MINI-F-16

You were impressed by Dick's .40-powered Jetster ducted fan which could do knife-edge (June, 1979). Now his dramatic F-16 powered by Midwest's Axiflo for .049s guarantees superb flying in a propless mode —something you may have hesitated to tackle. Believe us—it goes!

● Dick Sarpolus

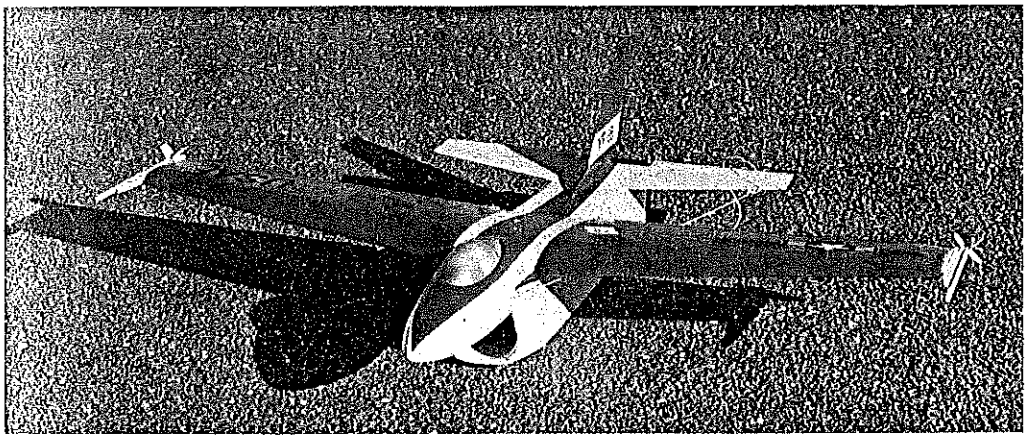
AN .049 ducted-fan model? You must be kidding. In many cases this is the first reaction to my mini F-16; but this is a good flying, practical sport airplane. Midwest's smallest ducted-fan unit, the RK-049, has been on the market for about a year now and is the smallest ducted-fan system available. Prior to this, most ducted fans had been designed around hot pylon racing .40s and .45s for high rpms and maximum power. I was intrigued by the possibility of a small, light fan model and so designed this F-16 styled model to see just what an .049 fan would do.

The result was successful; the model hand launches easily, flies very stably and is easy to handle. There is not too much power for vertical maneuvering but reasonable piloting skill permits consecutive rolls, loops, inverted flight, etc. It is hand launched normally even in completely calm weather conditions and can fly in reasonably windy weather. The Axiflo ducted-fan unit has proven completely reliable and trouble-free. I will recommend several slight modifications for the Cox .049 engine, but nothing major.

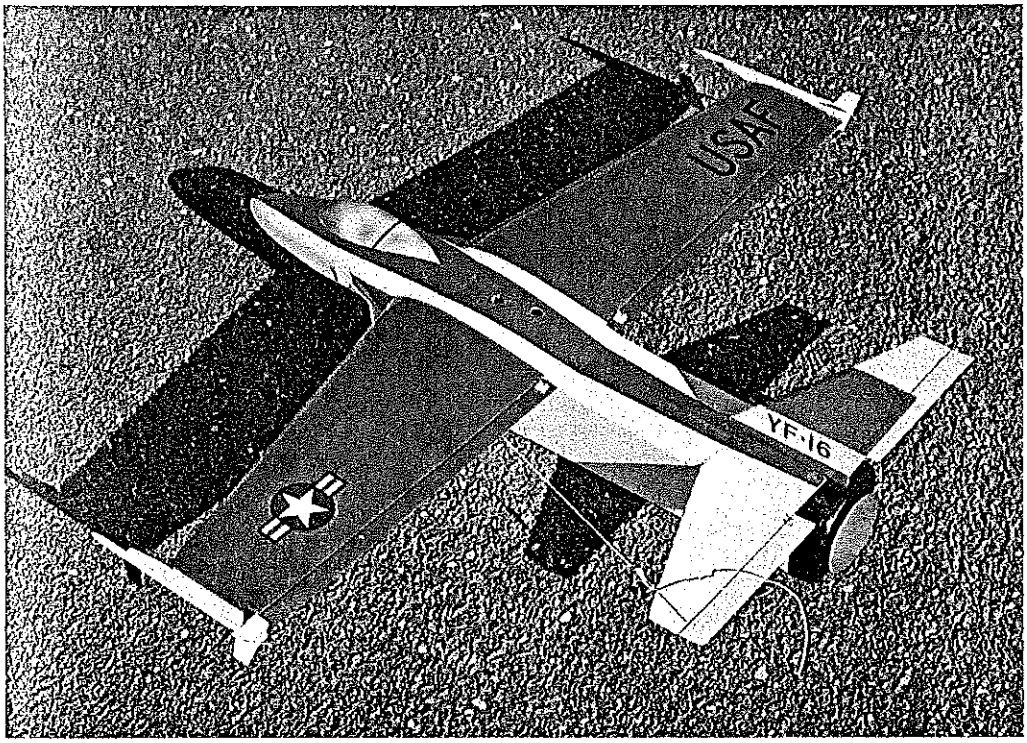
Modelers active 20 years ago may recall Berkeley's line of ½A ducted-fan free-flight models. These designs utilized an .049 with a 5- or 6-blade fan simply stamped out of sheet aluminum, with the blades twisted at an angle. The engines were mounted in a tube, and started with a string around a flywheel, I believe. The model structure was mostly bulk-head/stringer, with tissue covering for light weight, and I believe Berkeley kitted the F8U Crusader, F4D Skyray, and F9F Cougar. I understand the models did fly reasonably well as sport free flights, but thrust was marginal. With today's .049 engines, the Axiflo fans, and light weight RC gear, the Berkeley designs might be well-suited for our use.

