ILYUSHIN IL-2 "STORMOVIK"

This airplane was possibly the Soviet Union's most important aircraft during the World War II era. It builds into a contest winning model.

By David P. Andersen

Lenochka's Revenge

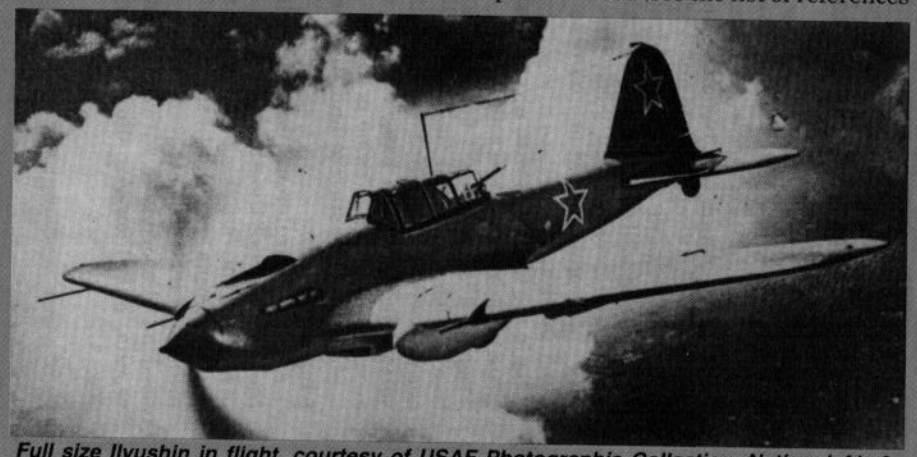
When the commander of the 237th Assault Regiment was killed in action flying a Stormovik, his seven-year-old daughter, Lenochka, wrote a letter to General Stalin. She included a few rubles she had saved and she asked the General to use the money to replace her father's lost airplane. Stalin answered her letter, he thanked her for her contribution and he said her request would be granted. Shortly thereafter, a new Stormovik was delivered to her father's regiment. It was inscribed in bright red lettering, "From Lenochka, for Papa."

The Stormovik was large, rugged, crude, and cheap to produce. It was designed to fly through ground fire at an altitude of 30 to 150' and attack armored targets, delivering a barrage of rockets and cannon fire, often horizontally. The forward half of the fuselage was a bathtub of armored panels up to 12 mm thick which protected the engine and crew. Even the radiator was protected for it was **inside** the fuselage, receiving air from an airscoop in front of the windscreen and exhausting it below. An auxiliary radiator below the wing was retracked into an armored box during combat. It was the only truly armored aircraft ever built.

Armament consisted of a large variety of weapons: two Shkas 7.62 mm machine guns, two Shvak 37 mm cannon, RS82 rockets, as many as 200 anti-tank bombs and even a grenade launcher. Empty weight of the aircraft was nearly 5 tons. Its wingspan was 48' and its maximum speed was 251 mph.

This airplane was possibly the Soviet Union's most important aircraft during the World War Two era. Joseph Stalin said of it, "Our Army needs the IL-2 as much as it needs bread, as much as it needs the air it breathes." It was a long-lived design, serving from the mid-thirties to the Korean War. The Stormovik was as important to Russia as the Spitfire was to Great Britain and the Mustang was to America, yet the Stormovik is not well known in the West. Perhaps we modelers can do something about that.

As a scale model, the Stormovik has excellent moments. It has a high-lift airfoil, a long, slender fuselage, a huge tail, and short, wide-apart landing gear with big wheels. The full-size Stormovik was designed for rough-field operation and low-speed stability — just the qualities we seek in a scale subject. It's odd that it is rarely seen in model form; the only other R/C design I know of is Bob Underwood's version which placed in the AMA Nats in the early 80's.



Full size Ilyushin in flight, courtesy of USAF Photographic Collection, National Air & Space Museum, Smithsonian Institution.

The Stormovik presented here was prepared by photo-enlarging the Aeromodeler/MAP drawings and filling in the structure. It is exact; no deviations from scale were permitted. If you use the Aeromodeler drawings for "proof of scale" documentation and you follow the plans faithfully, you should receive a perfect score for "accuracy of outline" in AMA scale contests. Only part of the Aeromodeler drawing is presented here; the complete drawing contains additional views and more detail. The Profile publication number 88 is apparently derived from the same Aeromodeler drawing, so it is also excellent scale documentation plus it contains many color schemes. Upgrading to Precision Scale or FAI scale is possible by adding more details.

If you decide to build this airplane, you should first gather all scale documentation before cutting the first piece of wood (see the list of references on the plans). Then, wait for a cold Siberian night, put on your boots and babushka, and march down to your shop. Shove a tape of Shostikovitch's *Leningrad* Symphony into the stereo and toast a "salut" to Mother Russia.

Let's begin.

CONSTRUCTION

Wing:

Wing construction starts with making wing ribs. It is important to drill the 1/4" wing rod holes as accurately as possible. Don't drill these holes with a twist drill — it will tear balsa wood instead of cutting it, and it doesn't permit accurately centering the drill. Here's a better way to do it.

Cut a 3/4" section of 1/4" o.d. brass tube. Bevel the inside edge of one end with a Dremel grinding stone. Grind the edge to be as sharp as possible. Chuck this in your drill press or electric hand drill. Place a wing rib on a flat piece of pine and slip it under the drill press. Lower the brass tube, motor off, until the tube touches the 1/4" circle marked on the rib. Align to a perfect match and turn on the drill. Lower the tube slowly until resistance is felt and withdraw. Voila! — a perfect hole. Remove the tube and push out the balsa plug. Resharpen after every 10 holes.

Build the 4-flap sections. All 4-flap horns must be exactly alike or else the flaps will not raise and lower together. To make 4 identical horns, stack 4 pieces of horn material with double-faced Scotch tape between them. Cut and drill all 4 at once. Complete the 4-flap sections and put them aside for now.

The wing is built on a wing jig, one panel at a time. If you have a commercial wing jig, use it. Otherwise, buy two 3', 1/4" steel rods from the local hardware store. Apply a very thin coat of oil to the rods, just in case some glue spills on them. Lay these over the wing plan, raised on short sections of wooden blocks beyond the root rib and tip rib.

Slip each rib onto the forward wing rod and align the ribs over the plan. The wing rods will not be parallel when all the ribs are assembled, so it is necessary to slide the rear wing rod through the ribs, rather than slide the ribs on the rod. Work slowly, twisting the rear rod through the rods while maintaining the rib spacing over the plan. When assembled, the ribs of the left wing panel will be upside down over the plans. Notice that the

MATERIALS LIST

All material is 4-6 lb. balsa unless otherwise specified.

3 — 1/16 x 3 x 36
2 — 1/4 x 3 x 48
15 — 3/32 x 3 x 36
2 — 3/4 x 3 x 36
3 — 1/8 x 3 x 36
1 — 1/4 x 1/2 x 36
1 — 1/2 x 1/2 x 36 triang-medium
1 — 1 x 3 x 36
2 — 2 x 3 x 12
2 — 3/4 x 3 x 24
2 — 1 x 1/4 x 36
8 — 3/8 x 3/8 x 36 medium
6 — 1/4 x 1/4 x 36 medium
1 — 18 x 12 x 1/32 ply
1 — 24 x 12 x 1/8 ply
1 — 24 x 12 x 1/8 Siglite ply
Misc soft balsa blocks
1 — 1/4 x 36 hardwood dowel
3 — 1/2 x 1/2 x 12 maple
1 — carbon-fiber pushrod
3 — 1/16 music wire
1 — 1/8 music wire
2 — 18 x 12 Sig cellulose-acetate butyrate sheet
1 — 3 x 6 lithoplate (thin aluminum) sheet

