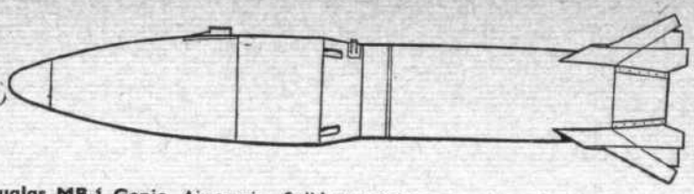
MISSILES 1957 . . . (continued from p. 880)



Douglas MB-1 Genie Air-to-air. Solid sustainer motor. Length, estimated at 9ft; diameter, about 17in over the warhead; firing weight, probably about 1,000 lb.

U.S.A.

AIR-TO-AIR

B.D.M. In our 1956 review we published notes on the various bomber-defence missile systems then current. No weapon system has been so hesitantly played with in recent years, but the two examples quoted below are still active programmes.

WS-126A It is intended that this system should replace the gun turret at present carried by the B-52. Engineering manager is Cornell Aeronautical Laboratory and among the companies involved are Bell Telephone Laboratories, Hughes Aircraft and Raytheon. The last-named examined the unique problems of cross-wind and rearwards launching with test vehicles fired one year ago from sleds at Holloman. Cornell's data has been turned over to industry and, although still bearing high priority, the system is in partial abeyance.

WS-132A This is the B.D.M. for the WS-110A chemical-fuel supersonic-cruise bomber (for which either Boeing or North American will receive a contract in a matter of weeks). There were two systems involved, one by G.E. and McDonnell and the other by Westinghouse and Republic, but both are reported to have been terminated late last year. Presumably the programme will be re-activated when the configuration and performance of the aircraft are known with certainty.

Diamondback It is known that the Sidewinder family of heat-homing air-to-air missiles is being progressively improved and is leading to more sophisticated weapons. Diamondback (likewise a member of the rattlesnake family) is reported to be the designation of one of these weapons.

Duck Originally reported in 1956 to be part of the weapon system of the Convair B-58 (WS-102A/L), Duck is stated to be an air-to-air weapon of the U.S. Air Force intended for the armament of "long-range supersonic bombers." Fairchild is reported to be the prime contractor and the system is said to have been in the research and development stage in July of this year. It is related to the Goose missile referred to on page 899.

Falcon One of the first air-to-air weapons to go into service anywhere in the world, Falcon is small enough to be carried and fired in salvo by U.S.A.F. intercepters. Development of the system as it is known today began under the management of Hughes Aircraft in 1950; the history was related in our 1956 review.

At the Hughes plant at Tucson, Arizona, there are now two types of Falcon in production: the GAR-1 series with radar guidance and the GAR-2 series of infra-red heat-homers. Many thousands of examples of the former family are in service with the U.S.A.F. Air Defense Command, current production being centred on the GAR-1D. The cylindrical body, for which Solar Aircraft at Des Moines is a major sub-contractor, is built up from magnesium castings. It houses beneath a bonded radome a semi-active radar which receives coded pulses from the intercepter reflected by the target. The warhead is relatively small, and at the rear is the Thiokol M58-E4 solid sustainer motor. Around the nose are four stabilizing fins and at the rear is a cruciform of wings: the latter are built up from a magnesium frame with a glass-fibre laminate skin, cured to give an inward buckle over unsupported portions so that differential expansion due to aerodynamic heating gives better stress distribution. At the rear are the control surfaces which, in the 1D and later versions, are carried well aft of the wings.

Production GAR-1Ds cost about $19,000 when they entered production last year, and about $12,000 today. Compared with their predecessors they have better performance and manoeuvring power at high altitude. The weapon is carried by all the A.D.C. aircraft, and by the F-101B which has a triple installation on a rotary door.

Similar in external configuration to the GAR-1D, the infra-red GAR-2A was planned in 1952: it is in production at Tucson at a cost of rather more than $9,000. Like most infra-red weapons, the seeker head is slaved to the target before the round is fired, and the homing accuracy is reported to be fractionally better than that demonstrated by the radar Falcons. A surprisingly large contract is the $2.25m awarded last month to the Hamilton Watch Company for "aircraft data recorders" in the development of the GAR-2 system. The infra-red Falcon has behaved extremely well when fired by F-102As against TM-61A, QF-80 and other aircraft and air-launched rockets. Mixed with radar GAR-1Ds it should be possible to achieve a kill-probability approaching 90 per cent with good resistance to countermeasures. Compared with the GAR-8 (Sidewinder), GAR-2 is a more sophisticated, all-weather system.

Genie Several years ago Douglas studied the concept of an air-to-air weapon with a nuclear warhead, and this was re-activated in 1955 to produce a weapon which would be lethal to attacking aircraft over a very wide radius. Originally the device was called Ding Dong, and later High Card, but its present soubriquet is that given above, and the designation is MB-1.

Douglas remain managers for the complete system, which includes substantial pylons on the carrying aircraft. As the drawing shows, the missile has no wings, and guidance takes the form of gravity-correction and rudimentary steering effected by the four movable fin-tips. Propulsion was to have been effected by an N.A.A. Rocketdyne liquid-propellant motor, but the sustainer is now a solid charge by Aerojet-General which burns for the first 9,000ft of flight. At the front is the warhead, developed at the Los Alamos laboratory of the A.E.C., with a yield of about 1.5 kilotons.

