

MISSILES 1958...

surfaces carried behind the trailing edge of the wing on outriggers. Both types of missile have blunt, rounded noses, one with a radome over the diminutive receiver dish and the other with a hemisphere of special glass covering the sensitive heat-seeker cell. GAR-1 and -2 are usually mixed in an interceptor load, and in most weather conditions it is common to fire one of each type in salvo to give the best chance of a kill.

Production is now concentrated on the much more potent GAR-3 and -4. Both incorporate the following major improvements: a longer Thiokol solid motor, giving higher specific impulse, greater thrust and longer burning time; a revised airframe with slightly lower supersonic drag; increased wing area and altered control surfaces for improved manoeuvrability (especially at high altitude); and complete redesign of the guidance systems. As might be expected, GAR-3 is a semi-active radar homer, and it is matched to the new Hughes fire-control systems now in service, such as MG-10. The receiver dish is very similar to that of the later GAR-1s, but it is housed beneath a radically different pointed radome, made of a dielectric ceramic with a surface better able to withstand heat and abrasion. The GAR-4 is the corresponding IR-homer.

All these Falcons have high-explosive warheads. For at least two years it has appeared feasible to develop a Falcon with a nuclear warhead—an incredible achievement when one remembers the bulk of the atomic bombs dropped on Japan. The resulting weapon is GAR-9, and it is so different from earlier Falcons as to merit a new name (which it will probably get). It will be at least 20 per cent larger in linear dimensions, and probably more than three times as heavy. It will have very much greater range, but will retain a semi-active radar system.

Imminent flight testing of nuclear warhead Falcons was reported last March, and development is already far advanced. The first definitive contract for Hughes in respect of this weapon is expected to be for about \$23m (not, of course, covering warheads), of which \$3m was recently paid. The GAR-9 will be carried by the North American F-108A, and possibly by suitably modified F-106 and F-102 aircraft. Politically, it is already having to fight the Navy's Eagle (*q.v.*), but the Air Force are likely to ensure that GAR-9 will not come out of this conflict second-best.

GAR-1 and -2: length, 6ft 5.8in; body diameter, 6.5in; wing span, 20in; firing weight, 110 lb (GAR-1D) or 122 lb (GAR-2A); burn-out speed, over Mach 2; effective range, up to about 5 miles.

GAR-3 and -4: length, 7ft 1in; body diameter, 6.5in; wing span, approximately 29in; firing weight, approximately 150 lb; burn-out speed, probably at least Mach 3; maximum effective range, more than 5 miles.

FIREFLASH

Royal Air Force (No. 1 G.W.D.S.).

Type: Beam-riding, air-to-air missile. Drawing: p. 896.

FOR a considerable period Fireflash has been the only British guided weapon in full user service. Designed to ride a pencil radar beam emanating from the launching aircraft, Fireflash—which bears the code-name of Blue Sky—has no sustainer, but is boosted to supersonic speed by two jettisonable boost motors.

A detailed account of the missile was published in our issue of August 16, 1957. Fireflash has been used during the past 18 months as an indoctrination weapon to accustom the R.A.F. to the handling of air-to-air guided weapons. The unit involved is No. 1 Guided Weapon Development Squadron, and an account of a visit to their base at Valley, Anglesey, was contained in our issue of October 17 last. Each round fired by them—from Swift F.7s—transmits data along 24 channels, and statistical evaluation of weapon performance is at present being collated. Fireflash has proved itself extremely reliable and effective; but, as the



Standard air-to-air missile for the fighter squadrons of the R.A.F. and R.N. will be the D.H. Propellers Firestreak. This round, seen under the wing of a Javelin of Fighter Command, has a conical plastic cover protecting its eight-faceted glass nose

chairman of the Fairey Aviation Company, who were responsible for its development and production, said in his recent annual report, "we must now look upon this project as being at an end."

Fireflash: length, 7ft 5in (9ft 3.75in with boosts); wing span, 28.1in; span of controls, 17.97in; overall height across boost fins, 23.63in; firing weight, approximately 300 lb; burn-out speed, over Mach 2.

