Work on a further-improved Sidewinder started in 1986 with the aim of improving acquisition range and ECCM performance. Under development by Ford Aerospace, the new round was initially known as the AIM-9M (PIP), but was later redesignated AIM-9R. This is the first Sidewinder to use an imaging infrared (IIR) seeker, and is expected to enter service in 1992.

The Israeli avionics company Elbit has developed a new Sidewinder control system for the USAF. Intended to give the missile off-boresight capability, it slaves the seeker head to the aircraft's radar or to a helmet-mounted sight. Tests were completed in March 1988.

Operators (AIM-9P) Bahrain, Oman, Saudi Arabia, Singapore, Thailand; (AIM-9L) USAF, USN, Denmark, Egypt, Israel, Italy, Japan, Norway, Pakistan, Saudi Arabia, Sweden, UK, West Germany; (AIM-9M) USAF, USN.

Hughes AIM-54 Phoenix AIM-54A and -54C Phoenix rounds rely on a flow of coolant from the parent aircraft, but the F-14D will be armed with the new AIM-54C+, formerly known as the AIM-54C (Sealed). This model is fitted with a self-contained closed-cycle cooling system. The older missiles can still be carried on the F-14D, but the absence of an aircraft-mounted cooling system imposes some performance restrictions on the aircraft to minimise aerodynamic heating effects. The C+ also has better ECCM capability.

Production of the AIM-54C+ started in March 1986, and by the end of 1987 Hughes had delivered 325 AIM-54C+ to the US Navy. February of this year saw production reach a one-month high of 40 missiles a month.

Operators USN .Navy (AIM-54A, -54C, -54C+), Iran (AIM-54A—limited number still operational).

Hughes AIM-120A Amraam Low-rate production of Amraam was ordered in late 1986, with plans calling for a total of 90 missiles to be fired during a programme of development flight-testing expected to continue until July 1988. By the middle of this year Amraam testing was 50 per cent behind schedule, largely a result of software development problems, and difficulties with drones and EW pods used in the tests.

Low-rate production of Lot 2 (400) rounds was ordered later in 1988, shortly before the GAO released a report critical of the programme. This listed deficiencies in the test programme, suggesting that flight-test conditions were in some cases being altered to improve the chances of a successful flight. "The combat performance of the missiles to be produced for the inventory is uncertain," the report stated.

First deliveries of rounds from the Lot 1 batch of 180 are due in September 1988.

IOC is now scheduled for October 1989. The maximum production rate at the peak of the Amraam programme will be 3,000 missiles per year. The DoD plans to buy 95 per cent of its Amraam missiles through competition. Second source will be Raytheon, which was awarded.a $111 million contract in November 1985 to build its first 15 missiles.

BAe, Marconi Defence Systems, MBB, and AEG joined forces inthe summer of 1987 to set up a consortium for European production of the AIM-120. This will be known as Euraam.

FY 1989 funding includes $20 million for work on an improved version of Amraam, but only half of this money may be spent until the DoD sets up a joint programme office to oversee the development of next-generation air-to-air missiles.

Operators On order for the USAF (F-15, F-16), USN (F-14, F/A-18). Planned for the UK initially on Sea Harrier, later on Tornado F.3 [F.2]), West Germany (F-4F), and other Nato users.

Advanced Air-to-Air Missile (AAAM) Initial development of this long-range US Navy missile is being tackled by two industrial teams, Hughes teamed with Raytheon, and General Dynamics plus Westinghouse. AAAM will be lighter than I Phoenix, allowing a Tomcat to carry a maximum load of eight rather than four when landing on a carrier, yet will have a greater range.

The Hughes /Raytheon design is based on a dual-mode active-radar/IR guidance system and a ramjet powerplant, while the GD/Westinghouse team favours a dual-band semi-active radar/EO guidance, and rocket propulsion. The missile would fly initially under the power of a booster, then jettison this and ignite a two-pulse sustainer (perhaps with a vectoring nozzle). The second sustainer burn would be used only during high-altitude engagements.

Demonstration and validation could end in 1992, leading to the choice of a winning design. Full-scale development would then run to 1996, after which time both members of the winning team would compete for production contracts. A total of 4,000 rounds is likely to be built, equipping the F-14D, F-18, A-12 Advanced Tactical Aircraft, and even the A-6 Intruder.

A total of $40 • 4 million in R&D funding has been allocated to the programme for FY 1989, but under the same restrictions as were placed on advanced Amraam funds (see previous entry). Congress wants to see this USN programme become a USAF/USN operation. If adopted by the Air Force, AAAM could be fitted to the F-15C/D and Advanced Tactical Fighter. For the moment, the USAF claims that it has no requirement for an extended-range missile such as AAAM, so is confining its role to that of monitoring the USN programme. If a requirement were to emerge, AAAM would be purchased.

