

# SUNDOWNNER

Everyman's dream of jet flight is now a reality. This Phantom is uncomplicated, safe, totally throttleable, and has thrust like a jet should.

by Bob Violett



Photo by Ed Sweeney

It's been a long time coming! There have been many noble efforts along the way toward the successful development of true ducted fan flight, but these have always produced something less than maximum efficiency. Having probably already glanced at the photos that accompany this article, I'm sure that your scepticism is equal to what mine was about six months ago, when AAM's Editor asked that I consider building an airplane around the new J.J. Scozzi "Turb-Ax 1." Let it suffice to say that, as a modeler tuned to the high performance spectra of RC, it took only one demonstration of the thrust of this unit to really turn me on to the project.

A reasonable question is why a 40 cu. in. engine was chosen, instead of a 60? The answer lies in horsepower and available rpm. The 5" fan must turn faster than an 11" prop, to gain com-

parable efficiency. At these higher rpm, the newer K&B 40s, Supertigres and HPs (rear rotor) develop more horsepower, on the same fuel, than do most of the pattern 60s. Furthermore, by using a 40, the overall mass of the power unit is held to an acceptable level, so that it adapts well to the airframe sizes to which we are accustomed.

The operation of the unit is uncomplicated. Starting is achieved by a prime in the exhaust and one snappy flip against compression. A belt starter, as utilized by the boat and helicopter folks, can be used by the less adventurous. Throttle is achieved by the same method employed on control line Navy Carrier models, via fuel metering and a slide exhaust baffle. The Turb-Ax instructions detail this throttle setup.

The vibration level of the fan is lower in amplitude, but higher in fre-

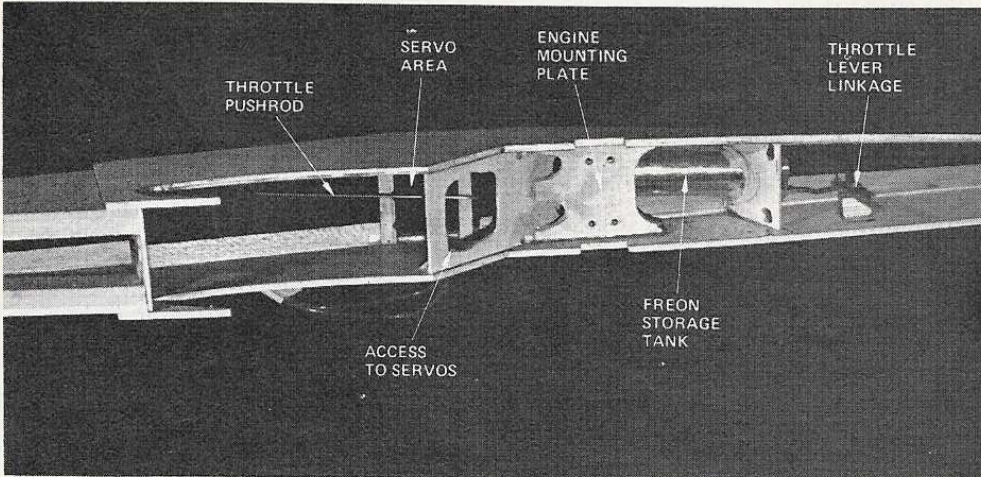
quency, than prop-driven engines. A nice secondary benefit of jet power is that, if you are thinking retracts, you'll never wear out another nose unit.

It is believed that the most enthusiasm for this new concept in power sources will emanate from stand-off scale and pattern (although the appeal to the average sport flier and would-be designer is very strong). With this in mind, the Sundowner evolved from a series of three aircraft, which were built and flown with the Turb-Ax unit. The first two were something less than fantastic; but then, I didn't win anything with my first pylon racer either.

