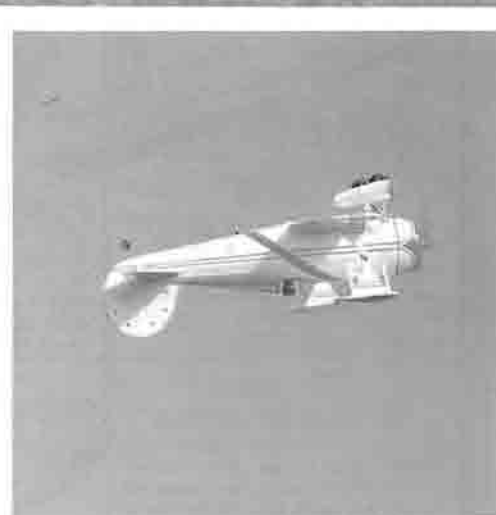


# HAROLD KRIER'S GREAT LAKES SPECIAL

**I**n 1956, Harold Krier and his brother Larry bought a 1931 Great Lakes 2T-1-A, a 2-seat tandem cockpit trainer with a 125 h.p. Menasco in-line engine. They totally stripped the airframe and cleaned it

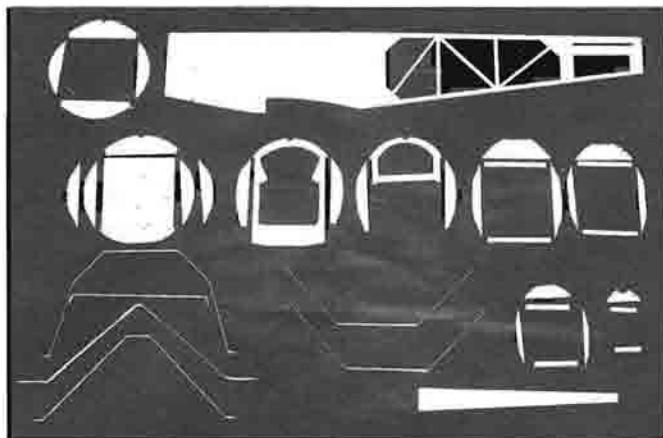


**By Gordon Whitehead**

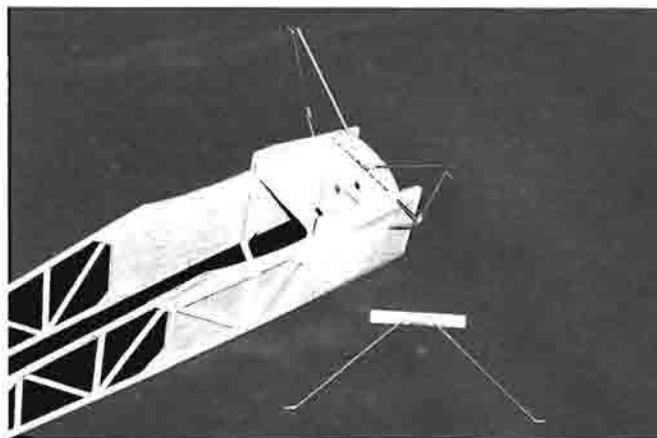


**Build this really neat 47" wingspan version of the greatest aerobatic biplane of the 1950's, and put some zing into your Sunday flying!**





**Fuselage components. Cut out all parts prior to beginning assembly.**



**Adding the landing gear. Secure L.G. wire with strong thread or soft wire.**

down to bare metal. The Menasco was removed, and replaced by a 185 h.p. Warner radial for which the cowling from a Fairchild 24 was an exact fit. The circular cowling was faired into the fuselage by means of aluminum formers and stringers, fuel and smoke system tanks were installed in the front cockpit, and the opening faired over. An extra long headrest completed the fuselage.

The wings were completely revised, with reduced span on the lower ones, ailerons introduced onto the upper ones, and incidence and dihedral reduced. Originally, "N" type interplane struts were fitted, but, later on, these were replaced by "I" shaped ones of welded steel tube faired with balsa, as featured on this model.

Changes to the landing gear included a wider track, and the fitting

of wheels and pants from a Cessna 170B.

The color scheme underwent slight revisions throughout the life of the airplane, and the one detailed on the plan represents the final version (with the odd omission for simplicity).

