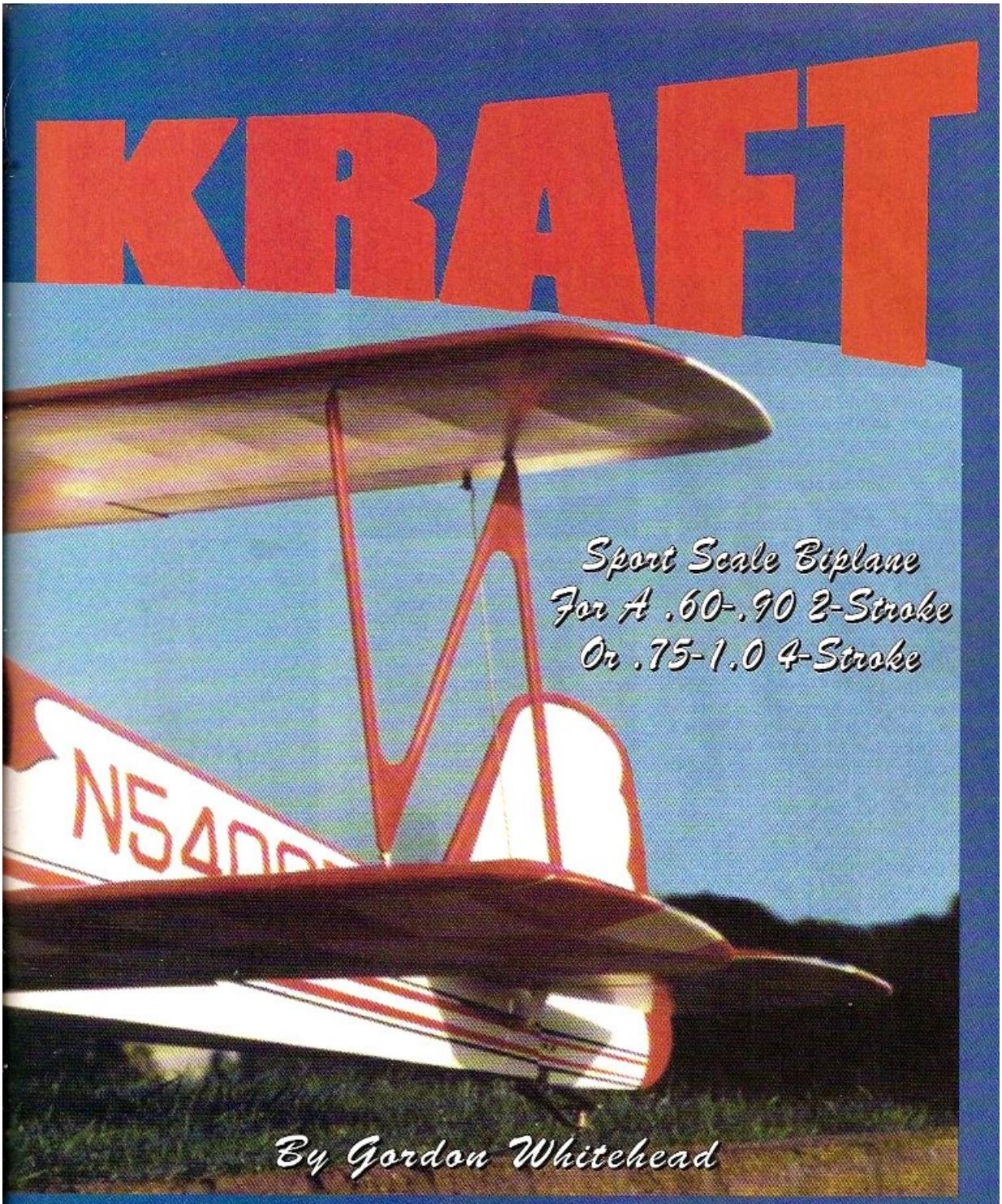
KRIER

In the early 1960s, there were very few specially designed aerobatic airplanes on the competition aerobatic circuit, the Pitts being virtually the only contemporary machine designed expressly for aerobatics and not hopped up from a trainer, as were the Zlins, Yaks, Stearmans, Cubs, etc. At this time, an outstanding one-off machine hit the headlines, called the Krier Kraft, and I must admit that it so turned me on the moment I first set eyes on a photo of it several years later, that I cannot understand why models of it don't grace almost every flying field. Maybe that situation is about to change!

