PHOTOGRAPHY: DICK SARPOLUS

A Giant Fun-Scale . . . P-51D Mustang

By Dick Sarpolus

A comfortable, simple giant that takes the worry out of being big and scale.

Another P-51 *Mustang*? Why? There must be enough different *Mustang* kits and plans available by now to suit anybody that wants one. The P-51 and the J-3 *Cub* have to be the most often modeled aircraft in history; almost everybody likes them and they've been built in various sizes and degrees of scale authenticity. I've been modeling for many years but have never had a *Mustang* so I finally had to do it. I like large engines and large, easy-to-build, uncomplicated aircraft with good aerobatic capability. Realism is important but for my sport flying enjoyment, an exact scale project wasn't wanted.

There are a number of really good P-51 kits available; I'd rate Dave Platt's *Mustang* one of the best and at 81-inch wingspan, it's a nice size aircraft. Byron's large P-51 is certainly impressive. At 85 inches span, with its prop drive set-up and scale accessories, you couldn't ask for more realism. But I wanted to use a Quadra 40 or Zenoah G-38 for power, with the usual 18-8 prop. I like these gas engines—low cost, economical to run, reliable, and reasonable power output. From past experience, a Quadra 40 in an airplane around 16 to 17 pounds with 1200 square inches would give the sport flying performance I wanted. A wing loading of about 30 ounces per square foot is very acceptable for this size aircraft. The weight is achievable with standard foam core surfaces and built-up fuselage construction in a model around this size. The size of this aircraft would also suit the SuperTigre 2500 or 3000 engines, which I wanted to learn more about.

With these parameters in mind, I grabbed a P-51 3-view drawing and headed for the drafting table. I knew exactly what type construction techniques would be used to suit my idea of fast and easy assembly. I'm sold on foam cored wing and tail surfaces for this size aircraft, along with a light sheet balsa and plywood fuselage. Foam cored surfaces eliminate the considerable drafting time required to lay out rib patterns, and I'd rather be building and flying than spending time at the drafting table. This construction has proven to be ample to withstand the power of the gas engines and all flight loads; but it's not overdone. Economically, foam isn't inexpensive and can be hard to locate in sizes large enough for this project; but there are custom cut foam suppliers around to do the job and it sure does make for quick assembly work.

A wing layout in the *Mustang* planform of 86 inches span provided about 1200 square inches and was a good start. With reference to an enlarged, scale, side-view drawing, I sketched in the *Mustang* shape around a Quadra 40 and some familliar, workable nose and tail moments used on previous designs. No, it's definitely not scale. The nose is shortened for easy balance with the Quadra, the fuselage is considerably slimmed down, and it's built with slab sheet balsa sides. But it looks enough like a sleek *Mustang* to make us sport types happy and it sure is easy to build with its fixed gear and no flaps. It's a basic 4-channel airplane. Retracts didn't interest me for rough field flying, but wing flaps would be a nice addition. There are some reasonably light retract units now on the market though which should be suitable. Dave Platt's and Impact Engineering's look good, so my next *Mustang* might be able to tuck up the gear.

By now I've turned away the scale enthusiasts, but if you sport/fun fliers are interested in a big straightforward *Mustang*, we'll proceed. There are plenty of P-51 types to model, from the early "A" and "B" turtledeck versions, the Malcolm hood type, to the bubble canopy "D" and later models. I went for the "D" model with the dorsal fin; two friends who would be constructing *Mustangs* along with me preferred the "B" type, so plans were drawn up for the "B" also. You'll see them later. This is a fun scale project, and we considered using a straight leading edge wing shape to make construction easier; but that would be straying too far from scale impression. The kink in the leading edge of the P-51 is one of its identifying characteristics and could be accomplished with a little more work on the foam wing cores.

A thick, fully symmetrical airfoil, about 16% at the root (not considering the forward extension) and a bit thicker at the tip, was used, again because earlier experience showed good aerobatic sport flying performance with such airfoils. Foam cored tail surfaces are also quick and easy to build. The

fuselage is basic 1/8 inch balsa sides, 1/16 inch plywood doublers, plywood firewall and bulkheads, and 1/8 inch balsa sheeting over the fuselage top. We made a few fiberglass cowls for our prototypes, and production cowls are now available from T&D Fiberglass (38624 Mount Kisco, Sterling Heights, MI 48310; 313-978-2512). I used a P-51D canopy purchased from Dave Platt Models for the prototype but felt it was a little small for this model. T&D should have one available by now that's a bit larger, for easier fitting and even better appearance. There's probably a foam core cutter around most clubs who could do the foam cutting for this project, but if you don't have a source for custom foam cutting I can recommend a real quality supplier, Aerosmith Model Aviation (RD#1 Box 290, Athens, NY 12015; 518-945-1091).

