The JETSTER

2C04

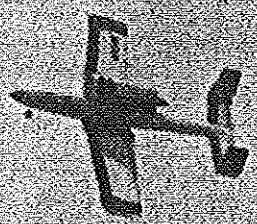
Developed from scratch on M.A.'s assignment, this airplane is designed for the Pattern/Sport flier as a relatively easy way to try ducted fan power. Is it maneuverable – or a flying brick? How does knife-edge flight grab you? By Dick Sarpolus

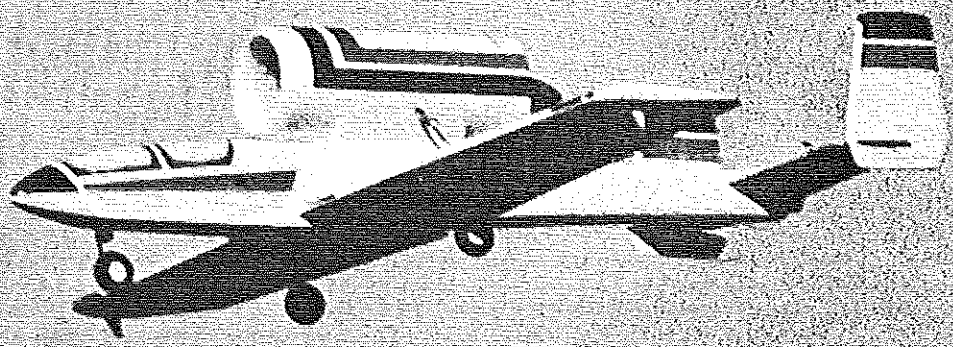
IT IS apparent that practical ducted fan power units are now available for the modeler who wishes to simulate jet powered flight. Most of the pioneering effort has been done by scale modelers looking for realistic jet aircraft projects. The Jetster was designed for the pattern and/or sports flier as a relatively easy way to try ducted fan power systems. I wanted to see if such a system was suitable for a non-scale, fun flying aircraft. This model has been flown from grass fields and in windy weather. It has an effective muffler and it does fly very well. There is no denying the extra complexity of a duct ed fan, but they do work. Ducted fans are not performance is good and you can have that jet age appearance. New Berkeley (a long gone kit manufacturer) had ducted fan kits on the market back in the 1950's. As I recall, the fan was simply stamped from sheet aluminum with twisted blades, intended for use on .049 engines. The aircraft structures were stick and tissue for light weight and the models were flown as free flights. Over the years many ducted fan projects have appeared in the magazines with a wide variety of fan and duct designs, structures usually aimed for light weight as very little fan thrust was available.

Jim Scozzafava brought out his Scozzi unit several years ago; this unit has been taken over by Jet Hangar Models. A well-known manufacturer, Midwest Products, is offering the Axiflo fan kit as designed by Bob Kress. (Editor: World Engines has developed an excellent unit, but has not introduced it.) The Scozzi fan has been well demonstrated by Bob Violett of pylon racing fame in his A-4 Skyhawk, which has placed highly in many scale contests and is available as a kit. Midwest is also producing a scale kit for their Axiflo fan, the Heinkel He 162, as designed by well-known stand-off scale modeler Nick Ziroli. I would not presume to say either unit was better. I have only used the Axiflo fan on this model and will, of course, comment on my experience with it.

The basic design aims of the Jetster were to get a ducted fan model with good aerobatic flying capability, relatively easy to build, and a fan installation which would be uncomplicated and accessible. Also desired was a modern jet styled appearance. Wing area was configured at 615 sq. in., typical for a .40 powered pattern model. Airfoil is 16% thick, a semi-symmetrical section for more lift, easier landings. Wing planform has a straight trailing edge and swept back leading edge. Foam core construction and strip ailerons are used for ease of assembly.

Fuselage design is a compromise. Low wing configuration is used for pattern flying performance and the





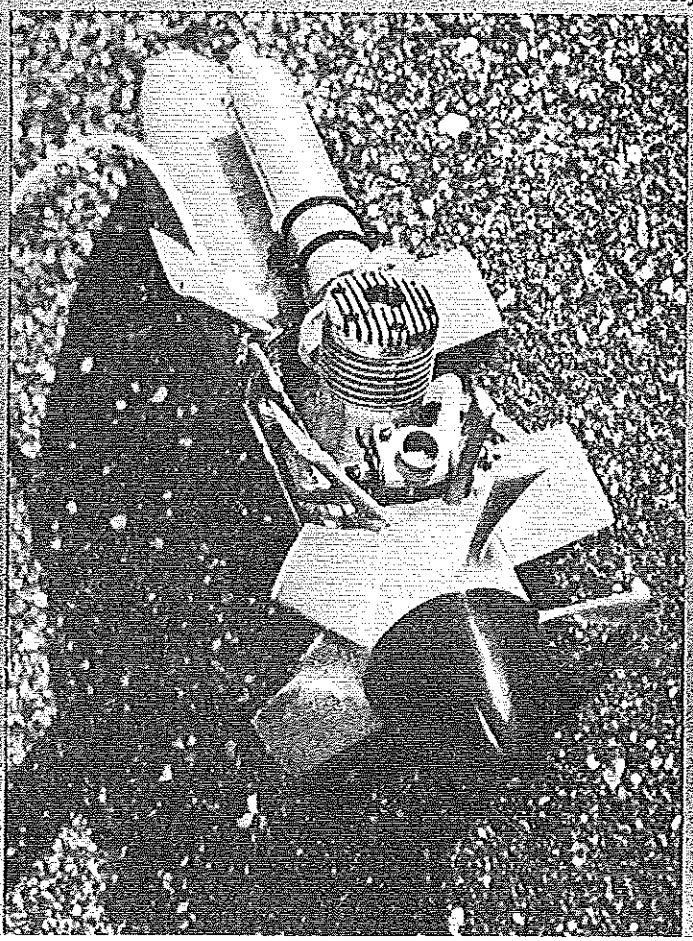
Caught during low pass for the camera, the ship displays its simple configuration—light on its feet, responsive and pleasant to fly. Right: One of a sequence of shots taken at a distance and greatly enlarged, shows the Jetster during run-through of the complete aerobatic pattern. No one claims it matches a Phoenix or Dirty Birdy, but it has a surprising turn of performance.

