

# Cruise Missiles



Project AIR 5418 Follow-On Stand Off Weapon has been in the pipeline for some years now, being in effect an outgrowth from the earlier AIR 5398 weapons project for the F-111, which has since materialised as the AGM-142/Mil-Std-1760C Block C-4 upgrade on the F-111. Current Defence planning envisages that the AIR 5418 FOSOW will only be integrated on the F/A-18A HUG and AP-3C aircraft. However, in the August Review of the Defence Annual Report 2002-2003, the Joint Standing Committee on Foreign Affairs, Defence and Trade recommended that the government make a statement on 'the need to ensure that key upgrades and deep maintenance on the F-111 continues through to 2010 with the possibility of extending the lifespan should the need arise'. This opens up the possibility that the AIR 5418 FOSOW could still be integrated on the F-111.

# for the RAAF

The aim of the AIR 5418 program was to provide the RAAF with a tactical cruise missile capability, which would obviate the need to penetrate unusually heavy ground-based air defences, and to reduce engagement opportunities for opposing fighters. An autonomous weapon with a range in excess of 150 nautical miles puts the launch aircraft at a distance that effectively defeats the range capability of ground launched fighters and SAMs. Industry sources indicate that the contest is now focused on three weapons: AGM-84 SLAM-ER, KEPD-350 and AGM-158 JASSM.

## Boeing AGM-84H/K Stand-off Land Attack Missile - Expanded Response

The SLAM-ER is the most mature of the contenders, but it is also the smallest and shortest ranging. It is in service with the US Navy and reported to have been acquired by South Korea.

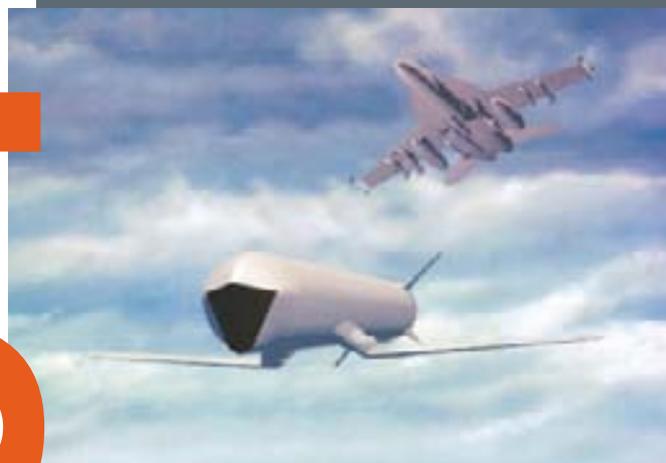
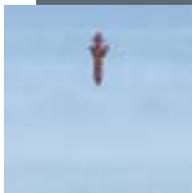
SLAM-ER is a derivative of the AGM-84 Harpoon, the most widely used anti-shiping missile worldwide. The air launched AGM-84A entered service during the late 1970s, followed by the improved AGM-84C Block 1B in 1982, the AGM-84D Block 1C in 1985, and the first generation AGM-84E Block 1E SLAM (Stand-off Land Attack Missile) in 1990. While the baseline Harpoons were specialised AN/DSQ-28 radar guided sea skimming anti-ship cruise missiles, the SLAM was primarily a land attack missile, using an entirely new guidance and seeker package, but retaining the Teledyne/CAE J402 turbojet engine, the 221kg (488 lb) WDU-18/B blast/frag warhead and the existing airframe.

The SLAM's guidance package uses the thermal imaging WGU-10/B seeker designed for the AGM-65 Maverick, a GPS receiver and the AN/AWW-13 Walleye glidebomb datalink. Launched like a Harpoon, but with programmed waypoints, the SLAM would activate its datalink and transmit the seeker image to the launch aircraft prior to impact, allowing the operator to use datalink commands to adjust the aimpoint.

The limitations of the SLAM were its Harpoon airframe, constrained standoff range and warhead, and limited autonomy. The US Navy initiated the AGM-84H SLAM-ER program during the early nineties, with Initial Operational Capability achieved in 2000.



