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Improved radar
IN MID-1980 the USAF will take delivery of improved versions of the F-15. Single-seat F-15C fighters and two-seat F-15D trainers will carry an updated radar, 2,0001b more internal fuel and fittings for fuel and sensor tactical package (Fast Pack) pallets. Present production versions of the Hughes APG-63 radar are fitted with a hard-wired signal processor. Any changes to the radar's capability can be made only by rewiring the proces-sor unit. The revised radar will con-tain a programmable processor with four times the present capacity, allow-ing the radar characteristics to be modified by means of a rewritten programme tape.

Not only are software changes cheaper than modifications to hard-ware; they are also much quicker to develop and de-bug. If the USAF had elected to upgrade the Eagle radar with a new design of hard-wired pro-cessor, the job would have taken four years rather than one. Any subsequent changes dictated by new develop-ments in tactics, weaponry or elec-tronic countermeasures should be simple to implement.

The signal processor is basically an

BRITISH AEROSPACE has developed an improved version of the Sky Flash air-to-air missile which goes a long way towards overcoming some of the limitations of present-day weapons. Although most existing types of mis-sile will react to a launch command within a second or so, they have rela-tively long "warm-up" times. The latest Sky Flash variant will cut this waiting period by an order of magni-tude.

At present the pilot of a fighter has to energise his missiles before enter-ing combat. Power from the aircraft is applied to the missile's homing head and autopilot electronics. As soon as this equipment is operating correctly, the weapon is available for use. The entire process takes around ten seconds on a modern missile.

Switch to internal power
A firing command can be given once the head has detected a target and locked on. This energises the mis-sile's batteries and the hydraulic or pneumatic power source for the hom-ing-head and control-surface actuators. In the case of an infra-red-homing weapon, the detector cell is often cooled to increase sensitivity. Initially this can be carried out by coolant from the parent aircraft, but a second supply within the round may have to be turned on.
The time actually required to carry out these final pre-flight actions is very short, probably about a second. As soon as they have been completed

or F-15C

electronic computer, and the four-fold increase in capacity will allow the radar to search while tracking. As one target is being tracked, the radar will be able to search around it for others. Radar lock-on will be switch-able from one target to another. During the development of the Eagle and the present APG-63 radar, McDonnell Douglas looked at the advantages of track-while-scan, but concluded that the 2J

2° beamwidth
of the antenna made such a feature of relatively little use. The radar would be unable at long range to pick out individual aircraft from a tight formation, since several of these targets could combine to appear as a single return on the display. In-creased signal-processing capacity seems to have solved this problem for the F-15C and D: a new raid-assess-ment mode will allow the set to identify targets within a single signal return.

APG-63 performance is already impressive. Targets can be tracked at tree-top height or at very high alti-tudes by using either medium or high pulse-repetition frequencies (PRFs). Eagle is the only operational fighter

and the missile is running on its own internal supplies, the rocket motor is lit and the round leaves the launcher rail to begin its flight to the target. This is however small consolation to a pilot who finds himself suddenly plunged into combat. If jumped by a hostile fighter, he has to carry out the longer process of energising his weapons from cold before being able to return fire.

On first-generation missiles fitted with vacuum tubes (valves) rather than transistors, this interval was literally a "warm-up" period, but the arrival of semiconductor electronics cut the waiting time to around 10 or 15sec. The new "snap-start" version of Sky Flash should cut the time down to a second or two. All rounds delivered to RAF squadrons will be of this type.
Three semi-actiye-homing missiles are being produced as potential re-placements for the widely used AIM-7E Sparrow. All have the basic air-frame of the earlier weapon. First to appear was Raytheon's own AIM-7F, which drew on the extensive experi-ence gained during the -7E pro-gramme. The newer version coupled a large motor and warhead with modernised electronics, but could not take advantage of the more recent miniaturisation techniques which have made possible the development of a monopulse seeker.

Rritain's Sky Flash retained the smaller motor and warhead used on the AIM-7E, since the increased

1527

employing both values of PRF, says McDonnell Douglas. The high fre-quency is most suited to detecting head-on targets at long range but gives a poorer range resolution than medium frequencies. Medium fre-quencies are best used on rear-hemisphere attacks such as tail-chases, or against manoeuvring tar-gets at low altitude. Resolution in this mode is about 500ft rather than the 5 n.m. of high-PRF radars.

F-15 general manager Chet Rrown has no doubts that the revised radar will remain effective well into the future. "Improved radar performance possible with a programmable signal processor goes well beyond search-while-track, raid assessment and the others. It means that as the potential threat evolves through the 1980s and radar technology advances, the Eagle's radar can also' advance—and do so with relative ease."

range offered by the -7F was not thought necessary for the European environment. The smaller warhead is at least partially offset by the smaller miss distance produced by the mono-pulse seeker (see Flight for April 9, 1977, page 894).

Longer timescale
By accepting an even longer time-scale, Selenia has been able to com-bine a monopulse seeker, improved motor and heavier warhead to pro-duce the Aspide dual-role air-to-air and ground-to-air missile. Initial pro-duction rounds are intended for use as SAMs; the air-to-air programme has a much lower priority.
With all three weapons on the market, a number of nations have been examining their merits. An official close to one such evaluation told Flight that on technical merit Aspide seemed most suited to the local requirement, but that the rela-tive timescales made Sky Flash the more likely to be chosen.
Given this sort of potential com-petition from the Italian missile, it is not surprising that the British and US teams are working on further improvements to their own conten-ders. A shorter reaction time should make Sky Flash even more attractive, while a monopulse seeker designed by Raytheon has been selected to equip an improved version of the AIM-7F following a competitive shoot-off which ended last year (see Flight for March 25, page 843).

Fast-reacting Sky Flash for RAF