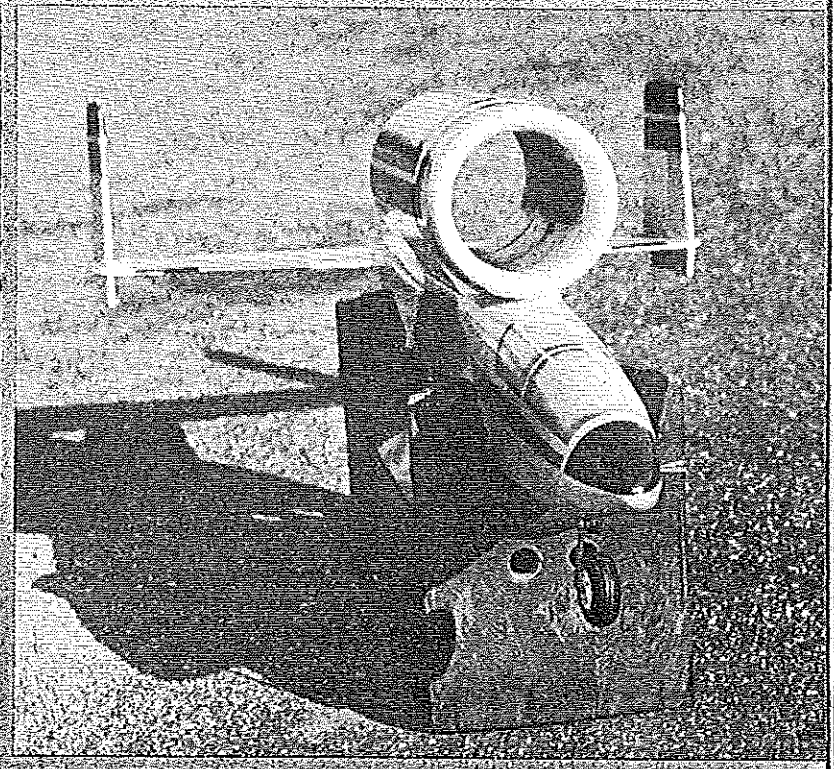
usual tricycle landing gear installation. It was decided to locate the fan unit atop the fuselage, a la Heinkel, for simplicity. A bulky fuselage with internal fan would be too time-consuming to build, and would have resulted in a large fuselage. The fan unit is located above the wing; because of the engine weight, the tail moment was made short and the nose fairly long to get the aircraft to balance properly. The prototype required about six to eight ounces added weight in the nose—I now feel the wing could be located one inch toward the rear and/or the fan unit moved one inch forward to ease the balance situation. Light tail end construction also helps.

The prototype weighs 7½ pounds, a little heavier than desired, due to the balance weight and a heavy paint finish. There is, of course, some weight penalty due to the ducted-fan assembly itself and the associated structure to accommodate it; but overall it's not bad and can still result in a practical, good flying model.

