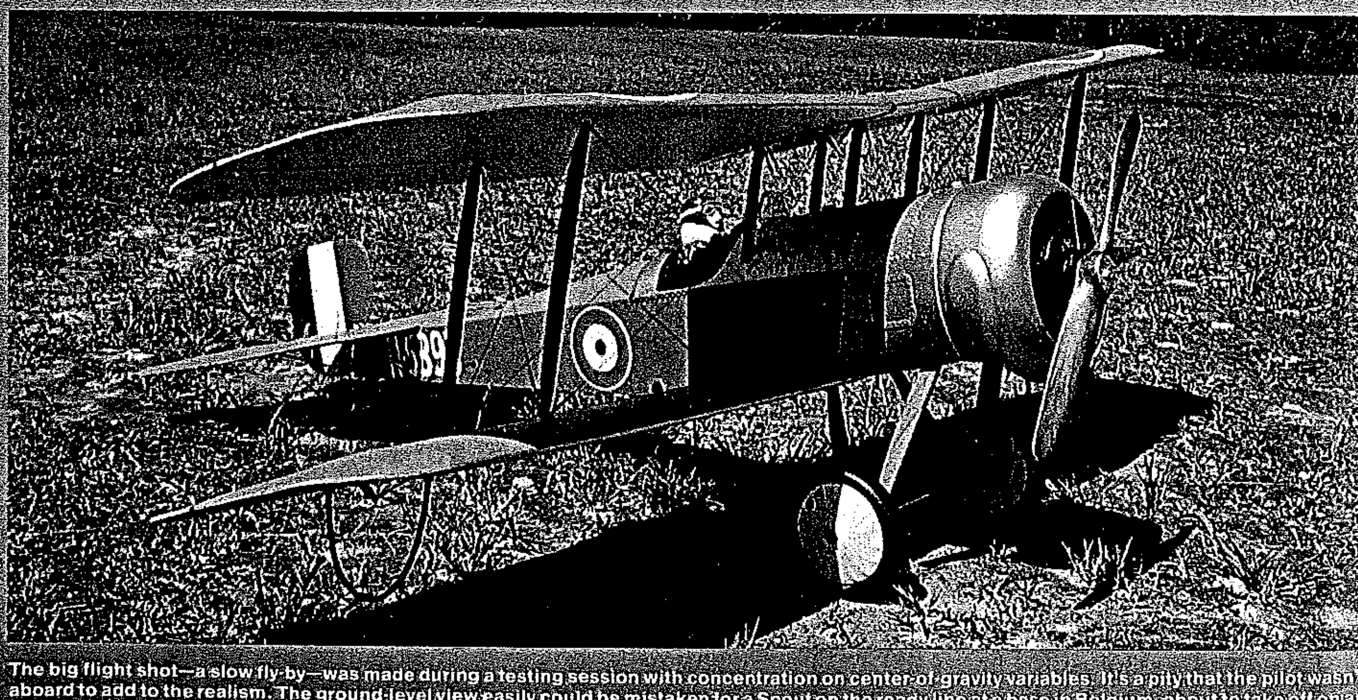
#328

Bristol Sco

This model was built for RC Precision Scale competitions, but it more easily could be Sport Scale or Giant Scale. Plans and sources allow going as far as the builder wishes. A .90 engine is ideal, though anything from a .76 on up to Quadra-size should be OK, depending on end use. Part 1. ● Hank Iltzsch Color pictures by Ernst Mausolf.

The Bristol Scout sometimes is mistaken for a Sopwith Pup or other aircraft of the period. Many of the Scout's distinctive features and lines can be seen in this view.



The big flight shot—a slow fly-by—was made during a testing session with concentration on center-of-gravity variables. It's a pity that the pilot wasn't aboard to add to the realism. The ground-level view easily could be mistaken for a Scout on the ready line at a base in Belgium, about to take off on an early-evening scouting mission in late spring of 1917. "Sir Percy" controls one of a handful of Scouts to see front-line service. Except for full-flying rudder, the general design easily could be from late Twenties or early Thirties.

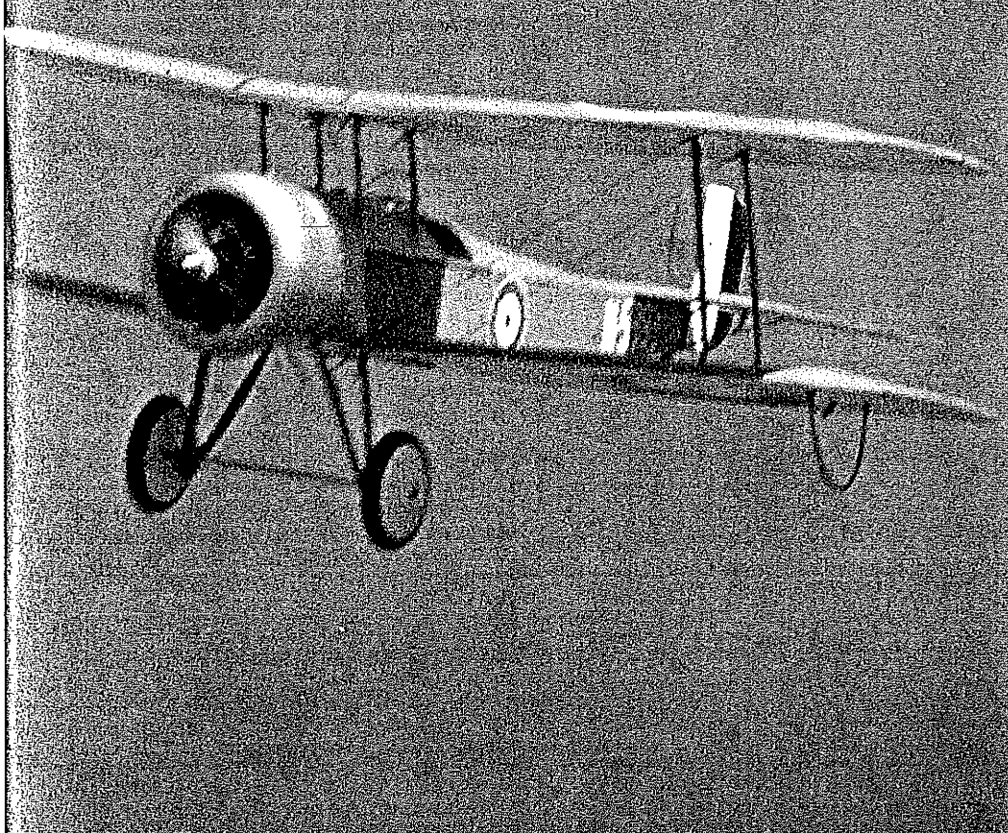
ut Model·D

THE BRISTOL SCOUT, popularly called the Bristol Bullet, is probably one of the best known planes of the WW I era, even though it did not have a distinguished record of combat achievement. This was due, in most part, to a series of pieces of unfortunate timing, as well as an amount of confused thinking on the part of the RFC and RNAS hierarchy.

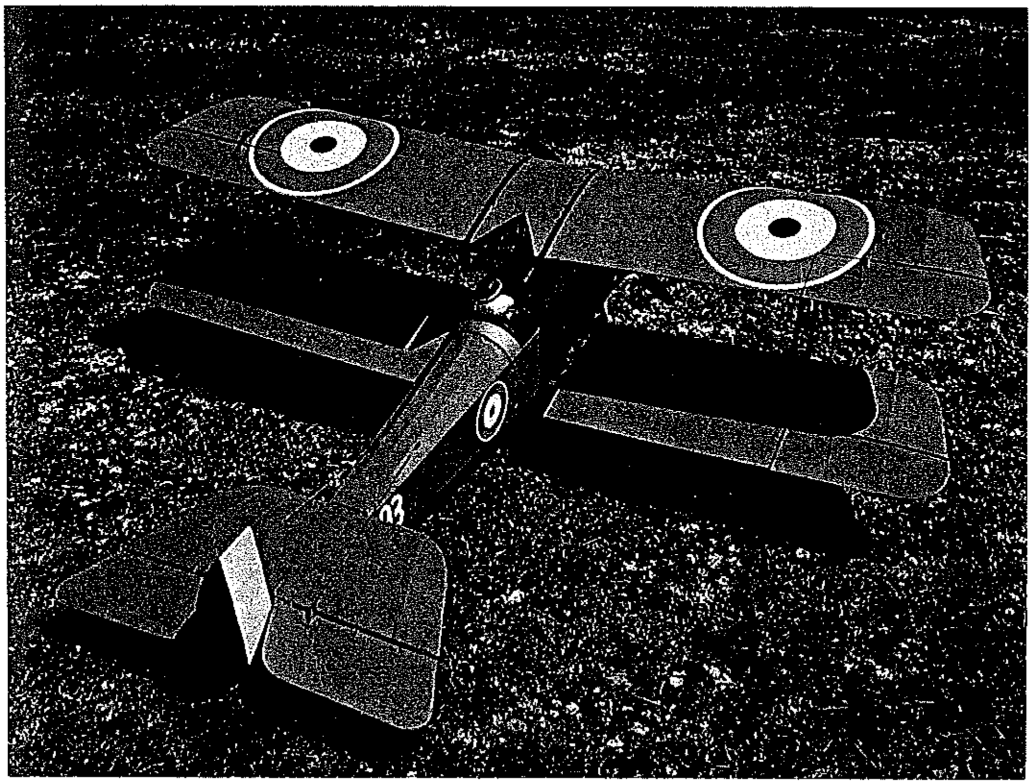
The design dates back to late 1913, and in retrospect, it must be considered as having been somewhat ahead of its time.

The series of Scouts encompasses Models A through D, with only the C and D models being produced in volume. There were, in fact, only one of the A models built, and two of the B models, followed by the C and D, which were produced in modest volumes of 161 for the C and 210 for the D.

Most Scouts were never seen in active combat, although a scattered few were to be found in almost all theaters of operation as late as 1917, mostly in stopgap situations. This can be attributed mostly to the ultimate mystery in the Scout's history: it was never properly armed with a gun synchronization mechanism. Even in the 80-hp C configuration, the Bristol Scouts were the equal to, or better than, a majority of Allied planes of the late 1915 and early



The author, Hank Iltzsch, isn't checking the weight of the Scout—but is expressing delight in finding no apparent damage after nosed-over landing. It weighs about 15 pounds.



The Scout has excellent overall moments, and a good layout in general. Note large horizontal tail surfaces, which contribute to exceptional pitch stability of model—as it did with prototype.

1916 time period in most areas of performance.

As with most planes of this period, the Bristol Scouts experienced a number of running changes in various configurations. The serious modeler must be careful to select a precise serial number, and chase down the variables which might be on that particular plane. Although the C and D models, for the most part, looked pretty much the same, there could be several areas of variation at any time, not the least of which were the differences between RFC and RNAS planes. Other areas of difference were in rudder and elevator configurations, ailerons, and cowlings for different engines. With careful research, and appropriate adjustments, any C or D model Scout can be constructed from the plans and information provided in this article.

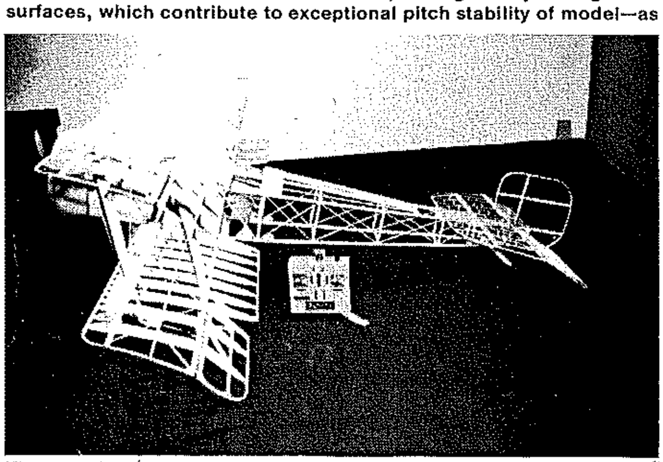
The reason for my selection of this particular Scout D—RNAS serial number 5393—was my access to three excellent pictures, showing good detail on this plane, in an issue of *Air Power* magazine.

The model did not start out to be a Scale project. I had previously designed and built a large biplane, ultimately named the "Great Waldo Bipe," which was published in another jounral. This was purely a sport plane. I then decided to build a stand-off or look-alike plane of some kind, which generally would fit the parameters of the Bipe. This would almost surely then be successful, as I had been through three seasons of successful flying with Waldo. After a good deal of study and sorting, I felt that the Bristol Scout at 3 in. = 1 ft. scale would fit the bill.

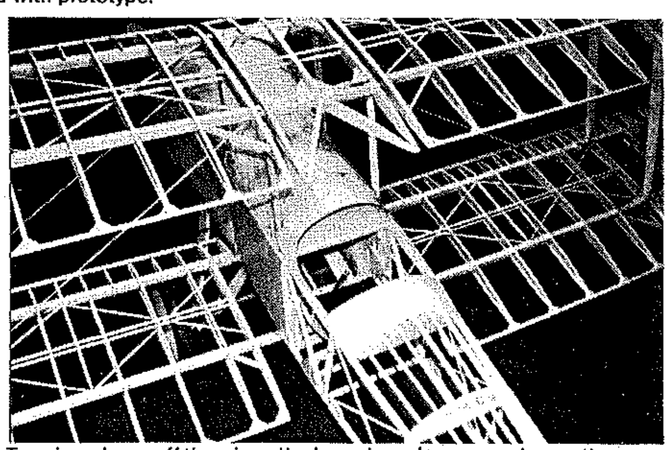
As with any project of this kind, you tend to look back through publications, etc., to see what others have done with a particular subject aircraft. In the process, I was gathering more and more information on Bristol Scouts. I could not, however, find any indication that this aircraft, although very well known, and much modeled, had ever been done for Precision Scale.

