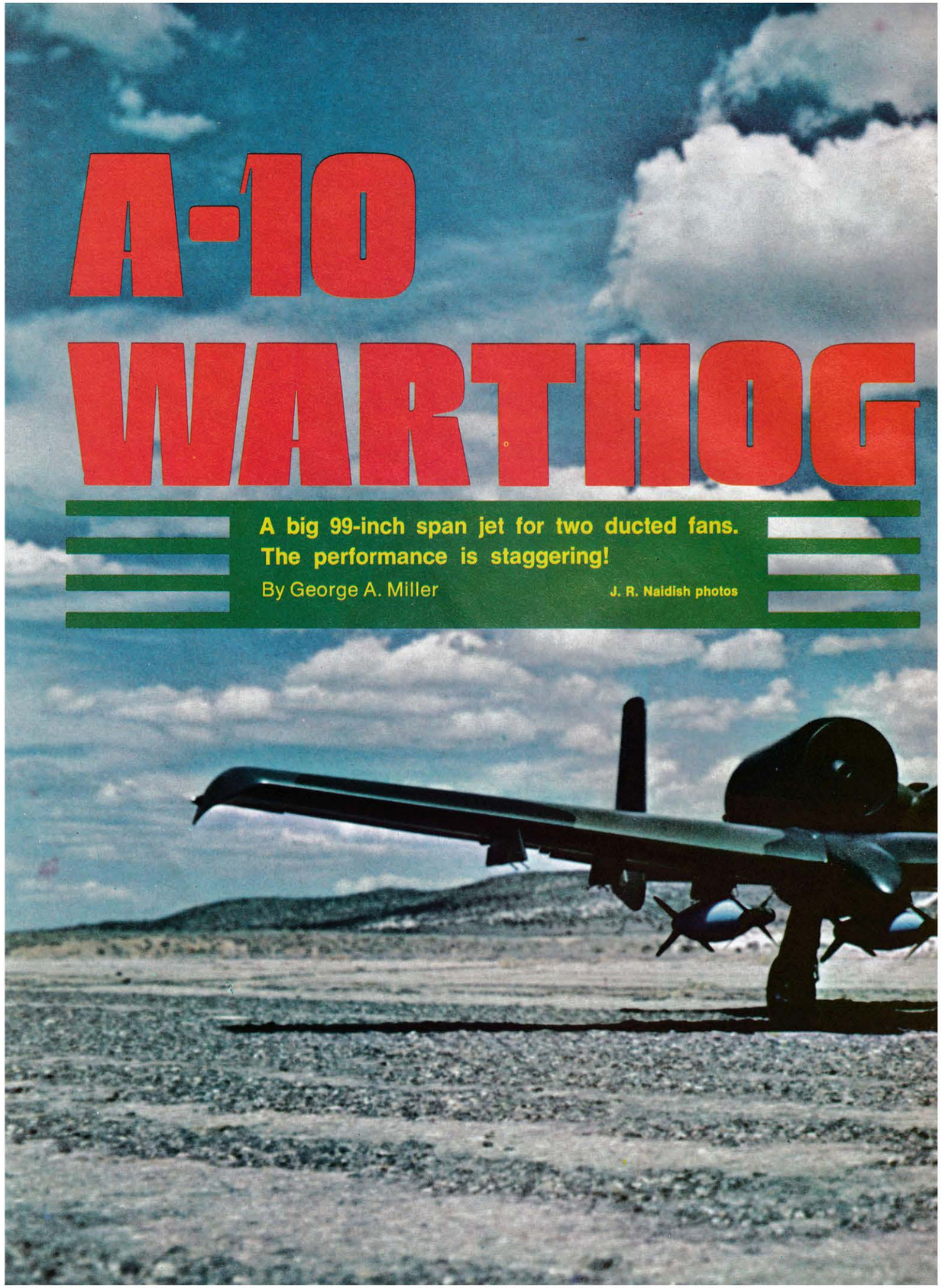
