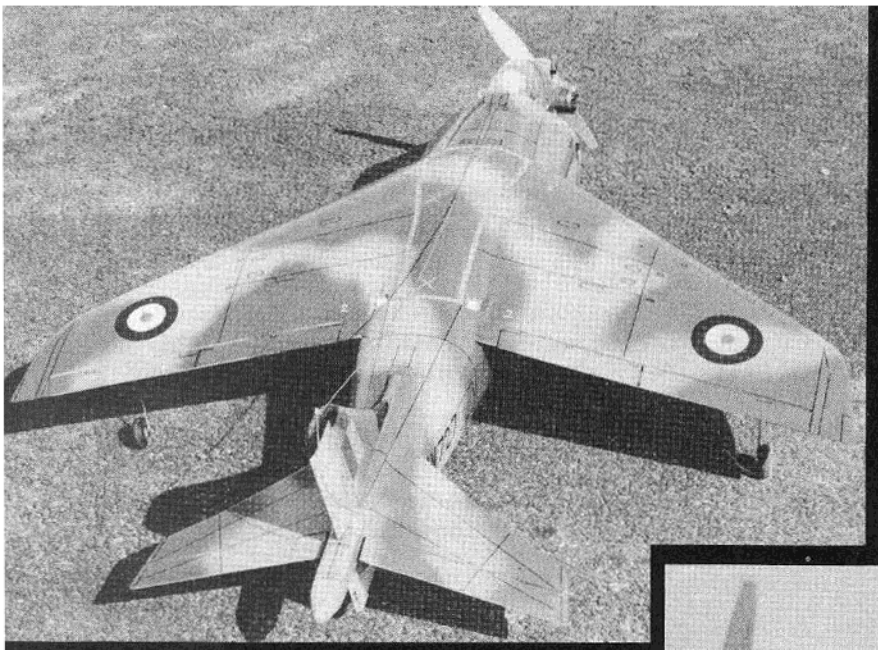
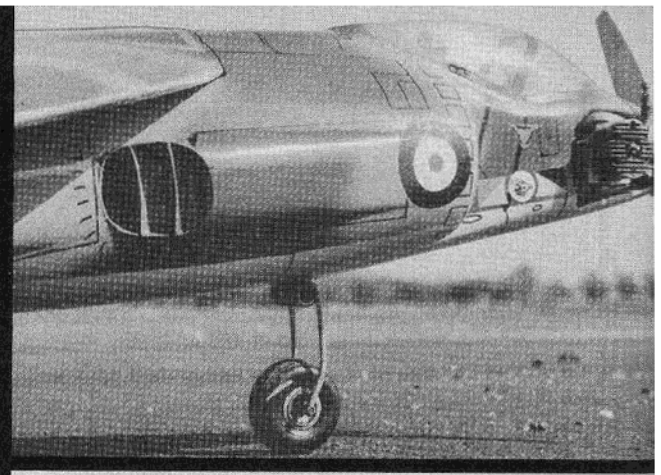
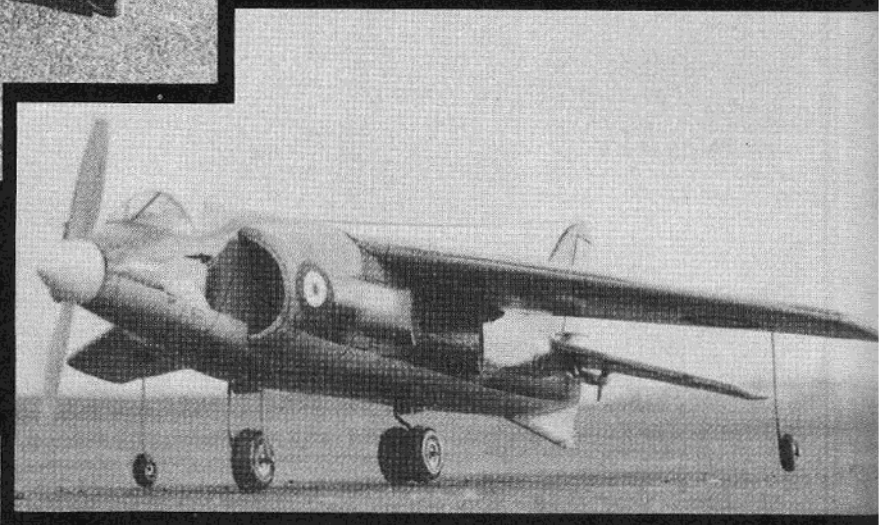
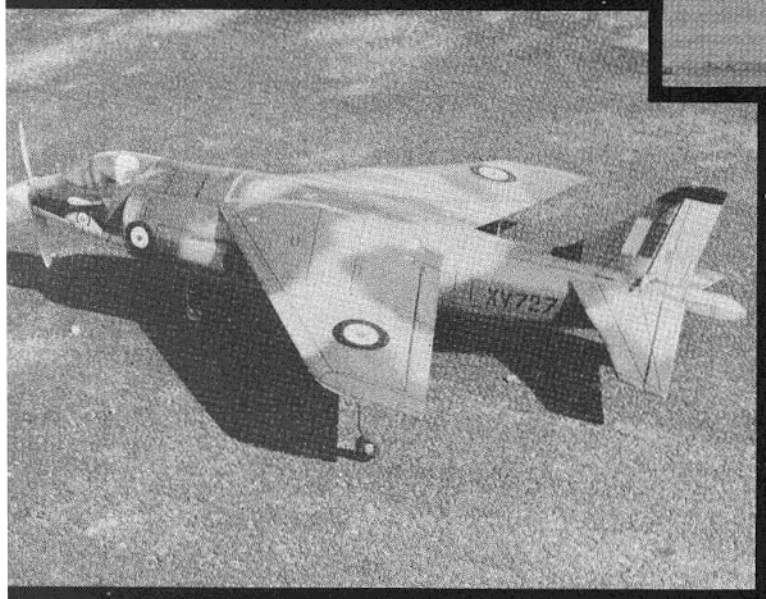




