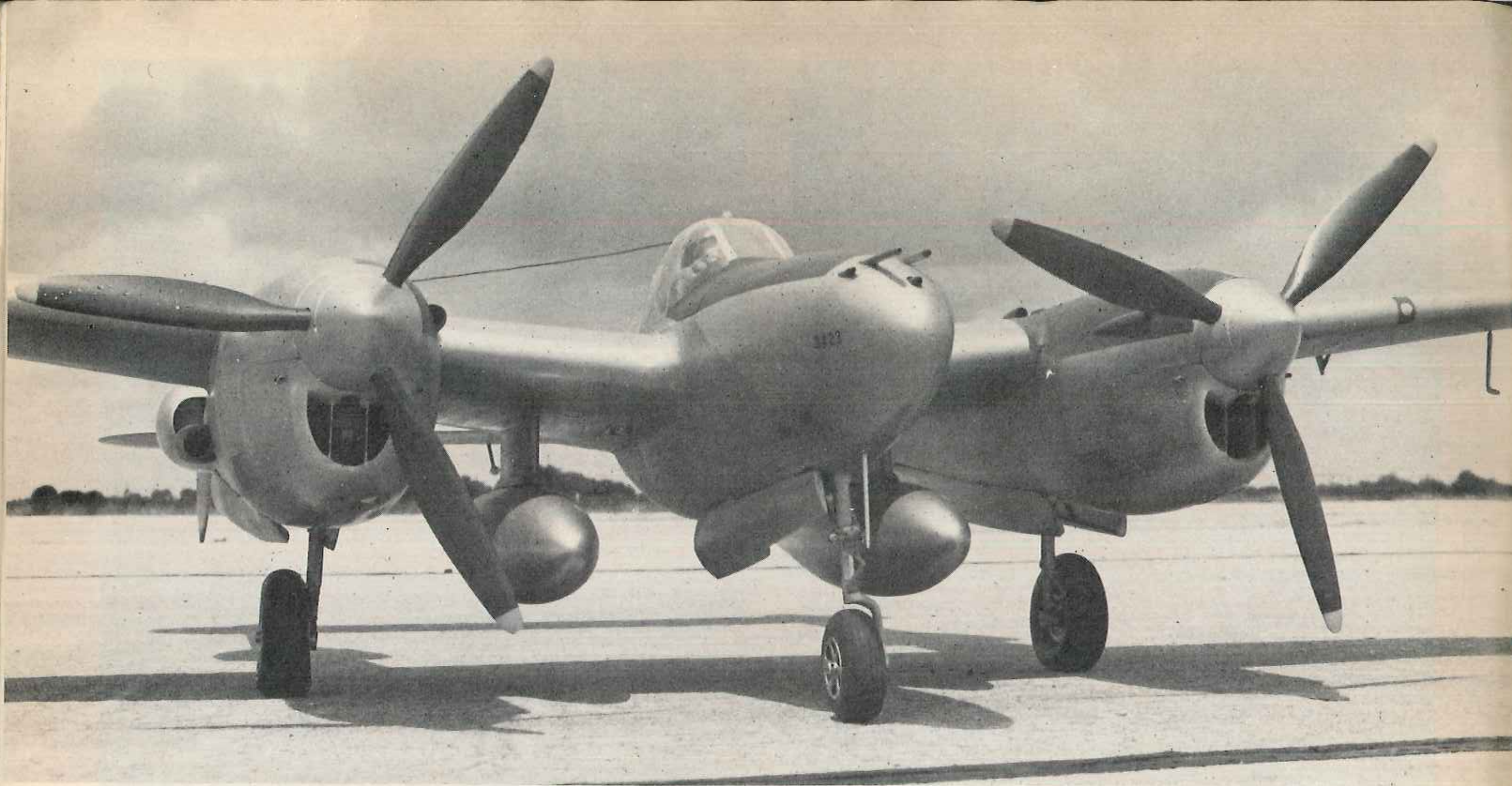


The GREAT P-38!

By COL. ART JOHNSON . . . The P-38 is a legend in itself, and the author's accurately outlined R/C Sport Scale model of this great fighting machine is just as exciting . . . to see and to hear. Why not pilot your own?

• The most beautiful airplane ever built? I thought so when I first saw the sun reflecting from the twin booms of a P-38 high over Southern California. It was early 1941, and Lockheed had not yet started painting the big twin fighter in the dull olive drab common to Air Force planes through most of World War II. First sight of the most different airplane I had ever seen, left me with a hankering to fly it that never stopped. I thought I would get my chance later in the Air Force, but it was not to be. Although I spent thirty years flying almost all of the other Air Force fighters, I never did get up in Lockheed's famous twin.

As the World War II fighters went out in favor of jets, it hit me that if I was ever going to fly a P-38, I would have to build my own. I had been a model builder before flying for the Air Force, and I don't think this activity ever really took second place. However, as you might guess, the idea for the P-38 model was around for a long time before anything happened. A P-38 was just not a project you jumped into back in the reed days. Later, when the right radios came along, there just weren't many designs or kits.

Even today, to my knowledge, there is only one RC kit for a P-38 on the market (Royal). I have seen several models from this kit fly, and some fly very well. However, it also seems that when this size model is equipped with retracts and all scale details, it becomes a real bomb. A full blown P-38 model with the wing area of the kit size has the same scale speed relation to a P-38, as a Formula I model has to a Goodyear racer. And single engine operation with a heavy model of this type is something you would rather not think about.

The problem begins with the highly tapered wing chosen by Lockheed. Great on the full size fighter; not an ideal shape for a model . . . particularly without the huge Fowler flaps Lockheed shoved out behind the wing to slow the ship down to a reasonable landing speed (More on this later). That taper really cuts the wing area. For example, the P-38, the P-82 Twin Mustang and the Grumman F7F Tigercat were all within inches of the same wingspan. However, the P-82 had 25% more wing area than the P-38, and the F7F had almost 40% more.

