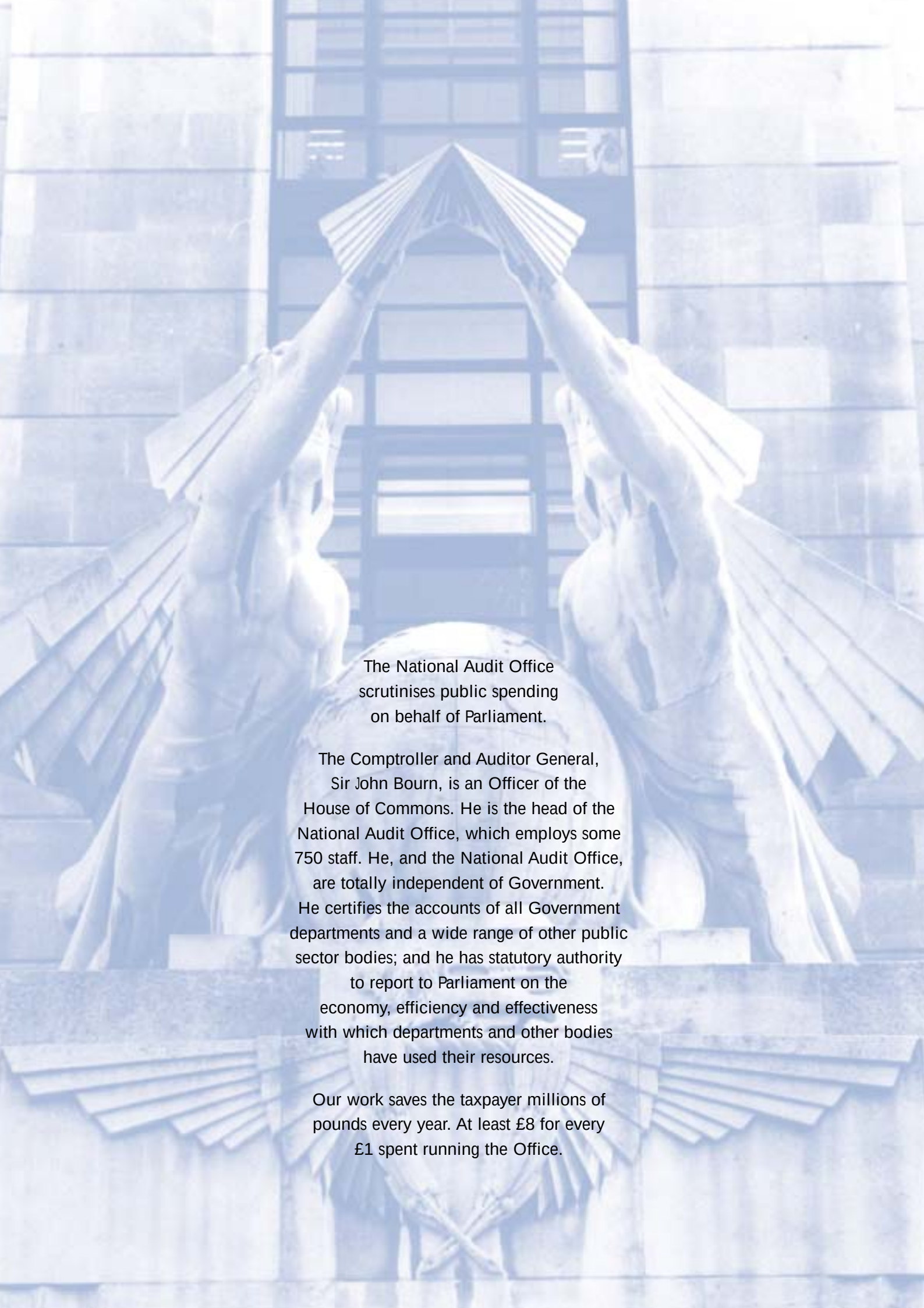
NATIONAL AUDIT OFFICE

Ministry of Defence

Building an Air Manoeuvre Capability: The Introduction of the Apache Helicopter

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
HC 1246 Session 2001-2002: 31 October 2002



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John Bourn
Comptroller and Auditor General

National Audit Office
23 October 2002

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"I have no doubt whatsoever that the Attack Helicopter will represent the biggest single enhancement to the Army's capability for many years. It will change the way we go to battle. Now we have taken the decision to buy the Apache, the Army must ensure that doctrine is developed to allow us to make the fullest possible use of its tremendous capability."

Chief of the General Staff, General Sir Charles Guthrie, 1996

1 The Westland Attack Helicopter 64 (WAH 64), known as the Apache, will improve the ability of the armed forces to conduct offensive mobile operations by delivering firepower and a level of protection that is more deployable and more mobile than existing equipments.

2 The decision to procure an Attack Helicopter was taken in the early 1990s. At that time, military doctrine was based on the assumption that the most likely threat to the United Kingdom was from the Eastern bloc and the Attack Helicopter was therefore seen as a direct replacement for the existing Lynx-based capability. By the time the contract for the supply of 67 WAH 64 Apache helicopters was placed with GKN-Westland Helicopters Ltd (Westland) on 1 April 1996, the perceived threat had changed and the Department had begun to develop the concept of Air Manoeuvre[1]. The concept has continued to evolve as the Department has sought to maximise the Apache's full potential.

