HAWKER HURRICANE

One of the heroes of the Battle of Britain teams with the Fuji 50 gas engine and becomes an easy flying giant, sport scale R/C ship.

By Dick Sarpolus

PHOTOGRAPHY: DICK SARPOLUS

Most airplane enthusiasts like the World War II fighter aircraft, and most have their favorites. *Mustangs, Spitfires, Thunderbolts*—each have their fans, and enthusiasts also have the planes they dislike, for whatever reasons. I was never too interested in the Hawker *Hurricane*; I think some of the other British fighters—most of the *Spitfires* and the *Sea Fury*—are great and have more of that fighter aircraft appeal. The *Hurricane* goes way back to 1935 and although it was a most successful aircraft with more than 14,000 having been built, and yes, it performed admirably in the Battle of Britain, I just feel it's not as attractive as most fighters.

But I did design this model project; my friend Lou McGuire likes the *Hurricane* and kept after me to work up a stand-way-off quick-build sport version of this aircraft. Another friend, John Sands, also was ready to build a *Hurricane* and he planned to use a new Fuji BT-50SA gas engine. A new engine is always an incentive to build a new plane. John also would be covering and painting his plane with the Nelson Hobby Specialties iron-on fabric covering material and water reducible paint; I wanted to see how these products worked out. I still feel the *Hurricane* isn't as sleek as some other fighters, but when seen in its military camouflage scheme it is a tough looking bird and has its own appeal. And this one does fly well.

If you really like the *Hurricane* and want to build a truly accurate detailed scale version, I'd recommend you go straight to Roy Vaillancourt. Roy, like Nick Ziroli, is noted for his expertise in designing all-balsa, true scale, good flying models of WW II birds. Roy has plans for a large *Hurricane* that builds up to an exact replica. That's Vailly Aviation, 18 Oakdale Ave., Farmingdale, NY 11738-2828. But if you'd like a fairly large, quick and easily built *Hurricane* with foam cored wings and tail surfaces along with a somewhat boxy fuselage and simple fixed landing gear, consider this one for some sporty scale aerobatic flying fun.

I'm sold on gas engines for their reasonable cost, simplicity, reliability, sound, power output, etc. Working from

AT A GLANCE

Type: R/C giant sport scale

Construction: balsa/ply/foam
foam wing with balsa sheeting
balsa/plywood fuselage
balsa sheet tail surfaces

Wing span: 94½ inches

Wing area: 1436 sq. in.

Airfoil: semi-symmetrical

Length: 70¾ inches

Weight: 22–24 pounds

Wing loading: 35.3–38.5 oz./sq.ft.

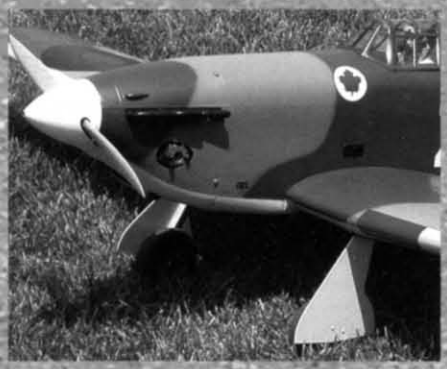
Engine required: 38–50cc 2-stroke

Radio: 4-channel, minimum
aileron, elevator, throttle, rudder
optional: retracts if modified

Servos: standard and large scale
four 80 in-oz or better for surfaces
one 40 in-oz for throttle

Also needs: 2 servo extensions
fuselage-Y-harness, 4½-inch spinner, 5-inch main wheels, fiberglass cowl, clear plastic canopy (see plan)

About the only portion of the Fuji 50 engine that shows outside the cowl is the carburetor. It fit well inside the cowl, with only minor modifications to the muffler. Note the dummy scale exhaust stacks.

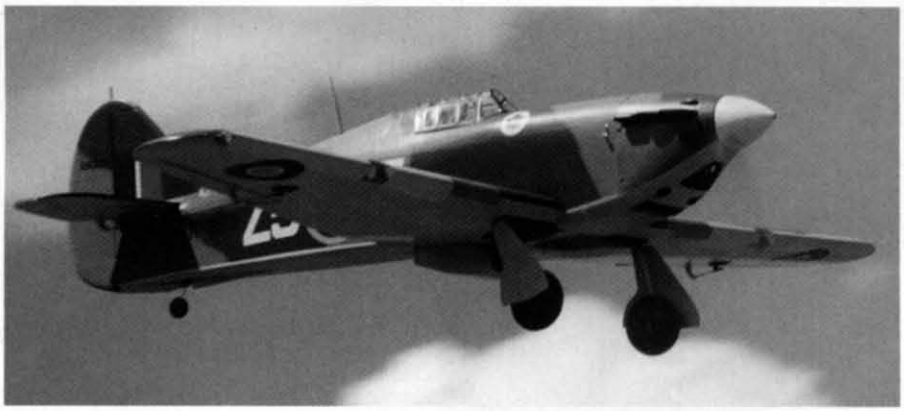


Builder John Sands (L) took Dick's (R) plans, built the plane (at left), but was able to add a few extra details like the pilot figure in the cockpit (at right) and stringers along the turtle deck for more scale looks.

past experience with other gas engine powered aircraft designs, my *Mustang* and P-40, I started off with a 94-inch span wing planform. A semi-symmetrical thick airfoil was used for easy handling characteristics and aerobatic capability. The *Hurricane* wing has tapered outer panels on a constant chord center section; it's rather stubby, so the scale layout worked out to about 1400 square inches. A little bigger than I usually go for, I still figured the plane would be pretty light and the Fuji 50 would certainly do the job.

There was no doubt that this would be a foam core project; I'm sold on the quick building properties of foam, particularly for scratch building, and believe there is not a significant weight penalty for this size and type aircraft. I drew up the templates for a foam wing core, along with a plywood center section spar and partial ribs to accept a simple fixed wire landing gear. Why fixed gear on a WW II fighter? Economy—this isn't a competitive scale project, it's a sporty aerobatic fun flier and retracts weren't in the building budget. The nose and tail moments and overall proportions were kept close to proven numbers, again from previous designs. The fuselage is a typical box type, slab sides with curved sheet on the upper portions. Easy and quick to build. The tail surfaces are foam cored, with a flat plate section. Again, easy and quick to build. I laid out drawings for a fiberglass cowl, and Fiberglass Specialties helped out with a plug and mold, so the cowl is now easily available, along with a formed plastic canopy.