As you can see, what emerged from the Krier Bros' workshop bore little resemblance to the basic aircraft. However, the job wasn't finished at

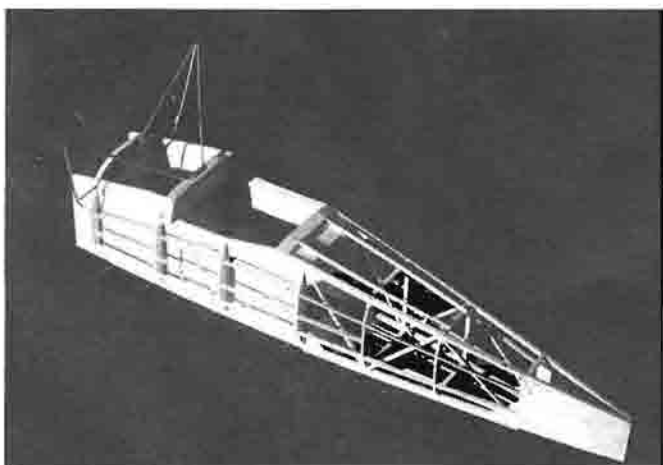
### GREAT LAKES SPECIAL

**Designed By:**  
Gordon E. Whitehead  
**TYPE AIRCRAFT**  
Sport Scale Biplane  
**WINGSPAN**  
47 Inches  
**WING CHORD**  
6¾ Inches  
**TOTAL WING AREA**  
550 Sq. In.  
**WING LOCATION**  
Biplane  
**AIRFOIL**  
NACA 2412 Semi-Symmetrical  
**WING PLANFORM**  
Constant Chord  
Swept Top Wing

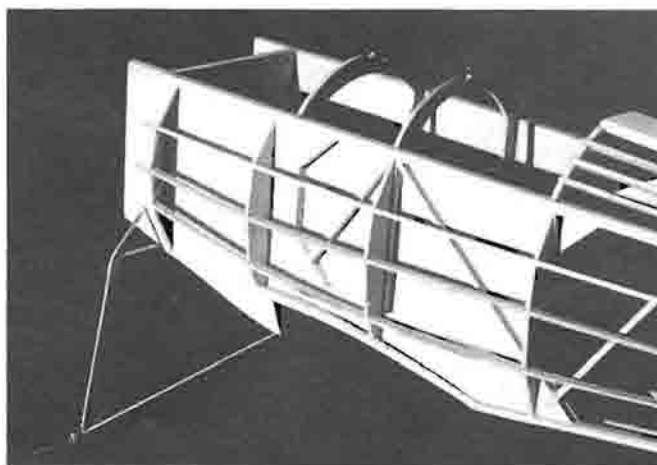
**DIHEDRAL EACH TIP**  
Zero Top, 1/4" Bottom  
**OVERALL FUSELAGE LENGTH**  
34 Inches  
**RADIO COMPARTMENT SIZE**  
(L) 7" x (W) 3½" x (H) 3½"  
**STABILIZER SPAN**  
17¾ Inches  
**STABILIZER CHORD**  
5½ Inches (Avg.)  
**STABILIZER AREA**  
95 Sq. In.  
**STAB AIRFOIL SECTION**  
Flat  
**STABILIZER LOCATION**  
High on Fuselage  
**VERTICAL FIN HEIGHT**  
8 Inches

**VERTICAL FIN WIDTH**  
7½ Inches (Max.)  
**REC. ENGINE SIZE**  
.46-.53 4-stroke  
.35-.40 2-stroke  
**FUEL TANK SIZE**  
6 Oz.  
**LANDING GEAR**  
Conventional  
**REC. NO. OF CHANNELS**  
4  
**CONTROL FUNCTIONS**  
REMA

**BASIC MATERIALS USED IN CONSTRUCTION**  
Fuselage ..... Balsa, Ply & Spruce  
Wing ..... Balsa, Ply & Spruce  
Empennage ..... Balsa  
**Wt. Ready To Fly** ..... 79 Ozs.  
**Wing Loading** ..... 21 Oz./Sq. Ft.



**General underside view showing the addition of the longeron capping strips, and just before the fitting of the F4 root fairings.**



**Formers and stringers in place. Stringers are 1/16" x 3/16" spruce.**



the rollout stage. There then followed many hours of exacting test flying to achieve perfect balance and controllability, involving changes in wing and tail rigging and design. This close attention to detail paid off over the next four years, with Harold Krier capturing every major flying precision airmanship award in the USA, the National Championship trophy, and the Joe Mackey trophy.