# 5418 AIR



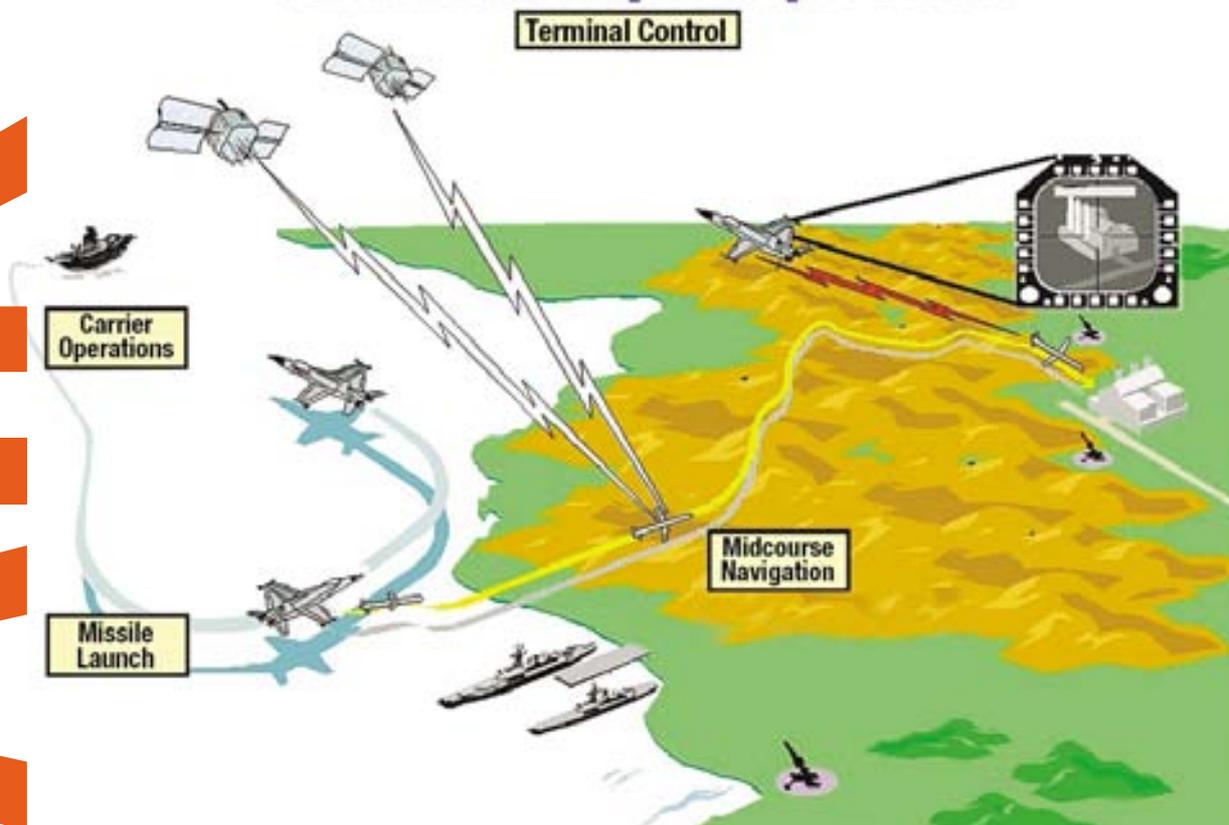
The 1,600lb SLAM-ER is the most radical evolution of the Harpoon, with a new pop-out swept wing, larger 360kg (800lb) WDU-40/B penetrating warhead from the Tomahawk Block III, and a revised AN/DSQ-61 guidance/seeker package with a new nose window design. The new guidance added a five-channel GPS receiver common to JDAM, a Ring Laser Gyro, an improved datalink with better jam resistance and range, plus software enhancements. The latter permitted reprogramming aimpoints in flight and 'search while track' selection of alternate aimpoints without breaking lock. Later blocks of the SLAM-ER include the Automatic Target Acquisition (ATA) function, which allows the weapon to autonomously select an aimpoint using a stored bitmap image. Cited range for the SLAM-ER is in excess of 150 nautical miles and launch weight 1,600 lb (730 kg).

## EADS/LFK/Bofors KEPD-350

The 2,800lb (1,300kg) weight class KEPD-350 is the largest and longest ranging of a modular family of powered and unpowered standoff weapons developed in the EU during the 1990s. The glide-only DWS-39, AFDS/MW2, rocket-boosted DWS-39R/MW-2R, KEPD-50, PDWS 2000 and KEPD-350 all share structural components, warheads, submunitions and guidance elements. The smallest DWS-39, AFDS/MW2, DWS-39R/MW-2R are EU equivalents to the AGM-158 JSOW, but using stub wings. The larger PDWS-2000 and KEPD-350 use pop-out swept planar wings, and a turbojet engine - the latter claimed to provide in excess of 190 nautical miles of standoff range.