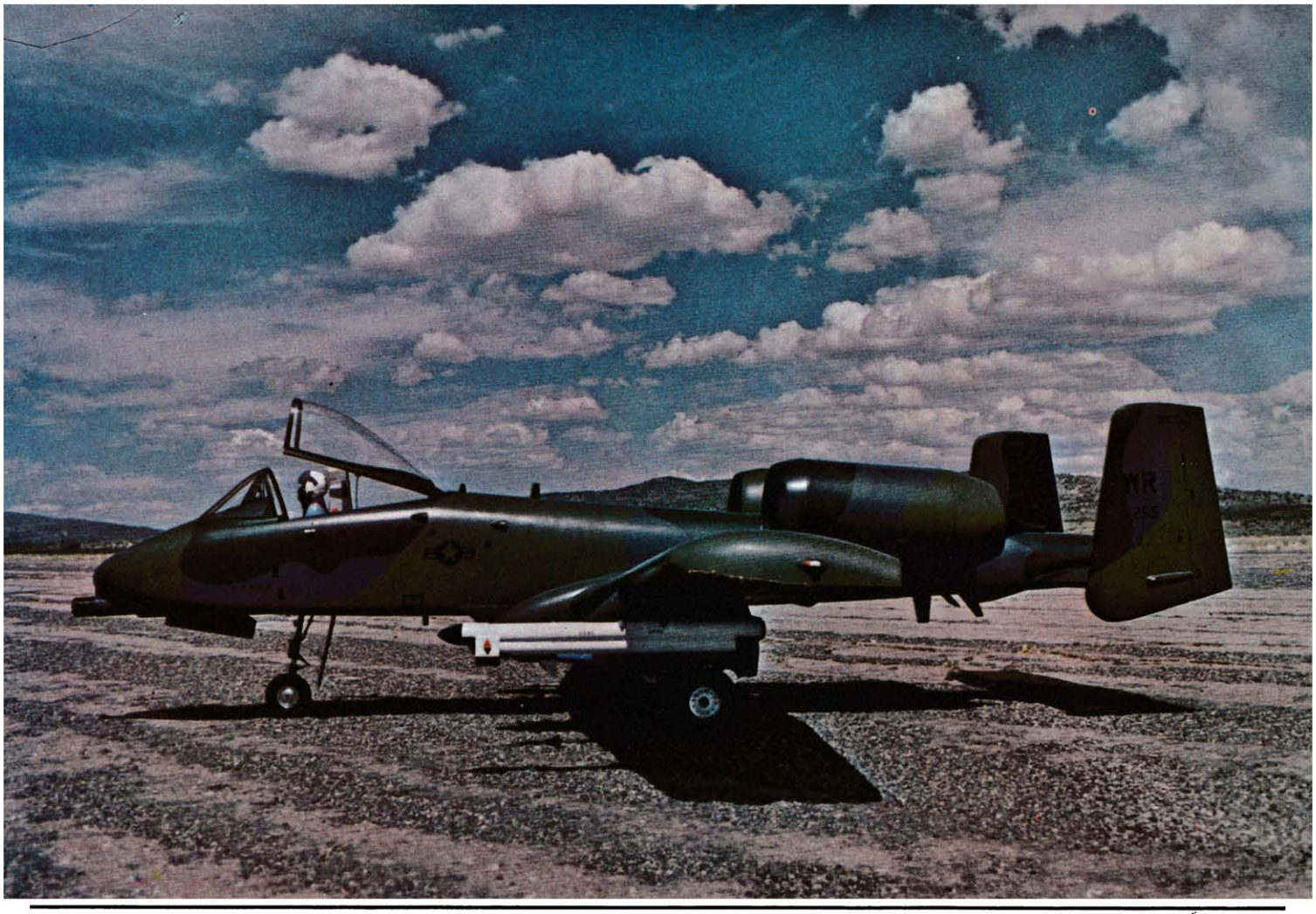
A-10 WARTHOG