Overall fuselage length is 64 inches plus the spinner. The fuselage is 6 inches wide, and if a Quadra 40 is used, part of the carburetor protrudes through the side of the cowl—it's convenient and doesn't bother me. The fuselage could have been made even slimmer, probably down to 5 1/2 inches. The horizontal stabilizer area is 240 square inches, 20% of the wing area.

One problem when modeling a *Mustang* is the spinner size; for this size model, the spinner should be 5 inches. Large spinners just aren't available, at least not at a price I considered feasible. I decided to compromise and shaped the nose to suit a 4-inch spinner, because a number of 4-inch spinners are available. I went with the reasonably shaped, and priced, spun aluminum 4-inch spinner available from Zinger. Standard, available model hardware is used throughout. I cut the grooved hardwood landing gear blocks on a small Dremel table saw. Bending the 1/4 inch music wire landing gear was done on a K&S wire bender, modified slightly to take this large wire size. The rugged bender did the job. Looking back now, installing commercial retracts probably wouldn't be much harder than making up the fixed gear. Oh well.

The plain wire fixed gear works fine; I've made a few less-than-perfect landings and the gear handled the bouncing with no damage. Ground handling is good, takeoffs are easy, and landings are easy. The setup is a lit-

There's no mistake, it's a *Mustang* but the nose is shortened, the fuselage is slimmer, and the sides are flat-all deviations from scale. If you want you can easily add extra scale detail, if you want.

Fun-Scale P-51B Mustang

tle springier than I'd prefer, although I may have the gear legs raked farther forward than necessary. The only source I know of for wire larger than 1/4 inch is SIG; they offer 17/64 inch wire, which would provide a stiffer gear arrangement. I'd like to try some larger wire sometime. The main advantage of this fixed wire gear is absolute simplicity and very, very low cost. I used 4-inch wheels but they appear a bit small; I'd now recommend 4 1/2 inch wheels.

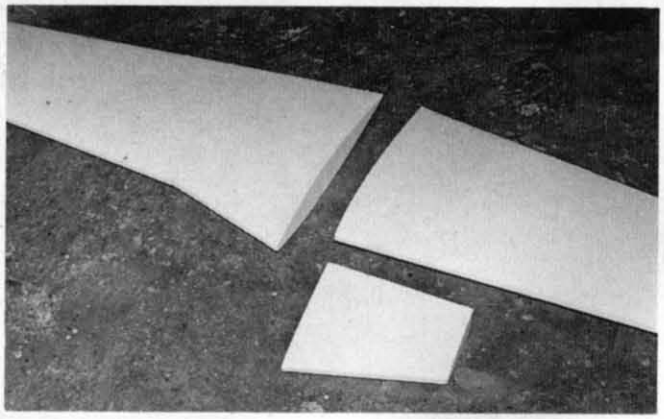
A Quadra or Zenoah is a pretty bulky engine and it's not completely enclosed in the fiberglass cowl. The carburetor pokes out the side and the cylinder head out the bottom. I used a 3/4 inch plywood spacer behind the Quadra engine mount so the current stock Quadra muffler, a new larger design, would fit; I wanted the stock muffler for more noise reduction than most of the aftermarket mufflers offer. The big SuperTigres could be mounted sideways to prevent any inverted engine difficulties, if desired.