For my first .049 fan project, I looked for the easiest possible subject. The main consideration was an open air inlet to insure an adequate air supply without complex dual duct construction. I also wanted to keep the whole model construction very simple and as light as possible without going the bulkhead/stringer route. The F-16

Finished in the red, white and blue color scheme of the Air Force's General Dynamics F-16 jet fighter, Dick's lively bird is adorned here with tip rockets for added realism.



Jaws—with wings. Significant reason for flight success is simple construction and light weight.



We can't quite call it stand-off scale—perhaps stand-way-off pegs it nicely. Major change was a fattened fuselage to house the Axiflo RK-049 ducted-fan unit. Note that tailpipe.

Holding miniature jet fighter is author Sarpolus with his good flying buddy, Lance Schneider.

was finally chosen; the Air Force's newest fighter with an overall configuration which would be easily recognizable; and the YF-16 prototype had a bright red, white, and blue paint scheme to utilize.

Obviously, the model is not really close to scale; the side view had to change to accommodate the Axiflo and still keep the overall size of the model down, exaggerating the air inlet opening and the bulk of the fuselage. The wing and tail surface outline shapes follow the F-16 with the wing and tail located atop the fan duct for easy construction.

The basic fuselage is sheet balsa, square for easy and quick construction and alignment. The only real shaping to be done on the model is the forward fuselage and canopy area. The wing incorporates a flat-bottom airfoil and 240 sq. in. of area; a generously sized wing to insure light enough loading for hand launching and easy flying. The wing uses spruce spars, a sheeted leading edge, and cap strips for a reasonably light, strong structure. With the flat-bottom airfoil and no dihedral, it is quickly built directly over the plans. The tail surfaces are simply light sheet balsa.