There is one sure way to beat the problem of a lot of aircraft structure and a small wing. Build it big and keep it light. The first is easy . . . the second is not. Any model with twin .40's and retracts will have about 3-1/2 pounds of hardware that you just cannot sand down to remove weight. With .60's, this runs about five pounds. I chose .60's for the P-38, and a scale of 1.8 inches-to-the-foot, as about the maximum practicable size. Anything larger, and you wind up making your own prop spinners . . . or your wife may leave you when you buy a truck big enough to haul it. At 1.8 inches-to-the-foot, the span comes out to just under eight feet. Shooting for a design estimate of 12.5 pounds, the model actually weighed in at just under thirteen BDT (before drop tanks), ready for the first flight. The drop tanks were added after the first dozen-plus flights, when it turned out that even at thirteen pounds the model was easy to handle.

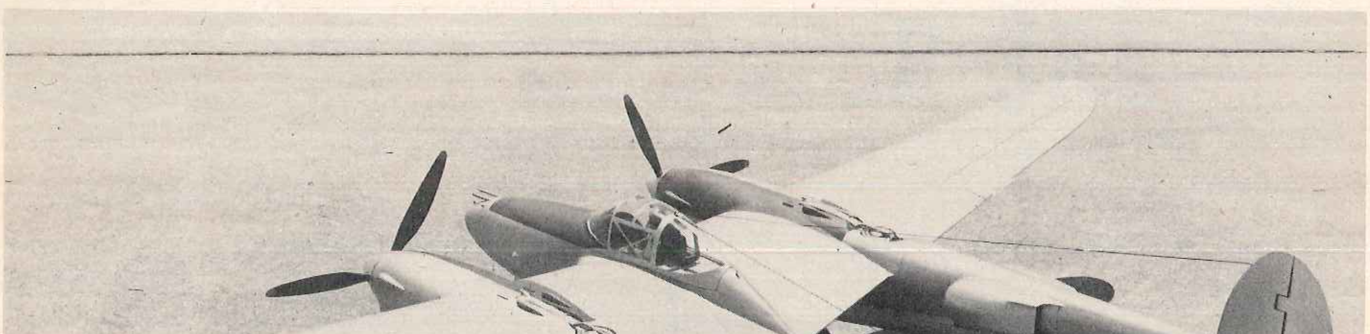
Flaps would be nice on this model, but the P-38 had four-section Fowlers that moved back behind the wing the full width of the flap as they angled down. My engineering talent was not equal to development of a track system for flaps that would stand up to the full blast of a couple of .60's on a go-around. If any reader comes up with such a system, I would sure like to know about it. The rear wing spar is positioned so that flaps can be added to the model if anyone wants to go all-out.

The "L" version of the P-38 was selected for reproduction for a

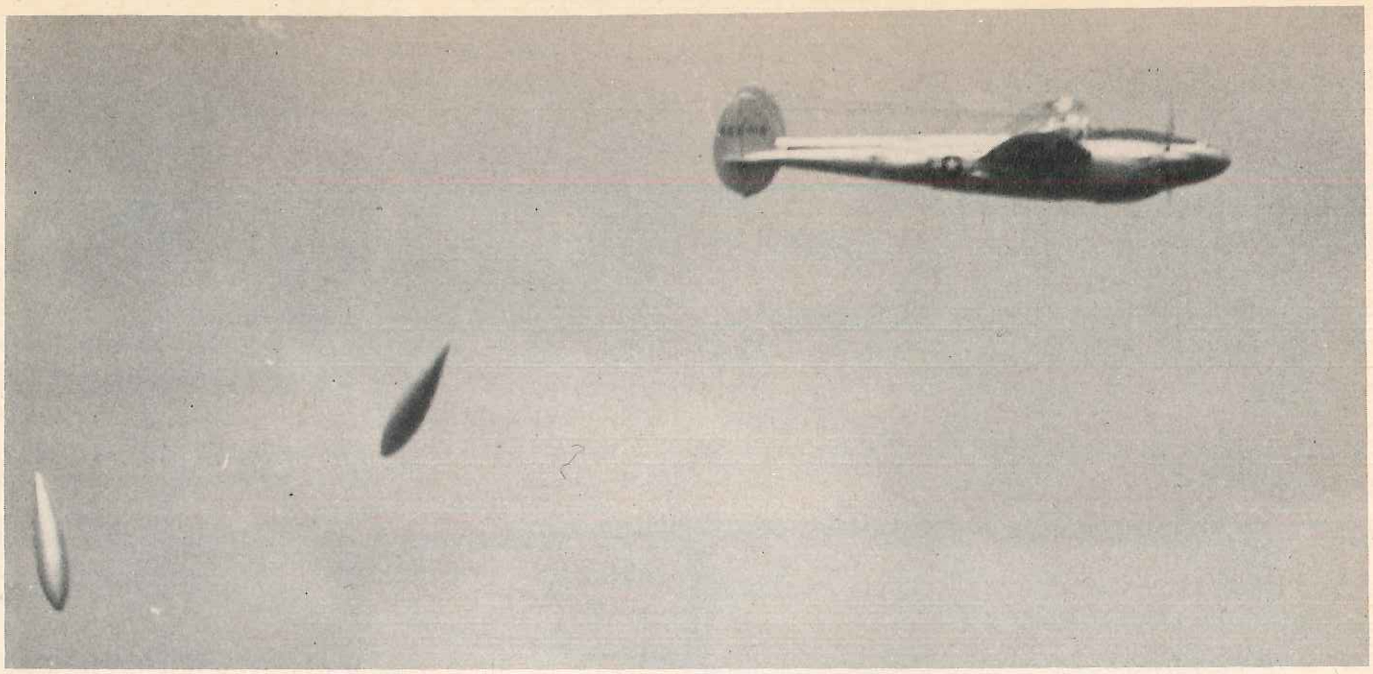
Col. Art Johnson's happy smile is well justified. The spectacular performance of his P-38L represents his most capable talents in the engineering and building of a very challenging subject. The ship is a consistent winner and show crowd pleaser.

number of reasons. It was the last and best of the P-38 production models, and was flown in combat by many top aces, including Major Richard Bong, the highest scoring U.S. fighter pilot of all time. It was produced mostly in natural aluminum finish and had the deep cowl which, in the 1.8 inch scale, completely hides any of the .60 size engines. There are also a number of good three-views available for the L version.

