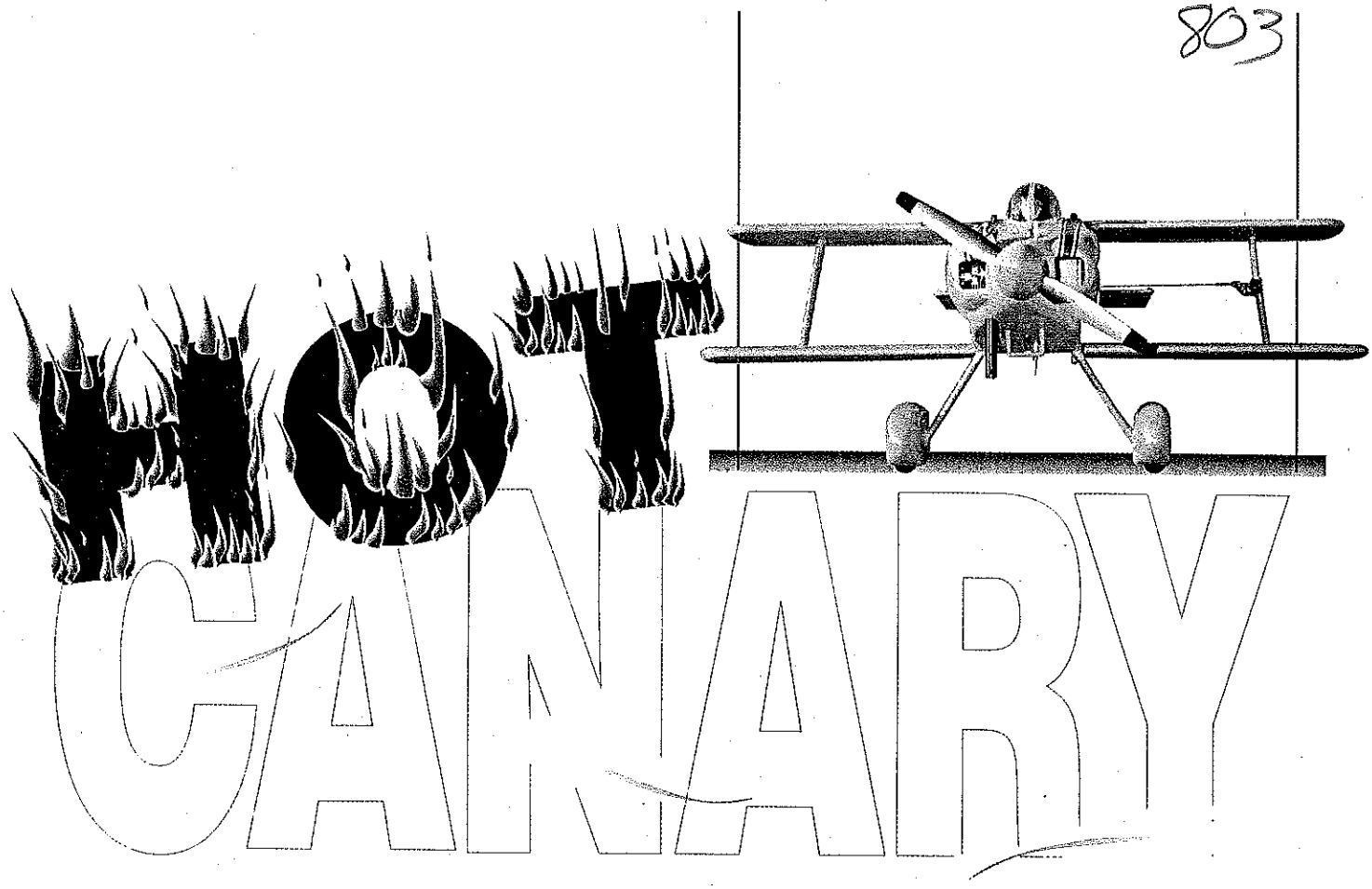
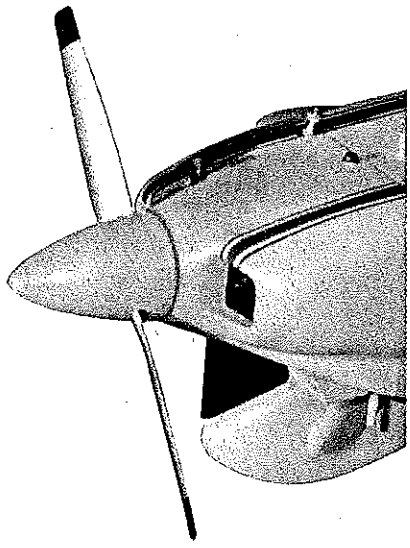
803



☐ **Frank Beatty**

A Max .32-powered Control Line "bird on a wire!"



SO YOU LIKE BIPLANES, but cabane struts and rigging wires are your downfall. You like streamlined airplanes, but have little patience with planking curved surfaces or carving fillets. You like colorful airplanes, but you are burned out on sunbursts and checkerboard color schemes.

Let me introduce you to Bill Warwick's W-4 Hot Canary. Despite its boxy fuselage and squared-off flying surfaces, it has the look of a speed wagon. It is a biplane without multitudes of struts and rigging wires. It has a striking color scheme with easily reproduced markings.

Bill Warwick created the Hot Canary in the late '60s to compete in the Sport Biplane air races. The negatively staggered upper wing and the location of the pilot provided exceptional visibility when making pylon turns. The entire airplane was covered with sheet metal or plywood.

The interplane struts were fitted between the fully cantilevered symmetrical-airfoil-section wings only to satisfy air racing rules. The airplane's top speed was 196 mph; it cruised at 150 mph and landed at 65 mph.

The Canary's first flight was August 26, 1969; it was always a hot contender during the race seasons that followed. Prior to the 1973 Reno Air Races the Hot Canary was donated to the Experimental Aircraft Association's Air Museum in Oshkosh, Wisconsin, where it is currently on display.

