AM1823

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SEMI SCALE R.T.P.
HARRIER

Designed By-

NEXUS SPECIAL INTERESTS PLANS SERVICE
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A 20½"WINGSPAN ELECTRIC DUCTED FAN ROUND THE POLE PROFILE MODEL

RECOMMENDED POWER:- BALLARDS' TAWNY OWL OR BARN OWL 1?

2- WEAPON PODS, 1/4"SHEET 'D' VERSION

5/8"WHEEL

BRASS TUBE, EPOXY TO POD

TIP WHEEL LEG 18s.w.g. WIRE EPOXY TO OUTER WING TIP 'D' VERSION

3/8"WHEEL

1/8"SHEET DROP TAN

MISSILE BALSA

PLUG IN WHEEL 'D' VERSION

18s.w.g.

TUBE SPACERS

1/16"SHEET LERX

POWER SOCKET UNDER WING

TETHER HOOK 18s.w.g. EPOXY TO L.E.

CENTRE WHEEL 'D' VERSION

OUTRIGGER WHEEL FAIRING W2 1/4"SHEET 'M' VERSION

W2

1/8"SQ. MISSILE RAIL

1m.m. PLY LEG SUPPORT

10B.A. NUT & BOLT

CLEVIS

NYROD LEG

3/8"DIA WHEEL

FRONT DUCT D1

FAN UNIT

REAR DUCT D2

W1

OUTRIGGER WHEEL FAIRING W1
1/4"SHEET 'D' VERSION
MAKE DUMMY WHEEL FROM SCRAP BALSA. 20s.w.g. LEG

1/8"SHEET WINGS

D WING

DROP TANK GLUE UNDER

M WING

W2

TIP WEIGHT, GLUE UNDER OUTBOARD WING TIP

1/8"SHEET TAILPLANE

ALUM. HINGES

TIP SECTION

W1

F1

F2

F3

FLAP

AILERON

F1

F2

F3

FLAP 1/8"SHEET

DROP TANK GLUE UNDER

AILERON 1/8"SHEET

FAN DUCTS, MAKE FROM 3/32"SHEET- GLUE TO FAN UNIT

WING DIHEDRAL TEMPLATE (CARD)

WING SECTION AT F1

FLAP SUPPORTS
1/8"SHEET, GLUE UNDER WING

F1

F3

F2

BALANCE

CHAMFER THIS AREA-BOTH SIDES

CHAMFER BOTH SIDES

1/16"SHEET FIN

BEND RUDDER 10° TO RIGHT

CUT OUT THIS AREA FOR FAN UNIT

VECTOR PLATE

8B.A. NUT & BOLT

3/8" SOFT SHEET FUSELAGE

3/32"SHEET

TAILPLANE ANHEDRAL TEMPLATE FROM CARD

TIP BLOCK 3/8" SHEET -GLUE UNDER WING TIPS

BRASS TUBES EPOXIED INTO FUSELAGE FOR PLUG-IN U/C. 'M' VERSION

2off x1m.m.PLY STRIPS X 1/4"WIDE, GLUE UNDER FUSELAGE

MAIN U/C LEGS BIND WITH FUSE WIRE & SOLDER

DRILL 1/16"DIA.

BEND AT 90°

PLUG-IN NOSE WHEEL LEG 18s.w.g.

BIND WITH FUSE WIRE AND SOLDER

1"DIA. WHEEL

1¼"DIA. WHEELS

BEVEL TOP EDGE

2 WEAPONS PODS 1/4"SHEET 'M' VERSION

PLASTIC TUBE CANNON

THIN ALUMINIUM THRUST VECTOR PLATE 2 REQUIRED

FRONT D1

REAR DUCT D2

AM1823

ROUND-THE-POLE HARRIER

The latest in a line of super RTP models from Peter Lambert in Tasmania

An article of mine in March '95 Aeromodeller describing ducted fans for RTP created considerable interest, but the thought of constructing their own fan unit still deterred some modellers. Luckily it is now possible to buy a ducted fan unit to suit most of our RTP models. The Tawny Owl and Barn Owl fan units sold by Ballards' are suitable for either a 12 or 18V motor and with a relatively low current demand, compatible with most RTP control systems. I've found the thrust/weight ratio about 10% better than that of the hand made units I used on my 747 Jumbo and Airbus models.

