A classic ⅓-scale aerobatic biplane

by Gary Allen

With two wings and a round engine, the Bücker Bü-133 Jungmeister, designed as an advanced aerobatic single-seat trainer, is truly the epitome of an aerobatic biplane. This masterpiece of Carl Bücker's German company, Bücker Flügzeugbau GmbH, rolled out of the factory in early 1935, two years after the introduction of the company's highly successful two-seat biplane trainer, the Bü-131 Jungmann.

The design of these legendary aircraft resulted from Bücker's collaboration with his brilliant young Swedish engineer, Anders J. Andersson. The two aircraft were very similar in design and construction, and they shared many jigs and components. Both aircraft were commercially successful and certainly provided a major inspiration for Curtis Pitts' design of the Pitts Special.

The only intended deviation from scale in my design is the wing airfoil. I elected to use a semisymmetrical section rather than the scale, flat-bottom section. All other outlines and sections are intended to be exact scale.

My design features standard balsa and aircraft ply construction and uses standard hobby shop and hardware store items. All the fittings are fabricated by hand from brass sheets. The cabane struts are fashioned from hardware store aluminum, and the interplane struts from hobby shop streamlined tubes. I actually built two identical models simultaneously. One is intended for fun scale and is relatively undetailed; the other is covered with fabric, painted and fully detailed. The fun scale version weighs 21 pounds, and the fully detailed version weighs an additional 9 ounces.

Bücker Bü-133 Jungmeister

SPECIFICATIONS

Model: Bücker Bü-133 Jungmeister

Type: ⅓-scale aerobatic biplane

Wingspan: 86½ in.

Length: 77½ in.

Weight: 23 lb.

Wing area: 2,086 sq. in.

Wing loading: 21 oz./sq. ft.

Engine range: 45 to 62cc

Engine used: Zenoah G-45

Radio req'd: 4-channel (rudder, elevator, throttle and ailerons)

Comments: designed by Gary Allen, the ⅓-scale Bücker Bü-133 Jungmeister is an excellent scale competition machine. The plans are accurate with the exception of the airfoil, which is semisymmetrical instead of flat-bottom. Construction is all wood, and the wing panels, rigging and tail feathers are all removable for easy transportation.

CONSTRUCTION

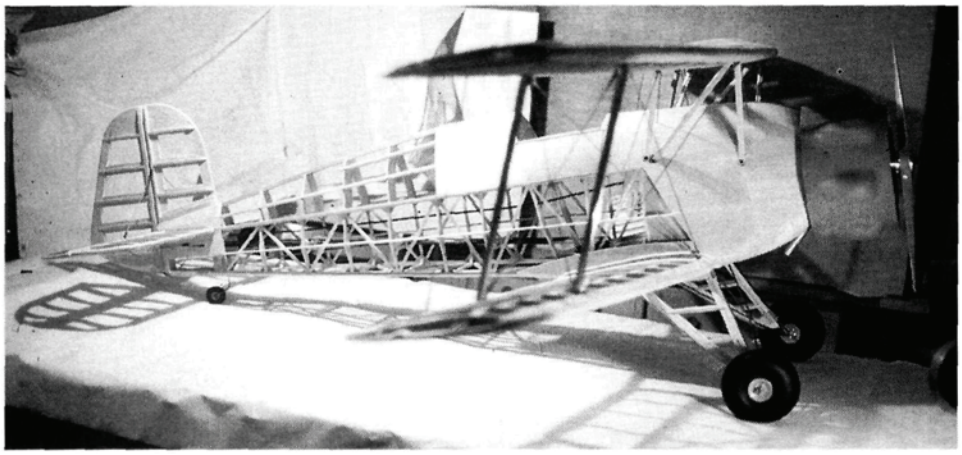
Construction is reasonably straightforward, and the experienced builder shouldn't require detailed, step-by-step instructions. It's important that the steps be performed in sequence, however.

Make two fuselage sides directly over the plans. Note that the longerons are ¼x⅜-inch spruce. Be sure to add the vertical-grain ¼-inch balsa fill, and use epoxy to attach the various ¼-inch ply parts, for example, the nose piece, F-15; the cabane mounts, F-18 and F-19; and the lower wing mount, F-21. Making a right and a left side, add the 1/16-inch ply doublers and gussets, then epoxy F-20 into place to finish the rear cabane strut mount.