Unbeknown to me, a group of highly motivated, ingenious, and prankish guys of Olean, NY, known as the STARS, were working parallel with my thinking. They eventually produced a whole fleet of magnificent stand-off 3-in.-scale Scouts of great fame.

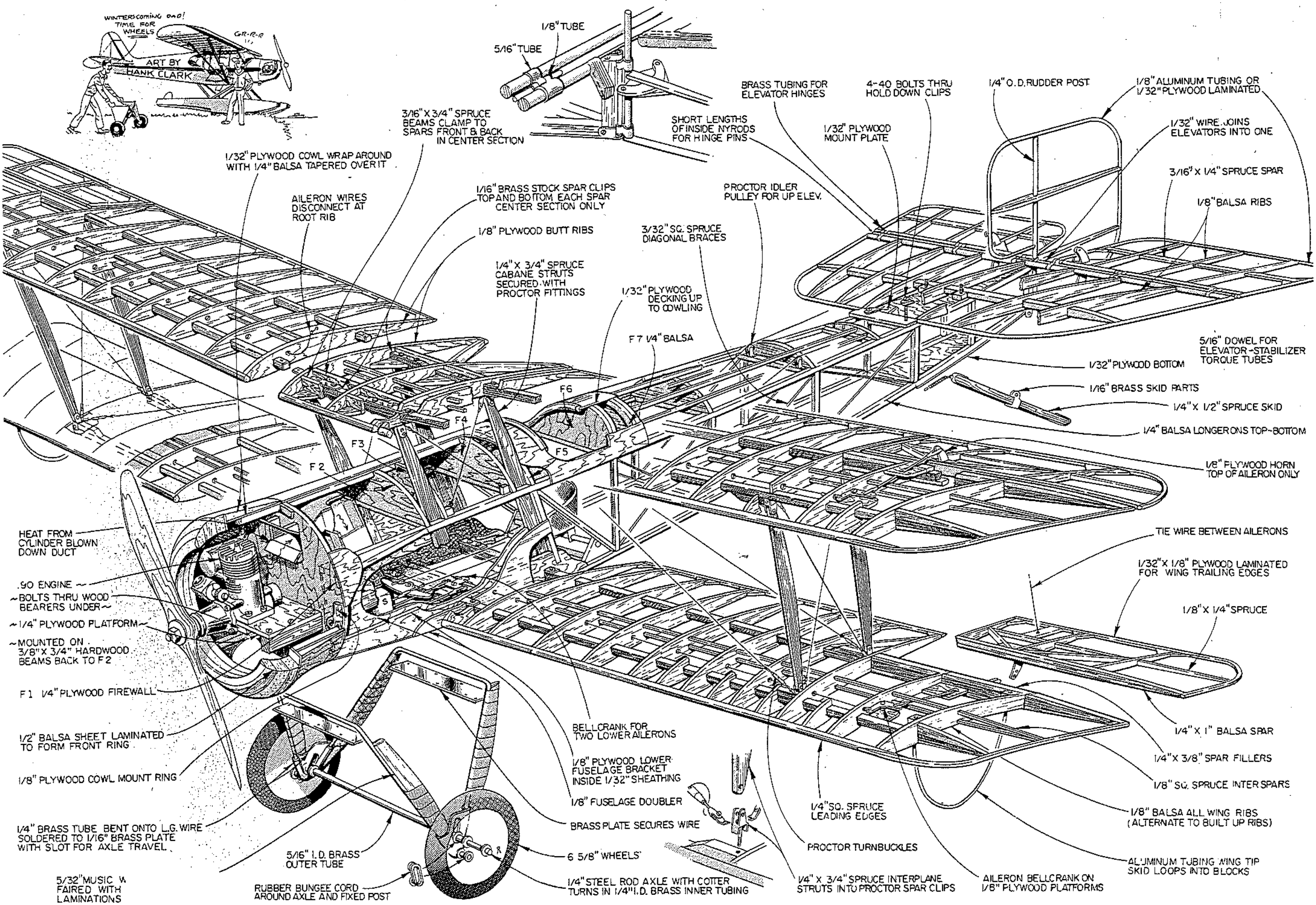
My project took a permanent turn toward all-out-scale when I learned that Leo Opdycke, who published a marvelous journal called *World War I Aeroplanes,* was beginning construction of a full-scale replica of the D, and he had original factory drawings. With this kind of information, it would not have been fitting to attempt anything other than a full-blown Precision Scale project. I might interject, here, that anyone interested in WW I aircraft should write to Leo and get on his mailing list. There is no subscription charge, only



The completed and temporarily assembled framework, ready for checks on alignment of flying surfaces and control cable runs.



Top view shows off the wing attachments and upper center section construction. Overall scale construction is well illustrated.


WINTERS COMING DAD! TIME FOR WHEELS
GR-R-R
ART BY HANK CLARK
1/8" TUBE
5/16" TUBE
3/16" X 3/4" SPRUCE BEAMS CLAMP TO SPARS FRONT & BACK IN CENTER SECTION
1/32" PLYWOOD COWL WRAP AROUND WITH 1/4" BALSA TAPERED OVER IT
AILERON WIRES DISCONNECT AT ROOT RIB
1/16" BRASS STOCK SPAR CLIPS TOP AND BOTTOM EACH SPAR CENTER SECTION ONLY
1/8" PLYWOOD BUTT RIBS
1/4" X 3/4" SPRUCE CABANE STRUTS SECURED WITH PROCTOR FITTINGS
3/32" SQ. SPRUCE DIAGONAL BRACES
1/32" PLYWOOD DECKING UP TO COWLING
F 7 1/4" BALSA
F6
F5
F4
F3
F 2
SHORT LENGTHS OF INSIDE NYRODS FOR HINGE PINS
BRASS TUBING FOR ELEVATOR HINGES
PROCTOR IDLER PULLEY FOR UP ELEV.
1/32" PLYWOOD MOUNT PLATE
4-40 BOLTS THRU HOLD DOWN CLIPS
1/4" O.D. RUDDER POST
1/8" ALUMINUM TUBING OR 1/32" PLYWOOD LAMINATED
1/32" WIRE JOINS ELEVATORS INTO ONE
3/16" X 1/4" SPRUCE SPAR
1/8" BALSA RIBS
5/16" DOWEL FOR ELEVATOR-STABILIZER TORQUE TUBES
1/32" PLYWOOD BOTTOM
1/16" BRASS SKID PARTS
1/4" X 1/2" SPRUCE SKID
1/4" BALSA LONGERONS TOP-BOTTOM
1/8" PLYWOOD HORN TOP OF AILERON ONLY
TIE WIRE BETWEEN AILERONS
1/32" X 1/8" PLYWOOD LAMINATED FOR WING TRAILING EDGES
1/8" X 1/4" SPRUCE
1/4" X 1" BALSA SPAR
1/4" X 3/8" SPAR FILLERS
1/8" SQ. SPRUCE INTER SPARS
1/8" BALSA ALL WING RIBS (ALTERNATE TO BUILT UP RIBS)
ALUMINUM TUBING WING TIP SKID LOOPS INTO BLOCKS
AILERON BELLCRANK ON 1/8" PLYWOOD PLATFORMS
1/4" X 3/4" SPRUCE INTERPLANE STRUTS INTO PROCTOR SPAR CLIPS
PROCTOR TURNBUCKLES
1/4" SQ. SPRUCE LEADING EDGES
BELLCRANK FOR TWO LOWER AILERONS
1/8" PLYWOOD LOWER FUSELAGE BRACKET INSIDE 1/32" SHEATHING
1/8" FUSELAGE DOUBLER
BRASS PLATE SECURES WIRE
6 5/8" WHEELS
1/4" STEEL ROD AXLE WITH COTTER TURNS IN 1/4" I.D. BRASS INNER TUBING
RUBBER BUNGEE CORD AROUND AXLE AND FIXED POST
5/16" I.D. BRASS OUTER TUBE
HEAT FROM CYLINDER BLOWN DOWN DUCT
.90 ENGINE
BOLTS THRU WOOD BEARERS UNDER
1/4" PLYWOOD PLATFORM
MOUNTED ON 3/8" X 3/4" HARDWOOD BEAMS BACK TO F 2
F1 1/4" PLYWOOD FIREWALL
1/2" BALSA SHEET LAMINATED TO FORM FRONT RING
1/8" PLYWOOD COWL MOUNT RING
1/4" BRASS TUBE BENT ONTO L.G. WIRE SOLDERED TO 1/16" BRASS PLATE WITH SLOT FOR AXLE TRAVEL
5/32" MUSIC W FAIRED WITH LAMINATIONS
S

voluntary contributions. The journal is a wealth of information in this subject area.

Let me tell you, folks, I had never attempted anything of this magnitude before, and I plunged into the project without giving myself the benefit of a consultation with a competent shrink, or better yet, an experienced scratch-Scale man of high experience. If I had, I am sure the project would have been terminated, and the plane would not have seen the light of day.

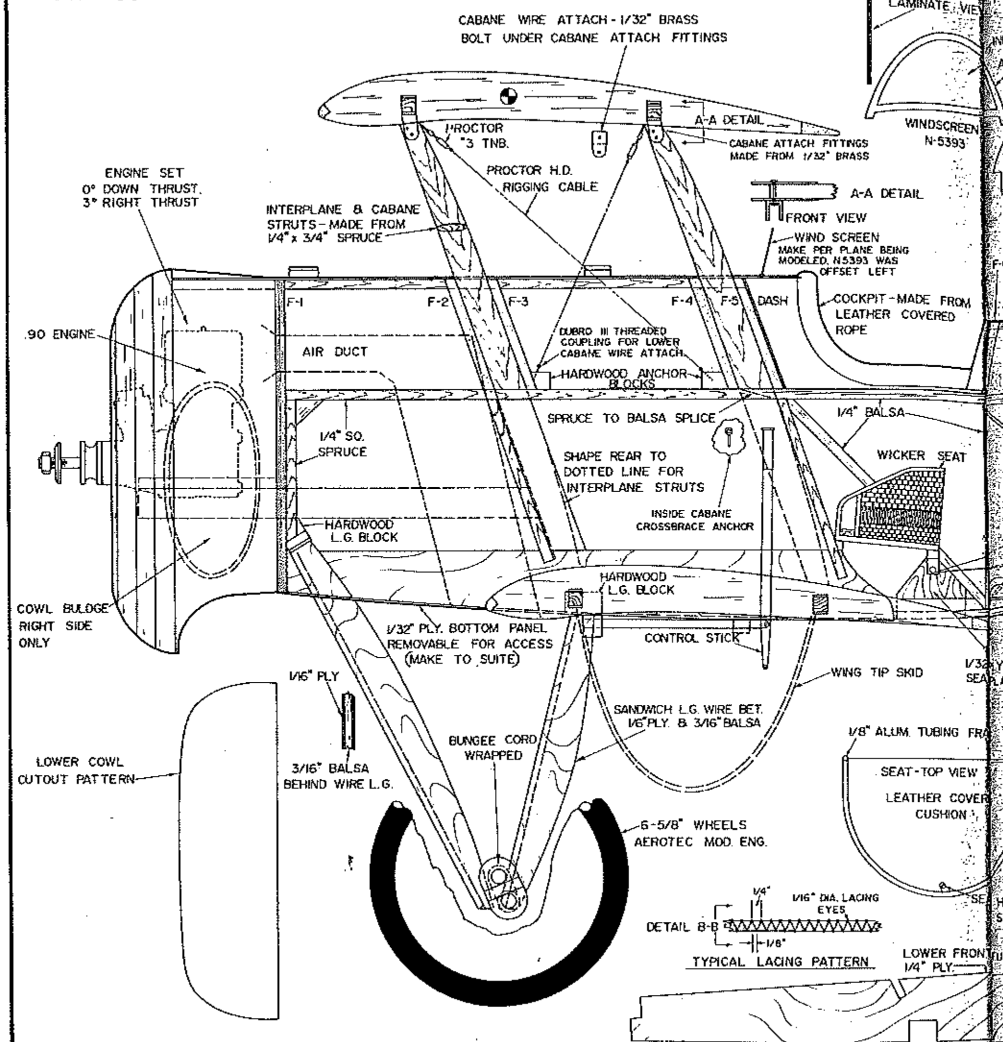
Although biplanes in general, and WW I planes especially, were my favorite subjects of study and modeling, I had only a vague comprehension of what was to be involved in a project of this kind. While building a second plane, in order to lock in details of construction, and to make a few desirable modifications of the original work, I would occasionally stand back from the original plane, and say to myself, "I could not possibly have accomplished all of this."