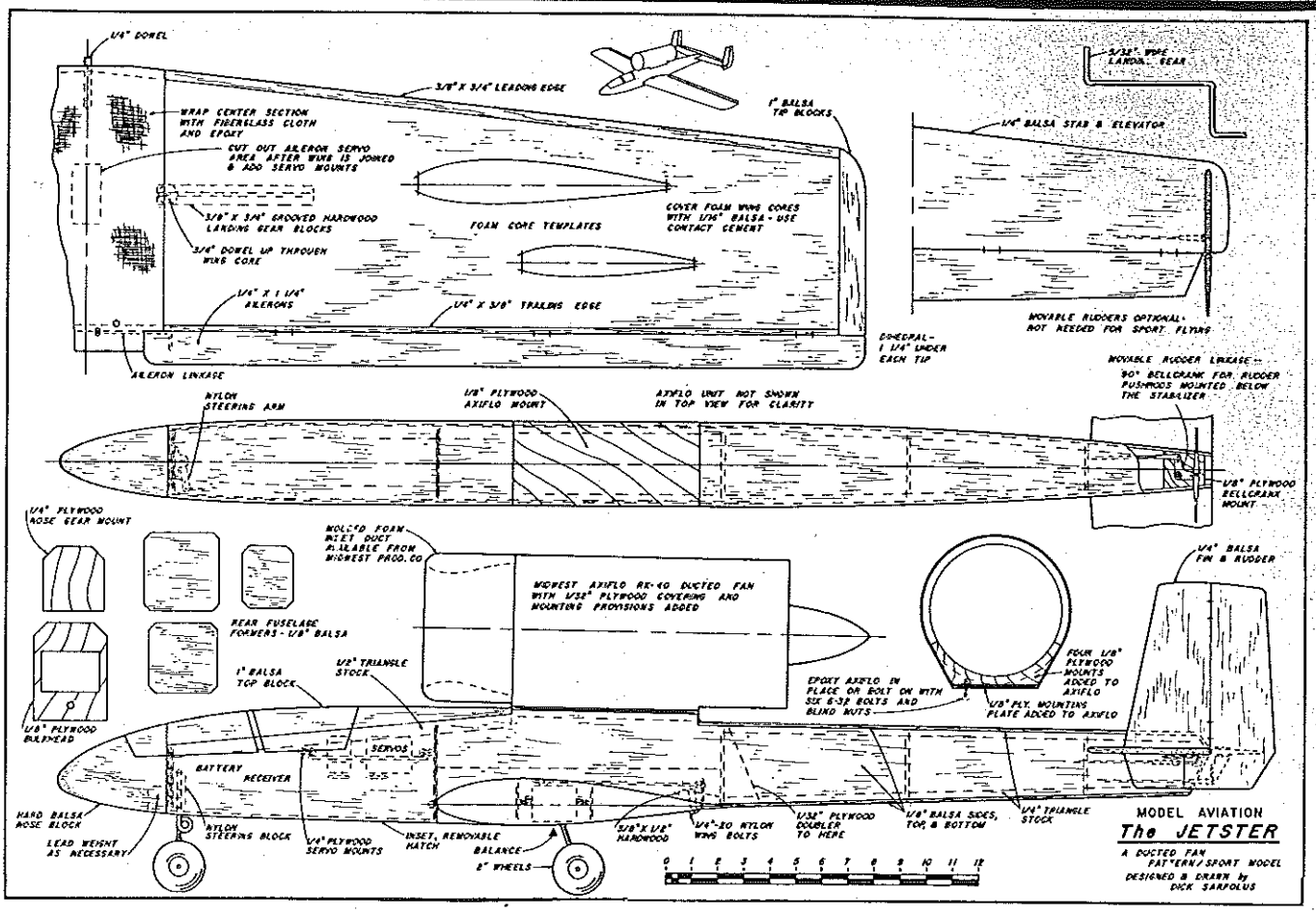
Tail assembly is simply ¼ sheet balsa; the twin rudders were used only for jet styling and a single fin and rudder could certainly be used if desired. The twin rudder linkage is external for simplicity and could be omitted with the rudders fixed in place for strictly sport flying.