Bill Warwick died in May 1994 in a crash during the first test flight of a Thorp T-18 that he was piloting.

R. H. Hirsch's three-view drawings were used to prepare the working drawings of the Hot Canary. Color and marking details were gleaned from color photos in *Sport Aviation*

(May '71), *Sport Flying* (August '71 and June '72), and a Bob Banka Scale Model Research Foto-Paak (No. 1208).

The model copies the Hirsch drawing exactly, except for one detail. The real craft has 4½° of engine downthrust—the model has a neutral thrustline. The full-scale model is so tiny that even though the model was built to a largish scale of 2 inches = 1 foot, the wingspan is only 28¼ inches and the length is 35¼ inches. Effective wing area is 335 square inches. The model weighs 64 ounces; the wing loading is approximately 19 ounces per 100 square inches of wing area.

Power is an O.S. Max .32 with a three-wire Roberts system for throttle control. (The new O.S. .32 with the rear-mounted "remote" needle valve is highly recommended for its cowling-to-needle-valve ratchet clearance. I wish that it had been available for my Canary.)

CONSTRUCTION

The Hot Canary is a relatively simple model to build. However, the sequence of construction is important in some instances. The two wings and the stabilizer/elevator assemblies should be built first so exact templates of their center cross-sections can be used to make precise locating cutouts for the wing saddle and stabilizer when the fuselage sides are fabricated.

Wings: Make two each of the plywood interplane strut support ribs C and D. Make 30 rectangles of ⅛ sheet balsa, and bolt fifteen of these between the two C ribs and fifteen between the two D ribs. These can be razor-planed, sanded to shape, and notched to provide accurate ribs for each wing.

The lower skins for both wings are made by butt-joining 1/16 balsa sheets. Reinforce the joint with a 1/16 x ¼ basswood doubler. Mark off the leading edge, aileron spar, and rib locations. Bevel the trailing edges of the skins.

Shape the leading edges. Shape the aileron spars as a one-piece ¼ x 7/16 unit and drill the ⅛ dowel-alignment holes at this time. Don't overlook shaping the upper-wing center-section filler piece.

Cement the leading edges and aileron spars to these skins. Now fit and cement all of the ribs in place. At this point these assemblies are quite flexible.

Select two flat building boards, and secure a wing assembly to each one—use a series of pins pressed through the skin just forward of the doubler. Shim up the leading and trailing edge of each wing with balsa blocks.

The upper and lower skin doublers can be turned into light-but-strong I beams by fitting 1/16-sheet basswood webs between each rib. Cement the 1/16 x ¼-basswood upper skin doubler into place. Cement a 1½-ounce weight to the lower-wing outer panel as shown.

Bevel the trailing edge of the upper-rear skins and cement these to each wing assembly. Now the forward skins can be cemented to each wing assembly.

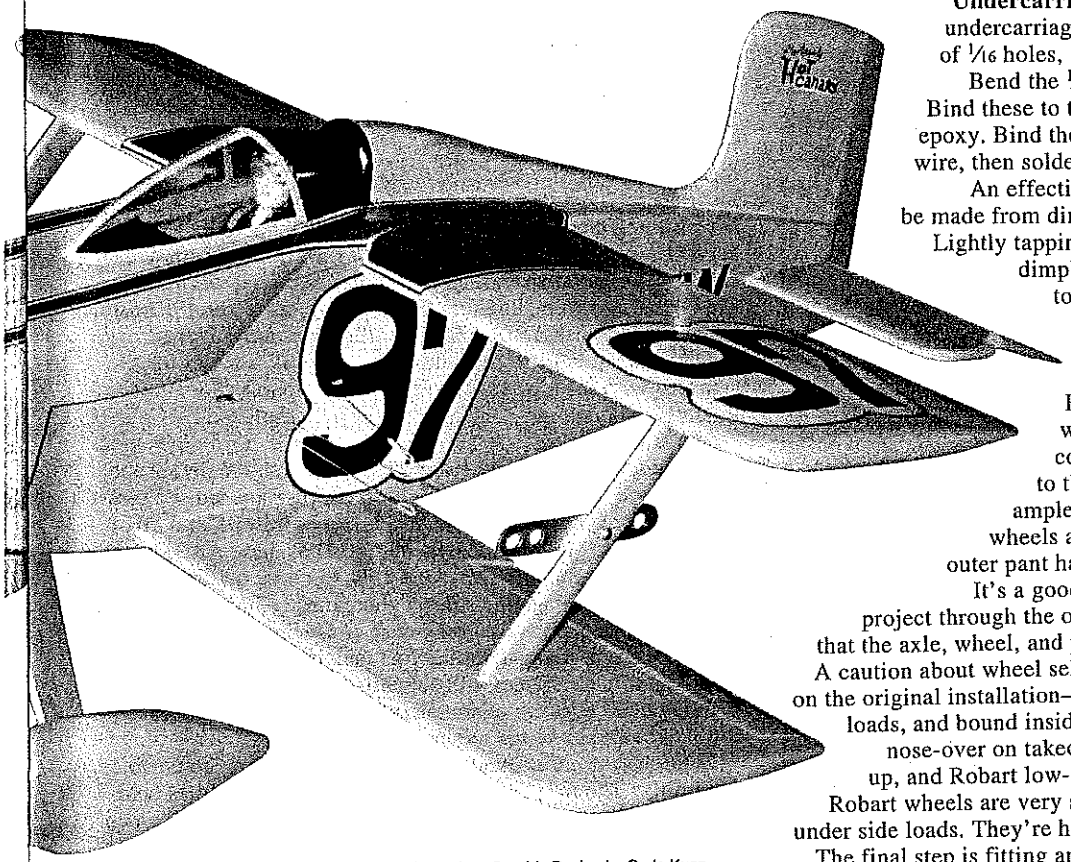
Mark the centerlines on each wing before removing them from the building surface. Mark off the interplane-strut end openings, and cut the slots for the strut locator tabs in each wing.

