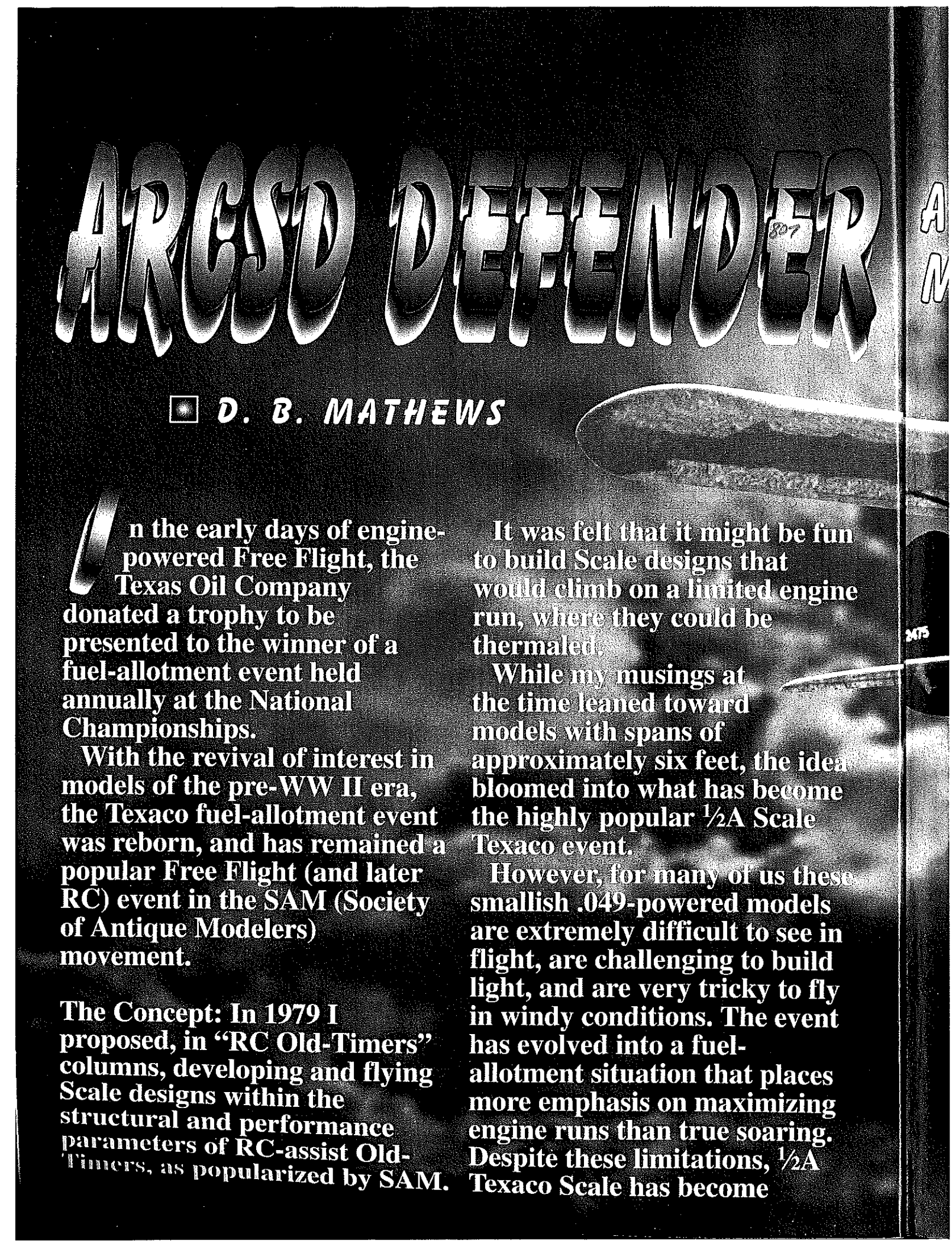
ARCSD DEFENDER

D. B. MATHEWS



In the early days of engine-powered Free Flight, the Texas Oil Company donated a trophy to be presented to the winner of a fuel-allotment event held annually at the National Championships.

With the revival of interest in models of the pre-WW II era, the Texaco fuel-allotment event was reborn, and has remained a popular Free Flight (and later RC) event in the SAM (Society of Antique Modelers) movement.

The Concept: In 1979 I proposed, in "RC Old-Timers" columns, developing and flying Scale designs within the structural and performance parameters of RC-assist Old-Timers, as popularized by SAM.

It was felt that it might be fun to build Scale designs that would climb on a limited engine run, where they could be thermaled.

