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Raytheon to develop prototypes of a Sparrow replacement to enter service in 1986, becoming the standard US beyond-visual-range air-to-air missile in the late 1980s. Requirements for the Advanced Medium - Range Air - to - Air Missile (Amraam) include an active radar homing head to remove the need for the launch aircraft to illuminate the target, and to allow multiple targets to be engaged in rapid sequence; a high-impulse motor to give short flight times; and a significant reduction in size and cost compared with Sparrow. Amraam will additionally use all-digital elec-tronics and a strapdown inertial mid-course guidance system. Each contractor is building 16 missiles for flight trials this year and in 1981. A 40-month full-scale development contract is then expected to be awarded to the winner of the evaluation by the end of 1981, leading to service entry in late-1985.
Allied programmes include the intro-duction of the F-15C, incorporating a programmable signal processor in the radar; this provides Doppler beam-sharpening and increases performance against multiple targets. Similar pro-cessors will be retrofitted in F-14s and are planned for the F-18. The second area of development in long-range, non-visual identification involves analysis of target signatures—such as engine har-monics—derived from millimetre-wave-length radars. Returns from a variety of sensors will be processed by computer and displayed to the crew, allowing them to engage targets outside visual range with a high degree of confidence. The Pentagon has asked European companies to provide technical details of Tornado and the Mirage 2000 so that the new missile can be made compatible with both. If adopted as a Nato-standard, weapon. Amraam could be built by production lines on both sides of the Atlantic.

Asraam A joint USAF/USN opera-tional requirement for a successor to Sidewinder was established in January 1979. The Asraam (advanced short-range air-to-air missile) programme is of lower priority than Amraam, be-cause AIM-9L Sidewinder still has poten-tial for further performance improve-ments; the new weapon is expected to enter service in the late 1980s or early 1990s. Basic information about the per-formance required for Asraam was provided by the Aceval/Aimval pro-gramme, and parallel work includes the Pave Prism studies of possible seekers, both infra-red and active laser. The US has proposed that if Amraam becomes a Nato-standard weapon, British Aero-space could become the Asraam prime contractor and would work with companies such as Matra and Boden-seewerk Geratetechnik to produce a missile which could also be adopted by the USAF and US Navy, then co-pro-duced in North America.

Martin Marietta M712 Copperhead Martin was awarded a $62 million con-tract in March this year for production of the Copperhead laser-guided 155mm artillery projectile for use against tanks and other armoured vehicles. The pro-jectile will be fired from the US Army's M109 and M198 guns and will addi-tionally be co-produced in Europei under the direction of PGM Systems, a con-sortium formed by Martin and Diehl. Other contractors involved would in-clude FM, Selenia, Hollandse Signaal-apparaten, MSDS and possibly a Greek

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company. Copperhead can be fired from European howitzers such as the FH70 and SP70, and can use the Ferranti LTM laser ranger/designator for illumina-tion in addition to US types such as the GLLD, LTD, Mule and Tads.

Martin Marietta 5in guided projectile Martin is developing a rocket-powered laser-guided projectile to fit the US Navy's Mk 42 and Mk 45 gun mountings, using shipborne designators such as the Honeywell/Northrop Seafire system for target illumination. Airborne or land-based designators may also be used. A larger version for firing from 8in guns has been abandoned.

Ford Aerospace Siam The Self-Initiated Anti-aircraft Missile is being developed to protect submarines, ships and land installations against aircraft attack. The weapon is vertically launched and uses a dual-mode seeker (active radar for the initial stages of flight, followed by infra-red terminal homing). The first flight test of a complete Siam was suc-cessfully conducted at the White Sands Missile Range in April. Siam is designed to be launched vertically, but for this test the launcher was inclined and both seekers were locked on to the target before firing. The missile's launch motor ejected the round from the tube at low velocity; the main motor was then ignited and accelerated the missile until burnout. The target was a QH-50 drone helicopter carrying a transponder and infra-red flare pots to simulate a larger moving helicopter. The QH-50 was hovering at a height of 450m and was 3,300m downrange; the Siam struck and nearly severed the alu-minium beam which held the flare pots. Siam is about 2-5m long, 32cm in diameter and weighs 68kg.

