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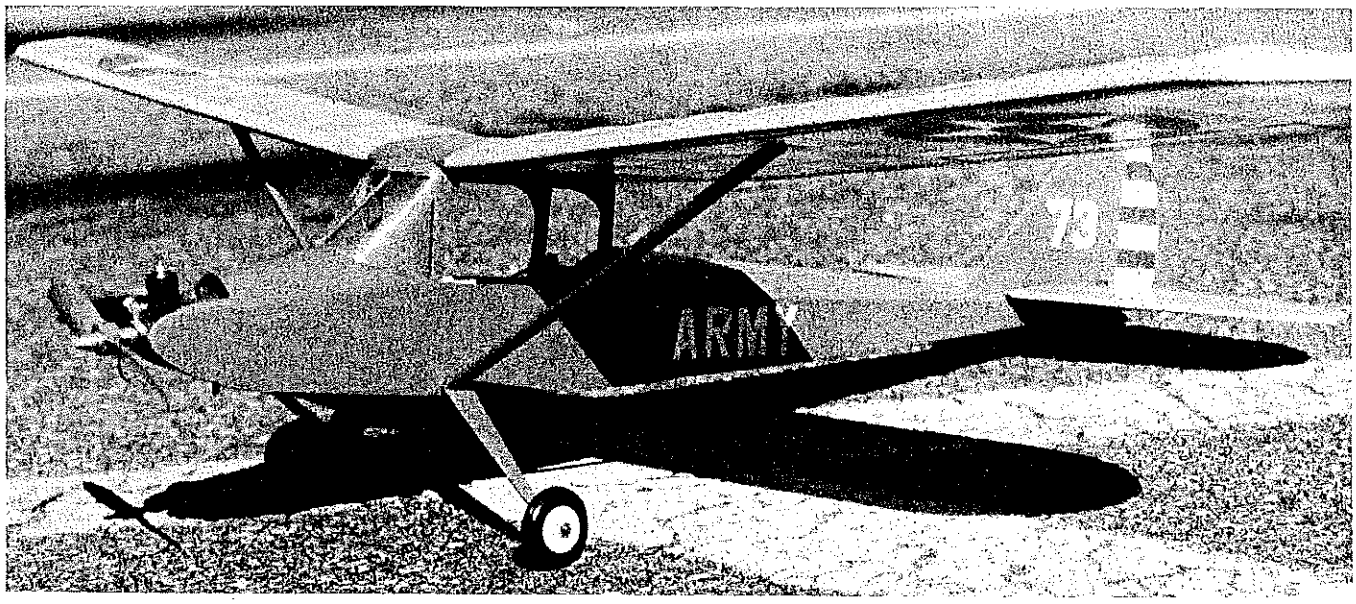
AIR CADET



Simple but pleasing lines and authentic Army insignia and numbers lend realism to this compact fun flier. The use of wing struts rather than rubberbands also improves the Air Cadet's static display appearance. The wheels are of lightweight plastic and have a plastic hub cover.

Fit an .020 engine and a micro radio system in this 13-oz. rendition of earlier era military trainers, and see if you don't agree that sometimes small is better. ■David Fortuna

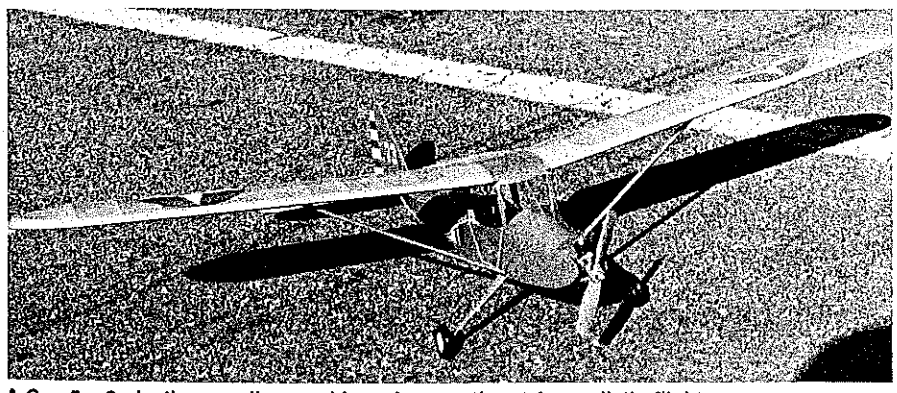
I'VE ALWAYS had an affinity for smaller models. My first models of many years ago were stick-and-tissue designs. Some of my best flights were with these airplanes, and their lightweight structure and see-through tissue covering gives them a certain charm.