Fabricate the landing-gear mounts out of ¼-inch ply as shown. Cut and drill the 1/16-inch brass landing-gear straps, then, using them as guides, drill the landing-gear mounting holes to accommodate 6-32 bolts. Install the blind nuts at this time. Fabricate the F-3 and F-6 former assemblies as shown in the cross-sections.

Using slow-setting epoxy, assemble the two fuselage sides with former assemblies F-3 and F-6 and the front and rear landing-gear assemblies. Check to ensure everything is square and properly aligned. After the epoxy has set, add the ¼-inch-square spruce cross-members between F-3 and F-6. Epoxy the four F-22 formers into place, then epoxy the identical top and bottom nose pieces, F-16, and the two firewall mount pieces, F-17, as well. Use clamps to hold everything in place while the epoxy sets. Again, it is important to ensure that everything is properly aligned. For easy reference, I marked the centerline on all top members. After the epoxy has set, hammer in the small reinforcement nails as shown. Add ¼-inch cross-grain balsa fill from F-15 to F-3, from the fuselage top to the front landing-gear mount on the bottom.

Pull the rear fuselage sides together and glue the tail post into place. Add the ¼-inch-square balsa cross-members and gussets as shown in the plans. Add a 3-inch length of ¼-inch cross-grain balsa fill by the rear landing-gear mount as shown. Add the nose formers, F-4 and F-5, and add the stringers. Then add the rear formers, F-7 to F-14. Note that F-8 and F-9 are glued together. Next, add the stringers, but don't add the ⅛-inch balsa sheeting at this point. Install the tailwheel mount



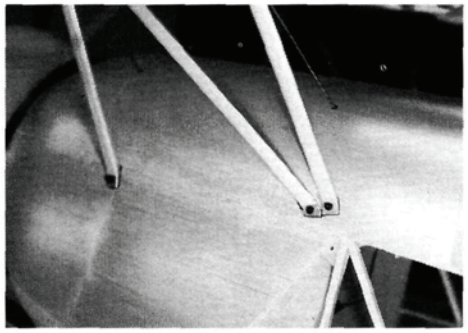
The completed fuselage shows its conventional, all-wood construction.

bracket (a ½A steerable nose-wheel mount) on F-24, then glue the former in the fuselage and add the ¼-inch balsa gussets. Epoxy into place the stabilizer mounts, F-25 and F-26, and add the ¼-inch-square balsa fill as shown in the plan top view. Add the ⅛-inch balsa sheeting, cut out the exits for the elevator and rudder pushrods, then set in place the ½-inch-square, ⅛-inch ply pieces to accept the tail-shroud mounting screws.

Epoxy the ¼-inch ply tail-brace mount to the bottom of the tail post, then fabricate the removable bottom tail hatch from balsa and 1/16-inch ply as shown. Removal of this hatch from the finished model provides access to the steerable tailwheel mechanism, the stabilizer mounting bolts and the pushrod exits.

Now fabricate the bottom wing center section. In preparation, stack pairs of the top and bottom ⅛-inch ply end ribs (two W-5 and W-6 pairs for the top wing and two W-5B and W-6B pairs for the bottom wing). Mark and drill the front and rear holes for the 5/16-inch fiberglass arrow-shaft, wing-mounting studs as shown in the plan. Keep the rib pairs matched for the remainder of the construction.

Carefully draw the mean chord line on the outside of each of these ribs. These lines will ultimately determine the wing incidences, so check them again for accuracy and consistency. Fabricate the front and rear lower wing spars by laminating ⅛-inch ply pieces for maximum strength. Mark and drill holes for the rigging fittings in the front spar. Slide both wing spars through the appropriate slots in F-21, then epoxy them in place. Make sure that both spars are square and are centered to the fuselage and parallel to each other. Install the rigging fittings with 4-40 nuts and bolts. Epoxy the nuts well, as no access is provided in the finished model. Make and install the 1/16-inch brass bottom wing-mount fittings to the front and rear spars as shown. Construct the removable bottom fuselage hatch from 1/16-inch ply as shown. At this point, the basic fuselage framework is complete.