The actual power pod installation, al-

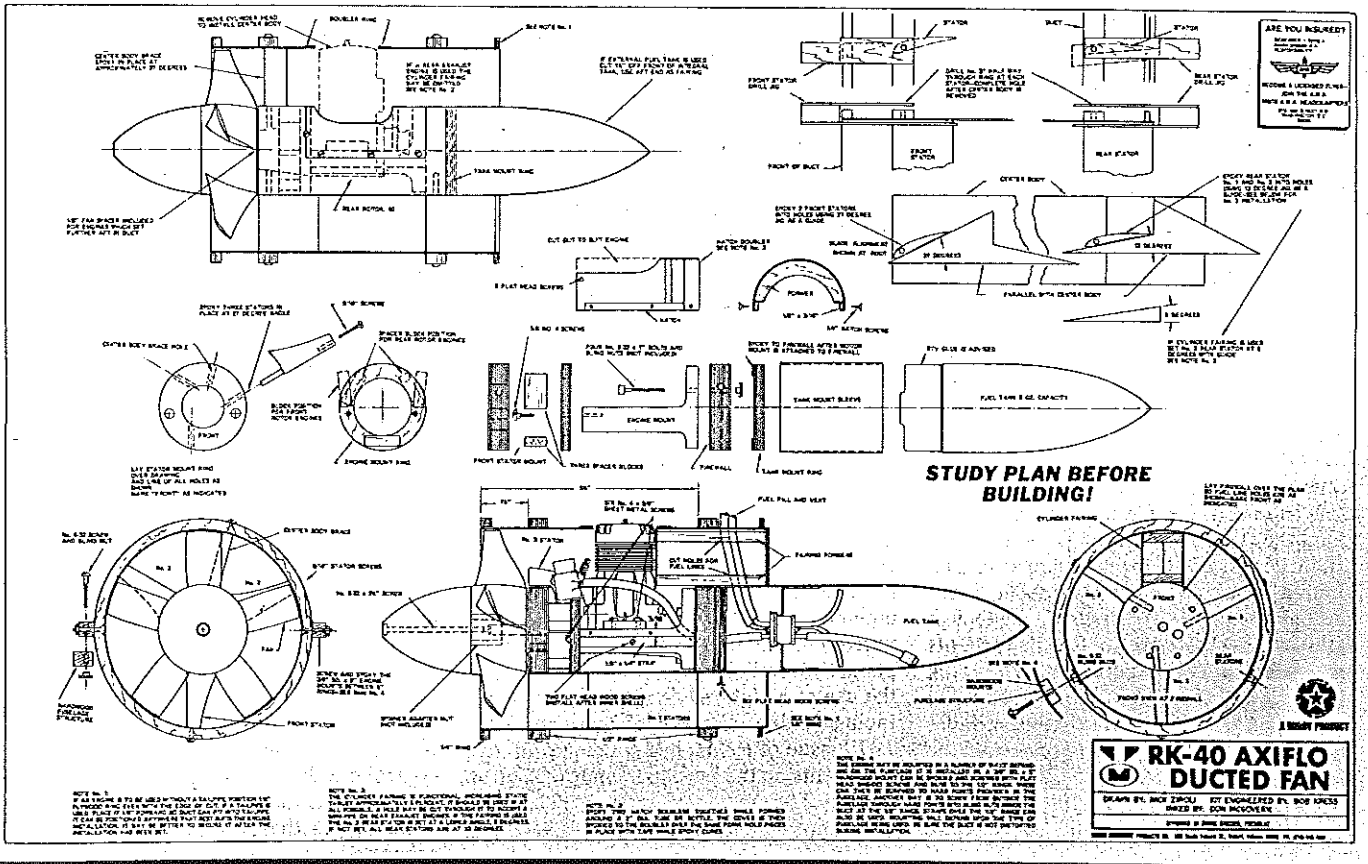




Left: The complete power pod consisting of the Midwest Axiflo ducted fan unit, and well-muffled K&B 40. Pod installation in this ship is uncomplicated and accessible. Right: On the field box but with power unit removed to show the duct internal configuration—compare to drawings.



The drawing below is a reduction of the larger drawing which comes with Midwest's Axiflo kit.



Dick and the propless bird. Was the pic taken before or after flight? If after, the wide grin is understandable. If before, he must have been optimistic—that's understandable, too.

though straightforward, took considerable planning. Midwest's Axiflo plans suggest several mounting arrangements, but none for an external pod mount. The added bottom saddle pieces combined with the 1/32 plywood outer skin make up an easy pod construction. Bob Kress wrote an extensive series on fans and duct design (see *RCM* Magazine 10/77, 11/77, 4/78, and 5/78) and the Midwest molded foam inlet duct was used. A tailpipe extension was also added to the basic Axiflo unit. The power unit was designed to be removable from the aircraft for easier servicing and adjustment. The fuel tank is completely within the fan unit, so no fuselage tank installation, pump, etc., are required. The throttle control cable loops out the back of the fan unit and into the fuselage for connection to the throttle servo.

A discussion on the muffler configuration may be worthwhile here. In much of what I have read on ducted-fan operation, high rpm are stressed for good performance; mufflers usually don't go with high rpm running. A tuned pipe can't be used here as it would be much longer than the whole power pod. I wanted a muffler for several reasons; obviously, for a reasonable noise level operation, also for reliable idle running, and to provide slight pressure for connection to the fuel tank for steady running. A good friend heli-arced an engine exhaust adapter and machined an expansion chamber which is coupled to the adapter with silicon tubing. The exhaust outlet can be easily changed in size to suit anyone's desires, and the result is an effective muffler. I'm sure it is holding back some engine power, but for the other benefits, I will sacrifice some performance; I don't want to run at 20,000 plus rpm for sport flying activity anyway. The Axiflo unit seems to be versatile; based on the designer's advice and test results, sport 40 RC engines can be used for reasonable performance due to the unit's efficiency, and the hotter 40's will give even more thrust. The Axiflo is designed to accept just about any 40–45 engine of any intake/exhaust configuration; the performance choice will be up to the user.

If anyone is interested in the muffler setup I used, you may contact Russell Zuback, 435 Raritan St., South Amboy, NJ 08879. He will make them up for sale at a reasonable price, to your specifications.

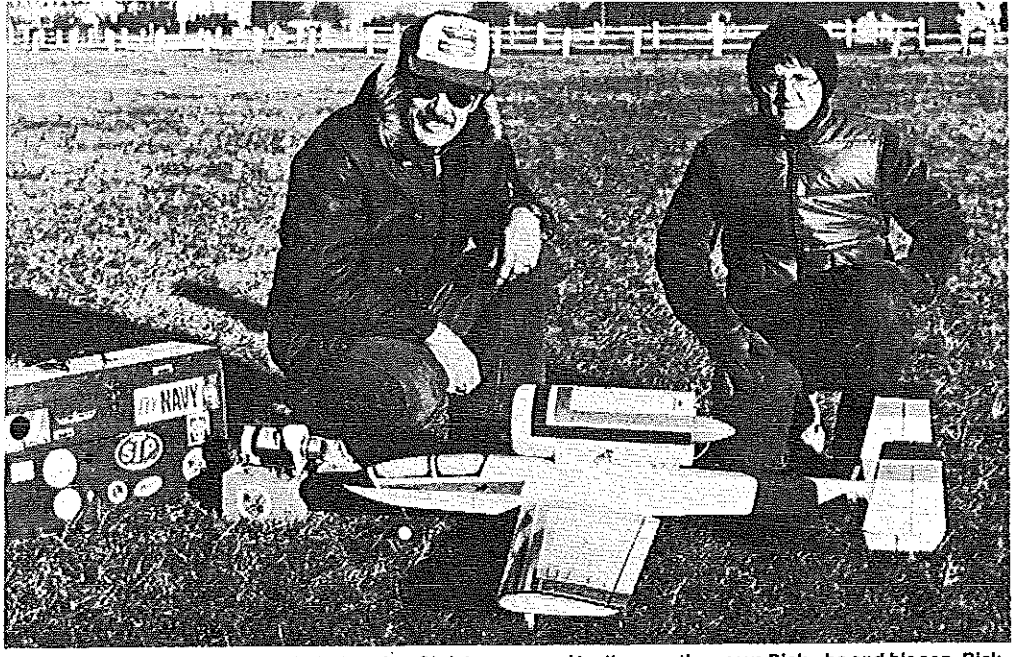
Before getting to the airframe construction, I will comment on the Axiflo's building. The Axiflo is a kit, and considerable assembly work is required. Assembly is not hard as the unit is well prefabricated; but care must be taken for correct alignment of all parts. I found the parts to be well machined, and the jigs and fixtures provided do work correctly. The resulting unit has two sets of fixed stators behind the 5-in. fan; these stators are airfoiled, twisted, and mounted at different angles to do their job; they also serve to mount the whole engine unit in the outer tube. The Axiflo's plans and assembly instructions are complete, and for even more coverage beyond the scope of this article, I refer you to Bob Aberle's review of the Axiflo assembly in the Jan. 1978 issue of *Flying Models* Magazine.