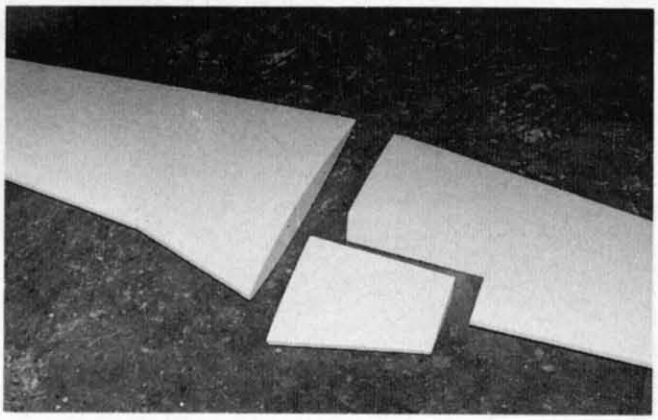
I didn't use wing root fillets. Working on the dummy exhausts and some cockpit detail finished my scale desires. I wish I had gone with the fillets; they do add to the appearance. The fillets could be small, with 1/32 inch plywood for the base and SIG's Epoxolite for the fillet material. At least I did put the tail wheel in the scale position; a *Mustang* with the tail wheel back by the rudder is going too far from scale even for me. A plane this size really needs a pilot figure and a bit of cockpit detail. I hate to see a pilotless scale aircraft flying around. I used the Williams Bros. pilot and shaped a cockpit headrest and a few simulated cockpit details from balsa blocks, just enough for some realism.

There are plenty of scale *Mustang* trim schemes from which to choose; two readily available Squadron/Signal publications, *P-51 Mustang in Action* and *P-51 Mustang in Color*, provide good Mustang coverage for scale detailing (you can usually pick either of these two books up at a local hobby shop or have them order them for you). If your scale desires are such that you want to replicate a particular *Mustang*, I urge you to get the Scale Model Research catalog from Bob Banka (2334 Ticonderoga Way, Costa Mesa, CA 92626; 714-979-8058). He offers "Foto-Paaks", sets of color photos of individual aircraft, and he has literally dozens of *Mustangs* from which to choose. I wanted to simulate the natural aluminum skin of most P-51D's, adding enough of a bright trim color to insure visibility when flying; so, I went for a generic, non-specific trim scheme with red and black on the wingtips and tail surfaces to show up well. The result is a "could-be-scale" appearance, just what I wanted.

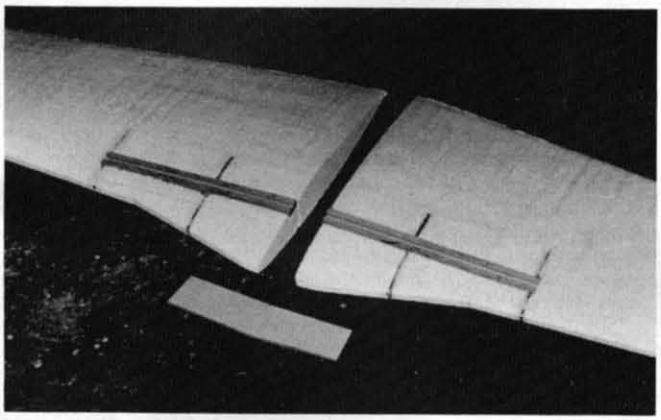
Plastic film covering was used rather than a painted finish for light weight. To simulate the aluminum skin, I used chrome MonoKote and rubbed it with steel wool and fine sandpaper after application. I also rubbed the MonoKote trim colors to get the flat, weather-worn appearance. Pactra Formula-U paint was used on the fiberglass cowl after trying two other paints, to get a reasonable color match, and some flat black epoxy was airbrushed on to simulate the exhaust smudges. Insignia decals are available in the right sizes from the large line produced by Major Decals. If you want a more scale appearance for the landing gear rather than plain 1/4 inch wire, shock absorbing struts with offset wheel yokes could be used even for a fixed gear set-up. Units are available from Impact Engineering.

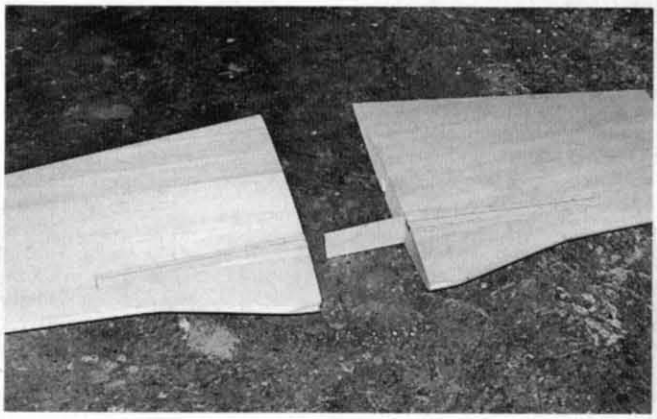
With no real effort made to keep weight down, I was pleased with the all-up ready to fly figure of 16 1/2 pounds. Performance was as expected; lively enough, aerobatic, and easy to handle. It's no trainer, but it's steady and has no bad characteristics. The first flights were a pleasure. By the third flight I was feeling confident enough with the plane to be doing rolls just after takeoff and low inverted passes. Really. Large gas engine power is reliable and reassuring; just what we want for fun sport flying. With less cost and effort invested than that required for most large scale projects, this P-51 is meant