(Before Art get's into the construction phase of this article, we felt the following episode, which he reported to us in a recent letter, would probably be of interest to those who might be concerned about the model's single-engine capability. wcn) "I had a chance to check out the single-engine performance on the P-38 at the Tangerine meet on New Year's Day. It



Mr. P-38 himself (Tony LaVier) would have to take a good look at this photo to recognize it as a model. Only the lift-off canopy parting lines give it away. No molded fiberglass parts or foam cores are used in the construction . . just carefully selected ply and balsa, and lots of it!



Bogies at one o'clock!! Those drop tanks tumble on release exactly as the real ones. Addition of tanks, pylons, and release mechanism added only one-half pound to the takeoff weight. Tanks are shaped from foam blocks, on a lathe, then hollowed and finished.

seems the right engine stopped when I lowered the gear on downwind on my second flight. The only problem was that another model was flying, and I could not hear my engine(s). The P-38 kept flying straight, but drifting slightly to the right. Before I knew it, I had full left aileron and rudder, with the plane going straight and getting farther out. I thought I had lost the radio. By then I decided maybe I should turn right. As soon as I tried, the P-38 snapped around to the right with the nose straight down and not too high, but a long ways out. By then I realized the radio was working, and that an engine must be out. I chopped the throttle and managed to get out of the most unusual position. On part throttle the model was O.K., and I could climb back for a no-sweat landing.

"The lesson is, that the P-38 will fly fine on one engine, but it will not turn into the good engine at full throttle. Cut back the power, and it handles fine on one. It will hold altitude on half throttle on one engine.

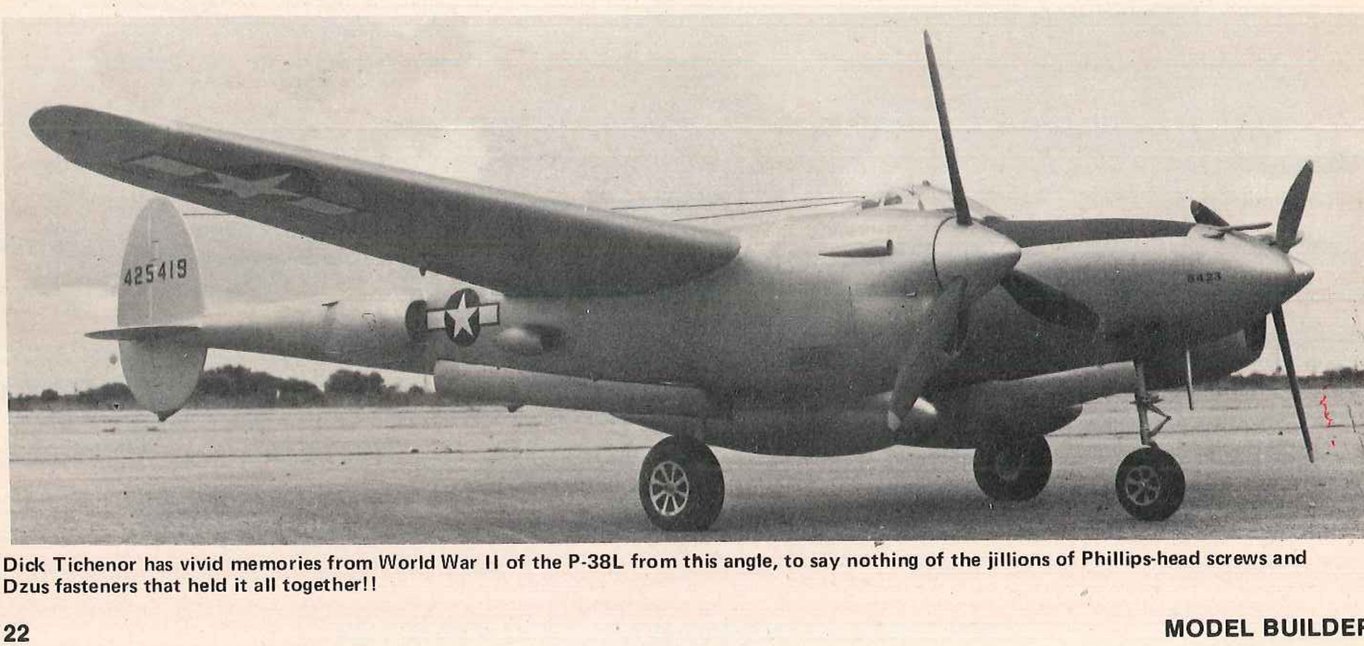
"Incidentally, I found out after tearing the engine down, that it had swallowed a hard object that grooved the piston, ring, and liner. It is possible that something flipped out of the nose gear when I put the wheels down, and went back through the engine. A freak deal, after thirty-two consecutive flights with no engine problems.

"The Tangerine had 19 Sport Scale entries this year. The P-38, with only one flight completed, missed first by two-tenths of one point."