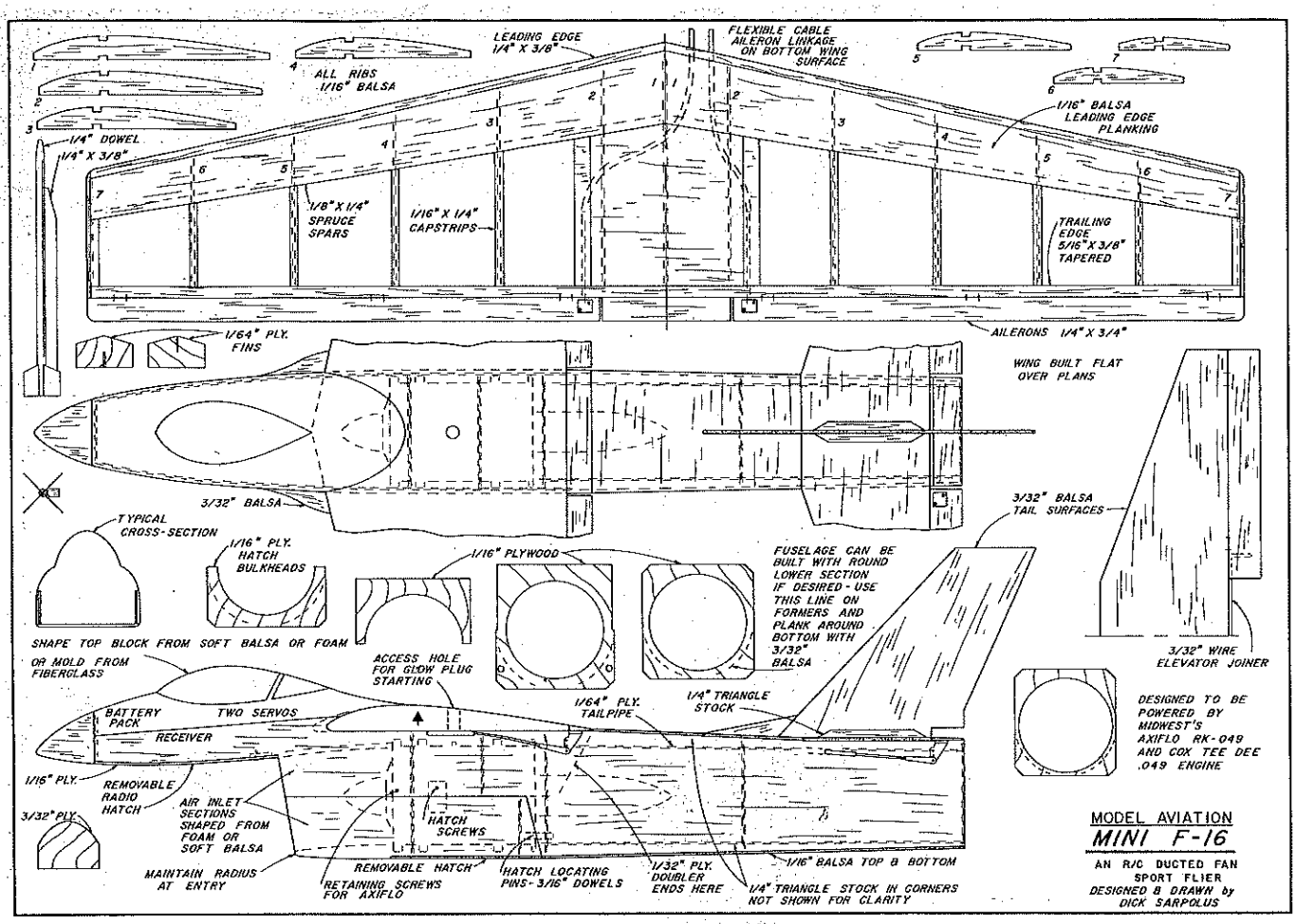
The space for RC gear installation is necessarily limited and the lighter equipment is desirable. The prototype model used two Kraft KPS-18 servos, a 225-mah battery pack, and the small Royal ½A receiver. Radio weight was less than six ounces. There is room for servos larger than the KPS-18; D&R Bantam Midgets could easily be fitted. Two-channel operation, aileron and elevator, is sufficient.

It was felt the added complexity and weight of rudder control wasn't justified for a sport type model, and throttle control would have complicated the Axiflo installation considerably. For the same reason, no landing gear is fitted; a jet model looks better without the gear down, and this model hand launches so easily and lands so easily that I feel the landing gear is better left off.

Weight is a major consideration; the lighter the model, as usual with any powerplant and particularly an .049, the better it will fly. Several heavy mistakes made on my prototype were a heavy molded fiberglass front end and painting rather than MonoKoting the fuselage and tail surfaces; all-up weight was 30 ounces and I was seriously concerned that the model wouldn't fly. I was pleased to find that it will fly and fly quite well at 30 ounces. As mentioned earlier, it hand launches in a normal manner; the pilot can easily launch it himself. There is no reason for the model to be 30 ounces if a little care is taken; a second model was quickly built which weighs 25 ounces and, of course, flies even better. It should be pretty easy to beat the 25-ounce weight.

As presented, the Mini F-16 is very easy to build, with some sacrifice in appearance due to the square fuselage. A friend of mine, Dick Newcombe, built this F-16 using the same wing and tail surfaces, but making a real effort to cut down on the cross-section of the fuselage. He located the Axiflo so close to the underside of the wing that the external ribs of the Axiflo protruded into the wing's lower surface. The fuselage skin was wrapped as tightly as possible around the Axiflo and the tailpipe. It made for a nicer appearing model but took a lot more work. My second model incorporated a round lower fuselage section, and this alternate construction is shown on the plans.

