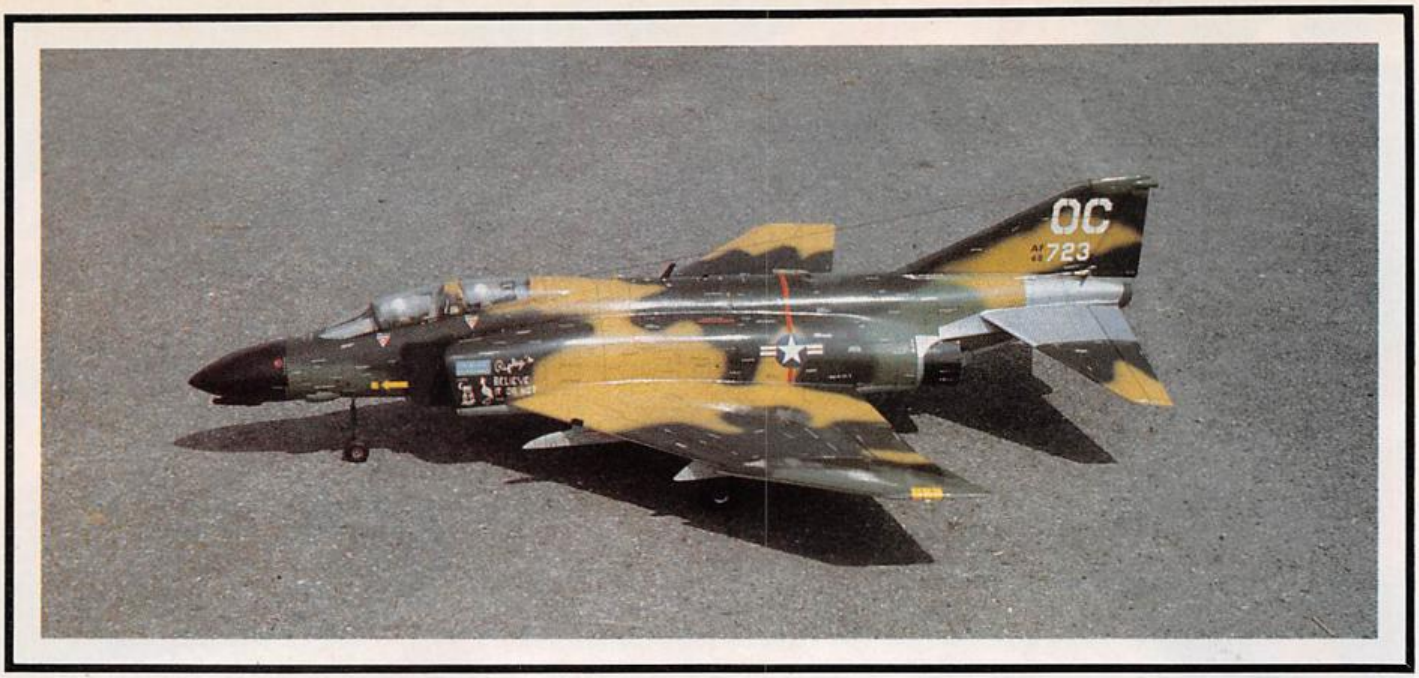


F-4 PHANTOM

A Stand-Off Scale F-4 for a single engine/fan unit.

By Pavel Bosak

The F-4 Phantom has already been modeled several times, with either a pusher propeller or ducted fan unit being used for propulsion. I have built F-4 Phantoms using both of these power systems. In spite of that, I decided to build another Phantom as I consider it to be the most beautiful aircraft ever built. Another reason that induced me to build my latest Phantom is that the development of ducted fan units has shown great improvement since I built my first fan powered Phantom. This model was originally designed for use with a Boss 602 ducted fan unit but I decided to use a Dynamax unit instead. This change was easy to accomplish. I used a Rossi .81 engine for power, although I think that an O.S. .77 would also be an ideal power choice; it retains all the good in-flight characteristics of its predecessors. This aircraft flies fast and is capable of performing all the basic aerobatic maneuvers; it is equipped with wing flaps which I use to make shorter take-offs. My model is also fitted with a braking parachute that does slow the landing roll out a bit, but I actually use it more for scale realism and show. It also features another extra: rockets that are capable of being fired electrically. Eight rockets are carried and can be fired at one second intervals.

As can be seen by viewing the plan sheets, this version of the F-4 Phantom is intended for RC'ers who possess a fair amount of scratch building experience and are accomplished pilots. The plan sheets and written text do not cover every detail and construction technique; however, the assembly process is quite conventional and well within the capabilities of any modeler who has built a few aircraft from plans only.

