ARADO 96B

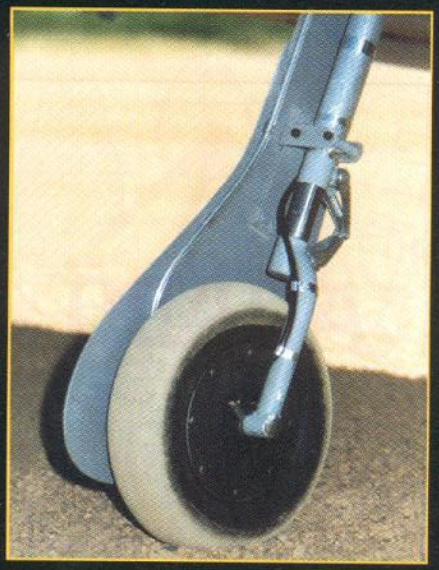
Part Two

By David P. Andersen

A One-Fifth Scale Model of WWII Germany's Standard Advanced Trainer

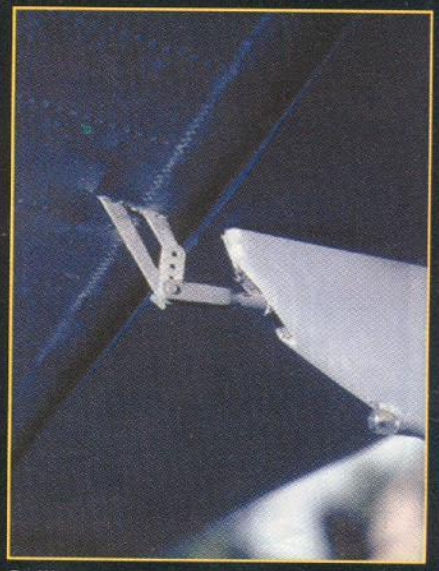
Scale surface rivets, panels, holes, hinges, etc., add realism.

Vacuum-formed canopy available from Aerotech Models.



Robart strut, Williams Bros. wheel, aluminum wheel door.

Saito 150 engine with stock muffler is enclosed in narrow cowl.



Sullivan metal control horn looks scale and is adjustable.

(Continued from May 2002 issue)

Ailerons:

Ailerons are assembled per the flaps on a flat surface. Apply small balsa blocks alongside the slot in the bottom surface where the horn will be installed. The base of the horn should be level with the nearest rib so that the base will contact the upper sheeting when it is installed. Insert the control horn through the slot in the bottom sheeting. Remove the aileron from the building board. Roughen the control horn, drop it through the slot and epoxy it in place.

Sheet the upper surface and round the leading edge per the detail view on the plans. Verify that the aileron hinges move at least 45 degrees up and down for a total of 90 degrees. Enlarge the slot in the leading edge with an X-Acto blade if necessary.

Carve a balsa trim tab. Tack-glue it in place and sand it flush with the wing, then remove it for later installation after the wing is covered and primed.

As you did with flaps, pin the aileron in place and spot-glue the hinges. Run a strip of sandpaper between the aileron and the flap to make the gap neat. Do the same at the wingtip. Add material if the gap is too big and sand it down again.

Sand the top and bottom of the aileron to be flush with the wing.

Adjust the flap and aileron throws, and center positions. When satisfied that all works well, reinforce the aileron hinges in the wing with blocks of balsa and epoxy.

Joining Wing Panels:

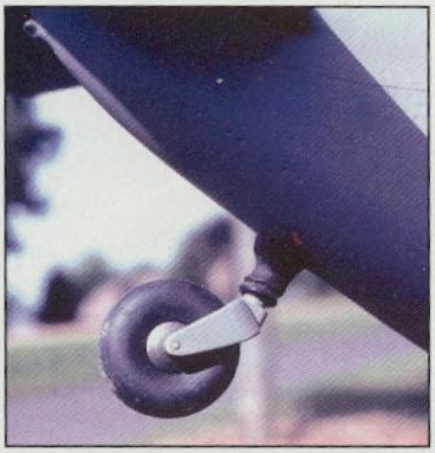
Find a large flat surface like the floor, and trial-fit the wing halves together. The dihedral braces from one panel should fit snugly into the slots in the other. Trim away material if they don't. Add shims if too loose. For max strength, it is important that the dihedral braces make direct contact with the spars.

Scale rudder cables aren't real. Operational cables are inside fuselage.

Lay a strip of waxed paper down, then put lots of slow-set epoxy on the dihedral braces, the surfaces of the root ribs, and in the slots where the dihedral braces will go. Connect the two wing halves and place them on the waxed paper. Elevate the tips 4-1/2" at rib 14. Wipe up any spilled epoxy with alcohol before it sets.

Complete the stringing of the servo cables. Glue the cables in place in the wing so that they don't rattle around. Stick connectors to the shear webs with double-faced foam tape so that they cannot separate.

Complete the installation of the trailing edge shear webs, and add the 1/8" ply wing bolt mounting plate. Fill the space between ribs 1 and 2 with 1/2" hard balsa over the holes in the mounting plate and re-drill the holes. Plane this to the surface of the adjacent ribs. This spacer will allow us to recess and hide the mounting bolts. Such are the rigors of scale modeling.



Scale Lyte-Flyte tail wheel. Boot is molded silicone glue.

SAC instrument panel and DGA pilot fill cockpit.

Glue-drop rib stitching on flap simulates fabric covering.

Emblem of the Second Fighter Pilot School, Magdeburg, Germany, 1943.

