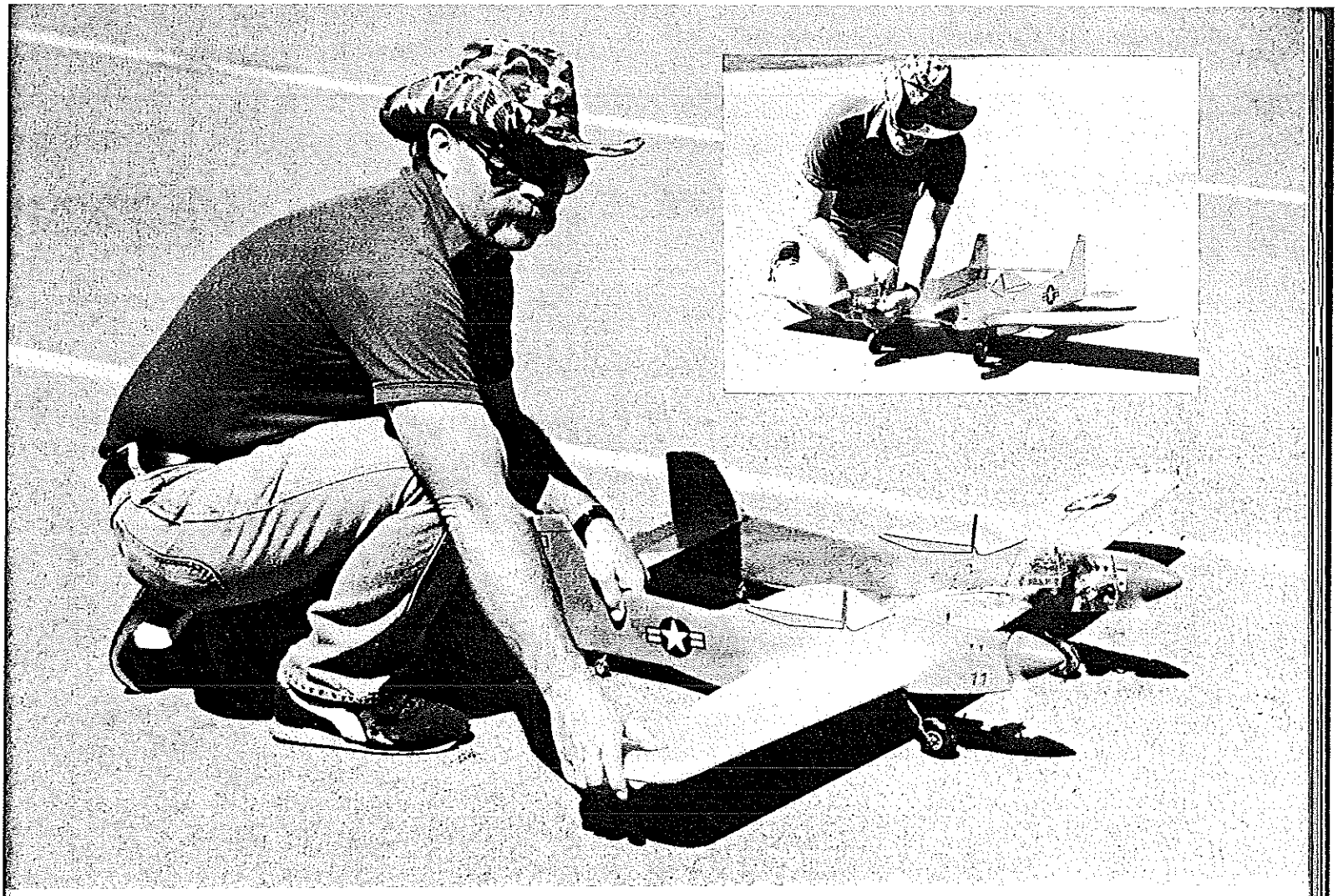


Big picture: The author preparing for launch. To start a diesel, one adjusts the compression to the proper setting, chokes or primes the cylinder, and flips the prop. With practice, you soon get a feel for what's right. Above: Adjusting the compression on the twin MVVS 2.5cc (.15-size) diesels. Needle valve setting and compression adjustments must be worked concurrently to get a proper run. Morrie Leventhal photos.