True the four wingtips, and fit the balsa wingtip blanks. Cut all four tips to the outline shape. Sand the wings to the final shape. Now the ailerons can be cut from the wings—the ailerons will always match the wings due to the predrilled alignment holes.

Stabilizer/Elevator Assembly: Not much weight can be saved by building up the tail surfaces of a small model like the Hot Canary—it's hardly worth the trouble. Accordingly, the stabilizer and elevators are made from ⅜ sheet balsa.

Alignment of the elevator halves was simplified by making them one piece, fitting the control horn, then removing the rudder throw cutout in the center of the elevators.

The hinges are made from 3/32 aluminum tubing and music wire. They are made and fitted prior to trimming the tail assembly for the elevator balance horns. These are now installed.



Photos by the author Graphic Design by Carla Kunz

Undercarriage: Cut out the ⅛ plywood undercarriage support platform. Drill four rows of 1/16 holes, spaced as shown.

Bend the ⅛ music wire main and rear struts. Bind these to the platform with button thread and epoxy. Bind the struts together with fine copper wire, then solder them.

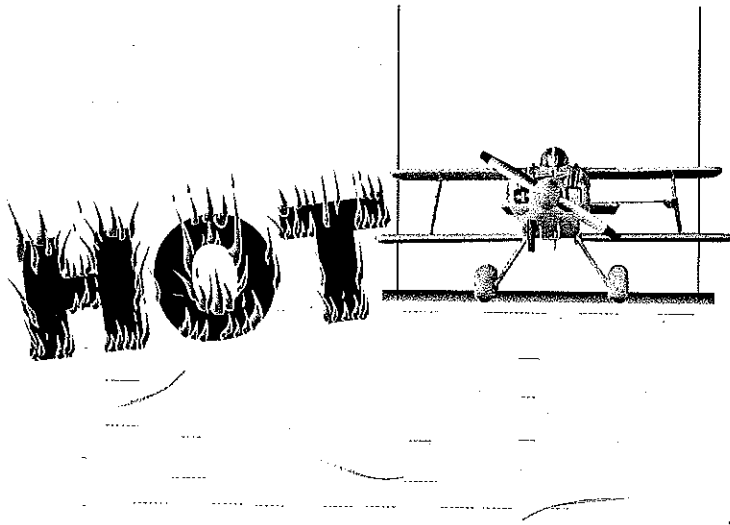
An effective anchor for the wheel pants can be made from dimpled .010 sheet-brass plates. Lightly tapping the plates with a 6D nail will dimple these plates nicely. Solder them to the main strut axles.

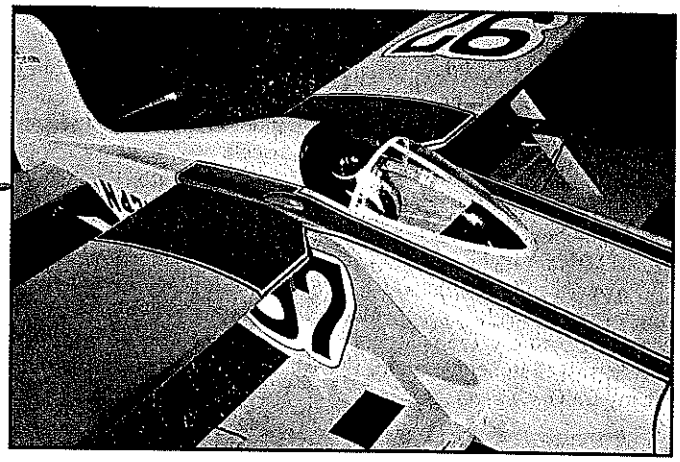
Each wheel pant has ⅛ hard balsa outer skins, and two ⅜ and one ¼ inner ply of balsa. Hollow the halves to suit your wheels, rough-shape the outer contours, then epoxy the inboard half to the dimpled brass plate. Use an ample number of washers to center the wheels and to reduce friction. Cement the outer pant half in place.

It's a good practice to have the axle nearly project through the outer skin of the pant. This ensures that the axle, wheel, and pant will flex in unison.

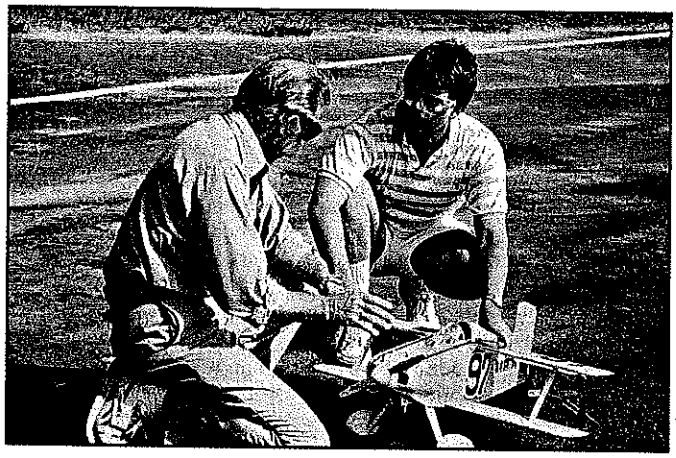
A caution about wheel selection: Brand X wheels were used on the original installation—the tires flexed badly under side loads, and bound inside the pants, causing the model to nose-over on takeoff attempts. The pants were opened up, and Robart low-bounce wheels were substituted. Robart wheels are very stiff, and have little (or no) flex under side loads. They're highly recommended.

The final step is fitting and installing the balsa strut fairings before setting the subassembly aside.