Several items on the fan unit necessary for operation in this aircraft are not covered in the Axiflo kit. Needed is a method of adjusting the needle valve from outside the unit. I used the head of a 6–32 Allen-head bolt and some brass tubing to solder this to the Perry carburetor's needle valve. For an adjusting tool, I soldered a section of an Allen wrench into a 4-in. piece of brass tubing; this tool can be inserted through a hole in the duct wall, into the end of the needle valve, used to adjust the engine, and then withdrawn. Works like a charm.

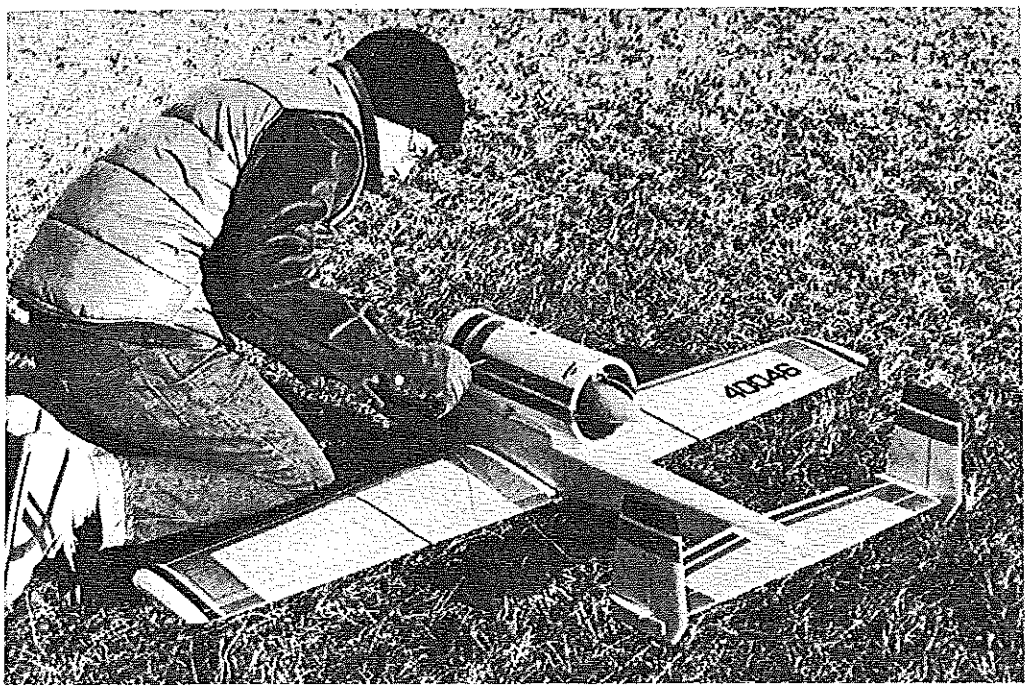
Another item is the fuel tank. Since it is not accessible from outside the completed unit, provision must be made to fill and drain the tank. The feed line to the engine is permanently attached before the fan unit is assembled; I used a fuel filter in that line and also used Delp's wire tubing clamps on all the internal fuel line connections to the fuel tank. Three lines were brought outside the unit, through a hole near the mounting pad on one side. Two lines from the two tank vents and one from the muffler pressure tap. The two lines from the tank are used to fill and drain the tank, and when running, one of those is plugged and the other connected with a U-bend of brass tubing to the muffler pressure line. Although the tubing outside the unit doesn't look great, it works fine.

One other thing. The glow plug must be removed when installing or removing the engine/fan assembly, but the cylinder head can be left on, contrary to the Axiflo instructions. This permits only a small hole in the outer shell, for plug installation and battery connection.

With the molded-foam inlet duct, the spinner on the fan is close enough to the



On a very cold and windy day-after-Christmas—usual testing weather, says Dick—he and his son, Rick, pose with the machine just before its first flight. Flight shots were taken by Rick with a 200mm telephoto, the ship quite far away.



Rick adjusts the needle valve with special tool. Near it, on top of pod, may be seen small hole for glow plug connection. Close inspection will reveal muffler exhaust pipe, fuel tank protruding, throttle cable looping out and into fuselage for throttle servo. Spinner is close enough for easy electric starting.

inlet opening to allow use of a standard Sullivan electric starter. If it is necessary to prime the engine, a piece of tubing can be used to reach the carburetor opening. I found the Axiflo unit to run smoothly with very little vibration, no more than an engine running on a conventional propeller. I had no trouble with any bolts loosening, although at this writing there are not too many flights on the aircraft. I did experience the fuel tank loosening and spinning in its mount, cutting off the fuel. Roughen up the mating surfaces and use plenty of silicon rubber to hold the tank in place.