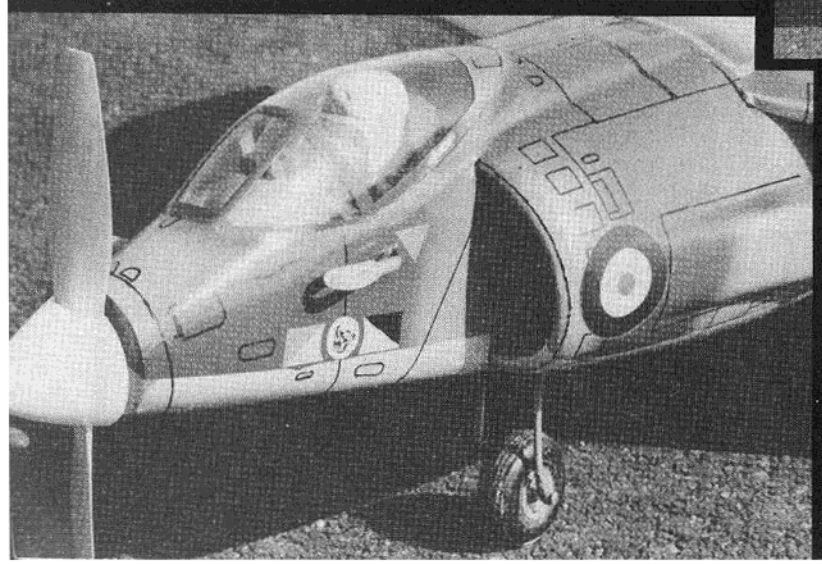
A superb .40 powered sport scale model of the (V/S.T.O.L.) jet fighter.

