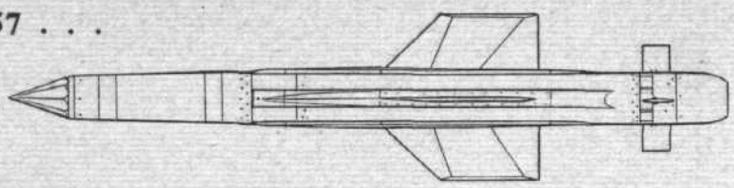
## Missiles 1957 . . .



**de Havilland Propellers Firestreak (Blue Jay)** Air-to-air. Solid sustainer motor. Length, 10ft 5.28in; body diameter, 8.67in; span of wings, 29.4in; span of controls, 19.1in. Weights and performance data restricted.

each other on a cylindrical body. The sharply pointed nose is built up from eight optically flat segments of material very transparent to infra-red radiation—probably some form of glass resistant to high temperature and abrasion. Inside is the homing head, in the development of which Mullard (one of whose directors, Dr. F. E. Jones, read a paper on infra-red, summarized in our issue of November 23, 1956) were brought in as sub-contractors, although de Havilland Propellers handled a very high proportion of the overall work themselves. In fact, virtually the only parts of Firestreak not designed and engineered by de Havilland Propellers are the warhead and the rocket motor.

The guidance and control system operates precision actuators which are apparently mounted ahead of the wings and move the control surfaces through rods carried outside the main body in four fairings. Each of the four wings is machined from a solid piece of light alloy and has a strong root flange through which axial rows of bolts attach the surface through the control fairings to the main body. The control surfaces are relatively small and are pivoted near mid-chord to a strong ring surrounding the propelling nozzle. The solid-propellant charge must be disposed close to the centre of gravity (just aft of the leading edge of the wings) and connected to the propelling nozzle through a motor tube. Around the latter is arranged a large toroidal air bottle which supplies all control and accessory energization. It seems fairly clear that Firestreak is an all-pneumatic weapon. Numerous D.H. Propellers missile accessories have recently been revealed; these were described in our issue of September 13 (page 445) and a further article on turbo-alternators appeared in last week's issue.

An account of the early development trials of Firestreak was published in our issue of May 3 last. So far as one can gather, the overall trials-programme has been satisfactory, and the missile has certainly been fired from a variety of aircraft at Aberporth and Woomera. Many of the trials at the latter range have employed the Avon-Sabre as the carrier, and —this aircraft not being designed to carry guided weapons—D.H. Propellers have evolved a neat package for the "aircraft" part of the Firestreak weapon system which fits a streamlined container under the Sabre fuselage. It is thus possible to convert any modern fighter to carry Firestreak in a matter of hours. In R.A.F. and R.N. service the weapon is carried on a standard pylon fitted with a non-expendable shoe through which pass the leads for hot and cold air and electric current.

Overall effort on the Firestreak is shared between all the U.K. plants of de Havilland Propellers. Hatfield is responsible for design, research and development; Lostock manufactures a proportion of the weapon (the remainder being sub-contracted) and is also responsible for assembly and testing; Farnworth carries out manufacture and assembly of development rounds; and a large new factory at Walkden is nearing completion and will handle all production assembly. The three last-named facilities are all in the neighbourhood of Bolton, Lancs.

Although no official announcement has yet been made to this effect, it seems fairly obvious that de Havilland Propellers is one of the prime contractors for the intermediate-range ballistic missile which is being developed in this country against M.o.S. contracts. Late last year a large steel structure was erected at Hatfield, and it is clearly employed in the cold-flow testing of an IRBM fuel system. No details of the weapon itself have yet been made public, but according to *Aviation Week* its development has been entrusted to three prime contractors; our American contemporary announces that "de Havilland Propellers apparently is the prime contractor on the IRBM programme and is building the airframe, with Rolls-Royce doing the rocket-engine work under a technical assistance agreement with North American Aviation, Inc., and Sperry developing the guidance system. Only static testing of the missile will be done at Hatfield."

**ENGLISH ELECTRIC** For more than eight years the English Electric Company has been one of the principal British guided-weapon contractors. The Company's guided-weapon division was formed in March 1949 for general research on behalf of the Ministry of Supply, with broad terms of reference. In the following year a development contract was placed for a complete weapon system for a land-based anti-aircraft weapon. Initially operations were conducted at Luton Airport in small premises formerly occupied by the Napier Flight Development Establishment, but English Electric now have a large establishment of their own at Luton, and since 1952 have operated an additional guided-weapon factory at Stevenage, Herts. Stevenage is now handling the bulk of the G.W. division's development and engineering effort.

By far the most important project yet undertaken is the surface-to-air weapon system originally known as Red Shoes* and now named Thunderbird. It is the first of its kind in Britain to be ordered by both the Army and the Royal Air Force.

The missile itself is of classical "British" configuration with cruciform wings and rear control surfaces and wrap-round boost motors. Initially the body was truly cylindrical, with a high fineness-ratio and a constant diameter. Early in the development it was decided to sweep back the leading edges of the wings by 45 deg to alleviate aeroelastic problems and acute taper was also incorporated in the control surfaces. All the early development rounds had liquid-propellant sustainer motors by D. Napier and Son, Ltd. (a member of the English Electric Group) and four pairs of solid-propellant boost motors. The liquid sustainer-motors have now been developed into the Napier Double Scorpion aeroplane boost engine which recently set the new world altitude record for aeroplanes of 70,310ft (and believed to be destined for use in English Electric's P.1 supersonic fighter).

It was early decided that a liquid sustainer was not suitable for service in the field; and, when major advances in the efficiency of solid fuels were made a few years ago, a solid sustainer was specified for Thunderbird. To obviate c.g. problems it is usual to place the propellant charge for a solid motor as close as possible to the c.g. of the missile. The hot gases are then taken to the propelling nozzle through a motor tube of relatively small diameter. In order to minimize the length of the motor tube, the solid sustainer in the Thunderbird has a relatively short after-body. This in turn has led to a substantial increase in the size of the four control surfaces, in order to preserve their effectiveness when operating on the reduced moment-arm. In addition, the body diameter is increased by almost 5in in line with the wings, thereafter returning to its original value at the trailing edge. Only four boost motors are now fitted. They occupy the peripheral spaces left between the adjacent

**Aviation Week*, September 30.

*A de Havilland Propellers Firestreak infra-red air-to-air weapon mounted beneath the port wing of a Venom night fighter during development trials.*