3 The Department's original procurement strategy was based on an international competition for the off-the-shelf procurement of a complete integrated weapon system through a single prime contractor. In practice, this strategy has changed in several ways. Training services and the supply of munitions have been procured outside the prime contract. Nor is the Apache merely an off-the-shelf buy of the United States' WAH 64 helicopter. Rather, it incorporates significant changes to meet the Department's specific requirements. Most notably, the installation of the RTM 322 engine made by Rolls Royce Turbomeca was included in the original contract and several amendments covering key improvements to the baseline aircraft, such as an improved Defensive Aids Suite and Communications Suite, have been agreed since.

1 *Air Manoeuvre is defined as "Operations within the Land Component Scheme of Manoeuvre, seeking decisive advantage by the exploitation of the third dimension: primarily by combined-arms forces centred around and integrated with rotary aircraft supported by other component elements, within a joint framework - nationally and multi-nationally".*

4 Introducing a major enhancement to the armed forces' capability such as Air Manoeuvre, involves considerably more than acquiring new equipment. The Department has therefore adopted an approach known as the "Six Lines of Development" to ensure that all the elements required to deliver a given capability are put in place. The Lines of Development are described in **Figure 1**.

1 The Six Lines of Development

Delivering defence capability involves more than just buying new equipment

1 Delivery of the equipment;

2 Development of appropriate structures and infrastructure;

3 Development of concepts and doctrine for how the equipment will be used;

4 Delivery of the required training;

5 Recruitment and retention of manpower; and

6 Supporting and sustaining the new capability once the equipment has been introduced to service.

Source: Ministry of Defence

5 Given the importance of Air Manoeuvre to the United Kingdom's armed forces, this Report examines whether the Apache helicopter is being delivered in a timely manner and as a coherent package. The report examines:

- The progress being made on the programme to acquire the Apache;
- How the Department is delivering the other five Lines of Development for the Apache; and
- The management structures that the Department has put in place to oversee the delivery of the Air Manoeuvre capability.

6 We found that:

- Delivery of the Apache is going broadly according to plan but, not surprisingly for such a complex weapon system, some acquisition risks remain and there may be some initial gaps in capability;
- The Department is working hard to deliver the remaining Lines of Development but further risks remain; and
- Managing all aspects of delivering the Air Manoeuvre capability in a coherent manner is challenging.

7 Given the challenges that the Department faces in ensuring the successful delivery of the programme and the achievement of its wider Air Manoeuvre objective, we plan to report again on the programme once the capability is in operational use.

Delivery of the Apache is going broadly to plan but risks remain and there may initially be some capability gaps

8 The Apache is generally being delivered to time and cost. Deliveries against the prime contract will be completed in April 2004, four months later than planned. The cost of the helicopter is currently expected to be £3.068 billion, which is £71 million above the original approved cost. This increase is due to a combination of higher than expected modification costs and the increased costs of trials. The total acquisition cost of the project, including the training package, is expected to be £4.117 billion. There is still some risk to the delivery of the Apache as development work to install a range of more recently contracted enhancements to the baseline helicopter has yet to be completed. The first 37 helicopters will require retrospective installation of some or all of the enhancements, in accordance with the contract amendments[2]. This should be completed by mid 2005.

9 Before the Apache can be accepted into military service it must receive a Military Aircraft Release from the leader of the Integrated Project Team responsible for delivering the agreed capability. This confirms that the equipment and its weapons systems are operationally effective and safe to use. This release is scheduled for August 2003. Whilst this is some two and a half years later than the original planned date, it is only eight months later than required by the contract amendments that introduced the latest enhancements. The Army has elected not to commence full pilot conversion training until the latest system enhancements are introduced. Achieving this date will be crucial to completing pilot Conversion to Role (CTR) training to enable the Department to achieve an Initial Operating Capability (IOC) in August 2004. Clearance of the aircraft to operate in conditions of ice is targeted for December 2006. The slippage in the Military Aircraft Release programme reflects in part the additional testing undertaken by the Trials and Evaluation Organisation (part of QinetiQ) once Westland has completed its contractually required tests. Obtaining the necessary data from the United States has also been a lengthy process, although the situation has improved since a Memorandum of Understanding was signed between the United Kingdom and the United States on 22 May 2000.

10 Problems remain with the performance of key systems on the Apache. There are problems with damage to the airframe caused by debris from both the Hellfire missile and CRV7 rockets. The Department is also working to ensure that it can fully exploit the performance of the Longbow Fire Control Radar and to overcome anomalies with the operational support of the Helicopter Integrated Defensive Aids Suite. The Department is working with the prime contractor and other industrial partners to resolve the difficulties. These issues are not currently preventing training from being conducted although some limitations have had to be imposed to ensure that this can be done safely. The Department is confident that it will be able to progress solutions to resolve these issues by the time the Initial Operating Capability is introduced in August 2004.