The model featured here, based on the Harrier GR5, has been designed with one of the Owl fan units in mind. Although some liberties have been taken with the wing, the overall appearance is undoubtable Harrier. By utilising all sheet construction, building is simplified. The prototype was built in about five hours, requiring only the addition of nose and wingtip weight before demonstrating excellent flight characteristics.

VECTORED THRUST

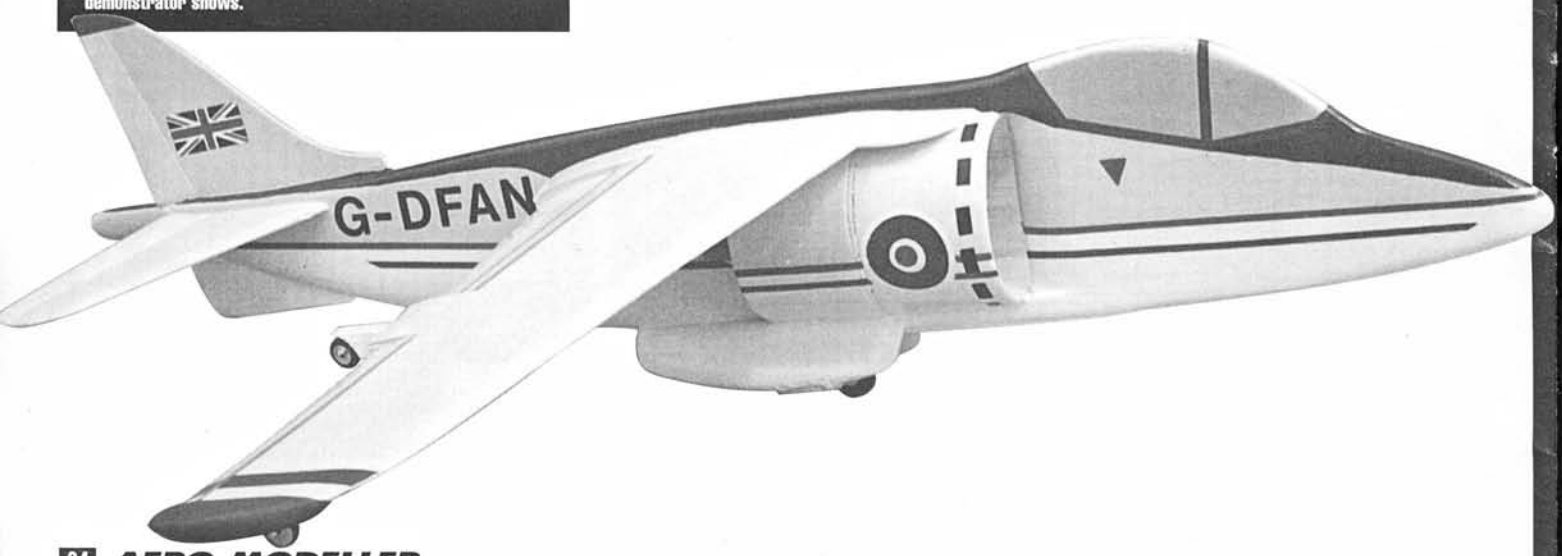
In addition to flaps, a special feature of this model is adjustable thrust vector plates which enable additional variations to flight patterns. Although not capable of VTO, shortened take-off runs are possible by careful adjustment of the plates and a blast of full power! A little experimentation will reveal the optimum setting for short take-offs. On the prototypes it was around 15 - 20°. The flaps and drooped ailerons (as on the full size aircraft) enable the model to fly quite slowly when power is reduced. These are shown on the plan as being fixed at optimum angles (which adds to the rigidity of the wing), although hinging in the same manner as the elevators would allow further variation to the flight pattern. Anhedral is incorporated like the full size aircraft, which contrary to my apprehensions during the design stage, imparts rock like stability. The full size aircraft has an all moving tail but elevators are used on the model to simplify trimming.

