The side-mounted engine streamlines the nose, giving the appearance of a full-scale airplane instead of a sport model.

Midsport 20

Sleek racing looks meet RC trainerlike handling

by David Fortuna

THE MIDSPORT 20 design was inspired by midget Goodyear racers. The first Goodyear Race was held at the Cleveland National Air Races in 1948. In 1964, the races were moved to the Reno National Air Races, which is still going strong today.

Because of their small size and simple construction, Goodyear racers made air racing affordable to many who thought they would never get the opportunity. With their short, stubby wings and small tail surfaces, these aircraft could be tricky to fly, even for an experienced pilot.

My idea was to design a model that was similar in appearance to the Goodyear racers, but with more wing and tail surface area, to make it easy to fly. The result was an attractive airplane with good handling characteristics.

Before you begin, review the text to see how it all goes together. The experienced builder should be able to quickly pick up on how it's done. The less experienced builder should study the plans and closely follow the text.

I tried to make the Midsport as easy as possible to build and still be attractive. To keep the building time down, you can purchase the landing gear and canopy ready-made. The tail surfaces are cut from solid balsa, further reducing building time.

CONSTRUCTION

One advantage of scratch building is that you get to select the wood, avoiding less-desirable pieces. It is important that the wood is not warped—especially for the

Right: This model is similar in appearance to the Goodyear racers. It has enough wing area to make slow, gentle landings.

wing spar, wing sheeting, and tail surfaces.

Please forgive me for not having the forethought to take pictures of the wing while building the prototype. Studying the plans should suffice.

The wing ribs and fuselage sides are cut from C-grain balsa. The wing sheeting should be a softer grade of wood that bends easily, such as A-grain. The tail surfaces and the rear fuselage top block are cut from medium-soft balsa, referred to as very light, or 4- to 6-pound stock.

Spruce is used for the wing spars. It is only a bit heavier than balsa but is much stronger and has less of a tendency to warp. Best results are with a slow-setting glue, for maximum penetration of the glue joints.

Plywood is specified as either aircraft plywood or light plywood. The former is used on heavy-stress areas, whereas light plywood is popular and is used where density is required.

Tail Surfaces: Since there is not much here, it's a good place to start. The entire tail is built from 3/16 sheet balsa. I used 3-inch sheets and joined them as shown on the plans. Notice that the wood grain varies on the fin.

The elevators are joined with a 3/16 hardwood dowel. Epoxy and microballoons are used to flair it all in. At the elevator horn, 1/32 plywood was recessed to keep the elevator horn from crushing the balsa.

The bottom part of the rudder is made from 1/16 balsa, sandwiched between pieces of 1/16 plywood. I used Du-Bro nylon hinges on the elevators and rudder.

Wing: Take your time and work accurately when building the wing. How well the model performs depends largely on how precisely the wing is built. If warps are built into it, it is almost impossible to eliminate them after the wing is finished.

Cut the ribs and then punch holes for the aileron control rods. An easy way to make the holes is to sharpen a piece of brass tube and twist the tube as you press it into the rib.

Cut the 3/16 x 1/4-inch bottom spars to length, and epoxy them to dihedral brace P-2. After it's dry, you are ready to build one side of the wing.

Start on the left panel (or the right if you prefer), by pinning down the 3/16 x 1/4-inch main spar and attached brace. In doing so, the dihedral angle will raise the right spar. By building the wing this way, it's a complete unit, assuring that it all fits together.