New ARM The USAF has proposed the development of a new long-range anti-radiation missile (ARM) for use against the Soviet Union's Mainstay AEW aircraft. Although a Nato collaborative programme has been suggested, to date nothing has resulted.

General Dynamics Air-to-Air Stinger (Atas) Stinger is also to be deployed as a light air-to-air missile on US helicopters such as the OH-58C and -58D, and might also be fitted to the AH-1 and UH-60. Test firings from GD's twin-round Air-to-Air Stinger (Atas) launcher started in 1986.

SOVIET UNION

AA-7 Apex (Soviet designation R-23) Broadly comparable with the* AIM-7E Sparrow, AA-7 exists in radar-guided (R-23R) and IR-guided (R-23T) versions, and arms the MiG-23S Flogger and MiG-25E Foxbat. The missile is reported to have been optimised for low- and medium-altitude interception.

Operators Soviet Union, Bulgaria [?], India, Iraq, Libya, Syria.

AA-8 Aphid (Soviet designation R-60) Like the . AA-2 Atoll which it replaces, AA-8 is available in radar and IR versions. It has already been seen on the MiG-21 Fishbed, MiG-23 Flogger, MiG-29 Fulcrum, and Yak-38 Forger. Mere manoeuvrable than AA-2, it is an effective close-combat weapon, and one which has apparently proved a problem for the South African Air Force during operations over Angola.

Operators Soviet Union, Angola, Cuba, India, Iraq, Libya.

AA-9 Amos This "snap-down" missile is now in service on the MiG-31 Foxhound. AA-9 seems to be a Soviet equivalent to the AIM-7M or Sky Flash. At high altitude it has a. maximum range of 40-45km, falling to around 20km at low level. During snap-down attacks it has successfully engaged drone targets at altitudes of down to 50m.

AA-10 Alamo The MiG-29 Fulcrum and Su-27 Flanker are both armed with the medium-range AA-10 missile. Several versions are known to exist:

Alamo A semi-active radar guidance / short rocket motor;

Alamo B IR guidance /short rocket motor;

Alamo C semi-active radar guidance/long rocket motor.

In recent USAF exercises, the head-on range of the Alamo was assumed to be six to eight miles, well below the 20 miles of Sparrow.

AA-11 Archer This agile dogfight missile arms the MiG-29 and Su-27, but no details of its size or configuration are available.

Anti-tank

ARGENTINA

Citefa Mathogo Similar in configuration—but not in dimensions or weight—to the Bofors Bantam, this wire-guided missile has been developed for the Argentine Army by Citefa (Scientific and Technical Research Institute of the Armed Forces). A single fire-control unit incorporating a binocular sight can be connected to up to four launchers positioned up to 50m away.

BRAZIL

Avibras MSS-1 This wire-guided weapon is 95cm long, 10cm in diameter, and has a wingspan of 49cm. These dimensions almost exactly match those of the MBB Cobra, a weapon for which Brazil has a manufacturing licence. It is tempting to conclude that MSS-1 is Cobra modified to suit Brazilian manufacturing methods, but the weight of the weapon seems to rule this out. MSS-1 weighs 381b (17-2kg) at launch, Avibras tells *Flight.* Cobra weighs only 10-3kg.

CHINA

Norinco Red Arrow This wire-guided anti-tank missile seems to be an unlicensed copy of the AT-3 Swatter, but it is possible that Chinese engineers have added their own improvements to the basic design.

Norinco Red Arrow 8 Similar in general concept to the Euromissile Milan, this Saclos-guided missile is launched from a 23kg firing post mounted on a 23kg tripod. The round is fired from its tubular launcher/container. The operator tracks the target via the optical sight in the firing post, while an infrared sensor tracks the missile and keeps it on the operator's sightline. Hit probability is better than 90 per cent, says Norinco. The firing post may be mounted on a truck, while a turret-mounted version has been developed for use on AFVs such as the K-63 tracked APC.

FRANCE

Aerospatiale Eryx Eryx is a low-velocity missile powered by only 2 • 8oz (80g) of propellant, and having a muzzle velocity of only 65ft/sec (20m/sec). It can be fired from inside buildings or from under cover. The launcher weighs 3 • 4kg and incorporates a X3 optical sight with a 200mrad field of view, and a charge-coupled device infrared camera used by the automatic command to line-of-sight (Saclos) guidance system. The round is 90-5cm long, weighs 11kg, and carries a 3-6kg warhead able to penetrate 90cm of steel. Cost of a round is expected to be a third that of Milan. The weapon is now in full-scale development. Evaluation ujials are due to begin in 1989, and the weapon is expected to enter service in 1990.

Thomson-Brandt Spiral The Thomson-Brandt Spiral guided round unveiled at the 1985 French Army show at Satory would carry a Thomson-CSF millimetre-wave seeker, and be fired from the 120mm mortar.