Wing Dowel And Wing Bolts:

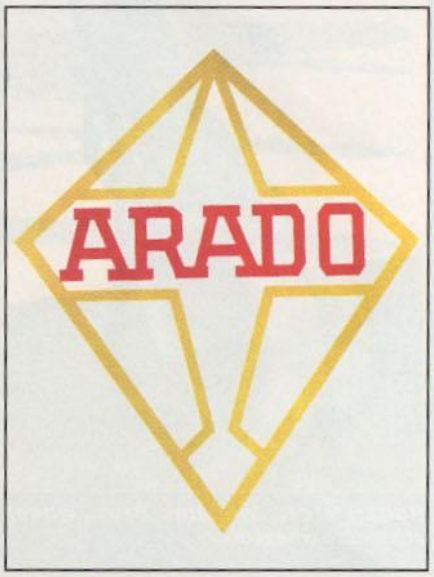
Remove the cowl and engine. Place the fuselage, inverted, on a stand.

Bevel the wing saddle aft of former 1F using the template provided on the plans. Lay the 1/32" wing filet base in place. Check the fit of the wing to the saddle and the filet base. Trim the wing saddle if necessary to get a good fit.

Add 1/4" ply wing bolt blocks to the side of the fuselage centered on where the wing bolts will be, between formers D and 1R flush with the wing saddle. Reinforce with balsa blocks.

Verify that the wing is exactly parallel to the stabilizer. Trim or shim the wing saddle if not.

Align the wing so that it is square to the fuselage. Do this by measuring from



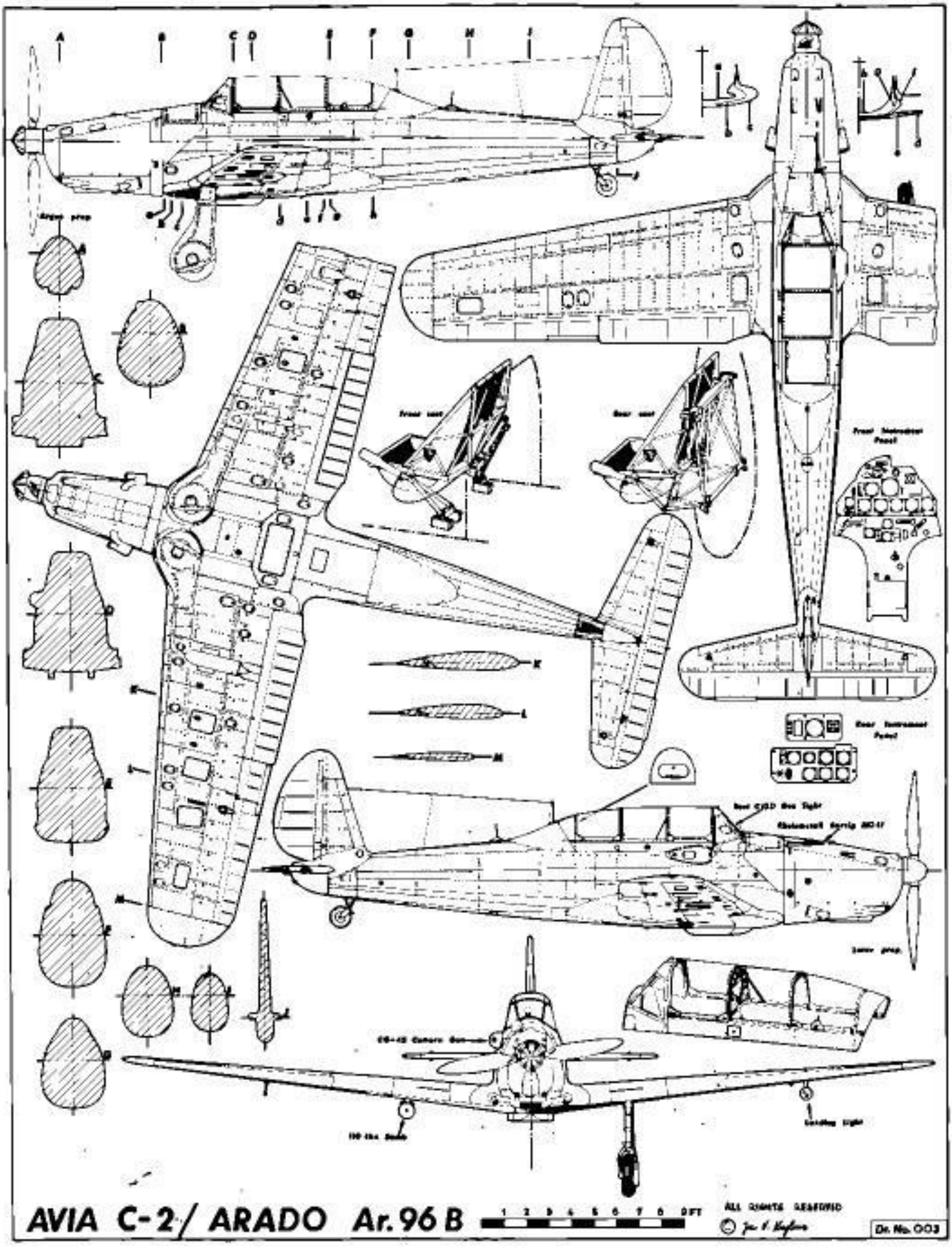
PLAN NO.1311

FULL- SIZED PLANS AVAILABLE (6 PAGES), SEE PAGE 177

Materials List

All material is 3-6 lb. balsa unless otherwise specified.
All dimensions are in inches.