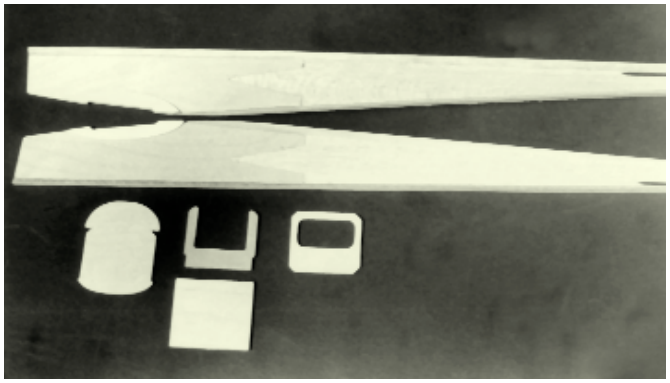
The author employed a universal muffler (no longer available), but others can be used. The .25 engine used in the prototype flies the Midsport 20 nicely.

A balsa hatch covers the landing gear and is held in place with 4-40 bolts and blind nuts. Several landing-gear types can be used.

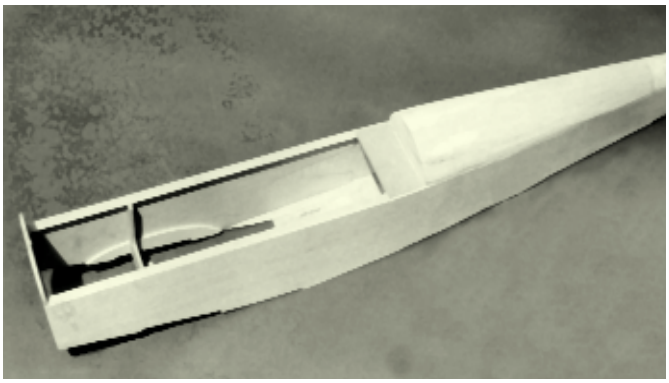
The author used Klett hardware throughout. Pushrods from the forward-mounted servos should be hard wire, to prevent trim changes caused by temperature.

Photos by the author

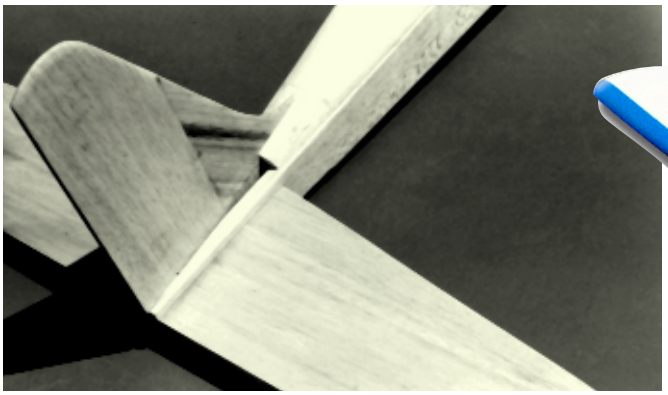
A racy color scheme accentuates the design. The model is well proportioned and has good flight characteristics. It was finished with fuelproof paint.



Fuselage sides are cut from 3/32 balsa sheet with 1/32 plywood used as nose doublers. At the landing gear area, 1/8 plywood was added with 1/4 triangular stock.



On the finished basic fuselage structure, the firewall (F-1) has been glued in place and holes have been drilled for the engine mount and 4-40 blind nuts. The rear top deck is temporarily in place.



The tail surfaces are cut from lightweight 3/16 balsa sheet. Notice the grain direction on the fin. Thin plywood is glued where the rudder horn and tail-wheel bracket will mount.