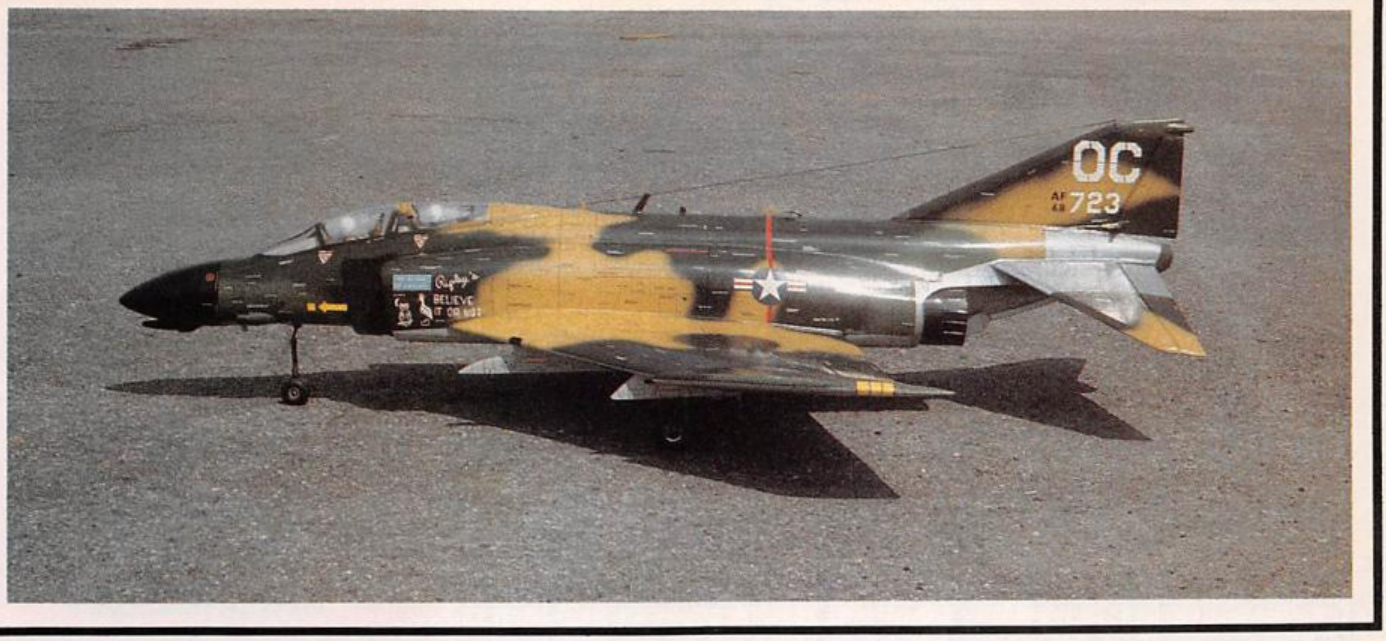
CONSTRUCTION

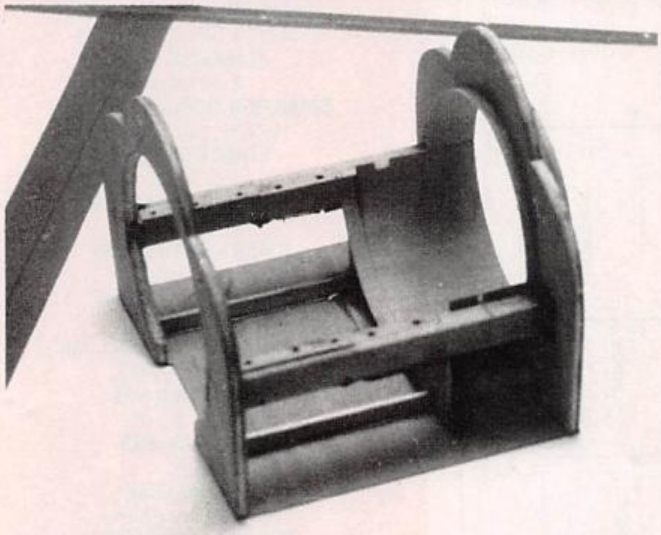
We will begin with the ducted fan unit. Screw the fan unit to the 5/8" square hardwood mounting beams. These mounting beams are now epoxied between formers F5 and F6. The 1/32" plywood (F9) floor is now glued in place. Install half former F5A between formers F5 and F6 as shown. Fabricate the 1/32" plywood air exhaust pipe and install it from the fan unit to former F6. The top half of the air exhaust pipe is made from 1/32" plywood strips (see photo). Cut the F7B formers from 3/16" balsa sheet. Place a 3/8" balsa strip between them and roll the 1/16" balsa sheet exhaust pipes from former F6 to formers F7B (see photo).

Next is the fuselage sheeting. My advice is to use a fuselage building jig. Cement former F7A to the end of the exhaust pipes and formers F7B and install the 3/8" sheet F8 part. Begin planking the fuselage, starting at the top and bottom, and gradually enclosing the entire unit. Cement the F3 and F4 formers in place, followed by formers F1 and F2. Install the retractable nose gear mounting blocks and plywood side braces on former F2. Now install the front fuselage planking between formers F4 and F1. On the bottom, extend the planking as far as the F7B formers.