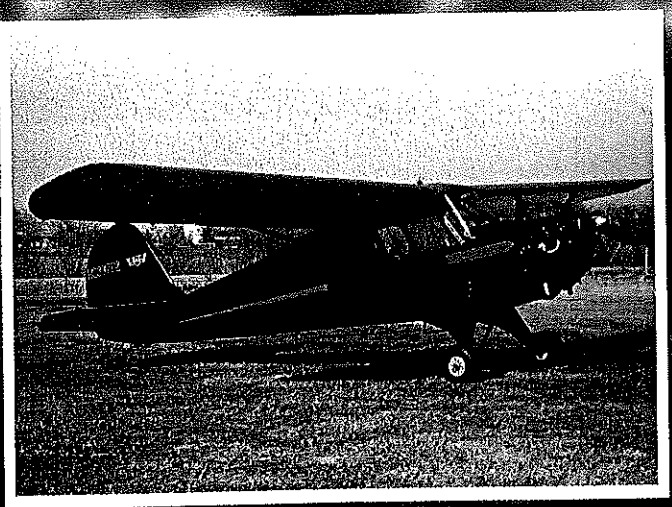
While my musings at the time leaned toward models with spans of approximately six feet, the idea bloomed into what has become the highly popular ½A Scale Texaco event.

However, for many of us these smallish .049-powered models are extremely difficult to see in flight, are challenging to build light, and are very tricky to fly in windy conditions. The event has evolved into a fuel-allotment situation that places more emphasis on maximizing engine runs than true soaring. Despite these limitations, ½A Texaco Scale has become

A 70-INCH-SPAN "A" RC SCALE DURATION MODEL FOR THERMAL HUNTING!

extremely popular, not only with competitive modelers, but with sport fliers as well.

To many of us, modeling holds no greater thrill than when we place a model in a thermal—be it an RC-assist Old Timer, a Free Flight model, a high-performance sailplane, or a simple Hand-Launched Glider. This combination of a man-made model and a phenomenon



The full-scale Defender Model T was Aeronca's first tandem-seat aircraft, and their first with a four-longeron box fuselage.

of nature is one of the hobby's most enduring attractions.

It's notable that with few exceptions, such as rubber-powered Free Flight and gas-powered Scale, most models flown in thermals bear only a slight resemblance to full-scale aircraft., The exceptions are the ½A Scale Texaco models.

Wouldn't it be neat to park an easily seen good-looking Scale model in a thermal, and watch it majestically climb with power off, as if driven by some unseen force, only to end the flight by landing the model at one's feet? That is what this design is all about!

The Model: This design should not be confused with the sport Defender published in the April 1995 *Model Aviation*! While the outlines and dimensions are the same, this version has been designed for maximum lightness to maximize its ability to thermal.

This version of the Aeronca Defender (Model T) was designed utilizing lessons I learned while converting a number of Old-Timer (pre-1942) Free Flight designs to two- and three-channel RC. While many of these Old-Timers are thrilling, many are not particularly realistic in appearance. This design combines the best aspects of an Old-Timer with Scale looks, in an easily seen and constructed size.

Powered by a K&B .20 Sportster, the Defender will climb to thermal height in 30 seconds or less. Its structure is just strong enough to withstand the turbulence of big boomers, yet light enough to stay up in all but the weakest lift.

It was not my intent to "trick up" an engine to keep it running for eight minutes of a 10-minute flight, as has happened in ½A Scale Texaco. We are interested in thermals, not engines.

For lack of a more-inspired name, I have labeled this "A" Radio Control Scale Duration, or ARCSD. Whether this concept has any appeal to the competition-oriented flier is beside the point. More power to them—I intend to fly mine for fun.

This size, weight, and power combination seems nearly ideal for a maximum of fun with a minimum of fuss. For anyone who has built a Old-Timer or a light-wing-loading sport design, the Defender's construction should be familiar. It's simple to build, easy to maintain, and aesthetically pleasing: a hard-to-beat combination.

This Scale Duration Defender is not intended for sport flying. Its aerobatic capabilities are severely limited by its structure. If loops, rolls, and other aerobatics are your thing, take another look at the sport version of this model in the April 1995 *MA*.

But if you have harbored dreams of flying a larger, radio-controlled version of those 25-cent kits from your childhood, or thermaling an easy-to-see Scale model, then this is the model to fulfill those fantasies.

CONSTRUCTION

I can't see this model as appealing to (or being suitable for) the inexperienced modeler. Therefore, these building instructions presume some degree of building experience.

The key word in building this model is *light*—not "strong" or "robust." All of the wood should be lightweight and free of imperfections. If stripwood of reasonable density cannot be located, consider purchasing a balsa stripper and cutting strip from light balsa sheet. Wing ribs are 10-12-pound C-grain, and the surface outlines should be light A-grain.

The main adhesive is cyanoacrylate (CyA) glue used sparingly. Epoxy is used sparingly to mount the firewall, landing gear blocks, and dihedral gussets. Avoid colored paint like the plague—the weight penalty is intolerable.