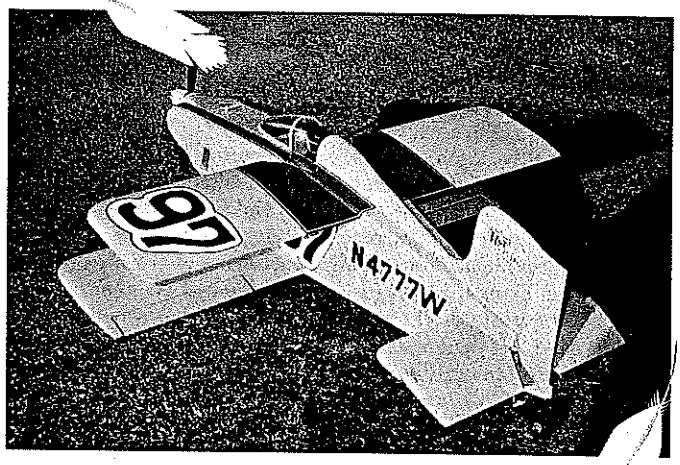




The Hot Canary's cockpit location and negatively staggered upper wing helped with visibility during pylon turns.



Several weekends were devoted to fine-tuning the model's initially-tricky ground handling tendencies.



The model will help satisfy your biplane desires *without* cabane struts, rigging wires, or a complicated fuselage.

The text outlines a simple method to reproduce the striking multicolor racing markings without complex masking.

HOT CANARY

Type: CL Scale
Wingspan: 28¼ inches
Engine: O.S. Max .32
Weight: 64 ounces
Construction: Built-up with balsa sheeting
Covering: Sig Ultra-Light Weight Glass Cloth

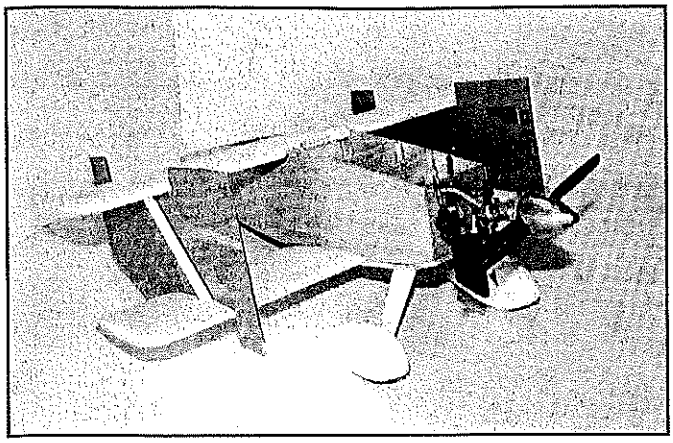
Struts: Interplane struts have a ⅛ basswood inner core, and 1/16 basswood outer panels. Fiberglass and fill the pants, then set them aside.

Finishing: The major subassemblies (wings, tail, undercarriage, and struts) can be finished more easily now than after they've been built into the aircraft structure. Accordingly, .56-ounce Sig Ultra-Light Weight Glass Cloth, two coats of clear dope, and two coats of K&B Super Poxy filler coat were applied, with wet-or-dry sandings at appropriate intervals. When you're satisfied with the base coat, you can set the parts aside until final assembly.

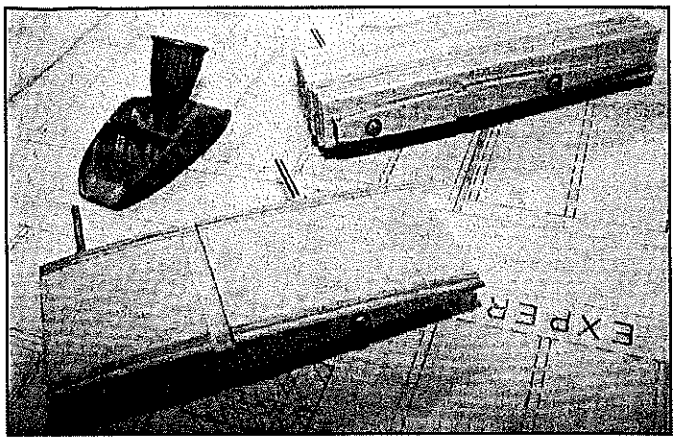
Fuselage: Make exact patterns of the wing and tail airfoil sections and transfer these outlines to the fuselage side patterns. Cut out the fuselage sides, the 3/16 plywood firewall, and all of the bulkheads. Mark the centerlines on all of these parts. Install blind mounting nuts for the radial engine mount on the firewall.

Assemble fuselage the sides and bulkheads 3 and 5. Add gussets and fiberglass reinforcement to the firewall joints as shown on the drawings. Set the fuel tank in place. Fit bulkhead 4 and the throttle crank (with supports) in position. Bulkheads 6-10 and the bellcrank mount are the next order of business. Bolt the bellcrank to the mounting plate.

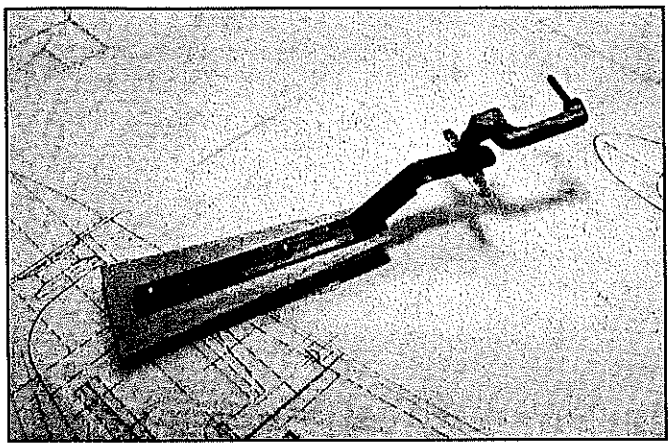
Assembly: The fuselage's upper and lower wing saddles, and the interplane strut design virtually guarantee correct alignment of the wings. Even so, simple corrugated cardboard templates were used to ensure that all alignment, spacing, and angles of attack were dead-on accurate. Test-fit both wings and struts. When you're satisfied with the alignment,