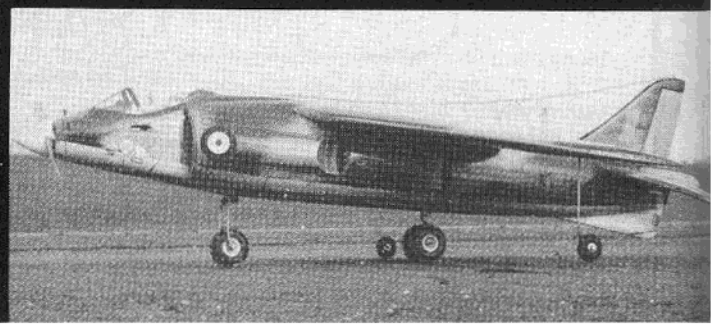


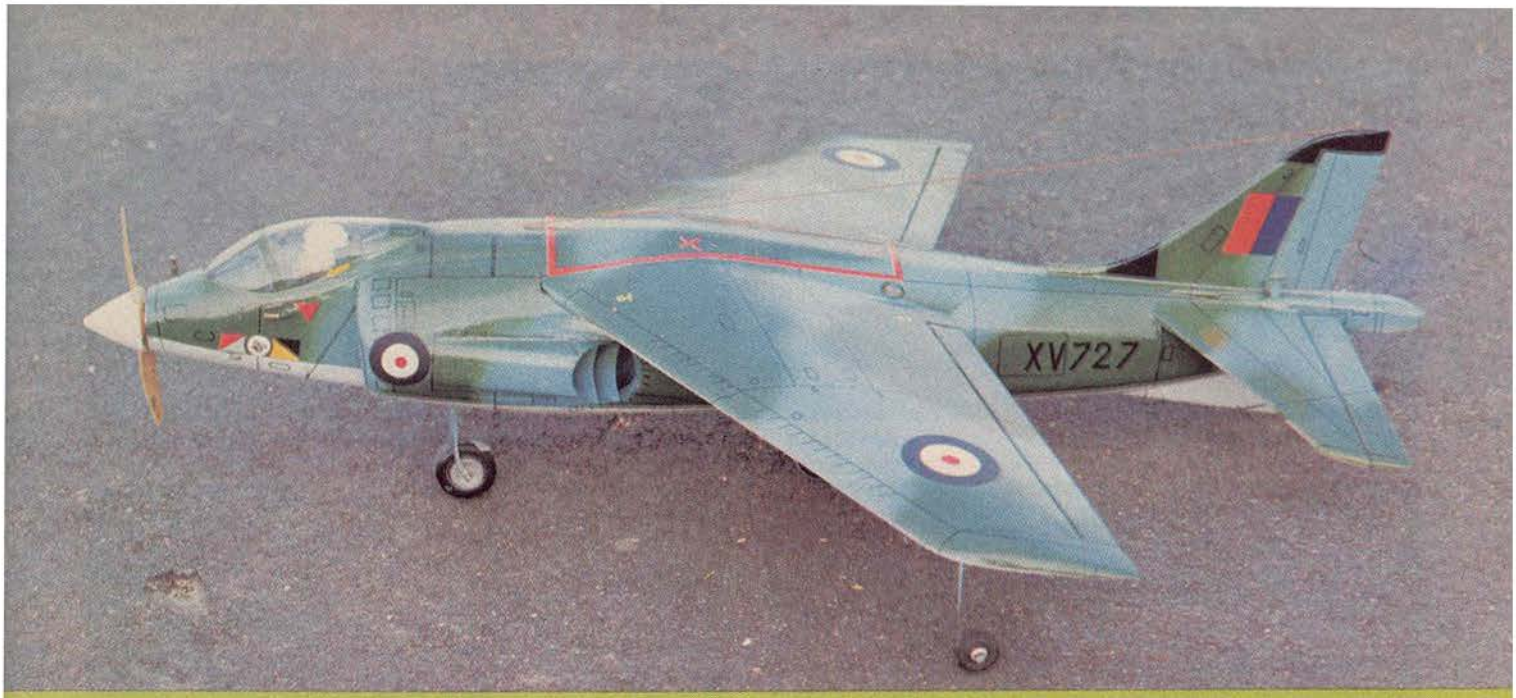


B. Ae. HARRIER

By Pavel Bosak







Thirteen years of service is a long time to wait for your moment of glory; but such was the case for the now celebrated Hawker Siddeley Harrier, the world's first operational Vertical/Short Take Off and Landing (V/S.T.O.L.) jet fighter.

Perched atop the decks of the Royal Navy assault carriers HMS Hermes and HMS Invincible, under the leaden skies of the freezing and windswept South Atlantic, Sea Harriers prepared for the inevitable struggle with Argentine forces that would determine the fate of the disputed Falkland Islands.

Dressed in a stark finish of low-visibilty grey matching their dismal surroundings, Harriers met the enemy: Argentine Air Force fighters, warships, and ground targets. The Harrier drew "first blood" in the Falklands in the late evening hours of May 8, 1980, when two Argentine Air Force Mirage fighters were downed. This victory was followed the same evening with the downing of a Canberra bomber by another Harrier of the Invincible's 801 Squadron. In one peculiar incident, two Harriers managed to down four Argentine Mirages with just three Sidewinder missiles!

The stage was set for victory and when aggressions ceased in mid-June, almost 105 Argentine aircraft and helicopters had been destroyed, nearly two-thirds of which were credited to Harriers. The Harrier had proven its worth as a weapon of modern warfare.