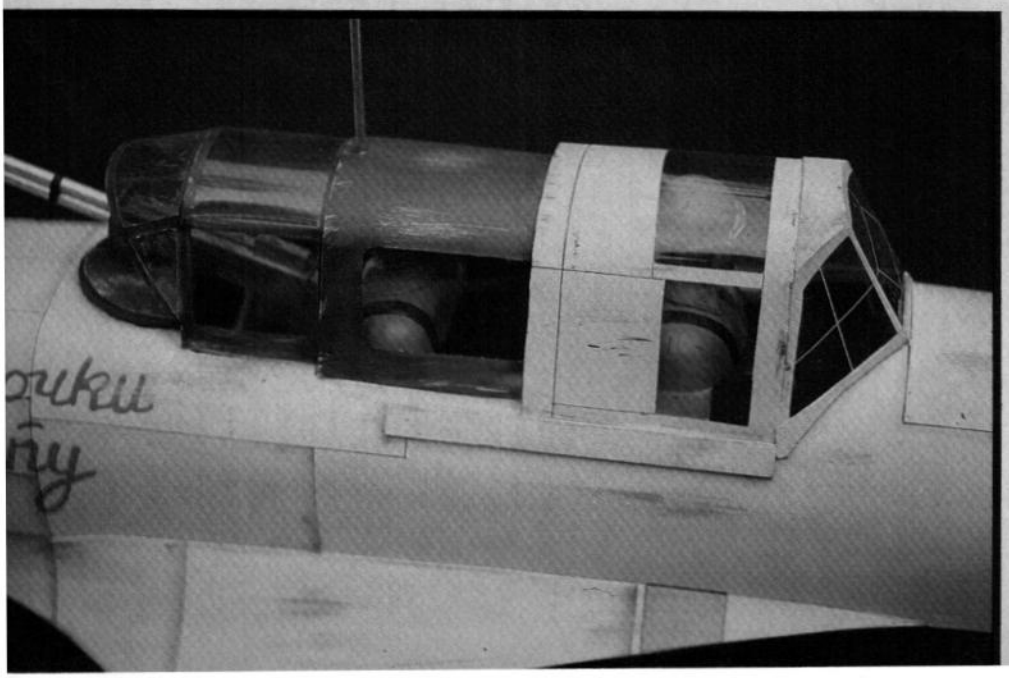
outermost ribs add washout to the wingtip — very important for low-speed stability. Glue wing spars, leading edge and trailing edge in place. Flip the wing jig over and add the topside spars and the dihedral braces. Be careful to align the dihedral braces well because any large error will cause problems when the other panel is built.

Sand the wing ribs with a very long sanding block to remove any irregularities in the rib contours so that the sheeting will fit flush with each rib without any dips or bumps. If you've drilled those wing rod holes accurately, this will be no problem.

Sheet the top surface and flip the wing over again.

Add flap and aileron linkage. Install the flaps but not the ailerons yet.

Install the maple landing gear support blocks and trial-fit the retract mechanism. Spring Air retracts were used on the original with excellent results, but Rhom-Air units will fit too.



Partially cut through the leading edge where the landing light will be. The partial cut will be a guide for the complete cutout later.

When you are satisfied that the flap and aileron linkages work okay, sheet the bottom of the wing.

Remove the wing rods — if you've spilled glue on them and you didn't oil the rods as you were told to do, you've got a problem.

Assemble the right wing like you've assembled the left, but this time, glue the dihedral braces in place while enduring the inconvenience of having the left wing panel attached. Shove

ILYUSHIN IL-2 STORMOVIK

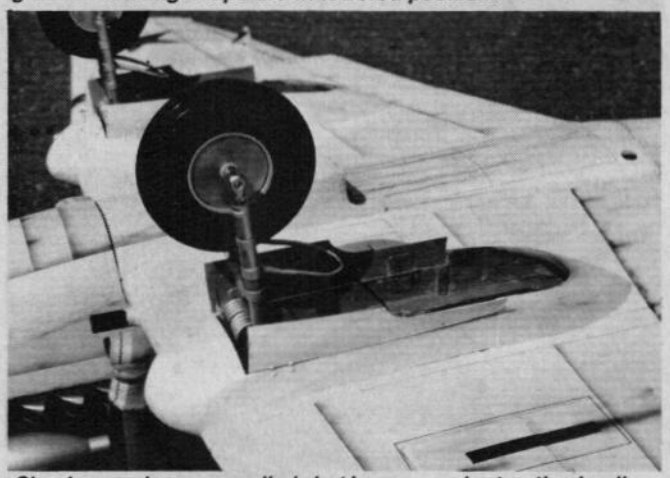
Designed By:
David P. Andersen
TYPE AIRCRAFT
Sport Scale
WINGSPAN
70 Inches
WING CHORD
18" Root, 7" Tip
TOTAL WING AREA
880 Sq. In.
WING LOCATION
Low Wing
AIRFOIL
14% Scale Flat Bottom
WING PLANFORM
Double Taper
DIHEDRAL EACH TIP
2 Inches
O.A. FUSELAGE LENGTH
58 Inches
RADIO COMPARTMENT SIZE
(L) 10" x (W) 4½" x (H) 3"
STABILIZER SPAN
25 Inches
STABILIZER CHORD (inc. elev.)
9 Inches
STABILIZER AREA
235 Sq. In.
STAB AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Mid Fuselage
VERTICAL FIN HEIGHT
8 Inches
VERTICAL FIN WIDTH (incl. rud.)
8½ Inches (Avg.)
REC. ENGINE SIZE
.90-1.08 2-stroke; 1.20 4-stroke
FUEL TANK SIZE
16 Oz.
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
6
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail., Flaps, Ret.
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa & Ply
Empennage	Balsa
Wt. Ready To Fly	**144 Oz.(9 Lbs.)**
Wing Loading	**24 Oz./Sq. Ft.**

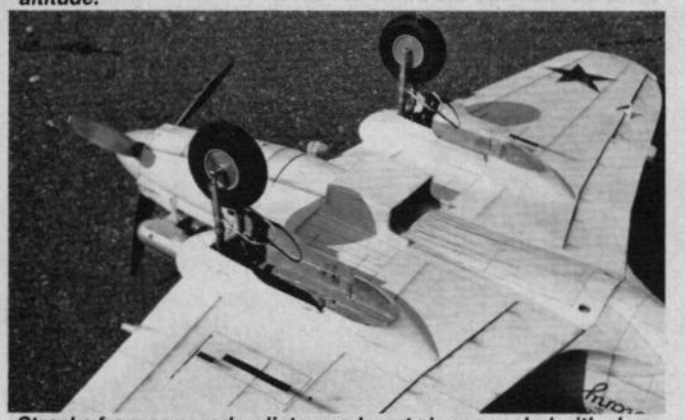
Stormovik's high-lift wing and large tail combined with slender, long fuselage are good proportions for a scale model. Stable flight, excellent ground-handling.

Panzer's view of oncoming Stormovik. Low, wide-stance landing gear designed for rough Russian airfields makes for good ground-handling. Flaps are in lowered position.

Stormovik is model of only truly armored aircraft. Not a fighter and not a bomber; it was designed to assault tanks at a very low altitude.

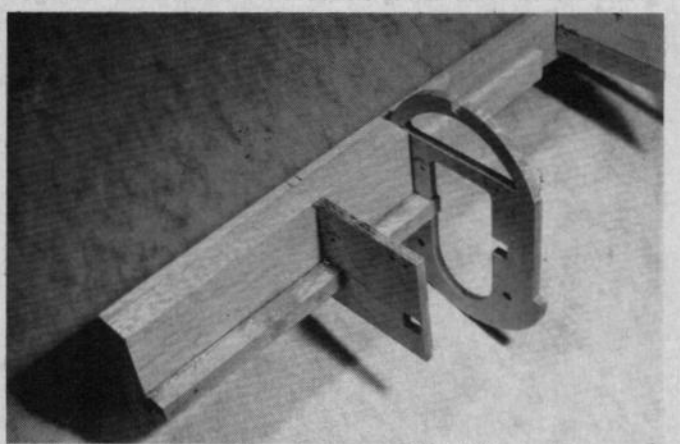


Simple gear doors are pulled shut by rearward-retracting landing gear. Wheel remains partially exposed after retraction. Wheel hub is lithoplate glued to Robart's wheel. Spring Air retracts. Fults struts.

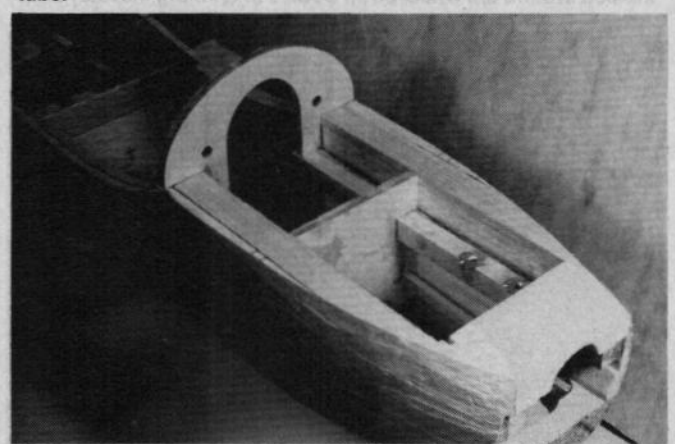


Streaks from armored radiator are burnt sienna sealed with clear dope. Weathering explained in text.