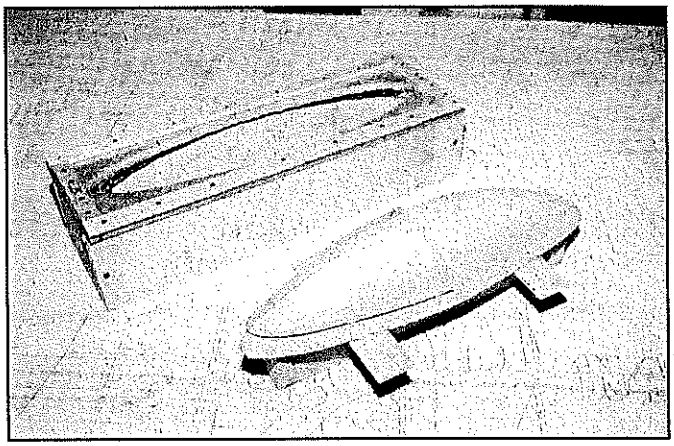
Corrugated cardboard templates can be used to ensure correct wing alignment, spacing, and angles of attack.



The balsa rib blanks are bolted between plywood templates, then razor-planed, sanded to shape, and notched.



The tailwheel bracket assembly uses components from C.B. Associates' kit #5513. It mounts a 1¼ diameter wheel.



The windshield is molded from 1/16 Perspex sheet. The symmetrical mold yields two windshields from one sheet.

epoxy the lower wing into position. Fine-tune the fit again, then epoxy the top wing and strut joints. The templates ensure that correct alignment is maintained during this activity.

Epoxy the stabilizer in position. Bolt the radial engine mount and engine to the firewall. Install all of the elevator and throttle linkages, and check for freedom of movement.

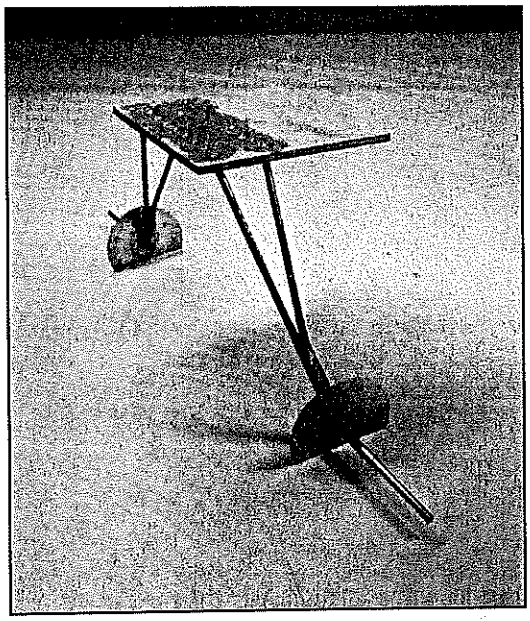
Epoxy the undercarriage assembly to the fuselage. Make the tailwheel bracket assembly using components from C.B. Associates (kit number 5513) and mount to the airframe.

Make and install the fin. Add the fuel-tank filler extensions. Generously work graphite into the bellcrank pivot point and slide. Do this before closing the area with the dummy pilot support platform. The graphite lubricates everything, and reduces the chances of the bellcrank binding after it is no longer accessible.

The fuselage top and bottom can now be closed off with ¼ sheet balsa; it's best to have the grain run *across* the fuselage. I fiberglassed the fuselage prior to installing the headrest fairing block.

The cowling is made of ¼ sheet balsa, and blocks that are hollowed to suit the engine. Drill and tap the radial-engine mounts for the 6-32 cowling hold-down bolts. The dummy air scoop is attached to the cowling; it slides off with the cowling when it is removed. The long fuselage-cowling fairing blocks are installed and faired into the cowling. Cut the cockpit opening now.