Hawker Hurricane

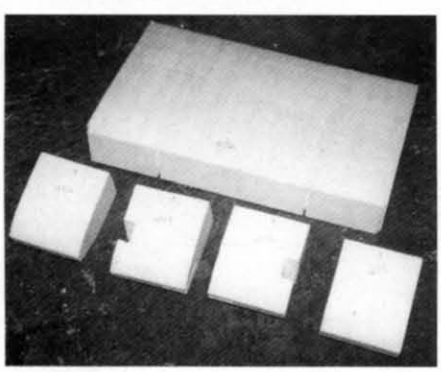


Since Dick designed the *Hurri* as a simple sport scale plane, he kept the gear fixed, using ¼-inch music wire for the main gear. Some scale gear doors will help add to the realistic appearance of the model.

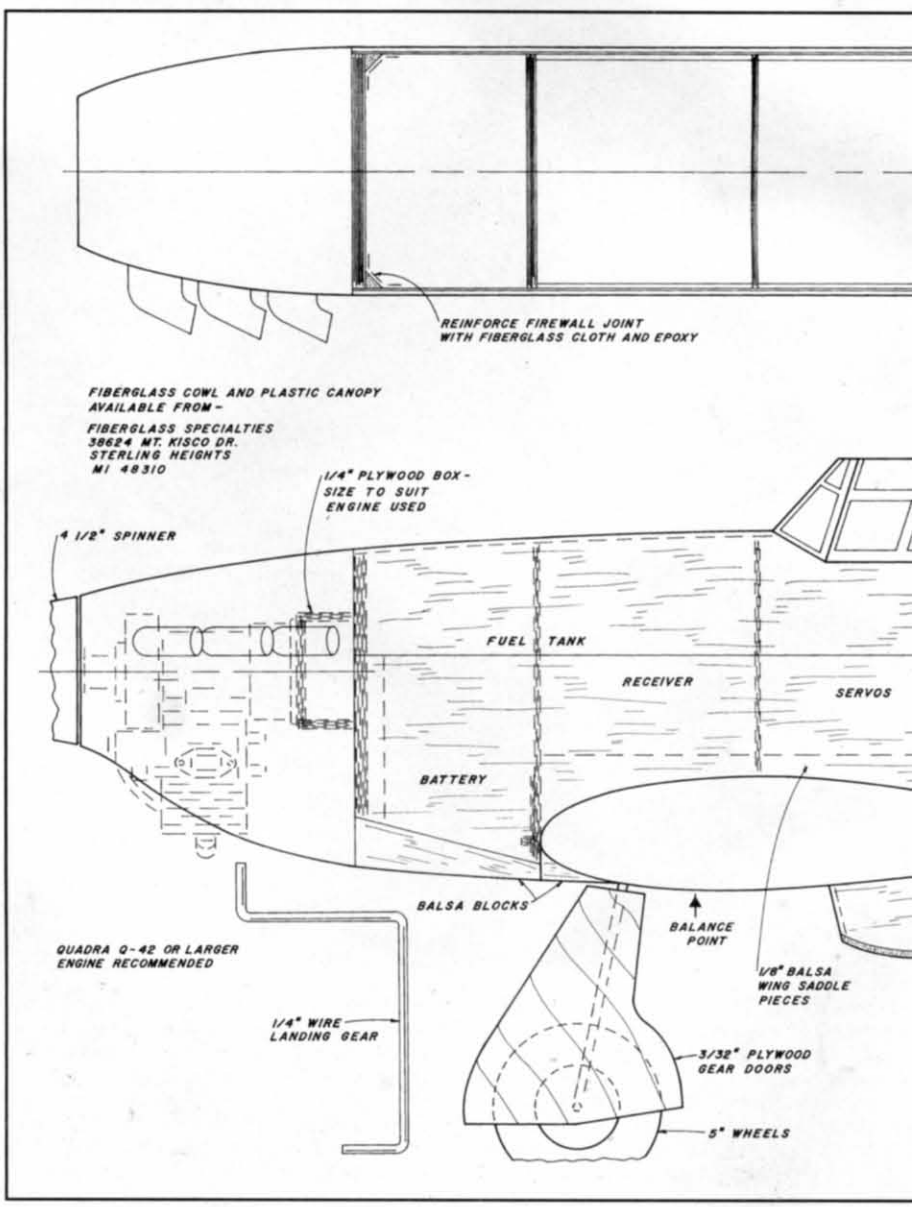
With the slab sided fuselage and simplified construction, this is definitely a stand way off scale project, but it's unmistakably a *Hurricane*. Flaps could be added for more fun. Retracts could be used, but for a sport aircraft on rough grass fields, I wouldn't bother with them. The formed ¼-inch wire is easy, not too heavy, takes a beating, and with the plywood gear doors the appearance isn't bad. A sliding canopy would be a great addition, even for this sporty model. The appearance of the plane on the ground with the canopy open might be worth the added trouble. Wing fillets, not too much work, would add to the appearance. Please use a pilot figure, I don't like to see a scale aircraft flying around with nobody at the controls.

I cut the foam cores and wood parts for both Lou and John, and the two planes were built up quickly. To skip to what's important, they both flew well. They differed in weight for several reasons. Lou's was built first and when it appeared the plane would be tail heavy, he went with a larger engine than we had planned for, a Zenoah G-62. We then changed the plans to lengthen the nose a bit, and John's plane, built later, balanced well with the lighter Fuji BT-50 engine. Lou went with an epoxy/fiberglass cloth covering job and painted camouflage finish. John covered his *Hurricane* with Nelson Hobby Specialties LiteFAB fabric, ironed on, and painted it with the Nelson water reducible paint. John's plane weighed 22 pounds, with Lou's being several pounds heavier. I'm sure the plane could be built lighter if less scale detailing was done. They have a decent scale appearance and handle well for sport aerobatic flying. The wing loading is higher than most sport aircraft, a function of going for a scale appearance, so like any heavier loaded aircraft, keep the speed up a bit on landing approaches. Make a low pass, pull up into a victory roll, and you'll have a *Hurricane* coming home after some Battle of Britain air combat excitement.

