P-38 Sport Scale Lightning

By Dick Sarpolus

Here's a large, simple scale rendition of the "Forked Tail Devil" that's easier on your pocketbook and on your building board.

Of all the World War II fighter aircraft, the distinctive Lockheed P-38 *Lightning* is probably the most easily recognized. With its twin engine layout, twin booms, cockpit pod in the middle and twin rudders, any airplane enthusiast knows the *Lightning*. And of course, the P-38 has been popular with modelers as long as it's been around.

Because of the twin engines and complex structural requirements, it's not an easy design to model. For those wanting a real scale P-38 project in a large size, I'd quickly recommend the one designed by Nick Ziroli; he does it right and his designs are capable of scale contest winning performance.

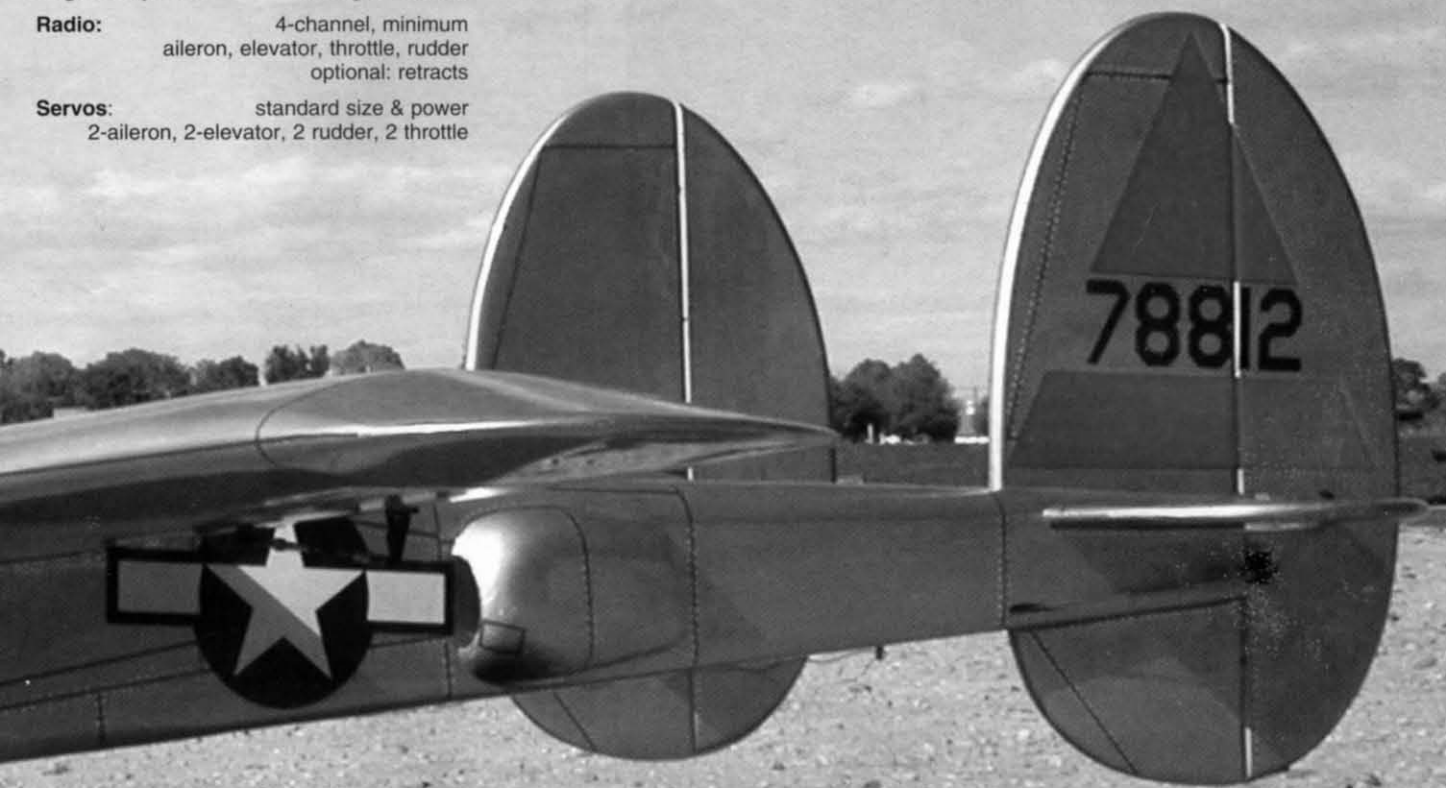
My good friend and flying buddy Lou McGuire wanted to build a P-38, but he wanted it to be a quick and easy project, not a real scale machine. So we went a different route with the P-38 design presented here; the aim wasn't scale authenticity but quick and easy construction with sport flying aerobatic capabilities.

It looks like a *Lightning* of course, but it's obviously not true scale. This model's wing isn't tapered as much as the real one, the vertical fins are larger, the nacelles and pod are squared off, and there are other deviations from scale to make this an easy building sport project. We'd charitably call it "stand-way-off fun scale." But, it's an impressive 104 inches in wing span, flies with two economical gas burning Cheetah 42s or equivalent engines, has a close to fully symmetrical airfoil for aerobatics, is light enough for lively flying, and goes together quickly and easily.