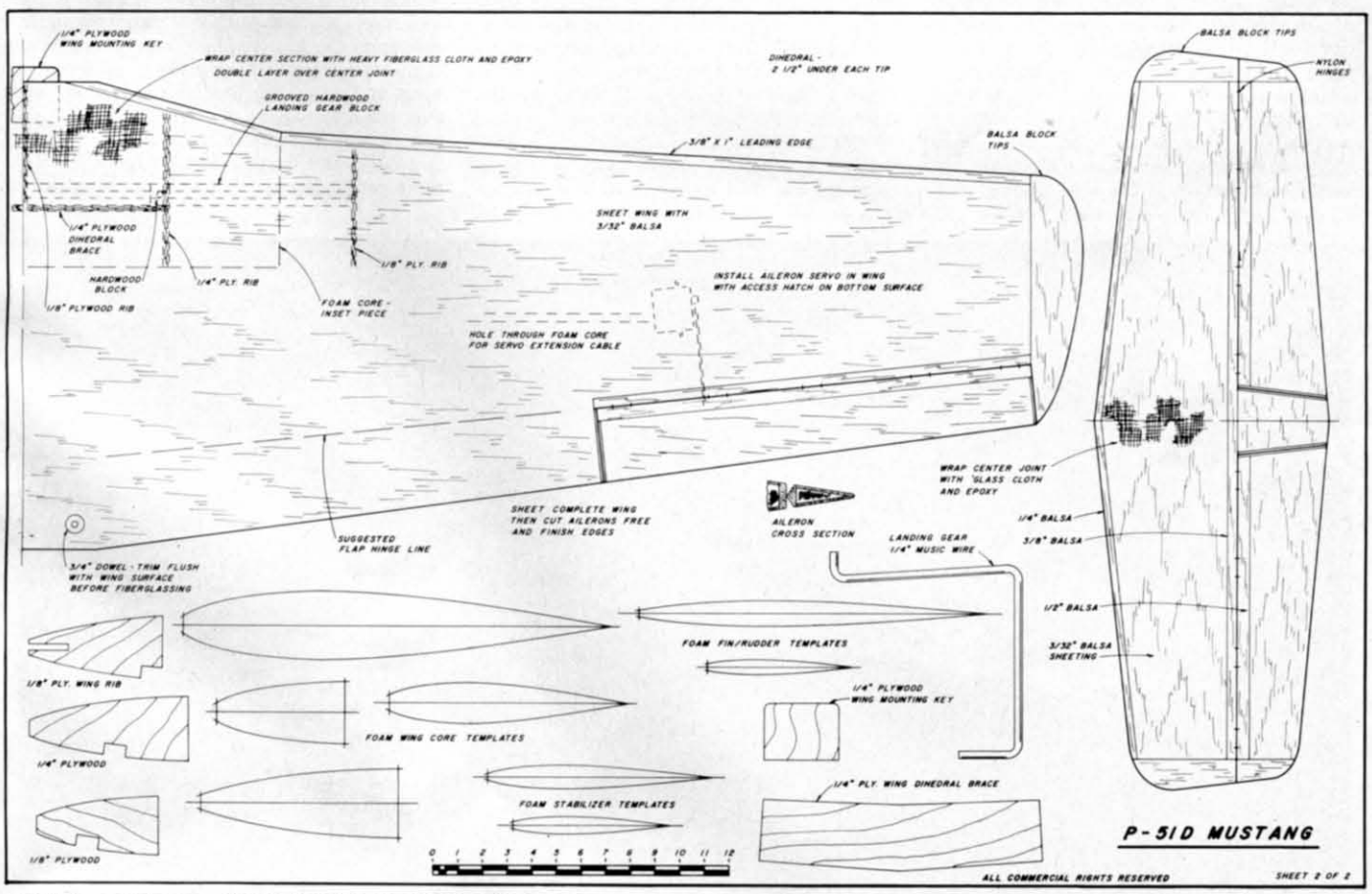




In order to keep construction simple, Dick used foam cores for the wings, but the characteristic inboard leading edge sweep of the *Mustang* provided a problem. So a standard, tapered core was cut along with a special inset piece **(above left).** A section of the main wing core was cut out **(above right)** and the inset piece glued in. Landing gear trunnion blocks with ply rib supports were glued in **(below left)** and the wing sheeted **(below right).**