The McDonnell-Douglas Phantom, after which the Sundowner is modeled, is the mainstay of the U.S. Navy and USAF fighter wings, as well as many allied air arms. As a subject for this project, it not only offers this universal



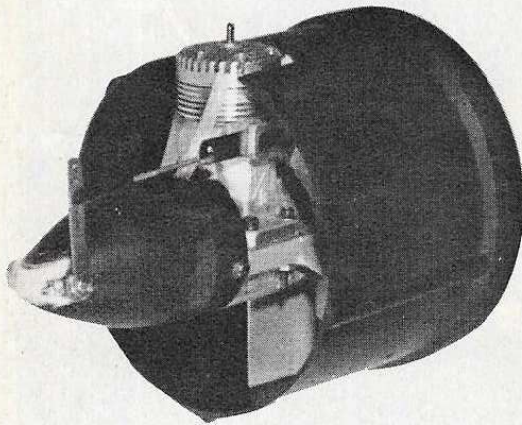
ABOVE: If the absence of a prop on the Phantom doesn't send you up a wall, tear out this page and make yourself a paper glider. BELOW: Typical equipment placement in the Sundowner.



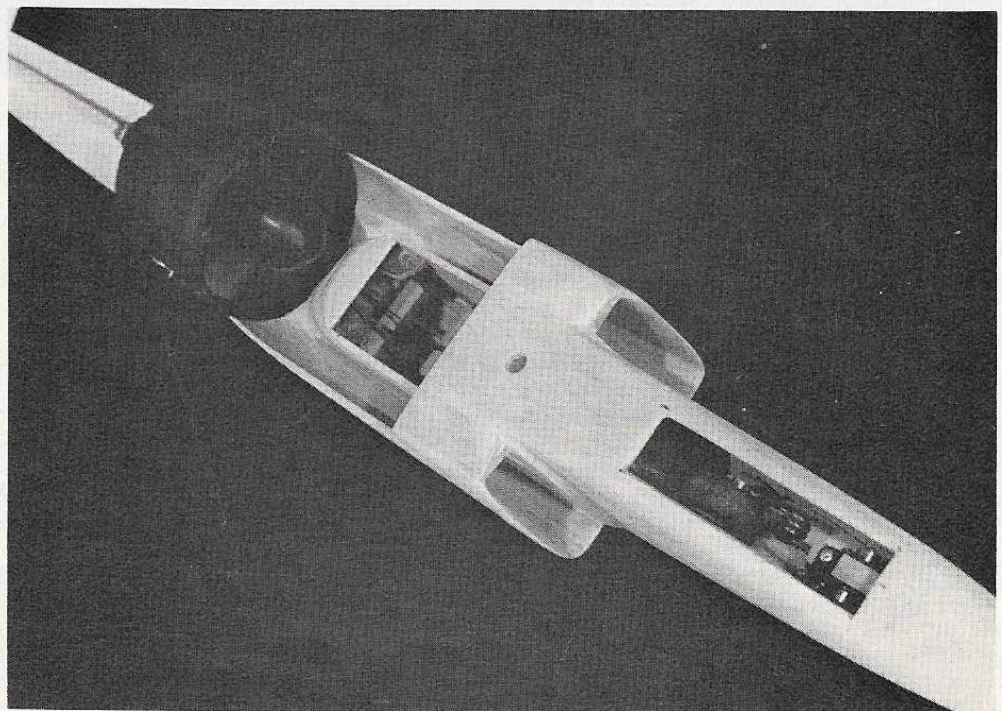
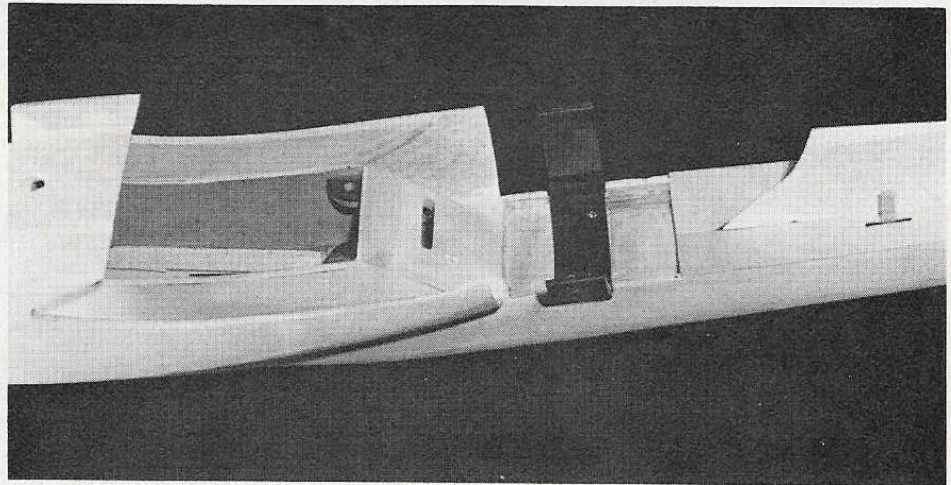
appeal, but the design has everything in the right place for an aerodynamically sound model. The proportions are generous enough that stand-off scale appearance could be achieved in a model designed around proven pattern aircraft moments and areas. The frontal view of the Phantom is almost completely captured and, except for the elongated tail moment and single power unit, the planform and profile are quite characteristic of the full-scale F-4B. The rakish lines of the model are true to the prototype's form. Sundowner is named after Navy Squadron VF III, whose F-4Bs sport this striking paint scheme.