Soviet Union

AA-2 (K-13A) Atoll and AA-2-2 Advanced Atoll This Russian equivalent of Side-winder has seen widespread use in the Middle Eastern and Indo-Pakistani con-flicts and in South-East Asia. It has poor performance, even in the advanced ver-sion, and the seeker does not always lock on to the target, although the launch aircraft may be in the optimum firing position.

Some sources suggest that the Ad-vanced Atoll exists in both infra-red and semi-active homing versions. An all-aspect infra-red seeker could be operational on Atoll by the mid-1980s. Operators Warsaw Pact, Afghanistan, Algeria, Bangladesh, China, Cuba, Iraq, Jugoslavia, Laos, Libya, Mozambique, Nigeria, North Korea, Peru, Somalia, Syria, Uganda, Vietnam, Yemen (PDRY), Albania?

Types equipped MiG-21 Fishbed C—two AA-2s; MiG-21PF Fishbed D—two AA-2s; M1G-21FFMA Fishbed F—two or four AA-2-2s; MiG-21M Fishbed J—four AA-2-2s; MiG2-SMT Fishbed K—four AA-2-2s; MiG-17 Frescoe E—two AA-2-2s; Flogger E, Su-22.

AA-3 Anab and AA-3-2 Advanced Anab Several thousand of these missiles have now been built. Two versions are in ser-vice—I/J-band semi-active homing and infra-red—and launch aircraft normally carry one missile of each type.
Types equipped Su-11 Fishpot C—two AA-3s or AA-3-2s; Su-15 Flagon—two AA-3-2s, one under each wing; Yak-28 (being phased out of service)—two AA-3s or AA-3-2s under outer wings—

Hughes AIM-54C improved Phoenix

all aircraft listed carry the Skip Spin radar.

AA-5 Ash Like the smaller AA-3, this missile exists in both infra-red and I/J-band semi-active homing forms, and the number built certainly exceeds a thousand.

Type equipped Tu-28P—two infra-red and two radar under wing—Big Nose radar.

AA-6 Acrid Similar to AA-3 Anab but larger. Standard MiG-25 armament, each Foxbat carrying four missiles—two using infra-red homing and the other pair employing semi-active radar guid-ance—on underwing pylons. It is likely that the weapons are ripple-fired in pairs, the IR round preceding the radar missile by about lsec. The MiG-25 Fox-bat A interceptor is known to carry a Fox Fire fire-control radar derived from the Big Nose equipment fitted to Tu-28 Fiddlers. Maximum detection range is believed to be 80 to 100km, targets being tracked out to about 50km. Missile speed is likely to be about Mach 2-2 greater than that of the carrier air-craft at launch.

Missile performance is probably limited by the Foxbat's Fox Fire radar and a maximum range of 70 to 80km can be expected when operating with the improved radar in Foxbat D. Given suitable radar technology both in the homing head and launch aircraft, Acrid could achieve a range of more than 100km. It also arms the Su-15 Flagon D and E.

AA-7 Apex Standard MiG-23S fighter armament, each Flogger carrying one missile under each wing (one using infra-red homing and the other semi-active radar guidance). Designed for use at low and medium altitudes. The radar version operates in conjunction with Flogger B's High Lark radar, which has a limited look-down search and tracking capability. Also carried by Fox-bat A.

AA-8 Aphid Dogfight weapon thought to be derived from AA-2 Atoll. Two are carried under the belly of MiG-23 fighters. May be similar in performance to AIM-9L Sidewinder.

AA-X-9 This new missile was being tested in simulated snap-down attacks during 1978.