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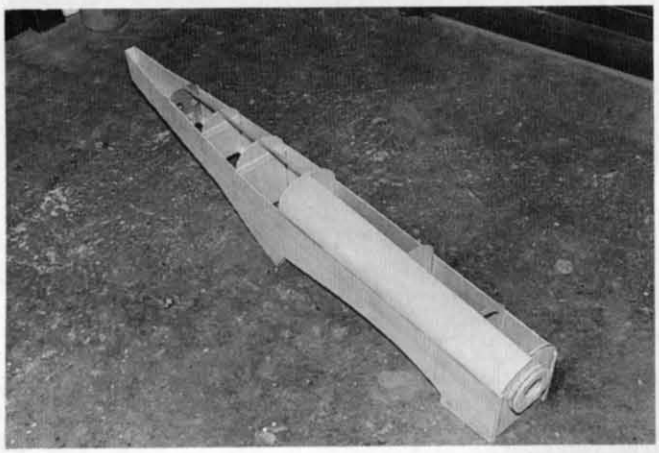
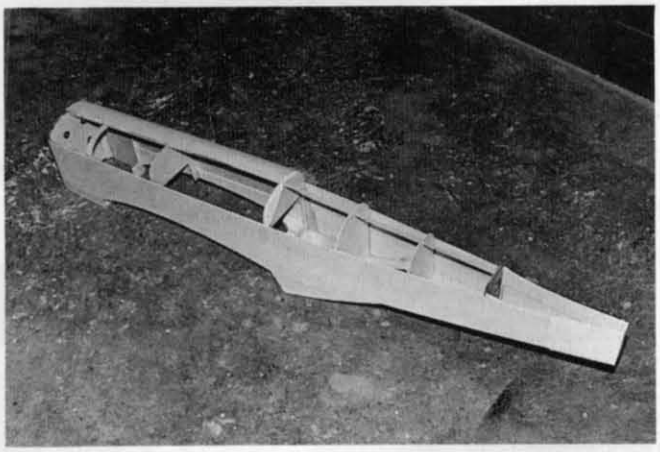




Some construction shots of the fuselage show the simple box structure **(above left).** The curved upper 1/8 inch balsa sheeting **(above right)** is applied in four sections, two forward and two rear. The *Mustang* is a large plane which accounts for the four forward fuselage formers being plywood. Larger R/C models generally require more structure to absorb additional vibration but Dick has carefully simplified the structure.

for active flying. Several other *Mustangs* are now being built from these plans for SuperTigre S-2500 power, and it will be interesting to see how these planes compare in performance with the gas engine powered version.

Construction details

This *Mustang's* structure is typical sheeted foam surfaces and built-up fuselage; those who have scratch built similar projects, even if smaller, will be comfortable proceeding with construction using your own techniques. Starting with the wing, the foam core needs some preliminary work. It must have a section cut out at the root to be replaced with a separately cut section providing the distinctive P-51 forward leading edge angle. Once this is done, work goes on as usual.

Before sheeting, several plywood ribs must be inserted into the foam core to receive and support the grooved hardwood landing gear block, along with the smaller block for the vertical leg section of the wire landing gear. A slot must also be cut into the foam cores for the 1/4 inch plywood wing joiner. I felt the grooved hardwood should extend to the wing's center joint and be reinforced with a plywood joiner to handle the landing gear loads. The landing gear blocks should be sized to fit flush with the wing sheeting. These hardwood blocks require some shaping; one edge is beveled to mate with the plywood wing joiner.

With the plywood ribs and gear blocks glued into the foam cores, now the sheeting is applied. I use 3/32 inch medium weight balsa for all the core sheeting, edge gluing it as necessary to get the needed width. I've used Dave Brown's Southern Sorghum contact cement for many years now and am comfortable with it. Many builders use epoxy glue, thinly applied, or 3M's No. 77 spray contact cement to adhere the sheeting to the cores.