While I still enjoy larger models, every once in a while it's nice to return to the simpler forms. Because of their short building time and low cost, I find them more relaxing to fly.

The Air Cadet fits that category. Designed as a fun flier, it's easy to carry to the field and requires only basic support equipment—battery and fuel. There's no need for a runway—just a gentle heave and the model is in the blue. You can equip it with a one- or two-channel radio, or let it loose as a Free Flighter.

The design is reminiscent of a Cessna Bird Dog. Its blue-and-yellow color scheme, though, echoes that seen on many military trainers in the 1930s. The Army stars, lettering, and numbers add realism.

Since I wanted the model to fly well on an .020 engine, it was important to keep the weight down. To me, using a larger engine would have been cheating. I recommend the Cox Tee Dee .020. If you use the Pee Wee .020, take extra care to keep the plane as light as possible. A micro radio set and tissue-and-clear-dope covering will help quite a bit.



A Cox 5 x 3 plastic propeller provides adequate thrust for realistic flights.

An .049 engine could be used with modifications. These include sheeting the entire fuselage with 1/16 balsa, building the tail surfaces out of solid 1/8-in. contest balsa, and bending the landing gear from 3/32 music wire.

I used radio equipment that I had on hand, a mixed bag of mini battery pack, microservo, standard servo, and four-channel receiver. A micro radio system would make a more practical choice. My radio equipment weighed almost 5 oz., which I consider to be the limit for optimal performance.

The finished model weighs 13 oz. ready to fly, giving a wing loading of about 7.5 oz./sq. ft. With its large wing and high-lift airfoil, the Cadet is sometimes reluctant to come down.

Construction. Very lightweight, 4-to-6-lb.-density balsa is used for most of the structure. The wood will vary in density; look for firmer sheets with straight grain. Use medium-to-hard balsa for the strip stock and spruce for the main wing spar. Providing you're using no larger than an .020 engine, you could substitute hard balsa for the main spar.

Spruce is also used for the high-stress areas on the fuselage. While it weighs a little more than balsa, you'll appreciate its extra strength on those less than perfect landings.

Wing. Build the structure in three sections. Make the center section first, since this will help in aligning the outer panels.

Glue the dihedral braces to the center section leading edge (LE) and spar. Once the glue has set, pin the LE, spar, and trailing edge (TE) in place. Add the bottom sheeting in two sections, fitting it between the LE, spar, and ⅛-in. sheet balsa TE.

Glue the C1 ribs in place. Glue in the rear filler blocks between and flush with the top surfaces of the ribs.

Drill holes for the 4-40 nylon hold-down bolts. Sheet the top of the wing, leaving cutouts for the 1/16 plywood inserts that support the bolts. To prevent the plywood from splitting, it's best to drill the holes before cutting out the inserts. Make sure the cutouts line up with the ones previously drilled in the balsa sheet, then glue the inserts in place.

Build the outer panels following a similar procedure. Check that the leading edges and spars are aligned with those of the center section. Glue on the bottom sheeting in three sections, fitting it between the LE, spars, and TE.

Pin the center section flat, block up the wing tip two inches, and join and glue the panels. When the glue has set, add the C1 rib and sheet the remaining top sections.

Sand the LE and wing tips to the correct contours. Very lightweight balsa sands easily, so take care not to overdo it.

The Army stars, lettering, and numbers show up nicely from the rear.

The wing struts are optional. I used them mainly to add realism in static display. The struts can be secured in several ways. Mine use an aluminum tab secured with 0 x ⅜-in. wood screws on one end, and a 1/32 music wire pin that plugs into a 1/16-O.D. aluminum tube epoxied into the fuselage at the other end.

Tail surfaces. Construction is fairly simple, with only a brief explanation necessary.

Build the fin and stabilizer from various sizes of balsa as shown on the plan. Cut a ⅛-in.-wide slot for the fin in the center of the stab. Note that the 1/16 balsa is glued to the bottom of the stabilizer only.

