Introduction ........................................... 3
In the Beginning ...................................... 4
The Power Behind the Throne ...................... 10
Harrier into Service .................................. 13
USMC AV-8A Service ................................ 25
Two-seat Harriers ..................................... 33
The Spanish Armada .................................. 36
'30 Miles from the Border' ......................... 40
Sea Harrier ........................................... 45
Harrier II/AV-8B/GR5 ................................ 56
Individual Aircraft Histories ....................... 61

Front cover:
The Harrier GR5 represents a considerable increase in capability over the earlier GR3 which it replaces, and appropriately No 1 Squadron was the first to convert to the new type. This picture shows the menacing head-on view to advantage.  Allan Burney

Below:
Exercise 'Hazel Flute' in September 1989 was the first occasion on which RAF Germany GR5s deployed 'into the field', when aircraft of No 3 (F) Squadron operated from Flying Sites 'Eberhard' and 'Jubilee'. Here, a Harrier makes a short rolling take-off from the rain-covered road at Eberhard.
Introduction

Before the Harrier’s introduction into service, military planners were frankly sceptical about the practicality of V/STOL jet fighter operations. The attractions of flying from dispersed sites were beyond question; the current generation of jet fighters was increasingly tied to long concrete runways, whose continued existence in a ‘hot’ shooting war in Europe was questionable. But the doubts remained. Even if the Harrier could take off and land vertically, what were the performance penalties associated with carrying around such a large engine, optimised for take-off but over-powered for the rest of the sortie? And would not the advantages of dispersed sites be negated by the logistics of the operation, as the RAF did not possess a single heavy-lift helicopter?

Today, these arguments have lost their validity. The 500 Harriers which have rolled off the production lines are adequate proof of the practicality of V/STOL operations, and the two RAF Germany squadrons realistically represent the only ‘survivable’ attack force available to NATO’s 2ATAF in Central Europe. At sea, the Sea Harrier’s exploits in the South Atlantic in 1982 made it perhaps better known even than the land-based Harrier from which it was developed. With the demonstration of the technical validity of the V/STOL concept, it is only surprising that other countries’ air forces have not joined the lead of the RAF and the US Marine Corps in putting the Harrier into their inventories. The ultimate self-delusion is that every air force general asserts he has the necessary offensive airpower to crater the enemy’s runways and render them unusable, while believing his own 8,000ft strips of concrete to be inviolate. Hardened Aircraft Shelters (HAS) protect his aircraft, but one well-placed weapon can still transform the runway into two 4,000ft strips, separated by a large crater. What price Mach 2 performance then?

In practice, the ‘V’ of V/STOL has shifted to give STOVL, the acronym which more accurately reflects Harrier operations — Short Take-Off and Vertical Landing. To understand the Harrier’s essential flexibility, take the case of the ‘big wing’ GR5, the latest of the line. Powered by a Pegasus 11-61 with 23,800lb of thrust (the engine version to be fitted to production aircraft from 1990), the aircraft is clearly unable to take-off vertically (ie relying completely on engine lift) at any weight approaching 23,800lb. To be capable of vertical take-off, fuel and/or warload must be reduced to a figure well below this, although a worthwhile payload can still be carried and the importance of the basing flexibility is not to be underestimated. At the other extreme, using a normal runway and a rolling take-off, the Harrier can launch at an all-up weight of over 30,000lb. Between these two options is the short rolling take-off, where the aircraft rolls forward with the engine nozzles pointing rearward to build up airspeed, then rotates them downwards to unstick. The Harrier’s wing produces an extra 7,000lb of lift at low forward airspeeds, which allows the aircraft to take-off at an all-up weight of 30,000lb at no more than 50-70kt and in a distance of just a few hundred metres. With such performance, any straight stretch of country road becomes a Harrier runway, and recoveries can be made vertically when the ordnance has been expended and the fuel burned off by a half-hour sortie over the battlefield. It is this style of operation which gave the Harrier its ‘jump jet’ appellation. Once in the air, the Harrier has other intrinsic advantages, such as the fuel economy of its Pegasus turbofan, a mainly specific excess power and a low infra-red signature — the results of employing a non-afterburning engine.

The Sea Harrier has made possible a similar revolution in carrier operations. While the US Navy continues to build (albeit at a rate of only one every four years) 80,000-ton leviathans, the Royal Navy has shown the way towards simplification. The angled deck and the steam catapult (both British inventions) were replaced by the Sea Harrier and the ski-jump (again from the same stable), this time in a ship of less than 20,000 tons. The result is affordable airpower at sea. Not only are the cost and complexity of the carrier operations reduced (only the USA and Russia are really in the attack carrier league now), but operational flexibility is increased. F-14 Tomcats and AWG-9 or not, a USN attack carrier has predictably steamed into the wind to give the requisite wind-over-deck for launching its aircraft, which can provide no air defence of any kind when the ship is tied up in dock. Spain, India and (soon) Italy have followed the Royal Navy into Harrier-carrier operations, and it is arguable that the Harrier has made more of a mark at sea than with land-based airforces.

Even smaller ships could be made Harrier-compatible using British Aerospace’s (B Ae) computer-controlled ‘Skyhook’ crane launch and recovery system. Further development of the Harrier line will almost certainly lead to a supersonic V/STOL fighter by the end of the century, although it will probably come from St Louis, Missouri rather than from the Harrier’s Kingston-upon-Thames birthplace. While such a type’s design will probably have relatively little in common with the current aircraft, it will certainly benefit from the 20 years’ V/STOL service experience of the Harrier and Harrier II.

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3