The Harrier is not an aircraft to sit long polishing its medals; for poised off the coast of war-torn Lebanon are a group of U.S. Navy carriers. Their decks are laden with several U.S. Marine AV-8A Harriers ready to strike should the multi-national peace keeping force entrenched in Beirut fall under attack. Let's pray, however, for the Harrier's continued peace time operation.

The model presented here captures all the unique lines and distinctive character of the Harrier without the complexities of using a ducted fan unit or attempting to make it super scale. Shooting for an exciting looking but practical sport scale model, I enlarged the wing and tail, reduced the anhedral, and made some minor outline changes all aimed at simplifying construction and aiding flyability. I don't think the result suffers much from these changes, so here it is for the model building public to judge.

CONSTRUCTION

Wing:

Begin with the wing which needs to be complete to aid in the construction of the fuselage. The wing is of conventional all balsa construction and should present no difficulties for any modeler.

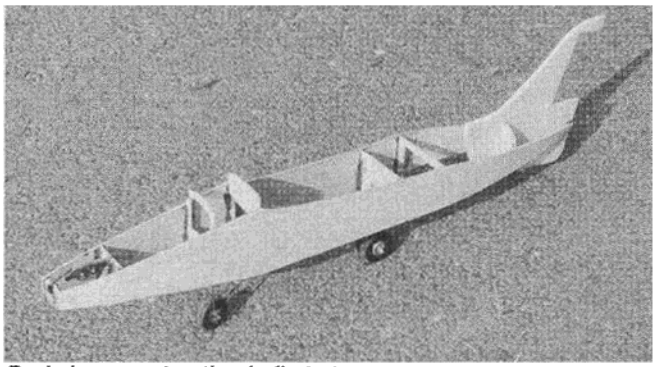
First, cut out all the 1/8" sheet wing ribs W-1 through W-7 and the 3/16" sheet main spars.

The angled slots in the ribs and spars are easily made by cutting slightly undersized slots and sanding

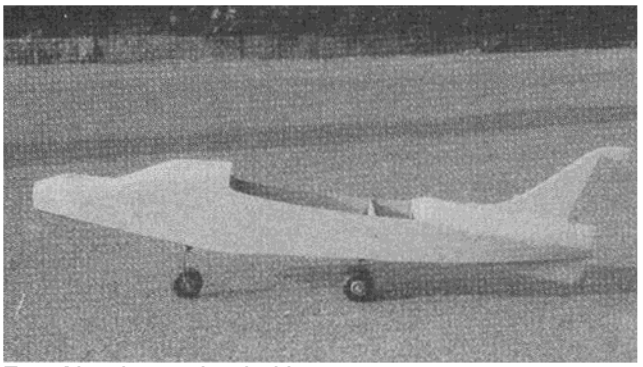
B. Ae. HARRIER
Designed By
Pavel Bosak
TYPE AIRCRAFT
Sport Scale
WINGSPAN
36¼ Inches
WING CHORD
Root 13⅜"
Tip 5½"
TOTAL WING AREA
350 Sq. In.
WING LOCATION
High Wing
AIRFOIL
Eppler 2010 G
WING PLANFORM
Swept Double Taper

ANHEDRAL EACH TIP
2⅜"
O.A. FUSELAGE LENGTH
45½"
RADIO COMPARTMENT SIZE
(L) 10" X (W) 4" X (H) 3"
STABILIZER SPAN
17¼ Inches
STABILIZER CHORD (incl. elev.)
5" (Avg.)
STABILIZER AREA
72 Sq. In.
STAB. AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
6 Inches

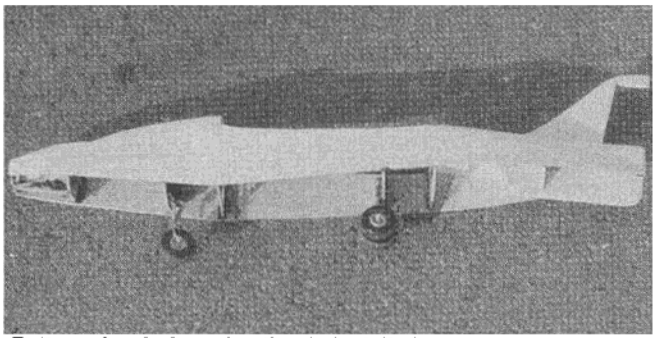
VERTICAL FIN WIDTH (incl. rud.)
6" (Avg.)
REC. ENGINE SIZE
.40 cu. in.
FUEL TANK SIZE
8 Oz.
LANDING GEAR
Tandem w/out Riggers
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Rud., Elev., Ail., Throt.
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa & Ply
Wing ..... Balsa, & Ply, Hardwood
Empennage ..... Balsa
Wt. Ready To Fly ..... 100 Oz.
Wing Loading ..... 41 Oz./Sq. Ft.