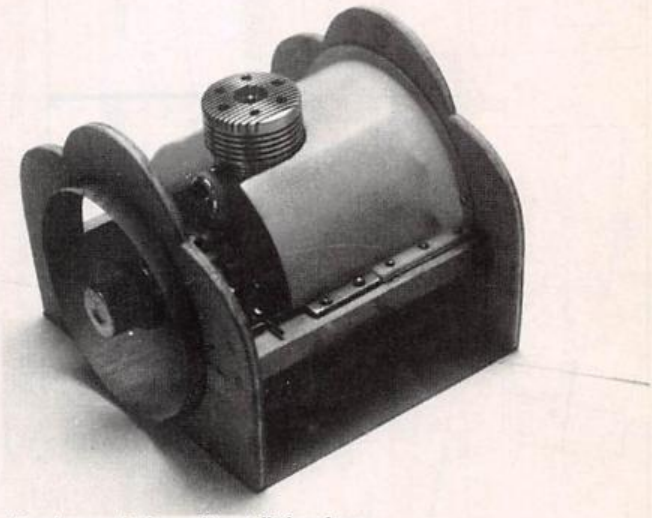
Carve and shape the balsa nose cone to the indicated contour and cement it to former F1. Sand the entire front of the fuselage to a smooth contour. Install the F10 3/32" balsa sheet pieces to the fuselage sides and onto them, formers ACH-1 and ACH-2, which are of 3/32" balsa sheet also (see photos). Install the fuel tank in the area above the exhaust pipe. Drill the necessary holes in former F6 for the fuel line tubing and pull the tubing through to where the engine/fan unit is situated. The remainder of the fuselage top planking can now be installed.

The wings are assembled next. They are primarily of balsa construction and the fabrication process is quite basic and straightforward. All wing ribs are cut from 1/8" balsa sheet and parts W10 and W11 are of 3/16" balsa





Basic motor mount/fan unit housing.



Engine and shroud test fit in place.

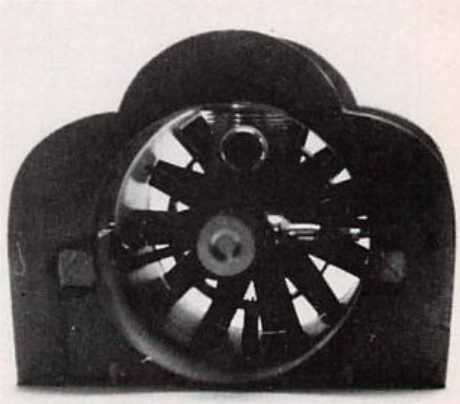
sheet. Both wing panels are assembled over the plan sheet. The left wing panel is constructed bottom side up over the right wing panel view which is shown on the plan sheet.

Note: By spraying the wing plan with a light oil, it can be reversed and the markings still seen clearly. This will allow you to use the same drawing for the left wing panel.

The wing ribs are glued to the main spars and the spruce spar caps are glued in place. Cement the trailing edge portions of the 3/32" balsa wing sheeting in place. Be sure to bevel the trailing edge of the bottom sheeting before installing the top sheeting. Glue the 3/16" balsa sub leading edge pieces in place. Install the plywood retract mounting plates, control cables, etc., and then partially sheet the forward portion of the wing panel.