The heart of this model is, of course, the Midwest Products Co. Axiflo RK-049 ducted-fan unit. Assembly of the Axiflo is a project like the construction of the model; it's not hard, but does require precise, careful work. The Axiflo parts are well prefabricated and it is an assembly



FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 128

job, using epoxy glue. The completed fan unit must be painted; I used K&B superpoxy to protect and fuelproof the Axiflo. The instruction manual and furnished plans are quite detailed and include a number of suggestions for top performance from the Cox Tee Dee .049 engine used.

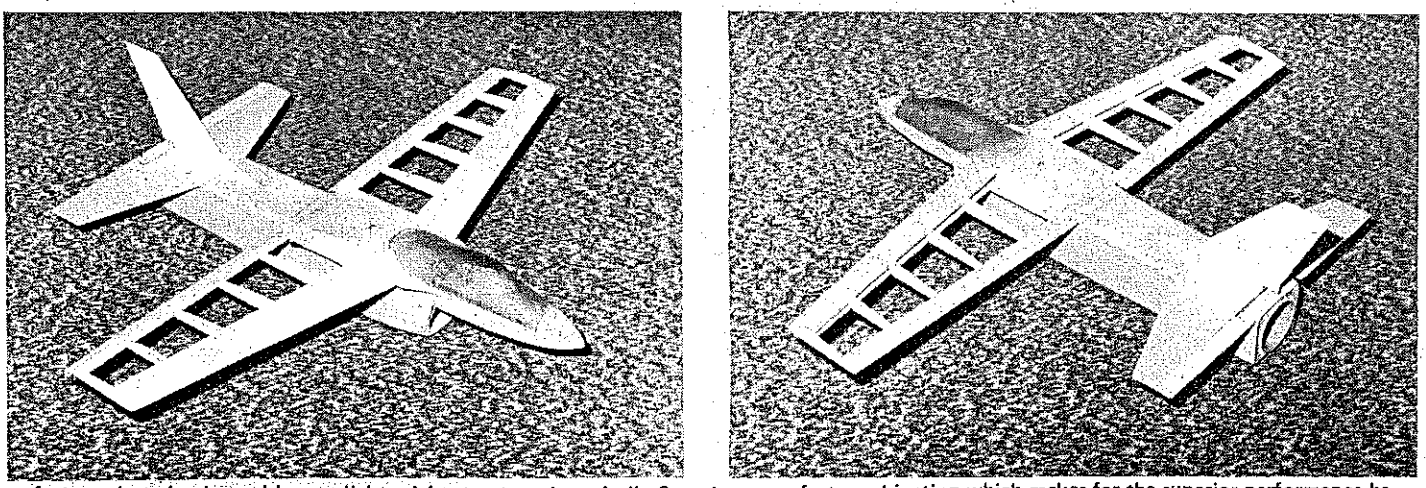
My Tee Dee had a good amount of flight time on it from use on several control-line stunt models. Two changes were made before installation of the engine into the Axiflo; a fine thread needle valve assembly was installed to make engine adjustment much easier, and a GloBee racing glow plug/head was installed for a possible rpm increase. The Axiflo/Tee Dee combination was run several times before it was put into the model, and it operated with no problems.

Starting was done with an Astro Flight ½A electric starter, which enables the engine to be started in the model without removing the hatch. For the first flights, the hand launching was to be done by my good friend, Lance Schneider. We planned for a fast run and a hard throw to prevent any possibility of the plane's stalling.

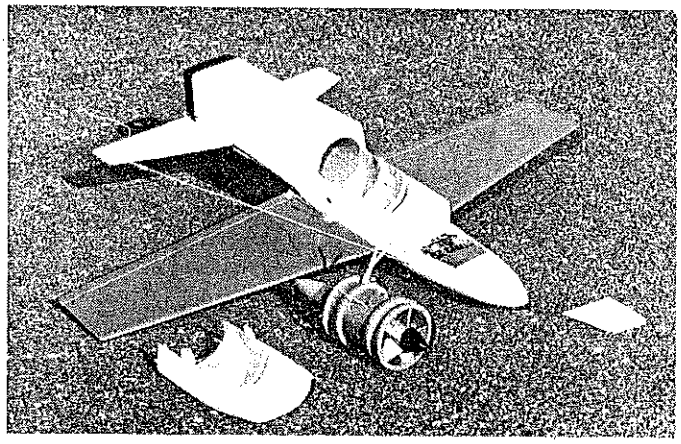
As soon as Lance threw the model, the engine stopped and the F-16 glided to the ground. This scene was repeated at least a dozen times, with the launches becoming more gentle in an effort to keep the engine going. We assume the lengthy distance between the engine and the fuel tank was resulting in the engine's stalling when thrown. Finally, the engine happened to remain running and a pretty good flight resulted—but it was obvious something had to be changed.