The story behind this plane is that Harold Krier found that his winning streak with the Great Lakes Special was coming to an end, and he needed to modernize his act with a more capable aerobat. So he

KRAFT

Sport Scale Biplane For A .60-.90 2-Stroke Or .75-1.0 4-Stroke



By Gordon Whitehead

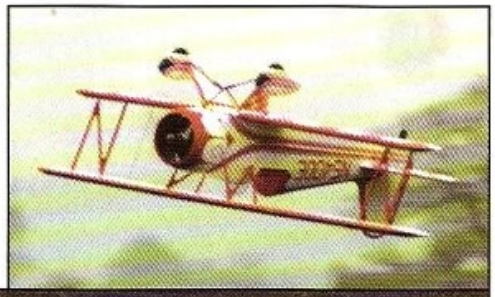
took the best features of the still very highly regarded Jungmeister, together with those of his Great Lakes Special, and designed the Krier Kraft, which materialized around 1962. The Krier Kraft was indeed a vast improvement on the Great Lakes, even though it had only the same Warner 185hp engine for power. The new plane was very light, and its big advantage over the 'Lakes was that it had vertical penetration; when he had flown down to the bottom of the aerobatic box, he could get back up to the top via a 4-point vertical roll, whereas in the 'Lakes he had to break off the sequence and climb.

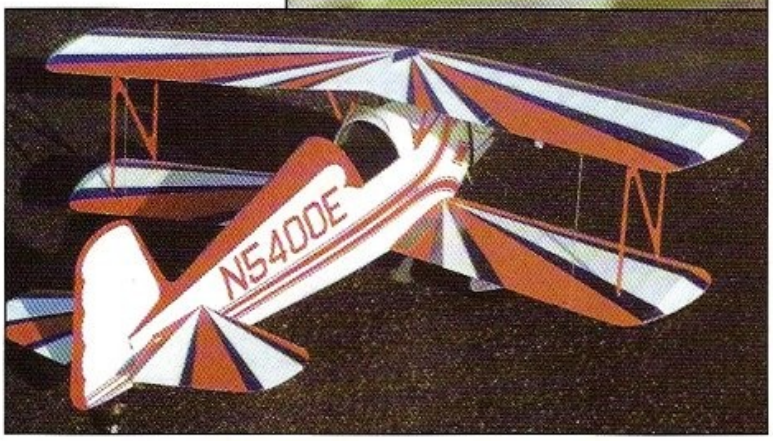
The Krier Kraft won its builder many honors, but by 1967 it too became outclassed, and Krier replaced it with a 200hp Ranger engined Super Chipmunk. In its

day, though, the Krier Kraft was a stunner, both in performance and paint scheme, and Krier thrilled audiences all over America with his virtuosity in this machine.

I designed and built this model around 1991, and had a ball with her from the very start. Originally powered by an early Laser 75, she had a superb aerobatic performance, though I did get rather fed up of the silencer and carb dropping off the engine, and oil leaking from every joint all over that complex paint job. So I fitted an ST 91 instead, and gave her mind-blowing performance; she would now perform a vertical Figure 8 — in knife-edge! And that was on straight no nitro fuel. Strangely, the ST ran for just as long as the 4-stroke on the same tank, principally because only a low throttle setting was required for most of each flight.

Actually, rather in the manner of the real Krier Kraft, I had made the machine ultra light, and this caused me a problem. Having fitted the ST, I found that in a power dive the wings could flutter. This was caused mainly by aileron flutter which resulted from my using insufficiently stiff torque rod aileron actuation, and partly by my using 1/32" leading edged sheet purely for aesthetic reasons, rather than for strength. I cured this problem by adding interplane bracing to my model. However, on the accompanying plan, I have shown a strengthened wing structure employing "traditional" 1/16" sheeting at the leading and trailing