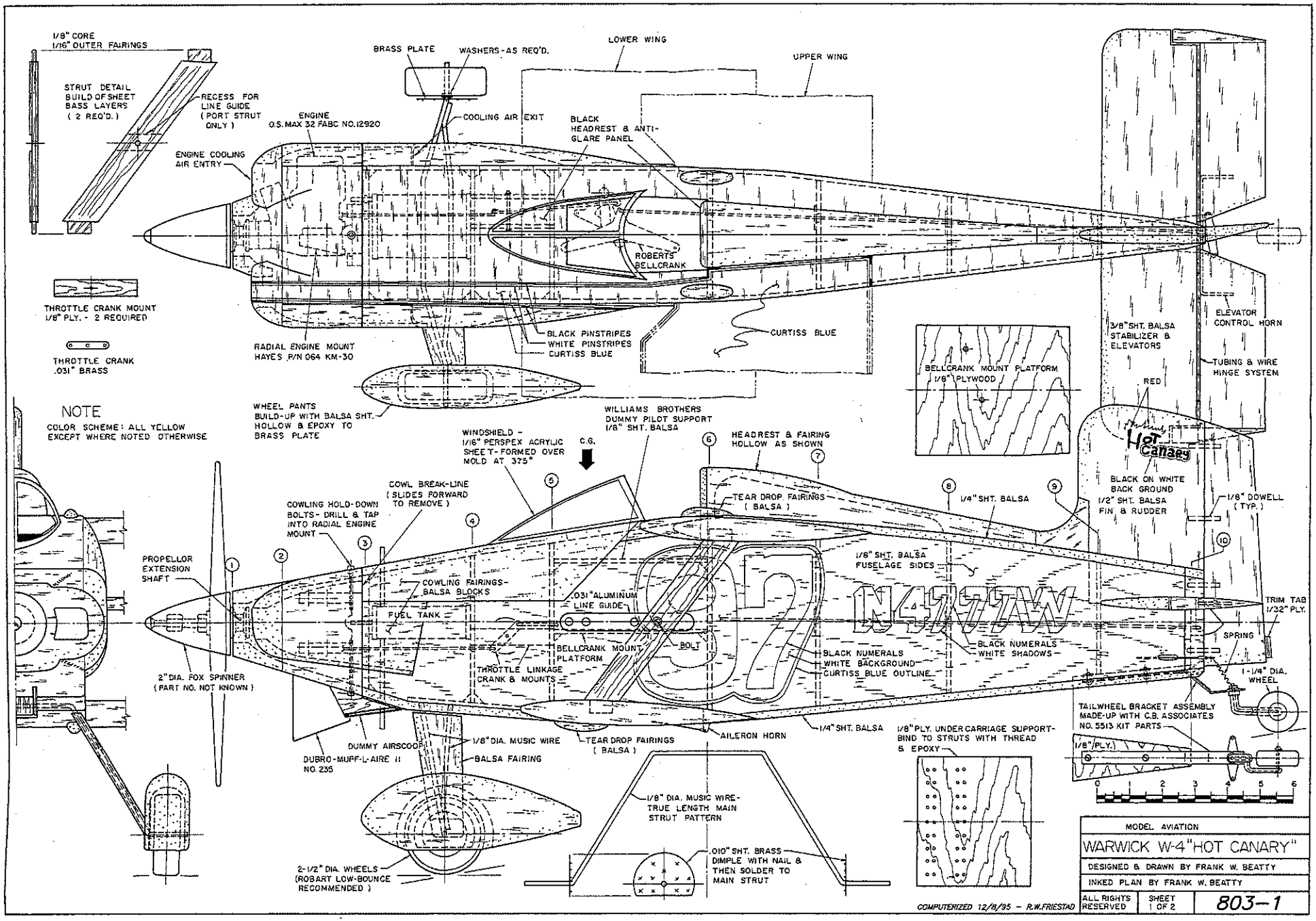
Finishing: The Canary airframe is complete. Now is the time to take care of any areas that still need to be fiberglassed, doped, or filled. With satisfactory base coats established, spray the entire model with six to eight coats of yellow. Mask off the cowling

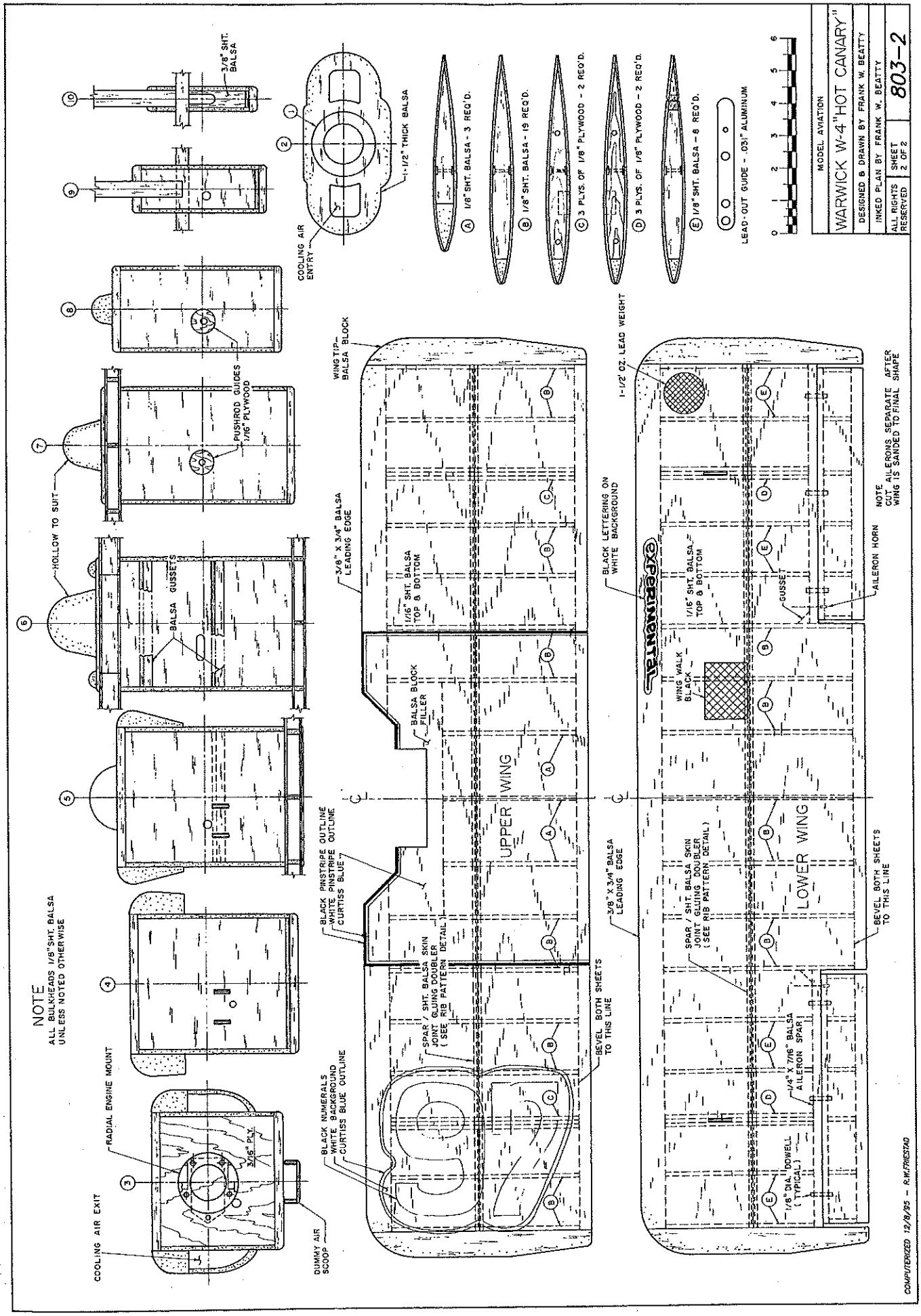


Dimpled .010 sheet-brass plates are soldered to the main-gear legs; these anchor the laminated wheel pants.

and wing center section and spray it with four coats of Curtiss Blue. The anti-glare panel, headrest, and wing walk should be sprayed black.