In 1955 a similar warhead was ballistically dropped at Holloman, and the complete weapon system has been one of the major responsibilities of the 4950th Test Group (Nuclear) of the A.R.D.C. since that time. Numerous rounds have been fired with conventional warheads, and Ting-a-ling is given as the name of a training version with a spotting charge. First aircraft capable of using the MB-1 system is the Northrop F-89J, and most of the earlier F-89s are being converted to this standard. Hughes received a $380,139 contract last month for the MG-12 fire-control system (a development of the E-9 used in the F-89H), which both fires the weapon and detonates its warhead. The flexibility of the MB-1 system permits attack from any direction, rendering collision-course fire-control inappropriate. A round was fired at 18,000ft from an F-89J last summer at Yucca Flat, Nevada, the aircraft pulling 3g to escape as soon as the missile left. The weapon travelled about 6,000 yards horizontally and was detonated by ground command; numerous observers were unprotected at ground-zero but suffered no ill effects.

Very large scale production is expected to be undertaken at Santa Monica for the U.S.A.F. Air Defense Command. Principal future carriers of MB-1 will be the Convair intercepters; the F-102 can be equipped to carry it on its underwing-tank pylons and the F-106 was designed to carry the weapon internally as its primary armament. In addition to procurement of the MB-1 for current use, the Air Force has asked for $19.1m to buy "mobilization reserve stocks."

Sidewinder Owing to its simplicity and to the large number manufactured, this is undoubtedly the cheapest homing missile in the world, yet it is an effective weapon for high-performance day-fighter aircraft. As we described in our 1956 review, Sidewinder was developed between 1948 and 1952 by the N.O.T.S. at China Lake, Cal., and has for three years been produced to BuOrd contract by the Philco Corporation. (General Electric have been second-source manufacturers for almost two years).

Beneath the hemispherical glass nose is a PbS infra-red seeker which, with its mirror system, occupies an axial distance of 4in. Behind is the guidance equipment, for which the Avion Division of A.C.F. Industries are sub-contractors, followed by the servos which operate the canard controls which are stabilized by a tiny turbine running at very high r.p.m. The warhead has a total of 5 lb of high explosive with Honeywell fuzing, there being an influence fuze lethal up to 35ft-radius supplemented by contact fuzes at the tips of the control surfaces. The rear 75in of body houses the solid sustainer motor by Norris-Thermador, Hercules Power Company or Hunter Douglas. The charge is composed of propellant grains which are rolled into a sheet used to form a cylinder, which in turn is extruded to give a compact motor, the nozzle being 7in long and having an inside diameter of 3in. Burning time is two seconds.

Like most infra-red air-to-air weapons, Sidewinder's seeker operates from the moment its parent aircraft takes off. When the pilot hears the seeker in his earphones he triggers a switch which fires the solid-propellant gas generator which drives the accessory turbine, making power available for the guidance and control systems. The generator also provides current for the igniting squib of the sustainer motor. In spite of its exceptionally low diameter/length ratio, the missile can manoeuvre at from 10 to 14 g. Training missiles have a special exercise head, which explodes in a white flash for a miss or a red flash for a hit. Approximately seven out of ten Sidewinders fired during development and training have hit their targets, and several drones have been destroyed by the impact of unfuzed Sidewinders.

Several thousand rounds have now been delivered by Philco, against a number of contracts. For FY57 the Navy told Congress that each round cost "about $3,600," but it has been questioned whether this includes the whole expenditure. Appropriation for FY58 amounts to $38m and the missile is widely used throughout all carrier-based day-fighter squadrons.

GAR-8 This is the U.S.A.F. designation of Sidewinder, for which quantity inventory procurement was made under FY58; G.E. were awarded a $17m production contract in October 1956. The GAR-8 incorporates a General Electric guidance unit and has been intensively engaged in air-firing since March. Principal carrier of GAR-8 is the F-104, which first fired the missile in May.

Sparrow The original Sparrow family was evolved for the Navy Bureau of Aeronautics as project Hot Shot by the Sperry Gyroscope Company. Test firings began in 1947 and the eventual Sparrow I, designated AAM-N-2, was evolved early in 1951. The weapon became operational in 1955 with both Atlantic and Pacific Fleets by which time ten years and four million engineering man-hours had gone into the system.

The basic missile has a pointed nose, a solid sustainer motor (by Aerojet-General, concentric grains with a plastic base) fixed tail fins and a moving wing cruciform. Guidance and control incorporates multi-axis gyros and accelerometers, aerials and receivers for detecting the intelligence in the fighter's radar beam, computing circuits to shape the signals to obtain proper beam-riding and servo-mechanisms for positioning the wings. The trajectory immediately after launching is controlled by inertial elements. Power supplies are furnished by electrical batteries and a high-pressure hydraulic accumulator, both close to the wing servos.

In June 1951 the Sperry-Farragut Division of Sperry-Rand was organized to build, equip and operate a Naval Industrial Reserve Aircraft Plant at Bristol, Tennessee. The 537,000 sq ft plant has produced thousands of Sparrow I missiles, conducting the manufacture, test and delivery of the whole system. No Sparrow prices have been published, but the breakdown of costing is as follows: avionics, guidance and control, 75 per cent; airframe, 12½ per cent; propulsion, 6½ per cent; warhead, 3½ per cent; remainder, 2½ per cent. Sparrow I went out of production one year ago.

Sparrow II This missile is described in the section dealing with the Dominion of Canada on page 876.