24 — 3/32 x 4 x 48
3 — 1/8 x 4 x 48
1 — 1/2 x 2 x 30 (dihedral braces — hard)
2 — 1/2 x 3 x 36
1 — 1/4 x 4 x 36
3 — 1/16 x 3 x 36
1 — 3/4 x 4 x 36
1 — 1-1/2 x 3 x 18
1 — 1 x 4 x 12
1 — 3 x 3 x 12
4 — 1/4 x 3/8 x 48 (spars — straight)
5 — 1/4 x 1/2 x 48 (spars — straight)
8 — 1/8 x 1/4 x 36
2 — 3/8 x 1 x 48
10 — 1/4 sq. x 48
1 — 1/8 sq. x 36
1 — 1/16 x 1/4 x 36
2 — 3/16 x 3/8 x 36
2 — 1/4 x 1/2 x 36
1 — 3/8" dia. birch dowel
1 — 1/4 x 12 x 24 ply
1 — 1/8 x 12 x 48 ply
1 — 3/32 x 12 x 24 ply
1 — 1/16 x 12 x 12 ply
1 — 1/32 x 12 x 24 ply
6 — Robart hinge points
21 — Robart super hinge points
1 — Robart #191 air tank
1 pr. — Robart #620 AT-6 retracts
1 pr. — #672 Robostruts (order retracts and struts as "620-Arado")
1 pr. — Williams Bros. #121 balloon wheels
1 — Du-Bro #376 tail wheel bracket or …
1 — Lyte-Flyte AR 96 custom tail wheel assembly
1 set — SAC Headquarters AR 96 instrument panels
1 — DGA #205 1/5 scale pilot kit
1 — 6 x 12 x 1/16 dural aluminum for flap horns
2 — 6 x 12 x 0.032 dural aluminum for wheel doors
3 sheets — Lithoplate (thin aluminum) for seats, etc.
1 — 5/16 x 12 aluminum tube for optional gun
1 — 3/16 x 12 aluminum tube for optional gun
1 — 7/32 x 12 aluminum tube for cable guide
2 — 5/8 x 4 tubes for cowl air intake
7 — 1/4-20 hex head nylon bolts
1 pkg. — Du-Bro #649 1/4-20 x 3 bolts
1 pr. — Sig SH-721 wheel pant mounts
12 — Sig SH-168, 2-56 x 3/8 F.H. screws
8 — 2-56 x 1/4 socket head screws
1 bottle — medium Loctite
60" — Proctor control cable
1 — Sullivan #557 control horn
1 pr. — Rocket City #69 swivel links
1 — Dave Brown carbon fiber pushrod
1 — Du-Bro #688 motor mount and bolts
1 — Du-Bro #665 4-stroke throttle linkage
1 — Throttle cable assembly
2 — 4-40 Sullivan clevises
2 — Carl Goldberg long control horns
4 — Du-Bro ball link connectors
1 — Tru-Turn TT-2732-B-120 2-3/4" AT-6 spinner
1 — Tru-Turn TT-0822-A jam nut adapter kit
1 — ElectroDynamics EDR-103 Glowlite
1 — Canopy and other vacuum-formed parts from Aerotech Models


AVIA C-2/ ARADO Ar.96 B
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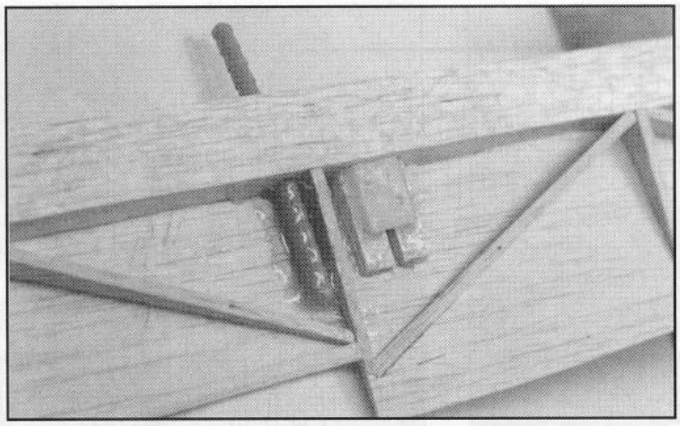
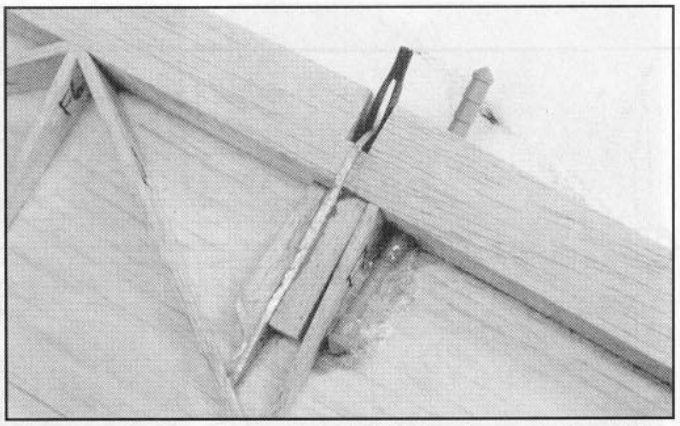
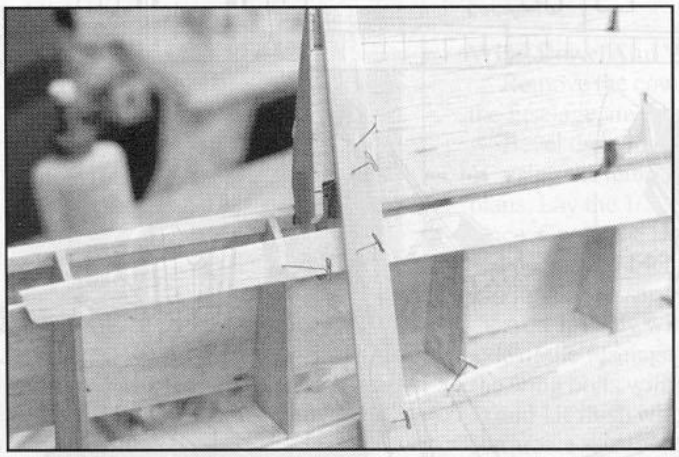
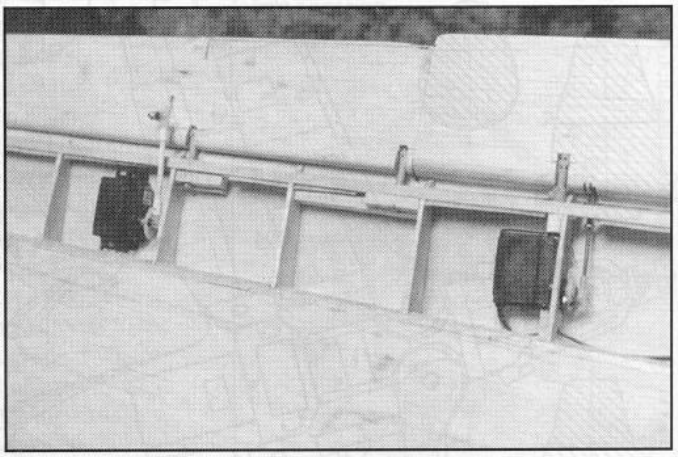
Dr. No. 003