There's nothing unusual or difficult in the construction techniques used. All materials are standard, available plywood and balsa. The grooved hardwood landing gear blocks can be easily cut on a small table saw. The fiberglass cowl and plastic canopy, and a suitable spinner, are all available commercially. Any plane this size does take a good bit of wood, so you'll probably be putting together a wood list for a mail order supplier. I'm pretty sure a scratchbuilt project like this can be built for lower cost than a similarly sized kit, but you have to do the parts cutting. A band saw or decent scroll saw is a necessity. I'd guess that most clubs have a member who can cut foam cores, and someone in the club probably has a wire bender. If you've built from plans before, you know all this. If you want to try scratchbuilding, this is a pretty easy one to start with.



These are the foam core parts for the wing center section. The outer wing panel cores will complete the wing. The tail surfaces are foam cores as well. Ply pieces for brace and landing gear are added later.



Construction notes

Starting with the wing, there are three foam parts, the center constant chord section and the two outer panels. The two dihedral angle joints are reinforced by the ⅛-inch plywood, full-depth spar and a fiberglass cloth and epoxy wrapping around the center section out past the dihedral joints. Before sheeting, the partial plywood ribs and the interlocking full-depth plywood spar must be epoxied into the foam core center section parts. I mark the foam and do the cutting with a band saw; it could also be done with a hot wire cutter. The separate foam sections cut away are epoxied back in place as the plywood parts are added. Be sure to maintain the proper airfoil shape as the plywood parts are installed into the foam core. Cutting also has to be done for the grooved hardwood landing gear block and the hardwood block which accepts the end of the wire gear; those blocks are epoxied in place, into the plywood ribs.

You might prefer to fit the grooved hardwood blocks into the plywood rib notches and foam cores, but not glue them in place until the core has been sheeted. This way you can cut the hole through the sheeting and glue the hardwood block in place flush with the sheeting. Cut the spar slots into the outer wing panel cores and fit them to the center section, but they are not glued on until they have been sheeted. Don't forget to burn the holes through the cores for the aileron extension cables before the cores are joined.

The wing sheeting, or skins, are made up of 3/32-inch balsa, edge glued together to get the necessary width. I make up the sheeting from 3- or 4-inch wide balsa, sanding the edges as necessary to get a good fit. I use the aliphatic resin type glue here as I feel it's easier to sand and get a smooth surface. Tape the balsa sheets together to get the width, flip the wood over, open the taped joint like a hinge over the edge of the workbench, and apply the glue. With the wood flat on the workbench, scrape the excess glue off the joint with a putty knife, and weight the wood down until the glue dries. Take off the masking tape, and use the taped side as the outer surface of the sheeting. Sand the sheeting before you apply it to the cores.

I recommend Dave Brown's Southern Sorghum for contact cementing the balsa sheeting to the foam. There are other ways to go; thinly spread epoxy glue, spray contact cements, whatever. Don't experiment on good cores, if not using a cement specifically sold for this purpose; be sure to check it on some scrap foam. Some cements can dissolve the foam, which would ruin your whole day.

Sheet the center section, which is a little difficult with the plywood spar protruding from each end, but not bad. Sheet the outer wing panels, trim the sheeting from all edges, and check for a good fit at the dihedral joint by sliding the outer panels over the stub plywood spar. Epoxy the wing tip panels in place. I sand the leading edge square, glue on an oversize balsa leading edge strip, and plane and sand it to shape. Cut a slot through the leading edge for the plywood wing mounting tongue, and epoxy it in place after the center section has been glassed.

The wingtip blocks are fairly large, so try to find some reasonably soft balsa for them, makes the carving job easier. Wrap the cen-