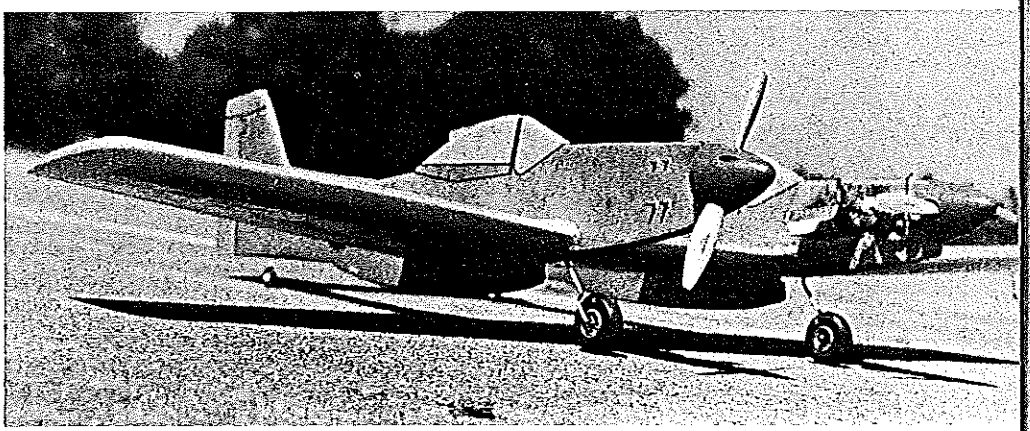
P-82 Twin Mustang

With its twin .15 diesels and dependable handling, this 45-oz., 425-sq.-in. version of a late-WW II twin Mustang gives double value for your building time. Use it as a trainer in twin-engined flying, or go for the heady pleasures of CL sport Stunt. ■Barry Baxter

THIS DESIGN grew out of my desire to try a twin-engine, semiscale CL sport Stunt model. After narrowing down the choices to the World War II P-series, I settled on the P-82 simply because it's easier than the P-38.

The North American P-82 Twin Mustang was developed near the end of World War II as a long-range escort fighter for the Pacific theater. Intended for missions up to 12 hours long, it required a second pilot. Only the outer wing panels and the canopies, both from the P51H, were interchangeable with the Mustang.

Although 500 P-82Bs were ordered initially, the contract was terminated on VJ-Day with only 20 machines completed. Some of the original 20, however, were



The Twin Mustang on the flight line. The wing dihedral keeps the wings level in both upright and inverted flight yet doesn't hinder aerobatic maneuverability. Morrie Leventhal photo.