Midsport 20

Type: RC sport

Skill level: Beginner builder, intermediate pilot

Wingspan: 55 inches

Construction: Balsa and plywood

Wing area: 497 square inches

Length: 37.75 inches

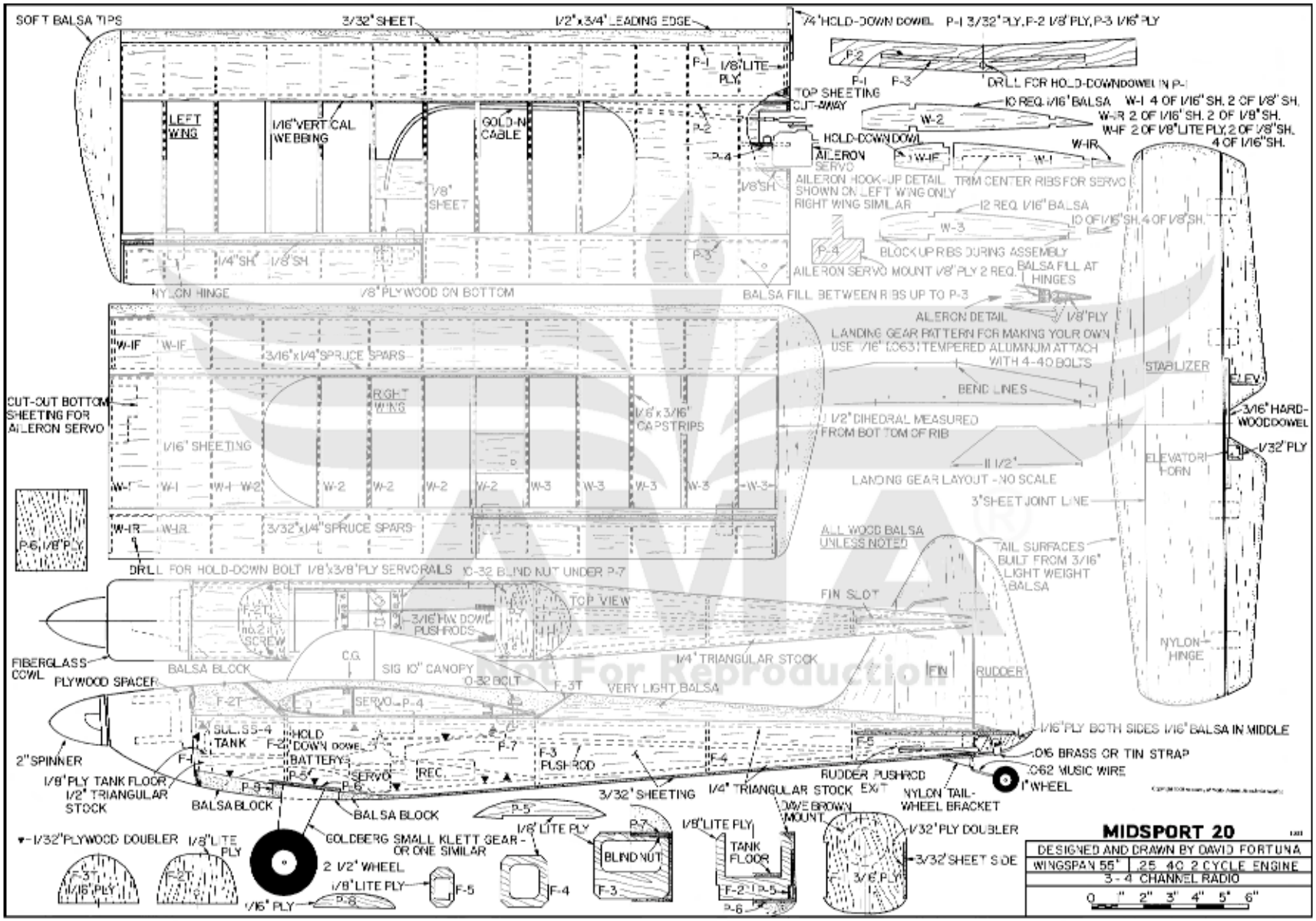
Weight: 4 pounds

Engine/motor: .25-.32 two-stroke/500 watts

Finish: Builder's choice (author used silk and paint)

Other: 4-ounce fuel tank, four-channel radio with four standard servos, 2-inch spinner, 2.5-inch main wheels, aluminum landing gear, clear bubble canopy

Full-Size Plans Available—see page 175



Now you can glue the ribs in place. Pin a 1/8-inch square fixture strip under the LE portion of the ribs. You can add a similar strip at the TE if needed.