A big 99-inch span jet for two ducted fans. The performance is staggering!

By George A. Miller

J. R. Naidish photos





I've been building model aircraft for about 30 years. Like most modelers, I started out building simple 1/2-A controlline planes, gradually moving into Combat and Scale. After my teens, I returned to controlline in a competitive way. I built contest-caliber Scale ships for many years, and I was quite successful with them. My last was the Roscoe Turner "Miss Champion," with which I set a controlline record in 1972. In '73, I saw the advantages of flying models without wires, and I got deeply involved in R/C.

I was primarily a sport flier, until 1984, when the Nats was scheduled to be almost in my back yard. I had always had an itch to enter Scale at the Nats, so I returned to my scale efforts. I had been to Stead AFB many times for the full-size air races. I had also flown some controlline contests in Reno, so knew that the winds were sure to blow, and that the density altitude would be a key factor. All I had to do was build the right airplane for the conditions, and I was ready to compete.

I have always been a scratchbuilder. I have probably built no more than 4-5 kits in my entire life. Many modelers think that scratchbuilding is hard, but it's not. The drawing skills come with practice, and the knowledge of construction techniques will develop from previous building efforts. The advantages of scratchbuilding are that you can select a subject which isn't too well known, and that you can pick your wood, and thus control weight. No one really wants to show up at a contest with just another Mustang or Cub. Because my current interest was ducted fans, I decided to scratchbuild a fan model which would be competitive at the high altitudes of Reno.

After some research, I selected the A-10 Warthog. It's a fascinating aircraft. The plane was designed to carry the 30mm Gatling gun; one of the most powerful weapons ever used. This gun is capable of firing an amazing 4,200 rounds per minute! The Warthog is a workhorse, carrying an underwing ordnance load of 16,000 pounds. It uses twin turbo fans, and is designed so that, if one engine fails, it can make it home on the other. One additional bonus feature of the A-10 is that its gear stays half exposed in the retracted position. Like the DC-3, you can belly land the plane without damaging the airframe. Another modeling bonus is the large, high-lift wing, which is undercambered, and has STOL Hoerner tips. This would be a plus in the thin air at Reno. One last bonus item was a tail volume that is 25 percent of the wing, for added stability, and the rudders are very generous.

As a ducted fan candidate, the A-10 works out quite well. The two engine pods are very large, to accommodate the Turb-Ax units. They are close to the centerline of the fuse, which would help if the engines got out of synch. Since the pods are hanging out in the open, there would be no internal air ducts or "cheater" holes. The only real disadvantage is that the engine installation puts a lot of weight aft of the C.G. I took a gamble that I could control the Center of Gravity by installing the radio in the nose. Since there is plenty of good documentation available, I could see how this project could fail. It was time to cut wood.

As luck would have it, just as I was finalizing my initial drawings, I ran across a photo of a completed A-10 in one of the model magazines. Well, so much for originality! I was not deterred and, as a matter of fact, my close working relationship with Lynn McCauley in Texas proved a boon to my project. We spent a long time comparing notes over the phone.

One of the primary problems Lynn was having with his Warthog was the landing gear. His plane weighed 19 pounds, and was supported by Rhom's 3/16-inch struts. Even these proved too flimsy for the weight. He sent me a video tape of his early flight attempts, and I could visually see how the gear was straining. The Warthog's gear only rotate 60 degrees, so I didn't even bother to investigate the commercial units. I immediately set about engineering my own landing gear system. The retracts shown on the plane are easy to build, and have proven totally reliable.

Lynn was using Robart scale wheels. These are hollow, and aren't designed to handle the weight of such a model. I got some of the foam inserts for these wheels, and this alteration makes them plenty adequate for the task. If your hobby shop doesn't have the inserts, you can get them direct from Robart. Also, when buying your tires, inspect them carefully. I found some tires which were torn in the sealing area. If your hobby shop won't stand behind these flawed tires, Robart will.