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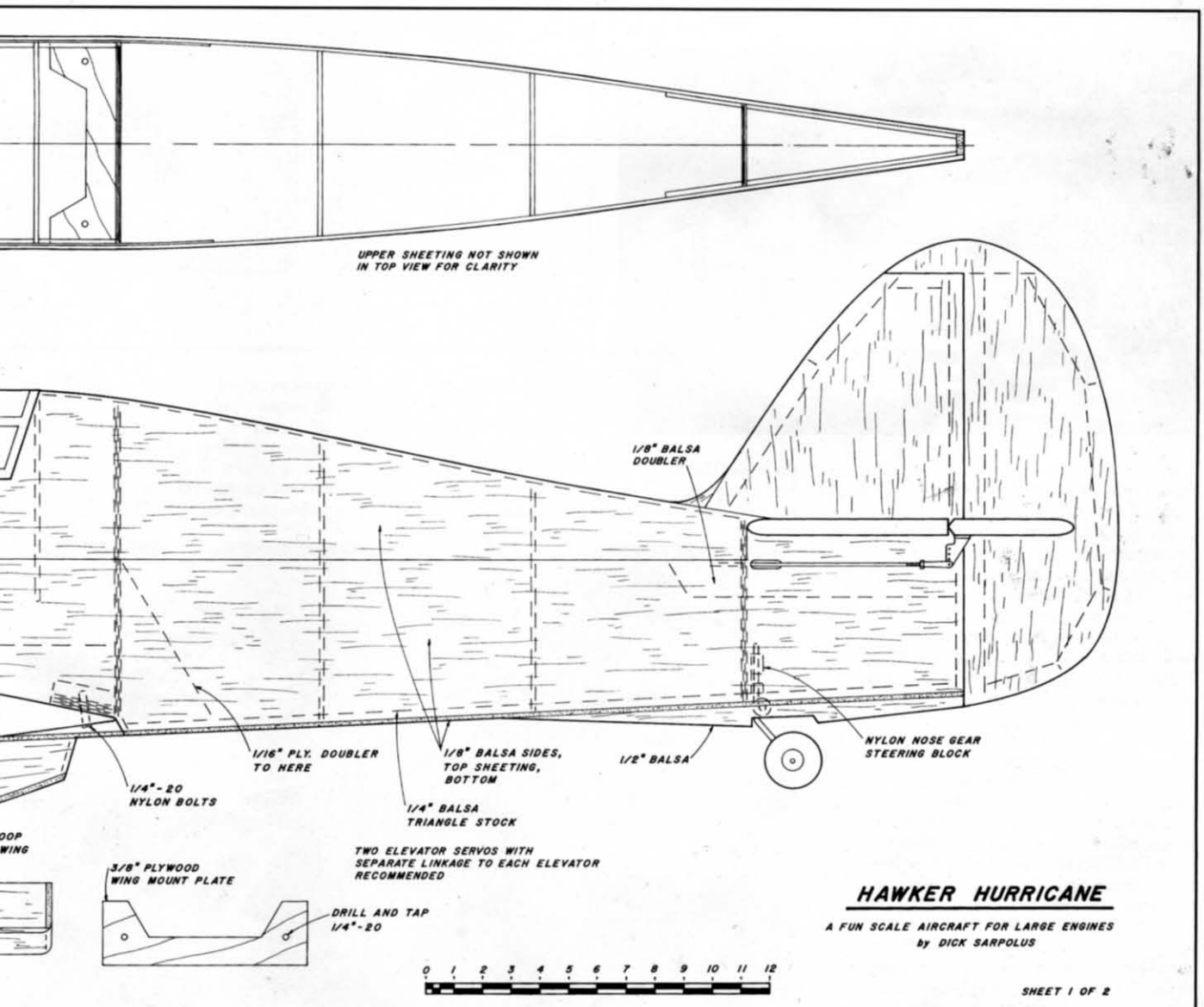
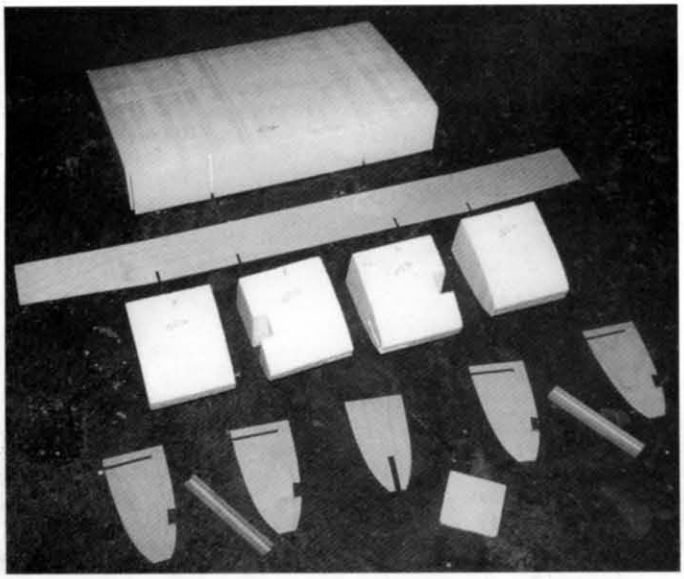
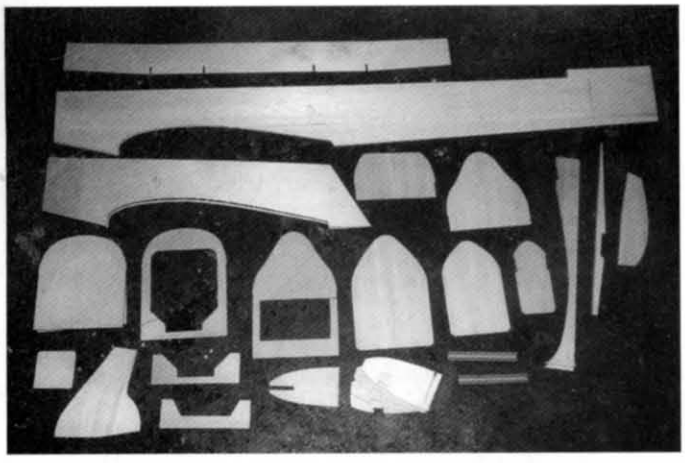
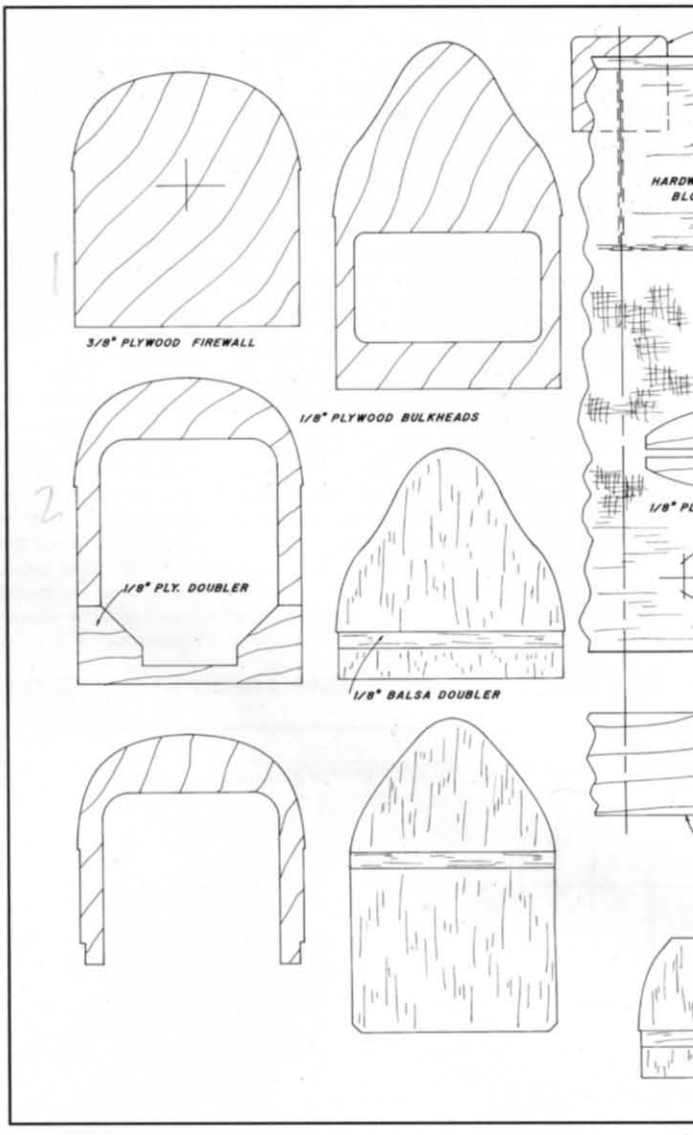


Hawker Hurricane



These are the plywood parts that have to be added **(above)** to the wing center section: the dihedral brace, and the ribs for the landing gear blocks. More of the plywood parts, mainly for the fuselage **(below)**.