My goal was to prove that, with the Turb-Ax fan unit and the horsepower available from a K&B 40, I could match the performance of a 60 prop-driven pattern ship. With this in mind, and a desire to stick with accepted construction techniques and materials, the Sundowner was born. If you can build and fly any of the popular balsa and foam pattern aircraft, and are interested in jet power, you qualify for this project.

If I haven't convinced you yet to build this Phantom, then skip over this next section, and read the paragraphs on "Flying," as well as the "Flight Report." Those should convince you to order a set of plans. Now we can con-



ABOVE: The Turb-Ax 1 unit, with throttle linkage mods, as shown in the instructions which come with the unit. The fan is a beautifully made and highly engineered assembly. TOP RIGHT: The engine mounting area is far less complex than the front end of the average prop-driven model. The mounting strap for the fan unit simply bolts in place. RIGHT: Resembling some sort of machine from a science fiction movie, the fuselage and fan assembly present a very "unordinary" appearance. The construction is just the same as any other fuselage.



All Photos by Eric Meyers, except as noted.

tinue with the construction text, which follows.

## CONSTRUCTION

It is assumed that you have the basic skills of building and flying, so I will only point out areas of particular importance to "Jet Flight."

Start the wing by notching the foam cores for the 1/2" full-depth medium hard balsa spar. Join the halves (no dihedral) with epoxy. Note that the retract boxes are located aft of the spar, where another piece of 1/2" balsa helps absorb the landing loads on the main spar. Install the aileron bellcranks and the 1/16" pushrods, allowing one end of the crank to extend beyond the polyhedral break. The 1/2" balsa spar for the ailerons is then glued in place, and trimmed to the foam surface. Sheet the cores with 3/32" light balsa skins, cap the leading edge and wing tips, razor plane where necessary, and sand the final structure to shape.

The polyhedral in the wing is a very obvious feature of the Phantom, and it is quite simple to achieve. Hack through the wing with a fine tooth saw (don't cut the bellcranks) and then simply sand the tip section to the proper angle. Butt-join with epoxy. How simple! Cut through the 1/2" aileron spar. Bevel the leading edge of the flapper and hinge.

Again, with a fine saw, hack out the center section shroud cut-out, and cap the sides with 1/64" ply. Use epoxy here—water base glues warp the thin veneer. The forward edge of this engine access area is radiused and capped with 1/2" soft balsa.

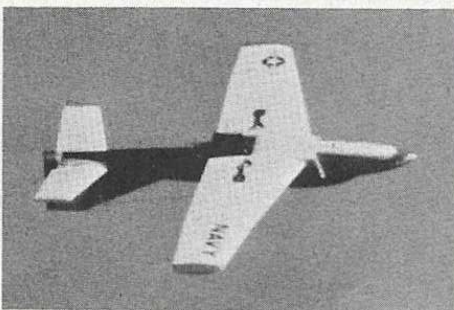
Retract installations are old hat now, so do your own thing here. Just keep the strut location as depicted. With all of these holes in the wing, you might wonder how it stays together? It relies on skin integrity and, for this reason, I suggest using the K&B 3/4 oz. cloth and resin technique, as spelled out in the Superpoxy instructions. A subject of a future article will be a wing unit that can utilize MonoKote.