You can expect the Warthog to come out weighing 19-21 pounds, depending how much detail you put on the model. It is imperative that ¼-inch wire be used for the main gear struts. The gear is only this piece of piano wire, and special control horn. If you don't have the tools to make this control horn, a machine shop can fabricate it for you. It is also important that the ¼-inch plywood bulkhead that the control horn rests against is secure in the wing.

Originally, the retracts were actuated by a pair of retract servos. This worked well, but any time I rolled the A-10 backward in the pits, I took the risk of actuating the retracts. Using a worm gear, with micro switches for limiting travel, is the best method. Janaco makes a good worm gear drive system. I have been using a stock Dave Brown nose gear, which has been drilled out for ¼-inch wire.

CONSTRUCTION

As with any ducted fan model, weight is a crucial consideration. Adding the scale detailing on the Warthog will build up weight rapidly; therefore, it is essential that close attention be paid to structural weight during building. I made liberal use of 1/64-inch plywood for sheeting the engine pods, pod fillets, tail feathers, etc. This material can be primed and painted, without the intermediate step of glass cloth and resin. By the time balsa sheeting is prepared for painting, it is heavier than the plywood, and it takes longer, too. The only trick with using this thin plywood is that any flaws in the skeleton beneath it will show. Proper sanding before sheeting will eliminate this.

The fuse is balsa sheeted, then

The author and his Warthog at the Nats flying site. Engine problems, high winds and a bumpy runway all kept him from recording an official flight.

Looking lean and mean, the A-10 is a potent fighting machine.

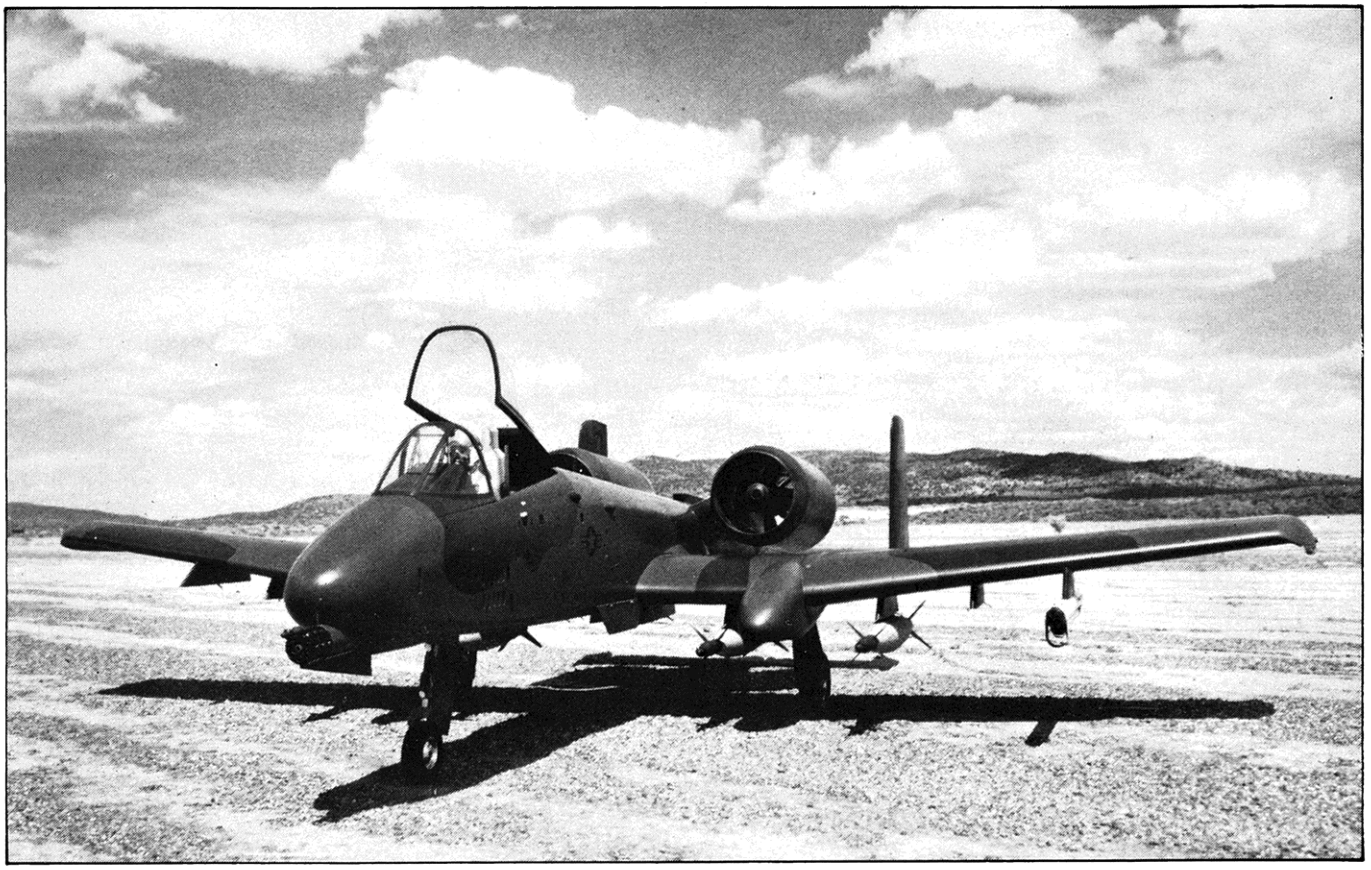
glassed with 4 ounce cloth. The wing construction is strong enough that I only used a coat of polyester resin (no cloth) to eliminate wood grain prior to painting. Rely on Zap for all the gluing chores, and you'll be on your way to saving weight. Remember, one of the big advantages of scratchbuilding is that you can control weight by selecting your own wood. Get out the gram scale and head for the hobby shop!