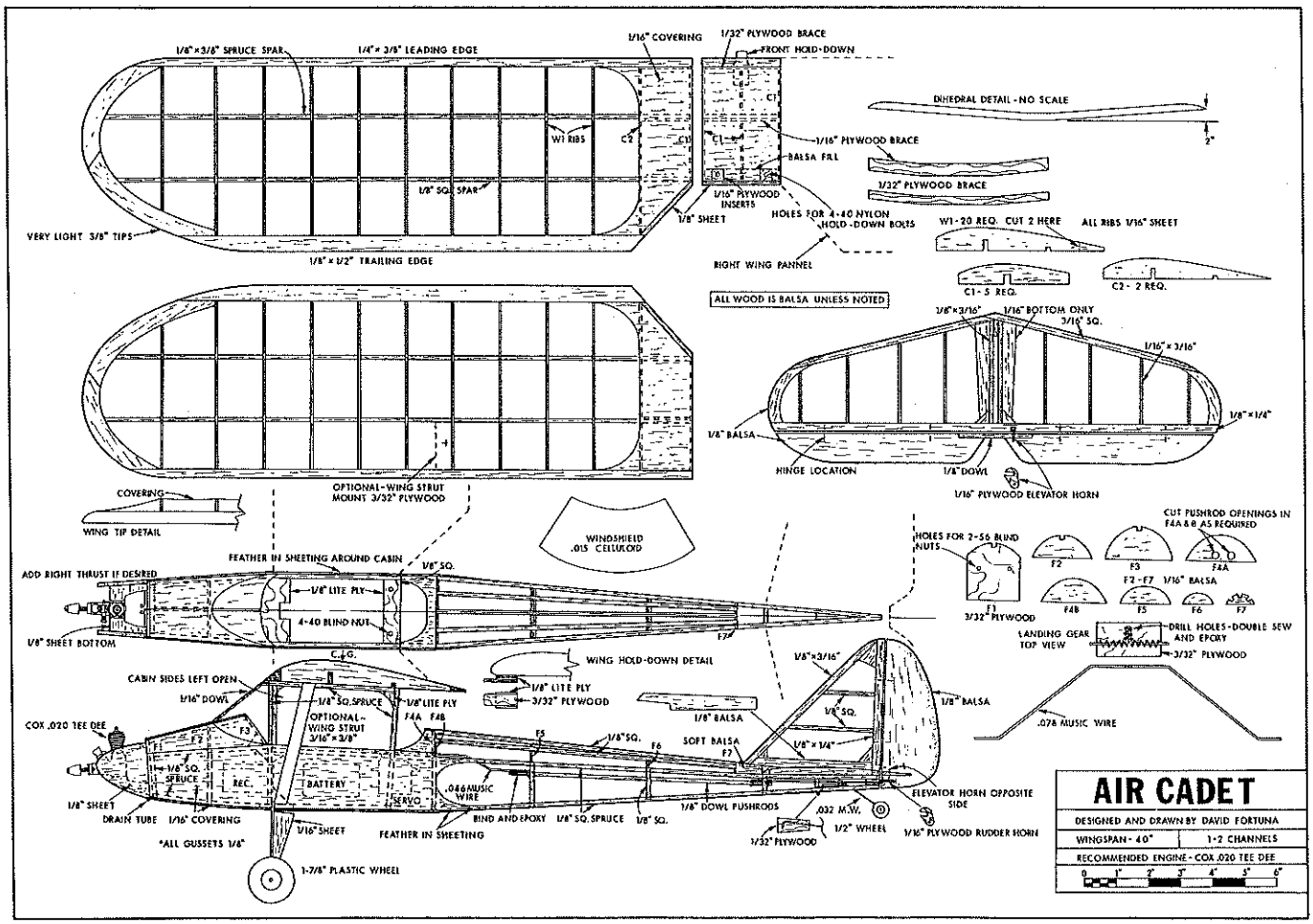
Cut the elevator and rudder from ⅛-in. sheet balsa. Join the elevators with a ⅛-in. dowel.

Cut the control horns from 1/16 plywood. These are lighter weight and less conspicuous than nylon horns, which appear somewhat bulky on a model this small. Glue the horns in place before installing the elevator and rudder. If you use nylon horns, you may have to cut them down a bit.