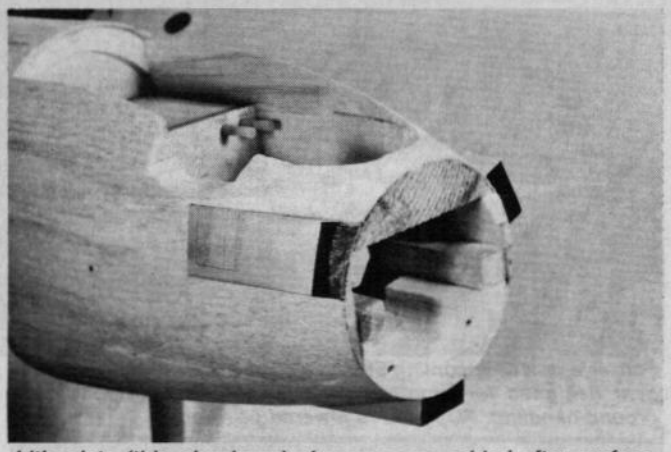
Dual-strut landing gear is Fults nose gear and Robart's scale wheels. Cannon barrel is removable, breakaway soft aluminum tube.



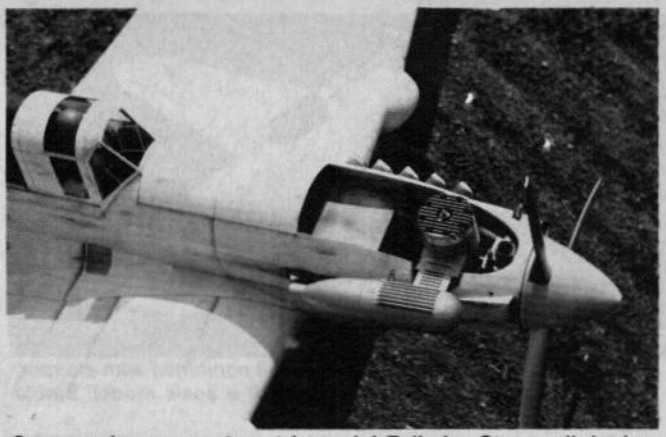
Engine bearer is maple beam supported by 1/4 inch ply formers and epoxied to balsa nose doubler. Battery compartment is between these two formers. Tank will be behind them.



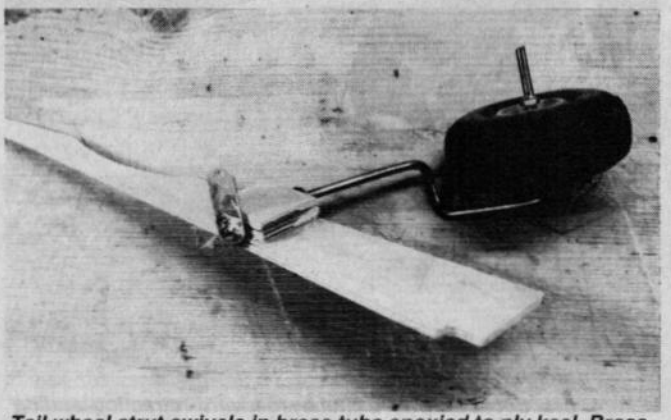
Bottom view of nose. Wing-rod holes in former will be used to drill wing-dowel holes in wing prior to adding chin block. Note blind nuts for engine are already installed.



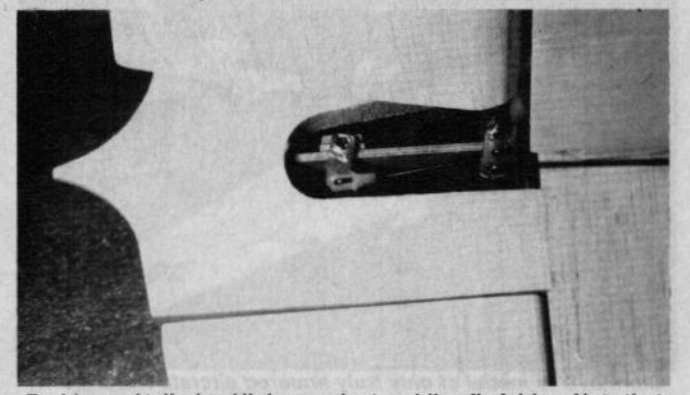
Lithoplate (thin aluminum) airscoops are added after surface preparation. Notch in side is for muffler clearance.



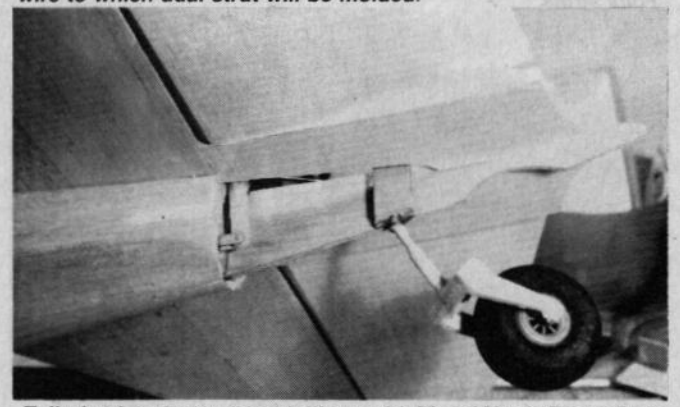
Open engine compartment is scale! Full-size Stormovik had a large airscoop in front of enclosed radiator. Tiny hole to right of carb is idle-adjust access. Needle valve extends on left side. CB Associates P-40 spinner.



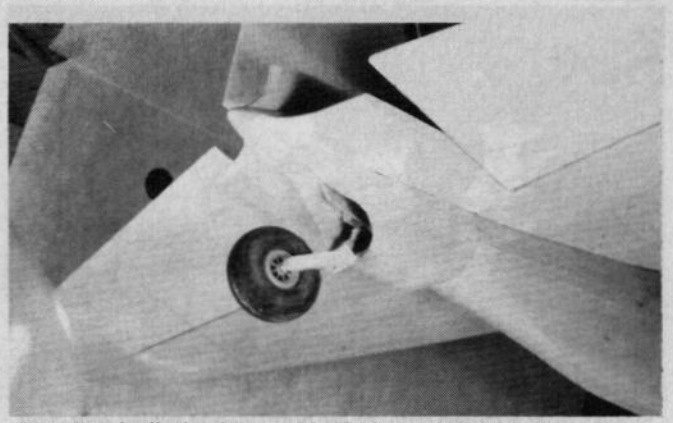
Tail wheel strut swivels in brass tube epoxied to ply keel. Brass tiller is soldered to strut. Exposed axle will support another thin wire to which dual strut will be molded.



Rudder and tail wheel linkage prior to adding fin fairing. Note that tail wheel has half the throw of rudder.

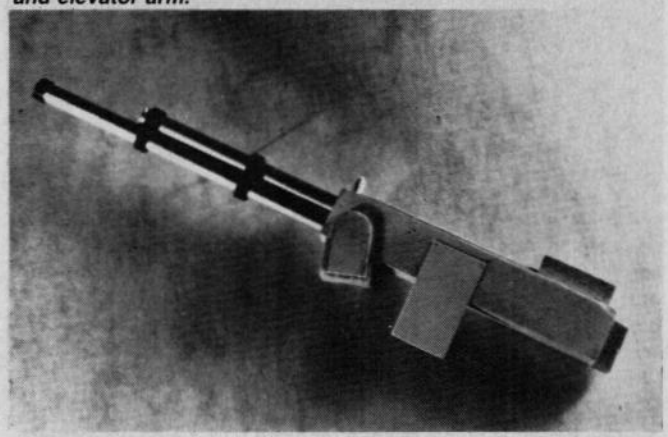


Tail wheel scale struts are built-up with Model Magic Epoxy Plus molded around tail wheel strut. Details in text. Sig elevator arm.