WARBIRD OR DEMONSTRATOR

Two versions of the aircraft are shown on the plan. The military one incorporates drop tanks, rockets and plug in U/C and adjustable outrigger wheels. The manufacturers demonstrator dispenses with all these items, having instead a small fixed central wheel situated between the weapon pods, and another on the outboard wingtip. These are barely visible in flight and are sufficient for a brisk take-off. As to be expected the reduction in weight and drag enhances performance, although both versions are capable of fast exciting jet-like flight, and sound the part too! On 6.5m (21ft) lines and on full power (using vectored thrust) the prototypes quickly run out of air space in the local gym.

The design calls for the jet unit to be built integral with the fuselage, but with the reliability of modern electric motors this shouldn't present any problems provided good a quality motor is used. Both my models are fitted with a 12V motor although Ballards can offer these fan units with an 18V motor.

Without drop tanks, underwing pylons and missiles the Harrier is quite a sleek aircraft as this attractive demonstrator shows.



Just remember that although you have the added option of vectored thrust for short take-offs, don't try to put the fan unit into after burner mode to achieve vertical take-offs. You will only burn out the motor. The thrust deflector plates are very effective up to a certain angle, beyond which they reduce the thrust and become counter productive.

So if you're ready to move into the jet age, let's get started with the construction. It is important to select light soft balsa for this model if you want good performance.

THE FAN UNIT

Cut the two fan ducts from 3/32" (2.4mm) sheet. Avoid using quarter grain as the balsa needs to be flexible enough to wrap around the fan shroud. The inlet duct has a slight taper and glues to the small lip in front of the fan flange. Using cyano adhesive for fixing the balsa ducts to the fan unit makes this a fairly simple process. The flange can easily be trimmed down level with the outside of the ducts by careful use of a sanding block.

FUSELAGE

Before cutting out the fuselage, prepare the two thin strips of 1mm ply which strengthen the central fuselage area. These are glued to the bottom of the fuselage before attempting to cut out the middle area for the fan duct. The fan duct needs to be a snug fit into the fuselage cut out, but not so tight that the duct is distorted causing the fan to rub. Cutting out the area slightly undersize and carefully sanding is probably the best way. It is also important to bevel both sides of the fuselage at the duct entry and exit points to minimise interference with the air flow.

If you intend to fit the plug in U/C (military version), now is the time to drill the holes through the ply on the bottom of the fuselage for the brass tubes, which should be epoxied in place.

While you've got the drill handy, drill the hole for the vector plate fixing bolt. Now would be a good time to make up the plug-in U/C if you are fitting one. Both nose and main legs are made from two parts bound and soldered together. The 1/4" sheet weapons pods need to have the top edge bevelled so that they form the correct angle when glued to the fuselage. The pods for the demonstrator version need short pieces of brass tube epoxied to the bottom for the central wheel. The U-shaped central wheel support is a push fit into these tubes. Don't forget the spacers to keep the wheel central.

WINGS

Cut from 1/8" sheet and leave the flaps and ailerons in place until after sanding to section. Also sand the wing root to give the correct anhedral angle using the template pattern. Carefully cut out the flaps and ailerons, and sand the front edges to make a good joint when glued at the correct angle, but do not glue them at this stage.

Next attach the wings to the fuselage. I have found the easiest method is to pin them in place, checking that the anhedral angle and the curve of the wing root are correct. The root curve is important as it is directly in the airflow from the fan. A few drops of cyano will hold the wings in place although the joint should be reinforced with a fillet of PVA white glue.