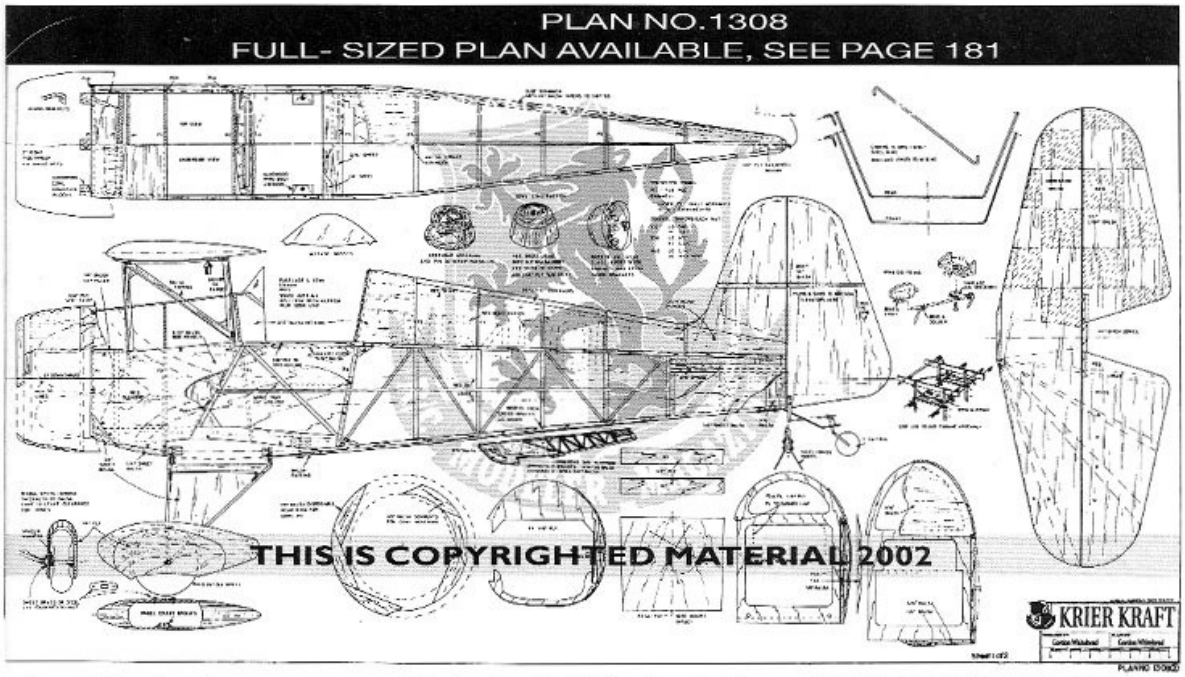




KRIER KRAFT

Designed by:
Gordon E. Whitehead
TYPE AIRCRAFT
Sport Scale Aerobatic
WINGSPAN
55 Inches
WING CHORD
8-5/8 Inches
TOTAL WING AREA
900 Sq. In.
WING LOCATION
Biplane
AIRFOIL
NACA 23012
WING PLANFORM
Swept Constant Chord
DIHEDRAL, EACH TIP
Upper: 0, Lower: 1/2"
OVERALL FUSELAGE LENGTH
44 Inches
RADIO COMPARTMENT SIZE
5" (L) x 5" (W) x 3" (H)
STABILIZER SPAN
23-5/16 Inches
STABILIZER CHORD (inc. elev.)
6-1/4 Inches (Avg.)
STABILIZER AREA
145 Sq. In.
STAB AIRFOIL SECTION
Flat Plate
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
7-1/2 Inches
VERTICAL FIN WIDTH (inc. rud.)
7-1/2 Inches (Avg.)
REC. ENGINE SIZE
.60-.90 2-Stroke, .75-1.00 4-Stroke
FUEL TANK SIZE
10 Oz.
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail.
C.G. (from L.E.)
5" (Top Wing at Fuselage)
ELEVATOR THROWS
1/2" Up — 1/2" Down
AILERON THROWS
3/8" Up — 3/8" Down
RUDDER THROWS
1-1/2" Left — 1-1/2" Right
SIDETHRUST
2 Degrees
DOWNTHRUST/UPTHRUST
—

BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa, Spruce & Ply
Wing ..... Balsa, Spruce & Ply
Empennage ..... Balsa
Wt. Ready To Fly ... 118 Oz. (7 Lbs. 6 Oz.)
Wing Loading ..... 18.9 Oz./Sq. Ft.