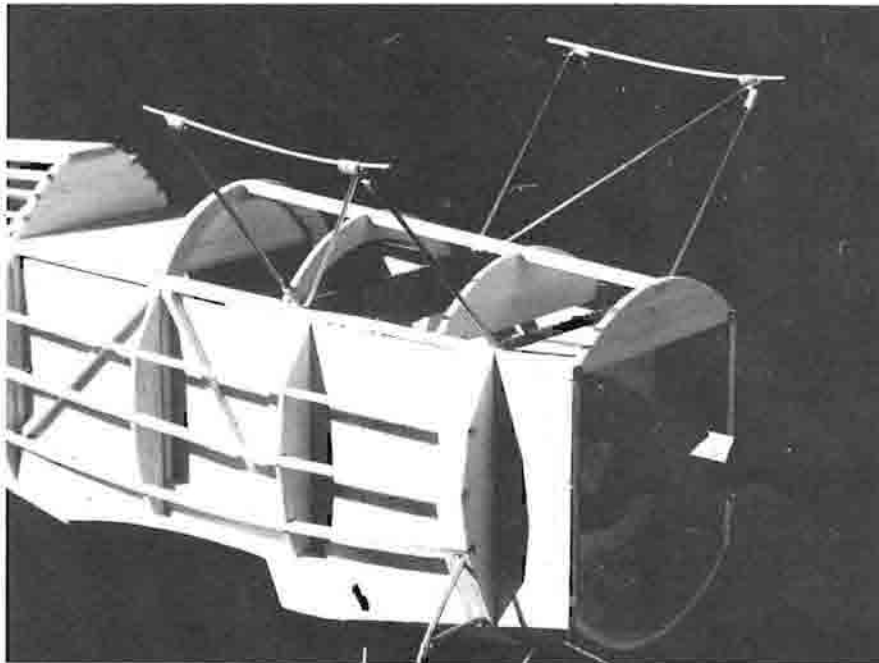
Harold Krier was a real showman, and with his business partner, Bill Sweet, hyping it up on the public address system, he thrilled many thousands with aerobatic displays

which included lurid-sounding figures like the Yankee Doodle Loop, Vertical Nassau Eight, Cobra Roll, and the Inverted Texan Eight. In 1960, at the Williston Florida National Air Show, Krier looped, slow rolled, did a hammerhead turn, and an inverted low-level pass, with some fellow riding on the center section! Apparently, both CBS and NBC filmed Krier air displays, the latter organization producing an episode of their then current "Danger Is My Business" TV series. What I would give to see a rerun of that particular feature.

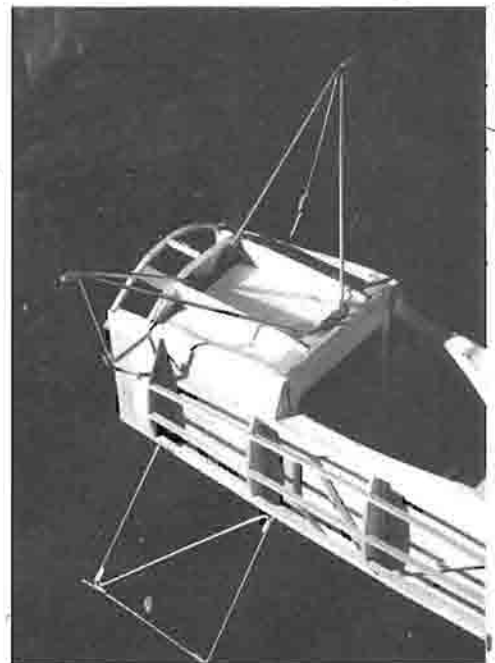
Well, it's fine talking generally

about exciting air displays. But just what kind of figures did the display routine contain? Try this, which is an excerpt from Harold Krier's now out-of-print book, "Modern Aerobatics And Precision Flying," published in 1963:

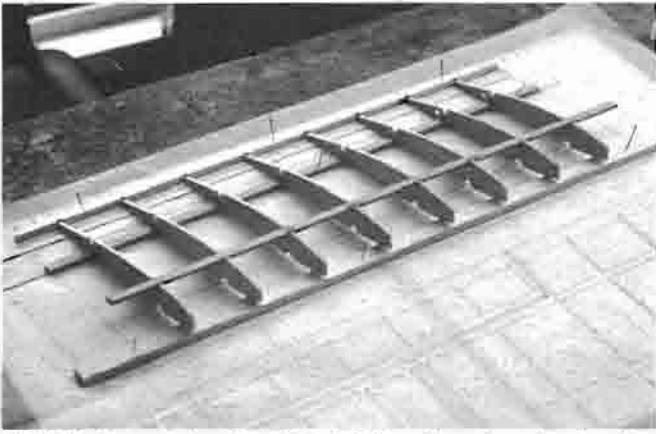
"We ease power to the 185-Warner up ahead until she holds us back against the seat-back with acceleration. As the controls come to life, we hold the airplane on the runway a bit longer than usual. We're going to need that extra speed. Now slight right stick. The left wheel leaves the runway, and then the right