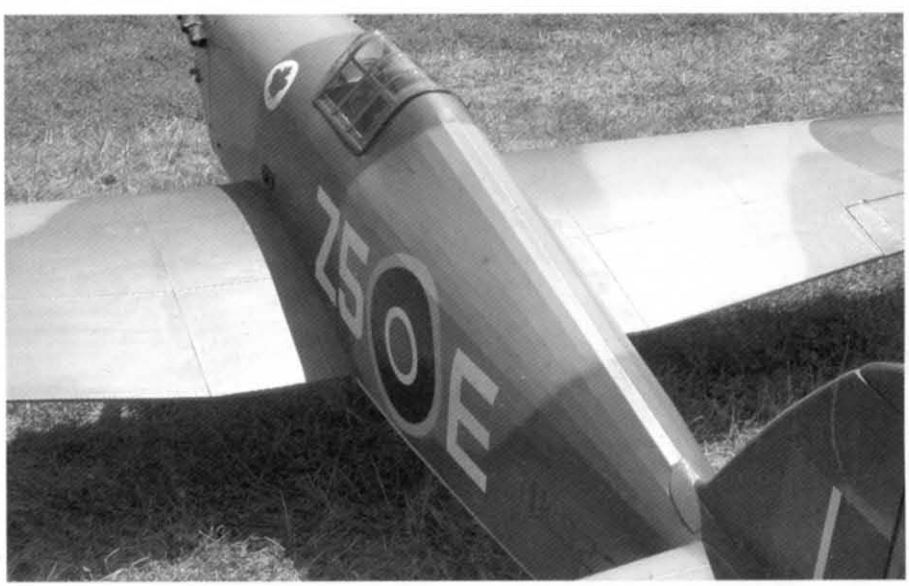




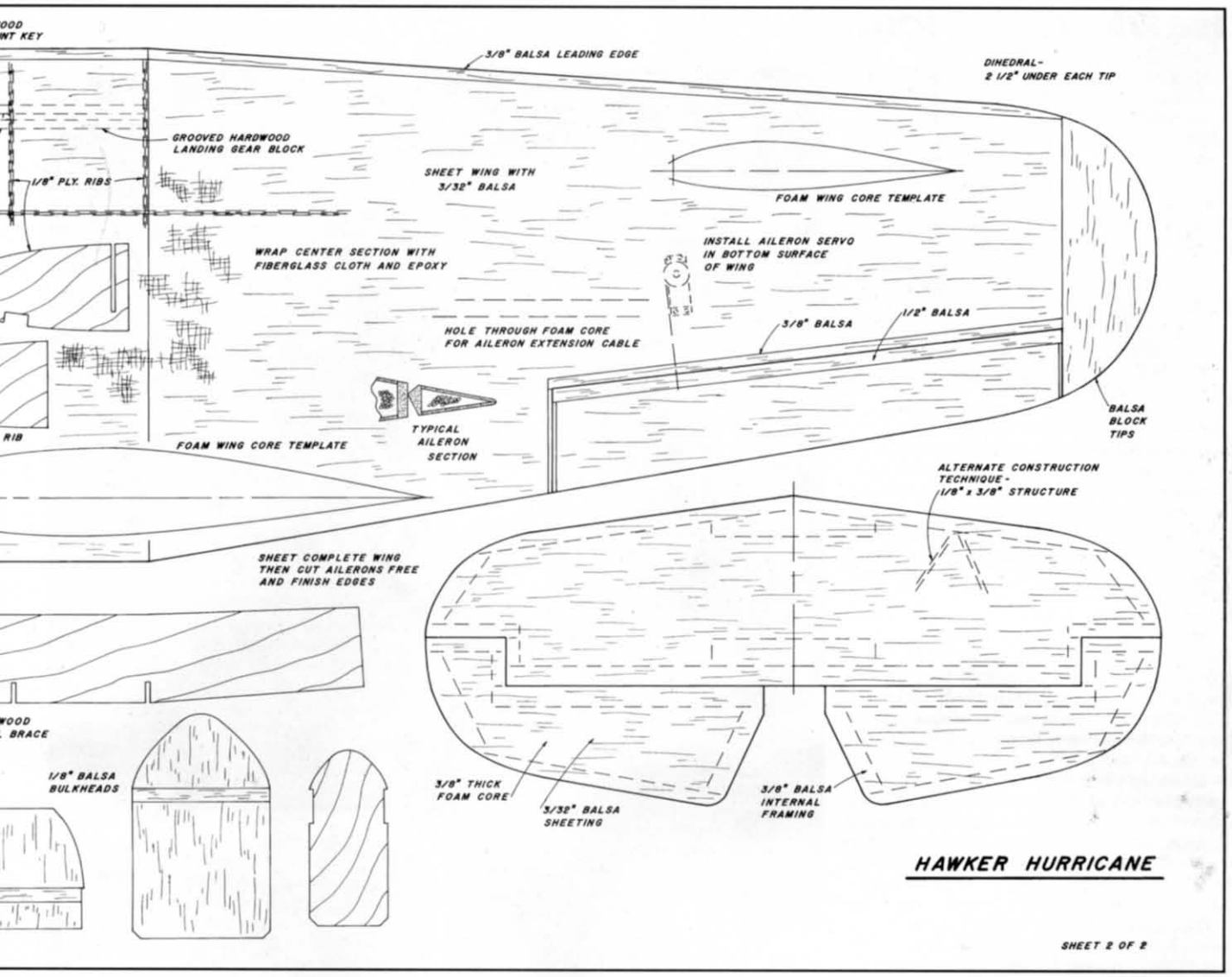
ter section of the wing with medium fiberglass cloth; have the cloth extend past the dihedral brace a few inches. This seems like a lot of cloth and epoxy, but if you scrape the excess epoxy off with a piece of cardboard, leaving just enough to saturate the cloth, there's plenty of strength with not too much weight.

The ailerons are cut from the sheeted wing panels, trimmed down to allow for the balsa edging to be glued on, and sanded to shape. We hinged the ailerons along the centerline, but installing the hinges near the top surface might improve the scale appearance. Use plenty of strong, freely moving hinges. Cut recesses into the lower wing surface for the aileron servo mounting. Removable hatches could be installed over the servos, but the trend is to simply install the servos into the wing and leave them visible. Doesn't look as neat, but the servos and their aileron linkage are certainly accessible for inspection and servicing.