Cut the hinge slots. Use whatever type of hinge you prefer, although small hinges are best. Check that the hinges do not bind and that the control surfaces move freely.

Lightly sand the leading edges to shape, feathering them to match the tip contour. The fin can be glued to the stabilizer after covering.

Fuselage. Begin by making two identical sides. Note that the uprights in the cabin area extend from the bottom longeron to the cabin top in a single piece.



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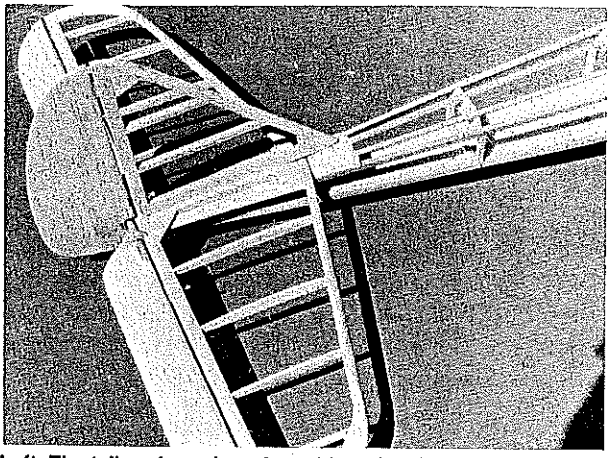
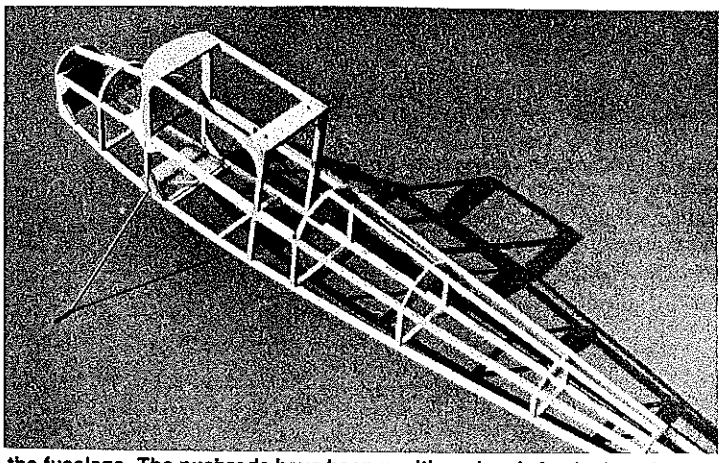




Left: The tail surfaces have been hinged and temporarily placed on the fuselage. The pushrods have been positioned and checked out but are not yet installed. Note the small balsa block in front of the stabilizer leading edge. After the stab has been glued in place, everything is faired in with plastic balsa. Right: The fuselage awaits sheeting and covering. The hold-down key is cut out before the front ply plate is glued in place.

When the glue has set, remove the sides from the plan and bevel the rear as shown in the top view. I shortened the right side by 1/32 in. at the nose to provide right thrust, though flight tests showed this to be unnecessary.

Glue the 1/8-in. crossmembers in place beginning in the cabin area. Pull the tail together, and glue it securely. Fit 2-56 blind nuts in the firewall, then glue the latter in place.

Bend the landing gear from .078 music wire. Using a No. 59 drill bit, drill holes in the 3/32 plywood gear plate at approximately 3/16-in. intervals, then thread 1/2A Dacron flying line through the holes to bind the gear in place. Coat the landing gear and Dacron line with either epoxy or CyA (cyanoacrylate glue). Glue the gear assembly between the 1/8-in.-sq. longerons.

Add 1/16 sheeting from the firewall to the landing gear plate. The sheeting is installed cross grained and flush with the bottom longerons. Glue in the side gussets and the 1/16 side and bottom sheeting. Feather the sheeting into the longerons aft of the cabin area.

As I learned the hard way, it's best to install the radio *before* gluing the turtledeck formers in place. I used 1/8-in. dowels for the pushrods and .046 music wire for the pushrod ends. Use only a 90° bend in the rear pushrod ends; since the plywood horns are glued in place before the control surfaces are installed, a Z-bend won't work. Secure the rear ends with a pushrod keeper.