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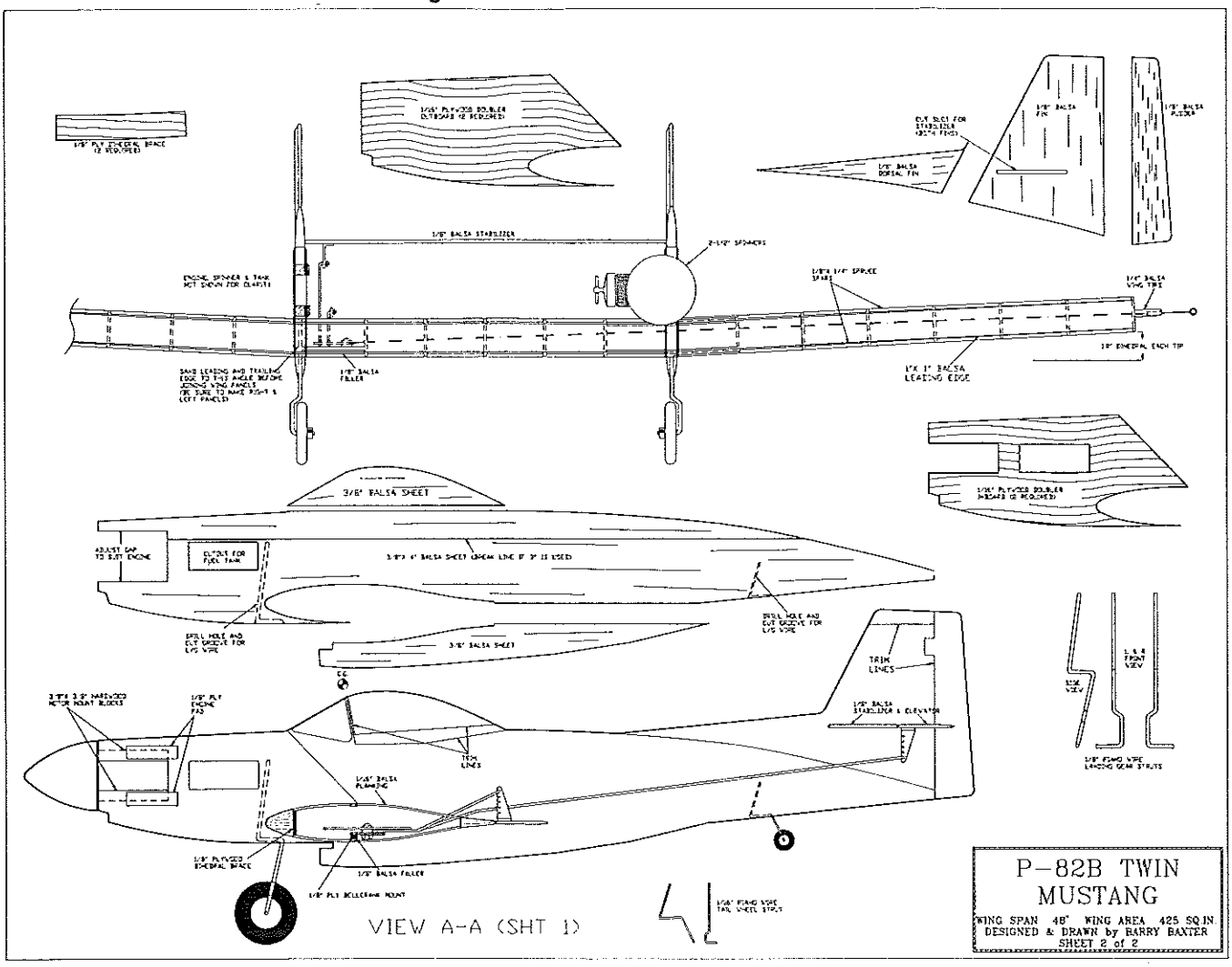
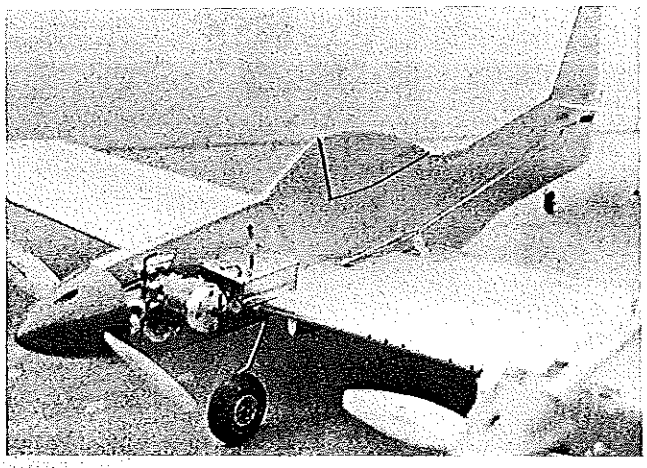