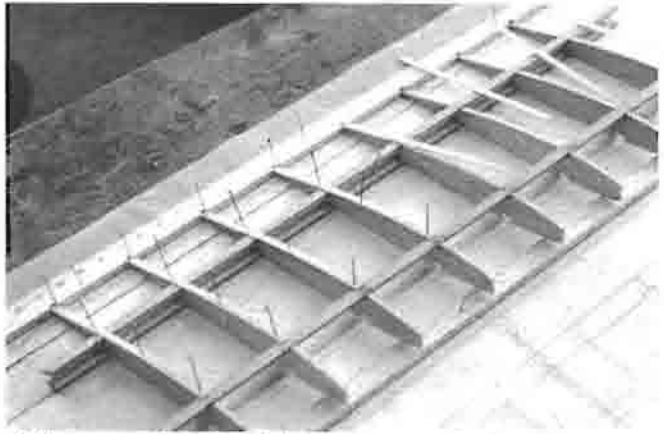
Center section struts now in place. Carefully align before gluing in place.



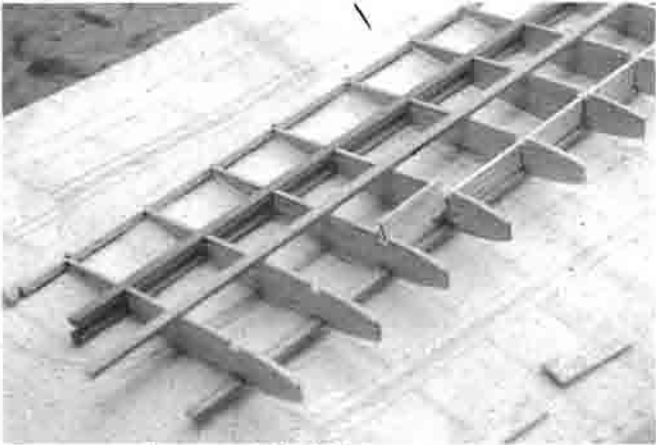
Landing gear and tank bay floor in position.



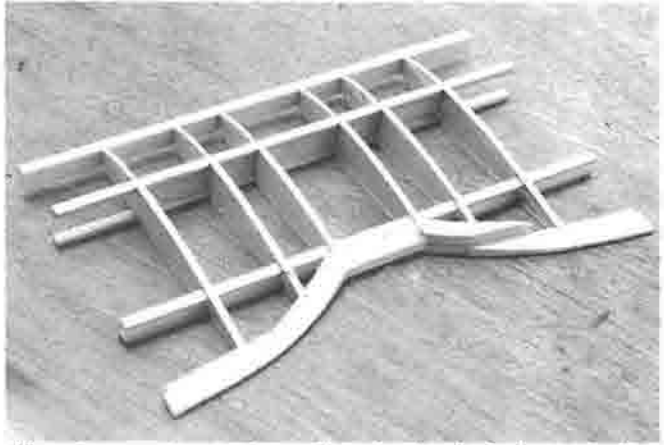
Initial laying out of a wing. Note 1/32" packing placed under ribs and spar during construction.



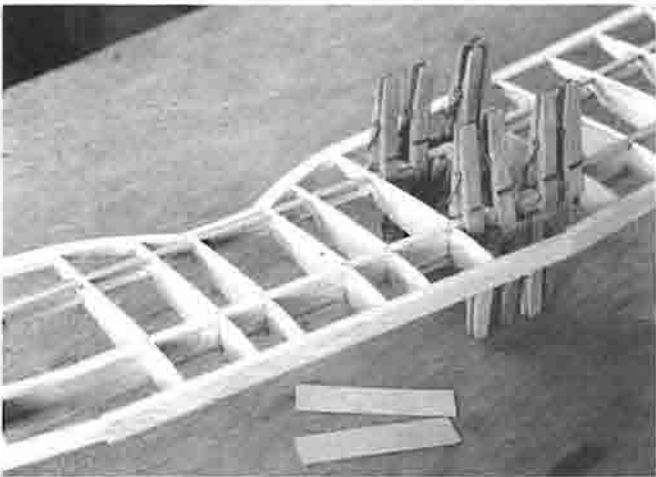
Adding cap strips after gluing upper spars in place.