The engine I used was the K&B 6.5 (.40), Schnuerle-ported front-rotor version. I have had some experience with this engine, using two of them on my Magnum .80 pattern twin, and have found them to be tremendously powerful. On the twin, with Missile Mist fuel (25% nitro) and 10–6 Zinger props, I set them at 15,000 rpm. International Products tuned pipes are used with my own adapters to the engines. I have not checked the Axiflo speed with a tachometer, so can't report on the rpm's being tuned, but the thrust produced is good; the plane flies well. For anyone contemplating the use of a high-revving Schnuerle-ported racing engine, Clarence Lee in the Feb. 1979 issue of *RCM*, had some informative comments on the life expectancy of such an engine. The horsepower levels being produced are high, and under this type of use, engine life is not long. If you want the utmost in performance, you must be ready to pay the price—in connecting rods and other assorted engine parts. This is true for any brand of engine. K&B has announced a new 7.5 (.45) engine, designed for ducted fan use, with such features as a Perry fuel pump and a machined, stronger connecting rod. I have not seen one yet, but it would appear to be a good choice for top ducted fan performance.

Construction comments can be brief as this airframe is easy to build. The wing is foam-core construction; if you can't get a foam core cut in your area, I would recommend Control Specialties Co., 205 Wood Ave., Middlesex, NJ 08846, as a source for very well done wing cores. The grooved hardwood landing gear blocks are available commercially and are epoxied into the foam; 3/4-in. dowel pieces epoxied at each end of the block extending to the top surface add strength. The wing skins are 1/16 sheet balsa, edge-glued to get the necessary width from 3-in. or 4-in. wide sheets. I use Goldberg's Blue Goo contact cement; if you use any contact cement not specifically recommended for foam wing covering be sure to try it first on a scrap piece of foam, or disaster may result. I prefer to skin the cores first, then block sand the leading and trailing edges, adding the balsa and shaping to the airfoil. Strip aileron linkages are added, wing tip blocks added and shaped, wing halves joined and the center section reinforced with fiberglass cloth and epoxy.

The fuselage is a pretty basic box-style construction; 1/8 sheet balsa sides with 1/16 plywood nose doublers are made up first, with the triangle stock along the edges, then the side assemblies are joined with the bulkheads. The nose block and top forward block are epoxied in place, the plywood Axiflo mount added, and the rear fuselage top and bottom planking added. The triangle stock in the corners and the top block permit the fuselage to be carved and sanded to shape. The servos, receiver, and batteries will be mounted ahead of the wing for balance, accessible through the bottom fuselage hatch.

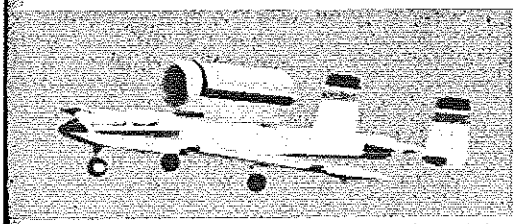
The tail surfaces are simply 1/4 sheet balsa, cut and sanded to shape. The movable rudders, if desired, require additional linkage as shown on the plans. With a built-up horizontal stab, this linkage could be enclosed within the stab; I used the simpler alternative of external linkage beneath the surfaces.

Construction of the basic Axiflo unit is well covered in Midwest's assembly instructions. After it is built according to those instructions, the mounting provisions are added, also the molded-foam inlet duct and the tailpipe extension. If the unit is to be bolted in place, be sure to add the blind-nuts to the mounting base before the 1/32 plywood covering is added to complete the unit. Looping the throttle flexible cable control out the back of the Axiflo, into the fuselage and forward to the throttle servo seems to be the best way to keep things separated.

I assemble the entire airplane, with all

The familiar test with nose held high to check needle valve setting. While the low wing is a basic pattern design, it bears resemblance to Heinkel He162 with engine pod above the fuselage, and to Air Force A-10, but with one engine. Since prop clearance is not a problem, landing gear is short.