The flap supports F1 -F3 and the tip blocks are now glued to the underside of the wing so that they butt up to the ends of the flaps and ailerons which should also now also be glued in place. The flap supports not only ensure the correct angle for the flaps and ailerons but tie the whole wing together and make it less prone to twisting. The tether hook is made from 18 swg wire and pushed into the LE before epoxying in place. Once this is fitted, the 1/16" sheet LE extensions (LERX) can be glued on. The small power connection socket is glued under the wing just outboard of the LERX.

TAILPLANE AND FIN

Other than the separate hinged elevator, the tail assembly is virtually a cut out, sand and glue on job. Use a sharp knife to make the elevator hinge slots, and cut the hinges from an aluminium soft drink can. Once the elevators are hinged in place, a drop of cyano into the hinge slots keeps everything in place. Use the same pin and glue method as used on the wing to secure the tail unit to the fuselage. The template on the plan should be used to ensure the tailplane set correctly set. It is a good idea to glue some offset on the rudder now rather than later. The amount is not critical and about 10o should be sufficient.

ALTERNATIVES

If you intend to complete the model as a warbird, the drop tanks are made and glued in place before painting. Do make sure that these are glued to the wing parallel to the fuselage, otherwise high drag (or even a rudder effect) will result. The rockets (made from drinking straws and balsa) are added after painting and are attached to the rocket rails with small strips of Sellotape.

The adjustable outrigger wheel legs are made from a piece of plastic tube with a clevis at each end. One clevis secures the wheel and the other, which is bolted to a small piece of 1mm ply on the underside of the outrigger fairing, allows the leg to be pivoted to the desired angle. I used a piece of Nyrod (as used for radio control models) for the outrigger wheel leg which enabled the clevises to be screwed onto the ends). The outrigger wheels don't need to revolve and serve only to keep the wings level during take-off and landing.

After fitting the small outrigger wheel fairings (W1) and the dummy wheels, (made from balsa) the clean wing of the demonstrator needs only the outboard tip wheel fitted before it is complete. The tip wheel leg is epoxied to the tip block.

FINAL DETAILS

Both prototypes were given two coats of dope and talc, rubbed back with wet and dry paper, then a thin coat of Humbrol enamel. Several air forces use the Harrier, including the US Marines, so in addition to a demonstrator version, you can choose from a number of military colour schemes.

FLYING

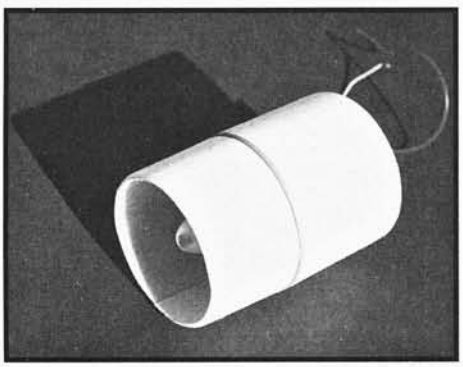
Check that the C of G is as shown on the plan. Add nose weight as necessary. Both prototypes needed more than the usual amount of (outboard) tip weight to stabilise the take-off run, probably due to the U/C arrangement. However, in spite of this, the models fly level even at very low speed.

The prototypes are usually flown on 21ft lines to fit the space available in the local gym. They can fly on line lengths of up to 30ft provided you have a control system to supply the extra power. Initial flights should be made with the thrust deflectors at a neutral setting and trimming carried out using elevator and/or weight adjustment. If the model shows any tendency to veer off course during take-off, check wheel alignment or add tip weight.