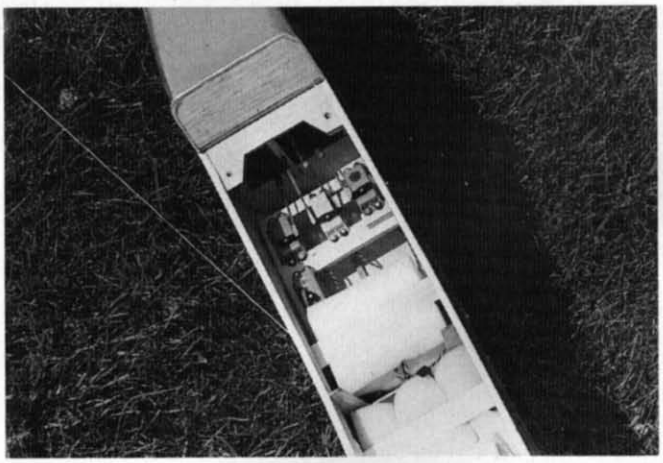
With the cores sheeted top and bottom, trim off the leading edges and block sand them square. Add an oversized leading edge strip and plane and sand it to shape. The wingtips are shaped balsa blocks. With larger balsa blocks being not so easy to obtain, I've glued smaller blocks together to get the needed size.

Cut the aileron sections from the sheeted wing panels, trim them down to allow for the added balsa edges, and sand to shape. Hinge the ailerons along the centerline—or the top edge if you prefer—using large, sturdy, free moving hinges . . . plenty of them! Cut recesses in the lower wing surface for the aileron servo mounting.

For installation of the aileron servo extension cables, I heat the end of a piece of 1/4 inch steel rod, then push it through the foam core from the root to the aileron servo location. Aileron servo mounts are glued into the wing, and removable hatches can be installed over the servo areas.

A 1/4 inch plywood wing mounting tongue is used at the leading edge rather than the more commonly seen dowels for wing posi-

For the modeler eager for a big *Mustang*, there plenty of scale appearance evident when the plane is finally framed up.



Extra air loads on the elevator dictate the use of two elevator servos, one to handle each of the separate elevator surfaces. In Dick's installation **(above left),** the elevator servos are on the outside. Use of a single, large heavy duty servo with a "Y" pushrod could be substituted. Center servo handles the rudder and the tail wheel; the forward servo controls throttle. A Williams Brothers pilot and a simple headrest add cockpit detail **(above right).**

tioning. It is reinforced by the plywood ribs at the root of the foam wing cores. I like the mounting tongue method as the forward method of retaining the wing. It can be trimmed or shimmed as necessary to get the right wing-to-fuselage fit. Butt glue the two wing halves together with the plywood dihedral joiner and plenty of epoxy and wrap the center joint of the wing with heavy fiberglass cloth and epoxy.

Starting on the fuselage, select firm to hard balsa for the 1/8 inch sides, edge gluing and splicing as necessary to get the size required. If you don't plan to use the 3/4inch spacer behind the Quadra mount, or if you're using a different engine, the fuselage sides could be made longer to suit and the fiberglass cowl trimmed to fit. Plan ahead. Glue the 1/16 inch plywood doublers, balsa wing saddle pieces, stab saddle doublers, and balsa corner strips to the two fuselage sides before adding the bulkheads.

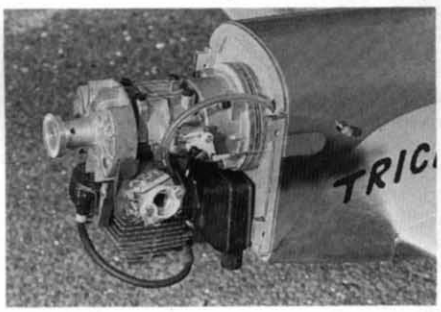
Glue the 3/8 inch plywood firewall and the next three bulkheads to one of the sides, being sure to install them at a right angle to the side. Add the opposite side to those bulkheads so that the sides are parallel from the firewall to the wing trailing edge position. Add the 1/4 inch plywood wing bolt plate and pull the tail end together to install the rear bulkheads, keeping the fuselage straight.

The fuselage top is sheeted with 1/8 inch balsa. I did the sheeting in four sections, one section at a time, the forward areas first from the sides to the top center strip and then the rear areas. Dampening the sheeting with water or ammonia, taping the wood in place till dry, and then trimming and gluing, was the procedure that worked well for me.