FIRESTREAK

Royal Air Force (Fighter Command) and Royal Navy.

Type: IR-homing, air-to-air missile for launching from supersonic aircraft. Drawing: p. 896.

DEVELOPMENT of this fine weapon, which bears the code-name of Blue Jay, has been a major project by de Havilland Propellers, Ltd., since the end of 1951, and an extensive history was contained in our issue of May 3, 1957. Well over one hundred completely equipped rounds have been fired during development, and Firestreak has shown its ability to exceed in performance the operational requirements laid down for such a weapon.

Firestreak is quite a large weapon and has a circular-section body which tapers slightly ahead of the wings. The stubby wings form a fixed cruciform around the centre of gravity, and manoeuvring is accomplished by a rear-mounted cruciform of small rectangular control fins. An internal solid sustainer is fitted. In the nose is the sensitive heat-seeking cell, in the development of which Mullard played a considerable part. It is protected by a pointed nose, formed from eight facets of special glass, which offers maximum transparency to the transmitted infra-red radiation. The main power services inside Firestreak are pneumatic, the air being stored in a large toroidal bottle surrounding the motor blast tube.

In all installations so far revealed, the missile is carried externally, on a standard shoe attached to the aircraft pylon. From the aircraft are tapped supplies of hot and cold air to demist the glass nose of the Firestreak, keep the seeker cell at the correct temperature and cool the electronics. Three months ago a selection of airborne equipment, including the search radar, power supplies, fire-control boxes and heater pack, were publicly exhibited. All units required only for the Firestreak can be packaged in a quickly-demountable tray; and the R.A.A.F. Avon-Sabres used during development trials at Woomera carry the equipment externally in a belly fairing.

Last month it was officially stated that the D.H. weapon is designed for firing from anywhere within the hemisphere to the rear of a

target, and, if fired from the bottom of this hemisphere, can be launched from a position 10,000ft beneath its quarry. The seeker cell is locked-on before the round is released. The prime contractor has succeeded in making Firestreak "practically impervious to IR radiation from natural sources . . . We believe that no other IR weapon has this degree of discrimination." On the same occasion it was stated that the warhead can destroy an aeroplane even from a large miss-distance and that a unique proximity fuze is employed.

Large numbers of rounds have been delivered to the R.A.F. and R.N. and, following the successful completion of acceptance trials, it should shortly be possible to release these to user squadrons. The principal carriers of Firestreak will be the Lightning, Javelin and Sea Vixen, the latter two aircraft carrying four rounds apiece. D.H. have inferred that the missile could, with development, be employed in the surface-to-air and air-to-surface rôles, and that more advanced versions of Firestreak are under development.

Firestreak Mk 1: length, 10ft 5.3in; body diameter, 8.67in; span of wings, 29.4in; span of controls, 19.1in; flight speed, clearly over Mach 2; maximum effective range, from 0.75 to 4 miles.

GENIE

United States Air Force (Air Defense Command) and, later, other formations, probably including NATO air forces.

Type: Unguided air-to-air missile with nuclear warhead. Drawing: p. 896.

ALTHOUGH unguided, Genie is a weapon of such importance that it would be undesirable to omit it from this review. Originally known as Ding Dong, Bird Dog or High Card (the training version, carrying a spotting charge only, was called Ting-a-ling), the production name for this missile is Genie and the designation MB-1. Prime contractor and airframe manufacturer is Douglas Aircraft.

The warhead is a miniaturized nuclear device with a sub-nominal yield (reported to be only 1.5 KT). This yield is large enough to destroy all aircraft within a radius of several hundred yards, and accordingly the only guidance necessary is spin-stabilization and correction against gravity-drop by four flick-out fins. Chief carriers of the Genie are the Northrop F-89J Scorpion, the McDonnell F-101B Voodoo and the Convair F-106 Delta Dagger. The F-89J carries the missile under wing racks, the F-101B mounts two on the underside of a rotating door and the 106 carries at least two rounds internally.

Pre-launch guidance is managed by the interceptor's Hughes MG-12 fire-control sys-