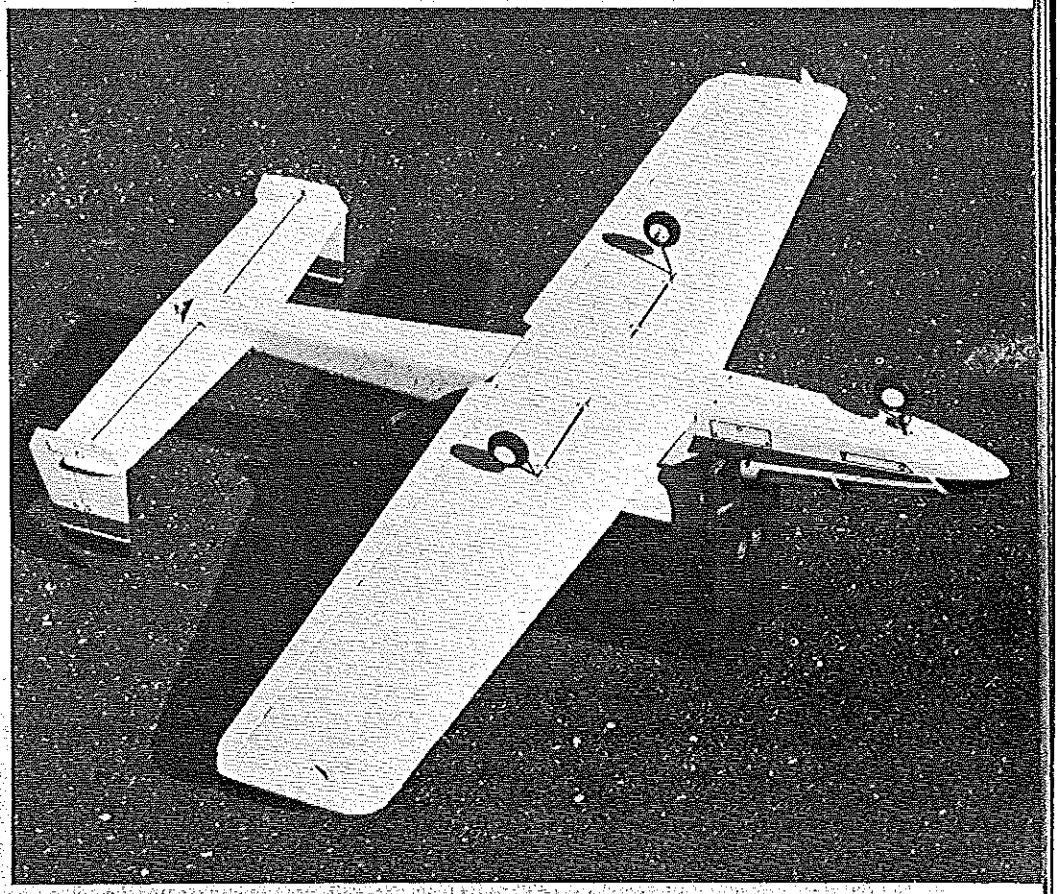
Rick works the sticks while dad checks out control responses with engine running before the first flight. The stubble flying surface wasn't given a second thought—plenty of thrust.



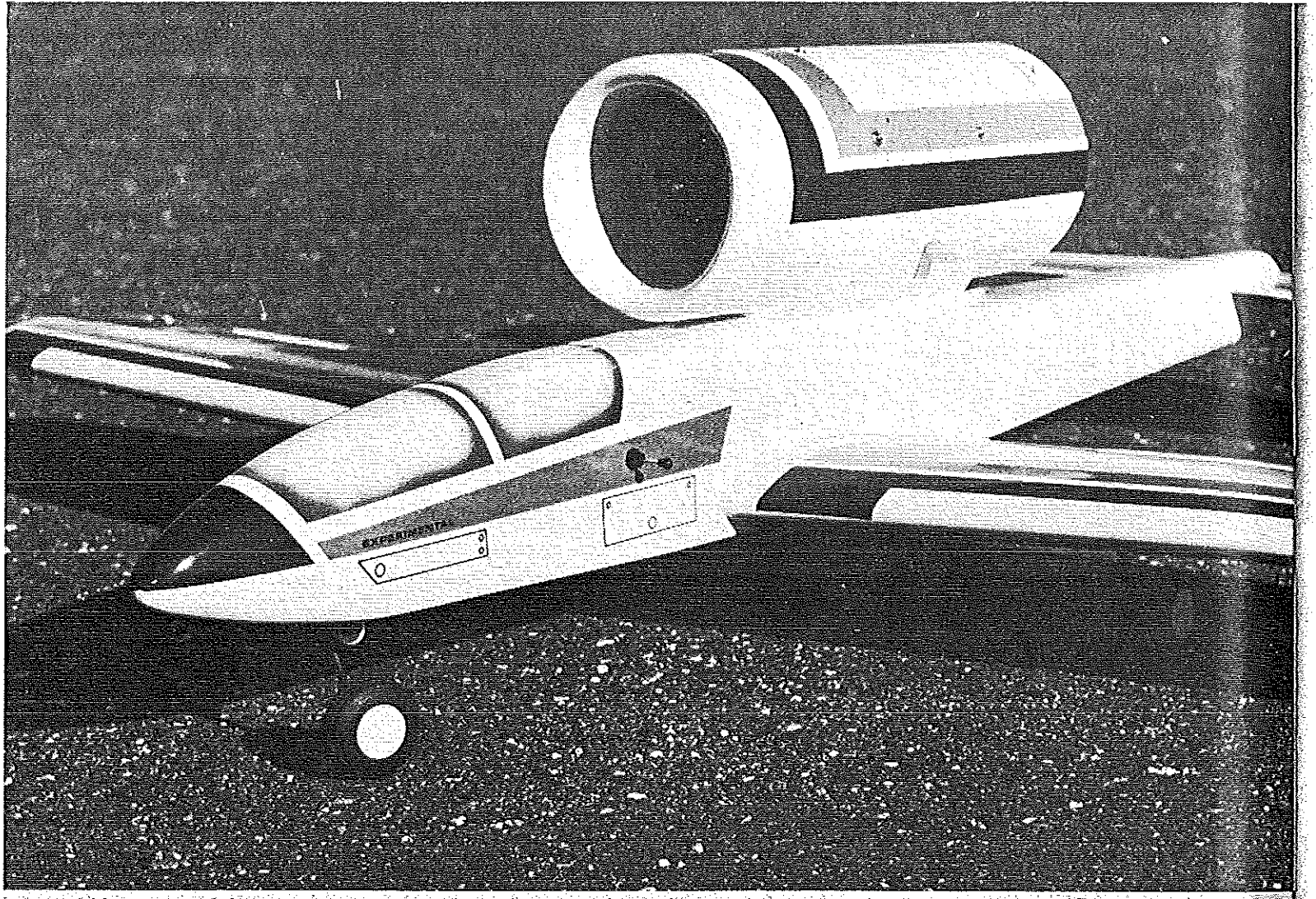
hinges, horns, linkages, etc., before doing any painting or covering work to be sure everything is set up correctly. Silkspun Coverite was used on the wing and K&B Superpoxy primer on the fuselage and tail surfaces to fill the grain. The model was finished with Sig butyrate dope, canopy area airbrushed, panel lines inked on with a No. 3 drafting pen, and three coats of clear dope applied for protection and gloss.