2 The first 18 helicopters will require all the enhancements. Helicopters 19 - 37 will require some of the enhancements.

11 The Apache will replace the Lynx helicopter fitted with Tube-launched Optically-tracked Wire-guided (TOW) missiles. The delay in introducing the Apache capability has led the Department to extend the life of some of the TOW missiles until early 2005 at a cost of £13.9 million. The life of the TOW missiles could not be extended further and any additional delay in introducing the Apache helicopter would result in a significant capability gap.

The Department is working hard to deliver the other key components of the Apache but risks remain

Structures and infrastructure: Likely to be in place

12 The structure that will deliver the Air Manoeuvre capability, the newly formed 16 Air Assault Brigade, is in place and the necessary infrastructure works at the Army bases at Wattisham and Dishforth are either already completed or due for completion in time for delivery of the first capability. The Army's Development and Doctrine branch has made good progress in developing the framework for how Apache will be used in support of Land operations, and clear priorities and milestones for delivering the Air Manoeuvre capability have been set. More recently, however, and following the terrorist attack of 11 September 2001, the priority has shifted towards deploying the Apache in smaller detachments.

Concepts and doctrine: How the Apache will be used is not fully decided

13 There has been a long-standing requirement to provide a squadron of Apache in support of Maritime operations. The nature of the requirement has changed, and these Apache will now play a role in delivering the "Littoral Manoeuvre" capability (sea-to-land operations). The Department is intending to deliver a capability in 2004 that is less than the full requirement the Navy has identified for basing the Apache at sea for long periods. Although the prime contract included requirements for Apache to operate in a maritime environment and be capable of transportation at sea, the Department's increased emphasis on the requirement for embarked operations is not reflected in the contract. The Department's risk assessment has estimated an additional £30 million cost of sending the Apache to sea which will lie with the Department. The full risks of operating at sea will not be clarified until trials are carried out in early 2004, although the Department is cautiously optimistic that it can achieve the required level of capability. There are also other issues to be resolved to deliver the required level of support for Maritime operations.

Training: Has been delayed

14 Pilots, groundcrew and maintenance staff are being trained for the Apache under a separate 30-year £1 billion PFI deal with a joint venture of Boeing and Westland known as Aviation Training International Limited (ATIL). Separation of the training services from the prime contract late in the procurement has led to a split of responsibilities, and the Department has incurred additional costs of £34 million for training courses that have not run. The joint venture is delivering simulators embodying advanced technology, and high-class training facilities. However, the specified performance of the Full Mission Simulator, used to train pilots in how to fly the new helicopter, was achieved some 17 months late.

A small number of simulator software problems remain and it needs to be fitted with the specified visual system before it achieves full functionality. However, the Department was not required to pay ATIL any sums related to the Full Mission Simulator until the specified performance was achieved. The delay in delivering the Full Mission Simulator, together with the late delivery of training material and an increase in the duration of pilot training, has delayed completion of pilot retraining in 16 Air Assault Brigade from April 2004 to February 2007. There is some doubt whether the planned pilot course numbers will deliver enough trained pilots for the key milestone of delivering the Lead Aviation Task Force in February 2005.

Recruitment and retention: The issues are being addressed

15 Introduction of the Apache will require a significant increase in manpower in the Army Air Corps, mainly in groundcrew and maintenance staff, and in the School of Army Aviation. The Department has identified the additional manpower required and most of the additional posts have been agreed. It does not expect there will be a shortage of aircrew to fill the pilot training programme, although experience with the United States' Apache suggests there may be a problem in retaining pilots at a later stage in the programme.

Support: The through-life management strategy is still developing

16 A number of elements have to be in place to provide effective support for the Apache, including arrangements for providing spares and consumable items and for repairing aircraft components and whole airframes. The Department also needs to consider the requirements for modernisation throughout the Apache's in-service life, which is expected to last until 2030. During the initial period after declaration of the In-Service Date the Apache was supported by Westland under an arrangement known as the Contractor Spares Package. The arrangement transferred the risk associated with supporting the Apache to Westland. As actual levels of flying were considerably lower than expected the outcome was a lower than expected cost to Westland. This arrangement runs out in October 2002, and the Department has still to put in place arrangements for the supply of some spares after this date. As a result of the delays in contracting for the period that follows the Contractor Spares Package there are likely to be shortages of some long-lead items. This could result in the Department having to source these items from Apache aircraft which are being held in reserve until trained pilots are available to fly them, although the spares inclusive repair contracts already in place partially mitigate this risk.

17 Arrangements for repair of aircraft components until 2005 are mainly in place. The Department is undertaking a review of the contractor-based maintenance policy agreed as part of the prime contract, with the aim of achieving savings of up to £1 billion in life-cycle costs from 2006. The Department is currently considering the options for major airframe repair - the preferred option being to set up a facility in the United Kingdom, at Westland's premises in Yeovil. The Department is also starting to consider the requirement to modernise the Apache in the future, although it has not yet developed costed proposals. The Department is now managing the Apache capability though a 30-year Through Life Management Plan which includes a Modernisation Plan. Under the auspices of the Memorandum of Understanding the Department is currently having discussions with the United States to explore the potential for aligning both nations' Apache support programmes.