AT A GLANCE

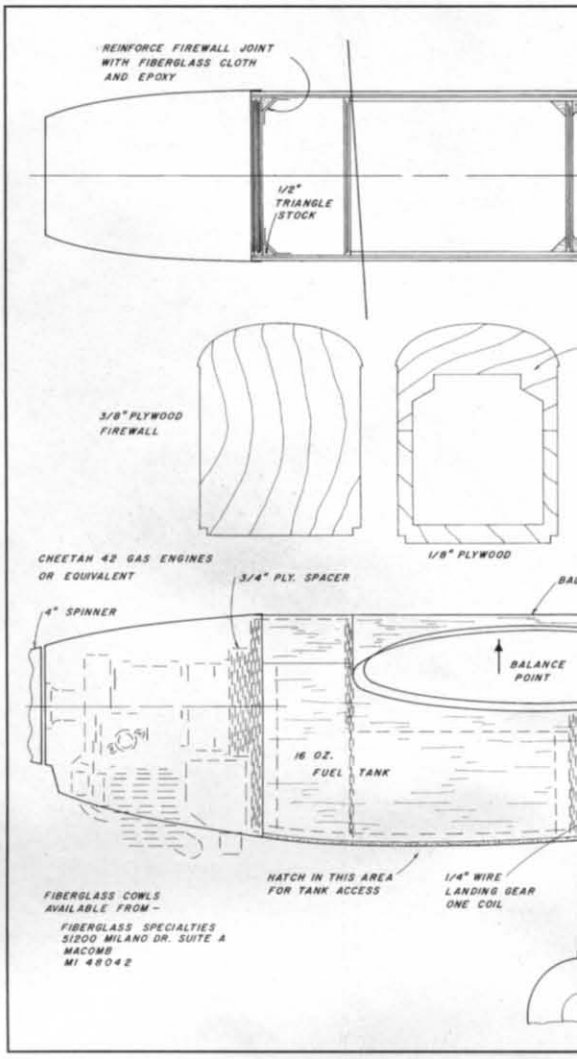
Type:	R/C sport scale
Construction:	balsa/ply built-up wing with balsa sheeting balsa/plywood fuselage balsa sheet tail surfaces
Wing span:	104 inches
Wing area:	1760 sq. in.
Airfoil:	symmetrical
Length:	77 inches
Weight:	31 pounds
Wing loading:	40.0 oz./sq.ft.
Engine required:	.42cc gas 2-stroke
Radio:	4-channel, minimum aileron, elevator, throttle, rudder optional: retracts
Servos:	standard size & power 2-aileron, 2-elevator, 2 rudder, 2 throttle

Though the full-size P-38 had a reputation as a tricky plane to handle, Dick's *Lightning* is easy to fly, especially with those large out-of-scale fins. The plans show a reduced but still effective size.



Though a fun scale plane, Lou used a Dave Platt technique for applying individual panels of chrome MonoKote on the plane, and adding some nice rivet detail. Canopy and cowls are readily available, having been "borrowed" from other designs.

Lightning



Having taxi tested the *Lightning*, the designer/author, Dick Sarpolus (L), and the builder, Lou McGuire (R) get ready for the maiden flight. Retracts were omitted to keep it simple.

This P-38 was first designed for bolt-together assembly; the twin booms bolt to the wing center section, the center fuselage pod bolts to the wing, and the center stabilizer section bolts in between the tail booms. Lou suggested a short cut for easier, quicker building—everything would be glued together, built in one piece except for the plug-in outer wing panels. Although large, the plane without wing panel sections would fit in the back of a minivan and field assembly for flying would be quick and easy.

We felt that if a plane of this size crashes, there'd be a lot more to worry about than unbolting the major parts from each other. The one piece assembly probably saved some weight and made alignment easier. I now think that's the way to go, depending on what you have to do to get your planes from the workshop to your car.

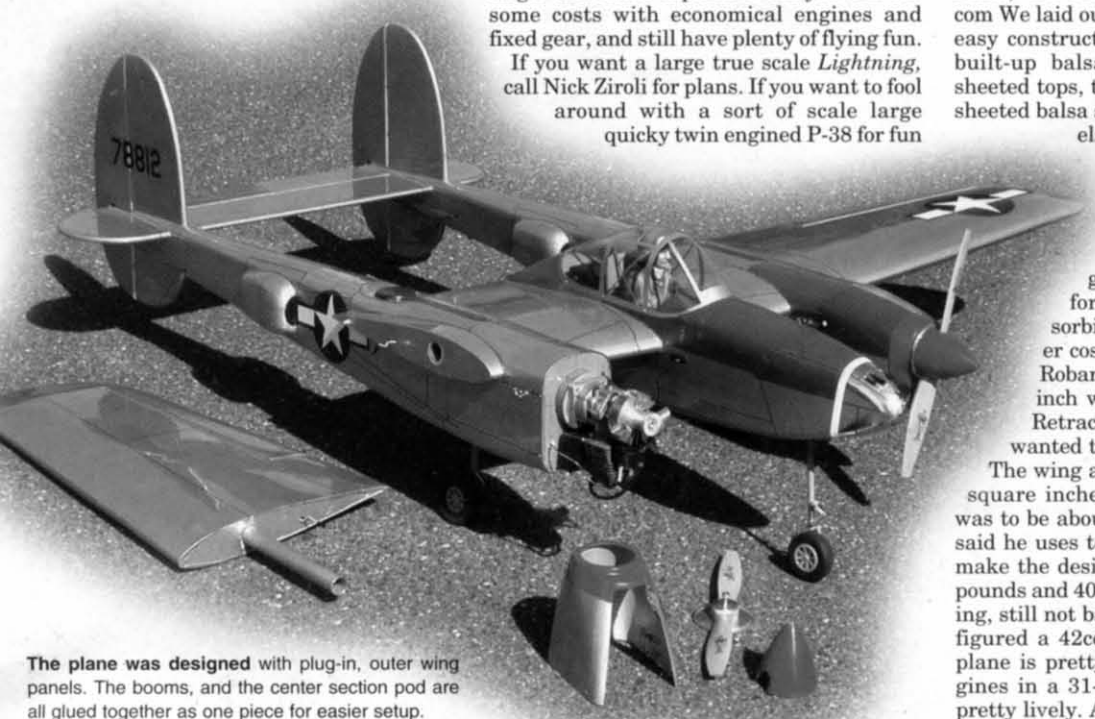
A cost cutting move was to go with fixed gear rather than retracts. Sure, it's a shame to see a WW II fighter screaming around with the wheels hanging out, but $600 is a lot of money, and retracts could always be added later if desired. R/C aircraft have been getting larger and more expensive but you can cut some costs with economical engines and fixed gear, and still have plenty of flying fun.

If you want a large true scale *Lightning*, call Nick Ziroli for plans. If you want to fool around with a sort of scale large quicky twin engined P-38 for fun and sport flying, consider this project.

