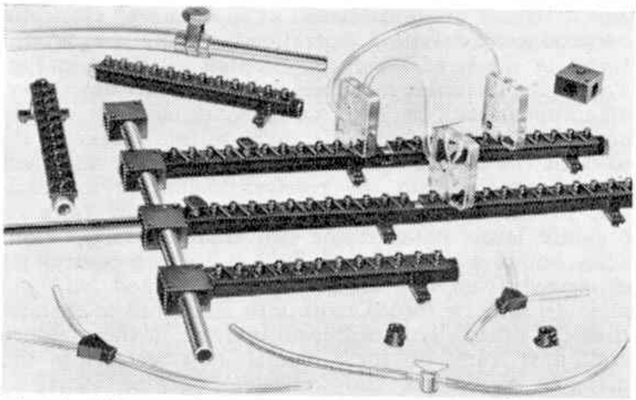


Fig. 4. The manifold method of connecting fluid amplifiers together. Each hole of the manifold is a source of air under pressure. *Photo: Plessey Company Ltd.*

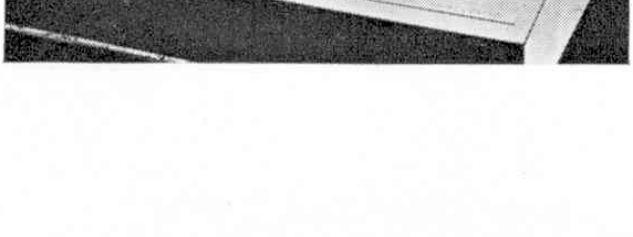
A recent American investigation showed that fluid amplifiers are six times more reliable than transistors in normal usage, 540 times more reliable when subjected to extreme vibrations encountered in guided missiles and 600 times when in the vicinity of a nuclear reactor.

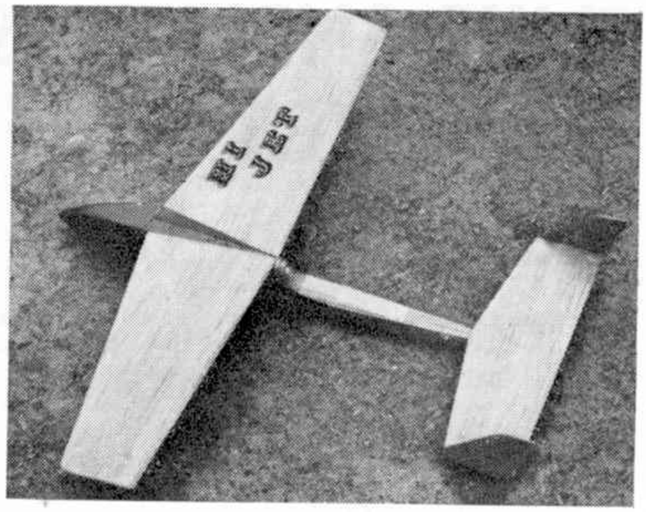
The range of power outputs possible with fluid amplifiers is much larger than that with transistors and is limited only by size considerations. At the lower end of the scale, it is found impossible accurately to mass-produce devices with nozzles smaller than about 0.01 inches. If air is then passed through at sonic speed, a power output of about a fifth of a watt is produced. With sufficient care in design, these very small devices can be packed into control systems at a density of five hundred per cubiv inch. At the other extreme, devices for controlling sewage disposal have been built with nozzles three feet in diameter and nozzles twice this size are planned.

One application of small amplifiers is the system shown in Fig. 5 for controlling the thrust reversal of jet engines. The devices can be seen just above the centre of the picture. Other applications have included the steering of rockets by deflecting their exhaust jet instead of the combustion chamber, a French device for controlling the speed of jet engines ,a "heart pump" to replace the beating action of the heart and which once operated continuously for about seven months without a hitch, and many devices for checking products on production lines, rejecting them if of incorrect size.

The possible total sales of these amplifiers in the years ahead are very large indeed. A recent estimate puts the figure at 150 million dollars a year in 1970 and nearly four times that figure in 1975 so these small pneumatic and hydraulic devices are becoming very big business.