Now you can either mask off and spray the markings in the conventional manner, or you can try another technique that I consider to be less tedious—and more likely to produce satisfactory results.


1/8" CORE
1/16" OUTER FAIRINGS
STRUT DETAIL
BUILD OF SHEET
BASS LAYERS
(2 REQ'D.)
RECESS FOR
LINE GUIDE
(PORT STRUT
ONLY)
BRASS PLATE
WASHERS - AS REQ'D.
LOWER WING
UPPER WING
ENGINE
O.S. MAX 32 FABC NO. 12920
COOLING AIR EXIT
BLACK
HEADREST & ANTI-
GLARE PANEL
ENGINE COOLING
AIR ENTRY
ROBERTS
BELLCRANK
THROTTLE CRANK MOUNT
1/8" PLY. - 2 REQUIRED
THROTTLE CRANK
.031" BRASS
RADIAL ENGINE MOUNT
HAYES P/N 064 KM-30
BLACK PINSTRIPES
WHITE PINSTRIPES
CURTISS BLUE
CURTISS BLUE
WHEEL PANTS
BUILD-UP WITH BALSA SHT.
HOLLOW & EPOXY TO
BRASS PLATE
NOTE
COLOR SCHEME: ALL YELLOW
EXCEPT WHERE NOTED OTHERWISE
WILLIAMS BROTHERS
DUMMY PILOT SUPPORT
1/8" SHT. BALSA
WINDSHIELD -
1/16" PERSPEX ACRYLIC
SHEET - FORMED OVER
MOLD AT 375°
C.G.
HEADREST & FAIRING
HOLLOW AS SHOWN
COWL BREAK-LINE
(SLIDES FORWARD
TO REMOVE)
COWLING HOLD-DOWN
BOLTS - DRILL & TAP
INTO RADIAL ENGINE
MOUNT
TEAR DROP FAIRINGS
(BALSA)
1/4" SHT. BALSA
PROPELLOR
EXTENSION
SHAFT
COWLING FAIRINGS -
BALSA BLOCKS
.031" ALUMINUM
LINE GUIDE
1/8" SHT. BALSA
FUSELAGE SIDES
FUEL TANK
BELLCRANK MOUNT
PLATFORM
BOLT
THROTTLE LINKAGE
CRANK & MOUNTS
BLACK NUMERALS
WHITE BACKGROUND
CURTISS BLUE OUTLINE
BLACK NUMERALS
WHITE SHADOWS
2" DIA. FOX SPINNER
(PART NO. NOT KNOWN)
DUMMY AIRSCOOP
DUBRO-MUFF-L-AIRE II
NO. 235
1/8" DIA. MUSIC WIRE
BALSA FAIRING
TEAR DROP FAIRINGS
(BALSA)
AILERON HORN
1/4" SHT. BALSA
2-1/2" DIA. WHEELS
(ROBART LOW-BOUNCE
RECOMMENDED)
1/8" DIA. MUSIC WIRE -
TRUE LENGTH MAIN
STRUT PATTERN
.010" SHT. BRASS -
DIMPLE WITH NAIL &
THEN SOLDER TO
MAIN STRUT
1/8" PLY. UNDERCARRIAGE SUPPORT -
BIND TO STRUTS WITH THREAD
& EPOXY
BELLCRANK MOUNT PLATFORM
1/8" PLYWOOD
3/8" SHT. BALSA
STABILIZER &
ELEVATORS
ELEVATOR
CONTROL HORN
TUBING & WIRE
HINGE SYSTEM
RED
Hot Canary
BLACK ON WHITE
BACK GROUND
1/2" SHT. BALSA
FIN & RUDDER
1/8" DOWELL
(TYP.)
TRIM TAB
1/32" PLY.
SPRING
1-1/4" DIA.
WHEEL
TAILWHEEL BRACKET ASSEMBLY
MADE-UP WITH C.B. ASSOCIATES
NO. 5513 KIT PARTS
1/8" PLY.
0 2 3 4 5 6
MODEL AVIATION
WARWICK W-4 "HOT CANARY"
DESIGNED & DRAWN BY FRANK W. BEATTY
INKED PLAN BY FRANK W. BEATTY
ALL RIGHTS RESERVED
SHEET 1 OF 2
803-1
COMPUTERIZED 12/8/95 - R.W.FRIESTAD


NOTE
ALL BULKHEADS 1/8" SHT. BALSA UNLESS NOTED OTHERWISE
RADIAL ENGINE MOUNT
3/16" PLY
COOLING AIR EXIT
DUMMY AIR SCOOP
BLACK NUMERALS WHITE BACKGROUND CURTISS BLUE OUTLINE
BLACK PINSTRIPE OUTLINE WHITE PINSTRIPE OUTLINE CURTISS BLUE
BALSA GUSSETS
HOLLOW TO SUIT
PUSHROD GUIDES 1/16" PLYWOOD
3/8" SHT. BALSA
COOLING AIR ENTRY
1-1/2" THICK BALSA
A 1/8" SHT. BALSA - 3 REQ'D.
B 1/8" SHT. BALSA - 19 REQ'D.
C 3 PLYS. OF 1/8" PLYWOOD - 2 REQ'D.
D 3 PLYS. OF 1/8" PLYWOOD - 2 REQ'D.
E 1/8" SHT. BALSA - 8 REQ'D.
LEAD-OUT GUIDE - .031" ALUMINUM
WING TIP - BALSA BLOCK
3/8" X 3/4" BALSA LEADING EDGE
1/16" SHT. BALSA TOP & BOTTOM
BALSA BLOCK FILLER
SPAR / SHT. BALSA SKIN JOINT GLUING DOUBLER (SEE RIB PATTERN DETAIL)
BEVEL BOTH SHEETS TO THIS LINE
UPPER WING
1-1/2 OZ. LEAD WEIGHT
BLACK LETTERING ON WHITE BACKGROUND
EXPERIMENTAL
WING WALK BLACK
GUSSET
AILERON HORN
NOTE CUT AILERONS SEPARATE AFTER WING IS SANDED TO FINAL SHAPE
LOWER WING
1/4" X 7/16" BALSA AILERON SPAR
1/8" DIA. DOWELL (TYPICAL)
MODEL AVIATION
WARWICK W-4 "HOT CANARY"
DESIGNED & DRAWN BY FRANK W. BEATTY
INKED PLAN BY FRANK W. BEATTY
ALL RIGHTS RESERVED
SHEET 2 OF 2
803-2
COMPUTERIZED 12/8/95 - R.W. TRUESTAD