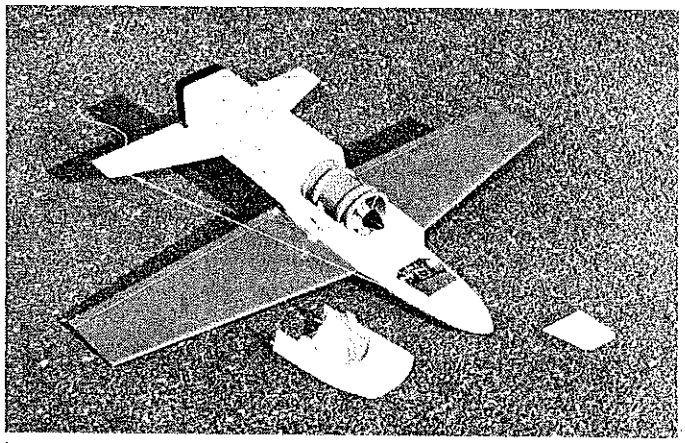
That night we drilled and tapped the Tee Dee's backplate for a pressure tap—silicone line from the tap was run outside the model along with the fuel tank filler and vent lines. After filling the tank, the filler line is plugged and the vent line is connected to the engine pressure line with a piece of brass tubing. The engine was started normally, adjusted for the highest possible rpm, and the plane was hand launched. The engine now continues to run smoothly until the fuel is gone, and never stops when launched.

From this experience, I feel the pressure tap is an absolute must for successful operation of the Axiflo and this model. Fortunately, it is an easy engine modification to make. I drilled and tapped a 4-40 hole in the center of the backplate, and made sure the pressure fitting did not protrude at all into the engine. There are a number of commercially available pressure fittings suitable for this use. I have used only 35% nitro fuel, with



A strong but simple, and hence, lightweight structure, is typically Sarpolus—a perfect combination which makes for the superior performance he obtains from the Axiflo powerplant. These front and rear quarter views of the ready-to-cover framework should make this obvious.





Inverted to show powerplant and radio installations with both large and small hatches removed, we see that the ducted-fan unit is located right on the Center of Gravity, with the radio and servos forward for balance. Large hatch attaches with two screws, Axiflo drops into place. Fuel lines and needle valve flexible extension lead pass through the fuselage sides, beneath the wing.

good results in this Tee Dee. Since crankcase pressure is being used, perhaps boring out the carburetor slightly would gain even more performance.

Enough on the aircraft design and the fan unit—we'll get on to the construction of the model. It is built in one piece; due to the small size, I felt a removable wing just wasn't worth the added complexity and weight which would be required. As usual, it is recommended that all parts be cut out before starting construction.

Make your own kit, and the building work can proceed smoothly. As mentioned before, light weight is important, so try to select light to medium weight balsa, use a minimum of glue, and use any weight-saving ideas you can come up with. It can certainly be built even lighter; I use a lot of epoxy and mostly medium grade wood.

The wing will be described first, and it is built in one piece directly over the plans. No dihedral is required, which simplifies construction. The bottom leading edge planking, lower spruce spar, center section planking, lower cap strips, and trailing edge are all cut to shape, glued and pinned to the board before the ribs are added. With the ribs in place, the upper spar and leading edge are added. The top planking and cap strips finish up the wing, which can be left pinned to the working board overnight to be sure no warps will twist in.

When removed from the board, only final sanding and hinging of the ailerons is required.