Fig. 5. A fluid amplifier control system for a jet engine thrust reversal control. *Photo: Plessey Company Ltd.*





Your full size plan

HI-JET

A simple all sheet jet model that really does fly "Hi" on its Jetex 35 motor

by W. I. Barrett

HI-JET is a 14 in. wingspan model designed for use with the Jetex Atom 35 motor. Construction is simple, and the complete model can be made from one sheet of $\frac{1}{16}$ in. balsa, 3 in. wide by 36 in. long. It is essential to use the lightest grade available—ask your local model shop to select a lightweight sheet for you.

Start by tracing the outlines of all the various pieces on the plan and transferring these to the sheet of balsa. Cut out the pieces accurately with a razor blade or modelling knife.

Pick out the upper rear fuselage decking, F7, and cement to its underside the stiffener F5. Add the two formers F4 and F6, ensuring that F4 is correctly positioned vertically with reference to the fuselage side. When the assembly is dry, it can be cemented to one of the fuselage side pieces, and the remaining formers (F1, F2, F3 and F8) added. Before the formers are completely set, cement on the other fuselage side and hold the assembly together with rubber bands. See that the fuselage is equally curved along both sides. Put the fuselage on one side to dry.

Now take the wing and carefully sand it to the section shown on the plan. This section is basically a rounded leading edge, with the top surface of the wing tapering down towards the trailing edge. When the wing has been finally sanded smooth, cut and separate the two halves. Apply cement to both cut edges, rub into the grain and allow to dry. Then apply more cement, and bring the two halves together as shown on the plan, supporting one wing at an angle to the other (the dihedral angle).

While the wings are drying, sand smooth the tailplane and fins, again rounding the leading edges and tapering the trailing edges, this time symmetrically. Cement the fins to the tailplane tips.

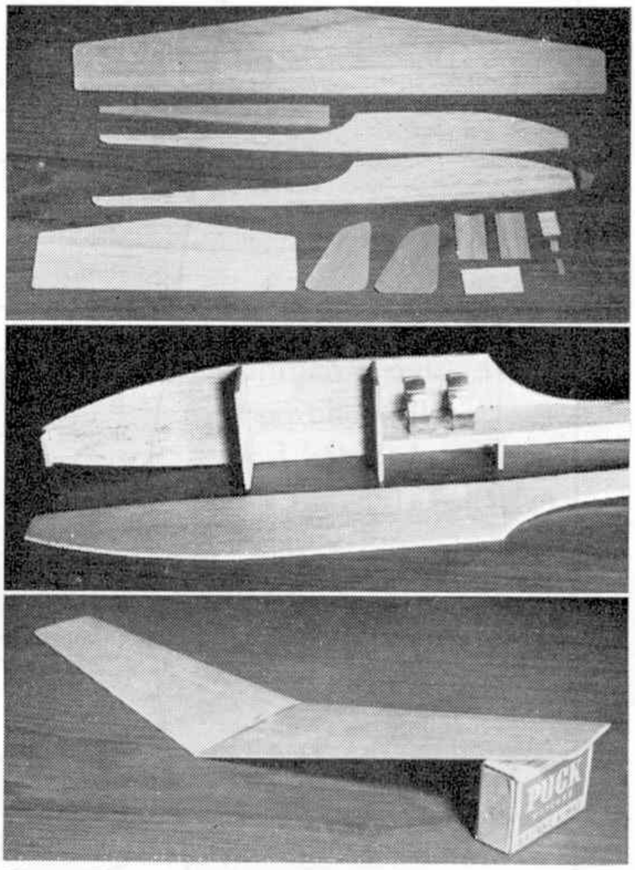
Back to the fuselage again, this time to screw in the Jetex motor clip, using the screws supplied with the outfit. With the motor in place, the fuselage sides may tend to spread a little, so leave the motor in position when the wings are added. Cement them firmly in position, making sure they are square with the fuselage, and are not twisted along their span. When satisfied, add the tail unit, again checking for squareness with the fuselage and wings.