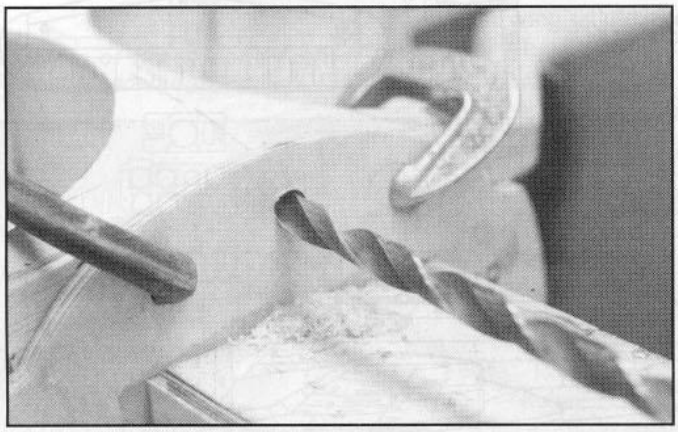


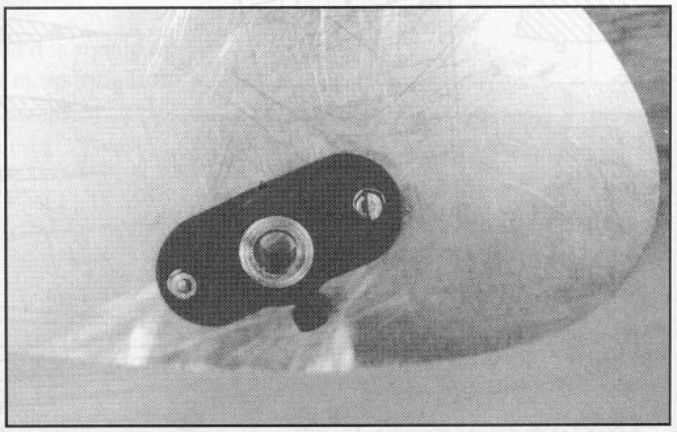
LEFT: Goldberg aileron horn and Robart hinge is installed before upper surface of aileron is sheeted. RIGHT: Flap horn, clevis, and flap hinge installed before upper surface of flap is sheeted.



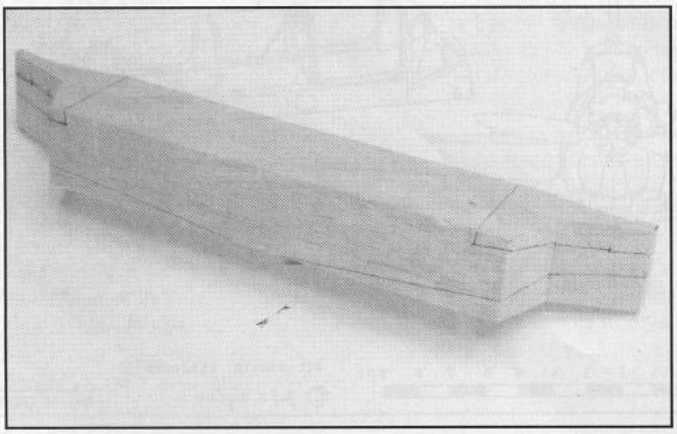


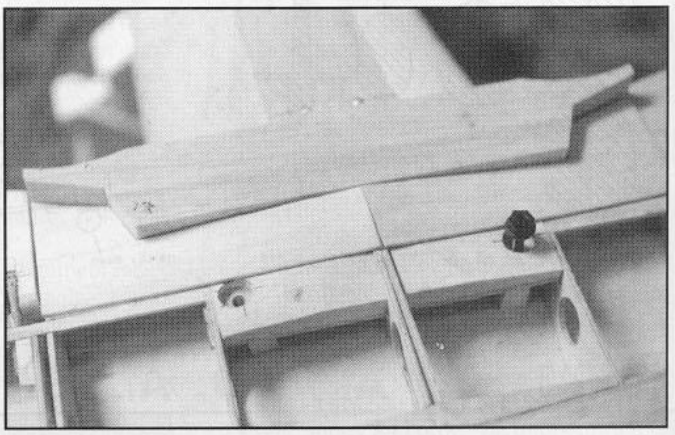
LEFT: Aileron pinned in place while hinges are glued. RIGHT: Aileron and flap servos are glued to upper wing sheeting. Lower sheeting can now be completed.





LEFT: Wing is clamped in place while wing dowel hole is drilled. 12" drill required. RIGHT: Sig wheel pant mount is bolted to aluminum wheel door and doubles as a wheel collar.





LEFT: Rear wing fairing is rough-cut. Marked for trimming while installed in fuselage. RIGHT: Wing bolts hold wing in place while fairing is shaped to wing and fuselage.

any point near the wingtip, such as the corner of the aileron, to a fixed point in the tail, like the tail wheel strut. Shift the wing so that the left distance is equal to the right distance.

Clamp the front of the wing to former B1 and clamp the rear of the wing to the wing bolt mounting plate with C-clamps. Measure the position of the wing again.