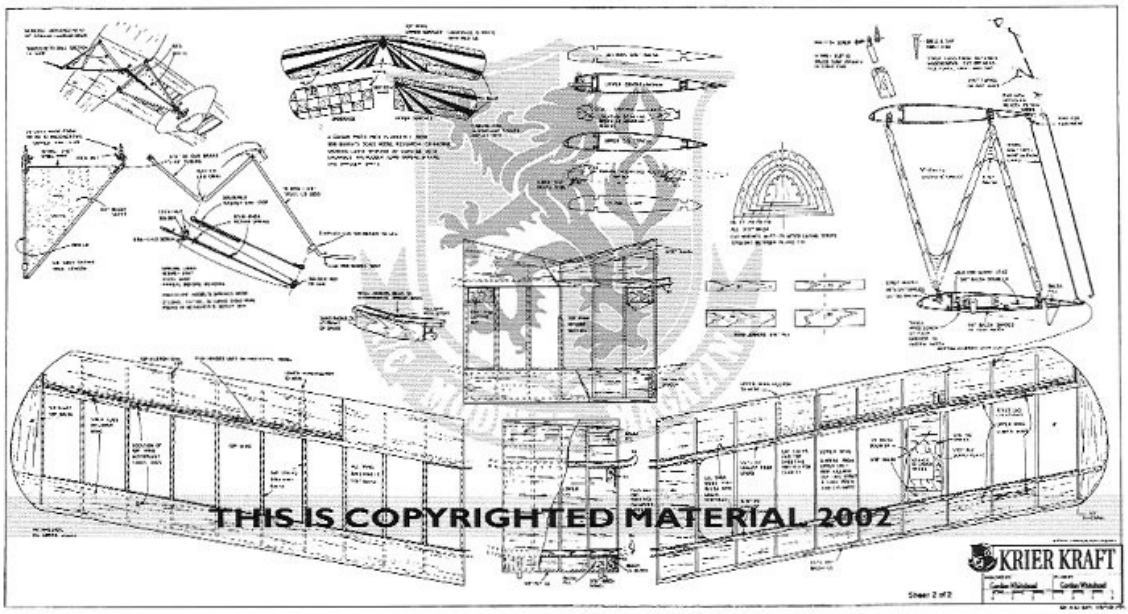
edge, and also shown is a more up-to-date aileron servo installation which I have since used on a number of models. There is now an all-sheet tail, since my machine carried 3 oz. of tail weight, and it was such a waste of effort designing and making the built-up tail you can see in the photographs.

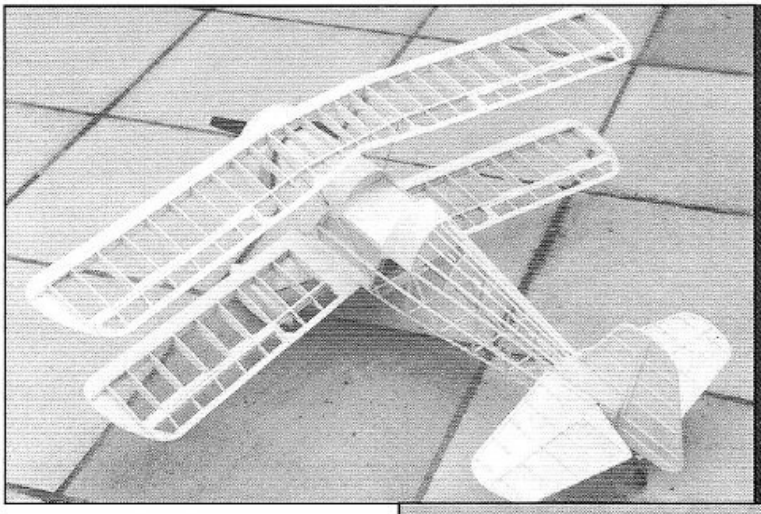
Regrettably I badly damaged the plane when purely through inattention to the job in hand, I sent her off with ailerons reversed, and I gave the remains to a clubmate. She is now flying again equipped with a Saito 80, and the new owner says she is the best handling plane he has ever flown. Since I designed and built this plane, the fun-flier movement has really got going. However, as I once mentioned to one ardent fun-fly fanatic, my personal ideal for a fun-flyer is a plane that looks just like the Krier Kraft!

For color reference, Bob Banka's Aircraft Documentation has a Foto Paak, and also a 3-view, which, however, did not tie up with the photos in several respects, so I did change a few things to match the pictures I had. The full-size machine still exists, and can be found in the Pioneer-Krier Museum, 430 W. Fourth (Highway 160), Ashland, KS 67831-0862, tel (316) 635-2227. Wish I didn't live the wrong side of the Atlantic! Maybe someone could get in there some day, measure the ship, and produce a really accurate 3-view of this stupendous and historic American aerobat.