With the flying surfaces securely in place, use scrap pieces of 1/16 in. sheet to cover the top and bottom of the fuselage. The upper nose covering can have the grain running across the width of the fuselage for ease of bending. Blend in this sheeting with the wing root leading edge. Add the nose, made from either a scrap piece of block or built up from several laminations of 1/16 in. sheet. When dry, sand the fuselage smooth, rounding the corners and streamlining the nose block.

The whole model can now be given a coat of cellulose sanding sealer and rubbed down when dry. Any colour dope for decoration should only be added to the nose—remember, colour dope adds considerably to the weight.

With the model complete, and an empty motor in the clip, the balance should be checked. Support the model by the finger tips under the wing at about half chord (i.e. half way back at the wing centre). The model should balance level. If not, cut a small door in the decking over the nose and add Plasticine for weight until the model is balanced correctly. Total weight should be under 1 oz. Temporarily secure the door in position, and test glide the model. This should be done on a calm day over grass. If the model dives rapidly, remove some nose weight. If the model lifts its nose, stalls and then dives to the ground, add some more nose weight. When you have achieved a long steady glide, cement the hatch back in place. Any tendency for the model to turn sharply one way or another can be corrected by gently twisting the wings. The wing on the outside of the turn should be twisted so that the trailing edge at the tip is slightly raised. The twist can be held in the wing permanently by gentle application of heat.

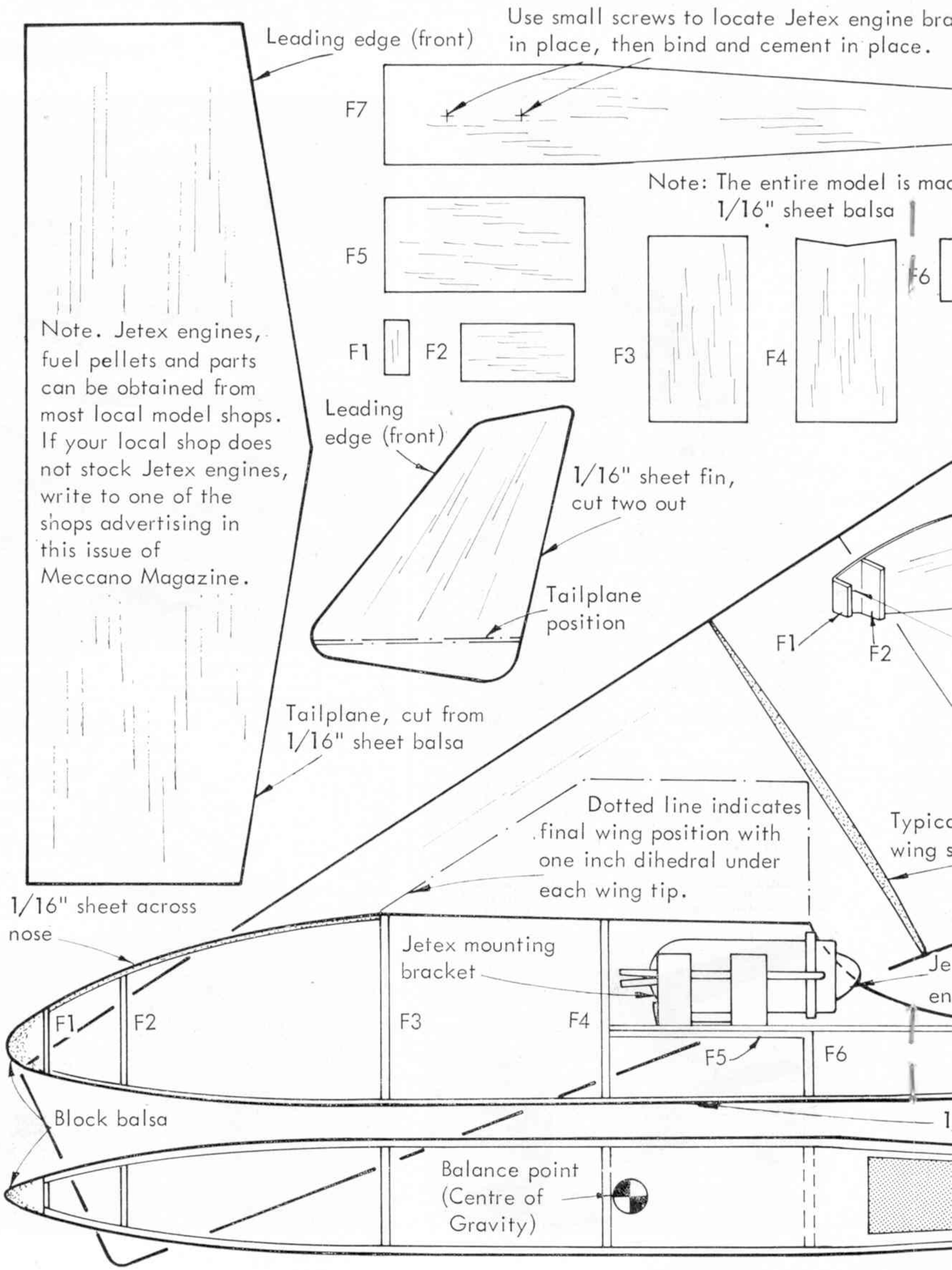
The designer's son shows the right angle for launching Hi-Jet. Wait until the Jetex unit has built up full thrust then give a smooth upward launch. Follow the launch through to make sure it is smooth.