When I was building the Warthog, I had no idea that a magazine was going to publish the plans. I had only working drawings when the Editor approached me, but draftsman Mike Beaulieu performed miracles. The finished plans are some of the nicest I have ever seen. The plans are done on three large sheets and, at $24.95, they are a real bargain.

FUSELAGE

Using the plans as templates, cut out all of the necessary pieces for the fuse and the empennage. Do *not* cut out the wing saddle at this time, for it will only confuse the alignment. Glue all of the formers to the fuse sides and bottom, then glue the engine mounts into the formers. Locate the position of the stab spars

Equipped with homemade retracts, the A-10 is a 21-pounder, flown with two Turb-Ax fans.



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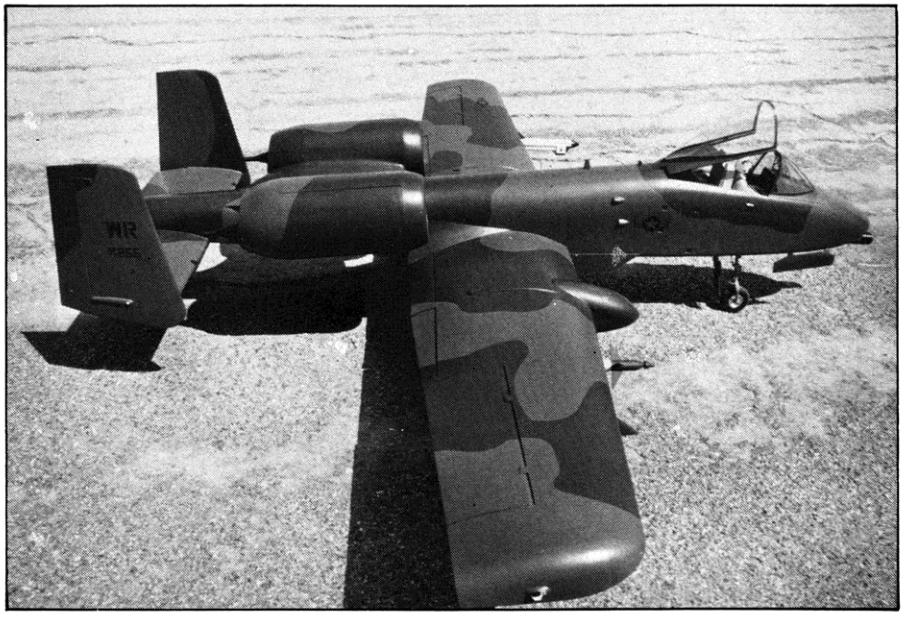
Lots of wing area and a large stab make the Warthog a good scale candidate.



on the fuse, and make the appropriate cut outs. Align and glue the spars, then slide the stab ribs in place.