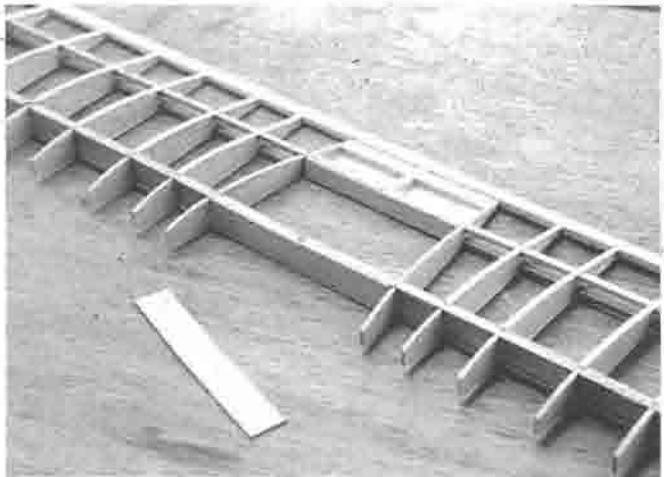
Front spar webs precede the bottom spar.



View of upper wing center section showing the before and after shape of the trailing edge strip.



Joining up the upper wing sub-assemblies.



Lower wings being joined.

one. Back slightly on the stick, with a little left rudder — and watch the right lower wing tip as it clears the runway. As we roll past vertical, feed in slight forward-stick and, at the 20-foot level, we are in inverted flight. You may be fairly sure that everyone is watching now." That was just for starters. The routine continues with a 90° turn away from the crowd, followed by a series of slow rolls through a 270° turn back onto the original track . . . The routine

progresses as follows:

Outside cuban eight.

Slow rolls: 6-point slow roll, 8-point slow roll, and 8-point back-to-back slow roll.

Chain loop series: loop with snap-rolls at top and bottom; 8-point loop, square loop.

Starting from knife-edge flight position: 1/2 outside snap-roll and 3/4 snap-roll. Then 1 1/4 snap-roll, knife-edge to normal flight position.

Inside cuban eight with 4-point slow

roll on each half, followed by inverted climbing turn.

Roller coaster: hammerhead stall turn with outside and inside recoveries.

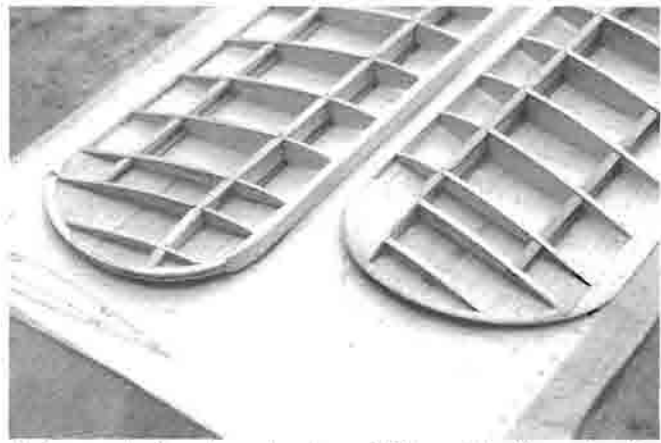
Series of inside and outside snap-rolls (from single to 2 1/2 snaps).

Series of outside loops: outside loop from normal flight, and two slow rolls in square outside loop (1/2 roll on each side).

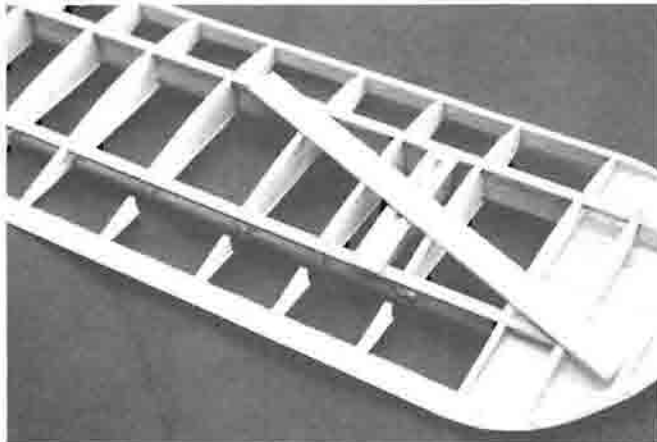
Spin series: from inverted flight, 2 1/2 turn outside spin with outside