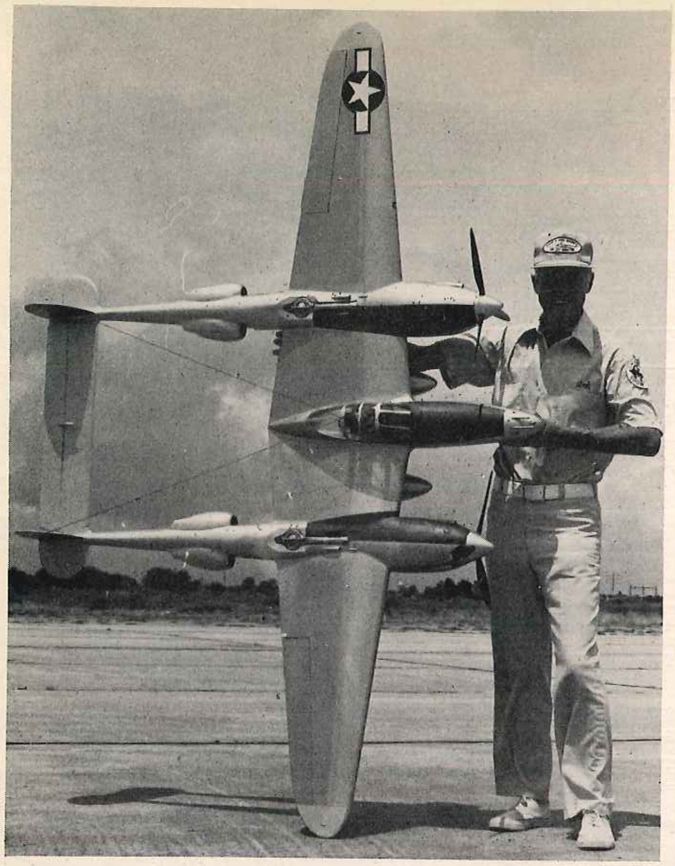
Best Regards, Art Johnson

Construction involves fairly straightforward, all balsa and ply techniques. The wing should be built first, because you have to hang everything else on it for alignment. Except for the ailerons, the structure will be familiar to anyone who has built a Top Flite P-51. Four-foot balsa will permit full length spars in each panel. Washout at the tips is the same as on the big P-38. Any twist in a wing this size could be disastrous on that first flight. I tack-glue straight 3/8 square balsa strips to each end rib while assembling the rib-spar structure. Sight along the wing, and the strips will give you a check on the washout angle. Use the same technique to make sure each panel lines up when glued together at the center.

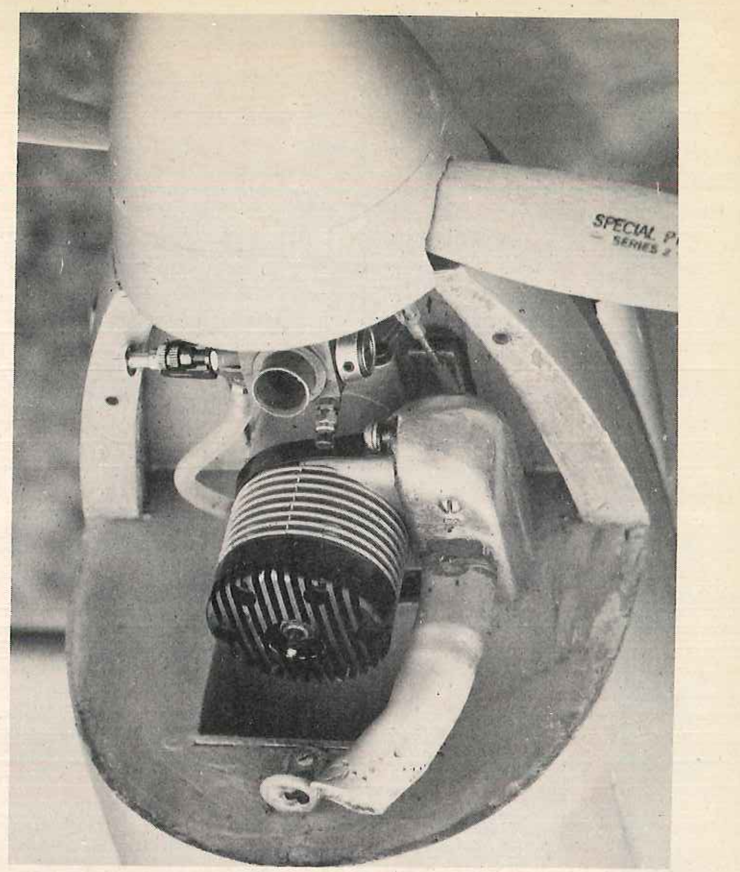
Rib centers are cut out as far as W-8, so that retracts hoses and control linkage can be added more



Dick Tichenor has vivid memories from World War II of the P-38L from this angle, to say nothing of the jillions of Phillips-head screws and Dzus fasteners that held it all together!!



How's this for direct size comparison? A key to the ship's realistic performance is its size. Keeps the wing loading within reason.

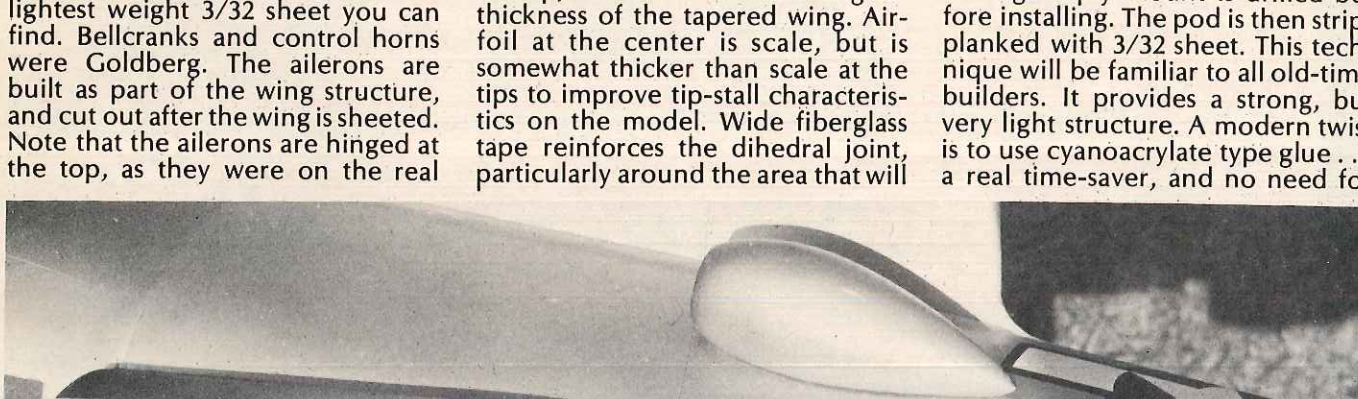


One Camloc allows instant access to engine. Note Tatone exhaust header with extension, and cooling duct behind engine head.