The stabilizer design was ripped off from Jim Martin's Banshee. As a matter of fact, he built this one for me. It would embarrass him to say how many he built before he got one that I would use. (Just kidding, Martin!) Actually, it's the best system I've seen for producing a light, airfoiled, straight stabilizing surface. The stab, complete with elevators, weighs 1 1/2 oz., less finish. Jim best describes the construction system in his Banshee kit by J&J Industries.

Build the stab as one unit, then saw it in half and bevel the inner faces to get 22° of anhedral (another distinctive Phantom trait). Butt-join with white glue. I'm sure some of you question why I didn't opt for a flying tail? Answer: The next model will have one. The

**TOP RIGHT:** The top blocks are ready for some mad whittling. It might be easier to contour the canopy as a separate block. **BOTTOM RIGHT:** The sculptured, clean lines of the Phantom are accentuated by the almost hidden engine. Painting the duct shroud would conceal it even more.

## SUNDOWNER FLIGHT REPORT AAM Staff



On flight day, the Sundowner arrived, so new from the building boards that dust hadn't even settled on the wing. The AAM staff had turned out, like a group from Missouri, with a skeptical "I'll have to see it to believe it" attitude. We still had trepidations about this being another marginally powered ducted fan model.

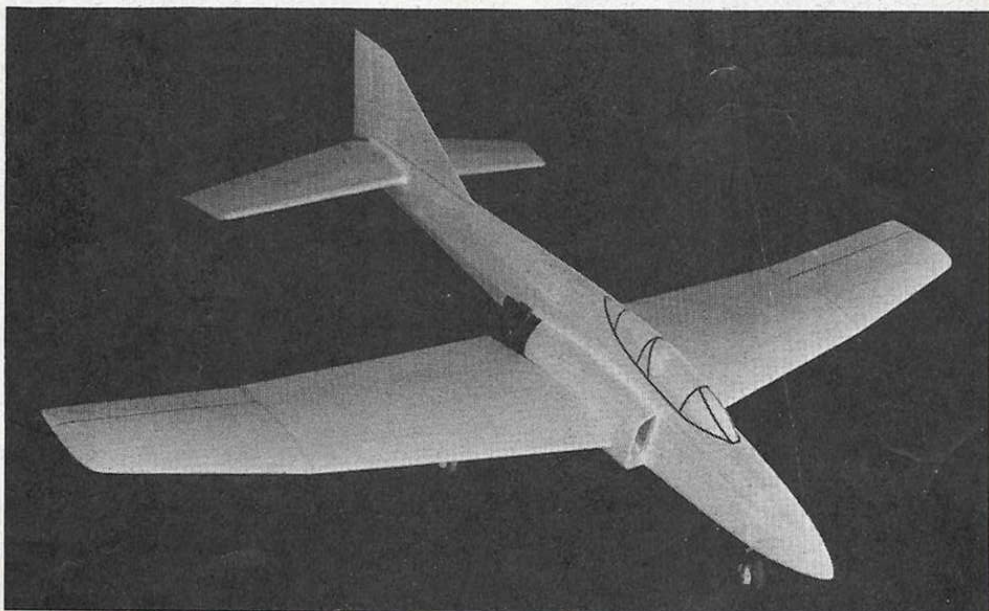
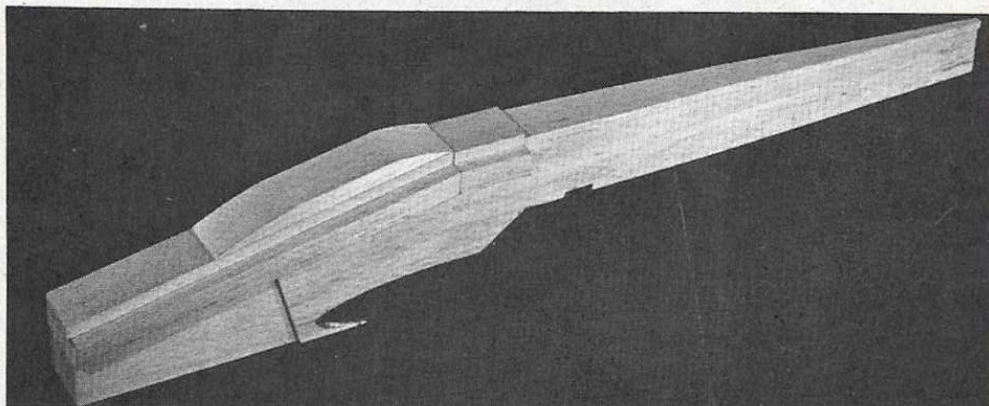
True to form, the wind was gusting at about 20 knots. After a one-flip start of the new Turb-Ax I fan unit, Violet was taxiing out, almost before the photographer could reload film. The fan howled as the F-4B accelerated.