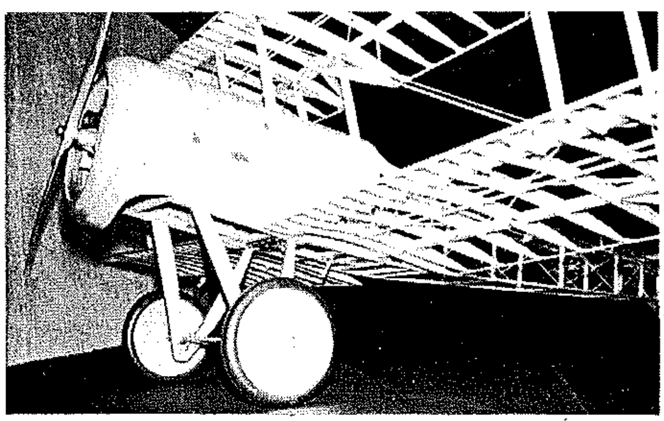
It was only through the continued encouragement of friends, Leo Opdycke in particular, along with my wife's enduring condescension, that it came to pass. Although I hope that, by the time this is published, the second plane will be flying, I feel a third or fourth plane will be required in order to fully and correctly do this wonderful aircraft. As Dave Platt so aptly put it, "You never finish a Scale plane; you just stop working on it."

Those of you reading this, and who have gone through the process of scaling up and building a WW I aircraft, will more fully understand that the single biggest problem I had to overcome with this plane was with the airfoil section. Those of you contemplating such an attempt—heed well the following saga.

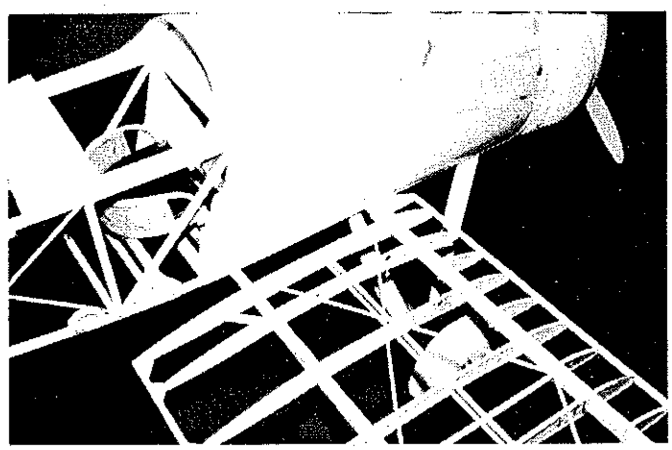
The Bristol Scouts utilized a modified Coanda airfoil section which was modified by Frank Barnwell, who designed the Scouts. It is a very thin, flat-top airfoil, remarkably similar to the Coanda I section, except for the unusual flat top. The Coanda I airfoil is covered in the EAA

FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 128

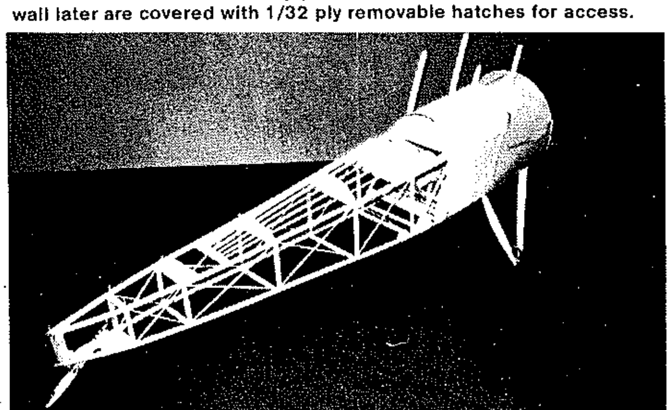




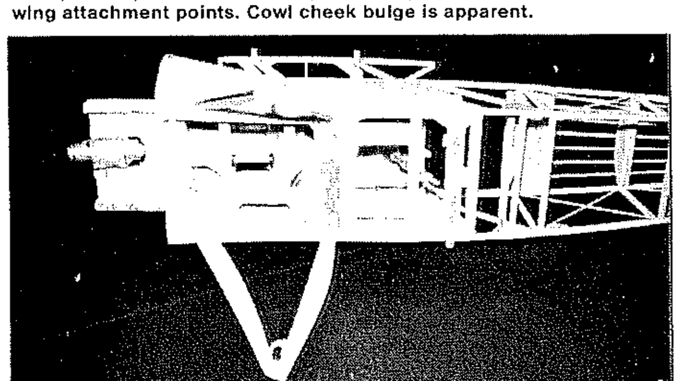
Note cowl cut-out and landing gear assembly. First two bays aft of firewall later are covered with 1/32 ply removable hatches for access.



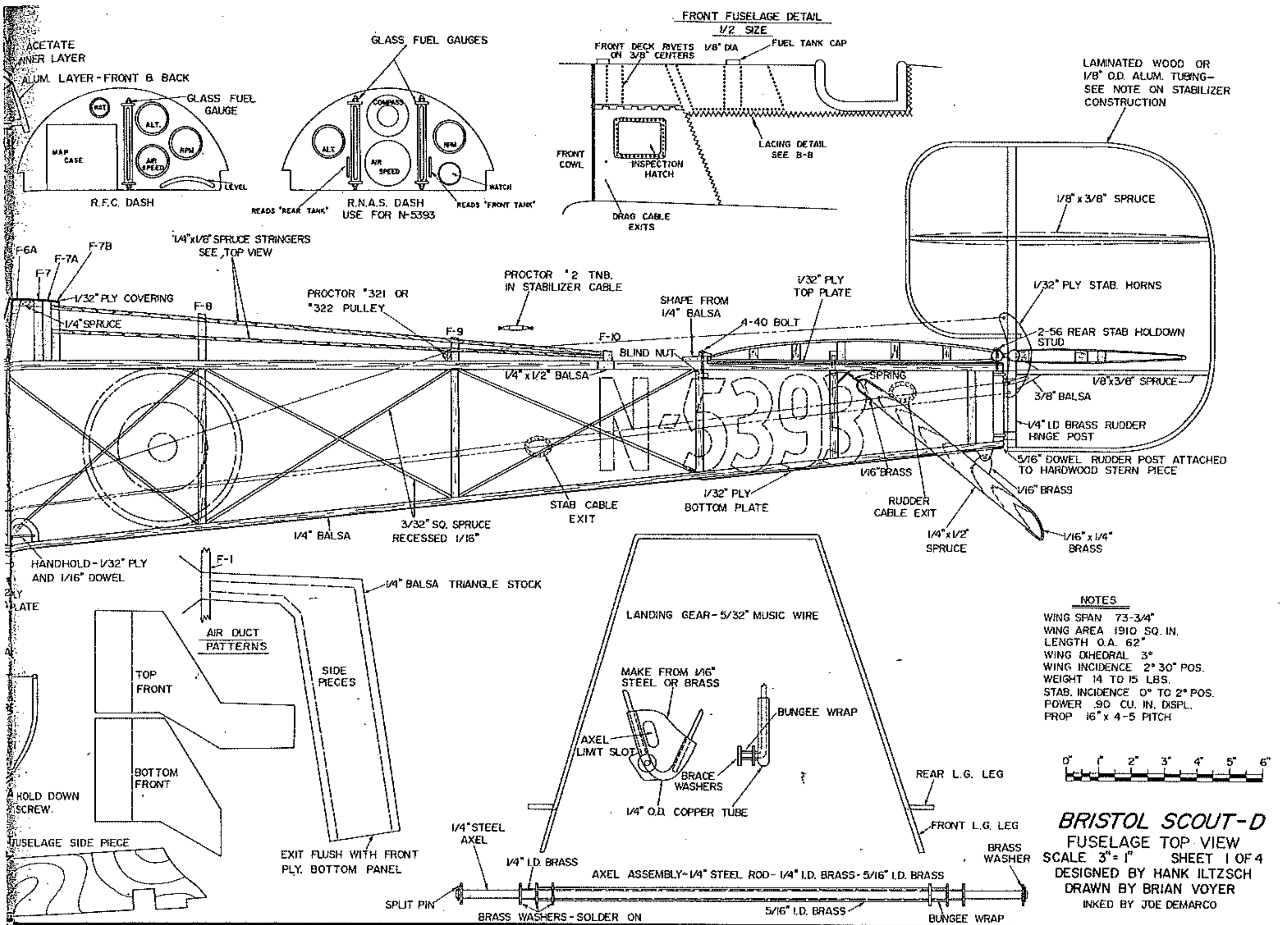
Cockpit area, scale seat already installed, and another look at lower wing attachment points. Cowl cheek bulge is apparent.

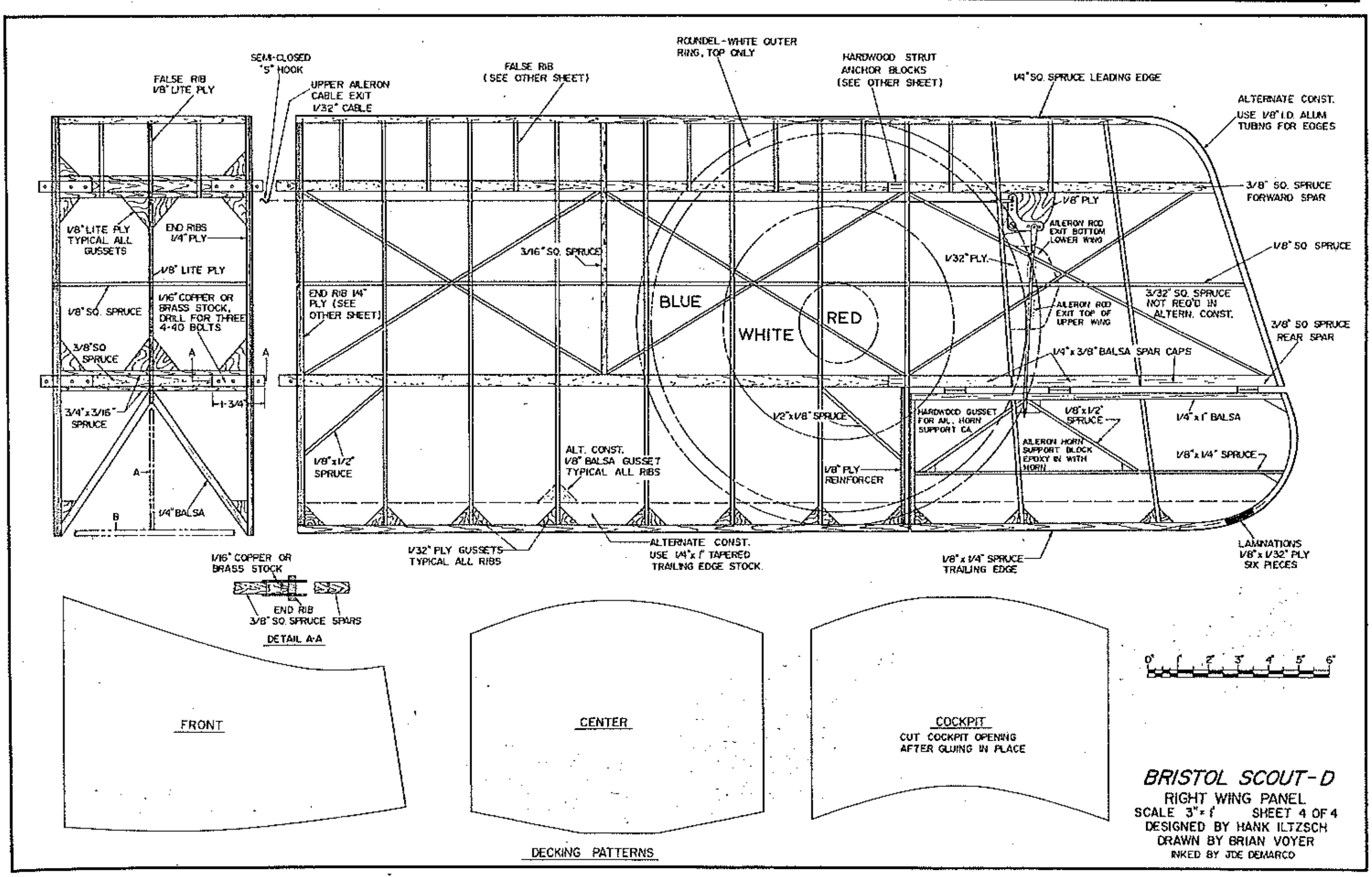


Between the stringers on the top fuselage rear and the stab leading edge, the covering is more or less flat—original design reason is unclear.



Mounting for engine servo on side of air duct can be seen in this view. Note lower right exit point for the engine cooling air duct.