The cabane struts are made from aluminum stock sandwiched between wood strips and sanded to an airfoil shape. They are then screwed into place with cap-head screws.

On a flat workbench, block the fuselage so that its datum line is parallel to the work surface. Glue W-10 and W-11 ribs into place. Epoxy the ⅛-inch ply end rib, W-5B, into position; make sure that the mid-chord line is parallel to the workbench. Add the balsa triangle-stock gussets and the ⅛-inch balsa sheeting and rib capstrips as shown. Drill the 5/16-inch holes in W-5B through W-11 and epoxy the 5/16-inch fiberglass arrow-shaft wing-mounting studs into place.

Now fabricate the upper wing center section, then make the aluminum cabane struts. Drill the holes in the cabanes to accommodate 6-32 bolts and make the bends in their ends as shown. Be sure to make right and left versions of each cabane. To make certain that the upper wing center section is exactly aligned relative to the lower wing center section, construct a temporary jig as follows: working directly over the side view, locate the fuselage bottom wing center section. Next, locate the completed top wing center section on the plan. Tie the two wing center sections together directly by tack gluing three pieces of hard balsa or spruce ¼-inch square stock to the end ribs, W-5 and W-5B, on both sides of the fuselage, in the form of an "N." Next, glue cross-braces between the jig members to restrict side-

FLIGHT PERFORMANCE

• GENERAL FLYING CHARACTERISTICS

Of all the model Jungmeisters I have flown, this ⅓-size version is certainly the easiest. As recommended in Greg Hahn's "Speed, Props and Power" article (*Model Airplane News*, March 1998), I fitted a 22x8 propeller to the engine. When correctly tuned and well broken in, i.e., more than 10 hours running time in my hands, my G-45 turns a very mellow-sounding 6,400rpm. This results in plenty of power for large, scale-like loops, easily sustainable knife-edge flight and other assorted maneuvers such as rolling, pitching and snapping. Vertical performance is definitely not unlimited, but a sufficient vertical line can be achieved to allow nice-looking stall turns and wingovers. Pilots who want performance more akin to a modern aerobatic biplane might prefer a G-62 engine.

• TAKEOFF AND LANDING

Unlike its full-size counterpart, this ⅓-size Jungmeister is fitted with a steerable tailwheel that makes taxiing and taking off a breeze. When full power is gradually applied, the model tracks quite straight; only a little right rudder is required. Off grass, the model is airborne in about 75 feet. When executing a procedure turn to the right, a bit of coordinated rudder and aileron is required to overcome the considerable torque generated by the big gas burner. Once airborne, the big biplane is amazingly stable. Landings are as easy as takeoffs. Like most biplanes, it is important to keep a bit of power on until just before touchdown. On my first flight, I made a perfect 3-point landing! Fortunately, one of my flying buddies captured it on film.

• AEROBATICS

I am not a very accomplished aerobatics pilot, but with this ⅓-size Jungmeister, I can easily execute point rolls, loops, single- and double-avalanches, level and climbing knife-edge flight, flat spins, snap rolls from any attitude, inverted flight, and so on. I tend to fly this model at full throttle most of the time. The large frontal area results in fairly constant speed—slow. This is by far the most fun model that I have ever flown.

to-side motion. The top wing center section should now be rigidly located in exactly the correct position relative to the fuselage.

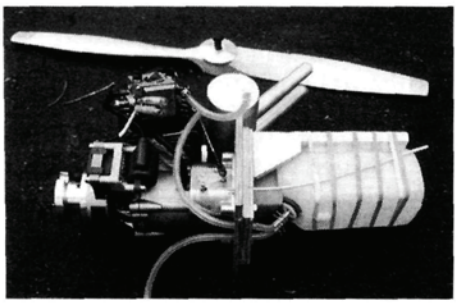
The top center section incidence should be minus 1 degree relative to the bottom wing. An incidence meter can be used, but I measure the difference in distance between the front and rear positions of mean chord lines of the top bottom wing end ribs. Once satisfied with the position of the top wing center section, fit and adjust each cabane strut to get the bend angles exactly right, then bolt them to the fuselage. Next drill directly through the top cabane strut holes into the top wing center section ribs to accept 6-32 bolts, add the blind nuts and tighten them. Remove the jig.