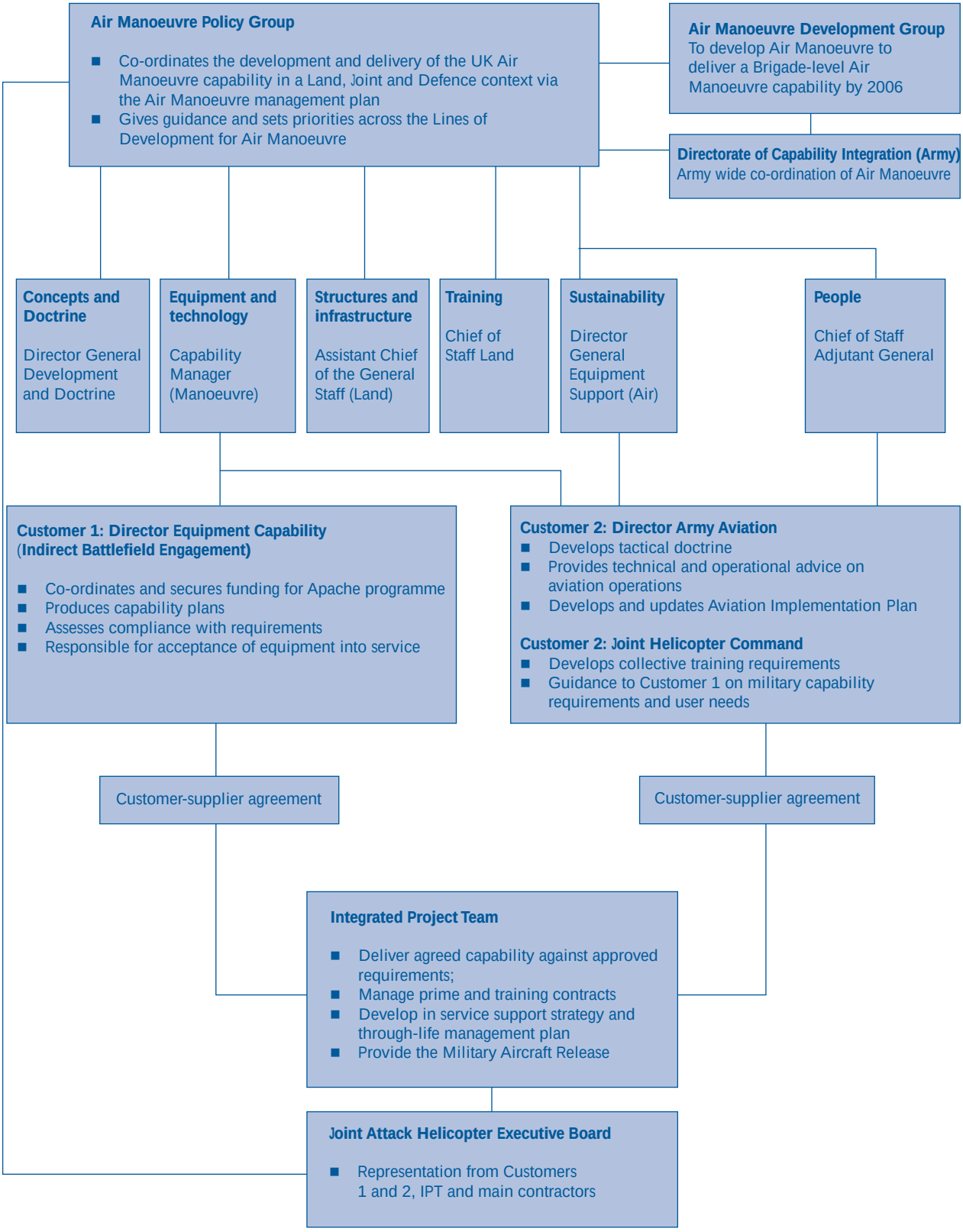
Managing all aspects of delivering Air Manoeuvre capability in a coherent manner is challenging

18 **Figure 2** shows that overarching responsibility for delivering the Air Manoeuvre concept rests with the Air Manoeuvre Policy Group (AMPG). The Group, established in March 2001, is chaired by the Assistant Chief of the General Staff (Land) and meets every six months. Each of the six Lines of Development has a senior representative on the AMPG. Responsibility for co-ordinating the equipment programme rests with the Director of Equipment Capability (Indirect Battlefield Engagement). A further key player is the Integrated Project Team (IPT) within the Defence Procurement Agency which is responsible for the manufacture, in-service support and, ultimately, disposal of the Apache. Responsibility for Army-wide co-ordination of Air Manoeuvre rests with the Director of Capability Integration (Army) who is also tasked with developing an Air Manoeuvre Capability Integration Plan.