Drill and tap the wing bolts. Countersink the head. This allows us to completely hide the wing bolts during static competition. After attaching the wing, one can fill the wing bolt holes with modeling clay and paint them to match the wing. Remove it later by jamming a ball driver through the clay. I learned this Hidden Bolt Trick from Greg Namey during the '87 Nats.

Using a 3/8" dia. drill at least 12" long, poke the drill through the wing dowel hole in former B1 and drill through the wing's leading edge, the forward dihedral brace, and into the root ribs. Remove the wing and epoxy a 3/8" dia. dowel in the wing.

The wing sheeting can be completed now or later. Add rib stitching to the flaps and ailerons.

Axle:

We can't use the axle that comes with the strut. Instead, we substitute a cut-down Du-Bro 1/4-20 x 3" socket head capscrew carriage bolt.

First we must destructively test the metal to be sure that it will not break on a hard landing (it can happen). A package includes four bolts. Clamp one of them in a vise and bash it sideways with a hammer. Wear eye protectors in case chips fly. The bolt should bend, not break. If it breaks, the bolts are too brittle to be used, so find another set.

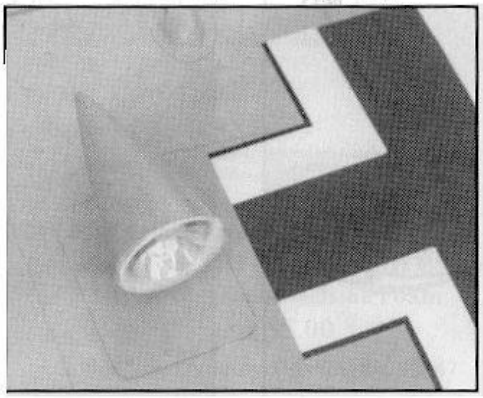
Slip a Sig wheel pant mount and wheel onto the bolt and screw it onto the strut as far as it will go. Mark the bolt where it exits the wheel pant, mount and remove.

Add #271 permanent Loctite to the bolt threads and screw it into the strut as far as it will go. Tork it down tight with an Allen wrench, never to be removed again. Cut off the head of the bolt at the mark. Cut off the excess on the other side of the strut too.

Now is a good time to test the fit of the wheel in the well. Or it can be done later if you choose.

Landing Gear Door:

The Arado has a simple gear door. It is a single unit that overlaps the wheel well rather than fitting into it, so there is little chance of the door hanging up. The door is attached to the axle with a Sig wheel pant mount. It is also attached to a sliding bracket further up the strut. The entire door rides up and down with the wheel as the oleo moves. We make the door from sheet aluminum so that it can slide through grass at high speed. This is heavier than ply or fiberglass, but it is durable. At worst, it will bend, not break.



Scale landing light is Estes NC-60B model rocket nose cone. Magicube flash bulb reflector.

The doors are replaceable in the field, allowing high-cut doors to be used on fields that have long grass or weeds.

Cut the doors using the pattern shown on the plans. Make a slight bend in the door as shown. Refer to the 5-view drawing for the angle. This scale detail tends to make the door a little stiffer.

Attach the Sig wheel pant mount with flat head 2-56 screws countersunk into the outer surface of the door. Use Loctite.

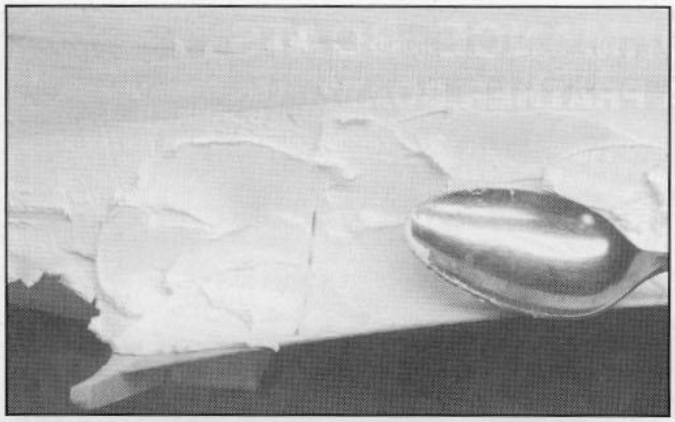
Make the upper bracket. A small sheet metal bending tool such as the Little Giant Metalworker is a good tool for making this part.

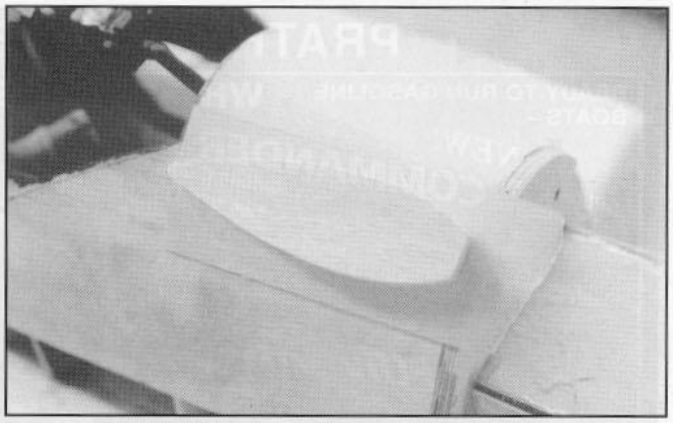
Attach the bracket and slider to the door with countersunk 2-56 screws. Fill the screw heads with JB Weld and sand to hide the screw heads.

File a flat on the axle. Trial-fit the door to the strut with four 2-56 socket head bolts on the upper bracket and the setscrew on the axle.