Once you have the basic skeleton of the fuse and stab assembled, it is time to install the controls, fans, engines, tanks, fuel lines, etc. I joined lengths of semi-flexible Ny-rods, and ran them to the front of the fuse for the elevator and rudder controls. Golden Rods can be used for the throttles. To keep things simple I fed both engines from a single tank, to which was connected exhaust pressure from both engines. This method allows both engines to run out of fuel simultaneously, under the theory that it's easier to land a dead stick model, than a twin which has only one engine running.

Once the hardware and fittings have all been installed, plank the fuse. I used 1/8-inch balsa for sheeting, with solid balsa nose and tail blocks. Once the sheeting is sanded, cut out the area for the scale cockpit, and neatly open up the sheeting for the canopy hatches. Sheet the stab with 1/64-inch plywood, as previously noted.

Make a balsa ring that fits the fiberglass tail cone of the ducted fan. Make this ¼-inch balsa piece a snug fit, and glue it to the back of the engine pod. Before gluing the tail cone in place, add a piece of ¼-inch plywood to which the Macs 7.5 DF pipe is mounted. Make sure the pipe is securely mounted.

Next, we make the access hatch for the fan units and install the internal duct sheeting. The hatch is hinged at the bottom with Klett hinges, so that the pins are removable. The engines are much easier to work on when the hatches are removed.

The fins, rudders and elevators are next. There's nothing special here, so just follow the plans and you'll not have any difficulties. You can either build solid balsa control surfaces, or build them up and sheet them with 1/64-inch ply.

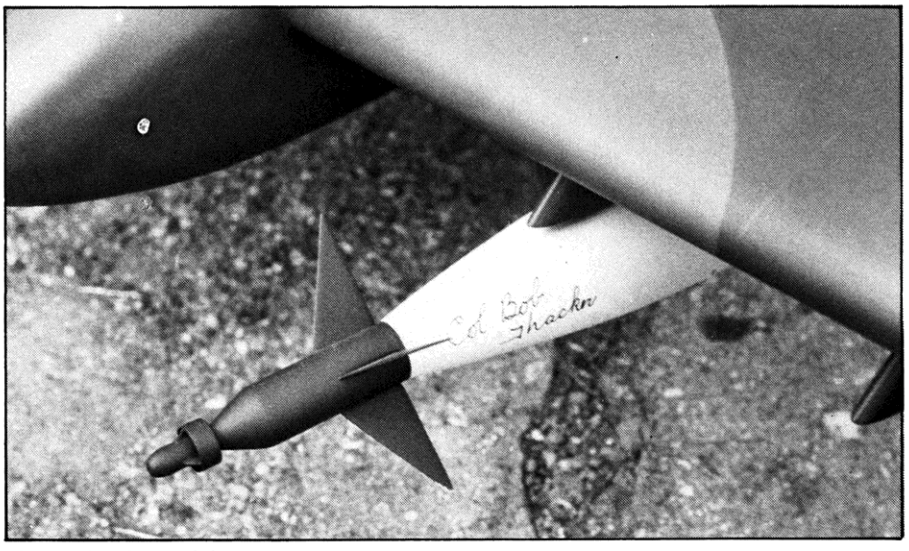
WING

The wing construction is started by sliding the brass bushings to the middle of the ¼-inch landing gear wires, then bending the gear strut wire to shape. Slide the ribs onto the gear wire, install the spars and glue everything together. You are fabricating only the center section at this time. Make sure that your building board is perfectly flat, since this undercambered wing isn't very tolerant of warps.