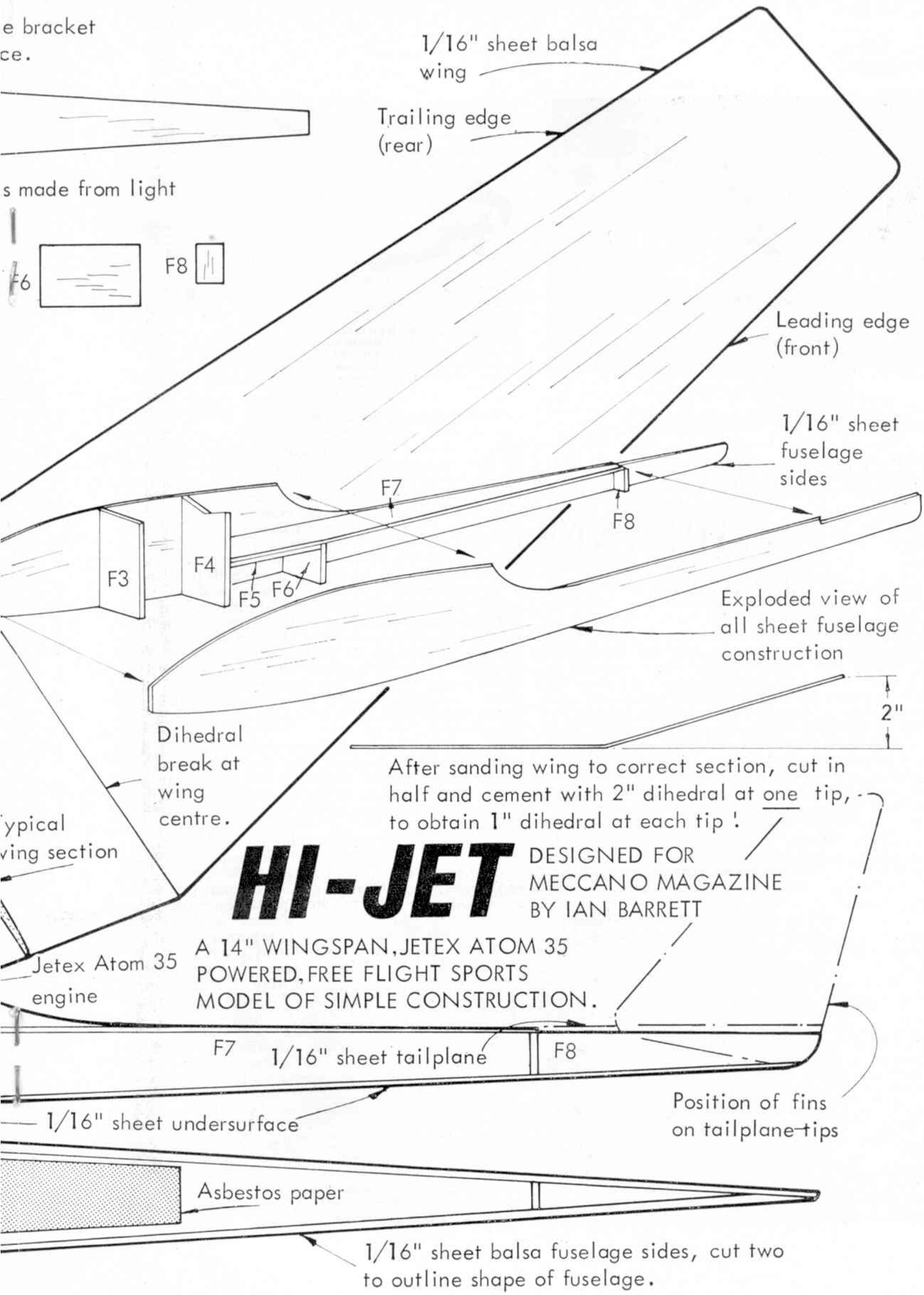


Above. Top, the component parts of Hi-Jet. Cut them all from lightweight 1/16 in. sheet balsa, note the proper grain direction (shown on the plan) as this factor adds considerably to the model's strength. Centre, the two 1/16 in. sheet fuselage sides with formers F3-F6 in place. Note the Jetex Atom 35 mounting clip. Next, the sheet wing being propped up 2 inches under one tip. This is to give 1 inch dihedral under each wingtip when the wing is glued to the fuselage.

Now try some power flights. Make sure that the Jetex unit is parallel to the fuselage centre line before lighting. Allow the thrust to build up, then launch into wind. Any signs of the model spiralling can be corrected by the method outlined above. Should the turns persist, check that the fins are correctly aligned with the fuselage.

Dope your model sparingly as unthinned dope adds a lot of weight to an all sheet model like Hi-Jet. It is better to apply two thinned coats of dope than one really thick one, sanding between.


Use small screws to locate Jetex engine bra
in place, then bind and cement in place.
Leading edge (front)
F7
Note: The entire model is mad
1/16" sheet balsa
F5
F6
F1
F2
F3
F4