The KEPD-350 was designed from the outset as a cruise missile, and a variant was offered to compete against the US JASSM contenders. The airframe has a trapezoidal section centre fuselage containing the fuel tanks and payload dispensers or warhead, with the wing pivots mounted on the upper fuselage. The tapered aft fuselage module with cruciform wings, and side mounted inlet scoops, is a self-contained propulsion/control/guidance package including a Williams International F122-15 turbojet engine. The nose has provisions for a thermal imaging terminal seeker.

## SLAM ER Concept of Operations



The 'Tri-Tec' guidance package combines a GEM III GPS receiver, a Ring Laser Gyro, and the EU TERNAV system for terrain contour matching navigation updates. This is a similar package to the Tomahawk series. The weapon includes software for optimising terrain following flight to defeat air defences, along with autopilot algorithms for pop-up terminal attacks. Earlier this year, Israeli manufacturer Tadiran Spectralink won a contract to develop a digital datalink for the weapon to permit in flight waypoint and aimpoint updates and bomb damage assessment imagery transmission.

Perhaps a unique feature of the KEPD-350 in its class is that it was built for the outset for submunition and penetrating warhead payloads. Submunitions available included the ATM anti-armour mine, the AMS anti-armour bomblet, the ADM area denial mine, the AMS fragmentation bomblet, the radar fused AMS 2 anti-armour bomblet, and the RCB runway cratering bomblet.

The launch customer for the KEPD-350 is Germany's Luftwaffe, intended for use initially on the Tornado IDS.

## Lockheed-Martin AGM-158 Joint Air-to-Surface Standoff Missile

The JASSM is the intended US multi-service tactical cruise missile, intended to arm the B-52, B-1B, B-2A, F-15E, F-16C, and likely also USN/USMC F/A-18s. Initiated during the mid 1990s, the JASSM was devised as a cheaper replacement for the cancelled Northrop AGM-137 Tri-Service Standoff Attack Missile (TSSAM) and is often described as 'son of TSSAM'. While the TSSAM was considered technologically exceptional, and arguably the most stealthy vehicle then devised in the US, its high cost was its downfall during the post Cold War downsizing period.

Boeing and Lockheed Martin competed for JASSM, and LM's design won the contract. The JASSM is perhaps unique in that from the outset mass production unit cost was a major issue, with a lower than US\$400k unit cost being cited, half or less the cost of a typical US\$1M cruise missile or stand-off missile. Like the TSSAM, JASSM was designed for high performance stealth.

The 2250lb JASSM uses an unconventional configuration, with a stealthy fuselage, planar swept wings and a single vertical tail. The cited engine is the Teledyne/CAE J402-CA-100 turbojet, providing a cited range in excess of 200 nautical miles with a 450kg (1000lb) WDU-42/B (J-1000) penetrating warhead. The guidance and seeker package includes an inertial unit, a jam resistant GPS receiver, a datalink, and a thermal imaging terminal seeker, incorporating a similar autonomous pattern matching terminal guidance capability to the ATA in the SLAM-ER.

A 500+ nautical mile range AGM-158B JASSM-Extended Range, powered by a more frugal turbofan, has been proposed as



a replacement for the AGM-86C/D Conventional Air Launched Cruise Missile (CALCM) carried by the B-52H - this weapon being produced by rebuilding Cold War stocks of the AGM-86B.

Other proposed evolutionary upgrades to the JASSM include submunition payloads and a specialised deep penetrating warhead, as well as Synthetic Aperture Radar imaging all weather seeker. Like the KEPD-350, the JASSM is in low rate early production.

The JASSM is the technologically newest of the three contenders and by far the stealthiest in its airframe shaping; available data suggests it outranges its competitors by a respectable margin. Indeed, reports some years ago claimed that the JASSM was selected as the preferred AIR 5418 contender.

Introduction of the AIR 5418 FOSOW will provide the RAAF with a potent niche capability, especially for defeating air defences and other very high value targets. A remaining issue will be the provision of near real time targeting imagery to support to this class of weapon along with adequacy in numbers and payload radius performance of launch aircraft.