Much of the forward sheeting is cut away for the cockpit opening beneath the canopy; the cockpit floor is then added to this fuselage area. With reference to any scale photo source, a few balsa blocks to simulate some cockpit interior equipment along with a pilot figure will add a lot of realism. The plastic canopy is cut to fit. I suggest retaining the canopy with small screws into inset plywood blocks, so it can be removed for trimming and maintenance.

Reinforce the firewall installation with triangle stock and fiberglass cloth epoxied behind the firewall across the joints to the fuselage sides. I'd also suggest the use of several 1/2inch long # 4 screws through the sides into the firewall for extra security against the vibration that a large gas engine can produce. Large 10-32 "T" nuts are installed in the firewall for the engine mounting bolts. Be sure the engine is located correctly on the firewall to position the prop and spinner in the right place. For the Quadra 40 in this aircraft, a 3/4 inch thick plywood spacer block was used to provide room for the Quadra muffler. Other engines, mounts, and/or muffler set-ups may require different spacing.

Before adding the fuselage bottom sheeting, cut holes in the rear bulkheads for the elevator and rudder pushrods. The steerable tail wheel assembly is mounted to its plywood bulkhead and controlled by its own



The ever popular and economical Quadra 40 is Dick's choice of powerplant **(above left).** In this left side view, note the ignition cutoff switch mounted on the firewall. This right side view **(above right)** shows the ply engine mounting spacers which allow the use of the very quiet stock Quadra muffler. Cutouts in the fiberglass engine cowl **(below)** provide engine cooling and carburetor clearance.

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A one-piece, bolt -on wing is one of the traditional and simpler design features of smaller models incorporated in the *Mustang*.

pushrod to the rudder servo. I usually wait until the tail surfaces are installed and the wing fitted to the fuselage before adding the fuselage bottom planking. Fit the wing to the fuselage, adjusting the fit of the wing mounting tab into the bulkhead as necessary, and drill through the trailing edge area of the wing for the mounting bolts. Tap the plywood wing mount in the fuselage to accept the 1/4-20 nylon bolts.

With the wing bolted to the fuselage, build up the lower simulated air scoop section to blend smoothly with the fuselage. This section is glued to the wing bottom. A balsa block is shaped to blend with the forward fuselage bottom area and also glued to the wing bottom surface.

The fiberglass cowl is trimmed as necessary to clear the engine cylinder and carburetor. To mount the cowl, epoxy four hardwood blocks to the firewall; they will be drilled and tapped for the nylon cowl mounting bolts. Scrap balsa can be trimmed and glued to the front of the firewall to provide a small ledge accepting the rear edge of the cowl. The exhaust manifolds are simulated with balsa blocks cut and shaped, glued to the cowl, plus lengths of 5/16 inch dowels inserted and glued into the blocks.

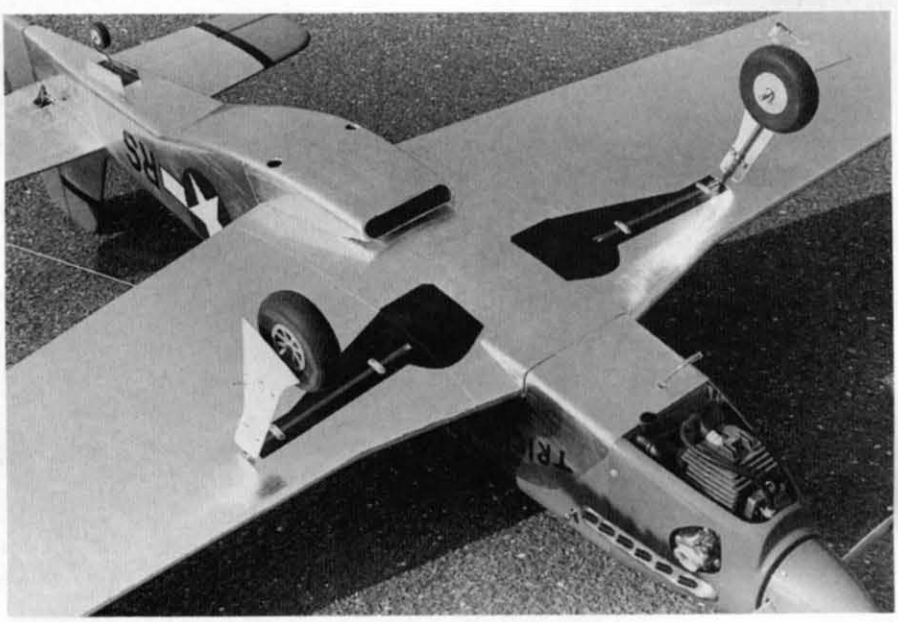
The tail surface cores are sheeted with 3/32 inch balsa as were the wings. Join the horizontal stabilizer panels, reinforcing the joint with fiberglass cloth and epoxy. Cut the surface apart along the hinge lines, allowing space for the added balsa edging. Glue the stabilizer onto the fuselage. Each of the elevators is moved by its own servo and pushrod.