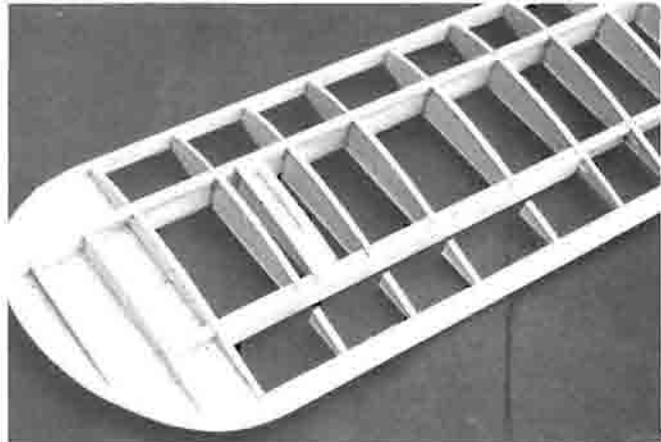
*Fitting the lower wing root riblets. Note the 1/32" sheet packing pinned in place.*



*Before and after view showing addition of leading edge tip sheeting. Wing tips are built up by laminating 1/16" pieces of balsa together.*



*Aileron ribs cut away for addition of hinge spars.*



*Rear spar web glued in place.*

Immelmann recovery, then a 2½ turn inside spin with normal Immelmann recovery, followed with a falling leaf.

Low level inverted flight with hands outside of cockpit.

Pass under ribbon.

Three-fourths of a normal loop to inverted flight recovery and a 90-degree inverted turn.

Inverted ribbon pickup between 20' cane poles.

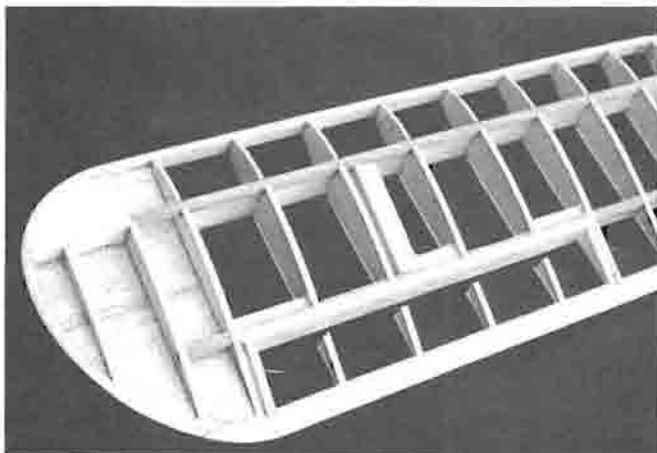
Inverted traffic pattern and half

slow-roll to upright position just before landing.

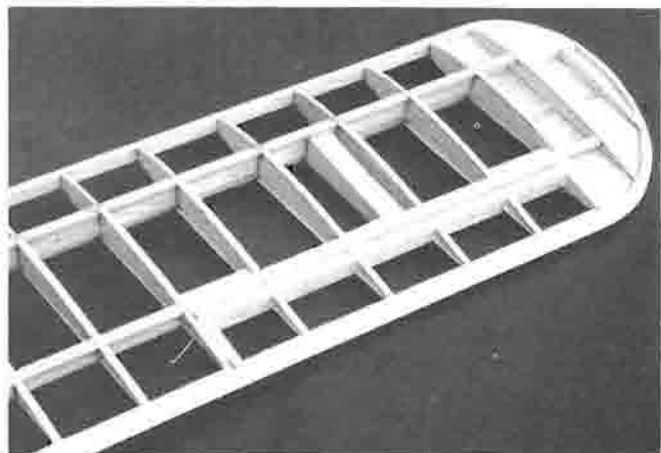
Now that is what I call an air display. In 15 minutes of concentrated action Harold Krier would pack some 44 maneuvers into a tightly flown schedule, with turnaround maneuvers at each end to maintain position ready for the next figure.

Apart from the rolling circle almost straight after take-off, the knife-edge snap-rolls, the ribbon pickup, the