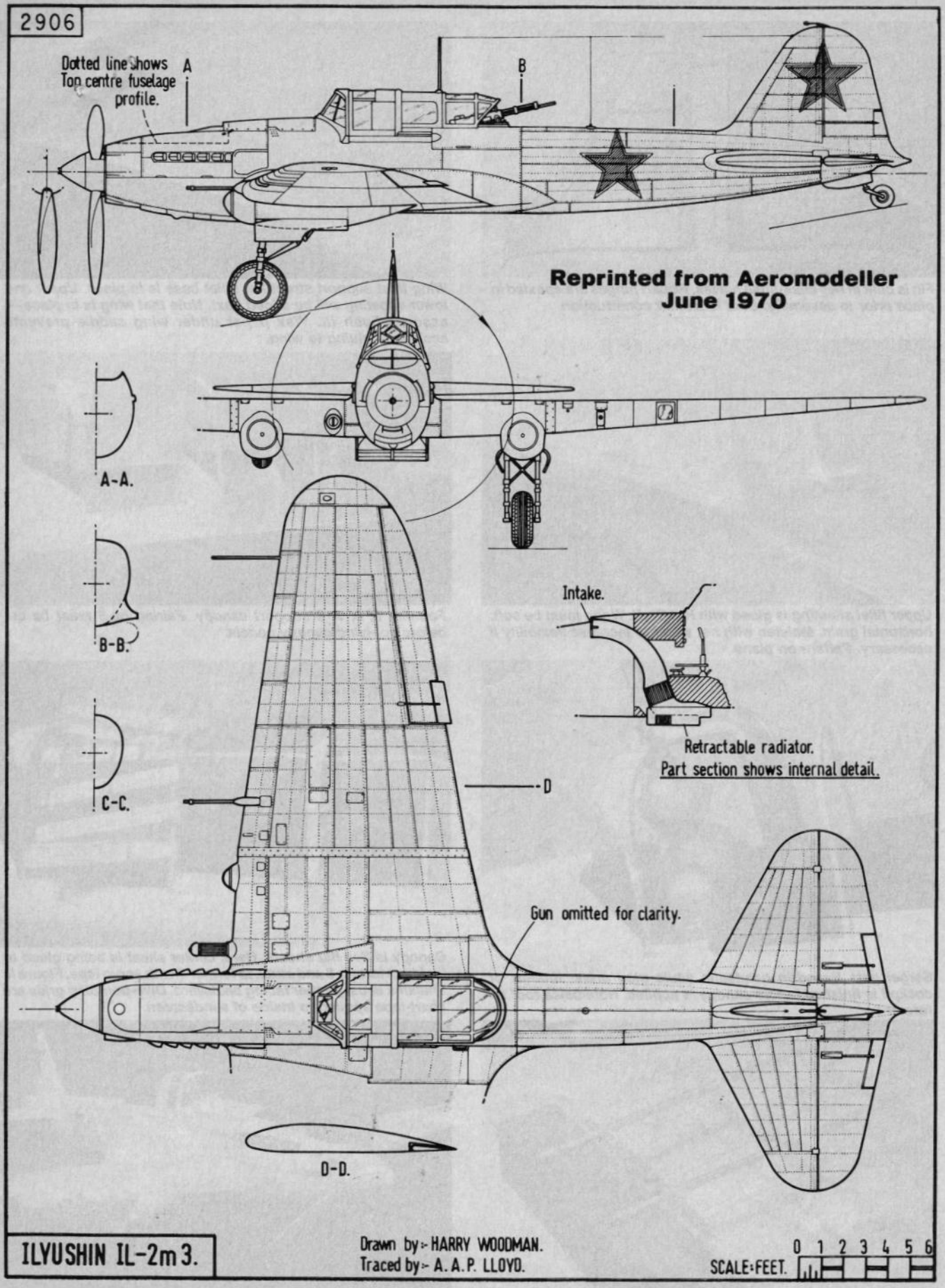


Completed tail wheel assembly. Tail wheel is sanded to remove gloss. Carved balsa fairing encloses tail wheel/rudder linkage and elevator arm.

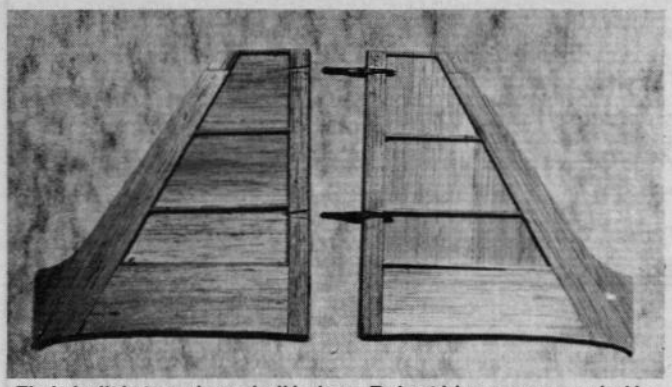
Large tail of Stormovik gives excellent low-speed stability and good ground-handling. Panel lines are Sharpie pen with airbrush shading.



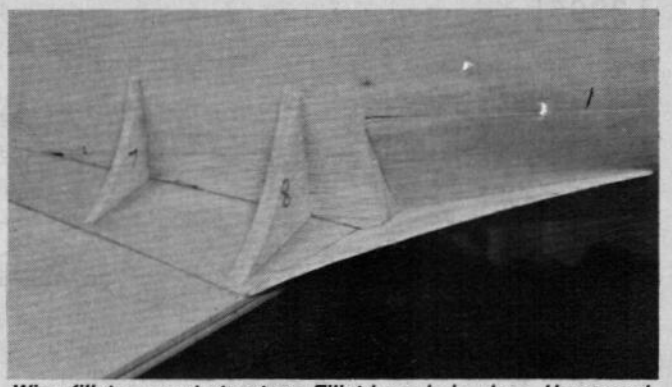
12.7 mm rear gun is aluminum tubing and balsa. Several turns of chart tape around barrel. Outline is exact scale but details are simplified for Sport Scale competition.



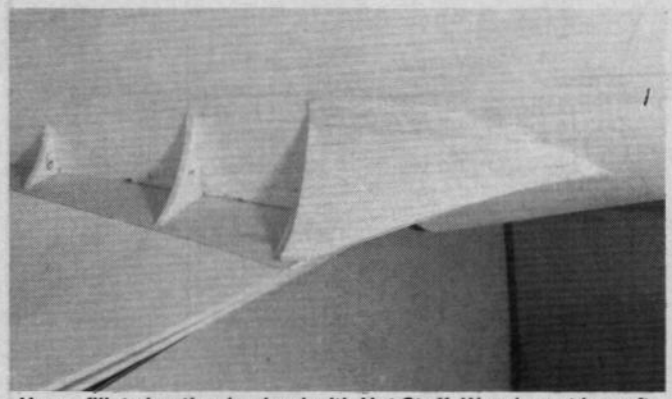
short sections of 1/4" dowels in the wingtip of the completed left wing and let half of the wing panel hang over the end of your workbench. Use a spirit level on the dowels before the glue sets in the dihedral braces to insure both wings are level. Assemble and sheet both surfaces of the right wing, leaving the center section open



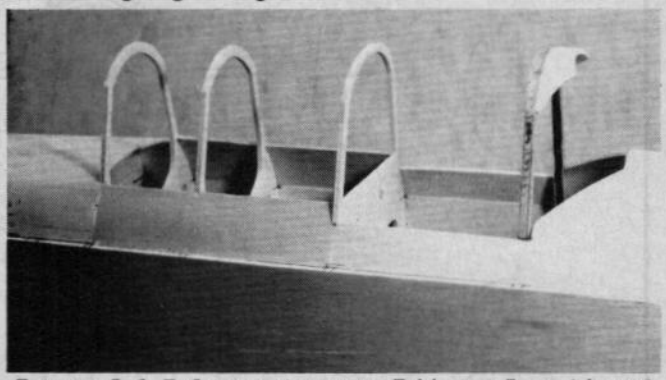
Fin is built in two clam-shell halves. Robart hinges are epoxied in place prior to assembly. Stab is similar construction.



Wing fillet support structure. Fillet base is in place. Upper and lower sheeting will be added next. Note that wing is in place — assures flush fit. Wax paper under wing saddle prevents accidental gluing to wing.