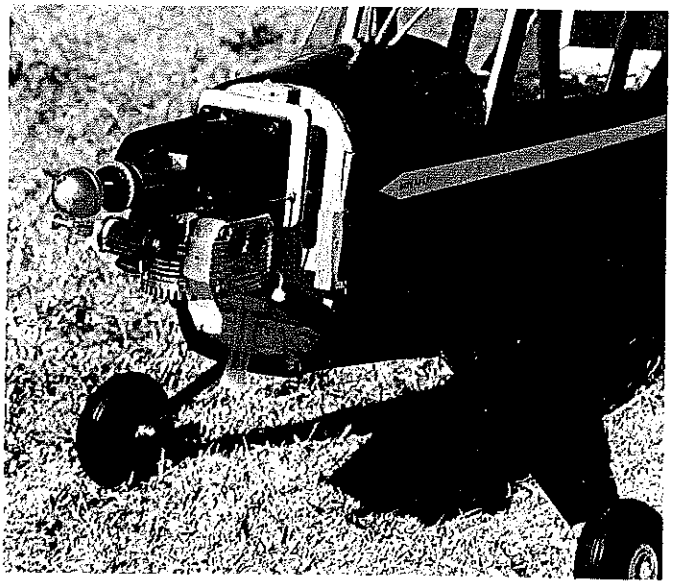
The structure needs the stiffness of MonoKote/UltraCote. I've no experience with Litespan, but it may well be worth consideration. Real craftsman may wish to use colored silk and clear dope.

All accessories (such as the wheels) should be selected for light weight. It's as if you are building a Free Flight model to which you

The Defender's design lends itself to thermal hunting. A K&B .20 Sportster carries the high-wing model to altitude.

The key to success with this Defender is keeping the construction as light as possible. Build it like a Free Flight model!

Photos by the author Graphic Design by Carla Kunz



An inverted K&B .20 Sportster provides the power. The engine is hidden inside a fiberglass cowl from Precision Fiberglass.

are adding the weight of a radio. Keep it *light!*

By using three one-ounce servos, a 1.25-ounce battery pack, and a 1.3-ounce receiver, I was able to hold the model very close to the 10-ounces-per-square-foot goal. If another ounce or so won't bother you, consider spending it on a 270-mAh pack. Twice I've been so absorbed watching the Defender float around that I've lost track of time and gone past the 20 minutes or so of charge that's available from a 100-mAh pack.

The torque-rod landing gear and shock-mounted fairings work rather well, and were the lightest ideas I could devise. Have some spare wire available in case you make a mistake when you bend it—it's virtually impossible to "bend out" errors in music wire.

The fiberglass cowling is available from Precision Fiberglass (2805 Big Bend Dr., Maryville TN 37801; Tel.: [800] 753-8469); it requires only a light coat of filler, followed by two spray coats of a color to match the covering.

The dummy cylinders are cut from block balsa. Use double-sided tape to hold sandpaper on the cowling, then rub the dummies against it to create a neat joint. Dowel sections are used to "nail" the cylinders to the cowling; use epoxy. Other details are made from scraps of balsa.

The inverted engine has not presented any starting problems when an electric starter has been used. The tank plumbing should place a vent on the top and bottom for easy filling and emptying.

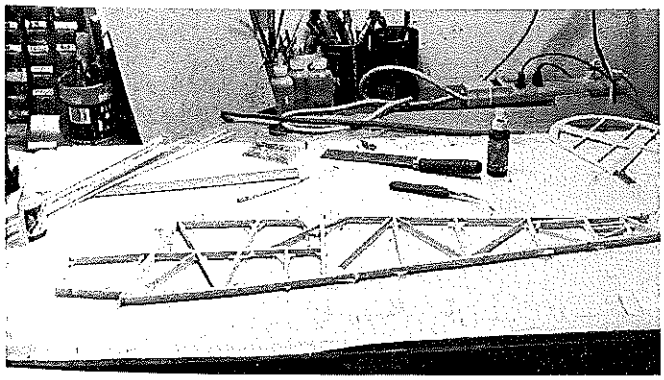
Tail Feathers: The outline pieces are easily developed; use carbon paper to draw the outline onto the balsa, then jigsaw the outline.

Do not separate the elevator halves until the wire joiner has been installed. The usual hinged surface shapes are block-sanded in, and the outer surfaces sanded to resemble the tubing of the full-scale. Install the hinges after the covering is complete.

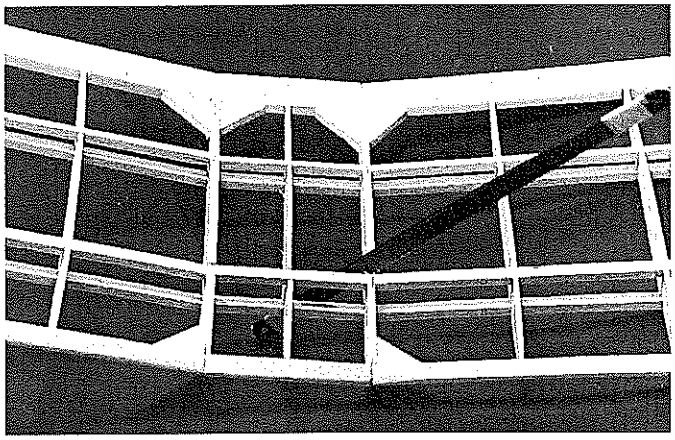
Wing: A wing-rib master pattern can be made by placing carbon paper between the drawing and a section of plywood. Use this pattern to cut the ribs from stacks of light C-grain sheet. To obtain the final contour use a jigsaw, or carve and block-sand them. Try to cut spar notches that are as accurate as possible.