ACETATE
INNER LAYER
ALUM. LAYER-FRONT & BACK
GLASS FUEL GAUGE
R.F.C. DASH
GLASS FUEL GAUGES
READS "REAR TANK"
R.N.A.S. DASH
USE FOR N-5393
READS "FRONT TANK"
FRONT FUSELAGE DETAIL
1/2 SIZE
FRONT DECK RIVETS ON 3/8" CENTERS
1/8" DIA
FUEL TANK CAP
FRONT COWL
INSPECTION HATCH
LACING DETAIL SEE B-B
DRAG CABLE EXITS
LAMINATED WOOD OR 1/8" O.D. ALUM. TUBING-SEE NOTE ON STABILIZER CONSTRUCTION
1/8" x 3/8" SPRUCE
1/4"x1/8" SPRUCE STRINGERS SEE TOP VIEW
F-6A
F-7
F-7A
F-7B
1/32" PLY COVERING
1/4" SPRUCE
F-8
PROCTOR "321 OR "322 PULLEY
F-9
PROCTOR "2 TNB. IN STABILIZER CABLE
F-10
SHAPE FROM 1/4" BALSA
BLIND NUT
4-40 BOLT
1/32" PLY TOP PLATE
1/32" PLY STAB. HORNS
2-56 REAR STAB HOLDOWN STUD
1/4" x 1/2" BALSA
SPRING
1/8"x3/8" SPRUCE
3/8" BALSA
1/4" I.D. BRASS RUDDER HINGE POST
5/16" DOWEL RUDDER POST ATTACHED TO HARDWOOD STERN PIECE
1/16" BRASS
1/16" BRASS
N-5393
STAB CABLE EXIT
1/32" PLY BOTTOM PLATE
RUDDER CABLE EXIT
1/4" x 1/2" SPRUCE
1/16" x 1/4" BRASS
1/4" BALSA
3/32" SQ. SPRUCE RECESSED 1/16"
HANDHOLD-1/32" PLY AND 1/16" DOWEL
F-1
1/4" BALSA TRIANGLE STOCK
AIR DUCT PATTERNS
TOP FRONT
SIDE PIECES
BOTTOM FRONT
HOLD DOWN SCREW.
FUSELAGE SIDE PIECE
EXIT FLUSH WITH FRONT PLY. BOTTOM PANEL
LANDING GEAR-5/32" MUSIC WIRE
MAKE FROM 1/16" STEEL OR BRASS
AXEL LIMIT SLOT
BRACE WASHERS
BUNGEE WRAP
1/4" O.D. COPPER TUBE
REAR L.G. LEG
FRONT L.G. LEG
1/4" STEEL AXEL
1/4" I.D. BRASS
AXEL ASSEMBLY-1/4" STEEL ROD-1/4" I.D. BRASS-5/16" I.D. BRASS
BRASS WASHER
SPLIT PIN
BRASS WASHERS-SOLDER ON
5/16" I.D. BRASS
BUNGEE WRAP
NOTES
WING SPAN 73-3/4"
WING AREA 1910 SQ. IN.
LENGTH O.A. 62"
WING DIHEDRAL 3°
WING INCIDENCE 2° 30' POS.
WEIGHT 14 TO 15 LBS.
STAB. INCIDENCE 0° TO 2° POS.
POWER .90 CU. IN. DISPL.
PROP 16" x 4-5 PITCH
0" 1" 2" 3" 4" 5" 6"
BRISTOL SCOUT-D
FUSELAGE TOP VIEW
SCALE 3"= 1" SHEET 1 OF 4
DESIGNED BY HANK ILTZSCH
DRAWN BY BRIAN VOYER
INKED BY JOE DEMARCO


SEMI-CLOSED "S" HOOK
FALSE RIB 1/8" LITE PLY
UPPER AILERON CABLE EXIT 1/32" CABLE
FALSE RIB (SEE OTHER SHEET)
ROUNDEL-WHITE OUTER RING, TOP ONLY
HARDWOOD STRUT ANCHOR BLOCKS (SEE OTHER SHEET)
1/4" SQ. SPRUCE LEADING EDGE
ALTERNATE CONST. USE 1/8" I.D. ALUM TUBING FOR EDGES
3/8" SQ. SPRUCE FORWARD SPAR
1/8" LITE PLY TYPICAL ALL GUSSETS
END RIBS 1/4" PLY
1/8" LITE PLY
3/16" SQ. SPRUCE
1/8" PLY
AILERON ROD EXIT BOTTOM LOWER WING
1/32" PLY.
1/8" SQ. SPRUCE
1/8" SQ. SPRUCE
1/16" COPPER OR BRASS STOCK, DRILL FOR THREE 4-40 BOLTS
END RIB 1/4" PLY (SEE OTHER SHEET)
BLUE
WHITE
RED
AILERON ROD EXIT TOP OF UPPER WING
3/32" SQ. SPRUCE NOT REQ'D IN ALTERN. CONST.
3/8" SQ SPRUCE REAR SPAR
3/8" SQ SPRUCE
1/4" x 3/8" BALSA SPAR CAPS
1-3/4"
3/4" x 3/16" SPRUCE
1/2" x 1/8" SPRUCE
HARDWOOD GUSSET FOR AIL. HORN SUPPORT CA.
1/8" x 1/2" SPRUCE
1/4" x 1" BALSA
AILERON HORN SUPPORT BLOCK EPOXY IN WITH HORN
1/8" x 1/4" SPRUCE
1/8" x 1/2" SPRUCE
ALT. CONST. 1/8" BALSA GUSSET TYPICAL ALL RIBS
1/8" PLY REINFORCER
1/4" BALSA
1/32" PLY GUSSETS TYPICAL ALL RIBS
ALTERNATE CONST. USE 1/4" x 1" TAPERED TRAILING EDGE STOCK.
1/8" x 1/4" SPRUCE TRAILING EDGE
LAMINATIONS 1/8" x 1/32" PLY SIX PIECES
1/16" COPPER OR BRASS STOCK
END RIB
3/8" SQ. SPRUCE SPARS
DETAIL A-A
FRONT
CENTER
COCKPIT
CUT COCKPIT OPENING AFTER GLUING IN PLACE
DECKING PATTERNS
0" 1" 2" 3" 4" 5" 6"
BRISTOL SCOUT-D
RIGHT WING PANEL
SCALE 3"= 1" SHEET 4 OF 4
DESIGNED BY HANK ILTZSCH
DRAWN BY BRIAN VOYER
INKED BY JOE DEMARCO

handbook on airfoil sections, with data on coefficients of lift, and the lift/drag ratios. From this data it can be seen that the Coanda I was not a very good airfoil. What the flattening-out of the top of the section does to it would be pure conjecture, as no data apparently exists on the Barnwell modification. Unfortunately, this information was uncovered only after the completion of the original plane, and the onset of problems, which were proved later to be directly related to the unusual wing airfoil.

I had felt that, in quarter-scale size, I would get performance somewhat comparable to that of the full-scale plane, as Reynolds numbers in the larger scale are generally more favorable. By all reports, the full-scale plane was a sweetheart of a flier, so I went blithely forward and duplicated the airfoil section faithfully.

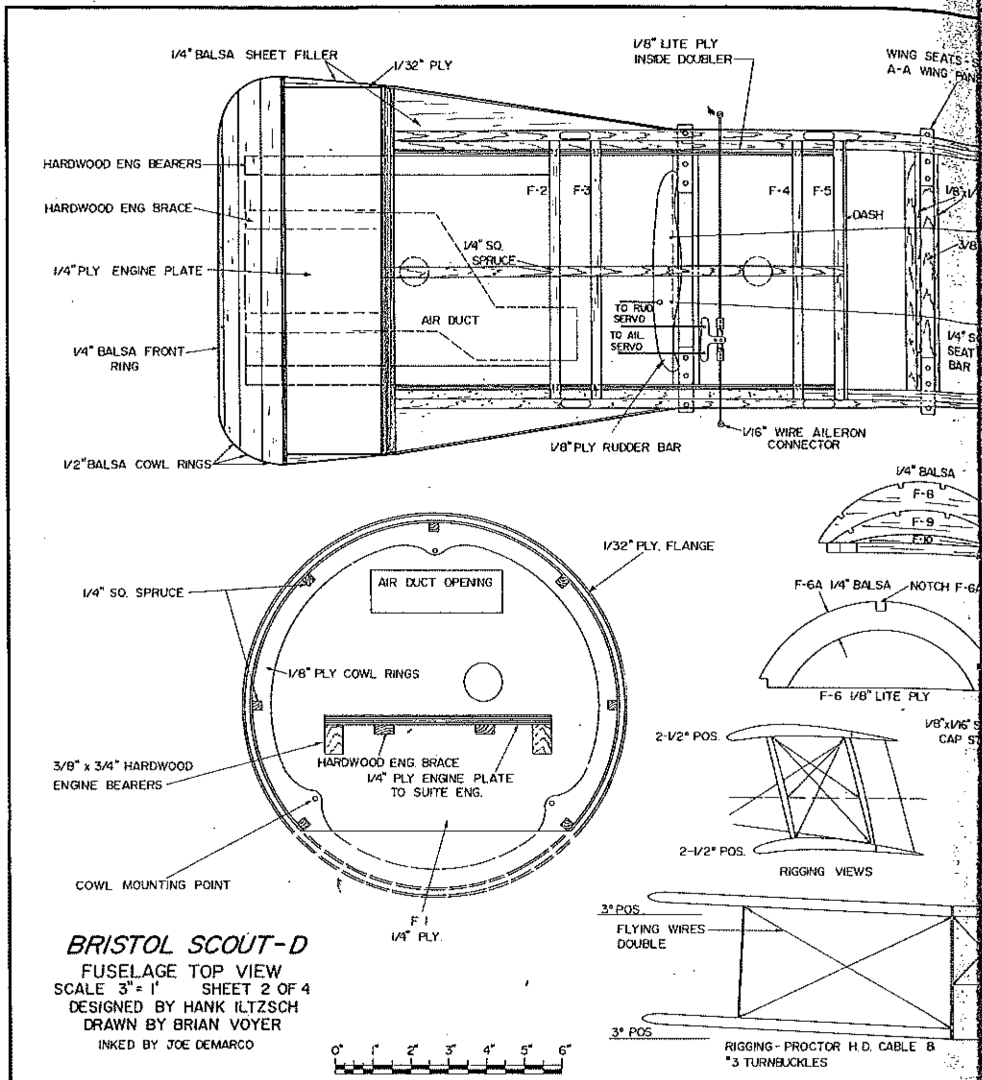
This is not a story of one of those planes, quoted so often, which "flew right off the drawing board with only minor trim changes," etc.

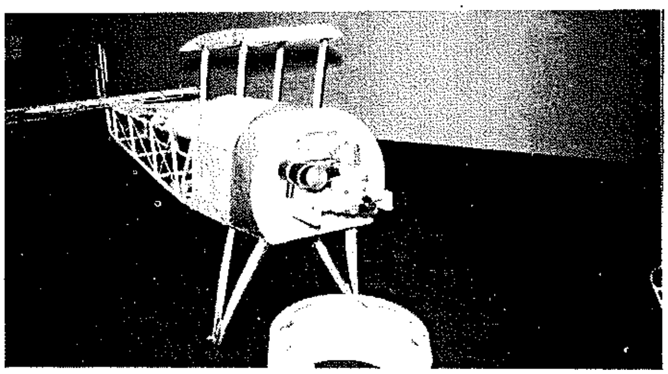
The plane, when completed, weighed just under 15 lb., and was equipped with an OS .80. With almost 1,800 sq. in. of wing area, this gave a wing loading right at 20 oz., and a power factor of about 300 oz./cu. in. There should be no problem, said I, as these stats were almost identical with my Waldo Bipe.

After several abortive attempts to get it flying, each time changing or adjusting something, I finally got it into the air. It flew like the proverbial stone. It could barely get out of it's own way! Altitude was come by dearly, and anything less than full power would initiate a descent. With power off (dead engine), it began a very rapid fall from the sky, with a glide angle approaching 90°.

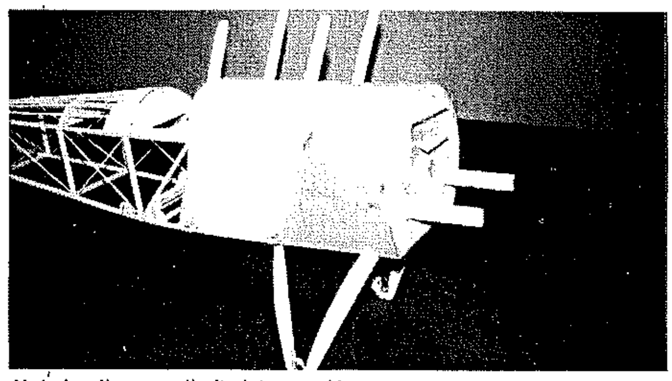
Subsequent test flights were pretty much the same, and even power-on landings were disgraceful. It would approach as if for a normal landing, but there was no flare out, and it would simply quit flying a few feet above the ground,

Continued on page 96

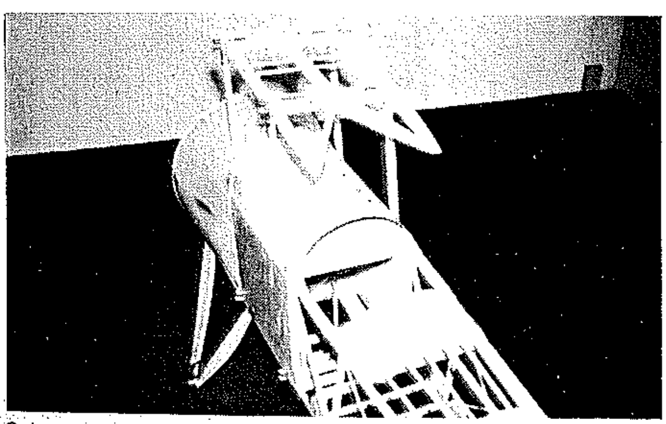




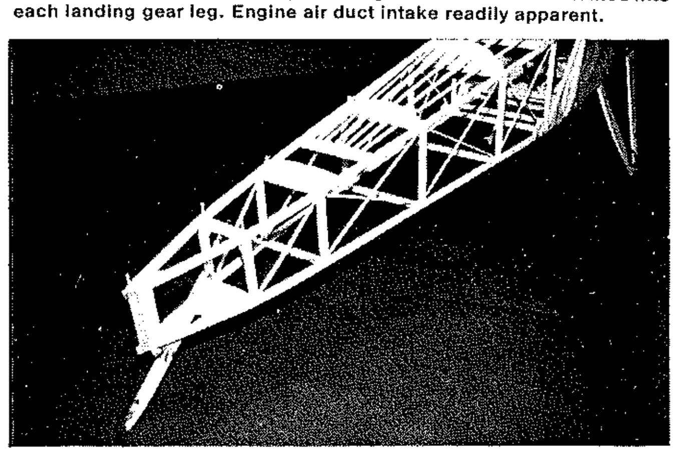
Engine mounting details become clear in this view. And that's what the inside of the cowling should look like.