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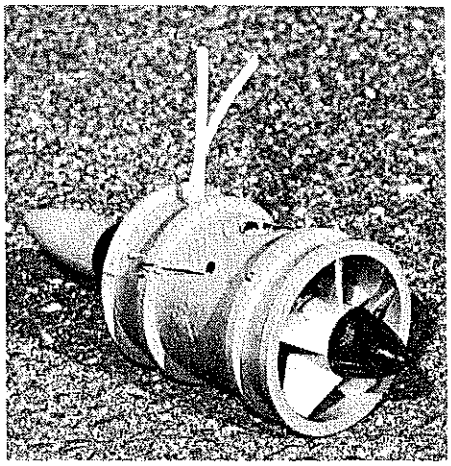
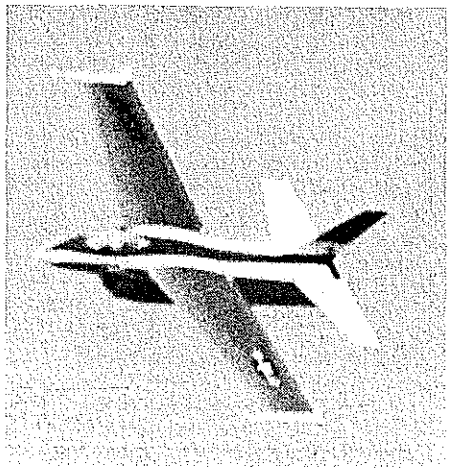
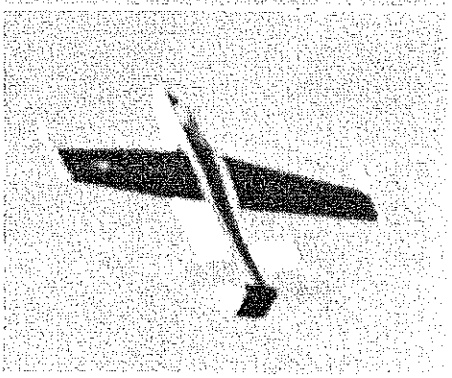
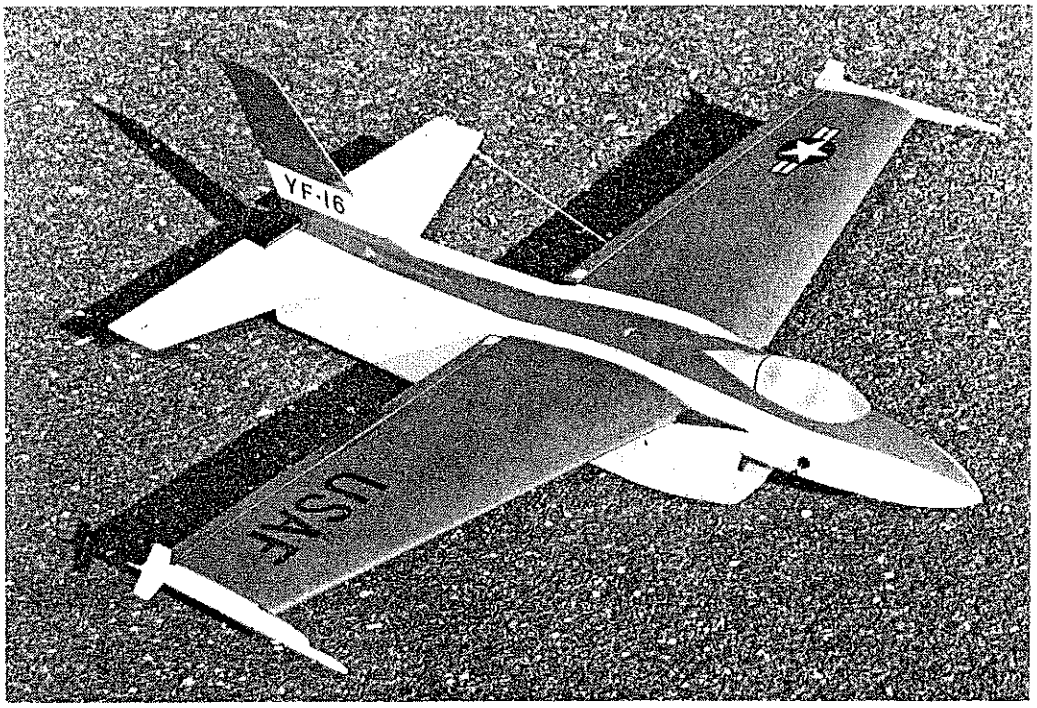


Close-up of the compact Midwest Axiflo ducted fan for an .049. Bob Kress, who designed and developed the unit, has two-stage version under tests—with large boost in thrust.

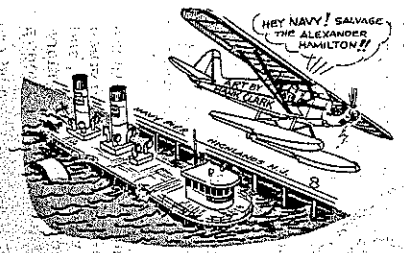




This and other flight shots show a reasonable resemblance to the F-16. Spectacular colors during maneuvers against a blue sky make it thrilling. No prop to spoil illusion.



If we didn't call your attention to this, you would never miss the wheels. You wouldn't see them in flight anyway and in small, light aircraft, belly landings on grass do no damage at all.