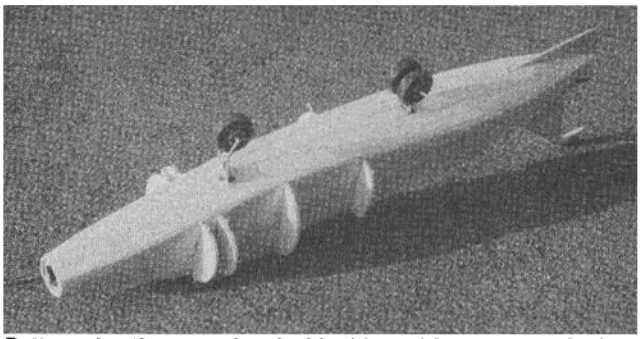
Basic box construction is first step.



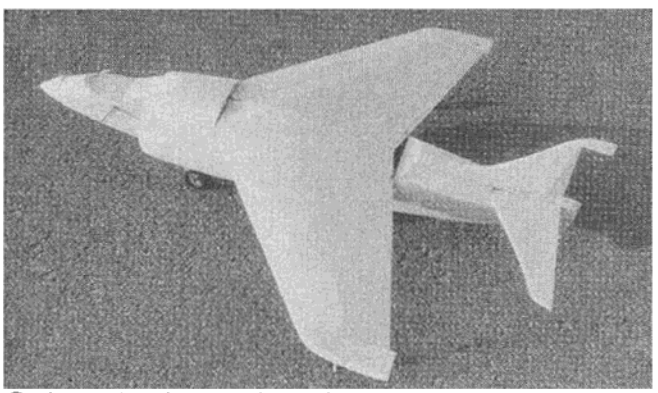
Top of box is completed with sheeting.



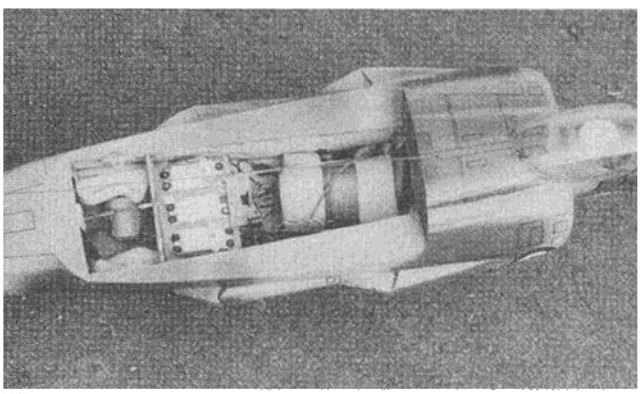
Bottom view before sheeting is installed.



Bottom sheeting completed with side pod formers attached.



Basic construction completed. We always put them together for early bench flying.



Wing removed for easy access to radio gear.

the bevels in with tools consisting of scraps of 1/8" and 3/16" balsa sheet to both sides of which 220 grit sandpaper strips are glued. Be sure to reverse the slot angles on one set so you don't make two sets of ribs and spars for the same side. Carefully bevel the front and rear of each rib, again making right and left hand ribs.

Pin the main spars down over the plans and start adding ribs. Check rib alignment carefully before positioning the 3/16" x 1/2" sub-L.E. and 3/16" x 1/4" T.E. strips. Scrap balsa shims may be used to raise the sub-L.E. and T.E. above the work surface. Sight along the structure to insure uniform shim height as you don't want to build in any warps.

Install the channeled L.G. blocks between ribs W-5 and W-6 then start making the 1/8" sheet wing skins. Give these ample drying time.

While waiting, prepare the wing for its anhedral by first beveling the root of the sub-L.E. and main spar to match the anhedral angle. Place the wing flat against the table upside down and glue the panels together after raising W-7 with a 4¾" shim. Glue in brace WB-1 and reinforce the main spar joint with 6 oz. fiberglass cloth and epoxy resin. Drill 3/8" holes in the center of the L.E. and main spar, then glue in the 3/8" hardwood wing mount dowel.