Glue the vertical fin in place, using several 1/4 inch dowels to strengthen its attachment to the stab. Rudder linkage can be done with a pushrod or cables. Balsa blocks are shaped and installed behind the fuselage top sheeting on each side of the fin, and the dorsal fin is added.

Recess the surfaces to accept 1/4 inch plywood pieces where the nylon horns are mounted to the control surfaces, ailerons, elevators, and rudder. Epoxy the plywood mounts into the control surfaces. The horns are mounted with self-tapping sheet metal screws.

I recommend using the larger 4-40 threaded rods and clevises for all linkages. Fiberglass tube pushrods are used for the elevator linkages. I use 1/4 inch plywood for the servo mounts in the fuselage. Using separate servos for the elevators, each with its own pushrod, allows the pushrods to be perfectly straight. Since the pushrods cross over within the fuselage, one of the elevator servos is mounted about 3/8 inch higher than the other to keep the two pushrods from rubbing together.

Aileron extension cables are made up into a Y-harness for the two aileron servos



Designed as a fixed gear model, the *Mustang* uses 1/4 inch music wire for the main gear. Gear doors and the characteristic belly radiator scoop add convincing scale detail.

Justly proud of his achievement, Dick poses with the *Mustang* **(above).** To give an idea of the size, the 6', 2" author stands **(at right)** next to the 82-inch span model. It's a comfortable size, big in the workshop but fine outdoors.

mounted in the wing. Another Y-harness is needed for the two elevator servos. A 1200 mAh battery pack was used, wrapped in foam rubber and positioned above the wing leading edge. The battery pack could be located behind the wing trailing edge position if necessary for balance.

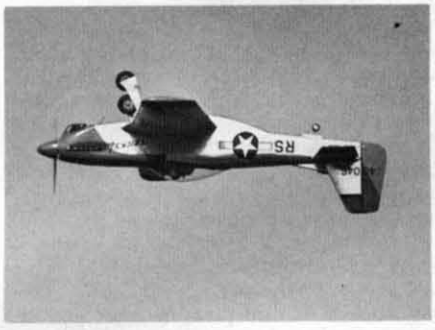
The fixed main landing gear was bent to shape from 1/4inch wire, available in local shops from K&S Engineering or SIG Manufacturing. Large nylon straps and screws are used to retain the gear in the grooved blocks. For appearance, landing gear doors are cut to shape from 1/16 inch plywood and held on the gear with small metal straps soldered to the wire legs. Robart has a line of good scale appearing wheels, but it is necessary to order directly from them the internal foam tire "donuts" to adequately support the aircraft's weight.

A 16-ounce fuel tank was used, and there is room for another 16-ounce tank for a smoke system if desired. In order to locate the ignition cutoff switch as close to the engine as possible, I mounted it with a sheet metal right angle bracket on the firewall so the switch handle protrudes slightly through a slot cut into the fiberglass cowl. Since the carburetor extends through the cowl, it's certainly accessible for choking and easy needle valve adjustment.

Any commercial muffler can probably be accommodated behind the engine and within the fiberglass cowl, but most of them really don't do much muffling. I did find the larger "stock" Quadra 40 muffler to be quite quiet, probably enough so for most fields, as good as most commercial types with the add-ons. If you have a noise problem and the muffler you're using isn't quiet enough, add a J'Tec Snuffler beneath the nose of the aircraft. So it doesn't look so great; we ought to keep the noise down.

For the finish I'd recommend the use of a plastic film rather than paint as it saves so much weight and this *Mustang* isn't intended for scale competition anyway.

For some fun and sport flying activity with a big P-51, build this one quickly and easily and tear up the sky! How about some simulated quarter scale pylon racing? See you at an IMAA Fly-In!



In the air, the scale appearance is even better **(above left).** Inverted flight performance **(above right)** is pretty good, thanks to the symmetrical airfoil. Though not a trainer plane it's a good sport model **(below).**