Build the wing panels over the drawing from the bottom up. Use precut shear webs to position the ribs. Cut the bottom spars flush with the outside of the tip rib, then position the tips. Scrap-balsa spar extensions are used to reinforce the tips.

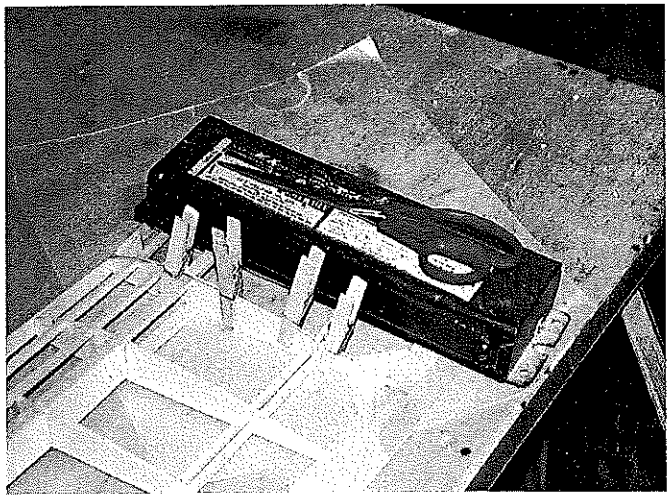
The most-inboard wing rib is tilted using the jig. The center-section ribs are installed at a right angle to the building surface. The panels are removed from the board, all edges are sanded true, and



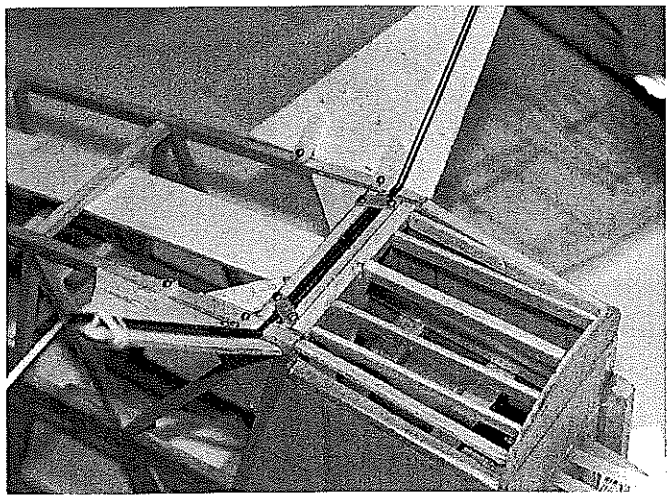
Building the fuselage sides in the classic one-atop-the-other method helps ensure identical construction.



The wing panels are glued together, then slots for the dihedral braces are cut with taped-together hacksaw blades.



The most-inboard ribs of the wing panel are angled; they provide dihedral when glued to the right-angle center-section ribs.



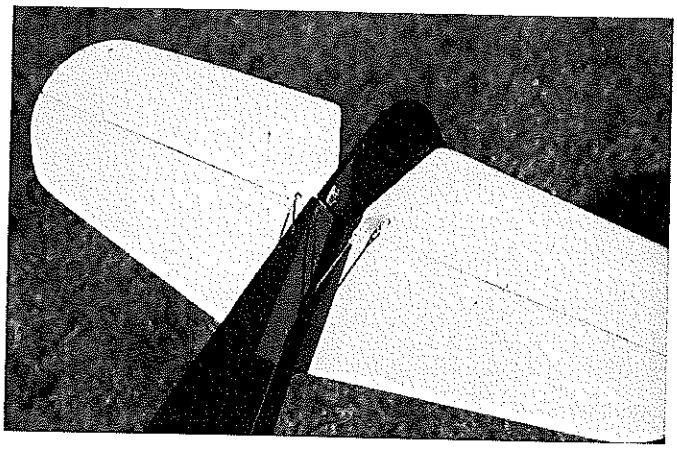
The bottom of the nose is developed with balsa strips that fair into the landing-gear mount. Fairing is ⅛ Lite Ply.

the dihedral bevel is sanded in.