The sub-L.E. and T.E. strips must be beveled now to accept the wing sheeting. Sheet the bottom first. Note that each of the four wing skins must have a shallow beveled arc cut at the root to mate properly at the wing's center. This is important as there is no center rib for support.

Glue the 1/8" sheet cap ribs onto the center of the bottom skin T.E. which also must be beveled to mate with the upper wing skin. The 3/4" square wing bolt filler blocks and the aileron torque rod assemblies may be added now. The wing is ready for the top sheeting.

Following a quick sanding with a long block, glue on the 1/2" x 3/4" L.E. strips. The 3/8" sheet ailerons may be tacked onto the T.E. with several dabs of Ambroid or similar cement. Glue on the wing tip blocks and the wing is ready for final shaping and sanding.

Remove the ailerons with acetone and a razor blade, then bevel them accordingly prior to hinging with small Du-Bro nylon hinges.

The aileron servo mounting box is made of 1/8" sheet sized to fit your particular servo and set into the bottom center of the wing.

All that remains are the outrigger L.G. struts which are bent from 1/8"

music wire and mounted with small metal straps and sheet metal screws.

Fuselage/Tail Surfaces:

Obviously, the fuselage will be the most time consuming part of this project and some techniques, such as planking, will require more advanced skills than did the wing. Study the plans and photos carefully to familiarize yourself with the construction process.

The best way to begin is by making yourself a "kit" of all the major parts. There are a lot of bulkheads and formers in this model, so take some time to identify each part after it is made.

Before actually assembling the fuselage, have the bulkheads drilled to accept the pushrods, fuel lines, and mounting hardware you intend to use. Also, you might want to make a cut out in F-3 for access to the nosewheel mounting bracket set screw. It is very difficult to do these things after the fuselage is assembled.

Bend both landing gear struts out of 5/32" music wire and silver solder the rear L.G. axle. Bolt these to F-2 and F-4.

Modify and drill the engine mounting plate to suit your engine and epoxy securely four 6-32 blind mounting nuts. Glue the engine mount to F-1 and coat this assembly with epoxy or fuel proof resin.

Now is the time to make the fin since it is built into the fuselage. Sheet the basic structure with 3/32" vertical grained balsa and mark the F-6 location on both sides.

Prepare the fuselage sides by laminating the 1/32" ply doublers with contact cement. Note that the doublers extend from the nose ring to just aft of F-5. Mark bulkhead locations on both fuselage sides and vertical centerlines on each bulkhead.

Now that the tedious preliminaries are out of the way, construction can begin. A simple jig is most helpful for building the fuselage straight and true. There are a few marketed and several "home-builts" described in magazines. If you don't use a jig, beware of twisting the fuselage.

Glue the formers to the sides using the top view and centerline as alignment guides. The centerline is your lifeline here, so keep the bulkheads aligned and you should have no problems. Fit the fin between F-6 and the fuselage sides using a large carpenter's square to check vertical alignment. When dry, plank the fuselage bottom with soft, straight grained strips of 3/16" x 3/8" balsa.

Fit the pushrods for rudder, elevator, and throttle; then mount the fuel tank. Be sure everything is correct with this installation and that there are no leaks, plugged lines, etc. For those desiring tank access, an optional hatch may be cut in the bottom planking between F-1 and F-2.

Using the canopy top view as a guide, cut the windshield floor out of 1/8" sheet. Position this atop F-1 followed by the canopy floor F-7. Glue a small scrap of 1/8" balsa vertically between the top rear of F-7 and F-2 to hold F-7 in position during planking.

Glue on F-5A beveled to mate properly with the top planking. Now plank the fuselage top.

Carve a hole in the nose to suit your engine, then give the main fuselage a thorough sanding.

The enormous air intakes and side mounted jet exhausts are among the Harrier's most characteristic features. Begin these by marking the positions of the intake formers FC-1 through FC-4 on the fuselage sides, then glue the formers in place. Plank both intakes.

Trim the planking ahead of FC-1 and glue on the 3/8" sheet nacelle rings. The planking must also be trimmed to conform to the wing seat.

Mount the 1/2" square hardwood wing mounting blocks. Let dry, then test fit the wing. Trim the planking as necessary. Now install the 1/32" plywood wing seats covering them with Saran Wrap before mounting the wing to prevent glue from sticking. When dry, remove the wing and lightly sand the seats.