For the fuselage, use firm to hard balsa for the two sides, edge gluing and splicing to get the size required. Glue the plywood doublers, balsa wing saddle doublers, stab saddle doublers, and lower rear edge strips to the two fuselage sides. For the 3/8-inch thick plywood firewall—which I prefer for the larger engines—I epoxy a piece of 1/4-inch and a piece of 1/8-inch plywood together. With one fuselage side flat on the workbench, add the firewall and the next three plywood bulkheads to that side, installing them perpendicular to the side.



John Sands simulated the stringers and fabric covering of the real *Hurricane* on his model. The combination of fabric and sheet metal covering was a characteristic of pre-WWII aircraft.



Nelson LiteFAB

Nelson Hobby Specialties' covering and paint system

There are lots of covering materials and types of paint that could have been used on this *Hurricane*. An iron-on plastic covering was ruled out because we wanted a painted camouflage finish for the scale appearance, although some plastic coverings can be painted. Many modelers cover the complete airframe with thin fiberglass cloth applied with epoxy. The fiberglassed surfaces can then be sanded, primed, sanded, etc., and finally painted. Such a finish also adds strength but can take a good bit of time and add significant weight also. John Sands decided to investigate the use of Nelson Hobby Specialties' water based paint system on his *Hurricane*, and after he spoke at length with Nelson, he decided to also use their LiteFAB iron-on fabric covering material.

Nelson LiteFAB is an extra-fine woven polyester fabric, sealed with a fuelproof and waterproof resin to protect the outer surface of the fabric. An heat activated adhesive on the back of the fabric is used to adhere the model to the airframe. The fine weave permits a minimum of paint to be used. John's comments on using the LiteFAB were brief as he simply found it so easy to use. He went ahead and ironed it on the complete airframe, reporting that it went on easily, handled compound curves easily, and stuck down very well. As the fabric is so well sealed, no additional sealer or primer is necessary and John went right to the color painting.

Water based paint was something new to us. We've read of water based house paint being used successfully by some large scale modelers, but have never tried it. I felt that if Nelson Hobby Specialties was handling this product, it must be good. And John was ready to try it. Nelson says it's an aircraft quality polyurethane paint that is water reducible. This paint doesn't smell and because it has a high level of pigment and solids it covers well. The paint can be thinned for easier brushing and spraying, up to 15%, and there's no thinner to buy. After the paint dries, it's completely waterproof and gasoline fuel is no problem. With the use of an additive, it can be made resistant to high nitro fuels but we didn't need that here. Although the paint dries glossy, John used their flat clear as a final topcoat for the military appearance.

Nelson says an inexpensive foam rubber brush can be used with good results, and that's what John used. I was amazed at the good results achieved with the foam rubber brush. The light blue was brushed on the bottom surfaces and the light tan brushed on the top camouflage surfaces. The dark green was sprayed on, using a small airbrush. The final topcoats of flat clear were brushed on, over the whole plane. Results were great. We were sold. You can check out information on Nelson Hobby Specialties products on the web at www.nelsonhobby.com.

Glue the second side to those bulkheads; the sides are parallel from the firewall to the wing trailing edge position. Add triangle stock and fiberglass cloth behind the firewall to reinforce its joint with the sides; I also add several small screws through the sides into the firewall. Add the plywood wing bolt plate, the two cockpit area bulkheads, then pull the tail end together and install the rear bulkheads.

The fuselage top area is sheeted with ⅛-inch balsa. On a fuselage like this, I try to use wide sheets of fairly soft balsa, dampening them on the outer side with water, taping the wood in place till dry, then trimming and gluing it in place. John added small balsa stringers on the rear fuselage section, over the sheeting, to simulate the full scale aircraft's use of fabric covering in that fuselage area. Lou, rather than sheeting the rear upper section, left it open from the bulkhead at the wing trailing edge position to the tail, installed ⅛ by ¼-inch stringers notched into the rear bulkheads, and covered that area with fabric to better simulate the real aircraft. Either way will work; I'd simply stay with the balsa sheeting. Cut away the sheeting around the cockpit area, using the plastic canopy as a guide, and add a balsa cockpit floor in this area to suit the pilot figure you'll be using. Add whatever cockpit interior detail, if any, that you desire before later gluing the canopy in place.

Make up a box or use several layers of ¼-inch plywood to position the engine mount ahead of the firewall for the correct nose length; you can use the fiberglass cowl as a guide. The size of the box is made to suit the engine being used. Reinforce that assembly with small nails and/or screws for security.

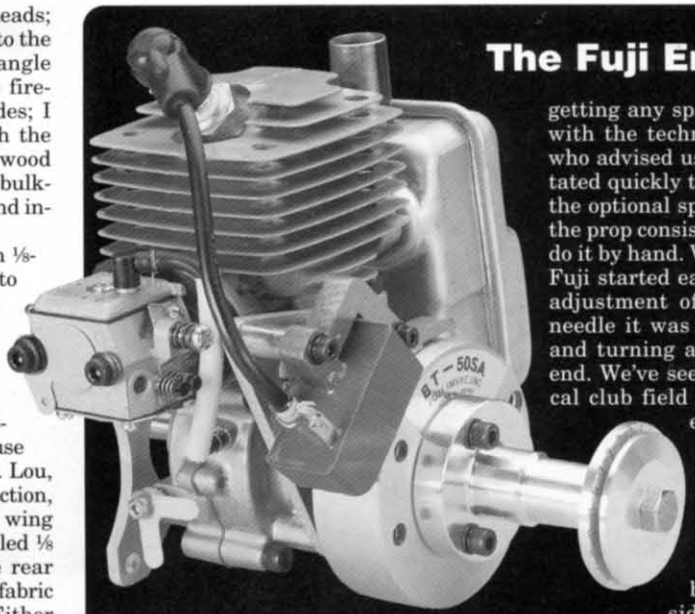
The fiberglass cowl is fitted to the nose section, held in place with a few nylon bolts threading into hardwood blocks epoxied to the firewall. The exhaust stacks are cut and shaped from balsa blocks. The cowl has to be trimmed to clear the engine cylinder, carburetor, exhaust, etc.