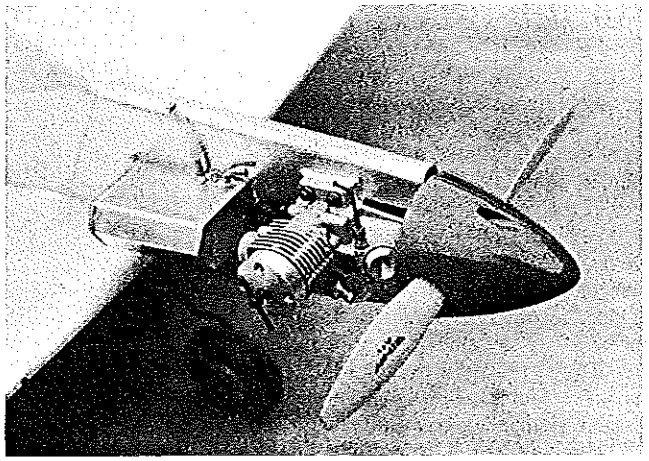
converted to P-82C and P-82D night fighters (differentiated by the type of radar pod installed below the wing center section). Packard Merlin engines were used.

In the fall of 1946, 100 P-82E escort fighters were ordered, together with 100 P-82Fs and 50 P-82Gs as night fighter variants. Allison V-1710 engines changed the power profile. As the only planes in the Air Force fleet with enough range to operate out of Japan, these P-82s saw service in the Korean War, both as fighters and in ground attack roles. Another variant, the F-82, claimed the first kill of the war on June 27, 1950. Removed from operational service in 1953, it was the last of the piston-engined fighters in the Air Force.

A total of 374 planes were produced. The P-82B was 39 ft. 1 in. long and had a wingspan of 51 ft. 3 in. It reached a top speed of 482 mph at 25,100 ft. The F-82 earned—and still holds—the long-distance record for piston-engined fighters by flying from Honolulu to La Guardia Airport nonstop.

Originally I intended to build the Twin Mustang the easy way, by joining two Sterling P-51 kits. A few quick measurements, however, told me that the Sterling kits were smaller and farther off-scale than I wanted. The good Stunting capability that I was after demanded a longer model. My design proved easy and





Left: Close-up of the right fuselage showing details of the engine, fuel tank, and pushrod installations. Note that the tank extends into the fuselage. Right: The MVVS 2.5cc diesel and uniflow fuel tank venting. The modified Smith fuel tanks work efficiently. They're among a variety of Veco-style tanks available from Generic Models. Note the fuel filter, a must for consistent engine runs. Morrie Leventhal photos.