Remove the top center section and the cabane struts from the fuselage. Add the side formers F-1S through F-4S, plus the ⅛x½-inch balsa strip. Add the ⅛-inch balsa sheeting to the nose of the fuselage and to the rear of the cockpit. Shape and glue into place the top and bottom balsa nose blocks. Locate the fuselage cabane-strut mounting positions, and carefully cut away the sheeting for a good fit. Add the ⅜-inch balsa wing-saddle piece, F-23. Add the ⅛-inch sheet-balsa fuselage side stringer and braces. Carve and sand the finished fuselage to shape.

Fabricate the servo mounts from ⅛-inch ply and ¼x½-inch spruce rails. I used one standard servo for each elevator and a single ¼-scale servo for the rudder. Support the outer pushrod tubes in at least four places. Fabricate the throttle servo mount and install it in the fuselage.

ENGINE MODULE

I designed the engine module to provide easy access to the engine-mount bolts and the fuel tank. It consists of the ⅜-inch firewall and an ⅛-inch, lite-ply fuel-tank platform. Remember to drill the holes for the six, 6-32 firewall mount bolts with the firewall in place and be sure to drill through the F-17 firewall-mount piece. Install and epoxy the blind nuts in F-17, then epoxy the hard-balsa triangle stock into place as shown. The tank is mounted



The engine and firewall are removable. The module setup includes the fuel tank but not the throttle servo, which is mounted within the fuselage. The throttle linkage must be undone for the module to be removed.

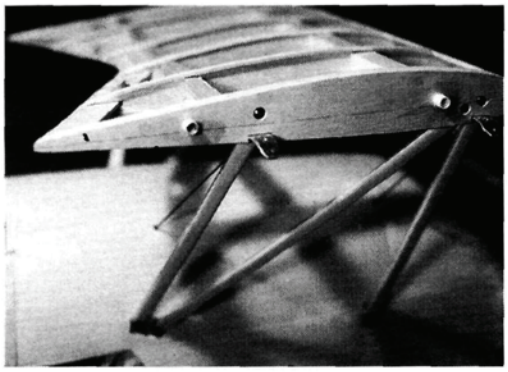
TO ORDER THE FULL-SIZE PLAN, FSP0300A, SEE PAGE 146.

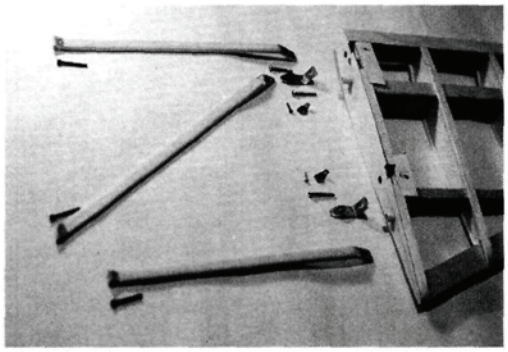
Editor's note: the author's notes and photos pertaining to rigging the wing's flying and landing wires are included with the plan.

over ½-inch foam and held in place with five no. 64 rubber bands. The throttle servo is mounted in the fuselage, so to remove the engine module, you must first loosen the pushrod connector to release the throttle pushrod from the carb.