Before adding the rear fuselage bottom sheeting, cut holes in the rear bulkheads for the elevator, rudder, and tailwheel pushrods. The steerable tailwheel assembly is mounted to the rear plywood bulkhead and connected by its own pushrod to the rudder servo. I wait until the tail surfaces are installed and the wing fitted to the fuselage before adding the fuselage bottom planking.

The tail surfaces are built flat on a workbench surface. The ⅜-inch thick foam cores are cut to shape, the balsa framing added, and the sheeting added, again with contact cement. Each of the elevators is controlled by a single servo and its linkage. I fit the wing to the fuselage next, adjusting the fit of the wing mounting tongue as necessary through the fuselage bulkhead. Drill and tap the plywood wing mount plate for the two ¼–20 nylon bolts that will retain the wing.

With the wing mounted to the fuselage, add the horizontal stab, aligning it with the wing. Blocking up the fuselage, a Robart incidence meter is helpful to insure the wing and stab are at 0 degrees incidence. The vertical fin is added, perpendicular to the horizontal stab; you can use several ¼-inch dowels into the fin and down through the stab to reinforce that joint.

The Fuji Engines BT-50



Gas engines continue to increase in popularity and the new Fuji Engines line, distributed by Great Planes, has already been well accepted by modelers. The Fuji we used here is 46.5 cc displacement, about 2.8 cubic inches. At 4.2 pounds, it's not the lightest or the heaviest for this size engine and it offers some nice features. Engine mount and muffler are included, along with a 90-degree bellcrank for the throttle hookup. The muffler mounts on the side of the engine and is of sheet steel construction. This made it pretty easy for a friend of ours to modify the muffler by some cutting and brazing to get it to fit completely within our *Hurricane's* cowl. If this wasn't a scale aircraft, we would have just trimmed the cowl to clear the muffler.

This engine has a magneto ignition system. As compared with an electronic ignition system, the magneto does not require a battery pack to operate, making for a simpler engine installation in a plane. But usually a magneto system is stuck with fixed ignition timing which has to be set at a compromise between easy starting and reasonable maximum power. An electronic system can automatically or by mechanical coupling change the timing to advance and retard the spark for both easiest starting and maximum power output.

The Fuji has with its magneto ignition an electronic "automatic timing module" which retards the timing for starting with no backfiring and advances the timing at high speed for maximum power. A nice feature along with the magneto ignition. John hooked up a kill switch, of course, to ground the magneto coil to the engine case and keep the engine from firing when we flipped the prop to choke it before starting. There's a terminal on the coil for this purpose.

We used the recommended 40 to 1 gas/oil mixture, which is a little more than 3 ounces of oil per gallon of gasoline. We started off with an 18–10 prop. We frankly got nowhere at first with hand flipping the prop, and figured we weren't getting any spark. After some discussion with the technicians at Hobby Services who advised us the prop needed to be rotated quickly to generate ignition, we got the optional spring starter which rotated the prop consistently faster than we could do it by hand. With the spring starter, the Fuji started easily and with just a slight adjustment of the high speed mixture needle it was idling at about 2400 rpm and turning about 7600 rpm at the top end. We've seen other Fuji 50s at our local club field and know they're started easily by hand, so our difficulties in hand starting this Fuji may have been due to technique. We expect even more rpm at the top end as the engine breaks in and loosens up, but we kept it on the rich side to do the breaking in while flying. We've used spring starters on other gas engines, and we like them for their ease of engine starting.

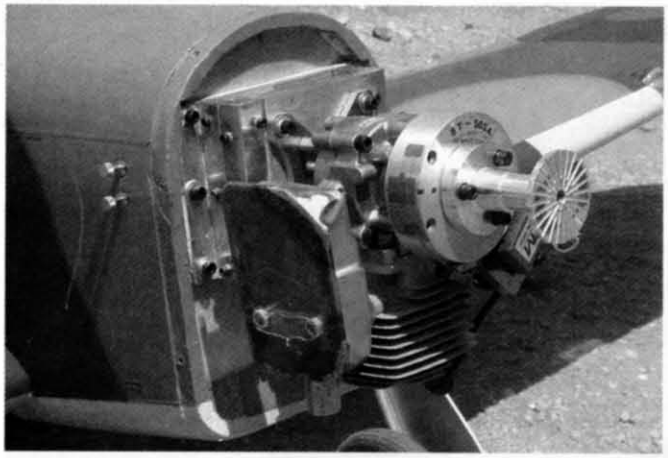
The 18–10 prop might not be the best choice and we intend to also try 18–12, 20–8, and 20–10 props. After test flying the *Hurricane*, the performance pleased us so much with the 18-10 that we just haven't gotten around to trying anything else. Maybe after there's more time on the engine.

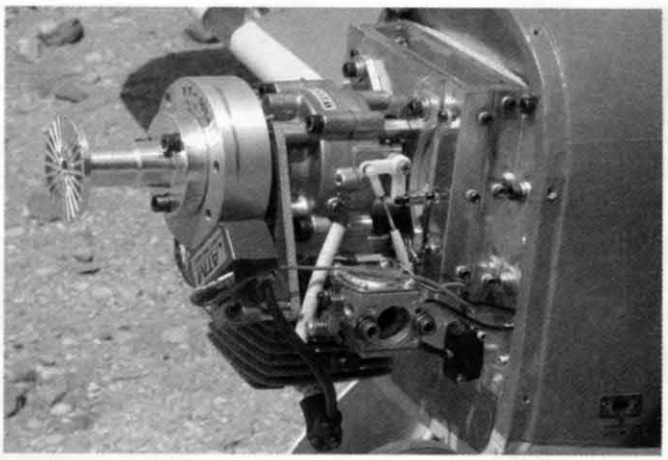
Another thing we liked about the Fuji was the single bolt prop hub; no need for a jig and a drill press to drill six holes through every prop to be used. For the spinner retention, a friend drilled and tapped a hole in the prop bolt to accept the spinner mounting bolt. Worked fine.

It's easy to say nice things about an engine that starts up easily, idles and runs reliably, provides ample power for good flying, and simply gave us no trouble at all. That's exactly what this Fuji BT-50SA did. To find out where to get yours, contact Fuji Engines, 1610 Interstate Dr., Champaign, IL 61822; phone: 217-398-8970.