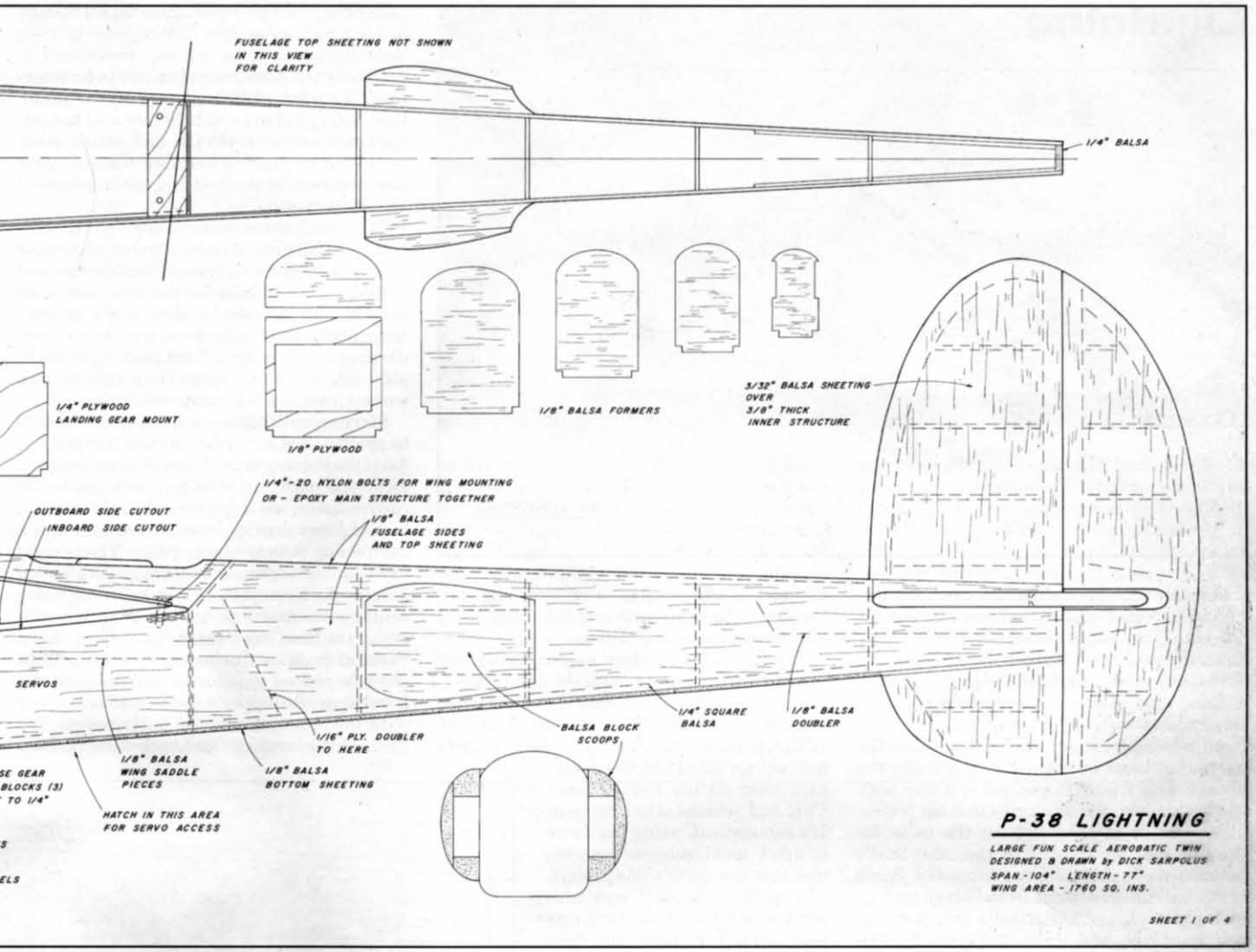
We started off as usual with 3-view drawings and some photos from Bob's Aircraft Documentation, 3114 Yukon Ave., Costa Mesa, CA 92626. http://www.bobsairdoc.com We laid out the P-38 with conventional, easy construction. The fuselage booms are built-up balsa and plywood boxes with sheeted tops, the tail surfaces are slab type sheeted balsa structures, and the wing panels are built up and fully sheeted. Aluminum tube plug-in spars are commercially available and all standard hardware is used.

For the fixed gear, we did go with Robart's RoboStruts for appearance and shock absorbing performance, still a lot lower cost than retracts. To mount the Robart struts, we bent up some ¼-inch wire stub landing gear pieces. Retracts could be added later if we wanted to spend the money.

The wing area of our P-38 is about 1760 square inches, and our hoped-for weight was to be about 27 pounds. Don't tell Lou I said he uses too much epoxy, but we didn't make the desired weight, coming out at 31 pounds and 40 ounces/square foot wing loading, still not bad for a project this large. We figured a 42cc gas engine in an 18-pound plane is pretty lively, and we had two engines in a 31-pound plane so it should be pretty lively. And it is.



The plane was designed with plug-in, outer wing panels. The booms, and the center section pod are all glued together as one piece for easier setup.



Having built and flown a few twin-engined planes over the years, I wasn't worried about the use of two engines. They don't have to be perfectly synced for the plane to fly well; reliable running is far more important. If one engine dies, I'd usually throttle back the remaining engine and head for the ground. When designing my own twins, I make the vertical fin/rudder area quite large, to improve the single engine flying ability. With powerful engines, I've had several twins that would fly just fine on one engine; even capable of rolls, loops, and turns in either direction safely, all on the healthy engine.

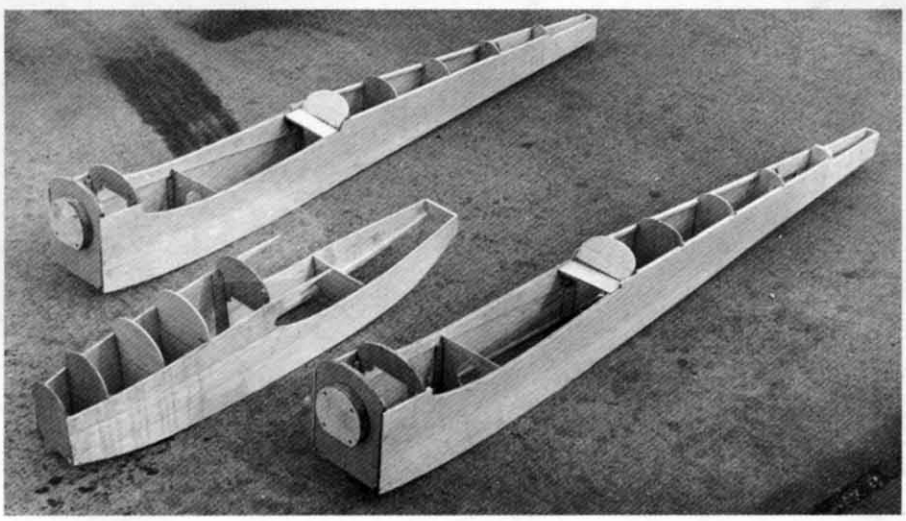
With the reliable gas/ignition engines in this P-38, we haven't had an engine failure yet but I think single engine handling should be pretty good. I've had several of Dave Reid's Cheetah 42 gas engines now, and they've all been easy starting with their included electronic module that retards the timing for starting; they're reliable, and run just fine. If an engine does stop, I'd plan to cut back on the remaining engine and head for the ground to be safe.