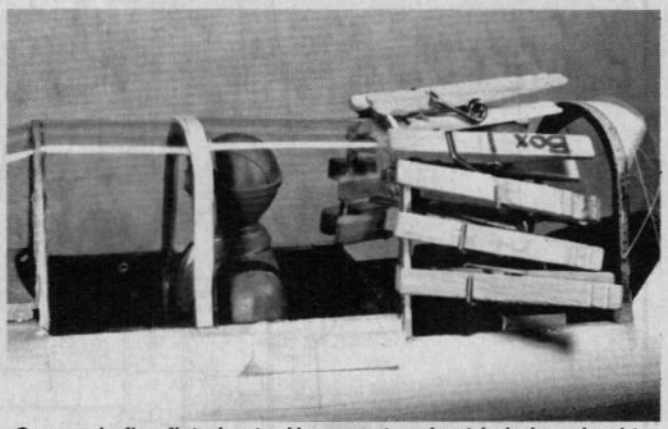


Upper fillet sheeting is glued with Hot Stuff. Wood must be soft, horizontal grain. Moisten with hot water to increase flexibility if necessary. Pattern on plans.

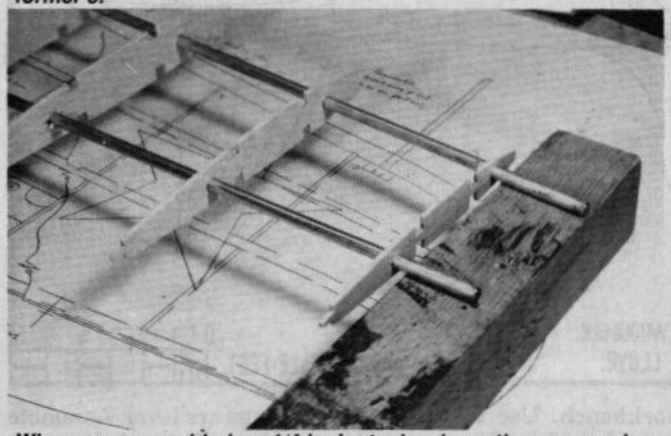


Formers 5, 6, 7, 8 support canopy. Fairing on 5 must be cut before applying canopy panels.

Sergei gets Excedrin headache while glue dries. Interior of cockpit is finished before canopy is applied. Note balsa roof on former 5.



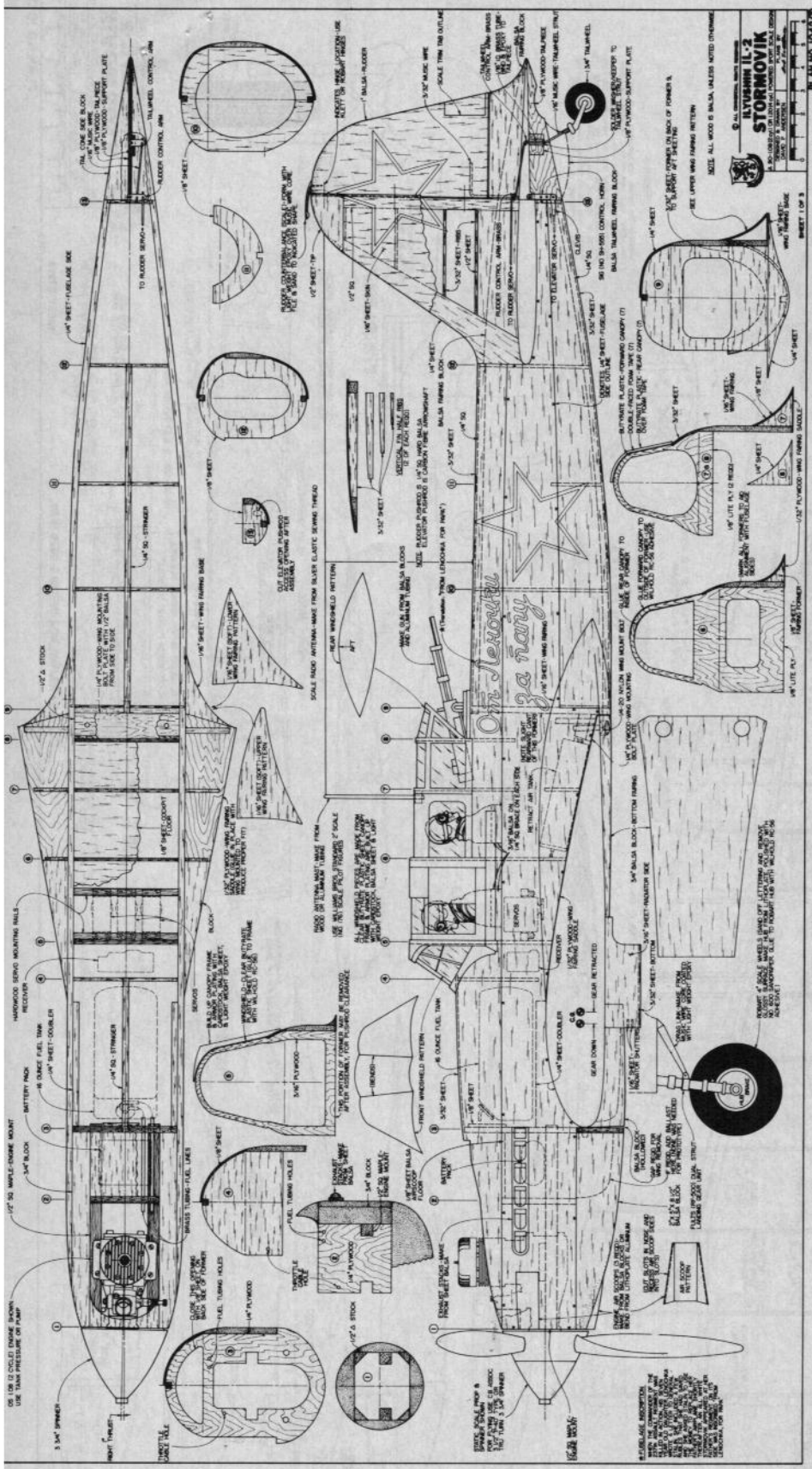
Canopy is five flat sheets. Here, center sheet is being glued to inside of former 6 and stuck to former 7 with servo tape. Figure is Williams Bros. gunner facing backward. Dive-bombing grids are chart-tape applied to inside of windscreen.



Wings are assembled on 1/4 inch steel rods resting on wooden blocks — or use a commercial wing jig.

Complete and ready to roll.

FULL SIZE PLANS AVAILABLE — SEE PAGE 304



for now.

Remove the wing rods and set the wing upside down on your workbench. Support the center section, which consists of only two dihedral braces at this time, with one of the wood blocks used previously. Before sheeting the center section, we must assure that the incidence angles of the two wing halves are exactly equal. These can be measured by inserting 1/4" wooden dowels in the wing rod holes in the wingtips and propping up everything so that both wingtips are level. Better yet, use a Robart Incidence Meter and take many measurements along both wing panels. Shim so both wings are equal incidence. Now sheet the bottom center section. Flip over and re-align everything all over again and sheet the top center section. Do not add wing dowels at this time.

Cut the ailerons and plane them considerably oversized. Sand only the leading edge to shape and install the ailerons. Add the wingtip blocks and plane to shape. Now plane and sand the ailerons to final shape. Notice that the washout in the last two rib bays requires a twist in the ailerons. Sand the ailerons to final shape with a large sanding block so they are flush with the wing.

After sanding the entire wing, cut out the landing light section using the previously completed saw cuts done earlier. Paint the inside chromate green. Add a cut-down Flash Cube reflector and enclose the landing light with a section of clear plastic sheet. Mask with electrical tape until all other painting is completed.

The pitot tube and gun barrels are telescoped sections of soft aluminum tubing. AMA rules require pitot tubes to be removed for flight. Curiously, they do not require cannon barrels to be removed. These cannot be seen in flight anyway, so make them removable too, for safety.

Put the wing aside for now until the fuselage wing saddle is ready for completion.