easily. Vertical strips of balsa on the ribs between spars provide a place to tie down the nylon tubes holding the control linkage, and also strengthen the ribs. Install all of the bellcranks and control linkages before covering the wing with the lightest weight 3/32 sheet you can find. Bellcranks and control horns were Goldberg. The ailerons are built as part of the wing structure, and cut out after the wing is sheeted. Note that the ailerons are hinged at the top, as they were on the real P-38. Du-Bro hinges worked fine on the original model.

Wing dihedral is a scale twelve degrees at the center reference line. This measures more than twelve degrees along the bottom and less on top, due to the radical change in thickness of the tapered wing. Airfoil at the center is scale, but is somewhat thicker than scale at the tips to improve tip-stall characteristics on the model. Wide fiberglass tape reinforces the dihedral joint, particularly around the area that will later be cut out for servo installations.

The center pod is built upside down on the building board, with 1/4 square balsa stringers tying the bulkheads together. Make sure the nose gear ply mount is drilled before installing. The pod is then strip-planked with 3/32 sheet. This technique will be familiar to all old-time builders. It provides a strong, but very light structure. A modern twist is to use cyanoacrylate type glue . . . a real time-saver, and no need for



Reinforcing the old adage that one picture is worth a thousand words, this one clarifies many questions about landing gear details. Rubber band tension on bellcrank closes doors as gear is retracted.

pins. Formers and rails for the removable canopy are added to the top of the pod after removing from the board. After making a mold to form my own canopy, I ran across a Sig 15 inch canopy, that when cut down, is a perfect fit. The canopy is held in place by two dowels at the front and a spring-loaded dowel at the rear. Glass the pod, using 3/4 oz. cloth and finishing resin, before cutting out the airfoil section where the pod joins the wing. The 1/4 inch square spruce braces from the nose gear mount to the wing spar are added after the pod is in place on the wing. The nose gear door area is reinforced with extra layers of glass cloth before cutting out the door. Robart hinges are used in all the gear doors.

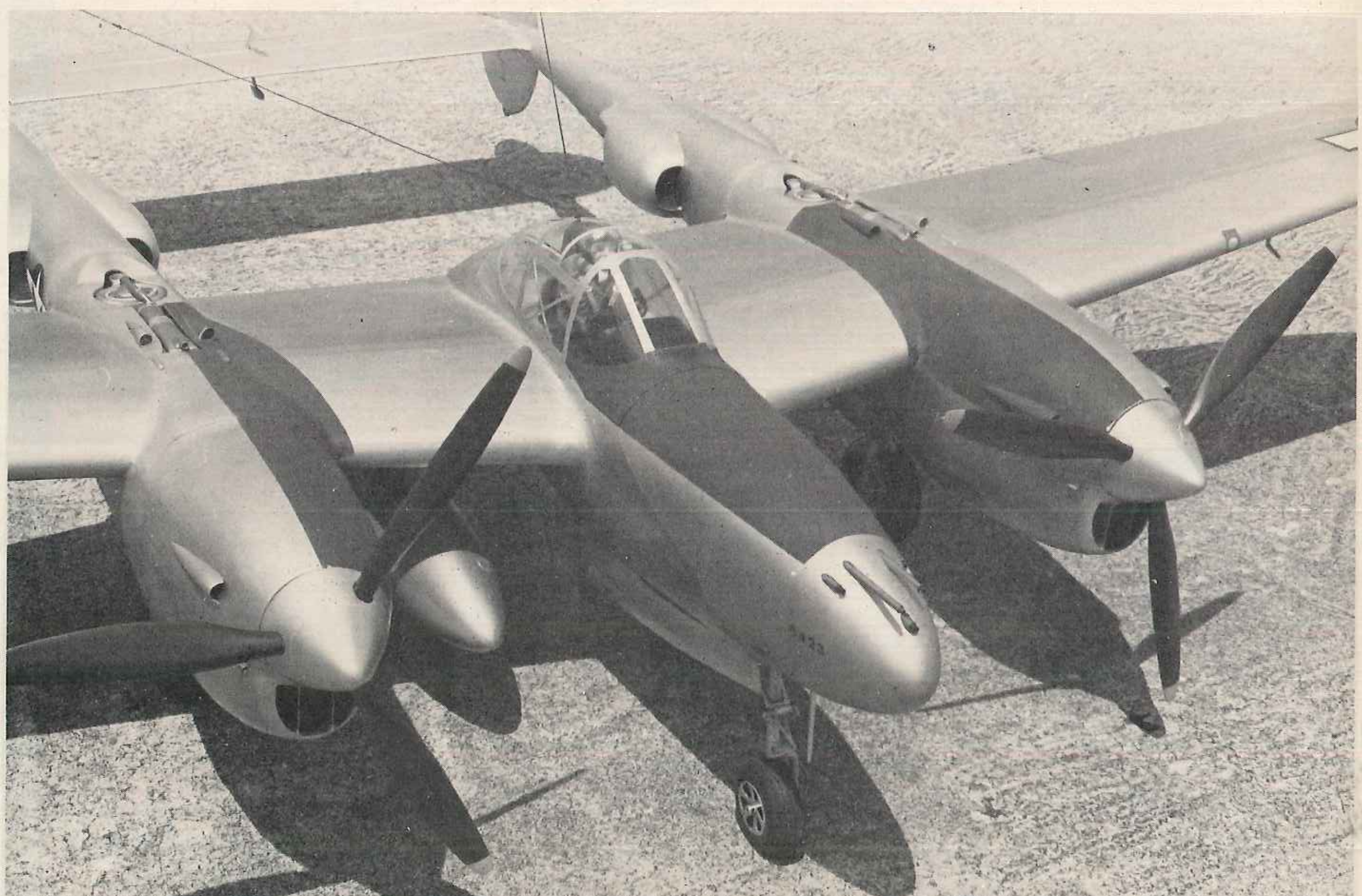
Build the engine pods by making separate assemblies of the motor mounts and ply bulkheads through FE and the rear formers and stringers, FF through FI. The two assemblies are joined, and the pod is then sheeted to the firewall with 3/32 sheet. The rear of the pod is in straight lines, so fairly large sheet sections can be used. Wet the outside, wrap around after spreading white glue on all points and areas of contact, and tape to hold until dry. Add 1/4 by 1 inch balsa doublers to the section under the wing to provide a saddle. Allow for trimming as the wing is fitted. Note that the wing saddle is different on each side due to the taper and the dihedral. You will also have a right and left pod from here on.