Glue in ribs, starting with W-2 and W-3. The plans show rib W-3 in two pieces, but it is easier to glue it in one piece and cut it later for the ailerons, which is what I did. At this point, the ribs are glued only to the 3/16 x 1/4-inch main bottom spar. As you are gluing in the ribs, lay a straightedge across the ribs to make sure they are aligned.

Glue in rib sections W-1, checking alignment against the other ribs. Add front rib sections W-1F. Cut out the center ribs for the hold-down dowel. Epoxy the dowel in, and then add front wing brace P-1 and the 3/32-inch LE. Now you can add the front and rear top spars.

After the wing panel is dry, remove it from the building board. Block the left wing panel up and pin the right main spar down. The right wing panel is built onto the left panel.

Once complete, add the bottom 3/32 x 1/4-inch rear spar, wing brace P-3, and rib sections W-1R. Sheet the bottom of the wing and cut out the ailerons. There will be a 3/16-inch gap between the aileron sheeting and rear wing spar. Add a 1/8 balsa TE behind the rear spar at the aileron. Also add balsa between the rear spars where hinges are to go.

Trim aileron ribs for the LE. Glue the LE in place and add plywood for the aileron horn mount.

To mount the aileron servo, cut the bottom sheeting out as shown. The servo mounts to P-4, which should be cut to fit your servo.

Route Sullivan Products Gold-N-Cable through the wing with a threaded coupler used on the aileron end. Use an aileron connector and Du-Bro Ball Link Dual Take-Off on the servo end.

Once it's hooked up and working properly, add the top wing sheeting and then the 1/2 x 3/4-inch LE and wingtips. Wingtips are made from lightweight balsa and can be carved out on the inside to reduce weight.

Plans show 1/16-inch vertical webbing between the wing ribs. I did not add vertical webbing on my model, but my flying method doesn't put a lot of stress on the wing. If you used a larger engine or like to fly on the wild side, it's best to add vertical webbing.

Add wing capstrips. These should be medium-soft balsa, which bends easily.

After you have sanded down the wing and shaped the LE, glue 2-inch-wide fiberglass tape along the center-section as reinforcement. You can put this down with 15-minute epoxy or slow cyanoacrylate.

Balsa, which makes the top part of the fuselage, is glued on the wing center-section at a later time.

Fuselage: Cut the sides from 3/32 balsa. Make the right side 3/32 inch shorter at the nose, to provide right thrust.

Cut 1/32 plywood nose doublers and glue them in place. The doublers are glued inside the 1/4 triangular stock, so you must leave a 1/4-inch border for this. Be sure to make a left and right side.

Bevel the 1/4 triangular stock at the rear, using the top view, and then glue it in place. Notice that the triangular stock extends past the sides at the bottom, just behind the landing gear. This is trimmed flush with the side after gluing in place.

Mark the fuselage formers' location on the fuselage sides, and cut out for landing-gear plate P-6, stabilizer opening, and pushrod exits at the rear. Glue in the 1/8 light-plywood doubler P-5 around the landing-gear cutout. Glue balsa in the tail, inside the triangular stock, and sand to shape.

All fuselage formers are cut from plywood. F-1 is 3/16 plywood, and the remaining are made from 1/8 light plywood.

Glue F-2 and F-3 to one side of the fuselage and ensure that they are 90° to the side. When dry, add the other side.

Before epoxying in F-1, decide what size engine you will use and how you will mount it. I employed a Dave Brown Products mount and a .25 engine. With this setup, I added a 3/8 plywood spacer behind the mount. Or you can use a long mount in this scenario.

I chose a Du-Bro universal muffler, extending out the cowl bottom. It is no

longer available, but other muffler types are suitable.

If using a larger engine or a sport muffler, you might need to mount the power plant upright for muffler clearance. Decide that before you install the mount and blind nuts in F-1.