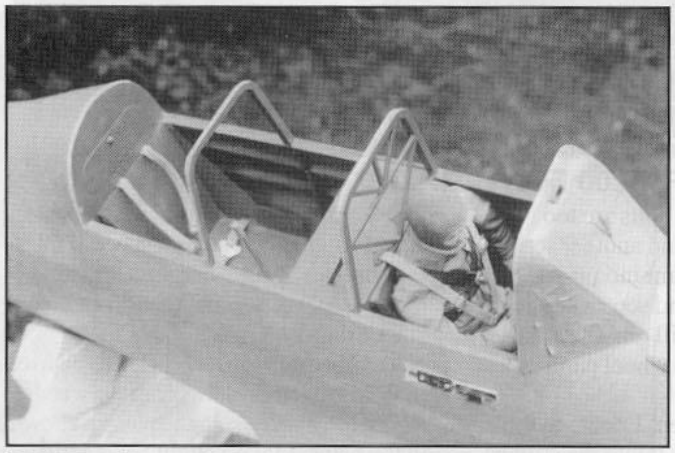
Note that the upper end of the door should move into the wing when the oleo is compressed. Compress the strut to verify that it slides without binding or striking the wing surface.

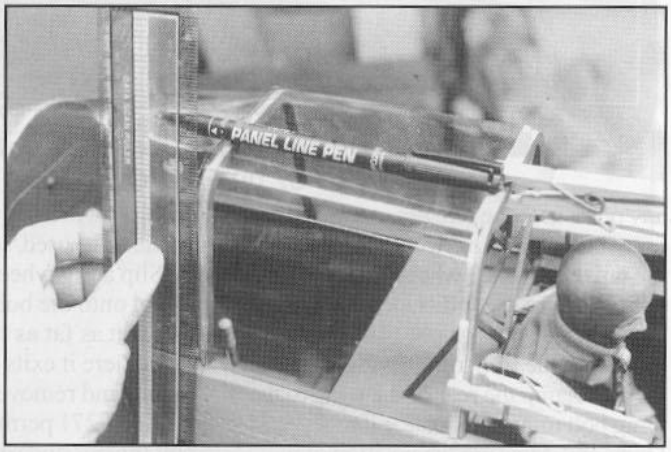
Operate the retracts once again and verify that the door lies flat or nearly flat against the wing and does not prevent the retract unit from locking in the retracted position. A very tight fit could prevent the retract unit from unlocking. A tell-tale sign is a loud click when the retract unlocks. The wheel should barely touch the inside of the well and the door should touch the surface of the wing, preventing things from rattling in flight.



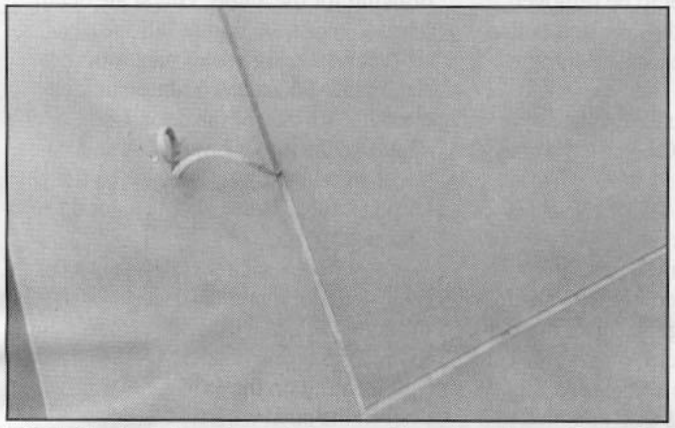


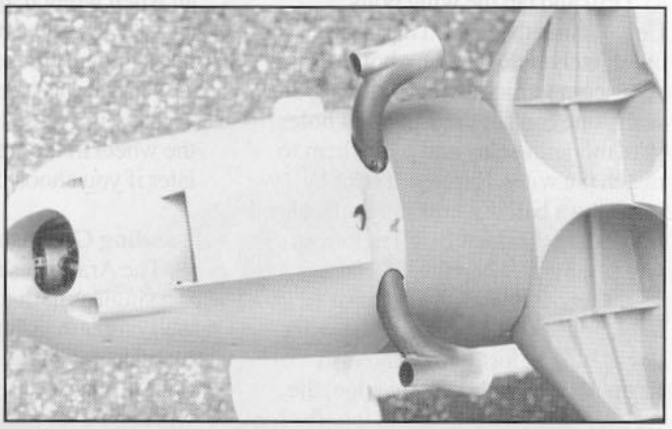
LEFT: Spackling compound applied to wing fillet with a teaspoon. Sand to final shape with dowel. RIGHT: Gun blister fitted by moving back and forth over sandpaper on fuselage, grit side out.



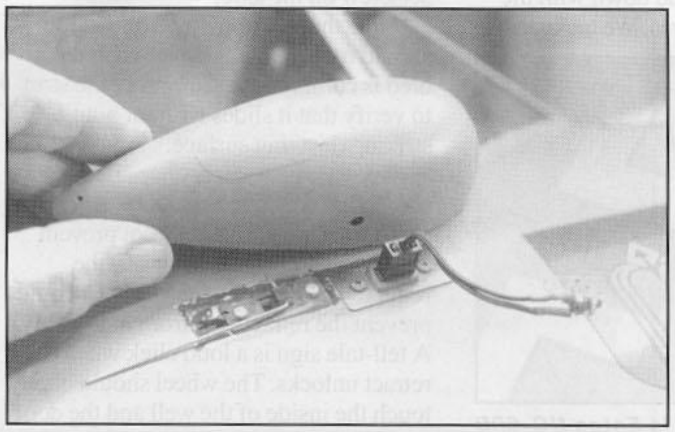


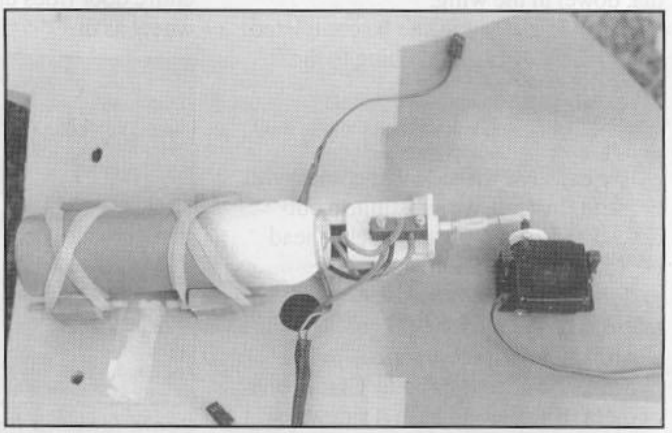
LEFT: Fuselage and windscreen are completed, ready for color paint before canopy is attached. RIGHT: Rough-cut canopy section clamped in place, marked for trimming. Rear to front installation.