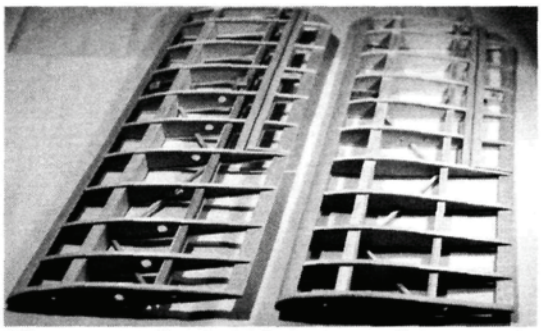
TOP WING CENTER SECTION

Lay out the bottom spars over the plans. Block up the rear spar with a ¼-inch balsa stick. Locate, square and glue in the W-1 and W-2 ribs. Assemble the ¼-inch balsa, W-4, and ⅛ ply rib, W-3, and glue them in. Add the top spars. Note: the top rear spar is made by laminating 1/16-inch-thick spruce into place. Add false leading- and trailing-edge (LE and TE) pieces. After you've beveled the top of the false LE, add the top LE sheeting and the top rib capstrips. Remove the assembly from the plan, then add the bottom LE sheeting and capstrips. Sand the LE sheeting flush with the false LE, then add the ¼-inch balsa LE. Add the ⅛-inch ply cabane mount reinforcement pieces to W-3. Working on a flat surface, carefully epoxy and clamp the two W-5 end ribs into place, and make certain there are no warps in the structure and that the mid-chord lines are parallel to each other. When everything is set, sand the wing to shape using the end cap ribs as a guide. Drill the 5/16-inch holes in W-5 through W-4 and W-3, and epoxy into place the 5/16 fiberglass arrow-shaft wing-mounting studs.





Top: the upper wing center section in place atop the cabane struts. Note the chord line drawn on the rib; it is used to make sure that the wing is rigged properly. Above: here are the cabane struts, mounting brackets and hardware and the upper wing center section.



Wing construction is fairly easy, as all four panels have a constant chord width.

WING PANELS

In preparation, fabricate the ply, interplane-strut mounting assemblies. Note that the top wing-panel assembly is one piece, and the bottom wing-panel mounts are comprised of front and rear assemblies. Don't forget to install the small reinforcement nails. Place the bottom spars over the plans while you block up the rear spar with a ¼-inch balsa stick. Glue into place the W-7, W-8 and W-9 ribs and epoxy the ⅛x½-inch ply strip to the bottom spars and against the first W-7 rib, as shown. Epoxy into place the interplane strut-mount assemblies, and note whether you are making a top or bottom wing panel. Use the root rib templates to get the correct dihedral angle for the first W-7. Remember, this is different for the top and bottom wing panels. Do not glue W-6 or W-6B into place at this time. Add the top spars. Add the false LE, the ¼-inch balsa aileron-mount piece, the TE and the gussets. Add the 1/16-inch balsa shear webbing then install the ¼-inch cross-bracing flush with the bottom spars. After you've beveled the top of the false LE, add the top LE sheeting, the top aileron-mount sheeting and the top rib capstrips.

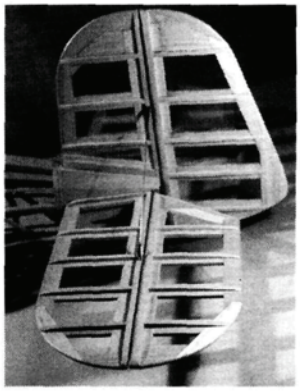
Remove the wing assembly from the plan and add the bottom LE sheeting, the bottom aileron-mount sheeting and the capstrips. Sand the LE sheeting flush with the false leading edge, then add the ¼-inch balsa LE. Glue the wingtip into place and add the balsa braces. Apply 1/32-inch ply lamination strips to the wingtip edge then add and shape the small LE wingtip blocks.

Aileron servo installation is shown on the plan. Carefully study the arrangement of the bottom aileron servo control horn and the aileron linkages. It is important that the geometry of the top and bottom aileron linkage horns be identical. Note that the aileron linkage horns are made from modified, standard, large control horns.

TAIL PARTS

By design, the entire tail may be removed from the model. First, glue together the ¼-inch balsa tail frameworks over the plan, then add the ⅛-inch ply control-horn mounts to both sides of the elevator halves and the rudder. Next, add the ¼-inch-square balsa ribs, TEs and LEs. Set in the 1/16-inch ply tail-brace mounts and the fin-to-tail shroud mount. Mark and cut the hinge slots in the tail parts and the tail post for the rudder. Sand everything to shape.

Epoxy the ¼-inch ply stabilizer mounts into place on the stabilizer top center section; make certain that these are exactly aligned with the fuselage stabilizer mounts. Add the ¼-inch balsa filler on the top and bottom of the stab, then position it on the fuselage and clamp it into place. Carefully mark and drill the four, ⅛-inch holes for the 4-40 stabilizer-mount bolts, then install the blind nuts. Next, fabricate and epoxy into place the front and rear fin mounts and install the 4-40 blind nuts. Temporarily assemble the control surfaces, then attach the horizontal stabilizer and fin to the fuselage with 4-40 bolts. Drill pilot holes in the tail post to pin the rudder hinges into place with two, no. 4 wood screws. Remember not to glue these two rudder hinges into the fuselage.