BASIC SPECIFICATIONS

Bore(mm): 32 **Stroke(mm):** 43
Displacement(cc): 46.5 **Weight(kg):** 2.4
Prop thread: M8x1.25mm
RPM range: 1,200 to 10,000
Normal propeller: 18–10 to 21–10
Output: 5.2 HP @ 10,000 rpm





With the prop off, the cowl is easily removed. This view **(above left)** shows the steel muffler for the Fuji 50, which is easily modified to fit inside the cowl. The Fuji engine in John Sands' plane has a plywood engine mount reinforced with aluminum angle stock **(above right)**. Wiring is for a servo actuated kill switch.

I like to recess the control surfaces to accept ¼-inch plywood mounting pads for the nylon horns going on the ailerons, elevators, and rudder. Epoxy the plywood mounts into the surfaces; the nylon horns are mounted with self tapping screws.

Use 4–40 threaded rods and clevises for all linkages. Fiberglass tube pushrods are used for the elevator linkages. I use ¼-inch plywood for the servo mounting plate inside 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 ⅜ 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 mounted in the wing. Another short Y-harness is needed for the two elevator servos. A 1200 mAh battery pack was used, wrapped in foam rubber and positioned behind the firewall; it could be relocated as necessary if needed for balance.

I bent the main landing gear to shape from ¼-inch music wire, using a heavy duty K&S wire bender. Nylon straps and screws are used to retain the gear in the grooved blocks. 3/32-inch plywood gear doors are held on the gear with small metal straps soldered to the wire legs. I like Robart's scale wheels, but be sure to order directly from them the internal foam tire "donuts" to adequately support the aircraft's weight. A 16- or 20-ounce fuel tank was used, and there's plenty of room inside this wide fuselage. The ignition cutoff switch was mounted with a sheet brass right angle bracket on the firewall near the bottom, accessible through the cowl cutout.

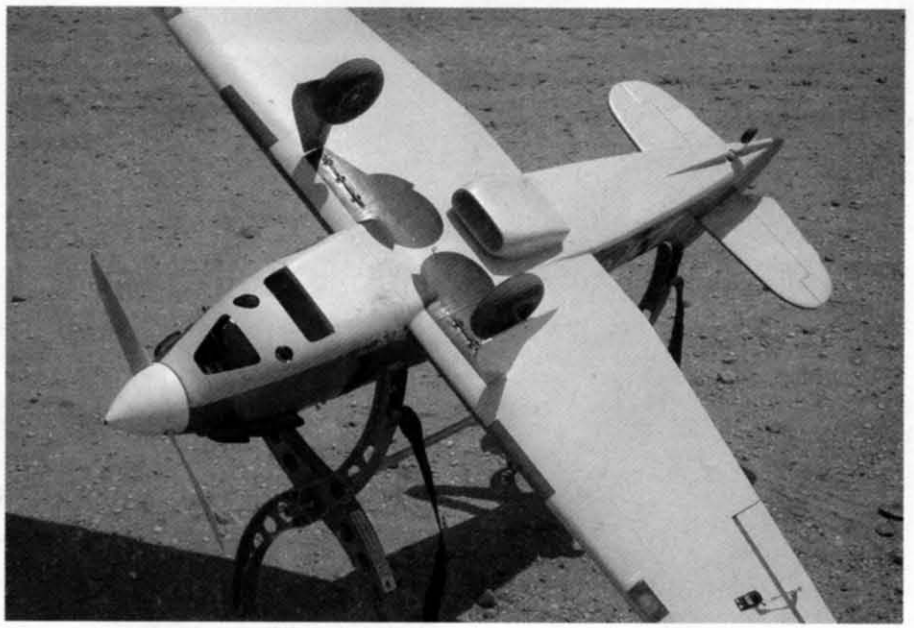
The Fuji 50 muffler on the side didn't quite fit inside the *Hurricane's* cowl, so our friend Ed Moran did a really nice job modifying the muffler for us. The Fuji muffler is steel, so it could be cut and brazed as necessary; the volume was reduced a little, but it didn't seem to bother the Fuji's performance, which was fine, and the sound level was reasonable, pretty quiet. The Fuji ran well and took only a little adjusting to get a good top end, and did a good job pulling the *Hurricane* around. It was definitely a good choice for this project.

I prefer ironed-on plastic film finishes on sport aircraft because they save a lot of weight and time, but both John and Lou wanted a painted camouflage finish. They took different routes to get there. Lou's traditional epoxy and light fiberglass cloth finish works well but is a bit messy and time consuming to apply, then takes some sanding and priming to get ready for paint. We're sure it weighed somewhat more than John's finish.

The Nelson Hobby Specialties iron-on fabric went on very easily according to John, and is a well-sealed material. He applied fine line tape on the covering before painting to simulate panel lines. John then went to the colored Nelson water reducible paint, and brushed on the coats of light blue on the bottom surfaces and light tan on the top sides. He then sprayed on the brown in a traditional camouflage pattern, followed by a brushed on coat of flat clear over the whole plane. The British insignias are commercially available (*try Major Decals, PO Box 304, E. Longmeadow, MA 01028; phone 413-525-7465—Ed.*). A close-up look at John's *Hurricane* reveals added details; landing lights in the wings, cockpit interior sides, fairings around the tail surface joints, etc. And all this on a stand-way-off sporty scale fun airplane.

Before flying Lou's *Hurricane,* balancing had shown the need for added nose weight even with the larger engine used. John's plane, with the slightly longer nose, balanced fine as built. First flights of both aircraft went fine. No problems, and the planes handled well. I'll mention some earlier bad luck with Lou's *Hurricane*; on one flight the spinner departed and the result was a chewed-up fiberglass cowl requiring replacement. Another flight saw the throttle servo failing, and after a long time of part throttle flying, the engine departed the aircraft—due to three mounting bolts vibrating out and the fourth bolt breaking off. The airframe received some damage on that "landing", but it was later repaired and campaigned on by a fellow club member. Things happen.

John's *Hurricane* is still going strong. If you're a *Hurricane* fan and don't want to do a full scale project, consider this sporty scale version for a pretty easy scratchbuilding effort. And consider one of those good Fuji BT-50SA gas engines, along with the Nelson Hobby Specialties covering and painting products. Happy flying. GC



There are minimal cutouts in the bottom of the cowl for the cooling airflow and exhaust. Note also the painted wheel wells that add another scale touch.