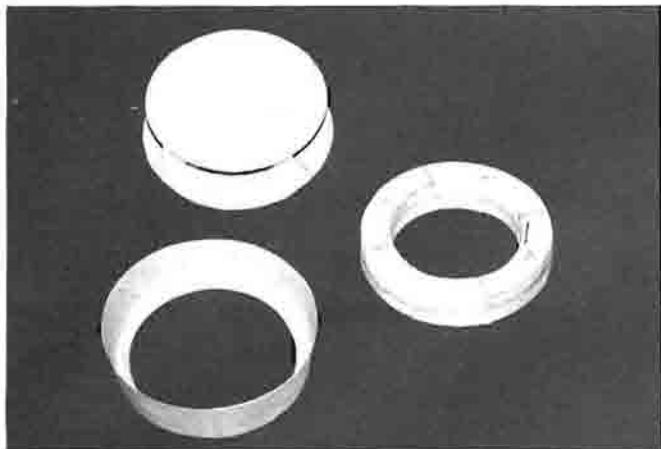
hands-off flow inverted, and the falling leaf descent, I can perform all of the foregoing routine with the little model presented here. The excluded figures just referred to either happen too quickly for me to follow, or are just too difficult! Nevertheless, over the past 10 months, I've been having a ball putting the ship through its paces. In fact, I haven't had a proper aerobatic biplane for the past 10 years, and I swear that I feel 10 years younger



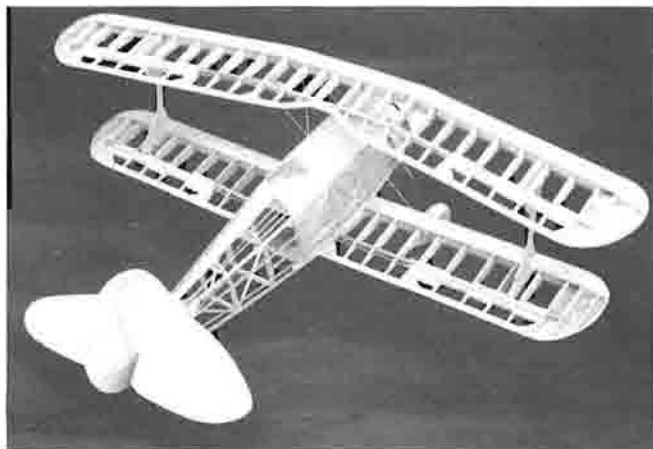
*Aileron end ribs glued in position, with 1/16" packing for end gaps.*



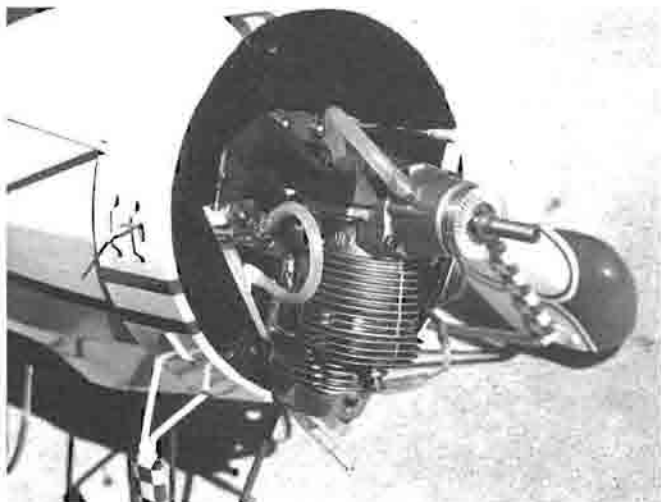
*1/4" aileron spar fitted at last. When the glue has dried, remove the aileron using a razor saw.*



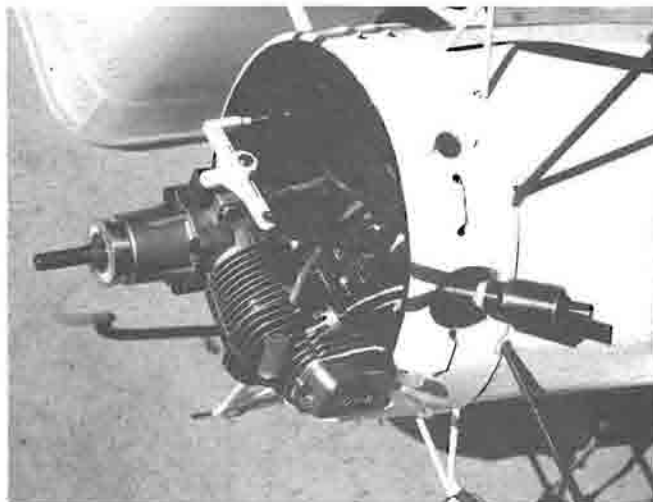
Cowling jig, card skirt glued to its 1/16" ply ring, and the laminated balsa nose ring.



Not long now! Model is completely framed up and ready for covering.



Right hand view of engine bay. Note fuel needle.



Throttle linkage reversing mechanism and exhaust outlet.

again.

Complete flying enjoyment is guaranteed with this machine, so let's get down to the serious part now — order the plans and start building today.