This P-38 is aerobatically capable; loops, rolls, any combination, low inverted passes, etc., are all done pretty easily. Takeoffs are easy; there's plenty of power, and landings aren't a problem. The plane slows down quickly, so hold some power on the final approach. Flaps could be built into the wing if you want and would probably enable slower landings; we didn't want to bother with the added work. Except for the weight and bulk, we treat the P-38 like any large sport aircraft; kick the tires, light the fires, and have fun.

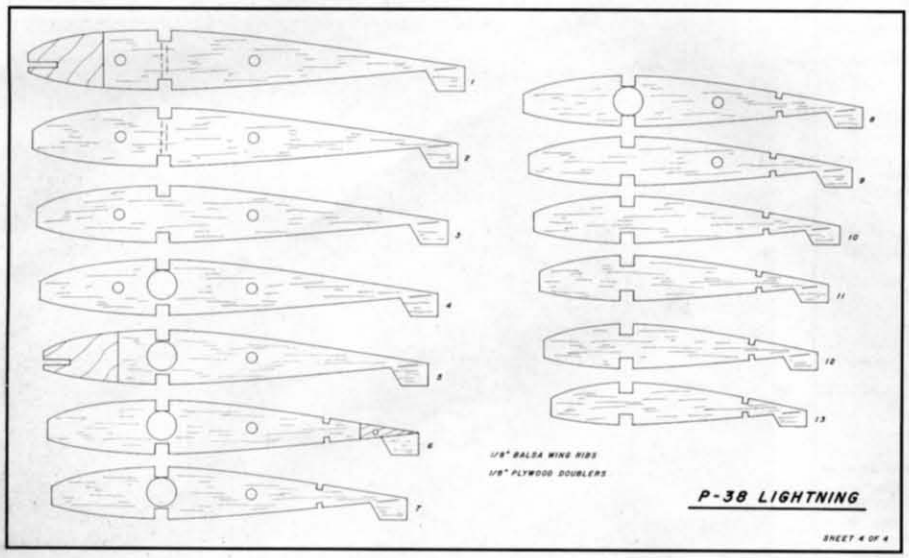
One comment on the design: I'm sure I went too far in enlarging the vertical fin area, even to insure safer single engine operation. The plane flies fine and we're now used to the appearance, but I did change the plans before inking them to reduce the fin and rudder size a little. They could probably be safely reduced even more for a closer to scale appearance if you want to.

On the building board

Construction notes will be fairly brief as the parts layout and buildup is straightforward and basic; this is about as easy building a large aircraft as you can get. Since Lou was going to be doing the building, I cut out



Partially framed booms and cockpit pod. The booms are essentially parallel for the first three bulkheads then pulled together at the tail. Note the spacers on the firewall, which provide clearance for the mufflers.



a complete set of parts for him to work with. I had two copies of the plans run off, and cut one set up for paper templates of the parts. Drawing around the templates carefully with a ball point pen, I cut the parts out with a band saw and my 50-year-old jig saw. Good tools last an awful long time.

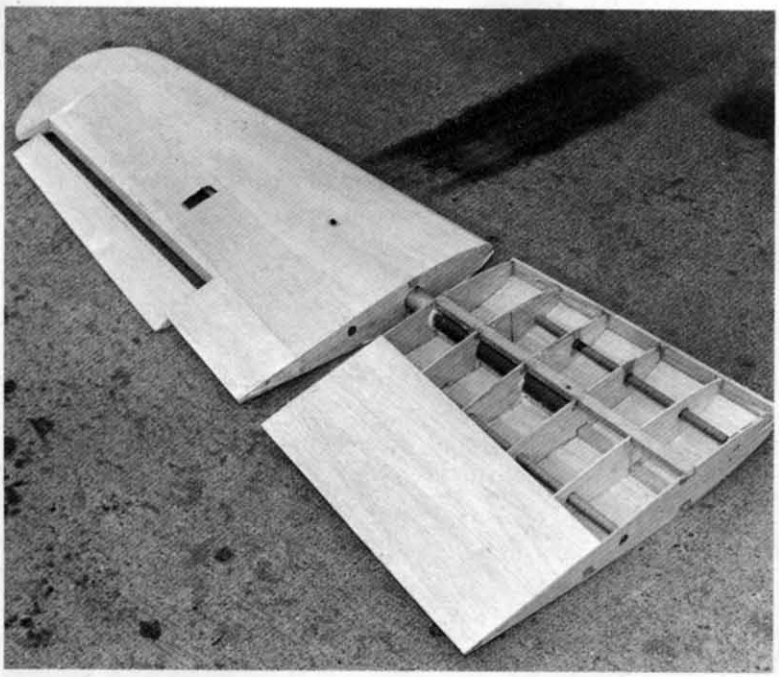
All wood sizes are shown on the plans; the parts that must be cut out are basically the nacelle and fuselage pod sides along with the bulkheads, the wing ribs and tip pieces, all of ⅛-inch balsa. Don't cut the holes for the phenolic spar tubes in the ribs; that's better done during the wing assembly. Some of the bulkheads are cut from ⅛-inch and ¼-inch plywood, and the nacelle and fuselage pod doublers are 1/16-inch plywood. The wings are sheeted with 3/32-inch balsa, the tail surfaces sheeted with 3/32-inch balsa, the nacelle and fuselage pod tops and bottoms are ⅛-inch balsa. Balsa blocks are used for the nacelle sections just above the wing panels. Miscellaneous other parts and strip stock are as shown on the plans.

The molded fiberglass engine cowls and plastic canopy are available from Fiberglass Specialties, 51200 Milano Drive, Suite A, Macomb, MI 48042, 810-677-0213. If the engine cowls look familiar, they're not just for this P-38, they were also used on my P-51, *Choice Cut,* and several other designs. It's economical, using the same molded cowl where possible and this is a sorta scale project. The plastic canopy was also used on my Stephens *Akro* project, and it worked out very well for the P-38.