CONSTRUCTION

The Krier Kraft is largely conventional in construction and will cause no problems for those familiar with this type of structure. The plan contains annotated sketches of the less common features, and so the accompanying notes will be brief and mainly relate any special-to-type

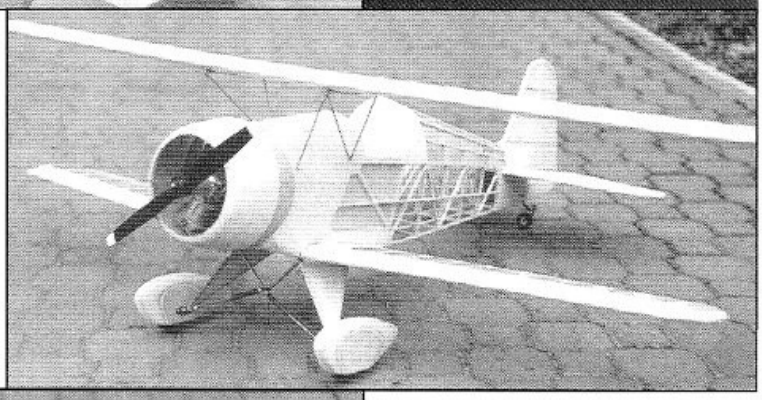


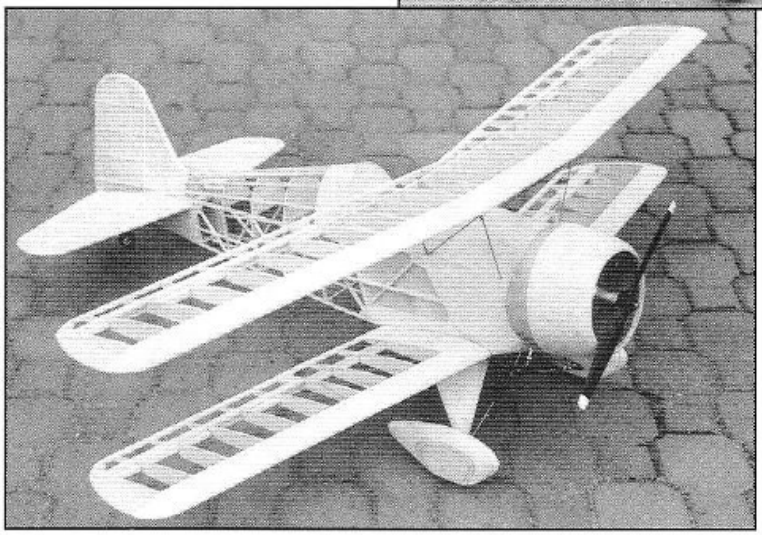


LEFT: Bare bones: Note that the plan now includes more extensive wing sheeting. Additionally, all-sheet tail surfaces are now specified, to simplify construction and obviate the need for tail weight to achieve balance.

BELOW MIDDLE: Conventional built-up structure is used for wings and fuselage. Tail pieces are now simple sheet balsa.

BELOW LEFT: The cowl is built-up balsa and plywood — see plans for details.





aspects. I use all the usual glues as required; contact glue for the ply fuselage doublers, epoxy for cabane and landing gear strong points, and mainly aliphatic resin glue for the remainder due to its user-friendly nature.

Fuselage:

Make up two basic sides, and join them initially using formers F3, F4 and F5, ensuring a square assembly. When the glue has set, add the cabane mounting strips. Next, draw in the tail end and add the 1/4" x 1/2" balsa sternpost, followed by the balsa rear cross-bracing. Remember to recess the lower ones to allow the depth of the underside stringer to taper to nothing.

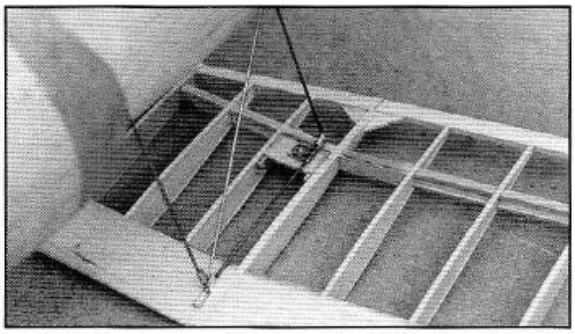
Using strong elastic bands, draw in the front fuselage and glue F1 and F2 in place. Former F2 is positioned to accommodate 4-stroke engines, and incorporate sidethrust; 2-strokes can also use the same long mount. Make up and fit the cabane struts, using the jig shown on the plan to ensure correct alignment during soldering. Make a paper pattern for the front decking, and use it as a guide for making a balsa version right the first time. The side panels, bottom sheeting, the rear decking and stringers can now be added, along with sheeting in the rear fuselage bay.