Now, add the leading edge, shear webbing and the 3/32-inch sheeting between the flaps. The center section framework is now rigid enough that it can be taken up off the boards and handled.

Glue the outboard wing spars to the center section. Install the ribs and leading edges of the outer panels. Now is the time to install all the hardware for the ailerons, flaps, retracts, etc. If you are going to have any operational wing ordnance, now is the time to fit all of the mechanisms. Once everything is to your satisfaction, glue the sheeting in place. The Hoerner tips are carved from block balsa.

When the wing is completed, cut the wing saddle out of the fuse, being careful to hold the correct incidence. The wing is held in place with the traditional dowel pegs in front and nylon bolts at the trailing edge. Once you are satisfied with the fit, add the wing fillets to the fuse and along the underbelly.



Although the author claims to have enjoyed making a friend of Col. Thacker at the Nats, this ordnance inscription seems to indicate something else.

MISCELLANEOUS

All that remains are the small details, which always seem to take so much time. I can only assume that anyone attacking a project of this magnitude is experienced enough to not need any help in fabricating scale details. Anyway, your method of doing things like cockpit detailing, rivets, etc., is probably as good as mine. However, realizing that no one knows everything, you can feel free to call me at (707) 523-4699. I live in California, so don't dial me at 8 a.m. New York time!

PAINTING

Painting a scale model can be a frustrating affair. I was displeased with the materials I had been using, so I set about searching for a better way. I stumbled on Chevron paints. While they don't advertise much, I managed to locate their phone number and I gave Denis Butts a call. I gave him the Federal Paint Standard numbers I was trying to match, and he sent me not only the paint, but instructions on how to match them exactly. I was impressed with the paint. It flows on well, hides beautifully, and the adhesion is superb. I always find that masking tape tends to pull up the paint, so great adhesion is critical where you are spending days masking off a complex multi-colored camouflage design. The paint also has no fumes, and it doesn't change shades once dry.

FLYING

Now comes the fun part! At least, that's what it says in the fine print. I knew that the A-10 would have to be highly detailed in order to be competitive at the Nats. I was prepared to go whole hog (or is that whole Warthog?!), but I wanted to see if the model was airworthy first. After completing the major construction, I gave the whole airframe two coats of the base color, put the C.G. at 25 percent MAC, and headed for the flying field.

PROBLEM No. 1: As any modeler who has messed with ducted fans knows, ducted fan units for .45-size engines are poor, at best. I feel that the Turb-Ax units are one of the best of these poor units. The multi-pieced unit which makes up the impellor of this unit is almost impossible to balance, and is definitely impossible to keep balanced. I have access to some of the finest balancing equipment available to NASA, so I'm not just blowing steam. Due to the extensions, multi-threaded pieces, washers, lock washers, etc., you will still have vibration after your best efforts to achieve static balance. The K & B 7.5 engine will work, but the tuned pipe must be securely fastened, or else it will vibrate off. My first trip to the flying field was cut short because of the Macs mufflers not being fastened well. I finally had two mounting brackets attached to each pipe. Foaming of the fuel was determined to be the cause of air in the fuel lines. Mounting the tank in foam solved this. Sullivan used to make an insert for the tanks which helped eliminate foaming.

PROBLEM No. 2: My second trip to the flying field was worse than the first, and almost resulted in a total disaster. In one of his letters, Lynn McCauley stated: "My A-10 weighs 19 pounds, has 750 square inches of area, and has a takeoff roll of 150 feet, with a good climb out." I didn't believe this. I have built a number of fan-powered models, and the thrust-to-weight ratio just isn't there for such STOL takeoff performance. Lynn's wing loading made such performance improbable. My Warthog also weighed 19 pounds, but with 940 square inches of wing. I had visualized a slow acceleration, with a ground roll of 250-300 feet. My calculations were that the climb woud be marginal with a 19 pound weight.