Epoxy F-1 in place and add 1/2 triangular stock behind it. Tightly secure the fuselage sides with masking tape or rubber bands until the epoxy is completely cured.

Mount the landing gear in place. There are several options for gear; the best is to buy one ready-made, which is what I did. I used a Klett small landing gear (item 255) from Carl Goldberg Products. I selected it for its scale looks, and since it's composite, it takes paint well.

Sig offers a number of aluminum landing gear. The Kadet Jr. type (item RP-BA-246) is close in size to the Klett variety.

If you decide to bend your own gear, make it from .063 (1/16 inch) tempered aluminum—not the soft kind found in hobby stores. When bending the aluminum, heat it with a propane torch; otherwise, it may fracture at the bending point. Do not hold the torch on one spot; overheating can also cause the aluminum to crack.

With the landing gear mounted on P-6, make sure it fits in the fuselage. I had to slightly carve out along F-2 and the fuselage sides to clear the blind nuts. However, that may be unnecessary, depending on what landing gear you use. Epoxy P-6 in place.

Cut the fuel-tank floor from 1/8 light plywood and glue it in place. I used a Sullivan 4-ounce slant tank.

Fuel-proof the fuel-tank compartment with a coat of epoxy glue. If you use 15- or 30-minute epoxy, it can be thinned with acetone, if necessary, for brushing.

Make the front bottom section from a balsa block, with P-8 glued behind it. A removable balsa hatch covers the landing gear so it can be easily removed, if necessary. The hatch is held in place with 4-40 screws and blind nuts.

Mount the tail-wheel bracket to a piece of 1/8 plywood that is recessed in the fuselage so that it fits flush with the bottom sheeting. Bend the tail-wheel gear from 1/16-inch-diameter (.063) music wire, and secure it to the rudder with a metal strap.

Fit the wing in place by gluing scrap balsa under its front and rear section, to make the wing saddle. This should be accurately sanded to shape using a template, since it will establish the wing incidence angle.

Set the wing and stabilizer in place and check alignment against each other. When everything looks good, glue the stabilizer in place.

Remove the wing and fit the rear hold-down plate, P-7, in place but do not glue it. You will need to trim the 1/4 triangular stock away so that P-7 fits flush against the fuselage sides.

Add balsa on top of P-7 and sand it to match the wing contour, and then mark and drill holes for 10-32 wing bolts. Those can be held in place with blind nuts or threaded hardwood blocks glued under P-7. Epoxy P-7 in place.

Cut the front top block to its approximate shape, and then carve it out on the inside, as necessary, to clear the fuel tank. Tack-glue the block in place and sand to shape.

To make the block removable for fuel-tank access, mount a blind nut to a piece of plywood that is recessed in the block. A 4-40 bolt goes through the top of the plywood spacer and screws through the blind nut in back of F-1 and into the blind nut in the block.

The rear section of the block is held down by No. 2 screws, recessed in the block to clear the wing. Insert small pieces of 3/32 plywood in the block at the screw holes to keep the screws from crushing the balsa when they are tightened.

With the front block screwed in place, glue in F-2. Locate and drill a 1/4-inch hole for the hold-down dowel.

Before installing the pushrods, set the fin in place. Small balsa blocks go on both sides of it, extending up to F-5. With the fin in place, check alignment and glue the blocks only to the fuselage. These blocks are sanded and shaped later, along with the rest of the fuselage top deck, and then the fin is glued in place.

For control rods, you can use one of the

popular types, such as Du-Bro Lazer Pushrods or Sullivan Gold-N-Rods. When using these, glue supports on the fuselage formers and epoxy the rods in.

I made pushrods from 3/16-inch-diameter dowel rods. Make a 5-64 hole 3/4 inch from the end of the dowel. Make a 90° bend 5/16 inch from the end of a 2-56 rod, and insert this end in the drilled hole. Secure the metal rod to the dowel by wrapping it tightly with strong cord, such as 1/2A flying-line thread, and coating it with epoxy or cyanoacrylate.