Note the duct from the firewall to the bottom of the pod below the fuel tank. Even though the engine is completely enclosed, cooling has been more than adequate with this system. The duct is sheeted with 3/32 balsa (you need a lot of that stuff for this bird). Resin the inside to fuel-proof. Forward of the firewall, the engine pod and removable cowl is built up by gluing block balsa (1/2 inch) in place. Face all surfaces on the cowl where it mates with the pod with 1/32 ply to provide a tight-fitting joint. Do the same on the pod-to-wing joints where the formers meet. The cowl is held in place with 1/8 inch dowel pins and a single Prather Camlock fastener. It can be removed in seconds without disturbing the spinner. This permits refueling and adjustment of the needle valve without any need for external access.

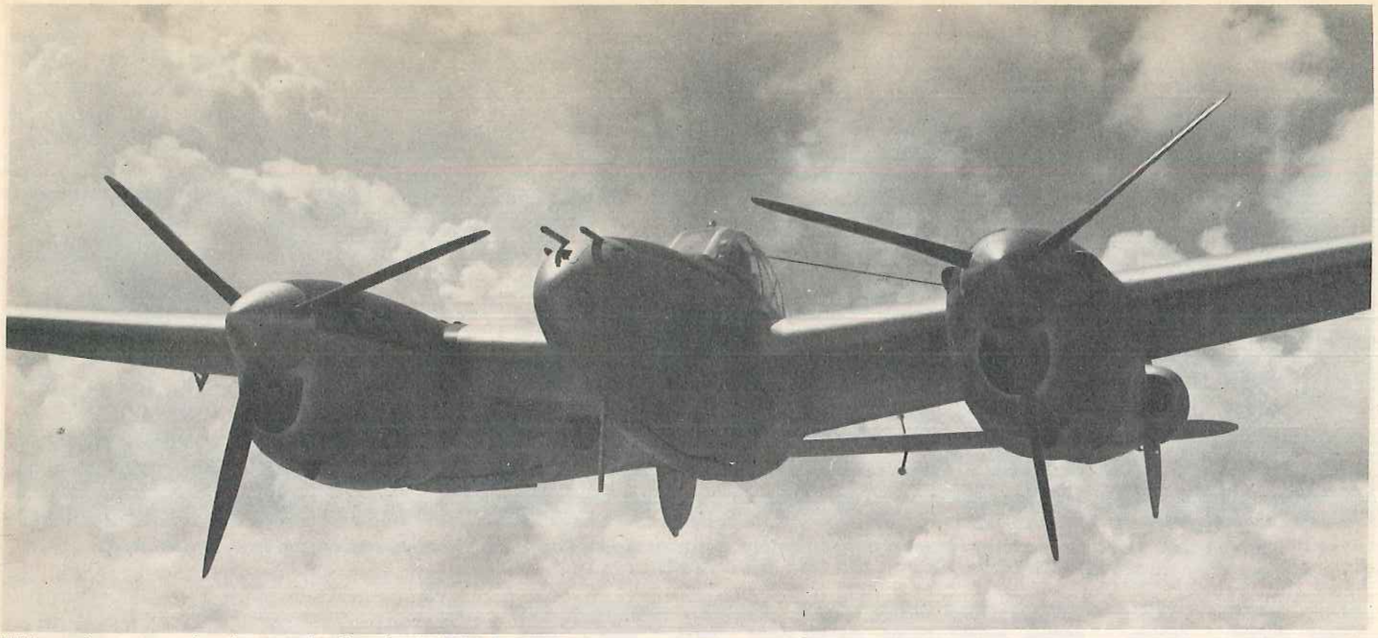
Radiator scoops were built directly onto the pods, using the same former and strip-plank technique as for the center pod. The intercooler scoop is carved from block balsa. The vertical fins and outboard sections of the stabilizer are built as separate units, then glued permanently to the engine pods. The stabilizer and elevator assembly fits onto 1/16 ply keys built into the engine pods. A sheet metal screw into the ply key from under the stab keeps everything in place after assembly.

A truss type structure is used for the stab, elevator, and rudders. When sheeted both sides, this gives an extremely rigid but lightweight component. The assemblies are easily built. Just block the leading edge to the midpoint of the spars and install rib strips that are the same width as the spar. The assembly is carved and sanded to airfoil shape after removing from the board. Make sure the ply key sockets are recessed into the front and rear spars. There will be considerable stress at this point on the stab.