Note landing gear limit plates, and bungee attachments fabricated into each landing gear leg. Engine air duct intake readily apparent.

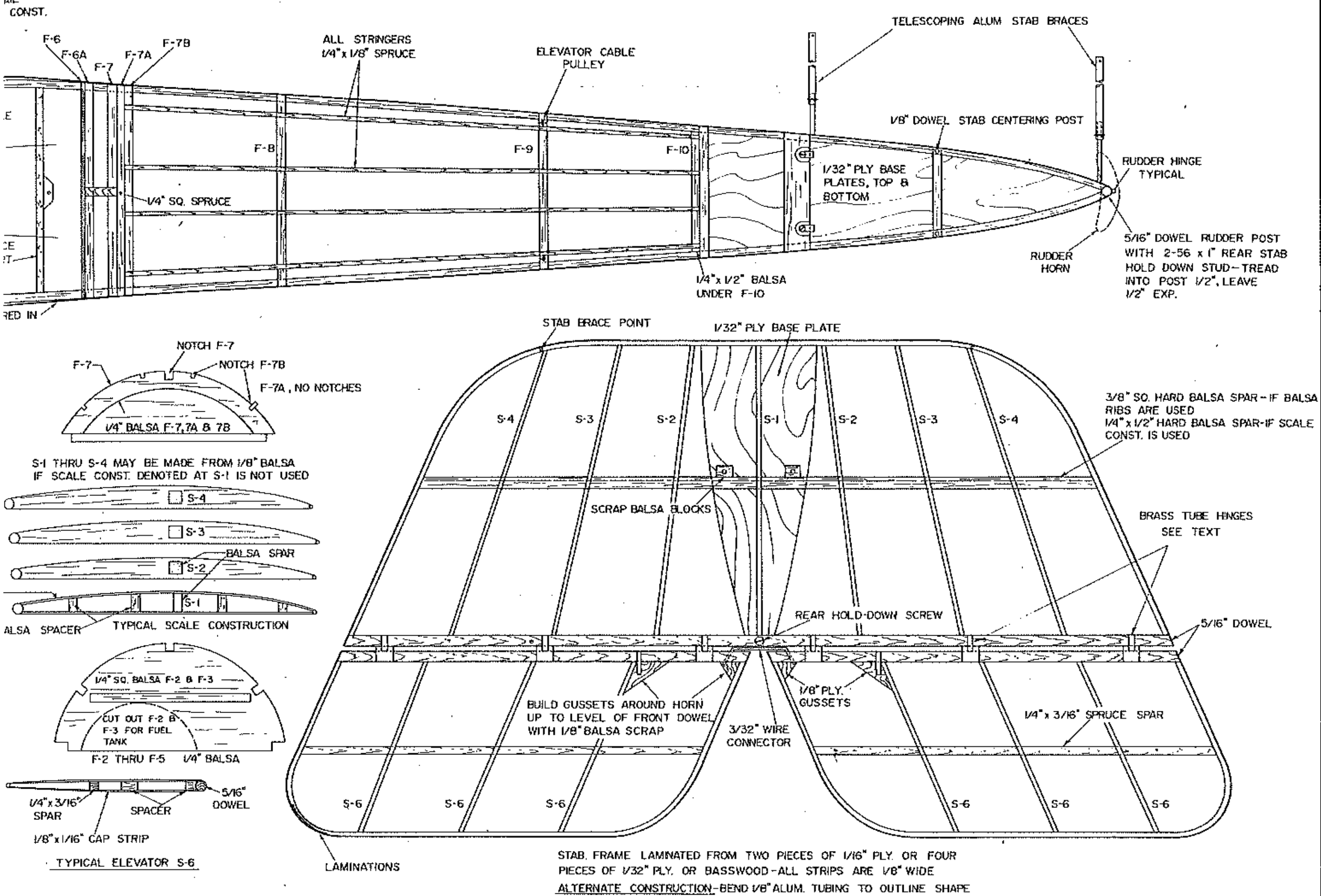


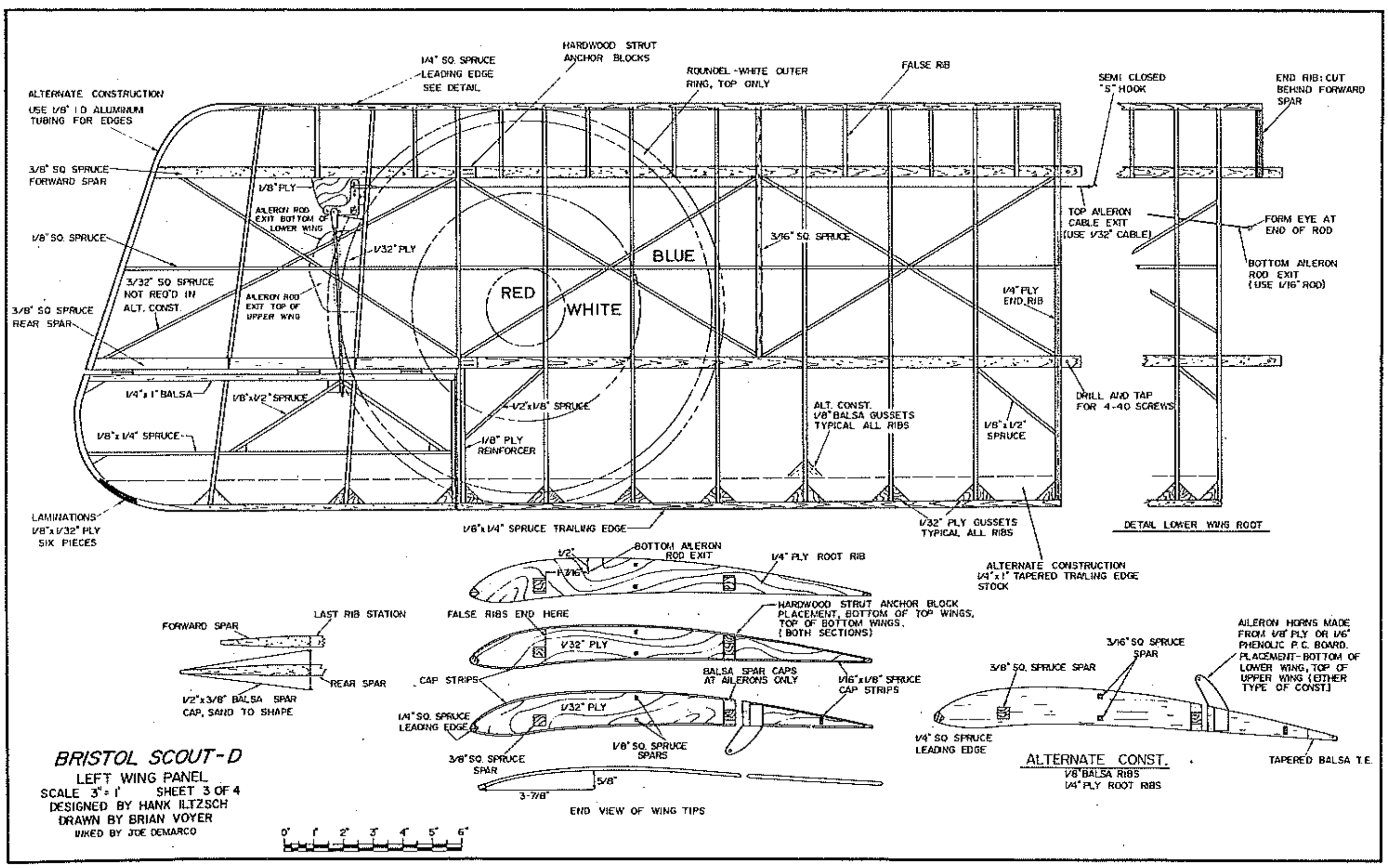
Cabane and wing center section mounting. This early photo shows seven fuselage stringers—a technical error, corrected later (plans OK).



Rear fuselage shot illustrates the functional tail skid, rudder post, stab alignment pins, and front hold-downs.

FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 128





Bristol Scout/Iltzsch

Continued from page 20

and thump down on the gear, bending the axles.

At this point, I tended to blame some of the problems on center-of-gravity (CG) placement, and a deficiency of power. So I installed a Profi .76, which had performed about 20% better than the OS .80 in my Waldo Bipe,and played with the CG—all to no avail. Performance was still lousy. It flew, but barely. Much head-scratching and deep thought finally laid the blame on the airfoil; analysis of all flight deficiencies definitely pointed that way.

You bipe builders know that building two wings is about twice the work of a single wing, but I came to the conclusion that the airfoil needed to be modified or changed in order to achieve a flyable model. To properly do this meant construction of a whole new set of wings! Much study of airfoil sections followed. I didn't want to deviate from the scale undercamber, so I searched for a section which would be esthetically acceptable, and still give the required performance.

I decided to gamble on the ISA-961 section from the EAA handbook. On paper it looked very good. I might interject, at this time, that I feel the EAA book on airfoil sections should be on every scratch-builder's book shelf. I have found that the data relates quite well to models. If you were to compare the data, for instance, of the ISA-961 with that of the Clark Y section, you would find them quite comparable in performance. We all know that the Clark Y is a good lifting section, though slightly high on drag; it still gives a very good lift/drag coefficient.

As I wanted to get a new set of wings built as quickly as possible, I used the alternate wing construction method shown on the plans. This uses ⅛ balsa ribs rather than the spruce-capped 1/32 ply ribs of the original, standard trailing edge stock, and aluminum wing and aileron tips in place of the laminated wood tips used on the original. With this method, construction of the new wings went rather rapidly.

The big day for testing arrived, and I was only slightly apprehensive in spite of previous disappointments. I had confidence in my calculations on the new wing section, as opposed to having dealt with a total unknown before. Fellow members of the South Shore Radio Control Club, who had witnessed some of the previous flights, were all set to witness another hairy-scary flight of the WW I monster. Only a few knew of the wing change, and it would have taken a very astute and knowledgeable fellow, indeed, to detect the difference between the new and old versions.

To shorten the story, the plane performed in a manner which I originally hoped it would. Take-off and climb-out were majestically scale-like. A few times around, checking various controls, and making only a slight aileron trim adjustment, it was time to see about the landing. I set the plane up for a landing approach, cut the throttle, and the plane began a nice low-angle glide. While still holding a bit of power, I flared the plane, and it settled in for a nice gentle landing. The only sour note was a graceful nose-over on roll-out, which was due to premature release of up elevator, a common error with tail-draggers.

Subsequent flights were made, and the only change after this was the installation of a freshly broken-in Webra .91 in place of the Profi .76. the combination was now complete, and dozens of flights were made in this configuration, as I prepared for the entry of the plane in the Rhinebeck WW I Jamboree.

The plans show both the true-scale and alternate methods of wing construction, as previously described. Choose the type or combination of construction that best suits you. On the second plane, for example, (that's the 3rd set of wings!), I am using the scale ply built-up ribs and spruce trailing edge, but retaining the ⅛-in. aluminum tubing tips, as they have proven to be very satisfactory. Instead of breaking a wing tip in a minor accident, the tubing will often just bend, and it can be re-shaped quite readily.

As to my power recommendation, I feel that a .90-size engine is a must. If you do not want to compete in AMA Precision Scale, you could get into the larger engines very nicely—as has been proven by the STARS with their Quadra- and Roper-powered stand-off models of this plane. This would require some modification of the firewall, and deepening of the cowl. I have several of the larger engines, and intend to put one of them in the original plane after completion of the second plane, which I will use for Precision Scale competition.

I know that the plane can be flown with an OS .80 or Profi .76, but the .90-size gives the edge needed to overcome the large frontal area drag, while retaining a margin of reserve power for emergency situations. Best prop size has proven to be a 16 in. with 4, 4½, or 5-in. pitch.

Construction, for the most part, is rather straightforward in most areas. I have attempted to duplicate original construction, within normal modeling limits, as closely as possible. At the same time, I wanted the plane to be transportable in something less than a moving van. The plane has gone to the field many times in a VW Rabbit, often accompanied by another plane or two of small size, along with all required support systems. As with any Scale plane, the small things seem to take the most time, while adding the greatest amount of authenticity. The following is a guide, which will serve the knowledgeable builder with almost all of the required information.

It should be noted that all photos accompanying this text are from the original plane. There have been areas of upgrading and change during the course of building a second plane, but since the second plane was not completed when this was written, I did not include any photos from its construction, in order to avoid confusion. The changes have been incorporated into the plans and construction details, however.

If descrepancies are noted, the plans contain the updated material relative to improved authenticity of construction, as well as attempting to give better methods of construction in certain areas. Using these changes will result in a slightly more favorable weight factor, as the original was marginally under the AMA limit for Precision Scale.