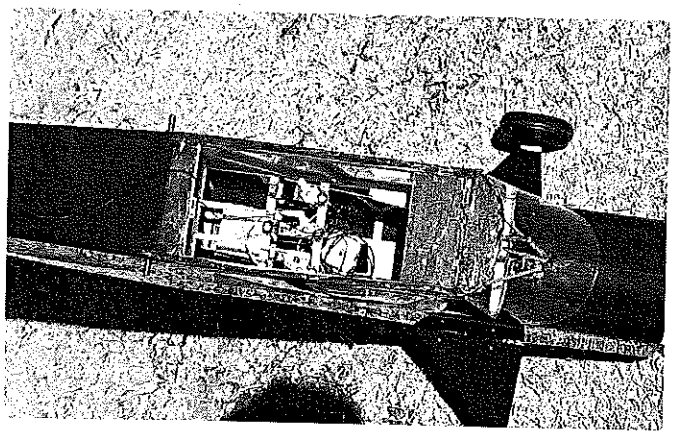
Since no center-section sheeting is used, it's necessary to use plywood dihedral gussets on this wing. I prefer to assemble the wing, then cut slots for the gussets with taped-together hacksaw blades. I then and mark and cut the plywood gussets, and epoxy them place. This way the wing dihedral is set by sanding, and the gussets are cut to match, greatly reducing the likelihood of error.

The leading-edge and tip fillers are sanded to blend into the overall contour.

Fuselage: Identical sides are developed in the classic one-atop-the-other Old-Timer fashion, using scraps of masking tape to keep them from sticking to each other. The firewall's triangular stock and the other miscellaneous pieces are installed after the two halves are popped apart.



Tail-section details showing the stabilizer and rudder control-horn locations. Nylon-tube pushrods are used.



Three one-ounce servos mount on basswood rails; Velcro attaches the battery and receiver to a strip on the cabin floor.

The "ladders" are fabricated directly over the plans. All of the holes should be located and drilled at this time. Assemble the two sides using the ladders and firewall to align the forward section. Use masking tape to hold things together while checking for squareness in all planes. Adjust the components until the box is true, then assemble everything permanently by flowing medium CyA along the joints.

Pull the tail section together with clothespins; the seam must be in the center of the fuselage. Place the model over the drawing's top view to check the alignment, then CyA the joint. Cut and install the crossmembers in pairs, constantly checking for squareness.

The engine should be rough-positioned in the cowling, so the appropriate shaft-exit and head-passage holes can be cut in the fiberglass. Place the engine and mount on the firewall, and adjust them to match the cowling. When you're satisfied with the alignment, spot-glue the mount onto the firewall with CyA, remove the cowling, and mark and drill the holes for the mounting bolts and blind nuts.

As with any cowled engine, there should be a larger allowance for air exit than air entry. Cut a largish hole in the bottom of the cowling, approximately the size of the cylinder head. Entry air will be routed in through the scale locations, and through areas around the dummy cylinders where fiberglass has been removed.

The sheeting for the tank area's top is moistened with water-diluted ammonia, then carefully pulled over the formers. Flow medium CyA into the joints and pull the sheet down, starting at the sides and working toward the center strip.

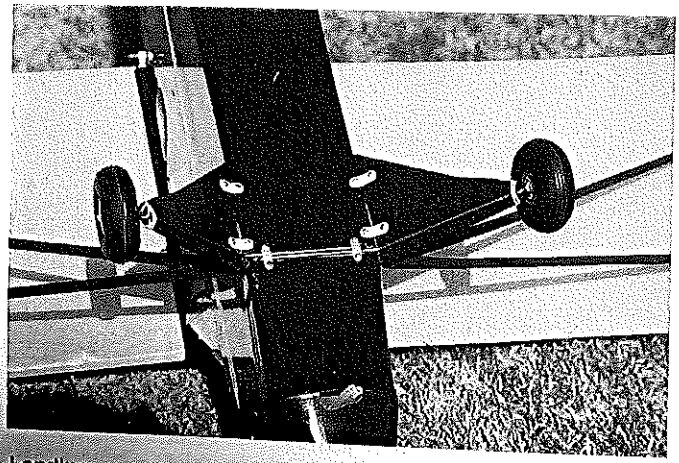
Use a steel straightedge to cut the midline, being careful to remove only half of the center strip. Repeat this technique for the other half. Use the straightedge to *carefully* trim the second sheet until it fits snugly against the first, then CyA it in place.

The bottom of the nose is developed with balsa strips that are block-sanded to fair into the landing-gear mount. Hardwood stringers are added to the sides, top, and bottom, then faired into the tail post.

