prefer to drill 1/16" holes through the spar and into the nylon pinned hinges. A toothpick section is then forced into each hole and sealed with cyanoacrylate glue. We have never had a pulled out or "sticky" hinge using this method.

### Struts

Assemble directly over plans. Carve and sand to an airfoil section after assembly has been completed. Drill holes for the wire **slowly**; cut spruce at right angles to the hole; cut along the length of the hole and remove section. Drill a second hole at right angles to the first, relieve a bit at the juncture for the wire bend. Epoxy roughened wire into the hole and slot and return the removed section to place; clamp tightly while setting. This provides a hidden joint of remarkable strength.

### Fuselage

Cover the plan with plastic wrap. Pin the previously cut and epoxied ply sides and wing root over the plans. Assemble one side and allow the glue to set at least 6 hours. Remove the pins that will obstruct the second side, cover the joints with masking tape to ease separation, and build the second side directly over the first. Allow for an overnight glue cure, remove from building board, and separate the halves using a table knife to gently pop apart.

Return the right side to the drawing and pin the ply sections flat. Trial fit bulkheads B and C and LGM for a right angle relationship then epoxy to place. Position left side, again checking for squareness in all planes using a carpenter's square and 90° triangles; epoxy to bulkheads.

Block up the tailpost to 2" at mid-line (1 1/4" at outside); pull the left side into position against the right tailpost and epoxy. Remove the fuselage from the work surface. Lay the bottom longerons flat on the top view. Add 1/4" balsa cross pieces top and bottom. Add the turtledeck formers and stringers. Remove from building surface. Epoxy 1/2" triangular stock to the firewall.

Use an X-Acto or Zona saw to cut notches through the outer half of the ply in front of, but parallel with, bulkhead B. Pull the nose section together with 4" C-Clamps. Pull up against bulkhead A then epoxy with Formula II or equivalent. This step should be done at a slow and deliberate pace, the ply will crack a little but bend a lot. Rub epoxy into the slot-crack for additional strength.

Add the sheet and block fillers and planking to the wing root. Cut out the skylight and reinforce its edges with 1/4" square balsa. Taper the base of former BT to blend into former B; glue it and the 1/4" square balsa in place. Sheet the cowl by butting a moist sheet of balsa to the ply side; slowly pull it into the 1/4" balsa strip. Use cyanoacrylate glue to stick it to the formers and the balsa strip. Cut the scrap edge using a straight-edge. Repeat for the other half of the cowl using a straight-edge to cut through it for a flush joint with the first section.

Complete the fuselage by constructing the hatch, etc. Sand and contour the nose area for a slip fit of the removable cowl. Temporarily install the servo tray unit on 3/8" square bass or maple rails. Temporarily position all the radio and power components. Set up and adjust the Nyrod system: note the scrap balsa anti-flex unit. I mark a scrap of balsa for the hole positions and drill them, then split the wood across the holes. The scrap is then placed around the holes with Nyrods in place and glued to the Nyrods and the fuselage members. The edges are trimmed flush with the fuselage side and sanded. Check for radio functions and proper C.G. (adjust radio components for a slight nose heavy position to compensate for the weight of the covering and finish on areas behind the C.G.). Remove all hardware and cover and finish the structures.

The dowel cabin frame is best installed after the fuselage is covered and painted. They need to be a contrasting color and can be painted separately. The windscreen is added only when the fuselage is completely finished. The pattern, as drawn, will require some trimming to fit the individual model.

The light ply gear fairings are best made up with the aluminum unit bolted onto the fuselage. Cut and trim the sections, then clamp onto the aluminum and drill through for the pop rivets. Follow the directions on the pop riveter used. Fill in with light ply on the inside face for a flush unit.

The prototype model was covered with MonoKote (mostly to determine if adequate strength was built into the structure . . . it is). The landing gear, cabin frame, cowl, struts, and other exposed wood (particularly the tank compartment), were filled with polyester resin filler (Quik-Prep, etc.) and painted with polyurethane paint. Trim stripes were done with Sig Stripe-rite; the number 5 with Sig 4" decals. The fin lettering utilized EZ Quik Stick vinyl letters purchased at an office supply store.

For the sake of longevity, the prospective builder might consider silk or Sig's Kover-all, finish with nitrate dope and urethane or epoxy paint.

### Flying

The prototype flies exactly like an R/C Assist Old Timer. Take-off is amazingly short; as a matter of fact, some down elevator is required to hold the model on the ground as the throttle is advanced. Ease back to neutral and she's off. The rudder is effective in the first short inches of forward movement, so that the steerable tailwheel is

needed only for taxiing.

The rate of climb with a diesel 35 is something to behold. The model does not climb nose-up so much as it just rises like an elevator. Frankly, a .35 Davis Diesel conversion is almost too much power. Its ability to swing a 12/6 prop with astonishing ease makes it ideal for a large-light model like this one. Fuel consumption is less than one ounce per two minutes, starting is ultra-simple, idle is excellent, and the sound is highly scale-like. I would recommend a Davis Diesel conversion to you. I love the doggone things. Everything experienced or heard about large volume diesel power plants in the past is no longer applicable.

Turns can be as gentle or as steep as the pilot wishes, with little tendency to dig into the turn, and a strong built-in self correction tendency. The expectations of power-off duration have been met. She will float and float in dead air and work a thermal with ease. In a strong "boomer" the model tends to center well, without any tendency to spin or become "dicey." Landings with power-on require placing the wheels on the ground, as the model will float in ground effect for several hundred yards. It is certainly assuring to know that a go-around can be executed with a slight advance of the throttle. Power-off landings require only that the model be positioned with S-turns then flared out as it approaches the surface.

The choice of the Taylor Cub has been most fortunate in that its square lines make it simple to construct, its ample wing area provides an excellent glide, and its exceptional tail-nose moment render the model superbly stable.

To those prospective builders who are attracted to this concept, I can recommend this model as an ideal way to explore the possibilities of "Silhouette Scale." Whether for competition or just plain fun flying, this T-Cub has much to offer. Build this oversized rubber scale model and enjoy!

#### **Postscript**

The outlines and shapes of this model were scaled from 3-views in "Light Plane" by Underwood and Collange, and American Modeler, August, 1969. After constructing and photographing the model, I came across a superb set of 3/4" to the foot drawings developed by Bill Knepp, 6214 S. Navajo Drive, Peoria, Illinois 61607. Bill has been researching the Taylor E-2 for several years, and is a walking expert on the subject. His drawings are based on information obtained when Gene Chase of the E.A.A. Museum uncovered the display E-2 for restoration. Knepp's work revealed that contrary to published drawings, the turtledeck is not pyramidal, but rather four sided. The corrected shape has been incorporated in the model and onto the drawings. You will detect a change between the structure shots, and the flight and some static shots.

Fortunately, the other shapes and dimensions match Bill's research closely. The exception, of course, lies in the enlarged stab., an old free-flight scale habit of mine. Those desiring a set of the superb drawings can obtain them from Knepp for \$5.00 at the above address. □

## **Editing By Hlsat. RCModeler Sep. 1980.**