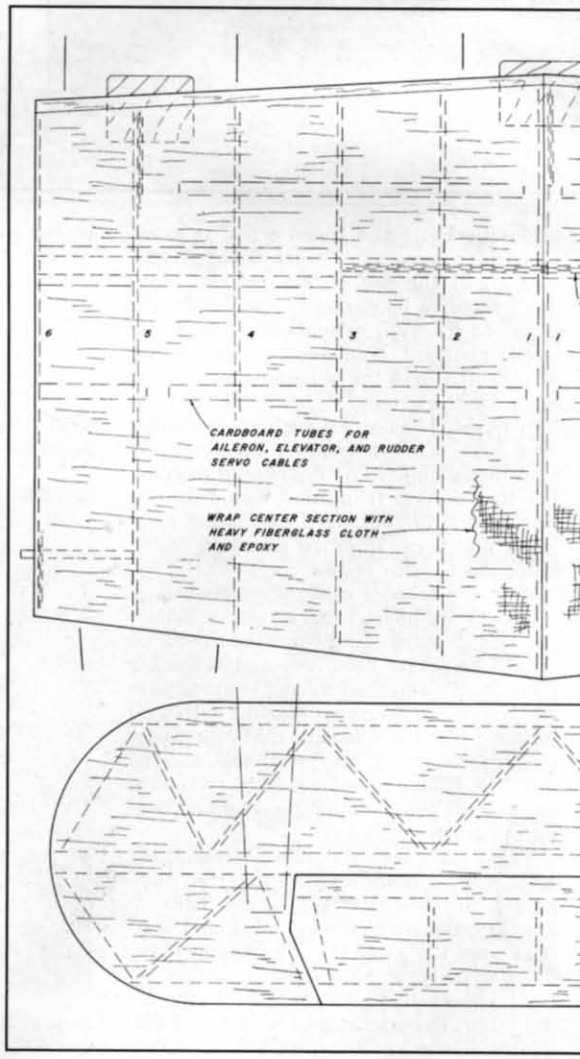
If retracts were to be used, they'd all be the nose wheel type, retracting straight back with only the nose gear of course to be steerable. We went with fixed gear on the prototype, using Robart's RoboStruts and mounting them on sections of ¼-inch music wire, bent with two spring loops for the nose gear and one loop on each of the main gears for shock absorption.

The wire gear sections were each mounted through three standard nylon nose gear brackets bolted to plywood bulkheads and drilled out to ¼ inch for the gear wire. We used Robart wheels for their scale appearance, adding the inner foam packing to handle the plane's weight. That packing is available only via direct order from Robart, and we've found it works very well.

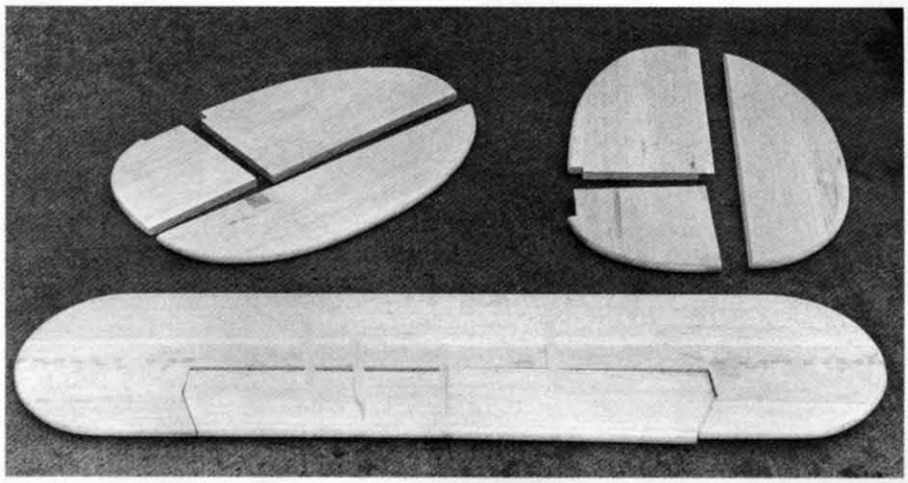
Starting with the wing panels: first step is to position the lower spars over the plans; I keep them located with small lead weights. I cut the plans up into separate pieces for convenience, and protect the plans with waxed paper during construction over them; been doing that for many years. The wing is built in four separate sections, with the two wing halves completed first before the two center sections are permanently joined. The ribs have "feet" by the trailing edge to keep them in position during construction. With the ribs pinned in position and glued to the lower spar, the upper spars are added, along with the rear spars on the outer panels. We sheeted the wings with 4-inch wide 3/32-inch



In this view of the left wing, the outboard panel has the wing tip added, the aileron section cut out and finished. Unsheeted portion of the inboard panel shows the glued-in phenolic wing tube.



Though the tail surfaces are flat, they are not sheet stock. Sheeting 3/32-inch thick sandwiches a 3/8-inch thick framework core. The elevator is in two sections, each driven by its dedicated servo.



balsa, putting the first 4-inch strip on along the trailing edge.