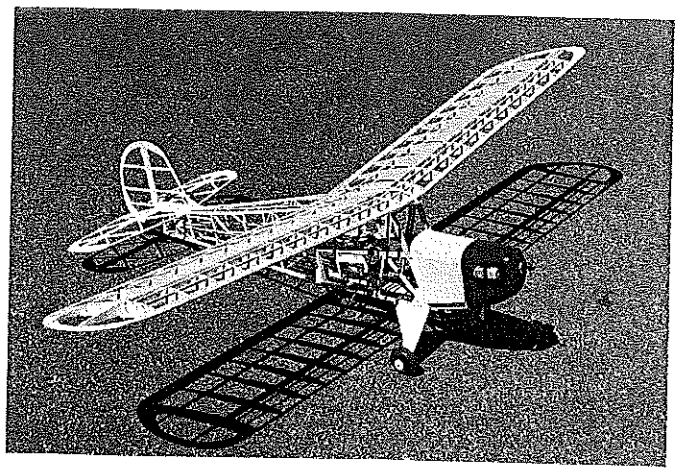
The cabin top (CT) is fabricated from cross-grained pieces of balsa that have been moistened with diluted ammonia. They are clamped to the bottom surface of the wing's center section with pieces of masking tape and allowed to dry. Use aliphatic resin glue between the halves, then tape to the underside of the wing's center section. Install it on the fuselage top after the adhesive has cured.

Scrap sections of balsa are used to build-up the area around the front-wing hold-down dowel so it's at the proper angle. It should be epoxied in place.

The radio installation should be as light as possible. Sections of ¼-inch-square basswood epoxied to Lite Ply side strips are used for the servo rails. Velcro attaches the battery and receiver to a Lite Ply



Landing-gear installation: Music-wire landing-gear struts mount in a grooved block; they're held in place with nylon straps.

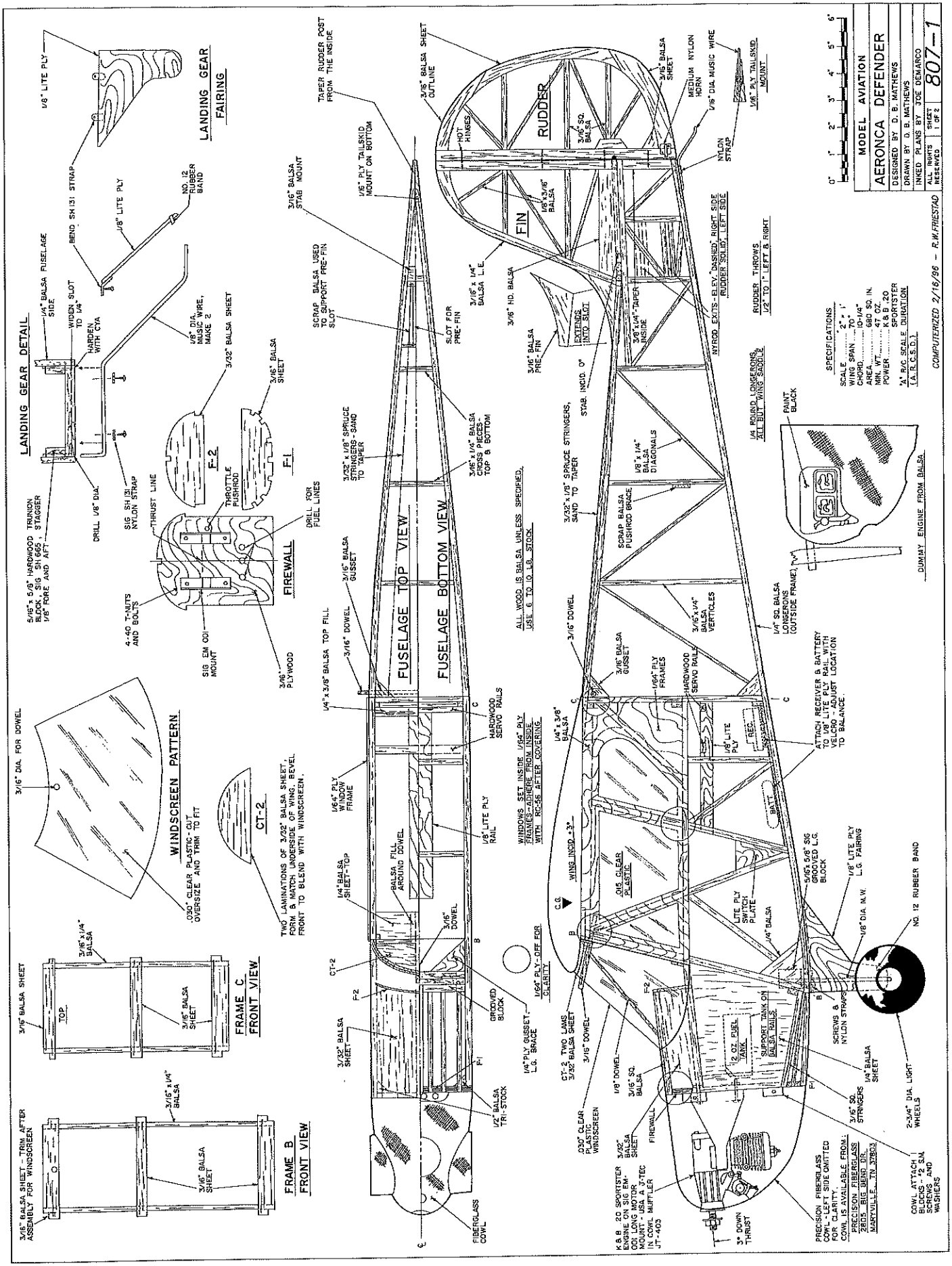


The extra-light construction requires a strong, MokoKote-type covering material. Avoid low-temperature "soft" coverings.