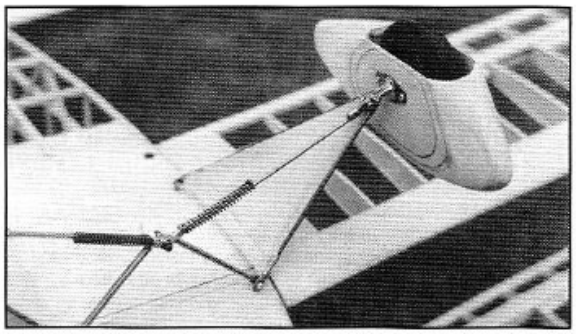
Next comes the cowling, which is a built-up balsa assembly and does not take long to make. It is light and, once encased in 1/2 oz. glass and epoxy, entirely strong enough in normal usage. Make a paper pattern to achieve the shape of the 1/64" ply rear skirt. Use the finished cowling to assist in positioning the mounting blocks and aluminum lugs.

Wings:

Note that the lower wings are shorter in span than the upper ones. The Krier Kraft had equal span wings originally, but later in its life the lower wingtips were moved inwards one rib bay, and this is the version I have modeled. The method of wing joining is slightly unusual but amply strong.

Each wing panel is assembled as follows. After cutting a spar to length, round off its forward face at the root end as indicated on the plan. Then pin down the trailing edge sheet and glue the lower rear spar in place. Next add

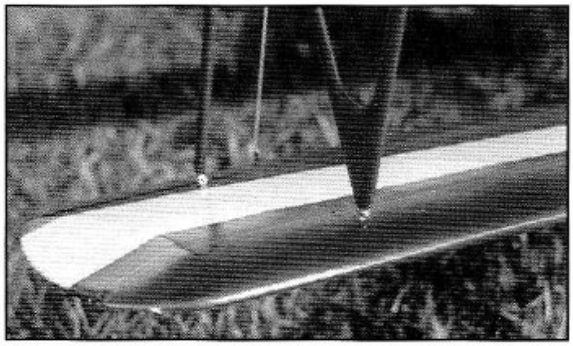




LEFT: The simple cabane wing mount is unobtrusive. Also visible is a ply wing joiner. Note: This photo shows the early wing sheeting configuration. RIGHT: This photo illustrates the landing gear springing. The text and plan have full details.

the ribs, supported by a spanwise strip of 1/4" sq balsa, pinned to the building board to keep the ribs aligned. Add the upper spars and the leading edge strip. Don't add the top leading edge and trailing edge sheeting yet, but you can remove the wing from the plan and fit the lower leading edge sheeting, the interplane strut anchor strips and doublers.

Next, assemble the center-sections in similar fashion, again leaving off the top sheeting, but including cabane and landing gear anchors, wing pegs and filler blocks, and all lower sheeting.



The method of securing the wing struts is very neat and unobtrusive. Quick to assemble and disassemble when required.

To join a wing panel to its center section, chock the center section so that its chord line is horizontal, and the appropriate wing panel similarly. For the lower wings, remember the 1/2" shim on each side for the dihedral angle. Offer a wing panel up to the center-section, and epoxy them together. With a razor-saw, cut a 1/16" wide gap through the root rib immediately in front of and behind the rear spar position. Coat the spars and 1/16" ply wing joiners with 5-min. epoxy, and using clothespins, clamp the joiners to the spar. Ensure that the rib is also glued to the plywood. When set, repeat the above process for the front spar and joiners, and follow on by adding the opposite wing panel in identical fashion.

When all wings and center-sections are joined, add the upper sheeting, spar webs, wingtips and capping strips, then cut out and face the ailerons and make the servo hatch mounts. Top hinging is shown, but your favorite method will be fine.

Interplane Struts:

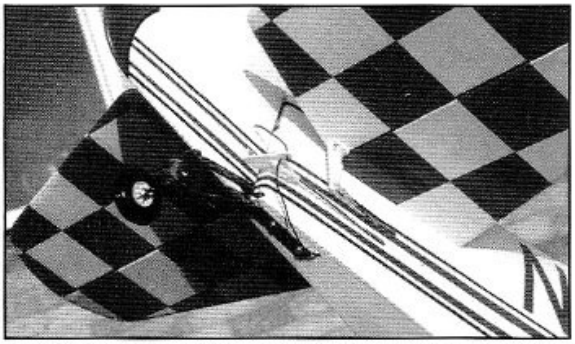
Make the strut anchors from woodscrews as shown on the plan, and screw them in place. One at a time, mount the wings and true them up in plan view (top view) before drilling and inserting the rear screws. Measure the wing gaps at each tip with a ruler, and ensure that they are equal on each side using shims if necessary. Now for the struts.