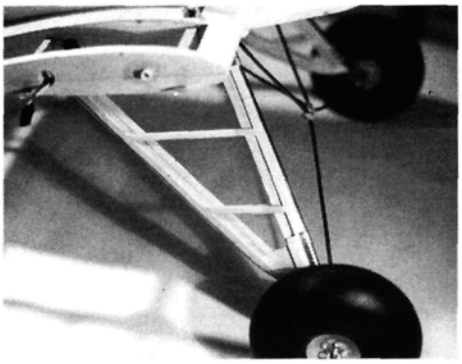


The tail feathers are of traditional wood construction, and the entire unit is removable.

The tail shroud should be flush with the fuselage rear deck stringers and should be made from ⅛-inch balsa. Remove the shroud and cover it with 1/32-inch ply to simulate the metal panel. Note that the 1/32-inch ply should overlap the rear deck stringers and that a tab should extend below the front of the stabilizer. The shroud is held in place with four, no. 2 wood screws screwed into the fin shroud mount.

LANDING GEAR

Cut the front and rear struts to length from ¼-inch music wire, and bend them to shape. Note that the rear struts are made in two sections and joined by a short length of brass tube. To ensure the proper shape and position, assemble and solder the landing-gear struts while they are mounted on the fuselage. Wrap all the joints tightly with thin copper wire and solder them well. From 5/32-inch music wire, cut to length and bend to shape the rest of the landing-gear structure. Note that the pyramid structure has only one



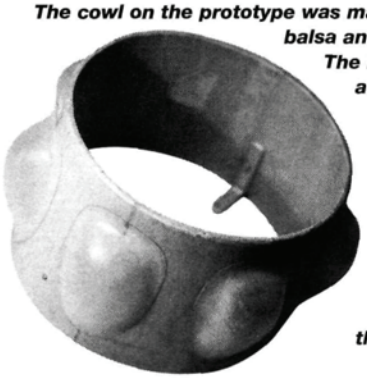
The landing gear is made by soldering music wire together and then adding wooden fairing strips. The entire assembly is then cloth covered.

leg connected to the left rear strut, and to provide shock absorption, the lower crossmember (the axles in the full-size aircraft) is attached to the pyramid with a no. 64 rubber band. After the gear has been completed, add the balsa structure and sand to shape.

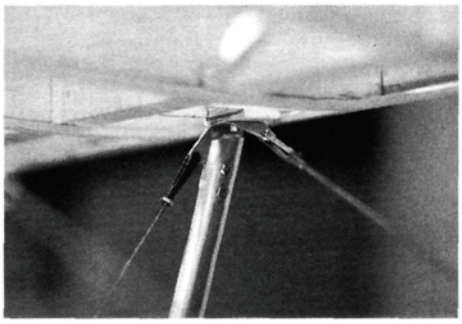
The fenders are very much a part of the Jungmeister's character and should be included on even a fun scale model. Fenders are available from several vendors, but I cannot attest to their scale accuracy. I fabricated mine from several layers of 6-ounce fiberglass cloth and epoxy formed over a carved mold. The brackets and hubs are constructed from wheel collars and brass sheet material.

COWL

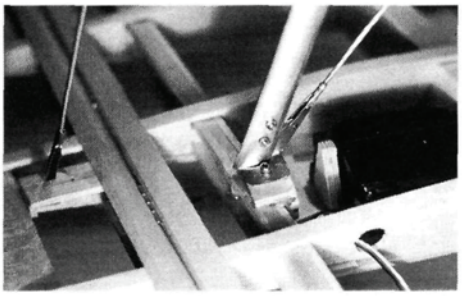
Several older ⅓-scale Jungmeister fiberglass cowls are available, but I chose to fabricate mine from scratch to ensure scale accuracy. The first step is to construct a form with two ⅛-inch lite-ply circles cut to the inner diameter of the front and rear of the cowl. The two circles are centered over each other and separated by lite-ply formers. Next, 3- or 4-inch sections of ⅛-inch sheet balsa are glued to each other then tack-glued to the form. Wet the balsa so it forms easily. After the first layer is complete, apply a second. After it has dried, sand the outer surface to the cross-section shown. While it is still attached to the form, apply 6-ounce glass cloth with epoxy to the cowl. After curing, the cowl is removed from the form, and the inner surface is also glassed. Add a second coat of epoxy both inside and out, then sand smooth.