Takeoff roll seemed very satisfactory (about 100' on a paved runway), and rotation was crisp and positive. The Sundowner was already into a big Split-S at the end of the field by the time everyone's heart beat was returning to normal. The only fair comment about the flight characteristics of the F-4B is that Bob did two low rolls on his first downwind pass!

After that convincing display, the rest was gravy. Acceleration was phenomenal. The FAI Top Hat had a nice high base leg, with the model tracking perfectly through the rolls. Within minutes, everyone realized that the Sundowner could hold its own with any pattern ship. All aerobatic attitudes were precise and cleanly defined. The rolls, which weigh so heavily in the new pattern, were easily ten pointers.

The flight ended with an engine flame out (jet talk for ran out of fuel), and Sundowner set up a very smooth and stable glide path (rock solid in the turbulent air). The landing was a good "mains first" affair.

Subsequent flights reaffirmed the exceptional potentials of this ship for competitive flying. There are no more doubting Thomases on the AAM staff anymore. We've seen that the Sundowner can fulfill the highest expectations of even the most demanding pilot.



vertical fin and rudder should be light and straight. To say more on that subject would just insult you.

When constructing the fuselage, keep in mind that the power package has changed location from that of the conventional (but now antiquated) prop-driven machine—thus, the stress members in the fuselage are relocated. Framing up the sides with 1/32" ply doublers, and formers 1 through 6, is very basic. Aft of the power platform, the fuselage sides bend gradually, to form a triangular cross section at the tail post. Use 6-32 bolts and blind nuts to secure the mounting strap (which is supplied with the Turb-Ax unit) to the 1/4" ply power platform. The aft turtle deck is of soft sheet, consisting of two side pieces, custom fit, then capped with the top plank.

The servos are mounted three abreast, on 1/4" ply rails. At this time, the pushrods are installed. I use 1/16" wire inside the yellow portions of semiflex Gold 'N Rod. The elevator rod must, of course, have a "Y" section soldered at the aft end, to operate the separate anhedral elevators.

The forward top deck and canopy are blocked up and spot-glued, along with the nose cone (more jet talk) and bottom 1/2" plank. Carve and sand the canopy blocks to the desired shape, then remove and hollow out. The canopy can also be constructed as a separate unit.

The intakes are functional, and require a little craftsmanship. Assemble them from 1" pieces and 1/4" sides, and tack-glue the assembly to the fuselage (with the Turb-Ax shroud in place) and shape the outside contour as indicated on the drawings. Now remove these sections and hollow out to a thin wall section (about 3/16"). Cover the inside with 3/4 oz. fiberglass cloth and resin, then glue the ducts permanently to the fuselage sides. Do this step with the wing in place, to ensure proper alignment.

Install the throttle linkage. Mount the tail surfaces, making certain everything works. Now button up the bottom by adding the laminated ventral fin and 1/16" balsa bottom sheeting. Install the nose gear, with operating door. At this time, also make the stone deflector

from .01 brass stock. Solder it to a wheel collar and install on the nose strut. This little gadget is essential to troublefree operation of the impeller blades in any ducted fan. The deflector may be removed for grass field operation. Cover the fuselage with 3/4 oz. cloth and resin, and the worst is over.