19 The arrangements that the Department has put in place to oversee the Apache's introduction provide a good demonstration of its flexibility in adapting to meet changing circumstances, notably the development of the Air Manoeuvre concept and structural changes following the Strategic Defence Review. In many ways the arrangements mirror the best practice promulgated by the Office of Government Commerce. The creation of the AMPG is a significant step in taking forward the delivery of Air Manoeuvre capability generally - and the Apache in particular - in a more coherent way, and provides a very important corporate focus.

2 Management arrangements for the delivery of the Apache capability

The Air Manoeuvre Policy Group has overarching responsibility for delivering the Air Manoeuvre concept



Source: National Audit Office

Recommendations

20 In 2001, the AMPG set revised milestones for the delivery of Air Manoeuvre capability. The Department is confident that the milestones for delivery of a Lead Aviation Task Force by February 2005 and an Air Manoeuvre formation capable of operating in a UK Divisional context by December 2006 will both be met. **Figure 3** lists a number of actions the Department needs to take if it is to maximise its chances of meeting these milestones.

3 Actions required to deliver the first milestone

The Department is aiming to deliver the first Regiment capable of operations using the Apache in February 2005

The Department should continue to update its risk assessment of the problems with the performance of key Apache systems and consider the implications for the delivery of the initial capability (paragraphs 10, 1.8, and 1.17 to 1.23).

The Department needs to maintain strong management of the remaining stages of developing and fitting enhancements to the baseline aircraft and obtaining clearance of these upgrades through the Military Aircraft Release programme by August 2003 if they are to avoid slippage to the introduction of the capability at the end of August 2004 (paragraphs 9 and 1.11).

The Department needs to focus on resolving the issues relevant to delivering support to Maritime operations including additional training requirements and the appropriate structure within 16 Air Assault Brigade for supporting Maritime operations. (paragraphs 12,13 and 2.14-2.17).

The Department needs to ensure that the remaining issues with the Full Mission Simulator are resolved quickly and full capability is achieved in time for the start of Conversion to Type training in September 2003. The Department should also ensure that a timetable is set for upgrading the simulator in line with enhancements to the baseline aircraft (paragraphs 14, 2.24 and 2.26).

The Department should review the assumptions on pilot training concerning wastage, sickness and flying rates and examine the scope for increasing throughput if found to be necessary (paragraphs 14 and 2.29).

The letting of some contracts for spares, which will be required from October 2002, has been delayed, with the result that shortages of key spares may have to be filled by removing them from stored aircraft. This is very unsatisfactory, and if proved necessary, will need to be very carefully managed. The Department should take prompt action to resolve this situation and put the remaining contracts in place for spares as soon as possible (paragraphs 16 and 2.37).

Given that there is likely to be a long lead time in designing and constructing a facility for major repairs to airframes, the Department should complete its evaluation of the available options as soon as possible (paragraphs 17 and 2.42).

Source: National Audit Office

21 There are a number of lessons which we consider can be learned from the Department's experiences in managing the delivery of the Apache capability:

(i) In future procurements, the Department should at the outset consider carefully the potential costs and benefits and the impact on risk allocation of removing elements from the prime contractor's responsibility; and ensure that contractual incentives are properly aligned between related contracts (paragraphs 14, 1.18 and 2.22-2.23).

(ii) The Committee of Public Accounts has previously expressed concern over delays and problems in cases where Defence equipment has been purchased from the United States, and the US government has withheld technical information (HC 487 1994-95; Ministry of Defence: Major Projects Report 1994). It urged the Department to make strenuous efforts to ensure that, in future, the required technical information was provided at the outset. The Department should make further efforts, when procuring equipment from the United States, to establish that technical information is available at the outset of the programme and whether it is likely to satisfy the Department's standards (paragraphs 9, 1.14-1.16).

(iii) In future procurements, the Department should align the processes used by the contractor and by QinetiQ for certifying the equipment design as part of the Military Aircraft Release programme (paragraphs 9 and 1.13).

(iv) In drawing up future arrangements for the initial support of an equipment, the Department should consider transferring more of the risk to the contractor by relating payment to measures of actual activity such as flying rates rather than a defined time period (paragraphs 16 and 2.36).

(v) Some of the Department's and the prime contractor's assumptions concerning time-scales for key processes and activities have proved over-ambitious, including development of the Full Mission Simulator, the MAR programme and pilot training. In planning the introduction to service of new capabilities, it is important that assumptions are supported by credible evidence and are as realistic as possible at the outset (paragraphs 9,14, 1.11-1.12, 2.24 and 2.27).

(vi) The introduction to service of a new capability typically involves the co-ordination of a large number of interested parties both within and outside the Department. The experience of the Apache programme reveals the importance of appointing - at an early stage - a senior-level individual with specific responsibility for directing and co-ordinating such a programme (paragraphs 19 and 3.8-3.10.

Part 1

Delivery of the Apache is going broadly to plan but there may be some initial gaps in capability

1.1 This part of our Report examines the Department's performance in acquiring the Apache. It concludes that the acquisition programme is generally going well, although there are likely, initially, to be some gaps in capability and some acquisition risks remain. These risks include the development of enhancements to the baseline aircraft and ensuring that the aircraft will receive its full Military Aircraft Release on time. The progress the Department is making on the other five Lines of Development is discussed in Part Two of this report.