The exhaust nozzles aren't as complicated as they look and their basis are four holes cut in the corresponding positions on each fuselage side. Cut formers F-8 and F-9 out of 1/32" ply, bend into approximations of the exhaust rings and glue them into the holes followed by exhaust louvers F-10 and F-11. The nozzle fairings are cut from 1/2" sheet and glued to the fuselage sides, then carved to shape.

Mount the wing again and install formers F-3A and F-5B beveling them as necessary. Remove the wing, and plank this section. Trim the planking front and rear to achieve a tight wing to fuselage fit.

The stabilizer halves are cut from

Bottom of wing showing aileron servo and outrigger wheel.

Designer Pavel Bosak of Zahradni, Czechoslovakia, with the Harrier. It does get cold in the winter.

3/8" sheet, shaped and sanded before mounting. Mark and cut the mounting slots in the fuselage then install the stabilizer halves at the same anhedral angle as the wing.

Cut the rudder and elevators from 3/8" sheet, sand to a symmetrical taper section, and hinge with small Du-Bro hinges.

The Harrier's distinctive long tailcone houses the rear passive warning radar (PWR) antenna. On the model, however, it is simply a carved soft balsa block hollowed to accept ballast.

My canopy was heat molded in the household oven from .030 butyrate plastic sheet using a carved balsa form. This technique has been well-described previously and one outfit offers a vacuum forming unit just for such applications. Of course, a commercially available canopy can be trimmed to fit, or a carved balsa unit substituted. I improved the cockpit by fitting an instrument panel, pilot, and ejector seat top.

Covering and Finishing:

The ultimate appearance of your model depends greatly on the time you spend at this stage.

Fine sand the whole model noting any unsightly gaps, nicks, or dips in the planking. Fill these imperfections with putty and sand again.

When you are satisfied with the quality of the airframe, give it three coats of clear dope, sanding lightly between coats. Cover with lightweight Silkspan paper applied damp. Damp Silkspan handles beautifully over sheeted surfaces. The Silkspan covering saves countless applications of sanding sealer and primers that add weight and always seem to leave some grain showing. Seal the covering with six to eight coats of dope thinned 50-50.

Aerogloss colors were used for the camouflage paint scheme and the panel lines were done in India ink with a ruling pen. All markings are decals sealed with a coat of Aerogloss fuel proofer.

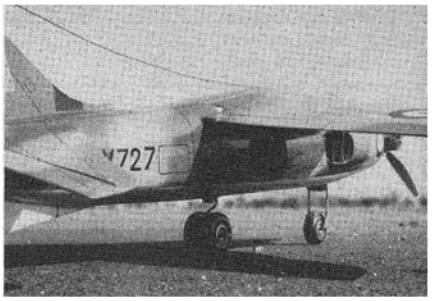
Squadron/Signal Publications offers a fine book on the Harrier showing a variety of color/markings schemes and other details, including Royal Navy colors used in the Falklands.

Completing the Model:

The final stages consists of mounting the engine, wheels, and R/C equipment.

The prototype used an O.S. Max .40 with muffler. The plans show a K & B .40 installed, but any good strong .40 will suffice.

There's plenty of room for R/C equipment in the Harrier's fuselage. Mount the servos on hardwood rails as



shown, epoxied securely. Due to the model's long nose, keep the radio as far back as possible to aid in balancing. Depending on your radio's size, try to mount both receiver and battery between F-4 and F-5.

Carefully balance the model according to the plan. If necessary, add lead to the rear inside the hollow tailcone.

Flying:

Before attempting an actual take-off with the Harrier, try a fast taxi run at full throttle to check nosegear tracking. It should roll straight ahead; if not, make adjustments and try again.

When you are comfortable with the model's ground handling, try a take-off. Because of its high wing loading, give the Harrier a long take-off run. The model should take off without the use of elevator.

After adjusting the trims, start to carefully explore the flight characteristics. I must admit I was worried a little about the anhedral, but these fears proved unfounded. I didn't notice any difference in high speed stability compared with other models. At minimum speed, however, the model does seem a bit unstable, so my advice is to land at a higher speed than the usual sport model. This is a semi-scale model for the experienced builder and flier. It is not for the beginner.

The Harrier should prove to be a most unusual and exciting model for the sport flier; one that will always be invited to the club demonstration show. □

From RCModeler Feb. 1984