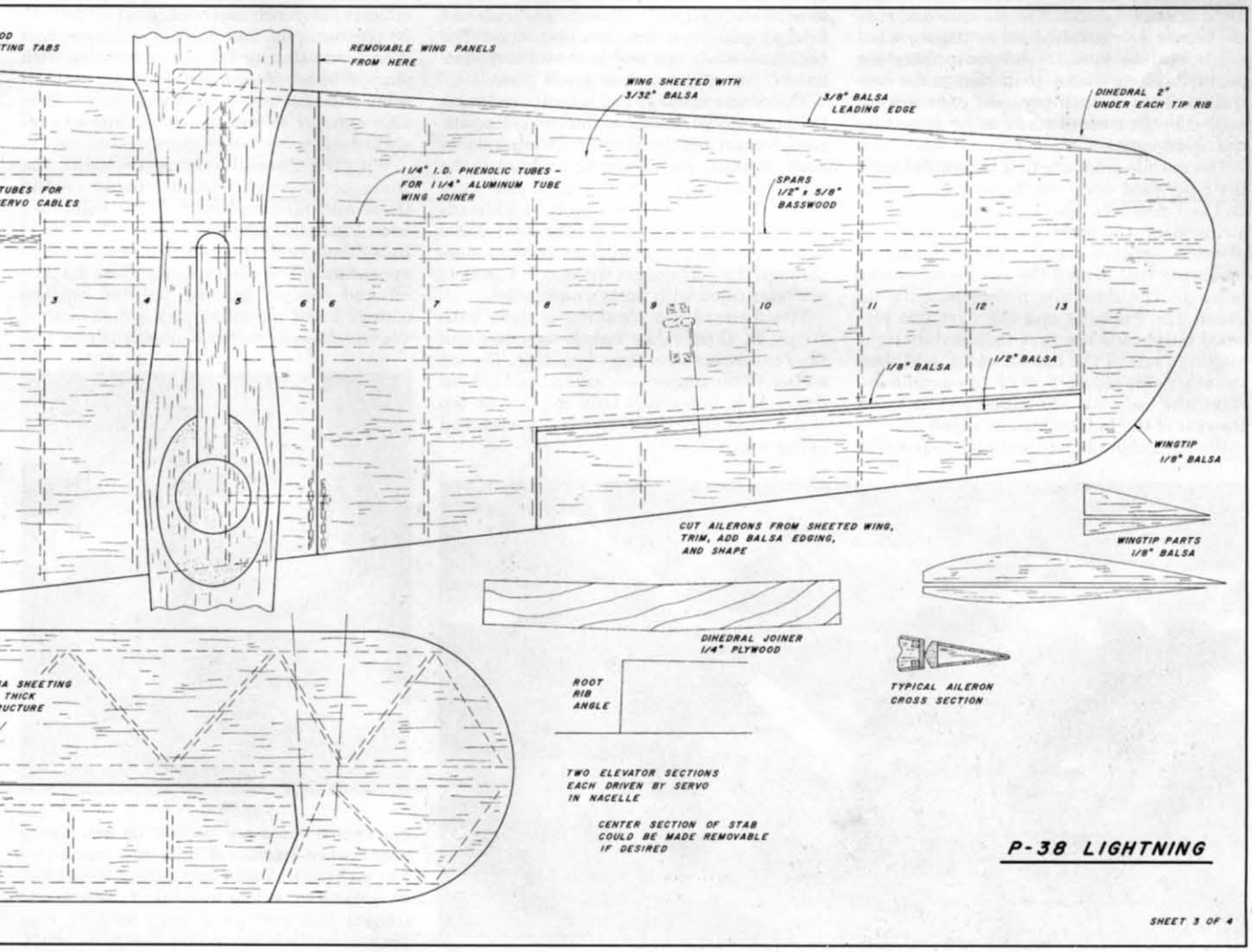
With that basic structure together, the holes for the phenolic tube joiners are cut in the ribs with a Dremel Moto-Tool; the fit doesn't have to be precise, they'll be epoxied to the ribs and spars. Put the aluminum tube joiner in place inside the phenolic tube sockets with the center and tip panels flat on the workbench together before gluing the phenolic tubes to the ribs and spars, to be sure the panels line up perfectly. Add the cardboard tubes for the servo cables, getting them in before the sheeting is completed.

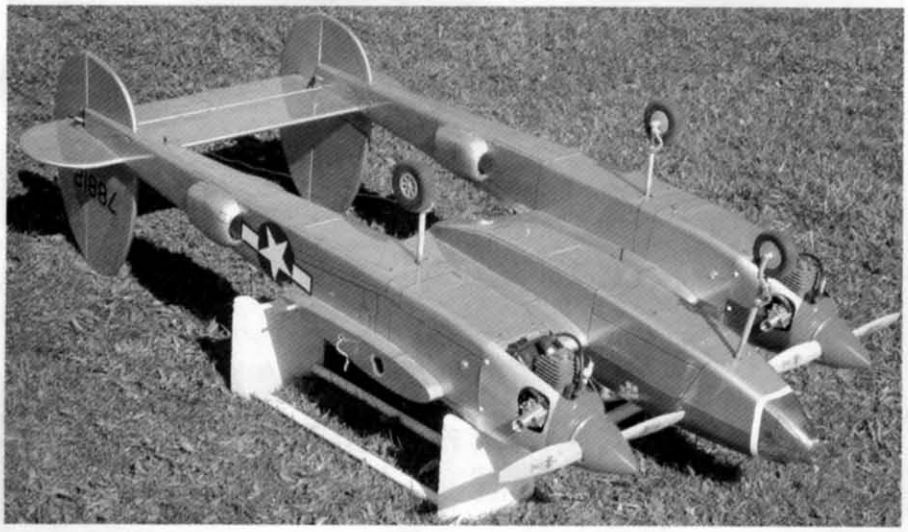
With the spar tubes installed and the panels partially sheeted, they can be removed from the building board and turned over to complete the sheeting. The two center panels are joined with the plywood dihedral brace; cut the slots in the center ribs for the brace and epoxy the panels together. We completed the sheeting, then block sanded along the front edge and added the balsa leading edge, planing and sanding it to shape. The plywood wing mounting tabs are added and make assembly easier whether you have a bolt-together airframe or build it in one piece.

The wingtip outline and braces are added to the outer panels, and then the tips are sheeted like the rest of the wing. The aileron sections are cut from the completed wing, trimmed back and the balsa edging added. We put some small balsa blocks inside the wing where the hinges would be installed. The aileron servos are installed in the bottom surface of the wing, using a plywood plate or hardwood strips between two ribs for the servo mounting.

We epoxied a 4-inch wide band of heavy fiberglass cloth around the wing center joint for extra strength. Access holes are cut into the lower wing surface where the nacelles and center fuselage pod will be to get to the servo cables; lengthened Y-harnesses will be needed as the two aileron servos along with the elevator, rudder, and throttle servos in each nacelle all must be run into the center fuselage for connection to the receiver. With the nose gear steering servo, that's a total of nine servos needed for this P-38.

The tail surfaces are easily built on a flat surface, with 3/8-inch thick balsa edging and ribs, all sheeted with 3/32-inch balsa. The elevator is made in two halves so each half can be driven by a servo in each nacelle; for power and redundancy. If you're making a bolt-





All the access hatches for servos, fuel tanks, receiver, and battery are on the bottom of the booms or the cockpit pod. Robart's RoboStruts work great absorbing the gear loads, as do the Robart Scale Wheels.

together airframe, the center section of the horizontal stab can be made removable. I'd use 1/16-inch plywood tabs above and below the surface, with the center piece sliding between the plywood tabs and held in place with nylon bolts.