3/16" DIA. FOR DOWEL

3/16" BALSA SHEET

3/16" BALSA SHEET - TRIM AFTER


LANDING GEAR DETAIL
LANDING GEAR FAIRING
FUSELAGE TOP VIEW
FUSELAGE BOTTOM VIEW
FIN
RUDDER
FIREWALL
F-1
F-2
WINDSCREEN PATTERN
FRAME B FRONT VIEW
FRAME C FRONT VIEW
CT-2
DUMMY ENGINE FROM BALSA
SPECIFICATIONS
MODEL AVIATION
AERONCA DEFENDER
DESIGNED BY D. B. MATHEWS
DRAWN BY D. B. MATHEWS
INKED PLANS BY JOE DEMARCO
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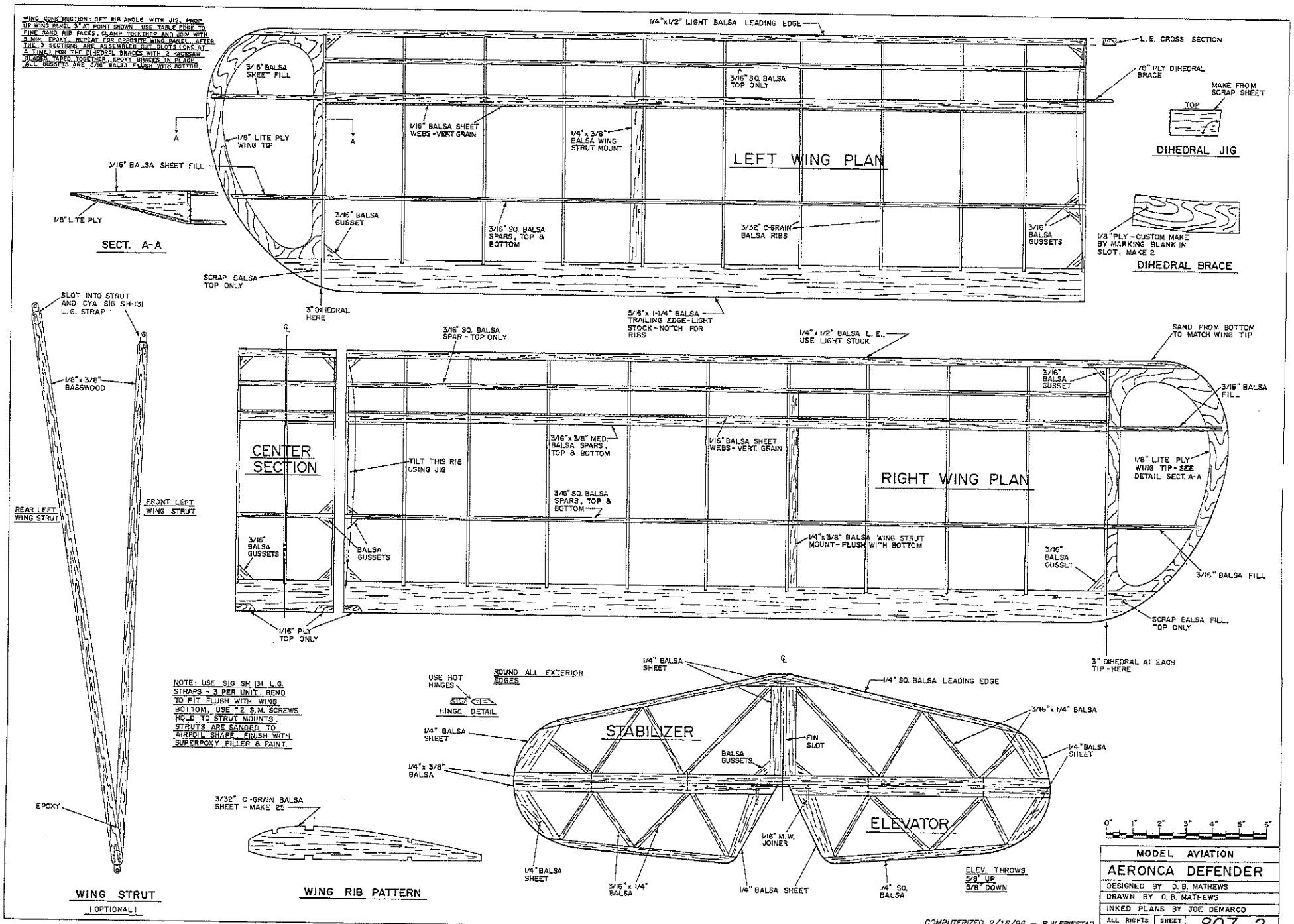
SHEET 1 OF 2
807-1
COMPUTERIZED 2/16/96 — R.W. FRIESTAD