Fuselage:

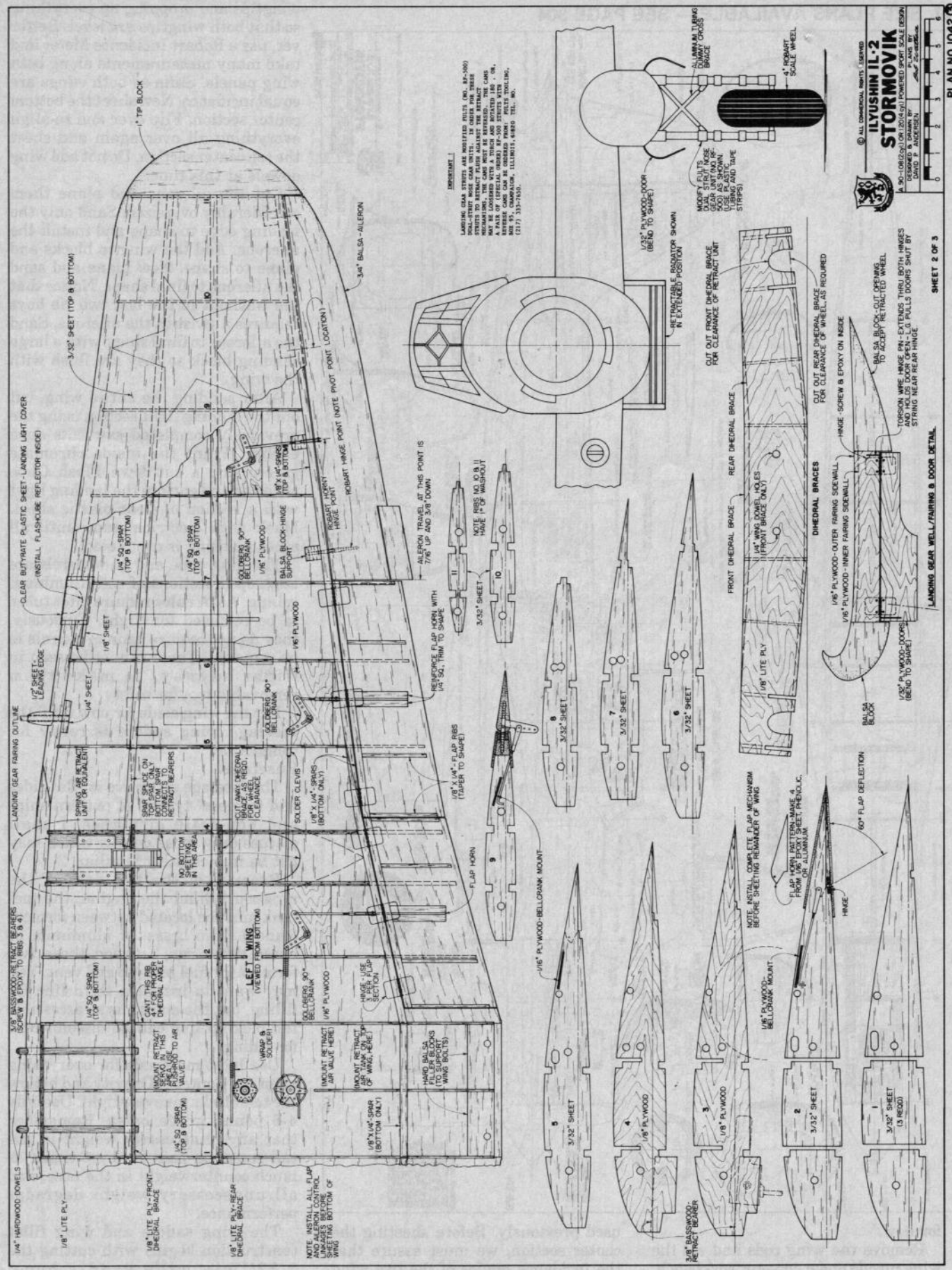
The fuselage structure is "flat sides and formers" typical of pattern ships and non-scale airplanes. I shall discuss only those details which may not be immediately familiar.

Because of the flat deck of the airscoop behind the engine, the fuel tank must be located between formers 3 and 4. Two brass, or aluminum or brass tubes run between these two formers for fuel pick-up and vent. You may want to install a third line for filling, but the engine is so accessible the pick-up line can be disconnected for filling.

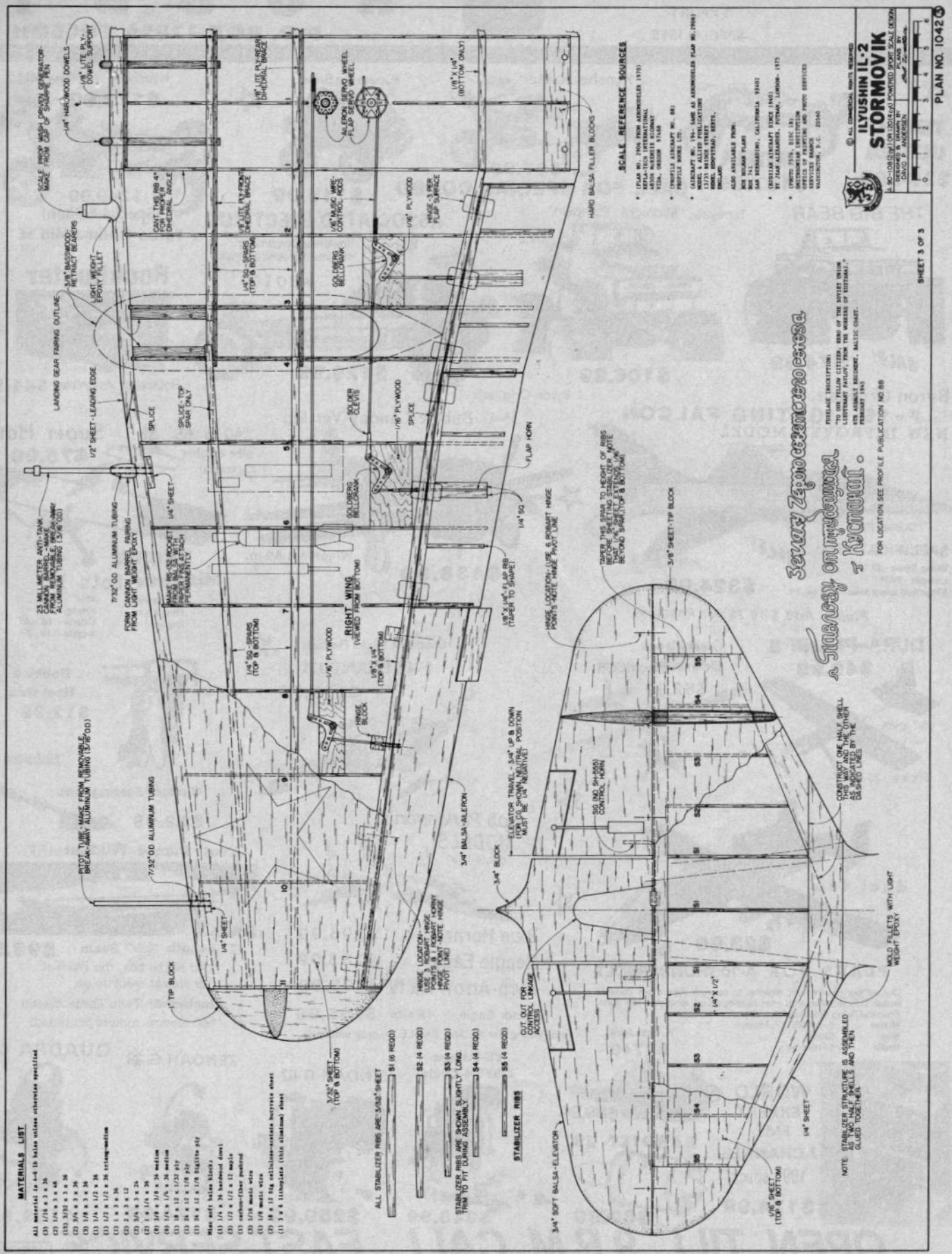
Use light materials for everything aft of the Center of Gravity and hollow the tail blocks to save weight. Use only 4-6 pound grade balsa. Remember that any unnecessary weight in the tail must be paid-for by 6 times as much counterweight in the nose, and all unnecessary weight degrades performance.