With all the parts boned out, the model should be assembled temporarily and checked for alignment. Trim the pod saddles so the engine is vertical to the ground, not the wing. Looking down, the thrust line should be outward on both pods. Draw a centerline on the engine pods and check that the distance is the same at the front and rear. Next, trim the wing saddles to get the correct thrust line and decalage. For lack of



Varying aluminum color tones on different panels can be detected in this photo. Alclad aluminum color differed slightly between mill runs. Finish is 3/4 oz. glass cloth, two coats of resin, two coats of auto primer (Rustoleum!), followed by Sig silver butyrate, much sanding throughout.



With engines stopped and props feathered, the P-38 does a little thermal soaring . . . If you buy that, we can also make you a good offer on the Brooklyn bridge!

a better idea, I used the incidence set-up from the real P-38. Thrust line is zero to the stabilizer with the wing centerline at 2-1/2 degrees positive. This puts the tips at about zero with the thrust and stab. Lockheed must have known what they were doing, as the model proved steady as a rock, with no control surface trim needed.

The engine pods are held onto the wing with four nylon bolts. The two at the rear are readily accessible through the main gear well. The two at the front are installed with a socket wrench guided by a cardboard tube through the fuselage. The fairing and supercharger details are permanently fixed to the wing after the engine pods are fitted.

The entire model is finished with 3/4 oz. glass cloth, two coats of resin, and six dozen sheets of sandpaper (At least it seems that way). This is followed by a couple of coats of auto primer, sanded almost completely off each time. I use Rustoleum auto primer, because it comes in spray cans and is available anywhere, not because I am worried about the airplane rusting here in Florida! After the first coat of Sig silver butyrate dope, you realize that finishing an airplane in natural aluminum is a pain. Every minor mark and dent suddenly shows up and you go back to the primer. When you are more-or-less happy with the first overall coat of silver dope, individual panel shades can be airbrushed on by mixing small amounts of black in the silver base paint. A coat of satin clear dope will help prevent streaks in the silver dope if raw fuel gets on the plane.

O.S. Max .60 Blackhead engines give more than enough power for this plane, even though the restrictor was retained in the throttle to insure good fuel draw at idle. Pressure is not needed, as the tank lines up perfectly with the spray bar. A Tatone manifold with a piece of aluminum conduit bolted on, provides silencing, and gets the oil and heat out of the cowl. Williams 3-1/2 inch P-40 type spinners are reasonably close to scale, as are the similar CB Associates' spinners. The latter weigh about a quarter of a pound more per pair.

True scale retracts for the P-38 would require a type that rotates considerably more than 90 degrees. Rhom Airs only travel through 90 degrees, so the mounting positions shown are a compromise to come as close as possible to scale appearance. Standard 5/32 Rhom legs are adequate, however, a special nose strut, available from Rhom without the coil, was bent into the correct scale shape for the nose gear. The nose gear was also modified to operate with a pushrod, same as the Goldberg retracts, rather than the two-cable Rhom system. It has worked very well, but then, I have a friend who modifies Goldbergs to work with cables. Take your choice.

Have you ever looked for ideas on how to operate the doors for a retract system? Either I buy the wrong magazines or there are no articles published that fit the P-38 problem. After a number of false starts, the final solution turned out to be too simple to believe. Rubber bands are the answer. The main gear doors are tied to a single bellcrank with quick-links. The bellcrank pulls the doors to a normally closed position via rubber power. The gear leg rides along a small spring wire epoxied to one door, forcing the doors open as the gear drops. The nose gear operates the same way, but no bellcrank is needed on the single door. The weight of the system for all five doors is less than one ounce. It has been foolproof on almost thirty flights.

The P-38 was used a lot in the Pacific theater during WW-II, and drop tanks were a pretty standard item. Scale tanks for this model are more than a foot-and-a-half long. Carving anything this large from balsa seemed like a hard and expensive way to go. Urethane foam shapes easier than cheese, and takes resin and epoxy with no problem, so this material was used for the tanks. Two slabs roughed out with a pocket knife are glued together over a 3/16 dowel, and the dowel chucked in a lathe. A drill would do, as the foam shapes easily with just rough sandpaper. It makes a mess though, so keep the vacuum cleaner handy.

After shaping to a template of the tank, the foam is covered with a couple of layers of 3/4 oz. glass cloth and resin. Cut it in half, remove most of the dowel, and all but a quarter-inch wall thickness of the foam. Epoxy the shells back together and add another strip of glass cloth around the joint. Wet-sand, prime and paint. You should now have a drop tank bigger around than the fuselage of a Kaos 40, but weighing only three ounces!

The pylons for these tanks extend quite a way below the wing. This required an indirect release system, with one end of a plywood shackle holding the tank while the other end was held by a Nyrod tube

Continued on page 96

it difficult to notice abrupt changes in engine speed.

During the first four hours, the mixture needed occasional adjustment, always a perilous procedure. Thereafter, the mixture was not changed for the rest of the flight. Lap times on 53.69 foot lines ranged from 8.7 sec to 10.1 sec. Most laps were near 9.75 sec, for an average speed of 23.6 mph. Line tension was comfortable, but inadequate for eyes-off flying. Exhaust fumes were barely noticeable because of the slow rate of fuel consumption and the numerous leaks in the large building.

Some physical discomforts appeared during the flight. Legs and back got stiff, demanding frequent vigorous exercise. I ran in place, danced, walked forward ala team race, did knee bends and back bends, stood still for nearly a full lap at a time, and even turned while kneeling or sitting on the rug, all to change the pace. Mostly I just rotated on my left hip. My hands turned a strange dark color, caused by restricted circulation past the bent elbow. A long safety thong allowed use of either hand, and both hands stayed discolored, but they were not numb. About six hours into the flight my hips began to ache from the rotation. This never got very bad, and actually subsided later. I was not dizzy or tired, until I stopped.

