



Having flown in the F-5M – with its HUD, MFD and large UFCP – the cockpit of the Eurofighter will not seem so unfamiliar. Furthermore, the avionics and datalink system allows the replication of radar functions in the F-5M without the expensive installation of a radar.

- Air data computer
- Monitoring of engine and fuel parameters
- Maintenance Data Transfer System, recording the problematic parameters an aircraft may encounter in flight (avionics, g-overload, engine, etc.)
- Angle-of-attack indicator
- Audio Management System, integrating communications, interphone and distinct alert tones coming from the radar altimeter and Smart Data Link
- Point of impact indicator for simulated bomb-practice (No Drop Bomb Score)

Also included in the upgrade programme is a Training Data Transfer System (TDTs) with virtual radar capabilities, which uses the data from aircraft transmitted through an intelligent data link (Smart Data Link). It will be combined with a Traffic Alert and Collision Avoidance System (TCAS), a system which provides a set of electronic eyes so the pilot can 'see' the traffic situation in the vicinity of the aircraft. Part of the TCAS capability is a display showing the pilot the relative positions and velocities of aircraft up to 40 miles (64 km) away. The instrument sounds an alarm when it determines that another aircraft will pass too closely. TCAS provides a backup to the air traffic control (ATC) system's regular separation processes. From a tactical point of view, however, the TDTs allows the student pilot to read real echoes, complete with latitude, longitude, altitude and distance, provided by the GPS receiver, a valuable tool for dissimilar air combat training. The virtual radar and corresponding software potentially can generate and display one or more fictitious 'bogey's on the displays and HUD.

The navigation suite includes a Ring Laser Gyroscope (RLG) Inertial Navigation System (INS) with an embedded Global Positioning System (GPS) receiver. A limited number of structural improvements are also foreseen, as is the integration of the AIM-9J into the HUD display. Although not part of the current programme, both the modification of the engines (standardising on two 5,000-lb/22.25-kN thrust General Electric J85-GE-21A turbojets, with afterburners like the F-5E/F) and 'zero-zero' ejection seats are under review.

One of the most important factors in the determination of the eventual competition winner was the participation of the Spanish aviation industry. IAI anticipated this by earlier establishing co-operation contracts with CASA (soon to become a division of EADS). IAI's Lahav Division was selected the prime contractor for the upgrade and is responsible for the avionics development and integration. Local industries EADS-CASA and INDRA are subcontracted to carry out the work in Spain. EADS-CASA is responsible for the complete installation of the new avionics package, structural improvements, test flights and production of the 'avionics kits' to be installed. It also participates in the development of certain avionics components. Documentation, training of EdA personnel and provision of test equipment is assigned to INDRA. The EdA participates through its Centro Logístico de Armamento y

contract worth 21 million Euro (about \$20 million) was signed with Israel Aircraft Industries Ltd/Lahav Division, the winner of the tender.

As presented in the winning offer, the new avionics package was based on previous IAI upgrade programmes for the F-5 (Chile and Turkey), and more specifically on the T-38 Avionics Upgrade Program (AUP) for the United States Air Force. Under the T-38C AUP, Lahav acts as the major avionics integration subcontractor for the Aerospace Support business unit of Boeing. Talons are being upgraded with a wide-angle head-up display in the front cockpit; multi-functional displays, electronic engine displays and upfront control panels in both cockpits; an integrated global positioning system/inertial navigation system; and a traffic collision avoidance system. In addition, Boeing is responsible for delivering ground-based Operational Flight Trainers and Unit Training

**AE-9-009 and AE-9-018 are two of the four F-5M 'prototypes', and are seen here outside EADS-CASA's Getafe plant. The yellow primer areas show where structural modifications have been applied to install the completely new avionics/cockpit suite. Work began at Getafe in early 2003 on the 17 'production' conversions, the last of which is due to be returned to Ala 23 in late 2004/early 2005.**



Devices, as well as logistics support of the aircraft's avionics and trainers. The Avionics Upgrade Program improves the avionics reliability of the T-38 by a factor of seven and reduces support costs significantly. By making use of similar systems as designed for the T-38 AUP, the EdA was reassured of continued supply and support, since the USAF programme will see some 500 Talons being modernised over the coming five years, while both logistical and technical support are guaranteed for at least some 20 years.

Basic elements of the Spanish avionics upgrade are:

- Head-Up Display (HUD) in the front cockpit (and projection of the image in the aft cockpit)
- Multifunction UpFront Control Panel (UFCP)
- Latest generation of powerful mission computer
- Two 6 x 8-in liquid-crystal colour Multifunction Displays (MFD) in both the front and back cockpit
- Electronic Flight Instrument System (EFIS)
- Hands On Throttle and Stick control
- New VOR/ILS, TACAN/DME and UHF/VHF radars
- Radio altimeter
- Flight Video Recording System in colour for debriefing purposes