049 ENGINE ON MOULDED MOUNT

MOULDED COWL AROUND CYLINDER

FAIRING BEHIND CYLINDER IS ALSO PASSAGE FOR VENT AND FILL TUBING

FUEL TANK CONTAINS TUBING FOR VENT AND FEED LINES

TAKE-APART VIEW OF ALL INSIDE PIECES OF MIDWEST 'AXIFLO' DUCTED FAN UNIT

FIVE BLADED FAN SCREWS TO ENGINE SHAFT

PLASTIC SPINNER SCREWS TO FAN

PLYWOOD RING AND TANK COUPLING SLEEVE

PLYWOOD FIREWALL BEHIND ENGINE MOUNT

3/32" BALSA RUDDER ELEVATORS & STABILIZER

FOAM, BALSA, OR OPTIONAL METHOD CANOPY/DECK GLUED ON

1/16" FAIRING

1/4" TRIANGLE BALSA BOTH SIDES

PLASTIC STATORS (6) SUPPORT ENGINE POD IN DUCT CENTER

FIBER TUBE WRAP-AROUND OVER MOUNT & TWO PLY DISKS

3/32" WIRE JOINS TWO ELEVATORS

1/16" BALSA CENTER SECTION PLANKING TOP AND BOTTOM

1/16" BALSA TOP-CROSSGRAIN FUSE. SIDES AND BOTTOM

GLO PLUG ACCESS

1/64" PLYWOOD 'TAILPIPE'

1/16" BALSA PLANKING LEADING EDGE TOP & BOTTOM

ELEVATOR NYROD

FLEXIBLE TUBE AILERON CONTROLS UNDER WING

1/4" TRIANGLE BALSA FOUR CORNERS IF SQUARED FUSELAGE IS USED

3/32" PLYWOOD FAIRING

1/16" PLYWOOD ALL BULKHEADS (CAN BE ROUNDED AT BOTTOM)

1/32" PLYWOOD DOUBLER INSIDE 3/32" BALSA SIDES

5/16" X 3/8" TAPERED TRAILING EDGE

1/4" X 3/4" BALSA AILERONS

SOFT BALSA BLOCK

3/32" PLYWOOD FRONT BULKHEAD

1/8" X 1/4" SPAR TOP & BOTTOM

1/32" PLYWOOD DOUBLER ENDS

1/16" BALSA ALL RIBS

1/4" X 3/8" BALSA

1/16" PLYWOOD BOTTOM AND HATCH

FUEL TANK CONE

1/16" X 1/4" CAP STRIPS TOP & BOTTOM

1/4" DOWEL MISSLE

SOFT BALSA OR FOAM HOLLOWED AS INLET

SOFT BALSA SIDES

FOUR PLYWOOD RINGS CONTAIN AXIFLO DUCT POWER UNIT (SEE DETAILS)

1/4" X 3/8" BALSA LEADING EDGE

LOWER INLET SHAPED FROM FOAM OR SOFT BALSA FLUSH WITH DUCT INTERIOR

HATCH SCREWS THRU PLYWOOD LUG

3/16" DOWELS MOUNT HATCH TO FUSELAGE

inches, then 45, then 72! A 45-in. P-12. Several 6-foot Bellancas. They'd rumble along on balsa-turned wheels, blowing back dust, lift-off, tail high, so gently, and swoop down to a smooth landing at field's far end. We wow Don Srull when he's flying at 30,000 by reminding him of our early 9-foot Cessna. It boggles his mind.

Covered with ordinary tissue and flour paste, it ascended for one flight, smooth as a ¼-scaler, and descended into the blackberry patch. The one flight was worth it. Cut-up inner tubes for rubber, a hand-carved prop from a balsa 2 X 4, and two guys straining to twist the prop as it attained the second row of knots. The 45-in. Boeing had 11 lead slugs from the police pistol range in the nose for balance. A bit much, we agree. These days short rubber is a must. But F.O. is from Missouri. A mule.

If a typical scale flight is like an indoor flight with the model coming down with turns on it, and turns are the name of the game, where is the real crossover value of motor length versus nose weight? The boys say it is hopeless. We keep thinking of all those turns–sure you are up a rubber size or two, but those old crates were a wonder to behold. Joe Ott, God bless you, and we hope you see this. You helped make us what we are today, a happy modeler, one among millions. We need new "prophets."

MINI F-16/SARPOLUS

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The aileron control linkage suggested is flexible cable in nylon tubing; the tubing is glued in place as shown on the plans to the bottom of the wing. When the wing is installed on the fuselage, almost all of the aileron linkage is enclosed within the fuselage.