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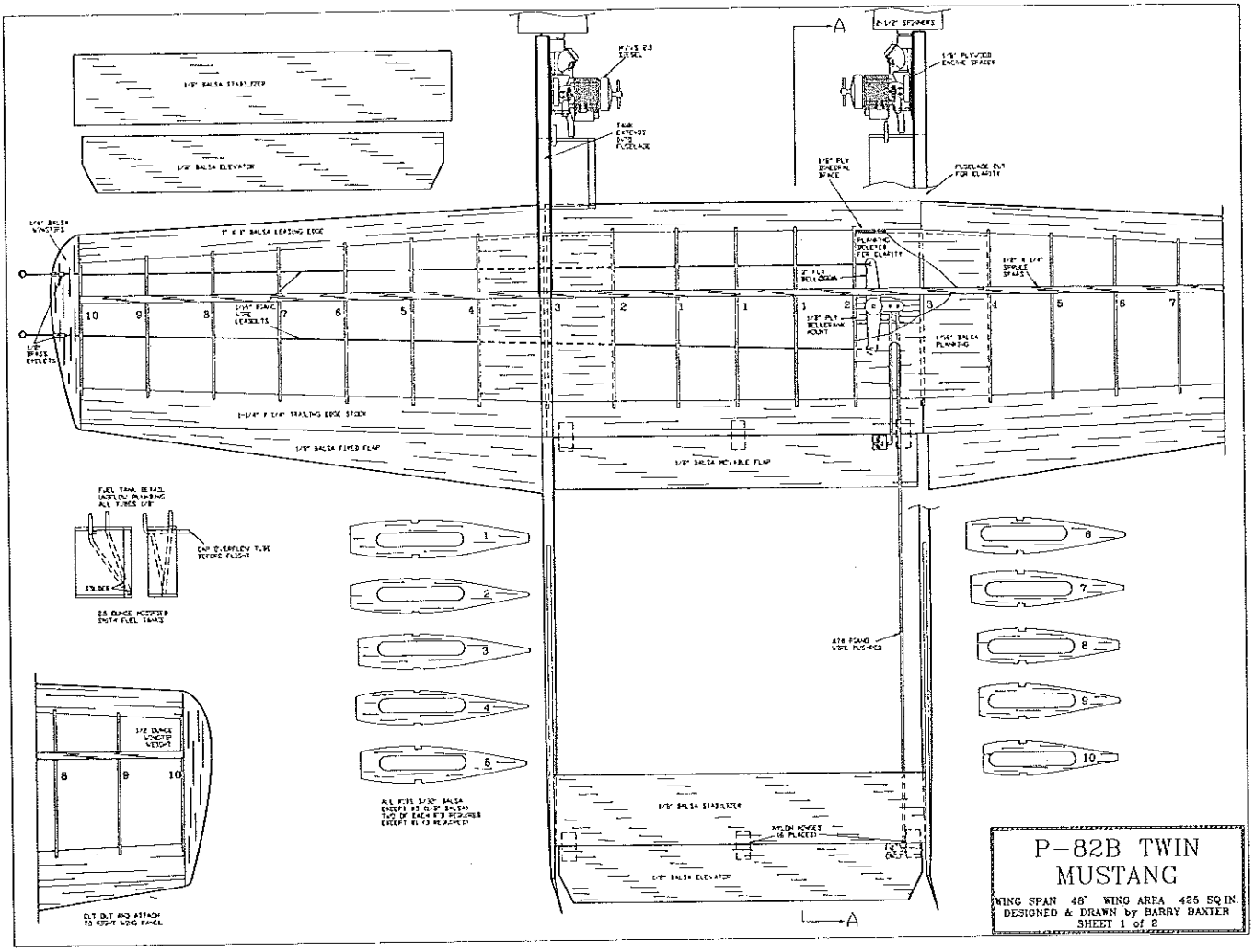

relatively inexpensive to build, and it's a satisfying flier. It also looks more authentic than the Sterling version would have.

Since I had two new MVVS 2.5cc (.15-size) diesels waiting to be broken in, a twin-engined model was exactly right. I had another motive, too. It was time to quiet the skeptics, those folks who insist that getting two diesels to operate simultaneously just can't be done.

It took about a half dozen flights to break the diesels in, and usually only one would still be running after the first few laps. But it was worth the effort. The engines were well synchronized and showed off the Twin Mustang's capabilities. This 45-oz., 425 sq.-in. model performs the entire Stunt pattern with ease—although, because of its high wing loading, square corners are a little wider than I'd like.

The P-82 also makes a wonderful twin-engine trainer. It's a versatile sport Stunter.

Diesel engines are fired by compression heat alone. No glow plugs are used, and the engines can be recognized by a T-bar adjusting screw on the head which varies the compression. The fuel is ether-based and highly volatile. Since diesels tend to have more torque than glow engines, they generally use larger props; the 9 x 6 size isn't uncommon on .15-size engines.

Diesels get extremely good mileage. A sport 2.5cc engine will run over seven minutes on two ounces of fuel at sea level, and much longer at high altitude. In Wyoming, at 5,000 ft. altitude, I've had