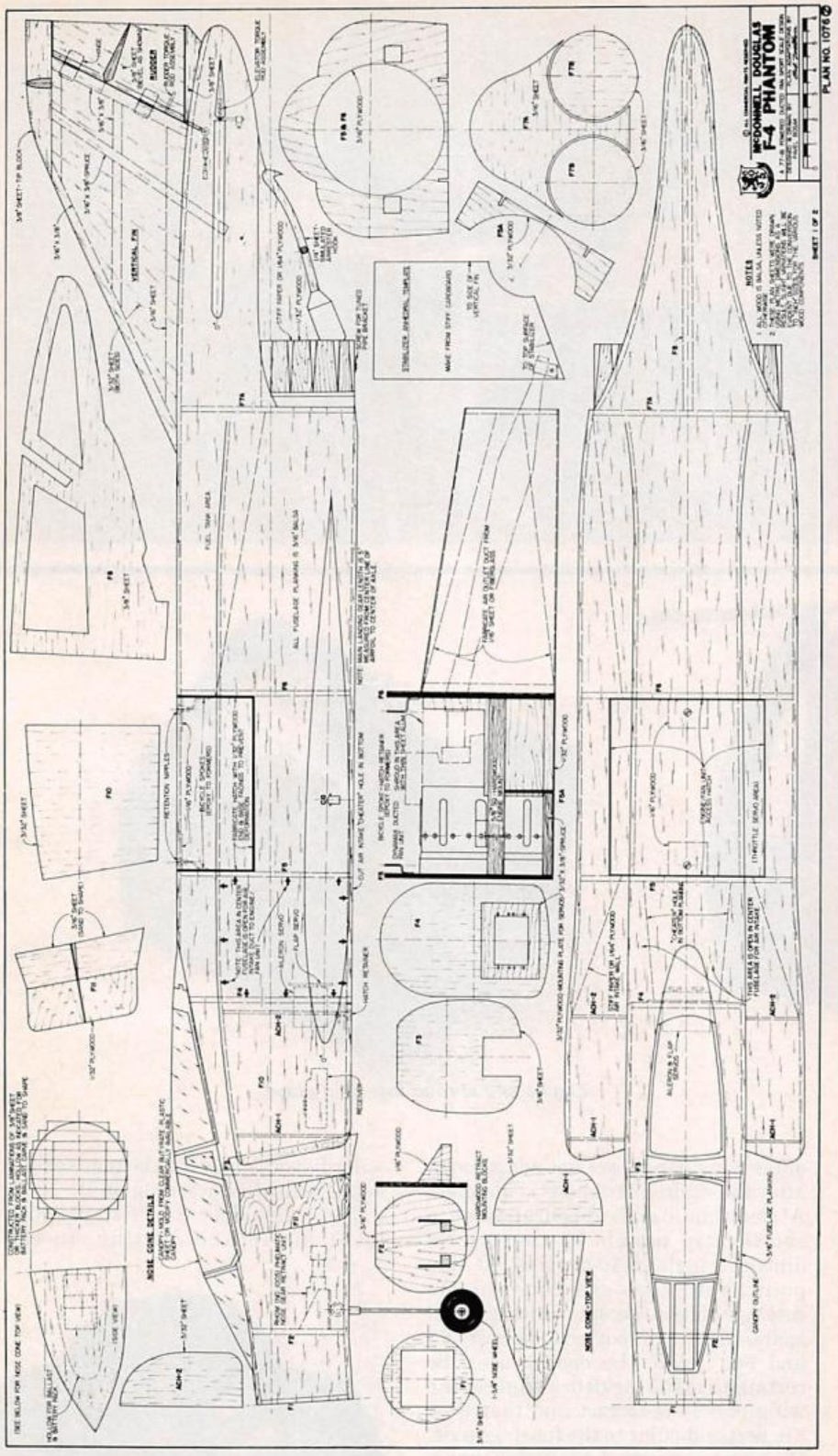
The Phantom is assembled with a fixed non-removable wing. **Note:** The outer wing panels are not added until after the main airframe is completed. At that time, use the dihedral gauge to set the tip panels at the proper dihedral angle of 10 degrees. At this point, the holes are cut into the fuselage sides to accept the wing panel spars, which are epoxied to formers F5 and F6. Before the epoxy cures, be certain that the incidence angle of the wing panels is correct and that they are perpendicular to the fuselage axis. When the epoxy has fully cured, install the remainder of the wing sheeting, the 3/8" balsa leading edges, and the balsa wing tip blocks. Sand the wing panels to the proper airfoil. The holes are now cut in the fuselage bottom for the retractable nose gear unit and the engine air intake "cheater" hole. Cut the main retractable landing gear holes in the bottom of both wing panels. Install the retractable landing gear units, which will allow the model to be more easily supported while working on it.

The stiff paper or 1/64" plywood front air intake ducting, to the



A Dynamax fan unit and a Rossi .81 engine were used on the author's model.