The delivery of aircraft has progressed broadly to time and cost

1.2 The Department's procurement strategy was based on the off-the-shelf procurement of a complete integrated weapon system through a prime contractor. The prime contract was intended to include the Apache itself, all munitions, an integrated logistic support package, spares, training simulators and training courseware. Following an international competition, a bid from GKN-Westland Helicopters Limited (Westland) to act as prime contractor for the delivery of 67 Apache WAH 64 helicopters was selected in June 1995. The bid was based on Westland assembling and outfitting the helicopters at the company's premises in Yeovil with all other members of the bid team, including McDonnell Douglas (now Boeing Corporation), the original US manufacturer of the Apache helicopter, acting as subcontractors. The key elements of the WAH 64 Apache are shown in **Figure 4** overleaf.

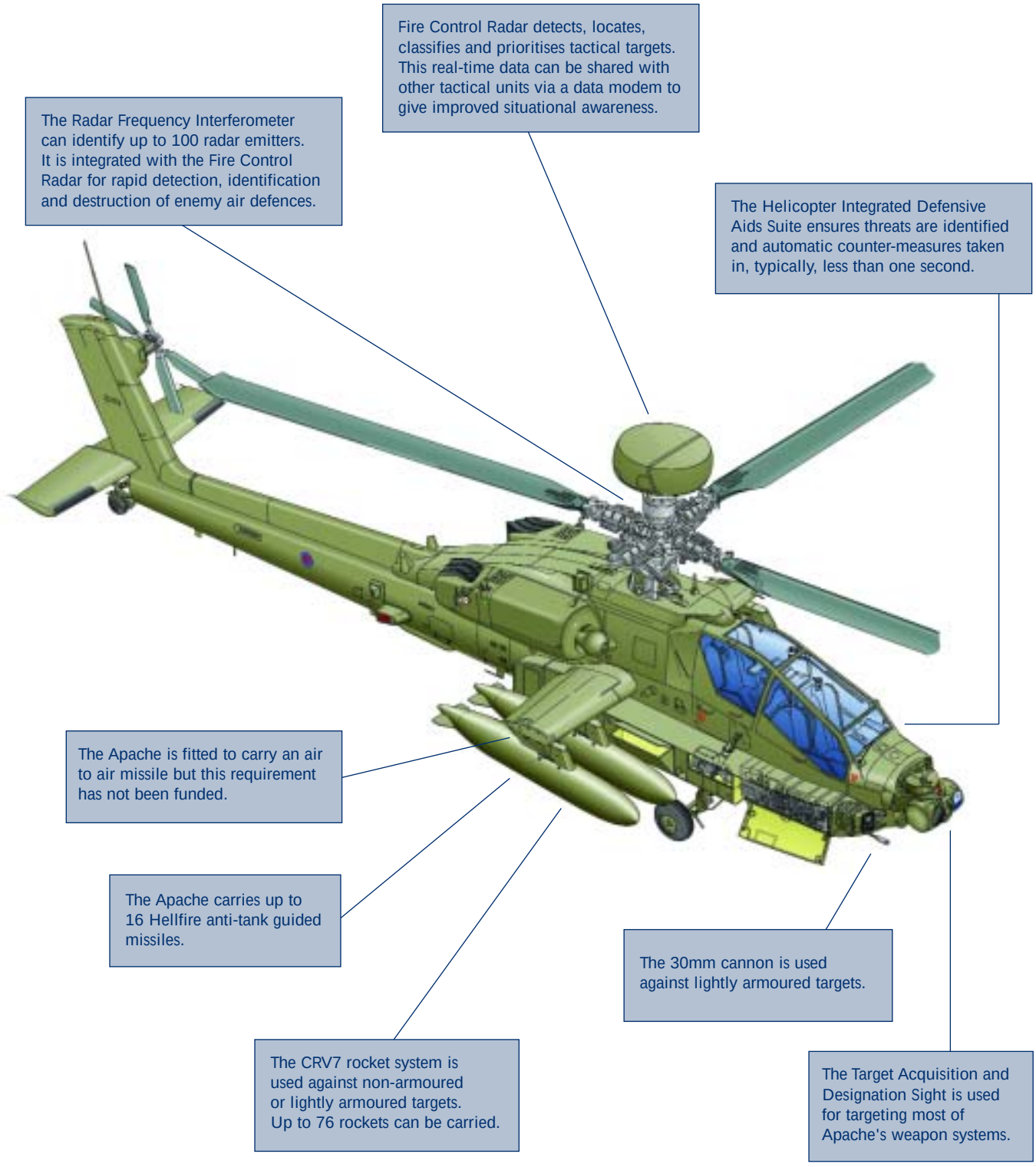
The Department's procurement strategy has evolved over time

1.3 The prime contract was signed in April 1996. **Figure 5** (page 13) provides a summary of the main contracts and amendments signed and **Figure 6** (page 14) shows the key contractual relationships. The Figures highlight how the Department's procurement strategy has evolved. In particular:

- The Department was unable to agree an acceptable price with Westland for training equipment and services. This element was removed from the prime contract and a PFI contract for the provision of training services was let to a joint venture of Westland and Boeing without a competition in July 1998 (paragraphs 2.19 - 2.21).
- The original Invitation to Tender included the supply of munitions. The Department subsequently decided to contract directly with a munitions supplier. In March 1996, the Department placed a separate contract with Huntings Engineering Ltd (HEL), now Insys Ltd, for the supply of munitions. The Department estimates that it has saved £30 million by contracting directly with InSys rather than including the munitions in the prime contract.
- The WAH 64 helicopter as finally selected by the Department was based on the United States' AH 64D helicopter but incorporated a number of changes to meet the Department's specific requirements. Most significantly, the original aircraft engines were replaced with the RTM 322 engine made by Rolls Royce Turbomeca.
- A number of significant contract amendments covering key improvements to the baseline aircraft were agreed between 1998 and 2000.

4 The main components of the Apache WAH 64 helicopter

The Apache is a highly complex helicopter, with components made by many subcontractors



Source: National Audit Office

5 The main contracts for the Apache WAH 64

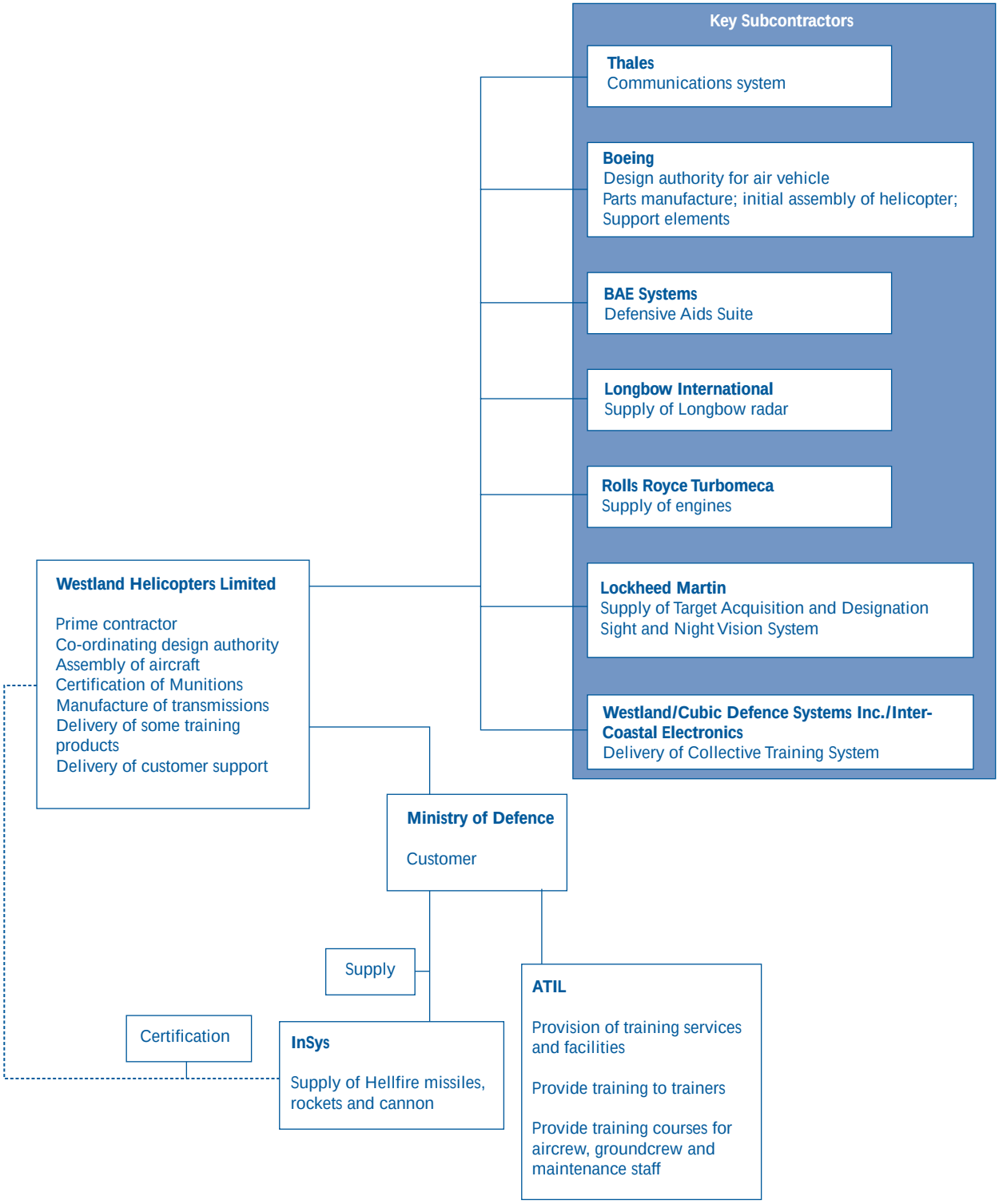
The contracts for the Apache were let between 1996 and 2000.