**The complete construction article comes with the plans.**



Oodles of room in the radio bay.

**First Flights:**

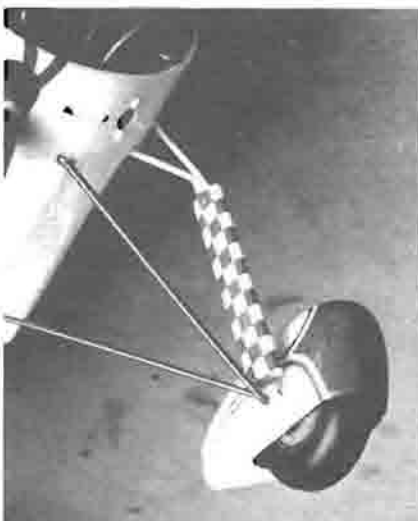
My prototype model uses an Enya .46 4-stroke turning a Graupner 11 x 6 grey propeller and burning 10% nitro 2-stroke juice — I like plenty of lubrication in my engines. The exhaust pipe sports an O.S. pressure fitting which applies exhaust pressure to the 6 oz. fuel tank.

For first flights, I suggest that you add lead to get the C.G. at the forward point. When you have become used to the model, try moving the C.G. back to the aft position.

The main wheels are set quite well forward and the gear has a wide track, making the ground stability good. However, the rigid legs make the model quite bouncy over rough ground. For all take-offs, use the low control throws as shown on the plan. A spot of up elevator at the start of the run will prevent nosing over, and slight right rudder is used to keep her straight. Using full throttle, the model breaks ground in less than 10 yards, and pointing the nose upwards produces one heck of a climb out. These small 4-strokes have come a long way in the past three or four years.

**Trimming:**

With the model at a good height you should trim her for straight and level flight. The model is pretty lively when flown on low rates, but with high rates selected, it is something else entirely! I use the third aileron rate setting on my trusty JR8 as a bonus, and set it to a very low rate for performing 15



Detail of wheel pant lug. Hole in lower panel is for tubular jack socket feeding current to glow plug.







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together well, a left hand snap-roll comes next, initiated with the snap button, and aiming to stop her exactly on the same vertical line. To achieve this requirement, one has to kick in a quick nudge of right rudder just before the snap, otherwise she'll come out with a hefty and nonremovable helping of left yaw. As she leaves the snap, forward speed will be decaying really fast, and the neatest way out of that situation will be a hammerhead turn.

The hammerhead is usually a reliable figure, but needs some throttle left on for the first half of the

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turn. On the way down, we go for a 1 1/2 outside snap-roll. If you have a snap-roll button this will be easy, but if not, you'll need full rates, and a burst of power to initiate the snap. What next? Oh yes! We're pointing earthwards, so with a smooth stick push we level off inverted at about 10' above the ground, going downwind, and follow up with an outside cuban eight.

After such a beginning to a flight, it's important to keep the rhythm flowing, otherwise it'll just degrade into another meandering flying session. Therefore I would recommend to you the type of sequence described in the introduction to this feature.

As mentioned earlier, the slow-rolling characteristics of this ship are first rate. You will revel in the ability to perform really reliable hesitation rolls, with as many as 24 points. She just tick-tocks round like the second hand on a kitchen clock, and beats any high speed pattern ship into a cocked hat. Super-slow 15-second rolls at low level are there for the taking, and all these time and distance consuming maneuvers need to be performed into the wind so that she doesn't get out of sight three-quarters of the way through.

Snap-rolls are definitely more reliable if you can set up a button with the extreme deflections shown on the plan. Executing a snap at the bottom of a loop with these throws is a sobering experience, and you can feel the air being lashed into turmoil as the wings thrash around. Of course, you only prove that you're an expert if you can execute just the one snap-roll here.

You should find no tip-stall problems with this ship. However, high-g figures are very draggy, so for the corners of square loops, it is preferable to fly a quarter-loop to minimize induced drag, and help with maintaining speed for those 1/2-rolls you may wish to include. Despite the semi-symmetrical wing section, provided you have taken the trouble to equalize the inside and outside loops by adding extra down elevator through introducing some differential throw, the model will be equally happy whether performing positive or negative maneuvers.

**Tailpiece:**

Shortly after I had gotten the ship trimmed out, my flying colleague, Dick Spreadbury, showed up with his camera. Following the inevitable in-flight photo session, which I hope produced pix suitable for publication, Dick took over the model, and with his first flight with the ship, put on the kind of flying display that convinced us that the little ship was a clear winner. Enjoy yourselves!

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