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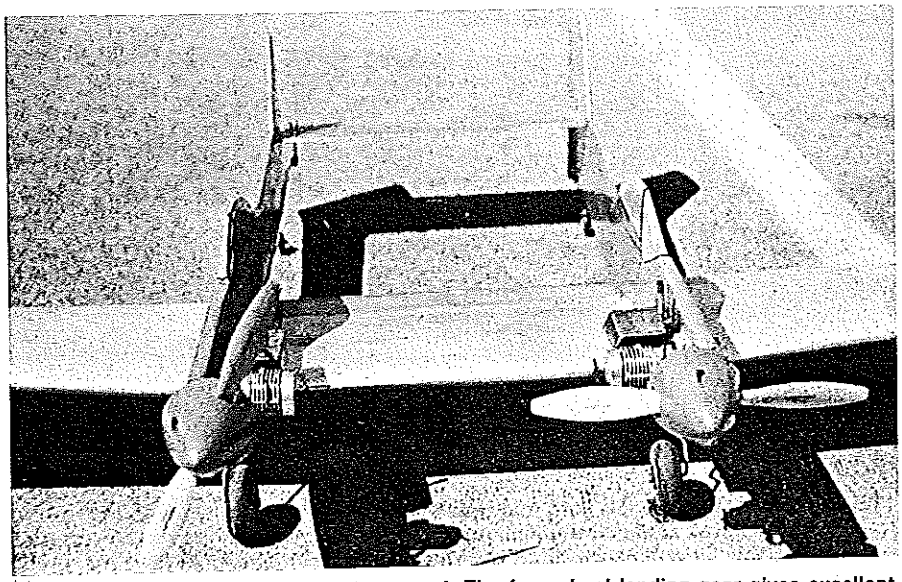
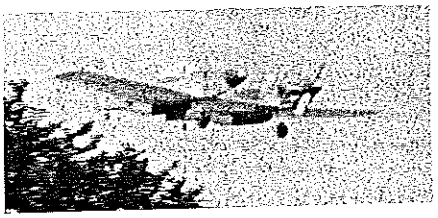


Looking at the model from the business end. The four-wheel landing gear gives excellent ground handling with power on or off, has proved its ruggedness. Morrie Leventhal photo.



Flying on the outboard engine. The P-82 flies beautifully with either engine shut down, but ouboard-engine flight is especially impressive. Morrie Leventhal photo.

Roy Scripps of the Scripps-Howard newspaper chain stepped forward at the last minute. He hired the lake steamer Greater Buffalo and put on a memorable affair.

After-dinner speakers were usually prominent personalities who gave inspirational messages. At one banquet, famed Marine speed and aerobatic airman Al Williams showed himself a polished communicator. Roscoe Turner, on the other hand, just couldn't generate the kind of excitement on the podium that he had no trouble stirring up when he whizzed around the pylons. As he droned on, sweating in his unique uniform, the audience grew inattentive and rude. I still experience some unease when reflecting on Roscoe's faltering efforts to be interesting.

Those were glorious days for aviation and for modeling. The hobby was becoming better known all the time. Many general interest publications found model events newsworthy. One edition of the *Detroit Times* gave the 1936 Nationals exceptional coverage. My copy is yellow and tattered. Big, beautiful pictures of contestants and their models take up the first two pages, and an action picture of Ben Shereshaw's mammoth twin-boom gas-powered pusher model aloft dominates the third. It shows the model heading straight for a tall man and a portly woman. The woman is fleeing, and a fence, house, and barn loom just beyond. I don't know how it turned out.

The Academy, by the way, was founded that same year (1936). It's always possible that the *Detroit Times* picture influenced the organizers to think about flying site selection, crowd control, and liability insurance as key long-term issues. □

P-82 Mustang/Baxter

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that two ounces last for over 15 minutes.

To start a diesel engine, simply adjust the compression to the proper setting, choke or prime the cylinder, and flip the prop. This requires some practice, but you soon develop a feel for it. You must work the needle valve setting and compression adjustments concurrently to get a proper run. Again, practice makes perfect. If the engine sounds as though it's laboring hard, it's probably overcompressed; if it's burping like a World War I rotary engine, it's undercompressed. Whether rich or lean, runs sound about the same as they do with a glow engine.

The biggest problem with twin diesels is the weight of the running gear. The MVVSs weigh 6¾ oz. each, and the additional tank, prop, and spinner bring the entire gear load up to 18 ounces. That's very heavy for what is basically a .30-powered airplane; two Fox .35s would have given me the same weight penalty. (Of course, the .35s require ½-in. balsa for the fuselage and even larger fuel tanks, so they'd have weighed the plane down still more. But in compensation I'd have had a .70-powered model.)