FULL SIZE PLANS AVAILABLE SEE PAGE 248

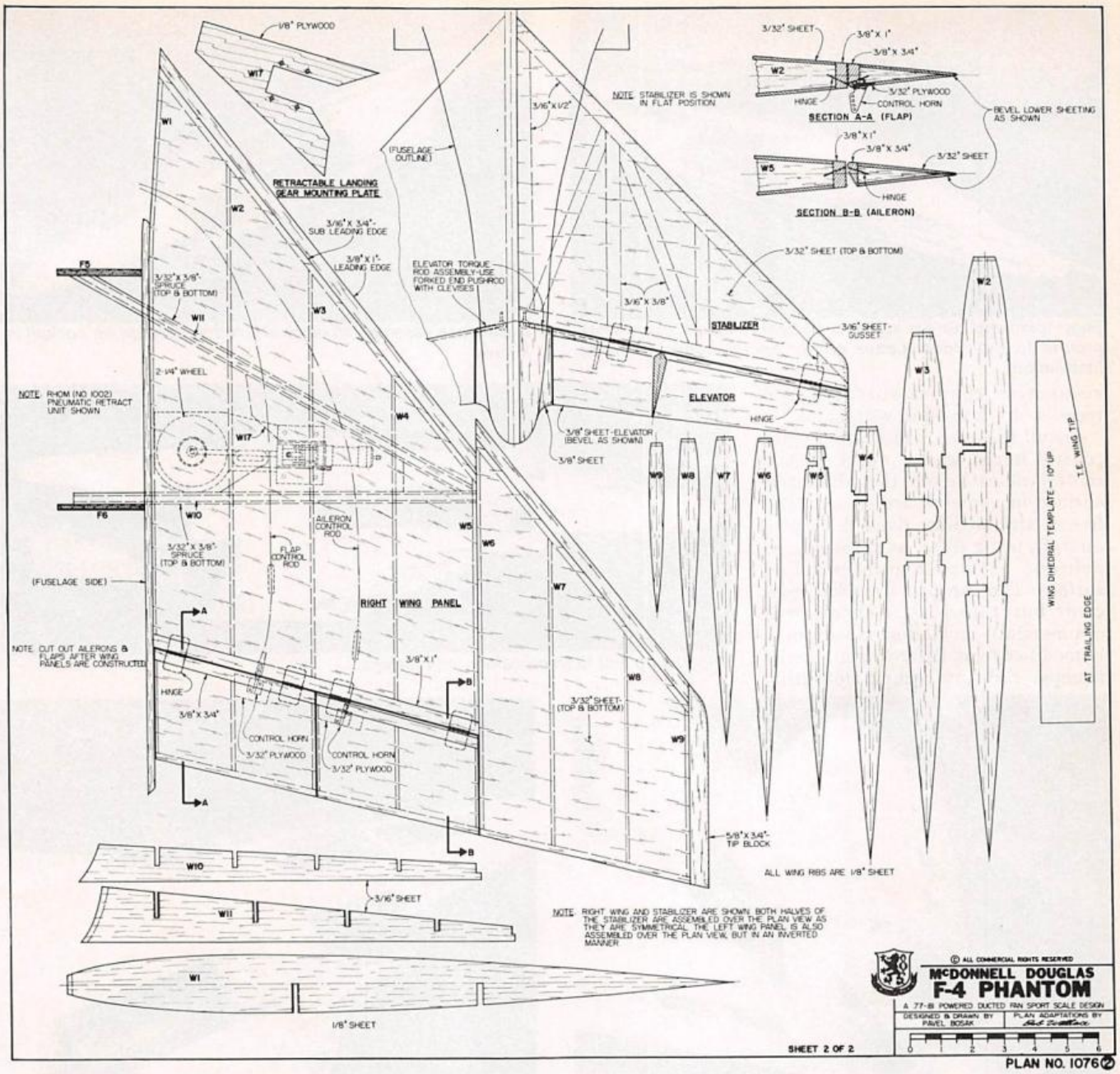


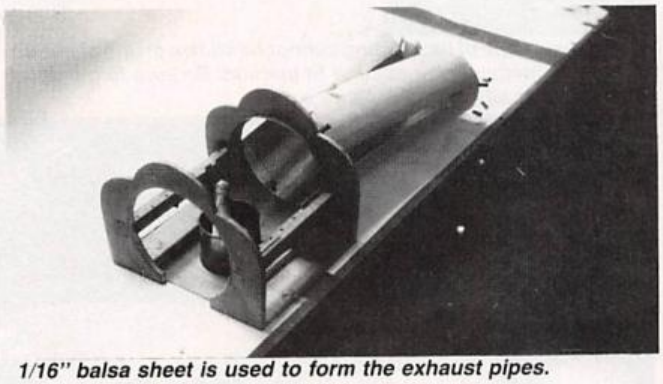
F-4 PHANTOM
Designed By:
Pavel Bosak
TYPE AIRCRAFT
Semi-Scale Ducted Fan
WINGSPAN
44½ Inches
WING CHORD
15¾ Inches (Avg.)
TOTAL WING AREA
930 Sq. In.
WING LOCATION
Bottom of Fuselage
AIRFOIL
Symmetrical
WING PLANFORM
Swept Lead. & Trail. Edge
DIHEDRAL EACH TIP
10 Degrees
OVERALL FUSELAGE LENGTH
62¼ Inches
RADIO COMPARTMENT SIZE
(L) 5½" x (W) 6" x (H) 4½"
STABILIZER SPAN
21¼ Inches
STABILIZER CHORD (incl. elev.)
6-5/16 Inches (Avg.)
STABILIZER AREA
155 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Center of Fuselage
VERTICAL FIN HEIGHT
6-5/16 Inches
VERTICAL FIN WIDTH (incl. rud.)
11 Inches (Avg.)
REC. ENGINE SIZE
.77-.91 cu. In.
FUEL TANK SIZE
16 Oz.
LANDING GEAR
Tricycle (Retractable)
REC. NO. OF CHANNELS
6-8
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail., Flaps, Ret.
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa, Ply
Wing ..... Balsa, Ply, Spruce
Empennage ..... Balsa
Wt. Ready To Fly ..... 187 Oz. (11.68 Lbs.)
Wing Loading ..... 29 Oz./Sq. Ft.

engine/fan unit, are now fabricated and installed. The actual shape of the ducting cannot be seen on the plan sheet. It must be made via the "cut and fit" method, using the construction photos as a guide. This ducting extends from ACH-1 and ACH-2 to former F5. **Note:** The air inlets are not opened in ACH-1 and ACH-2 until all fuselage sheeting is completed.

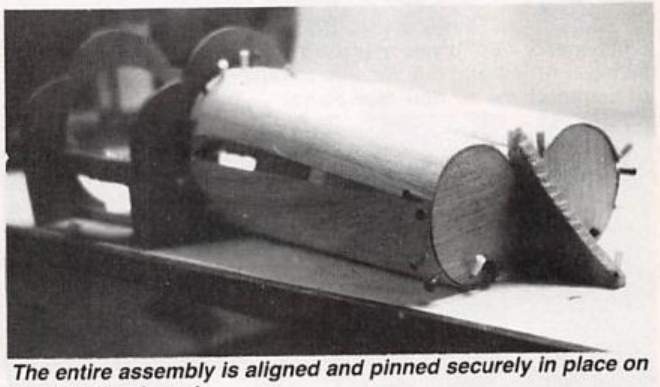
The tail surfaces are constructed over the plan sheet. The basic framework is of 3/16" x 3/8" and 3/16" x 1/2" balsa, which is covered with 3/32" balsa sheet. The rudder and elevators are 3/8" balsa sheet. The left stabilizer is constructed in the same manner as the left wing panel; by reversing that portion of the plan sheet and oiling it. When complete, install the hinges and elevator torque rods and sand the tail surfaces to the proper contour. The tail surfaces are now glued in place. Pay particular attention to the fin and stabilizer alignments. Use the stabilizer anhedral template and be sure the stabilizer incidence angle is correct before permanently gluing it in place.