Note. Jetex engines, fuel pellets and parts can be obtained from most local model shops. If your local shop does not stock Jetex engines, write to one of the shops advertising in this issue of Meccano Magazine.
Leading edge (front)
1/16" sheet fin, cut two out
Tailplane position
F1
F2
Tailplane, cut from 1/16" sheet balsa
Dotted line indicates final wing position with one inch dihedral under each wing tip.
Typica
wing s
1/16" sheet across nose
Jetex mounting bracket
Je
en
F1
F2
F3
F4
F5
F6
Block balsa
1
Balance point (Centre of Gravity)


e bracket
ce.
1/16" sheet balsa wing
Trailing edge (rear)
s made from light
F6
F8
Leading edge (front)
1/16" sheet fuselage sides
F7
F8
F3
F4
F5
F6
Exploded view of all sheet fuselage construction
2"
Dihedral break at wing centre.
After sanding wing to correct section, cut in half and cement with 2" dihedral at one tip, to obtain 1" dihedral at each tip !
ypical
ving section
HI-JET
DESIGNED FOR
MECCANO MAGAZINE
BY IAN BARRETT
A 14" WINGSPAN, JETEX ATOM 35 POWERED, FREE FLIGHT SPORTS MODEL OF SIMPLE CONSTRUCTION.
Jetex Atom 35 engine
F7
1/16" sheet tailplane
F8
Position of fins on tailplane tips
1/16" sheet undersurface
Asbestos paper
1/16" sheet balsa fuselage sides, cut two to outline shape of fuselage.