WING CONSTRUCTION: SET RIB ANGLE WITH JIG, PROP UP WING PANEL 3" AT POINT SHOWN - USE TABLE EDGE TO FINE SAND RIB FACES, CLAMP TOGETHER AND JOIN WITH 5 MIN. EPOXY. REPEAT FOR OPPOSITE WING PANEL. AFTER THE 3 SECTIONS ARE ASSEMBLED CUT SLOTS (ONE AT A TIME) FOR THE DIHEDRAL BRACES WITH A HACKSAW BLADE TAPED TOGETHER, EPOXY BRACES IN PLACE. ALL GUSSETS ARE 3/16" BALSA FLUSH WITH BOTTOM.
1/4"x1/2" LIGHT BALSA LEADING EDGE
L.E. GROSS SECTION
3/16" BALSA SHEET FILL
3/16" SQ. BALSA TOP ONLY
1/8" PLY DIHEDRAL BRACE
MAKE FROM SCRAP SHEET
TOP
DIHEDRAL JIG
1/16" BALSA SHEET WEBS - VERT GRAIN
1/4" x 3/8" BALSA WING STRUT MOUNT
1/8" LITE PLY WING TIP
LEFT WING PLAN
3/16" BALSA SHEET FILL
1/8" LITE PLY
SECT. A-A
3/16" BALSA GUSSET
3/16" SQ. BALSA SPARS, TOP & BOTTOM
3/32" C-GRAIN BALSA RIBS
3/16" BALSA GUSSETS
1/8" PLY - CUSTOM MAKE BY MARKING BLANK IN SLOT, MAKE 2
DIHEDRAL BRACE
SCRAP BALSA TOP ONLY
3" DIHEDRAL HERE
5/16" x 1-1/4" BALSA TRAILING EDGE - LIGHT STOCK - NOTCH FOR RIBS
SLOT INTO STRUT AND CYA SIG SH-131 L.G. STRAP
3/16" SQ. BALSA SPAR - TOP ONLY
1/4" x 1/2" BALSA L. E., USE LIGHT STOCK
SAND FROM BOTTOM TO MATCH WING TIP
3/16" BALSA GUSSET
3/16" BALSA FILL
1/8" x 3/8" BASSWOOD
CENTER SECTION
TILT THIS RIB USING JIG
3/16" x 3/8" MED. BALSA SPARS, TOP & BOTTOM
1/16" BALSA SHEET WEBS - VERT GRAIN
RIGHT WING PLAN
1/8" LITE PLY WING TIP - SEE DETAIL SECT. A-A
FRONT LEFT WING STRUT
REAR LEFT WING STRUT
3/16" SQ. BALSA SPARS, TOP & BOTTOM
3/16" BALSA GUSSETS
BALSA GUSSETS
1/4" x 3/8" BALSA WING STRUT MOUNT - FLUSH WITH BOTTOM
3/16" BALSA GUSSET
3/16" BALSA FILL
1/16" PLY TOP ONLY
SCRAP BALSA FILL, TOP ONLY
3" DIHEDRAL AT EACH TIP - HERE
NOTE: USE SIG SH 131 L.G. STRAPS - 3 PER UNIT. BEND TO FIT FLUSH WITH WING BOTTOM. USE #2 S.M. SCREWS TO HOLD TO STRUT MOUNTS. STRUTS ARE SANDED TO AIRFOIL SHAPE. FINISH WITH SUPERPOXY FILLER & PAINT.
USE HOT HINGES
ROUND ALL EXTERIOR EDGES
HINGE DETAIL
1/4" BALSA SHEET
1/4" SQ. BALSA LEADING EDGE
3/16"x 1/4" BALSA
STABILIZER
1/4" BALSA SHEET
FIN SLOT
1/4" x 3/8" BALSA
BALSA GUSSETS
1/4" BALSA SHEET
EPOXY
3/32" C-GRAIN BALSA SHEET - MAKE 25
1/16" M.W. JOINER
ELEVATOR
1/4" BALSA SHEET
3/16" x 1/4" BALSA
1/4" BALSA SHEET
1/4" SQ. BALSA
ELEV. THROWS 5/8" UP 5/8" DOWN
0" 1" 2" 3" 4" 5" 6"
WING STRUT (OPTIONAL)
WING RIB PATTERN
COMPUTERIZED 2/16/96 - R.W. FRIESTAD
MODEL AVIATION
AERONCA DEFENDER
DESIGNED BY D. B. MATHEWS
DRAWN BY D. B. MATHEWS
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SHEET 2 OF 2
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