Next, install the pushrods for the



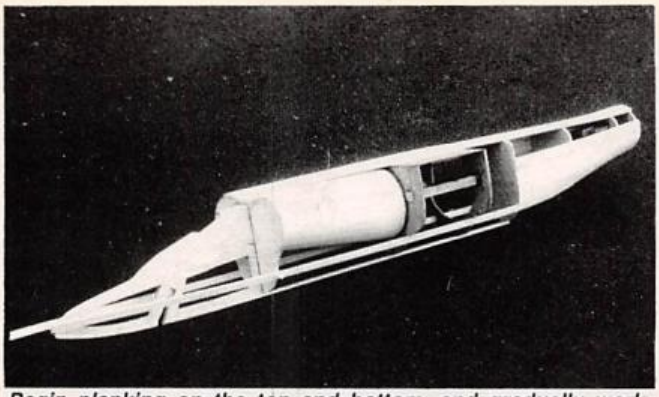


1/16" balsa sheet is used to form the exhaust pipes.

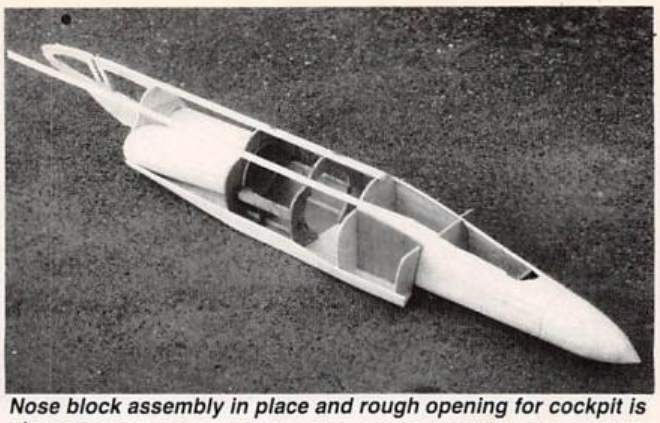


The entire assembly is aligned and pinned securely in place on the building board.

elevator, rudder, retracts, throttle, etc. After installing the pushrods, finish planking the fuselage and sand it to a smooth finish. Cut out the access hatches. One is above the engine/fan unit and the other is on the bottom, between the nose gear opening and the air intake "cheater" hole, for access to the radio compartment. The hatch covers are framed with 1/32" plywood to prevent deformation. The hatches are retained with bicycle spokes and their threaded end nipples. The aileron and flap segments are now cut out of each wing panel, and the



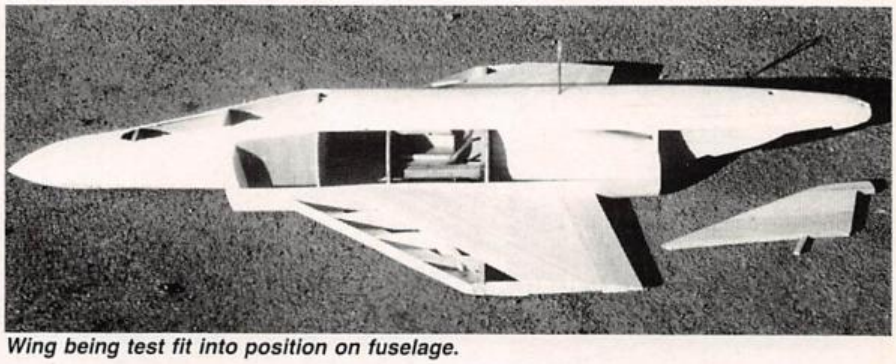
Begin planking on the top and bottom, and gradually work around to the sides. Leave center section open for wing installation.



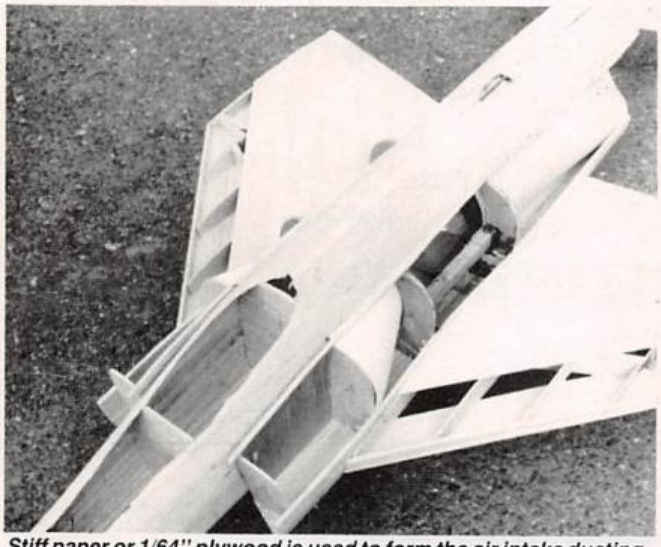
Nose block assembly in place and rough opening for cockpit is shown.

respective control surfaces and recesses are framed in with balsa.