The wing saddle and wing fillet construction begins with cutting the 1/32" ply wing saddle base. Temporarily tack-glue the wing saddle base in place on the inverted fuselage. Lay the wing in place on top

FULL SIZE PLANS AVAILABLE — SEE PAGE 304



of the wing saddle. Verify that the wing is perpendicular to the fuselage sides and butted tightly against former 3 — trim or shim as necessary. Also measure the distance from the wingtips to the tail; they must be equal or else the plane will roll in response to changes of pitch or airspeed. When all is true, drill and



tap and install the two nylon wing bolts in the trailing edge and pin the leading edge of the wing in place. This will hold the wing still while the holes for the leading edge wing dowels are drilled in the wing.

At this point, the fuselage nose should have been roughed-in with the chin block tack-glued in place.

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continued from page 57/48

Remove the chin block and place the drill bit (you will need a 12" long, 1/4" drill bit for this operation) in a wing rod hole in former 3 and drill through the leading edge of the wing. Repeat for the other wing rod hole. Remove the wing and epoxy the 1/4" wing rod dowels into the wing. Don't install the chin block yet.

We now return to the wing saddle program already in progress.

Lay the wing saddle bases in place, once again, but this time apply slow-drying glue between them and the fuselage sides. Lay Saran Wrap or waxed paper on the wing saddle and attach the wing. Before the glue on the wing saddle sets, tape the wing saddle base flush to the wing and add the fillet formers 6, 7, and 8. Add the fillet base. The remainder of the fillet pieces are 1/16" sheet balsa, rearmost first, as shown in the photos. The very front of the fillet is a small piece of carved balsa. Cut this piece with a jigsaw using the side-view pattern from the plan. Glue in place and carve it with a woodcarver's gouge and sand it smooth with sandpaper wrapped around a dowel. It is not necessary to taper the upper edge of the fillet into the fuselage completely. Stormovik wing fillets were overlapped and riveted sheet metal, so we prefer a sharp line here.

Note that there is an intentional gap between former 3 and the fuselage fairing under the wing. This gap allows the wing to be tipped downward for removal. This gap is unobtrusive and it appears as a panel line.

Now let's return to the nose.

The engine can now be mounted in place and the beam mounts drilled and blind nuts installed. Once again, tack-glue the beleaguered chin block in place. Add the spinner's back plate and draw a line around it on the nose blocks. Remove the engine and carve the nose to shape with a razor plane. Crack the chin block loose. Hollow out the chin block between formers 2 and 3; this makes room for the battery pack. Install the outer throttle cable at this time and Hot Stuff it to formers 2 and 3.

At last you may finally glue the chin block in place. Re-install the engine. Stick some sticky-back sandpaper to the back of the spinner's back plate and slip it on the prop shaft. Work it around and around to sand the nose flush with the spinner back plate. When the sandpaper is removed, there should be a hairline gap all around the spinner and the nose blocks. Test with the spinner bolted on tightly — there must be no contact between back plate and nose blocks. Wrap the spinner with masking tape for protection and sand the nose to final shape.

Add the muffler cutout and airscoops after the foundation finish is in place.

Canopy:

At first glance, the canopy construction looks complicated, but it is merely 5 flat sheets of plastic.

Construction of the canopy should begin after the foundation finish of the fuselage is completed and it is ready for the color coat. The little balsa roof on former 5 is cut with a jigsaw and sanded to final shape with a sanding block. The interior of the cockpit is completed and painted and the crew installed.

Have you ever noticed how Williams Bros. pilots always look too small? If you measure the head size or shoulder size of Williams Bros. pilots that are marked 2 inches to the foot, you will find that they are models of very small people. Fortunately, they are perfectly sized for the Stormovik which is actually 1.46 inches to the foot (approximately 1/8 scale).

Cut the windshield from Sig cellulose acetate butyrate sheet and fold it where indicated. Trial-fit this to former 5 and trim to shape. Leave it oversize on top; this will be trimmed later. The lines on the windshield are dive-bombing sights — apply these with chart tape to the **inside** surface of the windshield. Attach the windshield with Wilhold R/C 56 glue. Hold in place with clothespins until dry.

Now cut out the rearmost section and glue it in place. Cut the next section of plastic oversized and trim it to fit. Glue it to formers 7 and 8 and to the fuselage sides. Hold it in place with masking tape and clothespins until dry.

Next, apply a strip of double-faced foam tape over former 7 on top of the plastic just applied. Cut the next section of plastic to size and apply it over the foam tape on former 7 and glue it to the **inside** of former 6 and to the outside of the fuselage sides.

Finally, the last canopy section between formers 5 and 6 is cut to shape and glued to former 5 and the **outside** of former 6.

The armor plate on the roof of former 5 is shaped by masking its outline with 4 layers of masking tape and applying a thick layer of Model Magic Epoxy Plus. When dry, cut and sand it flat down to the level of the masking tape.

Main Landing Gear:

In Scale Masters competition, static scoring weights the landing gear as much as the entire fuselage — a little attention to detail here is well worth it.

Spring Air retracts mount on hardwood bearers which are, in turn, screwed and epoxied to ribs 3 and 4.

The retracts must be drilled for 3/16" music wire struts and the gear must retract through 90 degrees. These may be ordered directly from Spring Air or from Byron's or you can drill-out regular 5/32" units. The gear retracts backward, without rotating, to be only partially enclosed in pod-like fairings. The two plywood dihedral braces remain unsevered by the landing gear to provide most of the structural integrity of the wing, but the retract units themselves provide a further structural bridge across the forward spar.

The rather simple clamshell doors are held open by a torsion spring which acts as a common hinge pin for the 2 Klett hinges on each door. These hinges must be epoxied and screwed in place to absorb the pounding of the air loads and the gear retracts. A loose fishing string between the doors in the area of the rear hinge pulls the doors shut when the strut comes up. There is little danger of the doors snagging when the gear is down because the strut is in the way.

The landing gear strut is a modified Fults nose gear. In order for the strut to fold flush against the retract mechanism it is necessary to unsolder the cam with a torch, rotate it 90 degrees and re-assemble — or you can purchase modified struts from Fults Tooling, Box 95, Champaign, Illinois 61820. Ask for two RF500 struts with reversed cams and without nickel plating; price is the same as for unmodified RF500 struts.

The shaft of the strut is cut so that the cam rests against the retract's pivot block with the coil springs facing forward. (When tail draggers land, their main gear struts are flexed forward, not backward like a nose gear, so the coil must be reversed from its nosewheel position.)

The struts are dressed-up to look like scale oleo struts by slitting a piece of plastic tubing and slipping it around the strut. The sections of the strut are simulated with strips of kraft paper wrapped several turns around the strut and sealed with Hot Stuff. Cross braces are aluminum tubes stuck into holes drilled in the plastic tubing, wrapped with thread set in the intersection and glued with Model Magic Epoxy (it's flexible).

The wheels are Robart's 4" scale wheels with the shine and lettering sanded off. ("Deutsche fabrik" — made in Germany — is an unacceptable deviation from scale!) Wheel hubs are disks of lithographic aluminum sheet sanded with 600 grit sandpaper and glued to the Robart plastic hubs with Wilhold R/C 56.

The air tank is strapped with rubber bands to a balsa cradle on top of the rear portion of the wing. The filler valve is mounted unobtrusively under the wing in the rear of the radiator. There are no air hoses to connect while assembling the airplane at the field — this reduces the chances of air leaks and dirt contamination.

Cycle the landing gears at least 100 times on the ground before using them in the air to assure yourself that they function reliably.

Dual-Strut Tail Wheel:

First, fashion a single-strut tail wheel strut from music wire as shown in the photo; the rest of the tail wheel structure is just for show. Form a foundation for the other strut by soldering a thin wire from the bend above the wheel to the axle. Copy and cut out the side view of the tail wheel strut from the plans and glue it to the inside of one of the struts. Make a tiny box of thin sheets of soft balsa around this paper outline, glued in place to the paper. This set-up is very flimsy, but it only has to hold together well enough to contain Model Magic Epoxy Plus poured into the box. When cured, cut the balsa box and paper away and sand the epoxy to final shape. Do the same for the other leg of the dual strut and then the crossbar across the top. Model Magic Epoxy Plus is light and as flexible as rubber and even butyrate dope sticks well to it.

Finish:

Prepare the surface by oversanding

with sanding blocks and filling all cracks and pinholes and other flaws with spackling compound. When perfect, sand some more.

Here's my secret formula for a lightweight scale finish. It requires only 6 coats of dope.

Coat 1: Brush full-strength nitrate dope over the wood. Sand off fuzz.