I've had good luck with the MVVS diesels. They start quite easily and give consistent runs with lots of power. Though they come with two venturis and a crankcase pressure fitting, I've never used any of the higher-power setups. I've used the MVVSs in 80-mph Combat models with about 360 sq. in. of wing area; with the same fuel tank setup as in the P-82 and turning 8 x 6 Taipan props, they'll easily attain maximum speed.

I use 8½ x 6½ Rev-Up props on the P-82 primarily because I have several on hand. They've worked quite well, but since I haven't experimented with anything else I have no idea whether they're optimal. Although the sound is a little big for .15s, the two engines work synergistically to produce the power of a .30, and you run more pitch than is usual with a single engine to gain the power advantage of the twin setup. In all other respects, performance is essentially like that of a single engine. The MVVS diesels are available for approximately $85 from Carlson Engine Imports, 814 East Marconi Ave., Phoenix, AZ 85022.

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P-82 Mustang/Baxter

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Any engines in the .15-to-.25 range will power the Twin Mustang abundantly. If you went to a .35 size, performance would be much less forgiving when one of the engines quit. In multiengine flight, the pilot needs to be on guard against the minimum controllable airspeed (V_{mc}), or the low speed at which the plane is no longer controllable with one engine running at full power. If speed is allowed to drop to the V_{mc}, the engine will overpower the rudder, causing the plane to yaw uncontrollably and usually to snap roll inverted. Logically enough, the more powerful the engines, the greater the minimum controllable airspeed—that is, the faster the model will have to be traveling to maintain stable single-engine flight.

Single-engine operation has been quite successful with the .15-powered Mustang. On the outboard engine, the model will even loop; but don't exceed 45 degrees, since the lines get a little slack after that point. Diving a bit to build up speed is also helpful. Be careful about keeping up your airspeed; even with the .15s, V_{mc} can be exceeded. I learned about that while doing a loop on the outboard engine. The Mustang surprised me with a half snap roll to the upright position and cut across the circle.

The model actually flies better on the outboard engine than on the inboard one. It yaws out too much on the inboard engine, which slows it down excessively. On the other hand, this makes it easier to perform touch-and-go landings. The plane can be brought in for a landing, taxied for several laps, then slowed to about 10 mph by maintaining *down* elevator. Controls can then be neutralized to increase speed so that the model can again lift off.

I often mix my own fuel, following the same formula used in Red Max Fuel (available from FHS Supply, Inc., P.O. Box 9, 239 Bethel Church Rd., Clover, SC 29710; Tel. 800/222-7488). My brew consists of 35% ether, 20% castor oil, 2% amyl nitrate, and 43% kerosene. I've had great luck with this recipe since I began operating diesels in 1959.

By shifting the lead-outs to the vertical center-of-gravity, the wing dihedral keeps the wings level in both upright and inverted flight. In contrast, because their lead-outs aren't in alignment with the center-of-gravity, low-wing models tilt their wings downward in upright flight. The dihedral enhances scale appearance and doesn't hinder aerobatic maneuverability.

I used Hot Stuff UFO glue throughout. Available from Satellite City (P.O. Box 836, Simi Valley, CA 93062), this product doesn't smell up the place the way most CyA adhesives do (until you hit it with kicker, that is). It also works well on foam. Hot Stuff has relieved my sinus problems quite a bit. Now it's just balsa dust that I have to contend with.

Construction. It's easiest to begin by creating a kit of parts. The prototype fuselage halves were cut out of ⅜ x 4-in. balsa planks. An alternate joining line for use with 3-in. stock is shown on the plans.

Wing. Cut the right wing tip as indicated on the plan. Join it to the right panel. Lay the lower spar on the plan, and assemble the center wing section. Sand an angle in the leading and trailing edges of the outboard panels as shown in the plan front view. Assemble the panels over the plan, but don't glue on the spar.