The vertical fins and rudders are built in the same manner. The fins are made in upper and lower sections, and the rudders have a large slot for clearance and movement around the stab. The elevator and rudder servos are installed below the wing position, and we used Dave Brown fiberglass pushrods along with 4-40 linkage to the control surfaces. 1/4-inch plywood pads are installed in the control surfaces for mounting the nylon horns.

The nacelle sides are first assembled with their plywood doublers, balsa wing saddle and tail doublers, and 1/4-inch square balsa strips along the lower edges. We made the plywood spacers for the Cheetah engine mounting and drilled the engine mounting holes in the firewalls before assembling them. The firewalls and the next two plywood bulkheads are first installed at right angles to one of the nacelle sides, and then the other side is added. With the nacelle upright, the tail ends are pulled together and the rest of the bulkheads are added.

We use rubber bands and pins to position all the bulkheads in place and be sure the sides taper in symmetrically before gluing the bulkheads in place. The upper sheeting can be added, and the balsa is wet to make that job easier. The top sheeting could be done with strips if you prefer that method.

The side scoops are made from several pieces and can be completely shaped and finish sanded before adding them later to the nacelles. Leave the bottom sheeting and hatches to be installed later, after the pushrods and landing gear mounting has been done. The fiberglass cowls can be trimmed and mounted later, when the engines are in place.

The center fuselage pod is built up similar to the nacelles. Assemble the two sides with the plywood bulkhead at the wing leading edge position and the next bulkhead; the sides are parallel here. The front pieces are pulled together and the forward bulkheads added; the sides have a pretty tight curve here, so we cut a number of vertical slots through the balsa to get the curve. The slots are later filled with putty and sanded.

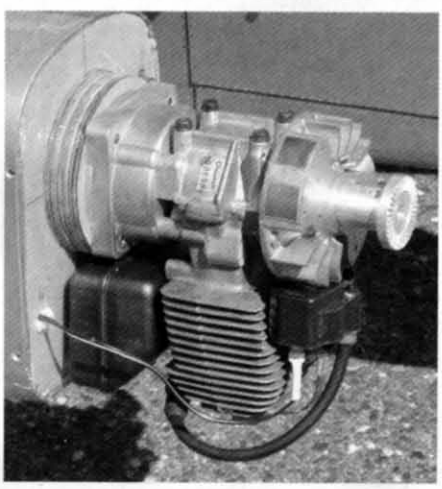
The forward top planking is done with strips; fit them fairly tightly together and sand to a smooth surface when done. The top section of the center pod, around and behind the cockpit, is actually built in place on top of the wing after the center pod is attached to the wing.

For final assembly, we blocked up the two nacelles on a flat table and put the complete wing in position on them. We then located the horizontal stab on the nacelles and checked the assembly from all sides to be sure everything was lined up, the nacelles were parallel, the stab was level with the wing, etc. We then pinned, weighted, and epoxied everything in place, adding the vertical fins and center fuselage pod later.

As mentioned earlier, the nacelles could be mounted to the wing with nylon bolts and the center section of the stab could be removable if you wish. We feel the alignment and assembly was a lot easier making it all into one piece. Without the outer panels, the plane does fit easily into a minivan.

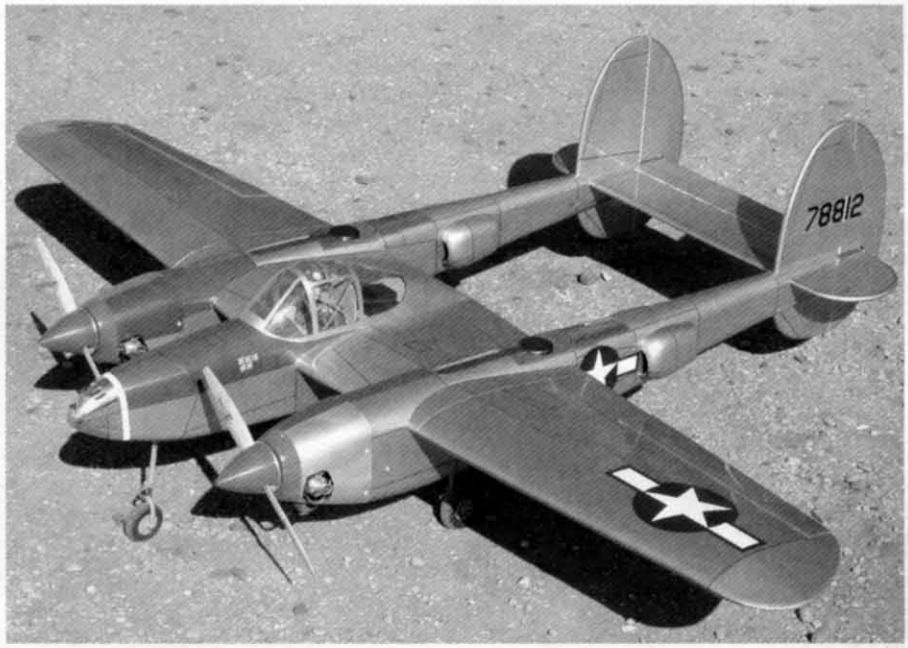
With the plane still blocked up, we added the center fuselage pod and completed the cockpit area, trimming the canopy to fit. The nacelle sections above the wing were shaped from balsa blocks; we felt that was the easiest way to go. Smaller blocks were glued together to make up those pieces, first cut to side view shape on the band saw and then planed and sanded to fit. Cockpit details, supercharger details, etc., are best left to the individual builder. We looked at a lot of scale reference material, a lot of good P-38 photographs, and did add a minimum of detail, simulating the superchargers with shaped balsa pieces, adding a pilot, backrest, and just a few cockpit details. That was enough to satisfy our stand-way-off scale desires.

With the Cheetah engines installed, the 'glass cowls were trimmed to fit around them and mounted with nylon bolts. We used 4-inch CB plastic spinners. The Robart RoboStruts and wheels also add some scale appearance. The plastic canopy was masked off and cockpit framing painted on; the canopy itself mounted with small screws. We've suffered broken canopies before and



The engine cowls are "generic" **(at left)**, having been used on a number of Dick's other projects, but they work well for a sport scale subject. They're easily removed for access to the Reid's Cheetah 42 **(above)**. Dick loves the engine's reliability, easy starting, and power output. Also have good mufflers.