The tail surfaces are simply cut from 3/32" balsa sheet. A 3/32" wire joiner is epoxied into the elevators, linking them together. I find one of the commercial hinge slot cutting tools helpful for installing small nylon hinges in the thin surfaces; or, the MonoKote covering could be used for hinging also.

Fuselage construction begins with gluing the 1/32 plywood doublers to the fuselage sides, with epoxy or contact cement. Next step is to join the fuselage sides with the plywood formers. If

OPENERS/WINTER

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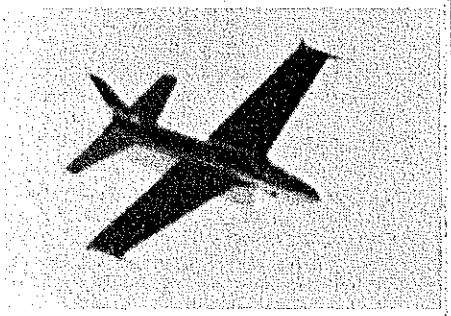
But why not design our own, following Ott's precepts? We no longer remember which were his, and what we cooked up. We know we built 500-plus! A Camel? Joe's. With that short nose? One put lead in the nose and you'd be surprised how high a Camel could get or how far it could fly. A Fairchild 72—ours, we think. Thirty

Published in Flying Models in the early 60s, our Airknocker given then to Norm Rosenstock who flew it up until now and gave it back. Putting in a 3-channel Kraft. At about 54 inches, light escapement, it flew sedately on a Fox 10—way back. Would appreciate suggestions from readers on what powerplant to select.

Still keeping the faith! Wings now covered on the Aristocrat, but it is hung up until we finish another book. Incidentally, extra vertical crosspieces are balsa, inside longerons, to prevent bowing from covering pull.

building the rounded fuselage version, don't try to roll the fuselage bottom until the 1/64 plywood tailpipe is installed. The tailpipe is next; when in the fuselage it adds a lot of rigidity to assist further work. The easiest way to make the tailpipe would be to have a tapered form to roll the plywood around, and hold it in place while epoxying the ¼" overlap seam joint. You can also use a hardwood strip, rolling the plywood and holding the overlapped seam on the strip until the epoxy cures. 1/64" plywood is really stronger than necessary, so any lighter, alternate material could be used to fabricate a tailpipe. When done, the tailpipe is glued into the fuselage, using the Axiflo unit to check its alignment.

The fuselage bulkheads must be relieved as necessary to clear the aileron linkage on the wing, and the elevator linkage must be installed at this point. The fuselage top and bottom planking can now be added, and the wing and stabilizer glued in place. With the wing on, the forward fuselage area is constructed. This has been done several ways on the test models built; some were cut and sanded to shape from foam, covered with thin fiberglass cloth and epoxy, and then hollowed out for the radio gear. Others were built of fiberglass in a plaster mold made from a plug carved of foam. Or it could be carved and hollowed from soft balsa blocks; the method left to the builder's ambition!



The nose block is glued in place, and carved to fit. A plywood hatch provides access to the radio gear in the nose section. The vertical fin is glued on, using ¼" triangle stock for reinforcement. The fuselage hatch covering the Axiflo is assembled, and uses several dowel locating pins and small plywood mounting tabs to permit it to be held in place with two small screws. The air inlet area in front of the Axiflo was filled in and shaped from foam in several models, and was built up of wood in another. Either method is satisfactory; the important thing is to maintain a smooth air inlet to the fan, with a rounded contour on the front edges of the inlet. Additional tips on the Axiflo installation will be found in the Axiflo instructions.

The tailpipe and engine area were sealed with several coats of clear Superpoxy to protect against fuel and oil soaking. The nose section and air inlet were painted, and the rest of the model covered with MonoKote for a quick, light weight finish. The prototype YF-16 had a colorful red, white, and blue paint scheme which can be used, or the Air Force gray/blue camouflage could be used. The F-16 is being used by Belgium, Denmark, Norway, and the Netherlands, so their paint and insignias may offer alternates. Wing-tip missiles can be fabricated of ¼" dowels, thin plywood fins, and balsa mounting rails for added appearance.

I consider this Mini F-16 a "first generation" sort of .049 ducted-fan project, and hope that its success will lead to more .049 powered jet designed around it.

For further information on the Axiflo, I have found its designer, Bob Kress, to be most helpful; he can be contacted at: Kress Technology, Inc., 27 Mill Road, Lloyd Harbor, New York 11743.