Fuselage. First, construct sides. Use epoxy on all joints. Laminate ⅛-in. lite ply doublers to inside of each fuselage side with epoxy. After carefully marking their positions on the inside of the front doublers, epoxy on the motor mount beams. Cut two each front and rear cabane pieces, using either shaped Proctor pieces or make from ¾ x ¼-in. spruce. Mark position of cabanes on outside of fuselage sides, and after cutting out a piece of the upper ¼-in. spruce longeron to accommodate, epoxy the cabanes in position on the outside of the fuselage. Use slow-setting epoxy, and carefully check alignment and that both sides are identical.

Epoxy firewall, F-2 through F-5, and the two wing seats in place, making sure of squareness in the top view. With the fuselage upside-down over the top view, and with the cabanes hanging over the edge of your workbench, epoxy in the shaped stern post. Add top formers F-6 through F-11, along with their bottom pieces. Add rear cross pieces and the 1/32-in. ply stern plates, top and bottom.

Now add the aft ¼ x ⅛-in. spruce stringers, and the short pieces of ¼-in. spruce between F-6 and F-7. Add ⅛ x ¼-in. spruce inside, and ½ x ⅜-in. balsa on top of main fuselage longeron between F-5 and F-6. Sand balsa piece to shape of formers.

Construct the cylinder head air duct per drawings. This may be fitted and installed now, or simply fitted and installed permanently at a later time when more convenient. Cut and fit servo tray bearers. Keep the servos as far forward as possible, and to the right of the fuselage in order to clear the cylinder head air duct. Mount three servos here: rudder, elevator and ailerons. Provide a mount on the side of the air duct for the throttle servo.

Construct and fit the rudder bar and aileron connector bellcrank. An excellent base for these can be made from molded nylon bearings, such as used on the firewalls for tricycle gears.

Bend the landing gear wires from 5/32-in. tempered wire per detail on plans. Fabricate a landing gear guide plate from thin sheet steel or brass. A piece of ¼-in. O.D. copper tubing is used to form the bottom U-shaped piece at the junction of the front and rear landing gear wires. The guide plate conforms to this shape, and goes on the outside of this copper connector. Be sure, when making up the wire gear, that you leave enough wire projecting out for the lower bungee retainers. It is best to make these too long, and cut off after having added the copper washers and copper tubing spacer to this piece. Hold the whole assembly in alignment on a separate block of wood. Check all dimensions, then silver-solder all parts well. Don't forget to add the copper washers and the spacer to the bungee connectors.

Install the landing gear blocks into the fuselage, then fit and add the wire gear assembly. Recheck alignment, and then fasten in place with 3/16-in. ply plates and ½-in. metal screws. this will allow for easier removal later, in the event the landing gear is bent.

The front ¼-in. spruce stringers should now be added. Note that front pieces splay out to the firewall edge. Add small pieces of scrap around the point where these pieces meet the firewall.

Install the rear seat brace of ¼-in. spruce between the two 1/32-in. ply plates on the outside of the fuselage. Below this is mounted a piece of ⅛-in. aluminum tubing, inside of a piece of outer Nyrod material. This is a bearing surface for all of the cables for the rudder and elevator. On the full-scale plane, small pullies were mounted here for each of the wires. The builder may elect to follow the full-scale practice here for added effect, but alignment of the control wires would be more critical and difficult.

Mount the spruce blocks at inside corners of each cabane. These are to accommodate the anchors for the cabane side brace wires. Sand to the contour of the adjoining formers, F-2 and F-3. These will be covered over with the front ply covering. At this time, fix into place the inside cabane brace wire connections. These may be small hook eyes or some form of convenient connection for the brace wires, and should be quite strong. As can be seen on the rigging diagram, these wires cross at a point just above the front covering, so placement can be best ascertained by running a straight-edge from the top of each cabane brace to a point on the opposite inside fuselage, which will assure that these wires cross above the covering, and not at a point below it.

Add outside ¼-in. spruce fairing strips from the firewall to former 6. Taper these into the sides.

Continued on page 102

Put ¼-in. balsa strips just beneath these, and shape the same. These pieces will form a point for the covering edge, as well as permit the insertion of pins for the side lacing. Now add ⅛ x 1-in. balsa lower fairing strips between the wing mounts and back to the ply seat mount piece. Add ¼ square balsa strips along cabanes, and sand to taper from top to bottom.

Install and shape pieces of balsa block (1 in. sq. by abut 7½ in. long) from the firewall to the front wing mount. This is a key piece in the cowling shape, so use a little time and care. The shape is somewhat apparent, but is generally rounded and tapered rearward as an extension of the firewall.

The front ply covering may now be added. Approximate patterns are shown on the plans, but make up patterns from cardboard and fit as required before cutting the parts from 1/32-in. ply sheet, as there will be minor variances between one model and another. Note that a slight lip is formed at the edges of the ply covering. Leave it—don't sand it off, as this was the way the full-scale was made.

Construct and install the tail skid and fittings. The pivot fitting is made from brass strip or sheet. Attach the base fitting to the hardwood stern post, using four small sheet metal screws. The fittings at the top and bottom of the skid are of ¼-in. brass strip. The full-scale plane used bungee cord to connect the front of the skid with the upper side of the fuselage, but I felt it to be better to use a spring attachment here to avoid the servicing which, otherwise, would be necessary.

Make up and install the control stick and dummy pivot linkage, which is visible below the bottom of the fuselage. I found that ¼-in. aluminum tubing was best for this. Use a short piece of rubber tubing for the control stick handle. I originally had the control stick hooked into the elevator linkage, but found that this caused periodic binding of the elevator, not a desirable affliction, so I dummied it off and simply ran a wire from the lower end of the control stick, around the underseat bearing rod and back to the upper connection on the stick. This simulated the real controls, and made the stick movable, without interference with actual controls.

Fair-in the landing gear wires. This consists of a sandwich-type construction of 1/16-in. ply outer pieces and 3/16-in. balsa inner pieces. Epoxy these together, with the landing gear wire forming the leading edges. They should then be sanded round, fore and aft. When covering, later, wrap with covering material in a diagonal striping pattern at about ½-in. intervals. This is as per full-scale practice.

To be continued.

Radio Technique/Myers

Continued from page 23

Measure it or calculate it. I'll show you how.

A = Downwash angle on the tail (in degrees). You'll have to guess about this one. It's about 5°. Downwash is what causes a plane to pull itself out of a dive, eventually, if there is enough room.

F = An empirical function of an angle which I have developed from wind tunnel tests. Use the following values in your calculations:

(A+D)	10	15	20	25	30
F	.0000462	.0000505	.0000545	.0000588	.0000630

To convert the answer into servo torque required, simply multiply by the ratio of servo wheel (or arm) radius/control horn radius. Actually, due to the angles involved, the conversion requires a bit of geometry. Since we are basing all of our servo measurements on a 90° servo motion, the servo radius at full UP is .707 x the radius measured from the wheel or arm. Likewise, the elevator deflection angle slightly reduces the control horn working radius, though the effect is small and can usually be neglected. Therefore, for estimating purposes, we can say:

$$\text{Servo Torque Required} = \frac{\text{Control Hinge Torque} \times 0.7 \times \text{Servo radius}}{\text{Control Horn radius}}$$

Putting it all together in one equation

$$STR = \left(\frac{.7L_1}{L_2}\right) V^2ScF \text{ in.-oz.}$$

The terms are: L_1, servo arm radius; L_2, control horn radius (in inches).

Sample Problem: Curare elevator.

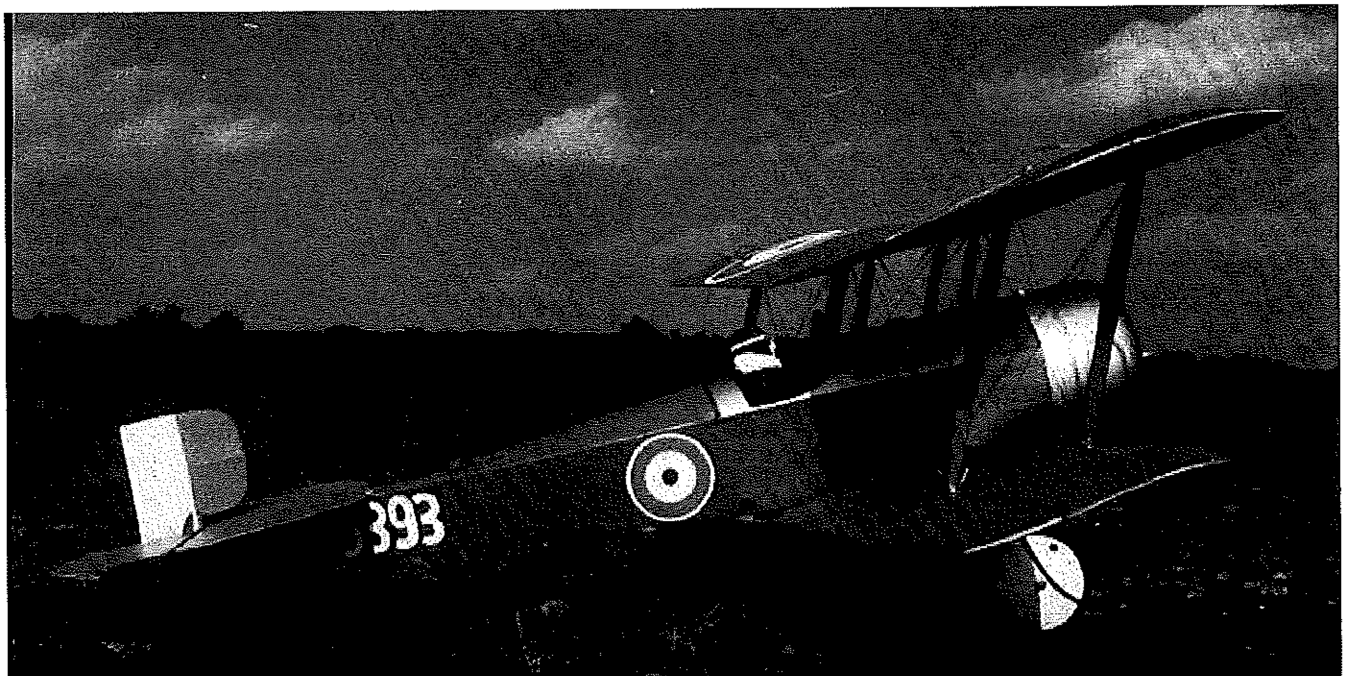
1. Find dive speed and Q.
   Takeoff weight = 9.75 pounds (full tank).
   Projected cross-section areas (gear retracted):

Fuselage	17.0
Cylinder Head	2.6
Header	2.4
Tuned Pipe	1.5
Propeller	4.5
	28.0 square inches

   Q = 9.75/28 = 0.348 pounds/square inch
   V_{dive} = 130 mph (from graph) propeller stopped.

Note: Dive speed can actually be less than, equal to, or greater than the value shown on the graph, depending on propeller pitch and the engine rpm. "Propeller stopped" is an average sort of answer.

2. Find servo torque required



Bristol Scout Model • D

Many of the fine finish details can be seen in this view of the completed model, caught in a very realistic pose. All construction drawings for the model were presented last month—see page 128 for price, ordering form. For real-life look, dummy pilot is a must.

Last month the author took us through design considerations in general, and in constructing the fuselage. He concludes, here, with wing and tail surfaces, controls and rigging, and flying. The model is suitable for RC Precision Scale, Sport Scale, or Giant Scale—.90-size engine ideal. Part 2. ● Hank Iltzsch

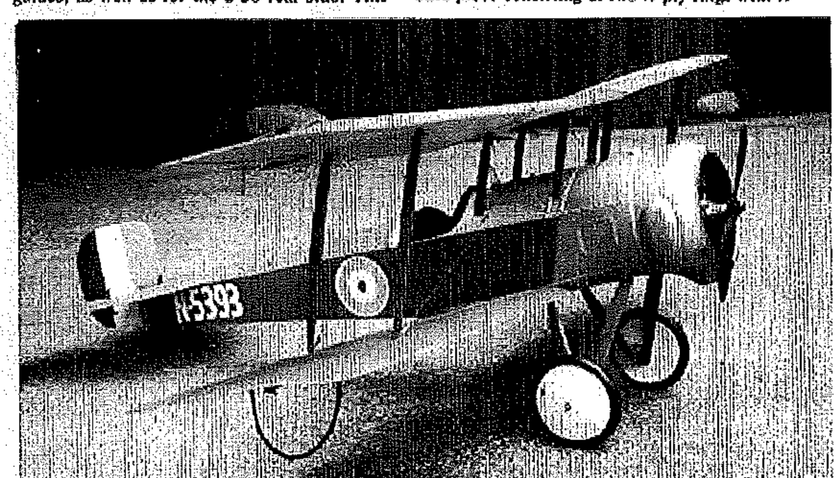
FABRICATE the elevator and rudder hinges. These are made up by silver-soldering two sizes of brass tubing together, ⅛-in. and ¼-in. outside diameter (O.D.) for the rudder, and ⅜-in. and 5/16-in. for the elevator. After soldering, cut off slices, and make the two hinge pieces by filing and cutting to fit. See plan for dimensions. Use short pieces of inside Nyrod for hinge pins, inserting a small brad down the center hole to lock in place.

Construct the stabilizer, elevator and the rudder assemblies, including the rudder post. The hinges must be placed on the dowels at the hinge lines of the stab and rudder before proceeding with construction. Leave them loose—align and epoxy or Hot Stuff into place later. Fabricate and install the elevator and rudder horns per positions on plans.