Except for the times in the first hours when the mixture needed attention, there was little to occupy my thoughts. Flying was easy and my mind wandered. "If flying is so great, why do I wish this were over?" Sometimes I was mesmerized by the repetition of the scenery flashing before my eyes; flying was often automatic. Frequent discussions with the crew, and a hope to empty the tank, kept me going.

We had just passed ten hours . . . into double figures. I began waving to the crew to indicate the time on my watch. Two seconds later when I looked back at the plane, it had climbed too high and the lines were slack! It flew level across the center of the circle and out toward the other side. I prepared to regain control when the lines got tight, but could not cushion the shock adequately. It flew back in. Frantically (you know how this goes), I ran to take up the slack, but in another half lap it landed hard, breaking the nose and prop. I was not too unhappy that it was over. The tank had not been emptied, but it was, nevertheless, a very successful day.

Flight duration at the moment I stepped outside the circle was 10 hours, 3 minutes, 25 seconds. Total distance flown was 237 miles. Enough fuel remained for another three hours. The engine had burned 20 fl. oz. in ten hours, and should get an EPA rating of 1500 mpg! It was as clean and tight as before the weekend flights. Echo Too is far from the ultimate endurance design: the airframe is too heavy. Clearly, the record could be raised to 15-20 hours, even flying outdoors.

An unnecessarily important aspect of this event is pilot endurance. The AMA C/L contest board recently rejected a rules change proposal to allow relief pilots, because a few board members believe that pilot endurance should be a major factor in this event. Flying control line for many hours nonstop proves nothing important about an individual's flying skill. With no physical conditioning for the flight, I certainly could have lasted fifteen hours. Most experienced pilots could do so, given enough determination. Still, I believe that this event should be for the best airplanes, not the best legs or the best electric swivel chairs.

Special thanks are owed to the witnesses, who encouraged me to try again. Thanks also to Bill Anderson for his efforts to schedule the hangar, and to Dean Smith and Tom Plummer for their help with the hardware. ●

P-38L . . . . . . *Continued from page 27*

attached to a servo. The nylon tank hook (made from a bellcrank) and shackle are similar to those used on actual bomb racks. Design is such that when the shackle is released, an arm on the shackle pushes against the top of the hook, forcing the tank away. A rubber band is the spring force. The only problem with this set-up is that it takes both hands and your feet to install the two tanks and work the transmitter by yourself.

Although an eight foot P-38 may not fly exactly like a real one, I think I was more concerned about the first flight than I would have been checking out in the original. Was the C.G. where it should be? What happens if an engine quits? Etc. etc. Our local flying field is sort of rough grass, actually mowed weeds. Could I get the big bird off of this stuff? No problem? At full throttle, the P-38 jumped into the air long before I expected and climbed out rock steady. The model was so stable I thought I was flying a C-47, rather than a P-38. The retracts and doors worked, and after a few passes, I thought I would see how it landed. First discovery! I overshot the turn to final even though the bank looked pretty steep. Then I remembered. This is a big airplane. It takes a lot more room to turn and it is really moving faster than it looks. Next try, I allowed for this, and it settled down and gently floated past the point of intended touchdown. Shades of the Ugly Stick! Could this by a P-38? On the ground, with both engines running, I looked at the transmitter. All the trims were still in neutral. What happened to Murphy's Law?

After the first flight, the elevator and aileron clevises were moved in a couple of holes so I could wrack the plane around a little tighter. That is the only change made since the first flight. The bird is not sensitive to trim and still flies with the original settings. The C.G. actually moves back when the gear is retracted, but you cannot detect the change in the air. The first three flights off the grass were the only test flights made before a series of contests and airshows. So the first and only (Before the Tangerine!) single-engine experience came on the fourth flight at the first contest. An engine quit on downwind after takeoff. This was not the time or place to experiment, so I eased the throttle back, turned into the dead engine and landed. No sweat.

The model was almost a year old when the drop tanks were added. I made one test before the '77 Nats to find out if they would hit the stabilizer when released. I need not have worried. They come off and tumble down exactly as did the originals. The tanks and pylons add over a half-pound for takeoff, but I can't detect any difference in flight, with or without them.

So if you are looking for a Sport Scale model to get away from the run of P-51s and Corsairs, try a P-38 with drop tanks. Now with a little napalm in the tanks . . . if you can find that judge that gave you a five. . . ●

Mammoth . . . . *Continued from page 31*

When you discover the right combination for you, your aircraft, and the engine, you'll find the difference like night and day. If you look back into the history of aviation, you'll find literally hundreds of blade shapes: scimitar, equal taper, square tips, swept forward, cuffed hubs, slow speed high rpm designs, and vice versa, etc. The biggest advance in propeller-driven aviation came with the controllable pitch prop, because aircraft designers had for years realized that no matter how much you try with a fixed pitch propeller, it's only a compromise. You can put on a cruise propeller or climb (shorter takeoff) propeller, but to get one good feature you have to sacrifice another. You have to have a tremendous change in horsepower to gain much improvement in a model, but only a small change in the propeller can mean a big difference.

When we started work on the Quadra, we were looking for something to drive a 16 to 20 inch propeller, as 18 inches is 1/4-scale and 20 inches is 1/3-scale to a lot of propellers in use on full-sized aircraft. We wanted the aerobatic type aircraft to look and sound realistic, which meant settling for an 8000 rpm figure to best use the available power. We found that 6 inches of pitch was about right to utilize full power, but this meant that the aircraft would be theoretically, limited to a terminal speed of far less than 45 miles an hour *if* the air screw theory were applied. In actual practice, 45 mph is far exceeded! Because of these different theories, various prop manufacturers measure different angles when determining pitch, and some use "effective" pitch equivalents so you might choose the right load for the engine.

There have been tremendous advances in prop design and theory in the last few years, but because of the excitement of jets, these have generally not been noticed by the