Coat 2: Brush on wet light-weight silkspan with thinned nitrate dope. Don't sand.

Coat 3: Mix thinned nitrate dope with Johnson's Baby Powder to the consistency of heavy cream and brush on one heavy coat. Sand nearly all of it off.

Coat 4: Spray one thin coat of silver butyrate dope. Don't sand.

Coat 5: Spray one coat of color (white in this case — see the Profile Publications 88 article for other color schemes).

Coat 6: Apply trim, panel lines, and weathering. Then seal it all with one sprayed, thinned coat of clear butyrate.

The base coat of nitrate dope adheres tenaciously. The next layer of nitrate-soaked silkspan is strong and hard, but the talc/dope layer is much softer, leaving a smooth, silky surface. Notice that this is the only step which requires much sanding. Do it outdoors; there are two reasons for this. First, it is very dusty — I sand nearly all of it off with sanding blocks; this creates a great white cloud of dust. Second, freshly sanded talcum powder releases a strong, lingering smell of cheap perfume; if you sand indoors, non-modelers will wonder what goes on in your shop.

You will find that butyrate dope sticks to nitrate as strongly as nitrate dope sticks to everything else. Metal parts, such as the antenna mast, should be primed with nitrate dope before painting with butyrate. Nitrate dope cannot be used over butyrate dope, however.

The pigment in silver dope is tiny chips of aluminum. It is extremely opaque, so only a thin layer is needed to cover glue joints, pencil marks, wood grain, etc. . . . don't sand it because this will turn it a dark color. With a uniformly light surface, a single coat of white dope will cover well. For a dirty off-white, an especially light coat will do. After this, the weathering is applied. A final coat of clear dope is needed only to seal non-fuelproof stuff such as Sharpie pen panel lines.

Weathering:

Stormoviks were flown from farm fields close to the front line. They were not hangared, of course, so they were exposed to snow, mud, ice, and, no doubt, they leaked oil. The winter camouflage scheme was all-white; you can be sure it didn't stay very white.

Weathering starts after the white coat and trim have been applied. Streaks and scratches are caused by dragging a sanding block of medium sandpaper downwind over the white, scaping through the white to expose the silver underneath. Worn areas, such as where the pilot steps onto the wing are created by sanding the white paint away with fine sandpaper. Elsewhere, a scratched effect around hatches and canopy frames is done by scraping the white paint off with a razor blade.

Underneath, one would expect rusty radiator fluid to leak and be blown backward by the propwash. Draw streaks aft of the radiator with burnt-sienna pastel pencil and smudge it with your finger. The final seal coat of clear dope will fix it permanently.

Panel lines are drawn with a fine-point Sharpie pen. Use a flexible plastic ruler on curved surfaces. It is best to draw the lines with a pencil first, in case you make a mistake.

Panel joints are dirt catchers and oil leakers, especially in the nose area. This grime will be blown backwards by airflow or seep downward by gravity. You can create this effect by thinning black dope at least 10:1, laying cellophane tape on the upwind edge of a panel line, and spraying a wisp of black on the line. Set the airbrush so it's blowing lots of air and not much paint. It's easy to overdo it — as soon as you can see the paint, stop.

Grease in hinges will be blown back too. Blast a puff of black paint from your airbrush at an angle backward from each hinge. Darken all control surface gaps to simulate the dirt that accumulates there. Dirty up the wing downwind of the cannon barrels. Apply a heavy streak aft of the exhaust stacks. Mess up the airscoop too. Mask off the gun access panels and spray a light shade of black all over them; this creates the illusion of a removable hatch.

Trim:

The red stars are easy. Use the stars from the plans as templates, mask off with electrical tape and spray bright red dope.

Interior parts — cockpit, wheel wells, landing light well — should be

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chromate green; paint these with a brush. Sig forest-green mixed with silver is a good approximation.

A lot of Russian airplanes had Cyrillic lettering — the Soviets were big on slogans — but don't let this discourage you. They are easy to do, due to Xerox and Speedball. Here's an easy way to do the elaborate Russian lettering.

Photocopy the lettering off the plans or enlarge other lettering from the Profile series 88 or some other source. Use an enlarging copying machine. Then cut out the lettering with an X-Acto knife. The remains is a stencil. Apply it to the airplane and trace the lettering with a soft lead pencil. Paint the lettering with a Speedball Painters Opaque Paint Marker.

These markers have a porous fiber tip and real paint. Unlike a brush, they leave a sharp edge — you can even use them with a straightedge. The paint isn't fuelproof, but it's compatible with butyrate dope.

Flying:

Check and double-check the balance point (C.G.) as shown on the plans. Further forward is okay, but don't let the Center of Gravity be aft of this point. If the plane turns out to be considerably heavier than 9 pounds, the C.G. should be even further forward.

Ground handling is outstanding. I have never nosed-over, ground looped, or broken a prop with my Stormovik. No up elevator is required for starting the take-off roll — just hit the loud-lever and steer with the rudder. When properly trimmed, it will lift off by itself. Good ground handling is to be expected, considering the rough field conditions for which the original was designed.

Note the neutral position of the elevator as shown on the plans: considerably below zero degrees. If this were a non-scale airplane, the incidence angle of the horizontal stabilizer would be adjusted to prevent this, but the design goal of no deviation from scale prevents this, so the neutral position of the elevator is set downwards instead.

The plane is quite stable and very smooth-flying. Slow-rolls are axial and uniform in roll rate — they draw applause. Low passes are chilling — this is the airplane that destroyed 70 German tanks in 20 minutes. When you see those cannon barrels coming at you and you hear the engine snarling, remember that the German Army called this airplane Schwarz Tod — "Black Death."

The flaps are very effective. Steep descents for landing with full flap cause no buildup in airspeed. I've found that 40° of flap is about right for a normal landing approach or for slow fly-bys. This permits slow flight without loss of stability. But full flap should be used only in steep descents, they slow the airplane too much in level flight.

The stronger the wind, the less flap deflection. If the wind is greater than 15 mph, don't use any flap at all for landings. Never use flap for take-offs except, perhaps, partial flap in dead-calm air.

Spins are slow with no tendency to become flat. Neutralizing the rudder and elevator instantly stops the spin. At the elevator throw shown on the plans, entry to the spin is critical. If you wish to do spins as a contest maneuver, you must use greater elevator throw for more reliable spin entrance — a good application for dual rates.

Retracting the landing gear causes the Center of Gravity to shift rearward about 1/2". This has little effect in normal level flight, causing only a slight increase in rate of climb. Retracting the gear during a steep, slow climb is not advised; it could precipitate a stall. The change in trim due to retracting the landing gear is compensated for by a down-trim change of about 1/8 of the elevator's trim throw. Robart scale wheels are recommended because they are lightweight. Be aware that if you use heavier wheels, the change in trim

will be increased.

Intelligence units have reported the German Army South Ukraine is approaching your club's flying field (perhaps you should have done a better job of maintaining good relations with the neighbors). Fly your Stormovik high above enemy locations downwind in order to select likely targets. Now retard the throttle and split-S downward into a steep dive. Advance to half throttle as you level out at a low altitude. Roar over the center of the field with your Shvak cannons blazing. Then advance the throttle to full power and pull up steeply to avoid ground fire.

A few more assaults like this should halt the enemy's advance. Fly high over their headquarters (that's the mower shed at my club's field) and drop the surrender ultimatum by flicking the flap lever quickly open, then closed. A length of red crepe paper with a paper clip on one end tucked inside the flaps will slip out and drift down slowly. Return to base to await capitulation.

Approach the field from a much higher altitude than you would typically fly a non-scale airplane. Reduce throttle to a fast idle and transition into a descending glide. When slowed, lower the landing gear; this will slow and steepen the glide even more. Slowly lower the flaps to full-down position. There will be a tendency to balloon until excess airspeed is bled off — resist this with a bump of down elevator. Let the plane drop into a very steep glide. It will settle by itself into a very steep descent without buildup in airspeed. Adjust the glide slope with down elevator if the glide slope is too high or add a crack of throttle if too low. Very little throttle is needed to flatten the glide angle — the flaps generate so much lift. (It takes some getting used to landing at such a steep angle of descent.) At about 10' of altitude over the runway, flare to touch down. The plane will now have so little airspeed that the rollout will last only 20'.

Raise the flaps and taxi back to Lenochka — she will be pleased.

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