Fit the stab assembly to the fuselage, aligning carefully, then drill out for 4-40 blind nuts at the front mounts, and for ⅛-in. dowel centering guides, as well as for the 2-56 rear stud. This arrangement provides for adding positive incidence to the stab if required, as per full-scale arrangement, as well as a secure stab mount—which also allows easy removal if needed.

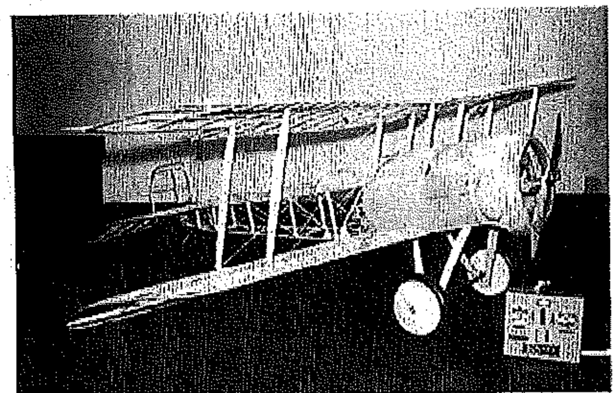
Cowl and front end. The cowl is made up of a base piece consisting of two ⅛ ply rings with ⅛

Hank Iltzsch and the Bristol Scout Model D. This shot by Ernst Mausolf, others by the author.

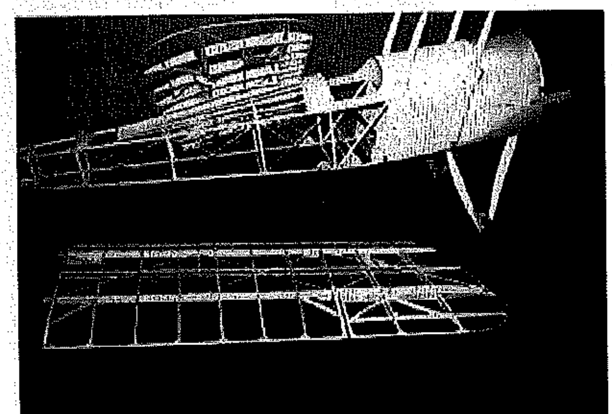


An early shot of the (nearly) finished model. Details such as dummy engine, cockpit interior, and other small items hadn't been added. See reference listing at end of the article.

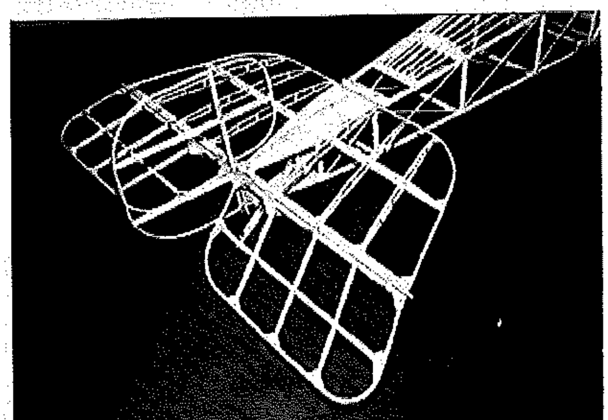
The completed model before the framework is hidden by Coverite—it takes four rolls—has such beauty that it is hard to think of hiding it.



Alignments, fits, cable runs, and control action must be right before finishing. Minor misalignments are difficult to correct later.



Enough pieces are shown in this picture for a monoplane—but there's more to be done, since this is a bipe.



Tail surfaces are true-to-scale. Long stab hinge pin, a piece of inner Nyrod, is temporary. Final installation uses short pieces.

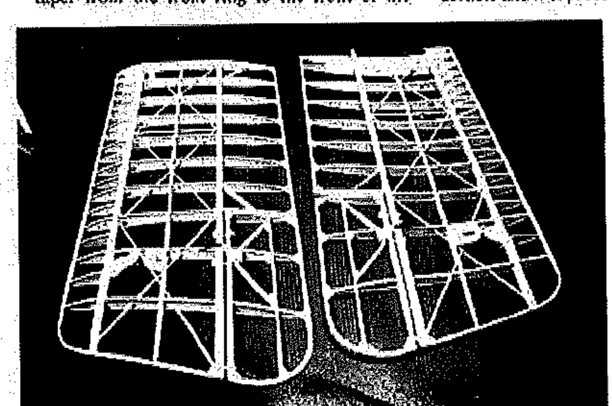
square spruce cross pieces. Note that the front ring is slightly larger than the rear ring. This gives a slight taper to the cowl, a point often missed on this plane. Wrap a piece of 1/32 ply around and between the rings, butting against the front ring and covering the rear ring. This will leave a small lip at the front ring. Sand off the excess ply covering at the rear, and fit to the firewall with #4 x ¼-in. sheet-metal screws at all indicated mounting points.

Add the balsa pieces around the perimeter of the cowl, grain running fore and aft. Use ¼-in. by about 1-in. pieces for this. When dry, fill between pieces with your favorite filler, then sand in the taper from the front ring to the front of the fuselage. Use about ¼-in. wide strips of 1/32-in. ply around the rear perimeter of the cowl and the firewall. This simulates the mating flange. Sand to a slightly rounded shape that fairs in smoothly.

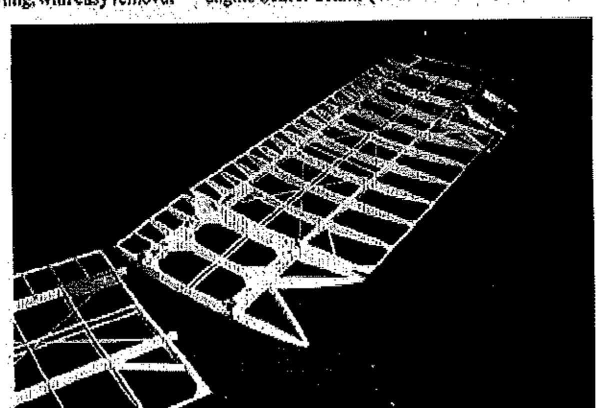
Next, make up concentric rings of ½-in. balsa (or pine if you are up to the task of sanding this to shape and want a more ding-free cowl). Add these rings to the front of the main cowl base, and sand to shape. When this is completed to your satisfaction, coat the whole cowl with polyester sanding resin. Two or three coats should be about right. Sand smooth on the outside between coats, then finish off with wet-or-dry 400 (use wet for the final finish). This will give a light, durable and fuel-proof cowling, with easy removal for access to the engine when needed.

Use the same resin and sanding technique on the ply front covering. When ready to finish these parts, spray with one or two coats of acrylic auto primer, and then several coats of Aerogloss Silvaire Aluminum dope, sanded with #400 between coats. A finish coat of a flat urethane varnish may be added to increase fuel resistance of the finish.

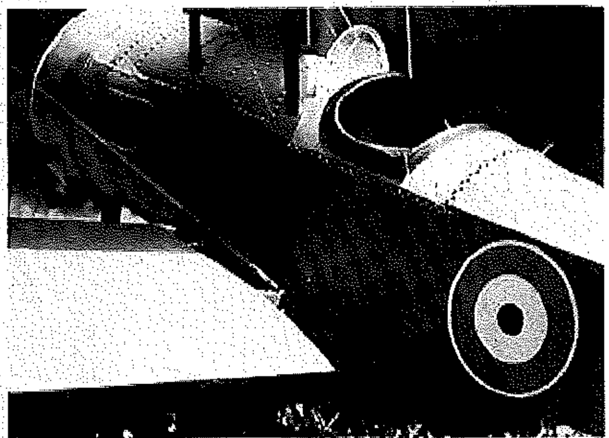
We can now make up an engine mounting plate to fit between the engine bearer beams. Cut out and fit to your engine, putting 3° right thrust into the mount. Make up a battery box of ⅛ ply. Coat with epoxy or resin, and bolt to the bottom of the engine bearer beams (or as I later did, make up a



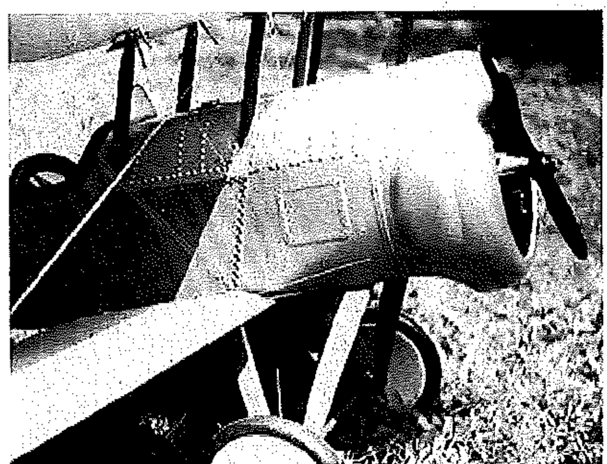
Scale construction used in original wings is not overly difficult, is esthetically pleasing, and surprisingly light. Exact scale airfoil shown here was all for naught, as explained last month in Part 1.



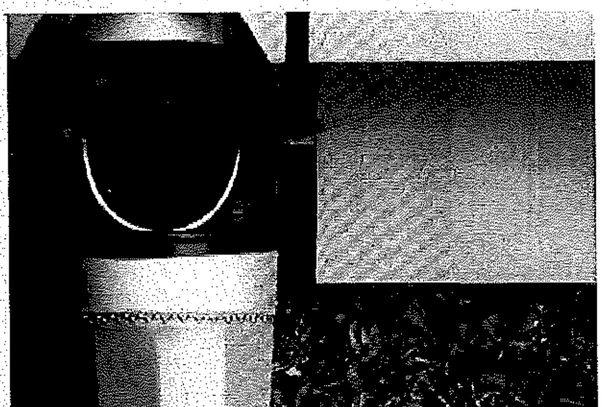
Upper wings (original scale construction) showing attachments to center section. A proper center section is important, as it affects all flying surface alignments—not difficult, just takes a little more time.



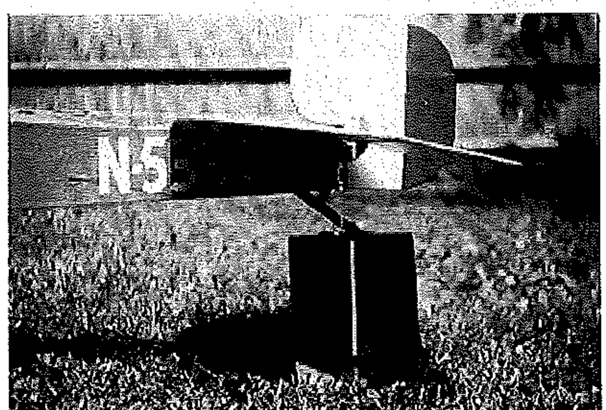
No instruments yet, but lots of rivets and lacing eyes. Left-side windshield placement was typical only for this particular prototype's serial number. Placement of the windshield was a pilot option.



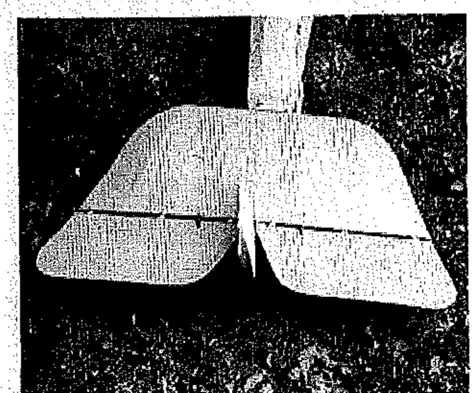
Good shot of the front end treatment. Note the exit points for the drag lines just aft of the cowl. Cabane cross bracing clearly shown.



Go ahead and climb into the cockpit. On your way into the pilot's seat, you can pluck the flying wires to check for proper adjustment.



Look carefully at the aft section of the model—for exit points of the control cables, rudder hinge, and tail skid.



Big stabilizer makes for a good flying model. Has around 340 sq. in. area. Note scale hinging system and front stab hold-downs.

box with ears along sides, and fit aluminum channels to the engine bearers). This allows the battery box to be taken out readily, with batteries intact, for inspection, charging, etc. The space between the bottom of the engine plate and the battery box is the place to put any lead needed to balance. Incidentally, I used two 550 mAh packs side-by-side, and hooked up through a "Y" yoke back to the switch. This gives a low profile, compact arrangement, with reserve battery power which is desirable on any plane of this size. The only drawback is that the packs must be charged individually, and not through the usual charging jack in the switch circuit.

Install the servos, fuel tank, and all linkages and lines in the fuselage. For the control cables, use 20-lb. test nylon fishing line for a temporary installation in order to check control, alignments, etc. When the permanent control cables are installed, use nylon-covered wire cable, such as is available from Proctor. Use the heavy duty. Do all of this final installation of control cables after the the covering and finishing are completed. You can check, with the temporary cables in place, as to whether or not the exit points of the cables from the fuselage sides are at the points indicated on the plans. If not, make note of any differences, as holes will have to be cut later in the fabric covering to accommodate these lines. Precise measuring of these points at this time will eliminate much fuss and needless patching later.