LEFT: Chartpak tape is peeled away after primer is sanded to form panel lines. RIGHT: Completed lower cowl. Engine exhaust aft of oil cooler.





LEFT: Radio switch and charging jack are hidden under gun camera fairing. RIGHT: Robart air cylinder, valve, retract servo installed on wing. No air line disconnects needed.

Adjust as necessary.

Rear Wing Fairing:

Use slow-cure epoxy to glue the wing filet base in place. Hold in place with Scotch tape. Before the epoxy sets, cover the center section of the wing with waxed paper and bolt it onto the fuselage. Turn the fuselage upright and tape the filet base flat to the wing. Add the 1/32" ply filet former.

After the epoxy has set, remove the wing and invert the fuselage.

Cut the wing fairing FW from medium balsa. Place it on the fuselage without gluing it. Bolt the wing on. Trim the fairing until the wing fits easily.

Mark where the fairing meets the wing, remove the fairing and carve or plane it to be continuous with the wing. Use a woodcarver's gouge on the upper surface to become flush with the 1/32" ply filet base. Carve and sand to final shape without gluing in place.

Remove the fairing and cut away unneeded material from the underside. Glue in place.

Strengthen the little piece that sticks out by applying thin CA glue to the end grain.

Wing Filet:

There are lots of schemes for making wing filets. Use whatever works best for you. But please consider the following method.

Sand the fuselage to final shape in the area surrounding the wing filet if not the entire fuselage.

Copy the outline of the wing filet from the side view on the plans. Cut it out with scissors. Tape it to the side of the fuselage and trace around it with a fiber-tip pen. Remove.

Add two layers of masking tape on the outside edge of this line.

Using the back of a teaspoon, smear on lightweight spackling compound. Dip the spoon in water and trowel to shape. Use the 1/32" filet former as a guide, gradually reduce the radius of the filet toward the front. Let dry for several days.

Sand to final shape with sandpaper wrapped around a dowel. It's a little crumbly to sand but that's okay. Remove the masking tape and it will leave a sharp overlapping-type panel line.

The result is flexible but soft, so harden it with a coat of Z-Poxy finishing resin.

To prevent the edges of the filet from curling, apply several coats of clear butyrate dope to the underside. Its tendency to shrink will hold the filet flat on the wing.

Gun Blister:

Cut the gun blister from 1/2" sheet balsa. Round it to shape and hollow the inside, leaving a thin lip at the front.

Place a sheet of sandpaper, rough side out, on the fuselage where the gun blister will be. Place the gun blister on the sandpaper and slide it fore and aft in short strokes. This shapes the bottom of the gun blister to the shape of the fuselage.

Completely finish and prime the gun blister separately from the fuselage. Glue in place before the color coat is sprayed.

Windscreen:

The windscreen should be attached after covering and sanding the fuselage prior to the primer coat. The other canopy sections should be attached after the fuselage is primed.

Cut the windscreen per the pattern on the plans. With a straightedge or a sheet metal bender, fold the windscreen in two places as shown on the pattern. Fit it to the windscreen frame and trim to size.

Roughen the inside edges of the windscreen where it contacts the frame using sandpaper or a Dremel tool. Apply RC 56 canopy glue and glue it in place. Mask off the clear parts of the

windscreen. Apply thickened epoxy to the lower part of the windscreen where it meets the fuselage and form a small filet with a wet finger.

Smooth the junction of the windscreen to the fairing with epoxy filler or spackling compound and sand smooth.

Complete the interior of the cockpit if there is anything more to be done. Mask the entire cockpit to keep out paint spray. Return to canopy completion after the fuselage has been sprayed with primer and other surface detailing has been completed.

Canopy:

On the full-size Arado 96, the three canopy sections were stepped. The rear section slid forward under the center section and the front section slid backward over the center section. Although the plans show nonmoveable, closed canopy sections, they are stepped per the full-size. This follows Chuck Nelson's well known principle, "If you can't make it scale, make it look scale."

There are four ways to form the canopy sections. Flat sheets of thin plastic can be bent and glued in place. Better results can be obtained from balsa molds using the formers as patterns. Hot plastic can be pulled down over the molds. Or thicker plastic canopy sections can be vacuum-formed over the molds. Last, one can purchase vacuum-formed canopy sections from Aerotech Models.

The canopy frames should be painted except where the canopy sections will make contact. This is your last chance to complete the interior of the cockpit. Remove all dust from the cockpit. It will be hard to reach after the canopy sections are in place.

Starting with the rear canopy section, cut the canopy slightly oversize and place it on the canopy frames. Tape it in place. Using a flexible straightedge and a MonoKote panel line pen, draw the front line on the canopy to match the canopy support on former E. Notice that the rear canopy section will be attached to the 1/8" sq. canopy support of former E, not the outside of former E. Remove and trim along the line with small, sharp scissors. Place it back on the fuselage. Tape it in place.

Draw the bottom and rear edges. Remove and cut with scissors. Trim to fit with a sanding block if necessary. Roughen the inside of the canopy where it will contact the canopy frames. Glue it in place with RC 56 canopy glue.

Use the same technique to attach the middle canopy section to the canopy support on former D and the outside of former E.

Use the same technique to attach the front canopy section. The front canopy section should be flush with the windscreen frame.