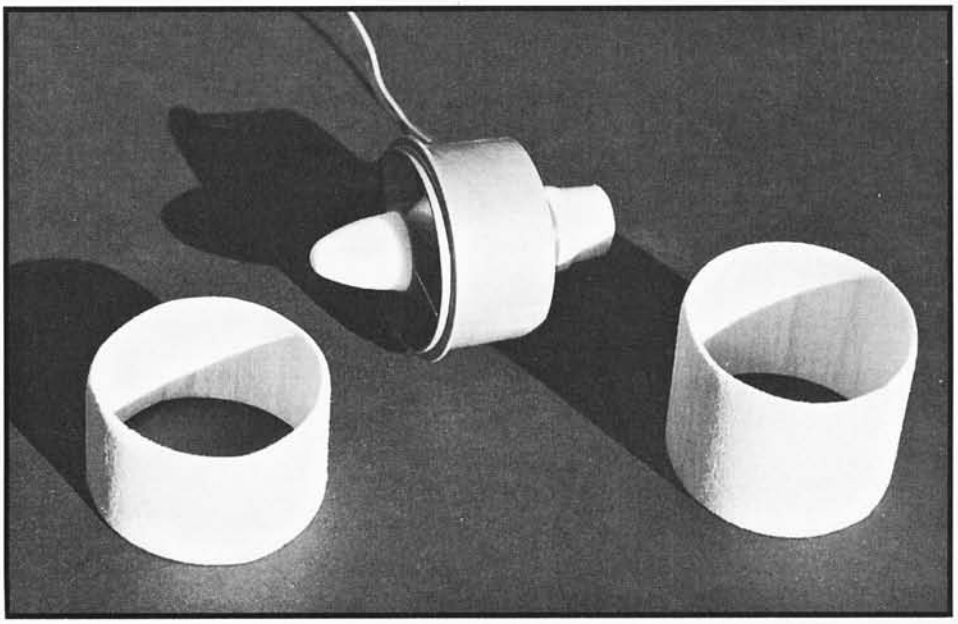
Only after you have trimmed the model and become familiar with its flying characteristics should you start to vary the angle of the deflectors. You will find these are quite effective in increasing climb rate and shortening the take-off run. With zero thrust deflection, high speeds are possible and with two models in the air at once, the sight and realistic sound of "jet" aircraft having a joust certainly adds a new dimension to RTP combat.

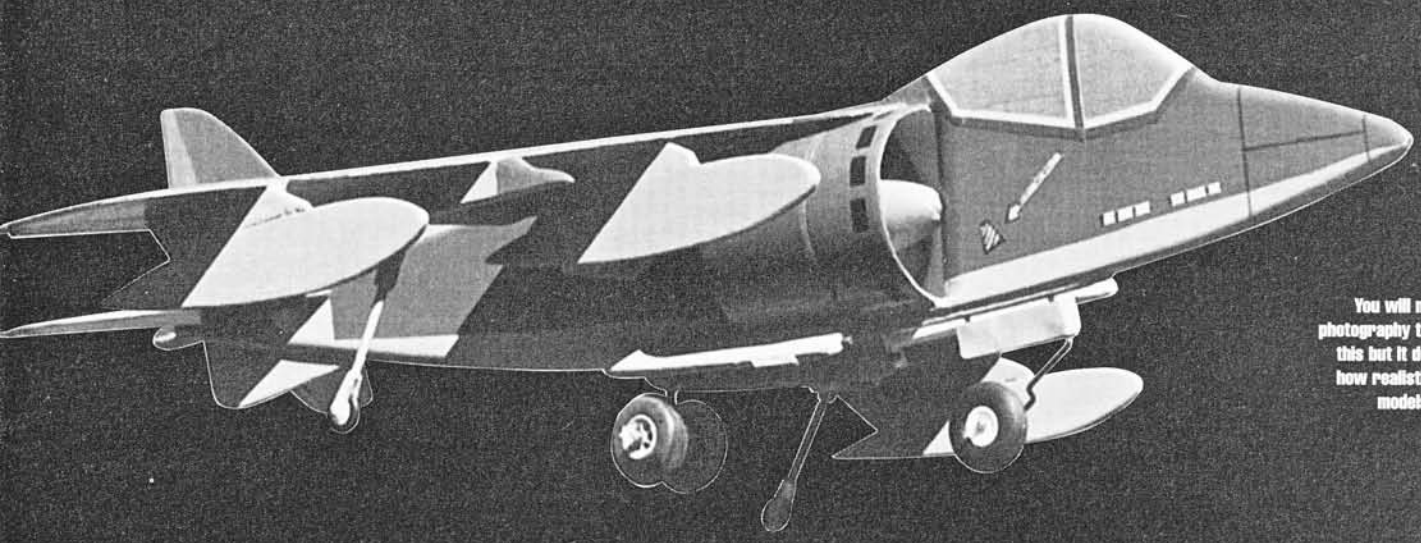
So, come on all you would-be jet jockeys, get out the building board, the jet age has arrived!