Wing construction. Cut out ribs, after deciding which type of construction to use. If scale ribs of 1/32 ply are to be used, it is convenient to set up some sort of a jig to hold cap-strips in place and to hold the web piece in place 1/32-in. off of board while gluing up. Cut main spars to length, and taper tip ends as shown. String ribs onto spars, and locate over plan; hold in position, and glue. I prefer to use DuPont Duco cement for this, something I learned from building Lou Proctor's kits. Add leading edges, trailing edges, and trailing edge gussets. The ailerons are made by cutting out later, so build as if it were a solid wing.

Glue on tips with epoxy. If formed aluminum is used, drill 1/16-in. holes at points of contact with spars, and fill with epoxy when glued up. This will give a strong bond, as epoxy does not, otherwise, hold well to aluminum. Add the balsa fillers at the aileron sections. Cut out and add aileron front piece, then glue together. Add the packing spars, top and bottom, and bend together and glue at tips.

Remove the wing from the building board, and sand the aileron section to shape, tapering to tips, and then sand leading edge to shape. Cut ailerons off at trailing edge and wing tip. After sanding rough spots, add the hinges temporarily. Put in the bellcrank bases, bellcranks, and rods (wires in upper wings). Check for smooth operation. Next, add the aileron rod fabric supports, keeping them level with the surface of the ribs.

Construct the wing center section, complete with wing mount stub fittings and cabane attachment fittings. Fit the wing center section to the cabanes. Drill through the mounting holes with a 3/32-in. drill, and mount with 2-56 bolts. Rig cabane braces per drawing, using Proctor rigging wire and Proctor #3c turnbuckles. This phase of rigging can be done on a temporary basis at this time, or done permanently at a later, more convenient time in construction, or after finishing. It must be done right, however, as it is the real strength of the center section, just as it was on the full-scale prototype.

Fit the wings to the fuselage and wing center section stubs. You can either use temporary jury-

Continued on page 116

therefore, was not used to transmit collective pitch commands to the rotor head. Instead, either a pushrod running inside a hollow shaft, or a wire rod running in a slot along the outer diameter of the main shaft, was used. For those Helicopters, both cyclic and collective pitch were available—but not mixed as in the Kavan Jet Ranger (see Sketch 2). You might recognize the example as the Heliboy beginner head. Later, as Sketch 3 shows, the mixers were added to make the system comparable to that of Sketch 1, with one exception—no other linkage is required to prevent collective pitch changes to the servo rotor, since seperate cyclic and collective linkages are already used.

So, as you see, both direct control and servo rotor control may be applied to the main blades. The little mixer is usually set so the majority of authority is from the servo rotor, but remember, Larry Axelson reversed his mixer ratio (see the February column). Larry felt the shortened-flybar Heliboy was sluggish (slow follow rate); the mixer change brought things back in line.

And that's the end of this line. See you next month.

Dave Chesney, Rt. 9, Box 621A, Greensboro, NC 27409.

Bristol Scout/Iltzsch

Continued from page 44

rigged interplane struts at this time, or go ahead and cut and shape the finished interplanes as closely as possible. At each stub fitting, drill through (carefully centered on the the stub area) with a 5/64-in. drill. Remove wings, and drill out spar stub ends to 7/64-in. so as to clear 4-40 bolts. Tap 4-40 threads into the copper wing center section and fuselage stubs. Put the wings back on, and insert 4-40 x ¾-in. bolts through each point. Fit as required—so that wing stubs go in and out, and bolt goes through and tightens without difficulty.

Control system. The following is a description of the control system in general, and should help clear up some of the slightly nebulous points in the various constructions relating to control functions. Rudder—pushrod from servo to rudder pedal: use of ball socket links is best here. Locate the link on the rudder pedal as close as possible to the point of connection of the control cable; otherwise, differential rudder will result. Run cables from the rudder pedal, under seat and Nyrod-covered bearing bar, and then back to the rudder horns.

The elevator wires run from the servo arm, one from each side of the arm, under the bearing bar, with the lower ones run out the side of the fuselage at exit points noted on plan, then to the lower end of the elevator horn. The upper cables, after leaving the bearing bar, run over small pulleys (Proctor) on top of the fuselage, then to the top of the elevator horns. There is a small turnbuckle in each of these upper cables, for adjustment, as per full-scale. It is also desirable to have some sort of an adjustable clevis on each side of the servo output arm. This should then give any needed adjustment for trimming the elevators. A Du-Bro #111 threaded coupler and clevis clip will do the job here.

The aileron controls consist of a bellcrank assembly amidship, as shown on the plan. Run a pushrod from each side of a long servo arm to each side of the long arms on the center bellcrank. Make up short rods connected to the short ends of the bellcrank, using ball socket connections, out through the fuselage side about ½-in., with an eye formed on the outside of the fuselage. These eyes are connected to eye-end rods running to the lower wing aileron bellcranks, with 2-56 bolts and lock nuts. On the top wing, a cable connects the two top aileron bellcranks, with a hook disconnect under the center of the wing center section. The upper and lower ailerons are connected with a cable. A small turnbuckle at the bottom end will give some adjustment if needed to balance the ailerons.

Remember, the aileron circuit runs in a continuous circle. For example, a right turn command will pull the left aileron down; this, connected to the upper aileron, will also pull it down; through the wire connection of the upper bellcranks, this will raise the upper right aileron which, in turn, pulls up the lower aileron. This type of rigging is quite reliable, and it also allows the disconnection and removal of wings in pairs without upsetting the fixed rigging parameters.

Rigging. This may be carried out either before or after painting the wings. Probably it is best done before, then dismantled, painted and final-rigged later. Rigging is critical. If you take your time and follow the directions listed hereafter, you should have no difficulty. Remember that the wings stay rigged in pairs. Field assembly consists only of plugging in the wing stubs and fixing into place with the 4-40 x ¾-in. bolts, connecting the upper aileron wires, and affixing the drag lines.

Assemble strut and rigging fittings at all points on the wings. Use Proctor fittings, or make up your own as desired. All flying wires are double; landing wires are single. Use Proctor #3C turnbuckles at all points indicated. These are scale size as confirmed by factory drawings. For rigging, I recommend the use of Proctor heavy duty rigging wire.

The next step is to set the fuselage in a level position. If you have an incidence gauge (highly recommended) the wing center section should give a 2½° positive incidence, and the stab 0°. If not, correct now, as this is the foundation for rigging.

Install the wing stub fittings into fuselage and cabanes, and bolt in place. Block up lower wings so that they have 3° of dihedral and 2½° of positive incidence. Fit interplane struts carefully, so that the upper wings show the same dihedral and incidence as the lower wings.

Drill holes through the struts at the fittings, and bolt on, using Proctor #210 bolts or equivalent. Do not move the plane or any of the blocks during this time, or you will need to start over again and recheck each point. Next, install the interplane strut bracing wires, the landing and flying wires semi-tight. Check dihedral and incidence, and adjust gradually with the turnbuckles until all wires are tight, and all incidence and dihedral specs are correct. Properly done, the wings are now permanently rigged, and with all turnbuckles safety-wired in place, they can be removed and transported without further checks. Plan to spend two or three evenings on this phase.

Install the drag wires. I used light springs on each side of the firewall to connect and give slight tension. The wires then exit through the side cowl, and are connected to the upper and lower rear interplane strut fittings. A convenient connector for these can be made from small swivel snaps as used on the end of fishing lines. These are the only parts of the rigging which are taken off at disassembly. Tension on these is not critical; just keep them reasonably taut.

Finishing touches. Covering can now be done. I used Super Coverite, as this gives a good fabric look, is tough, and can be painted with very few coats. Bring the covering on the fuselage right up to the lips of the front decking and cowling edges.

Study pictures of the plane you are copying to get correct access hatches, rivet detail, and other small but important items of detail. If you make the 100-hp Monosoupape-powered version, as mine is, be sure to put the cowl bulge on the right side. These models were the only ones so equipped; all other cowls were smooth.

Rivets can be made from ⅛-in.-head escutcheon nails. Lacing eyes are about 1/16-in. diameter, so use pins with this size head, and stagger the lacing per plan detail.

Color scheme, of course, will be determined by the plane being duplicated. Refer to publications listed in the bibliography at the end of this article for various color schemes.

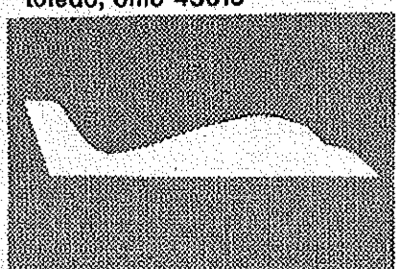
For the cockpit surround, I made up beading from thin leather, with a piece of clothesline rope laminated in the fold. This, in turn, is cemented and stitched around the cockpit opening. A dummy engine can be made from Williams Bros. 3-in.-scale LeRhone cylinders.

Wheels in the proper size (6⅛-in. dia.) can be obtained from Lou Perretti, as were my originals, or from Williams Bros.

Flying. After the plane was sorted out, it performed very well indeed. As with any WW I model, flying in strong winds is difficult, at best, but the plane can handle moderate winds with no difficulty.

Initial flights can be made without the cowl, to enable you to make proper engine adjustments, etc. Be sure to add the equivalent weight of the cowl in the form of lead (or whatever is convenient) to the front when testing in this way. After the cowl is added back, the plane is cleaner, and will fly better due to less frontal drag.

I found that, on takeoff, it was easiest to add up-elevator trim. This prevents the tail from lifting too high before takeoff speed is attained, which tends to put the plane over on its nose in an ungraceful fashion. The tail comes up rather quickly;



let the plane run out and gain good flying speed, then gradually give up elevator. Some slight rudder correction will be needed, but tracking is not much of a problem as long as you keep the nose directly into the wind. Under low-wind conditions, the plane will not take off by itself, no matter how long the ground run, without adding up elevator. After lift-off, let it climb out, removing the up-elevator trim. Get some altitude before turning. Turns can be made with ailerons alone, coordinated rudder and ailerons, or just rudder. Each type of turn is a bit different, so feel out the plane, and see which you like best for the various maneuvers.

All things happen slowly no matter what the command. Scale flight is what you get with the plane, and there is nothing prettier than a low, slow fly-by with this big baby.

Landings should cause no problem. Set it up for enough out, throttle back to idle, and begin descent. If it sinks too fast, give it some gentle throttle to adjust. Let it settle onto the field at its own pace, and begin final flare-out at about 3-4 ft. off the deck, with full up-elevator at set-down. Punch the throttle, and hold full up-elevator if it looks like it wants to nose over. Let it roll out for a bit, then taxi it to the hangar. Ground handling is not too bad for a skid-equipped tail-dragger, if you are on dirt or grass.

Anyone willing to tackle this plane will be duly rewarded, both from the challenge of building and the fun and showmanship you get when flying a large vintage biplane. There should follow many hours of exciting and enjoyable flying.

If you are competition-oriented, this plane, done right, should be very competitive in either AMA Precision Scale, Sport Scale, or Giant Scale.

At this point I would like to extend my thanks to a number of individuals, without whom this plane and article would not have been possible. Firstly, thanks to my draftsman, Brian Voyer, who did all of the basic drawings in his Seekonk High School drafting class, under the able guidance of Bruce Downing. His assistance at the field was also helpful. Though he was only a competent beginning flier when this was written, it is hoped that we can get him far enough along to be able to use his drafting talents on a model of his own conception.

My thanks to Leo Opdycke, without whose generous advice, information, and constructive criticism, the plane would not be what it is. To Lou Perretti, my thanks for periodic advice, and for steering me into the area of WW I Quarter Scale. My gratitude is extended to all of my friends and flying companions of the South Shore Radio Control Club, who saw me through many trying times, and whose encouragement and appreciation helped to keep me motivated.

Lastly, to my wonderful wife, who endured many hours apart from me, knowing that I had drifted back in time to 1916, and hoping that I would return.

References

1. Profile Publications—#139 Bristol Scouts C & D.
2. *Bristol Aircraft Since 1910*—C. H. Barnes.
3. *British Aeroplanes 1914-1918*—J. M. Bruce.
4. *Model Airplane News*—June 1978.
5. *Airpower*—November 1975.
6. *World War I Aeroplanes*. #58—August 1976. #65—November 1977. 15 Crescent Rd., Poughkeepsie, NY 12601.

CL Scale/Byron

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or in the evenings browsing in stores, bookshops, and any other place which appears interesting, looking for airplane information. It is this love which a Scale modeler must have to enjoy the hobby to the fullest.

Once you have decided which type of aircraft you wish to build, you must then weigh several different factors before a final determination can be made whether to build the model you have in mind. To start with, in order to have the documentation necessary to build the model, you must remember that in Sport Scale, a three-view is mandatory if you want to receive points for aircraft outline.

You must also have color documentation to receive your color and markings points. This can be done in several different ways. You could furnish a black-and-white line drawing and color chips for this requirement; however, I have found the Profile Publications type of material to be well accepted and quite adequate for competition in the Sport Scale event. It is my observation that the Scale judges will actually judge your model in relationship to the documentation presented, even though there is a possibility that the documentation's coloring may not duplicate the original colors on the aircraft. So, in the case of Sport Scale, I suggest keeping in mind to duplicate the colors which you *see*, rather than duplicating *what they are supposed to be* unless, of course, you are the devout purist who wishes to know in his own mind that the color documentation is correct. This is just the human factor that I have observed in the last several years.

When deciding on a museum-quality Scale airplane, it is extremely difficult to build without actually having the airplane at your disposal; this is not always the case. It is not always possible to build the airplane you wish, because of a lack of