Servos are mounted on 1/8 x 3/8 plywood rails, glued to the fuselage sides, with 3/16 x 1/4 balsa strips glued under the rails. Servos might need to be shifted slightly for balance. Also, make sure they don't interfere with the aileron servo.

With the rudder and elevator in place, check controls for smooth operation and make certain that no binding occurs. For control throw, I used 1/2 inch on the rudder, 1/2 inch up and 1/4 inch down on the elevator, and 1/2 inch up and 3/8 inch down on the aileron.

Sheet the rear bottom section of the fuselage, and glue the rear top block in place. Use extremely light balsa for it. You can carve the inside portion of the block to a 1/4 inch wall thickness to reduce weight. Glue F-3T in place.

Mount the wing, glue balsa on top of the wing, as shown, and open the wing-bolt holes. Now you can shape and sand together the entire top deck and wing center-section. Glue the fin in place.

Cowl: You can make a simple, open-ended sport cowl by gluing 1/4 balsa sheet to the fuselage sides, leaving the top and bottom open. This setup works best for an upright engine installation.

I made a fiberglass cowl by using the balloon method. To do this, make a cowl plug from sheet and block balsa. Sand the structure to shape, leaving it 1/32 inch undersized.

Glue a 3/8-inch-diameter dowel that is approximately 3 inches long on the back of the cowl. Hold the cowl in place by putting the dowel in a vise.

Drape Saran Wrap over the cowl, and follow that with heavyweight fiberglass cloth. The cloth is held in place with thumbtacks pushed into the back of the cowl.

Coat the fiberglass cloth with slow-drying (15- or 30-minute) epoxy. Inflate a balloon and push it over the cowl while slowly letting the air out. The balloon should be large enough that it doesn't burst when it's forced over the cowl. You should have more than one balloon for this process.

Once the balloon is over the cowl, let it set overnight. Then peel off the balloon and add another layer of fiberglass cloth. Sand the cowl and fuselage together so they match up.

Covering and Finishing: Fill any imperfections with lightweight spackling paste. Make fillets with epoxy and microballoons. Carefully sand the model with 320-grit paper, and apply the covering of your choice.

I covered the fuselage and tail with medium-weight silkspan and the wing with Dave Brown Products Skyloft. This bonded nylon material is inexpensive, lightweight, and extraordinarily strong.

My finishing method is to apply two coats of clear dope to the entire model, followed by a light sanding. Then I dope the covering in place and trim it.

I brush on two coats of clear dope, followed by four coats of a dope/talcum powder mix (or your can use sanding sealer). After that has dried for several days, I sand it with 320- and 400-grit sandpaper until most of it is removed.

I epoxy the canopy in place, tape it, and then spray the model with colored dope. This gives the Midsport a lightweight, scale-type finish that is durable and easy to touch up.

Flying: Epoxy the control surfaces in place and check the controls. Make sure they move in the correct direction. The model should balance on the main spar, with the nose level or pointing slightly down.

Do a radio range check and inspect the model carefully. Many crashes are caused by small things that were overlooked.

If you have flown several sport models, the Midsport 20 should present no problems. Make the first flights on a calm day. If the model is out of trim, wind will only make things worse.

Everything went smoothly on the first flight; only a small trim adjustment was needed. I don't owe that to luck, but to thoroughly checking for warps and alignment during construction and making sure that the balance was right and that everything worked correctly before flying.

Many happy flights! *MA*

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Sources:

Du-Bro
(800) 848-9411
www.dubro.com

Carl Goldberg Products:
Great Planes Model Distributors
(800) 637-7660
carlgoldbergproducts.com

Sullivan Products
(410) 732-3500
www.sullivanproducts.com

Sig Manufacturing
(641) 623-5154
www.sigmfg.com

Dave Brown Products
(513) 738-1576
www.dbproducts.com