Use a dihedral support to raise the tips one inch while gluing in the dihedral brace. Glue the dihedral brace to the leading edges, then glue the leading and trailing edges together. Finish installing the upper and lower spars. Keep them in one piece, and make sure there are no warps in the wing. The spars will easily bend around the slight curve at the dihedral break.

Install the wing tips and then the control system components. Tie the pushrods together to keep them from flopping around while you're working on the rest of the model. Plank the wing, and set it

aside.

Fuselage. Make sure you've cut out both a right side and a left. Assemble all the balsa parts including the doublers and engine mounts. Maintain a solid doubler on the outboard side of the fuselage by using plywood shims for the engine. These will prevent the case from extending through the fuselage. Don't install the belly scoop at this point.

Assemble the rudder, and attach it to the fuselage. Sand the fuselage sides to shape, then fair in the rudder. Glue the sides to the wing, and install the stabilizer through the slots in the fins. Make sure everything is square.

Hinge the center flap and elevator, taking care to keep glue out of the hinge line. I used standard nylon hinges with pins. Install the control horns. Connect the pushrods. Adjust the travel to equal amounts of Up and Down; make sure the flaps and elevators are at the neutral position together.

I gave the flaps about 20 degrees of travel and used 40 degrees for the elevator. Though it's been the subject of much debate, that ratio works for me. Additional flap travel could slow the model to its dreaded V_{mc} threshold. Still, you're welcome to try a different ratio (1:1, for instance), as long as you don't tilt the balance in the other direction. If you allowed more flap than elevator travel, you'd be courting disaster.

Install the bottom scoop and the outboard fixed flaps. Glue the landing gear into the prepared holes and notches. This is a rugged gear. It even survived the harsh finale to that unplanned half snap roll when the model slowed down too much on the outboard engine.

Covering and finishing. Give the structure a thorough sanding, and you're ready for covering and finishing. I covered the prototype in aluminum MonoKote and painted it with Formula U Flight Silver. Be sure the silver is clear-coated. Otherwise it's guaranteed to come off and make a sorry mess. I used Black Baron clear—the second time around. The trim lines were done with tape.

Be extremely selective about covering materials if you're using diesel power; many of the plastic iron-ons will shrivel up after a few weeks' exposure to diesel fuel and exhaust. The only materials I can recommend at this point are MonoKote and colored Micafilm. Paint is acceptable, except for the aforementioned silver—and that stuff comes off even with no fuel around.

The prototype uses modified Smith fuel tanks with uniflow venting, available from Generic Models, 521 Jansen Ave., San Dimas, CA 91773. Generic makes a variety of Veco-style tanks with standard or uniflow venting. Mounting the tanks required moving the stock plumbing to clear the fuselage. Glue them into the slots in the fuselage with UFO.

With uniflow venting, the vent is submerged in the fuel so that a vacuum builds up above the fuel and reduces head pressure in the tank. As the engine leans out, the model picks up speed and more air is rammed into the tank. Fuel head pressure and fuel flow increase, richening the mixture and slowing the plane down. Apparently the theory is a sound one, because these tanks work efficiently.

Check the balance point. The center-of-gravity should either match that shown on the plans or be within ½ in. forward of it. Adjust the balance as necessary by adding weight to the appropriate end. The prototype balanced without added weight.

Flying. Starting the left engine first prevents your getting your hand in the running engine while trying to flip the other prop. Since this airplane performs better on the outboard engine alone than on the unaided inboard engine, it's no problem if the inboard engine quits first.

A predictable flier, the P-82 does extremely well on two engines—and with .15s, there are no surprises when one engine quits. As noted earlier, however, airspeed becomes more critical on one engine. If you want to do single-engined aerobatics, make sure you've built up enough speed to complete a given maneuver. Novice fliers had best not attempt this.

The P-38 Mustang gives you the flexibility of two planes in one. Use it to learn the characteristics of twin-engine models, then move on to the sheer exhilaration of Control Line sport Stunting. Or skip the trainer step entirely, and enjoy the model for its full aerobatics capabilities. The choice is yours. □