Some of the scale deviations are obvious on this overall look at the model. But fidelity has been sacrificed to easier construction.The plane is generously sized at 104 inches, and at 31 pounds, is sprightly.



wanted to be able to easily replace the canopy if necessary. 16-ounce fuel tanks were used, and we've found the Cheetahs to burn that economical gasoline at a very low rate. An 1800 mAh battery pack was used, installed in the center fuselage along with the receiver and nose gear steering servo. We checked the balance, found it was close enough, and didn't relocate anything or add any nose or tail weight. Flies fine!

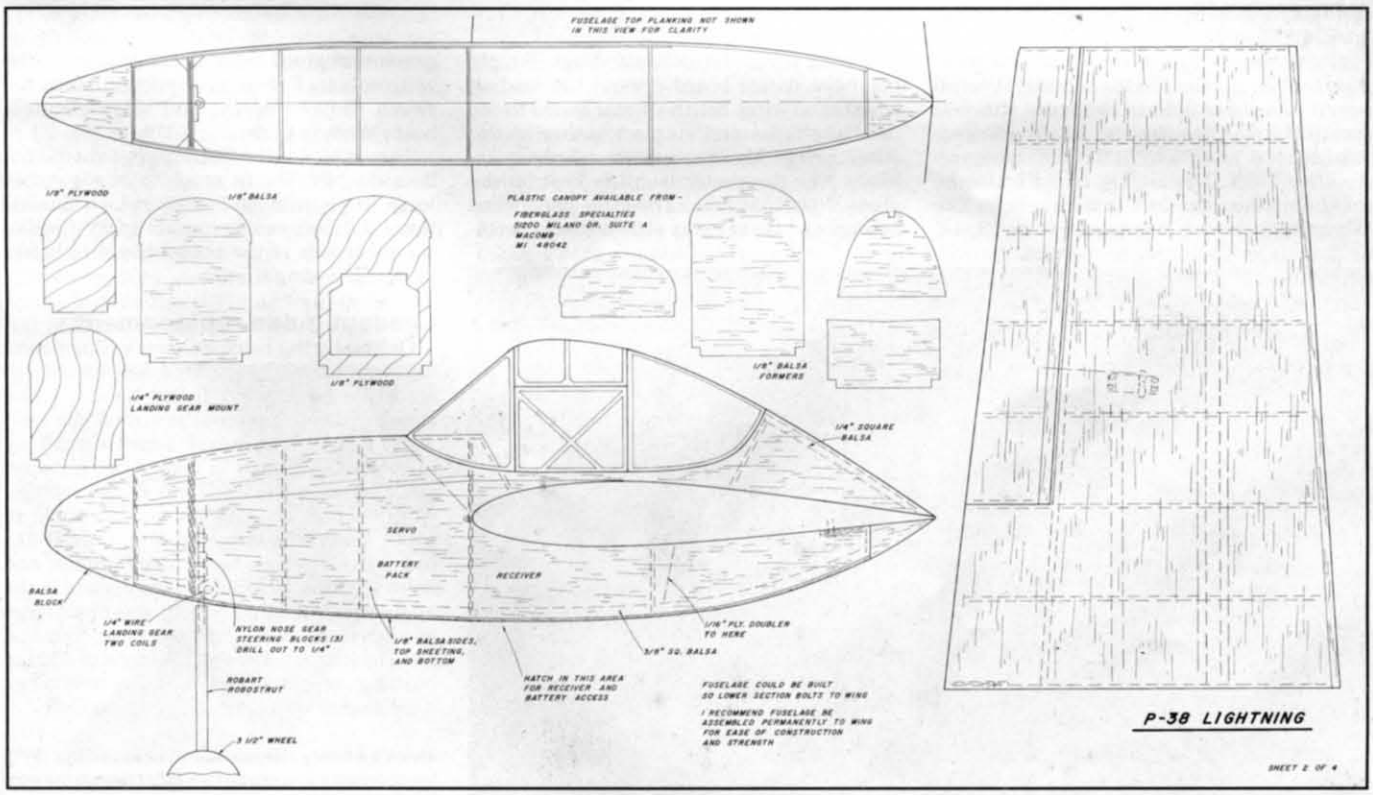
For the overall finishing, we considered using epoxied, thin fiberglass cloth all over and painting the plane. To save time, effort, and weight, Lou decided to go with ironed-on MonoKote. But it wasn't a "quicky" job, as he used a method he had seen of cutting the iron-on in small sections, punching small holes around all edges, and applying it over a different color strip; the end result being simulated rivet detail and panel outlines. I think it took Lou longer to do the covering job than it took him to build the whole P-38. And this on a stand-way-off sport aerobatic ship! We're pleased with the final result.

Test flights were really uneventful. We took plenty of pictures first and had one session at the field just to run the engines and get everything adjusted before any test flying. The Cheetah 42s were brand new, and we removed the cowls for the test running. Some slight adjustment of the throttle linkages so both engines moved to the idle stops and open throttle together, and we ran them separately. They both idled well, and we set and tached the top end at 6700 rpm with Zinger 18–10 props, which we felt was conservative for the new engines.

We ran them together and taxied the P-38 all over a large field for a good engines-running range check. We burned a full tank of gas through each engine, plenty of taxiing and running in place at fast and low speeds, with no engine stoppages.

First flights were made from the middle of a large sod farm field, on a quite windy day. The wind was steady and with this large an aircraft we felt was okay for the testing; we were anxious to see how this thing would fly. Taxiing on the grass was easy, the takeoff run wasn't too long, and the plane felt solid in the air, not affected much by the wind but it seemed awful fast going downwind. Rolls were easy, loops easy, split S, Immelmans, a little inverted flying, all with no problems, felt good.

Very steady on the landing approach, the plane did slow down quickly when throttle was cut, so I added power and kept it on for the final. With several flights, several smooth landings, that first day out was a success. Subsequent flying has shown this to be a pretty easy handling fun sport aerobatic ship; no bad tendencies, and that twin-engine sound is great. No, it's not a real scale project, and yes, those fins may be too large (smaller on the plans) but it's easy and quick to build, looks an awful lot like a P-38, and it's just plain twin engined fun. I'm glad we did it.



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