The cowl on the prototype was made from balsa and plywood. The bumps are added after the cowl has been shaped over a wooden form. Details are shown on the plan.



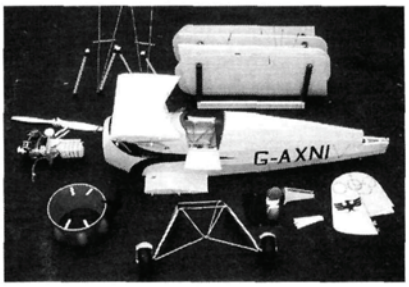
This shows the top wing attachment point for the wing rigging wires. The brass brackets are fairly easy to make.



This close-up shows the right interplane-strut and aileron-linkage attachment setup.

To make the cowl bumps, carve one out of balsa and attach it to the cowl in an appropriate position. Create a fillet around it with epoxy and microballoons, then sand smooth. Fill the imperfections and finish-sand it. Either repeat this six times or use the first bump to make a female mold using Bondo auto-body filler. The rest of the bumps can then be molded from glass cloth, trimmed to shape and epoxied into place.

Make the mounting brackets from ⅛x½-inch aluminum stock and attach them to the cowl with PFM* adhesive. With the engine in place, center the cowl in position and use the holes in the mounting brackets to mark the locations of the cowl-mounting screws in the firewall.



The entire model is designed to come apart for easy transportation. Note that the wing rigging (upper left) is removable and remains fairly intact.

INTERPLANE STRUTS

Fabricate and bend the strut end fittings from 1/16-inch brass, then drill the 7/64-inch holes for the 4-40 wing and rigging mounting bolts. Be sure to make right- and left-hand versions. Cut the interplane struts to length from ⅝-inch streamlined aluminum tubes. Cut them to length and insert the ¼-inch dowel stiffeners, leaving enough space at each end of the strut for the fittings. Insert the fittings into the top and bottom strut ends, and fill the space between the fitting and the strut with scrap basswood. Glue the bottom strut fittings into place with a little CA, then mark, drill and add the two 2-56 bolts and nuts. The top strut fittings will be glued and bolted into place during the rigging procedure.

FINISHING

I covered the fun fly version of the two models with Oracover*. It is quick, durable and looks great. It is, however, not really scale. I covered the scale competition model with Solartex*. For this version, I also constructed the wing fairings and the ply wing walk. The major parts for the wing fairings are shown in the plans. I added rib stitching (white glue) and rib reinforcement tape (3M hair-setting tape), and I simulated the top and bottom nose metal panels with primer. I made the nose metal side panels and the luggage compartment cover from polystyrene plastic. For either version, construct the windscreen and the cockpit crash pad as shown and glue them into place with J&Z Products* RC-56 glue. Other details include the Pitot tube, the wing walk, the zippered fuselage access panel on the left side, the external fuel gauge, the interplane strut and rigging wire leather boots, and the aileron and elevator trim tabs. None of these details is very difficult to make. Dozens of well-documented color schemes are available for the Jungmeister.

ENGINE AND PROPELLER

The power choice for the ⅓-size Jungmeister was based on the considerations detailed by Greg Hahn in his excellent article, "Speed, Props and Power" in the March 1998 edition of *Model Airplane News*. The full-scale Jungmeister weighed 1,290 pounds fully loaded and was typically powered by a Siemans Sh. 14, 7-cylinder radial engine rated at 160hp, giving a power-to-weight ratio of around 1:8. Assuming that a normally aspirated 2-cycle gas engine yields about 1hp per cubic inch, and applying the full-size power-to-weight ratio to the 21-pound model, an engine displacement of about 2.7ci would be required for scale-like flight. Accordingly, I selected a Zenoah* G-45 (2.75ci) as a perfect match. With the G-45 fitted with a Bisson* muffler and a spring starter up front, the finished models balanced perfectly without the addition of ballast fore or aft.

I hope you enjoy building and flying your Bücker Jungmeister as much as I did.

**Addresses are listed alphabetically in the Index of Manufacturers on page 150.* ✚