It was very windy that day, so we decided to start with some high speed taxi runs. After tweaking both engines, I commenced a taxi exercise. To my surprise, every time I advanced the throttles, the A-10 would lunge forward, exhibiting a terrific amount of power. It was only when I attempted a high-speed taxi that I realized that Lynn's comments were no exaggeration. The Warthog bolted forward at full throttle, and lept off the ground in about 100 feet. I didn't want the plane to fly, so I chopped the throttles, and fed in some down elevator. Of course, I should have been giving up elevator, to begin a landing flare. The plane dug the nosewheel in, and commenced to start a wild kangaroo hop. A wind gust caused a wing tip to get hooked, and before I knew it, the plane was a pile of rubble at the end of the runway.

We all know the feeling such an event gives. You know that the proper thing to do is fall flat on your stomach, flail your arms and legs wildly, and hold your breath until you turn blue. You resist, of course, but you can't help throwing a politely violent tantrum. Since I'm a scratchbuilder, I have a lot of these episodes, and the modelers at the field know that I get it out of my system, then go home and rebuild.

Mistakes are always the best teachers. Going over the mess on the runway, I found that the plane had really only suffered minor damage. This verified the correctness of my building techniques and the soundness of the A-10's basic design. I had only used 1/8-inch ply stiffeners at the fuselage wing saddle. The fuse had broken in half in this area. I replaced the stiffener with ¼-inch ply on the plans.

The home made retracts had been so severely stressed that they ripped a large slot in the sheeting. Fortunately, they had sprung exactly backward, and not sustained any damage. The engines were still purring away in their pods, so I knew that the power modules were intact. Two days later, I was ready for the third attempt.

The third trip to the flying field was a success. The engines were

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started, a brief taxi test followed, and then I hit the throttles and let the A-10 do its thing. The climb out was like that of a Pattern ship. Virtually no trim adjustments were necessary. I made procedure turns in both directions, and was amazed at the stability of the Warthog. After about five minutes, one of the engines went sour and quit. Fortunately, I was upwind, so I made an easy turn downwind, and came in for a picture-perfect landing. The model was capable of at least sustaining some semblance of safe flight on one engine.

I went home and proceeded to add an additional two pounds to the model's weight in scale detailing. With an all-up weight of 21 pounds, I knew that I couldn't enter the model in the Sportsman Class at the Nats. I requested to be changed to Giant Scale, but for some reason that seemed too major a problem, and I was left in the Sportsman Class.

As luck would have it, I was unable to fly the A-10 at Reno. It was bad enough that I was having one engine act up, but the runway was not of the best standards, and the crosswind was too much for even my heavy model. I did attempt a flight, but aborted just as the A-10 broke ground.

But, the Nats wasn't a total loss. My plane was the hit of the convention center, were the models were displayed and static judged. I met a lot of nice people, and had a great time. Just having the opportunity to meet Col. Bob Thacker was enough to make the Nats worthwhile.

The next contest I was able to attend was a Scale meet at Crow's Landing Naval Base. This was the Radio Control Flyers Unlimited's Giant Scale meet. This was one heck of a great contest. Everything was low key and fun. That steak dinner on Saturday night was just perfect.

After Saturday's static judging, it was time to fly. My bad luck seemed to be following me. That same engine was acting up. I did manage to finish my flights, but the engine was ruining my fun at the contest. I really wasn't keeping too much track of the scores. Only when the contest ended did I realize that I had won the first place trophy.

The A-10 has proven a total success. I have racked up a lot of flights, and I'm just itching to get to more contests. The plane is amazingly stable, and is rock solid on the controls. Skilled pilots like Tom Cook have proven the viability of twin ducted fans, and I can only say that flying a twin fan is a whole new world from single-fan performance. There's plenty of reserve power, and a lot of added safety and reliability. I'm so confident of the Warthog that I wouldn't hesitate to hand the transmitter to any intermediate flier . . . that's how good it really is! □

The aft-positioned fans require the radio to be installed far forward in the nose. Note the generous area of the vertical fins.