I use the K&B Superpoxy paint system, and find it to be the best and most durable paint on the market today. It's conceivable that you may want to use high nitro fuels for an extra 1/2 pound of thrust (when you really want to show off). You can pour that hot fuel all over Superpoxy and not harm it. The gray is mixed with K&B's satin hardener, for a nice matte finish. The finish, from bare balsa to what you see here, weighs 12 oz. It's hard to beat that for strength and durability. The finished prototype airframe (no equipment installed) weighed 3 lb. 3 oz. All-up weight on the taxi strip is seven pounds.

### FLYING

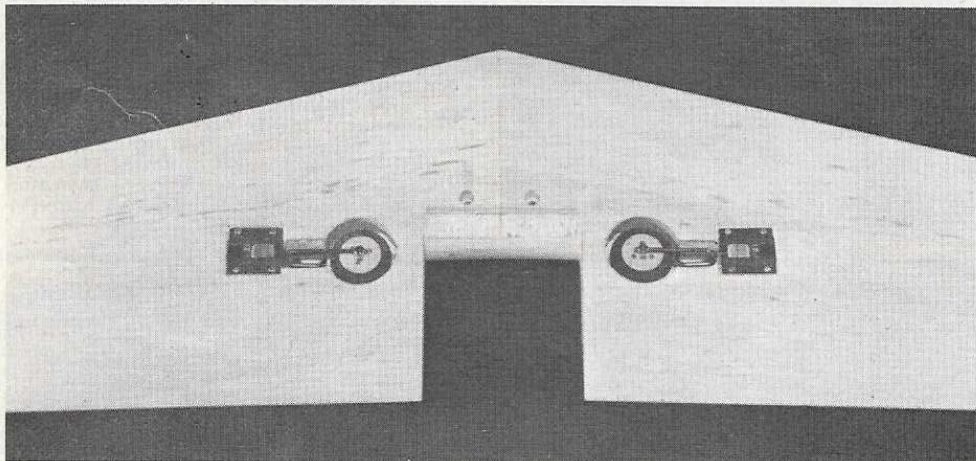
Cast away your fears and disbelief—you're in the "Jet Age" of model aviation now. There are some differences in technique involved in flying a fan which, once mastered, can maximize the performance of your sleek F-4B. On the positive side, consider that there is no prop wash over the flying surfaces and the front of the fuselage. There is no P-factor or prop effect—no 11" gyro acting on the front of the aircraft. The fan itself is a gyro, of course, but a much smaller one, which is positioned very close to the center of gravity.

You will notice all of these advantages on the first takeoff. Right rudder, during roll out, is not required... Sundowner just bores straight ahead. This same smoothness and directional stability exists throughout all of the maneuvers. Having the lower part of the rudder in the jet stream is very effective for the Figure M and Stall Turns.

The takeoff roll is slightly longer than the average pattern ship—about 100' on pavement, and 125-150' on grass strips. When maneuvering, a slightly larger radius of turn, and more smoothness on the controls, will conserve energy. These characteristics are inherent in full-scale jets as well, and will require a slight readjustment of your control techniques.

Performance was discussed earlier, and you probably want to know exactly how good it is. Expect speeds of 100+ mph. Sundowner will do the new FAI Top Hat from a level run in, and it rolls axially better than any model I've flown. If you still disbelieve, suffice it to say that I will be flying the aircraft in pattern competition this season. Also, there will be a Super-8 color film available to clubs and interested groups. For information on obtaining the film, write to me at Route 1, Box 64-B, Clarksburg, Md. 20734. But, don't wait for a film preview of the action...build a Sundowner and experience the exhilaration of being a model jet jockey.

My thanks to Mike Grady, Jim Martin and Eric Meyers for their contributions and encouragement. To the staff of AAM, a thanks for their assistance in getting this material together.



Retract installation is per usual techniques. The large cut-out, which slips over the ducted fan assembly, does not weaken the wing. Note the radiused face at the front of the cavity.

The engine assembly is totally accessible (and quickly removable). Operation of the Turb-Ax is totally safe and reliable.