The entire canopy can now be masked for painting the fuselage. Don't forget to apply canopy rivets before spraying.

Gun Camera Fairing:

The switch and charging jack were previously installed on the side of the fuselage during the cockpit construction. We use the gun camera fairing to hide the radio switch and charging jack.

The gun camera fairing can be carved from balsa, or it can be vacuum-formed from sheet plastic or it can be purchased from Aerotech Models. Trim the fairing to fit, add paint and surface details.

Make a short extension cord for the charging jack with a radio connector on one end and a Radio Shack subminiature phone jack on the other. Cut a hole in the bottom of the fairing and install the Radio Shack jack in it.

Drill a 1/16" dia. hole in the rear of the fairing. Also drill a 1/16" hole in the radio switch lever and drop a short

L-shaped length of 1/16" music wire in the hole. Poke the other end of the wire through the hole in the rear of the fairing. Lightly spot-glue the fairing in place, just in case you might ever need to remove it.

You will also need an adapter to your expanded scale voltmeter to connect to the jack in the fairing.

To turn the radio on, pull on the tiny bit of exposed music wire with needle-nose pliers. To turn it off, push the wire in. How delightfully deceitful the scale illusion can be!

Markings:

The prototype model was covered with silkspan and nitrate dope (see the reference Silkspan Applied as MonoKote) and primed with Dupont 30S.

The references show several color schemes -- overall gray, camouflage greens and bare aluminum. German and Czech markings.

I recommend a base color of PPG Delstar which is acrylic enamel, mixed to the exact color by your local auto paint store. (Protect your liver -- wear gloves and a charcoal respirator.)

Photocopy the balkenkreuz, swastika, and numerals from the plans. Cut out with scissors and trace them lightly on the a/c with a soft pencil. Apply masking tape and spray. Apply markings using Model Master enamel in the correct Federal Standard colors. If you mess up, wipe the Model Master paint off with thinner and try again. Model Master thinner will not affect the Delstar base color.

Copy the school emblem onto sticky-back paper. Cut out the emblem and blacken the edge with a black felt-tip pen or MonoKote panel line pen. Peel off and apply to the aircraft.

Emblems of all the other Luftwaffe flight schools can be found in *Luftwaffe Fledglings*.

To obtain a uniform flatness and fuelproof the markings, spray the entire painted surface of the aircraft with Delclear DAU 75 acrylic urethane with a small amount of DX 685 flattening agent added. The clear coat dries quickly as the solvent evaporates. Initially it will be glossy. Don't despair. About 30 minutes later a flat spot will appear. Then another and another. The flat areas will grow, merging and mixing. Watching paint dry can be so interesting!

Flying:

The full-size Arado 96B was a very successful advanced trainer. It had excellent aerobatic performance combined with stability, firm control, and good ground handling. These are the qualities we generally seek in a scale model.

Because the engine is inverted, I recommend using an on-board glow for added engine reliability. But, as Klotz the Kat said, "On-board glow is best used on engines that don't need it." On-board glow should not be used to fix faults. Change glow plugs every season.

Check the balance point as shown on the plans. Move the batteries if necessary. The prototype needed no ballast to achieve the proper C.G.

To start the engine with an electric starter and not scuff the paint on the spinner, use a 3-inch cup such as the Miller R/C Products Big Cup (see references).

The forward wheel position combined with the long tail moment provides excellent ground handling with no tendency to nose-over on grass. It is not necessary to hold up-elevator while taxiing; but do it anyway.

Take off by advancing the throttle slowly while steering with the rudder. For a realistic take-off, use a lot of runway and climb at a shallow angle. Use the ailerons to keep the wings level while steering with the rudder until sufficient altitude is reached for the first turn.

The long tail moment and the large fuselage side area allows good slow rolls. Really slow and straight slow rolls can be performed by beginning in a slightly nose-high position at full throttle. Push and hold a small amount of left aileron. Slowly add down elevator as it rolls inverted, then slowly back off to neutral. Release the aileron quickly as the wing resumes level. No top rudder is needed because lift from the side of the fuselage supports the plane while the wings are vertical.

The big rudder rotates the plane well at the top of a stall turn. But use early opposite aileron to counteract the roll that dihedral tends to cause.

When at low speed and nose-high, steer with the rudder, not the ailerons. The huge rudder remains effective at low speeds, especially if it is exposed to prop wash.

Flaps don't affect trim very much; it depends on the airspeed at which the flaps are lowered. If the nose rises as flaps are lowered, you are flying too fast. Flaps should be lowered after slowing and transitioning into a shallow glide. Then, lowering the flaps slows the airplane further which lowers the nose. Full flaps cause a steepened glide angle without build-up of airspeed, simplifying a spot landing. Very steep approaches with flaps can be made by holding a steady amount of down elevator. Try this at altitude first. Notice how stable the airplane is, even in turns. Flaps stabilize flight by increasing washout.

Lowering the landing gear tends to affect trim. Lowering the gear moves the Center of Gravity forward and the center of drag downward. This tends to lower the nose slightly, increasing stability even more.

Raise the flaps immediately at touchdown to prevent bounce by killing lift. If you didn't flair well and it bounces anyway, add power.

You will be pleased with the sound of the engine. The soft mount dampens the high frequencies, reducing overall intensity, mellowing the bark and increasing realism. It doesn't sound like a Saito 150 anymore.

Acknowledgments:

Thanks to Joe Krybus for documenting the Arado 96B for history. Thanks to Chuck Sostak of Robart, Ray Lightfoot of Lyte-Flyte, Larry Maurer of SAC Headquarters, and Wayne Siewert of Aerotech Models for providing custom parts. Thanks to Roy Maynard, Kelsey Maynard, Kirk Hall, and Mike Kuller for the action photos; James Coplin for the computer graphics; Nancy Kapp for Franz the pilot; Dave Platt for design ideas. And thanks to the Scale Flyers of Minnesota who so generously share their skills.

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