The completed fan unit with the ducts fitted which aid efficiency.

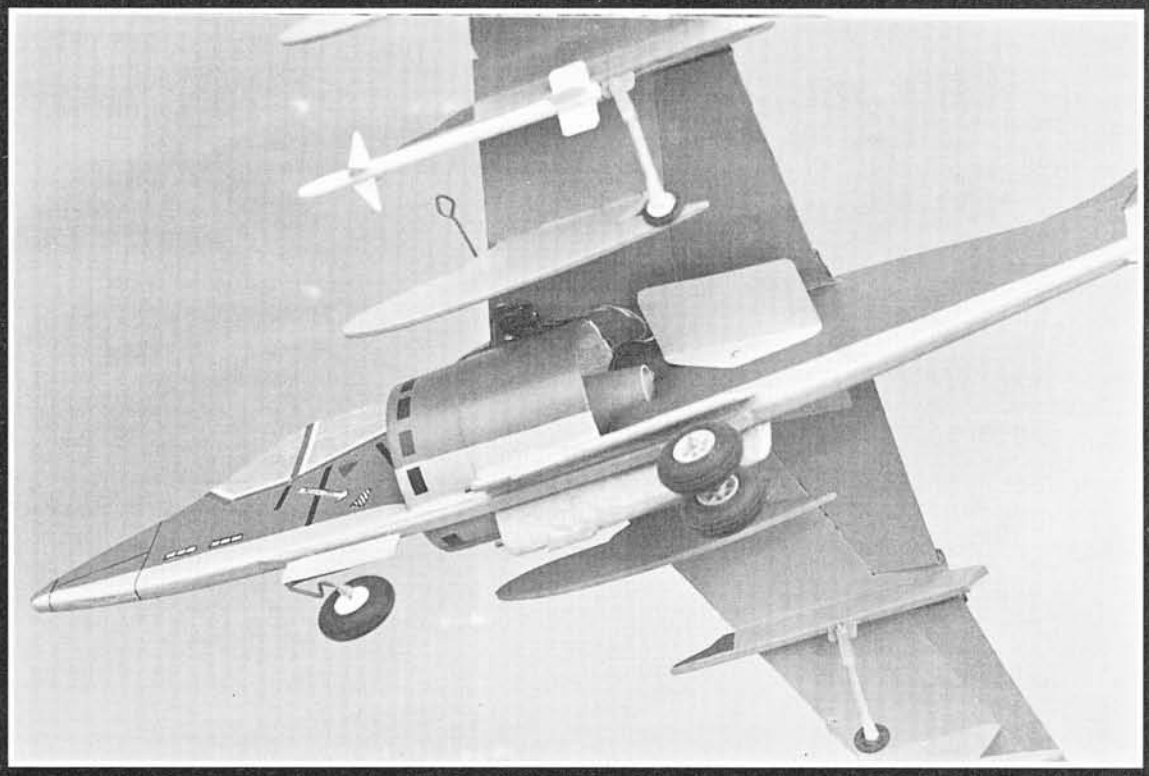


The Owl ducted fan unit from Ballads and the two balsa ducts.





You will need trick photography to achieve this but it does show how realistic Peter's models do look.



This view of the underneath shows all those stores carried on the Military version and the adjustable plates for vectoring the thrust.

The A Intruder version which has small wheels buried in the drop tanks.