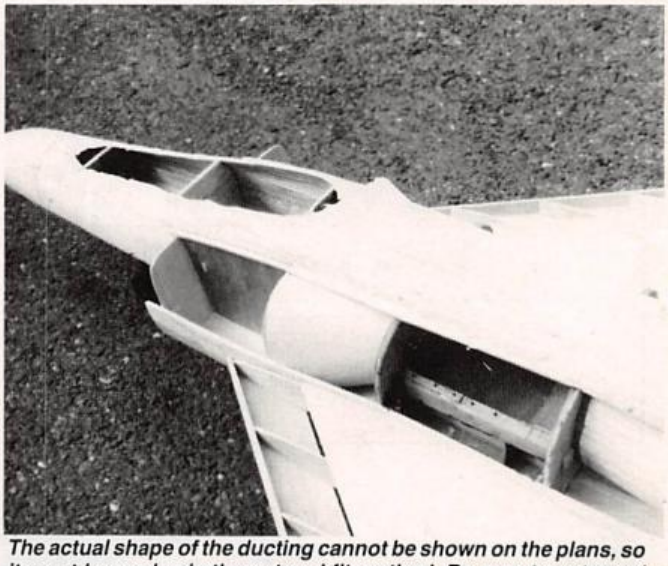
Install the aileron and flap hinges, control horns, and connect up the control cables. Be sure that all control surface movements are smooth and free of any binding. Sand the entire aircraft, using filler, as necessary, to achieve a smooth unblemished surface. The canopy is molded from clear butyrate plastic sheet, or a commercially available canopy may be modified to fit. Before installing the canopy, add any cockpit detailing,



Wing being test fit into position on fuselage.

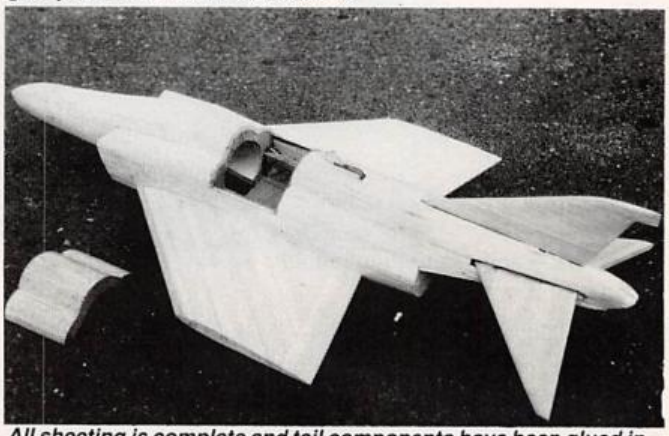


Stiff paper or 1/64" plywood is used to form the air intake ducting between ACH-2 and F-5. Be sure to radius the corners at F-4 to help smooth the air flow (see plans).



The actual shape of the ducting cannot be shown on the plans, so it must be made via the cut and fit method. Be sure to get good glue joints at all contact locations.

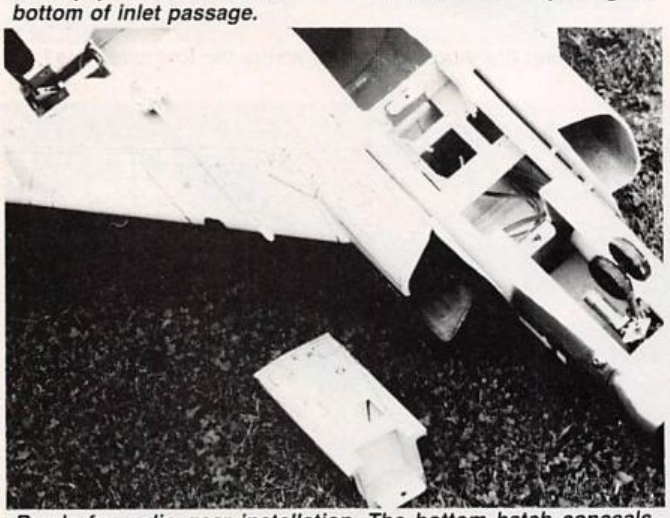
The air inlet ducts in ACH-1 and ACH-2 will be opened after sheeting is complete. The landing gear is now installed so model is easier to work on.



All sheeting is complete and tail components have been glued in place. Top and bottom access hatches have also been cut out.