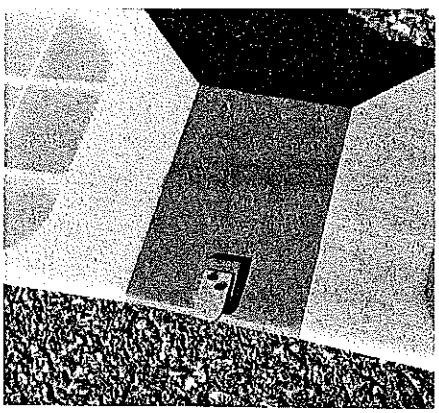
If desired, use an .032 Sullivan Gold-N-Rod instead of making your own pushrod. A standard-size clevis may be used, but the pushrod exit holes in the fuselage may have to be relocated.

Pin the tail in place and temporarily position the servos while hooking up the controls. The servos may have to be shifted later to balance the model correctly. They can be mounted on 1/8 x 1/2-in. plywood rails.

Add the turtledeck formers. Bevel F3 at the top and bottom. Depending on the pushrod locations, F4A and F4B may have to be cut out for pushrod clearance. Add the top fuselage stringers and the remaining sheeting, including that for the cowl sections. Install the small balsa block behind F7, and sand it to the fuselage contour.

Bend the tail gear from .032 music wire. Epoxy the gear to its 1/32 plywood plate. Glue the plate to the top of the 1/8-in.-sq. longerons.

Mount the wing to the fuselage with a 3/32 plywood tab (or 1/32 aluminum, as used in the prototype) at the front and 4-40 nylon bolts at the rear. The front tab fits under a 1/8-in. Lite Ply plate that is keyed for the plywood tab mount. Install 4-40 blind nuts in the 1/8-in. Lite Ply plate at the rear, and glue the plate in place. Make a balsa-and-microballoon fillet between the wing leading edge and the cabin top.



Bottom view of the wing center section showing the front hold-down tab and the holes for the 4-40 nylon bolts at the rear.

Covering and final assembly. Make sure that all parts of the structure are shaped and sanded smooth. Any rough joints or cracks can be filled in with plastic balsa and resanded. Fuel proof the inside of the cowl with epoxy, taking care to keep the adhesive off the blind nuts.

Cover the model with your choice of tissue, silkspan, or a lightweight iron-on covering. I used Sig Manufacturing's medium-weight Plyspan Japanese tissue. This strong, lightweight material can be applied wet, making it easier to work out the wrinkles. To reduce warping, I used Sig Lite-Coat dope exclusively.

I brushed on two coats of clear dope to prepare the wood on all areas that contact the covering. Sand the dope with 400-grit paper when dry.

Cut the covering slightly oversized, and work out the wrinkles while it is still damp. Attach the covering by brushing clear dope through it along the edges. On sheeted sections, brush the dope over the entire area covered. Trim off excess tissue, and dope down the edges.

Cover the fin and stabilizer separately, then glue them together, cutting the tissue away where necessary. Glue the assembly to the fuselage. I faired in the tail with plastic balsa, finishing the job with small sections of tissue.

To keep the weight down, I used clear dope on the wing and horizontal tail, limiting the colored dope to the fuselage and vertical tail. Three or four coats of thinned dope should be sufficient.

Install a 1/16 dowel for the windshield brace, then add the windshield. The side windows are left open for radio access.

Install the engine, control surfaces, and wheels. I used Sig lightweight plastic wheels. Add the radio, making sure the center-of-gravity matches that shown on the plan. Glue the servo rails in place.

Flying. Choose a calm day and a large, grassy field for your first flights. It's best to surround yourself with lots of space until you've developed a feel for how the model flies.

Test glide the airplane. The glide should be flat with no tendency to turn.

Check that everything is operating properly and that the battery pack is securely positioned inside the fuselage. With an open-cabin model, you don't want your battery pack to go sailing out during a loop.

Adjust the engine for smooth operation through the entire run. The secret of starting small engines and keeping them running is to use high-nitro fuel (25-30%) and to keep the engine clean. Avoid spilling raw fuel on the model; it's hard on the finish.

Enjoy the simplicity, ease, and good flying habits of this versatile little airplane. □

air cadet

DAVID FORTUNA