If you have questions on model designs for use with ducted fans and operation of the fans, I suggest you write Bob Kress, who has been most helpful concerning his Axiflo designs. His address is: Kress Technology, Inc., 27 Mill Road, Lloyd Harbor, NY 11743.

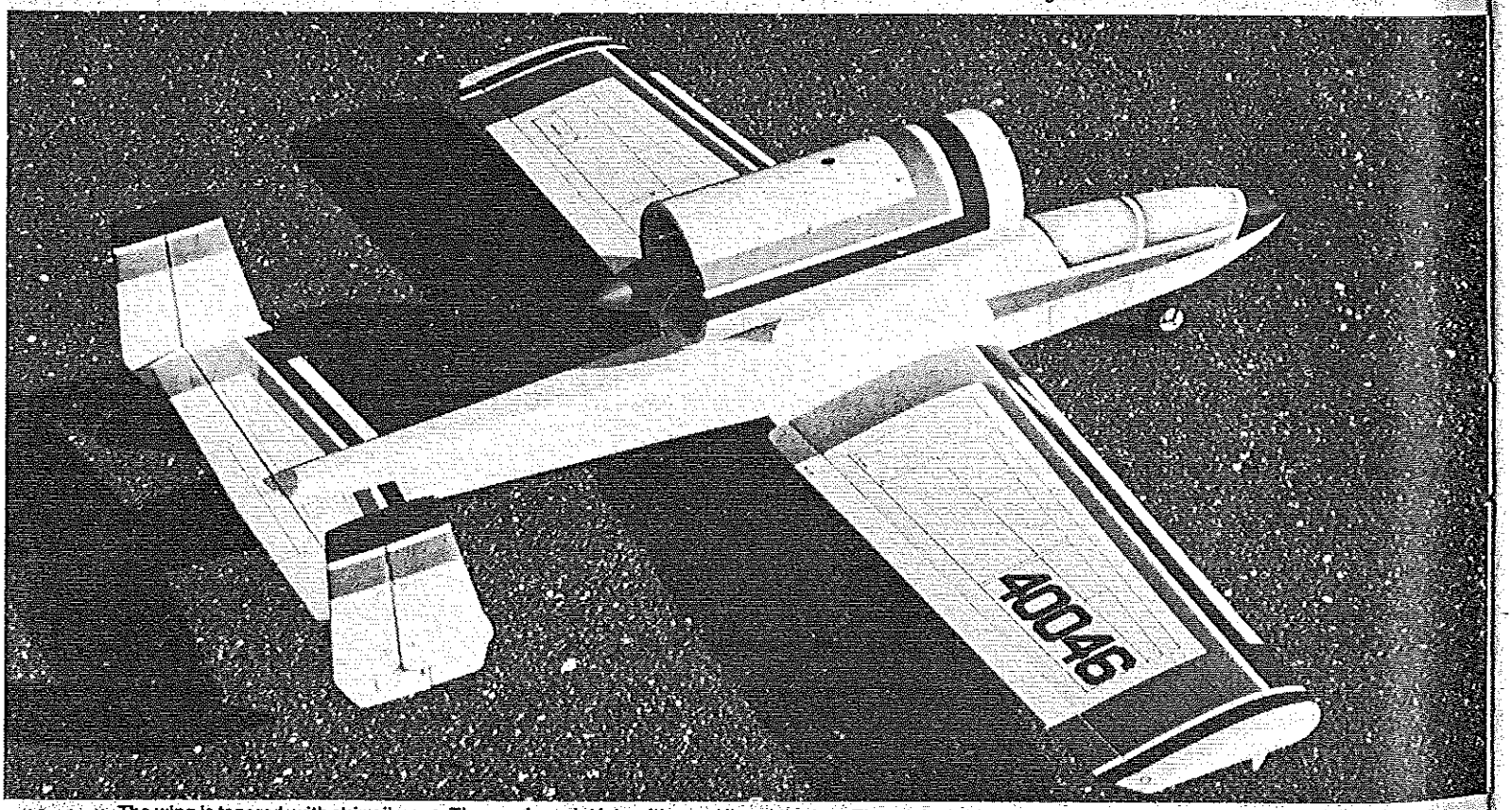
This was a project I thoroughly enjoyed. The ducted fan is something new and different, always fun in this hobby. Use of the ducted fan certainly doesn't have to be restricted to scale modeling, and we can now design our own "jet"-powered models for sport and/or pattern flying. I know I intend to do more with ducted fans, and am already thinking of a twin fan installation in a futuristic design. Maybe. Happy fanning!



This bottom view shows wing bolted on, radio hatch on nose section bottom. Showing faintly is the tie rod for the external linkage of the twin rudders.



The simulated canopy is airbrushed in black, with two tones of blue for "glass."



The wing is tapered, with strip ailerons. Three-color paint job, with panel lines inked on. The original ship was finished with butyrate dope, but if you go the iron-on route the eye-catching color scheme is easy to duplicate.