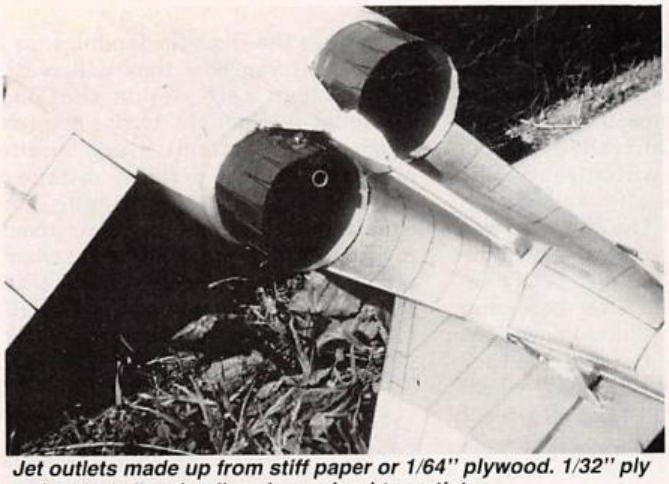
Access hatch and fuselage opening are lined with 1/32" plywood to help prevent deformation. Note cheater hole opening in bottom of inlet passage.

Completed model framed up, sanded, and ready for finish.



Ready for radio gear installation. The bottom hatch conceals receiver and servos. The air inlets are now completely open.

Rubber seal is used to seal against air leaks around cylinder head and help ensure proper cylinder head cooling. Note fuel tank filler/vent lines.



Jet outlets made up from stiff paper or 1/64" plywood. 1/32" ply strips form "eyelets" and are glued to outlets.

Flap and aileron servos can be seen through the air inlet cheater hole. Extensive panel lines add much to overall finish. Also, note location of air control valve for retracts.

such as a pilot, instrument panel, ejection seat, etc., that you wish.

Before finish sanding the aircraft, remove formers ACH-1 and ACH-2, and F7B. Sand the air intake and exhaust opening mouths to a smooth contour and cement the "engine jets" to the end of the fuselage. These are made from stiff paper or 1/64" plywood to which are cemented the strips of 1/32" plywood and then they are rolled into a cylindrical shape and glued in place.

Finishing:

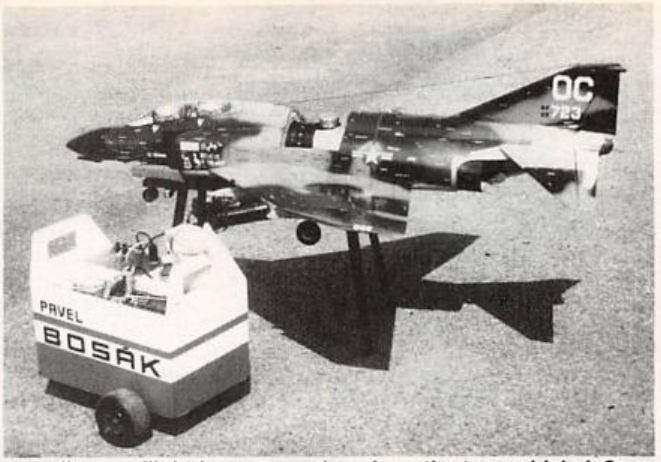
My model was covered with thin tissue and then six coats of nitrate dope were applied. After fine sanding, the color coats were sprayed on, using lacquer type paint. A final coat of fuelproofing lacquer was sprayed onto both the outside and inside surfaces of my model. I used Top Flite decals to detail the model which greatly enhanced the overall appearance of the Phantom.

Flying:

After reinstalling the radio system components, engine/fan unit, retracts, fuel lines, etc., I filled the fuel tank and balanced my aircraft according to the balance point (C.G.) that is shown on the plan sheet. All control surfaces were rechecked to be certain that they were moving freely and in the proper direction.

The engine was started and adjusted, and the control surface operation was rechecked with the engine running. My Phantom was now ready for its maiden flight. Any modeler who has had some ducted fan experience will have no difficulty in mastering the Phantom, as it flies very well. However, the newcomer to ducted fan flying should keep several

Underside of nearly completed model.



Pavel's neat flight box — wonder where the tow vehicle is?

Completed model on the ramp, ready to fly! An outstanding aircraft in all respects.

factors in mind. The first being that you will be flying a relatively heavy model in relation to its smaller wing surface area. Secondly, always remember that a ducted fan powered model will respond more slowly to increased throttle inputs, when compared to a propeller driven aircraft. This is particularly important during the take-off and landing phases. Take-offs should be made by first allowing the aircraft to pick up sufficient ground speed before feeding in elevator to become airborne. Similarly, during landings, if it becomes necessary to use increased throttle, wait until the aircraft's speed has increased before applying "up" elevator. If you use "up" elevator with the aircraft flying too slowly, its sink rate will only increase.

My initial take-offs were made without using flaps. The Phantom was allowed to pick up speed down the runway for about 300 feet before up elevator was fed in. After becoming accustomed to my Phantom's flight characteristics, I now use 5 to 7 degrees of flaps for take-offs, which permits much shorter take-off runs. I do not use the flaps for landings, so I cannot tell you how they will react. What I can tell you is that my Phantom is a delight to fly, attracts much spectator attention, and is quite aerobatic. It will perform sustained inverted flight, loops, rolls, spins, etc. This is about all that I can relate about my Phantom. If anything is not clear, either on the plan sheets or in the text, I will be happy to explain "how I did it" via correspondence. My address is: Pavel Bosak, Zahradni 731/III, 339 01 Klatovy, Czechoslovakia. □