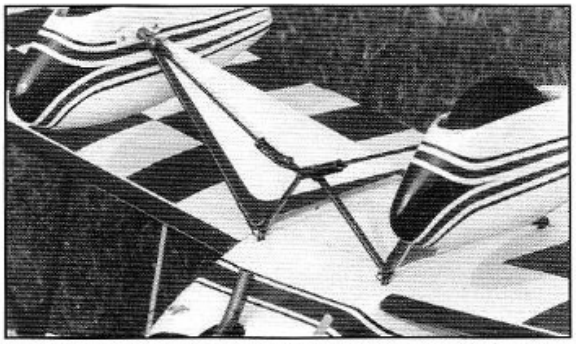
Make up the struts from the plan, but do not glue the tubing lugs in place yet. Mount the struts and adjust the wings so that they show no warps, before fixing the ends with CA. The strut anchors are removed while the wings are covered — just make sure you screw them back in to the correct depth after covering.

Tail Unit:

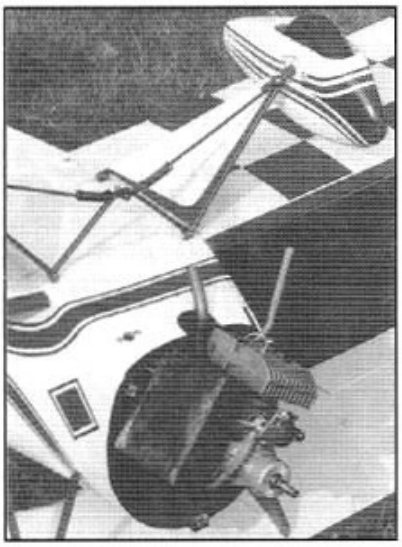
Choose light stiff wood for these surfaces, and ensure that you plane and sand the rudder and elevators to the sections as shown to help keep the rear end light. Only glue the tail in place once you have trial-fitted and trued up the wings. Look along the fuselage from the rear to check that the stabilizer is level with the wings. Shim or sand down the stabilizer seat if needed, then glue in place. Mount the fin at right angles to the stab, and add the block fairings.

The steerable tail wheel assembly can be home-made, from 3/8" wide thin





LEFT: Tail group and steerable sprung tailwheel. Note also the details and trim. Each elevator is operated by its own horn using a pushrod which divides towards the back end. RIGHT: Details of the finished sprung landing gear showing paint scheme on wheel pants to advantage.



An ST 90 Heli engine replaced the Laser 75 originally used. This shot shows how the engine, heat sink, and homemade muffler fit easily inside the cowl, with exhaust ducted clear for a nice clean model.

spring steel sheet, a couple of wheel collets, one of which is soldered to the leaf spring as a bearing, and a short length of wire. However, commercial ones are readily available in this size if you can't lay your hands on the materials. Springy dural will work, but you will need to drill the end to take a short 3/16"-1/4" dia. metal or nylon screw which is secured with a nut; the screw is drilled through to form the bearing for the steerable leg.

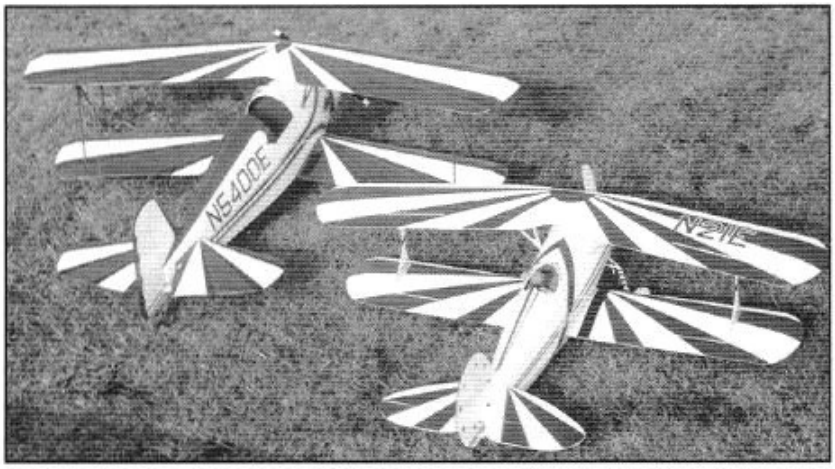
Sprung Undercarriage:

This design is simple, strong, and works very well. The auto parts dealer where you buy your brake line tubing might be able to help with the springs, as vehicles are full of them. Unlike the full-size assembly, which used a Piper Cub unit, this system works with the springing in compression. It would be pretty easy to make it work via elastic bands or rubber O-rings in tension, however, if you so wish.