Obtain three plates of 12 x 18 glass with ground edges. Coat one side of each plate with a thin film of soapy water and allow to dry. Spray paint one panel black, one panel white, and one panel Curtiss Blue. The soapy film will act like a release agent—sections of the painted surface can be cut out, lifted from the glass, and applied to the model. They're very similar to decals.

An X-Acto knife and straightedge will enable you to slice all the black and white striping you need. Lift 1/16-wide strips off the glass (they are stronger than you might think). Saliva or a wet paint brush will temporarily hold the strip in place. After the strips are in place, flow—*do not* brush—thinner onto the strips to permanently set them in place. Protect the markings with a clear dope overspray. On the Canary, all the black striping was applied first, followed by the white striping.

Larger markings like numerals or roundels must be X-Acto trimmed, lifted off, and bonded to the model's surface with a thinned, watery mix of Elmer's Carpenters glue. Squeegee out any excess moisture. Flow on thinner to seal all of the edges, then protect the markings with a clear dope overspray.

The Canary's black "97" markings were lifted off the glass and glued to the white-doped glass. They were squeegeed, then the edges were sealed to the white background dope. This two-color combination was in turn trimmed and applied to the blue sheet. A blue rectangle was cut out around the numbers, then the assembly was lifted off the glass. The blue background was scissor-trimmed to the proper 1/16 border around the numbers, then the assembly was bonded to the model, edge sealed, and protected with clear dope overspray.

The black-and-white shadow

registration numbers are made as follows: X-Acto trim the black numerals, then bond and edge-seal them to the white background. Trim around the white shadow and black numeral, lift them off, seal them to the model, and protect them with clear dope.

The "Hot" and the flame over it were drawn on the fin with a red Sanford Sharpie permanent marker. Like the numbers, they are protected with a clear dope overspray.

The "Canary" and "Experimental" markings were drawn on the white-painted glass with a black Sharpie, then protected with a clear dope overspray. When dry they were trimmed, bonded to the model, and protected with a clear dope overspray.

Final Details: Remaining details like the aileron horns, the rudder trim tab, the rudder horn and spring assemblies, and the line guide can now be installed. The fin and ailerons are attached with short lengths of ⅛ dowel.

Photos show the forms used to mold the windshield out of 1/16 Perspex acrylic sheet. Both forms were heated to 375° in the kitchen oven, then a pressing was made. Allow the windshield to cool completely before releasing pressure, or the plastic may try to assume its original shape. The forms were symmetrical so that two windshields would be available, providing an extra if one was damaged during the trimming process. I damaged the first one but still had a spare.

The finished windshield has four triangular tabs cemented to its bottom edge to help locate and bond the windshield to the fuselage. Cyanoacrylate glue was used, and the installation was so neat that the usual epoxy-and-paint fillet was deemed unnecessary.

Have your two-inch Williams Bros. pilot climb into the cockpit, and head for the flying field.

Flying: This was my first control line model with negatively staggered wings; it also has the shortest tail-to-nose moment arm of any CL Scale model I have built. This was cause for some concern prior to the first flight. However, the model balanced as indicated on the drawings without any ballast.

When balanced, the model flies fast, with a good pull on the lines. It also flies rock-steady, with virtually no fore and aft trim oscillations.

The wheels are located quite far ahead of the model's center of gravity. I assumed that the model would be blessed with impeccable ground handling. This was not so.

On the ground the average control line model wants to yaw out or run in a straight line; the control line keeps the model

traveling in a circle. The Hot Canary's forward-mounted gear, its long nose, and the short distance of the line guides from the model's centerline allowed the model's tendency to run in a straight line to become the dominant force. This pulled the inboard wing down, where it dragged on the pavement until enough speed was built up for takeoff.

Several weekend flying sessions were devoted to testing various modifications (to the model and to my flying technique) in order to sort out the best way to improve its ground handling. The following modifications to the model proved to be effective:

Control line sweepback was eliminated by moving the line guide forward, as shown on the drawings. Also, the rudder offset was reduced to approximately ⅛ inch.

It was also noted that if the model was moved out briskly during the takeoff phase, and if the model was kept moving at a brisk pace during touch-and-gos and taxi operations, the tires' ability to grip the pavement (and yaw the model out) was vastly reduced. "Walking with the model" during the slow parts of ground-handling operations is also recommended.

The model's stable flight characteristics are a definite plus. They enable you to make nicely controlled landing approaches. Touch-and-gos and taxiing are still not exactly a piece of cake, but they almost never are with a rather heavy, clipped-wing Scale model.

Scale purists will always insist that wheel locations be exactly on the mark. Pragmatic fliers who prefer good ground-handling characteristics might choose to locate the wheels about one inch aft of the scale location. It's your choice. Happy landings! ✈

Frank W. Beatty
2608 Pontoon Rd.
Granite City IL 62040