The plan is self-explanatory, but note that the swivel joints need a lock-nut, which may need soldering to the appropriate bracket or leg. If you don't fancy bending the loops in the sprung links, make end-lugs from tubing, soldered in place with the end flattened and drilled, along the lines of the main leg end-lugs.

Comparing the plan with the photographs, you will note that on my prototype model, the front leg anchor was fixed in the fuselage just ahead of the wing cut-out, the rear one being mounted in the wing. This arrangement proved to be a pain, in that the rear landing gear pivot screws had to be removed to extract the lower wing, and the landing gear itself then obstructed access to the radio compartment. The plan shows a superior arrangement and the landing gear chassis now comes off with the lower wing and does not need disturbing.

I always fit wheel pants if the full-size plane used them. I never have problems with them snagging in grass where a wheel would not snag, or jamming a wheel. Ensure that there is at least 3/32" gap either side of the tire inside the pant, to prevent binding when the tire flattens under load.



Dynamic Krier duo, in the shape of Great Lakes Special (RCM Plan #1053) and the model featured here. All those sunbursts sure brighten the place up!

Engine And Radio Installation:

The cowl is large enough to accommodate most engines without requiring cut-outs. Mount the cylinder at a suitable angle to enable exhaust goop to be ejected below the model. An 8 oz. fuel tank goes behind F2 and is supported in foam, alongside the NiCd pack and receiver. The servos are screwed to a lite-ply plate between F4 and F5. I used 3/16"

dia. dowel pushrods to actuate the rudder and elevator. The receiver antenna passes down the fuselage and exits through a hole in the covering at the sternpost.

Covering and Finishing:

I covered the model in clear Solartex, which I then brushed with clear dope, followed by cellulose color and clear 2-part fuelproofer. The white background was sprayed all over, then the wide color stripes, sunbursts, and checks were masked and sprayed. The narrow pin-stripes were applied with a mapping pen, which was held in a compass when any curves were required. As you might imagine this was not a quick job, but the whole color scheme was really well worth the effort.

Flying:

First, despite its extrovert appearance, this machine is so stable, responsive, and forgiving that anyone who can fly an aileron-equipped model will have no difficulty controlling this machine, using the low rate throws for the initial flights.

The Krier Kraft is my favorite aerobatic model of all time, and is so safe, strong, and predictable that even the most outrageous maneuvers never cause any qualms. Indeed, this machine makes you dream them up. Things like a 4-point roll from take-off, and landings comprising a bounce, snap-roll and land sequence, aided by the sprung landing gear, never give any cause for concern, as her roll and snap-roll behavior are completely controllable, and stop instantly when you neutralize the controls. Another striking maneuver is the knife-edge approach to land. At a good height and passing downwind, roll her to the vertical and throttle back, and then holding full rudder to prevent the nose dropping, descend in a swooshing vertical side-slip while coming back into wind. At the last moment, level the wings and land — in a 3-pointer if possible. In a recent e-mail, Dereck Woodward reminded me of one maneuver I used to do with it which he called "Gordon's Grinder," where you perform a snap-roll at the 90-degree points of a loop; the most "entertaining" snap is the last one at the bottom of the loop, as the combination of high-g and high rotation rate really make the air near the model scream for mercy, and you always wonder if you've overdone it on this occasion. But her light loading and impeccable manners make even this maneuver reasonably safe.

Whenever you don't feel up to the knife-edge landing approach, try Krier's usual landing pattern; i.e., perform the landing circuit in an inverted glide, and at the last moment push in a tad of down elevator to raise the nose, and roll rapidly erect to let her settle, with a gentle bounce. That light 19 oz. wing loading and biplane drag combine favorably to let you take all kinds of liberties with this model that a sleeker more heavily loaded monoplane would find more difficult.

I guess that I had better close now before I frighten folks off this machine! As a welcome change from the current, and apparently interminable flush of Ultimates, CAPs, Extras, Giles, etc., why not try a blast from the past which really oozes character, and which in its time was the most outstanding aerobatic bipe in the U.S?