1996	
April	A prime contract is placed with Westland for the supply of 67 Apache helicopters and support equipment, and the qualification and certification of the weapon system, including munitions
	A contract is placed with Huntings Engineering Limited (now InSys Ltd) for the supply of munitions
1997	
1998	
July	A contract is placed with Aviation Training International Limited, a joint venture of Westland and Boeing, for the provision of a Training Service under the Private Finance Initiative. The contract runs for 30 years with a break point at 2017 to allow the contract to be renegotiated.
September	Contract amendment for an improved Defensive Aids Suite agreed under the prime contract. The sub-contractors are BAE Systems and Boeing.
1999	
November	Contract amendment for upgraded Communications Suite agreed under the prime contract. The sub-contractors are Thales and Boeing.
2000	
April	Contract amendment for Health and Usage Monitoring System agreed under the prime contract. The sub-contractors are Smiths Industries and Boeing.
July	As an amendment to the main contract a £64 million contract for a collective training system is awarded to Westland. The subcontractors are Cubic and ICE.

Source: National Audit Office

6 The contractual relationships for the Apache

The contract arrangements for the acquisition of the Apache, its munitions and training services are more complex than originally proposed



Source: National Audit Office

Aircraft are being delivered broadly to time and cost

1.4 The prime contract, signed in April 1996, stated that the 67 aircraft should be delivered over the period from March 2000 to December 2003. In practice, the first aircraft was delivered in May 2000 and by August 2002, 25 aircraft had been delivered. The expected date for final aircraft delivery has only slipped by four months, from December 2003 to April 2004, despite the incorporation of the contracted changes (Figure 5). Delays to the delivery of Apache training have meant that surplus aircraft would have to be stored and the Department has therefore agreed an amended delivery schedule to reduce the need for such storage and to accommodate delays caused by fitting the upgraded Defensive Aids Suite.

1.5 The Department's definition of the In-Service Date - delivery of the first nine aircraft by December 1999 - was set when the procurement was approved in 1995. However, the contract required Westland to deliver the first nine aircraft by December 2000. The slippage was primarily due to the decision to replace the original engine with the RTM 322 engine, which represented a significant technical challenge, and the Department re-scheduling the programme to match the available resources. The contracted In Service date was achieved in January 2001 only two weeks late. It is important to note that, although aircraft are being delivered and the Department's In-Service date has been achieved, the Apache's full military capability will not become available until the other five Lines of Development listed in Figure 1 have been achieved. We examine progress against each of these Lines of Development in Part 2.

1.6 **Figure 7** shows that the approved acquisition cost of the programme is £4.117 billion. The only variation currently forecast is for the procurement of the aircraft (an increase of £71 million or 2.4 per cent) which is due to a range of factors including higher than expected modification costs and the increased costs of trials.

Development of enhancements to the aircraft is not yet complete

1.7 Between 1998 and 2000, the Department commissioned a number of enhancements to the baseline aircraft. These included improvements to the Defensive Aids Suite, the communications systems and the fitting of a system to monitor the "health" and usage of the aircraft. The development work to install these enhancements has not yet been completed. The first 18 aircraft were built to the baseline design. As they become available the required enhancements to the aircraft are being progressively fitted to aircraft 19 to 37. The first 18 aircraft will subsequently be retrofitted with all the upgraded equipment, leading to all 67 aircraft being fitted with upgraded equipment by mid- 2005.

7 The approved costs for the Apache WAH 64 programme

The Apache helicopter is a major acquisition programme

Element	Approved cost £ m	Cost variation £m
Procurement of the Apache - covers procurement of 67 WAH 64 helicopters, initial spares and support	2,997	71
The PFI training package - provides individual training for pilots, groundcrew and maintenance crew and related training equipment	1,053	
The collective training system - provides integration of training hardware and software onto the aircraft to allow collective training of pilots	64[1]	
The support reappraisal project - to identify revisions to the current maintenance policies for the aircraft and achieve savings of up to £1 billion in the costs of supporting the aircraft through its lifetime	3	
Total expenditure	**4,117**	**71**

NOTE

1. All costs calculated on a resource basis except this figure which is outturn cash

Source: National Audit Office

Risks to the timely delivery of the full Apache WAH 64 capability remain

1.8 In September 2000, the Department established a capability working group to identify gaps, options and priorities for management of the capability and to bid for funding to address these. In July 2001, the Department undertook a risk assessment of the programme. The work of the capability working group and the risk assessment show that, while the Apache is likely to be a highly capable aircraft, there are issues concerning the Military Aircraft Release programme and the performance of some of the aircraft's key sub-systems.

1.9 The risk assessment also identified 11 other key risks to the successful achievement of the Air Manoeuvre capability objectives. These included development of the Full Mission Simulator, arrangements for supporting the aircraft and the use of the aircraft in Maritime operations. We discuss these risks in Part 2 of this report.

Military Aircraft Release has been delayed

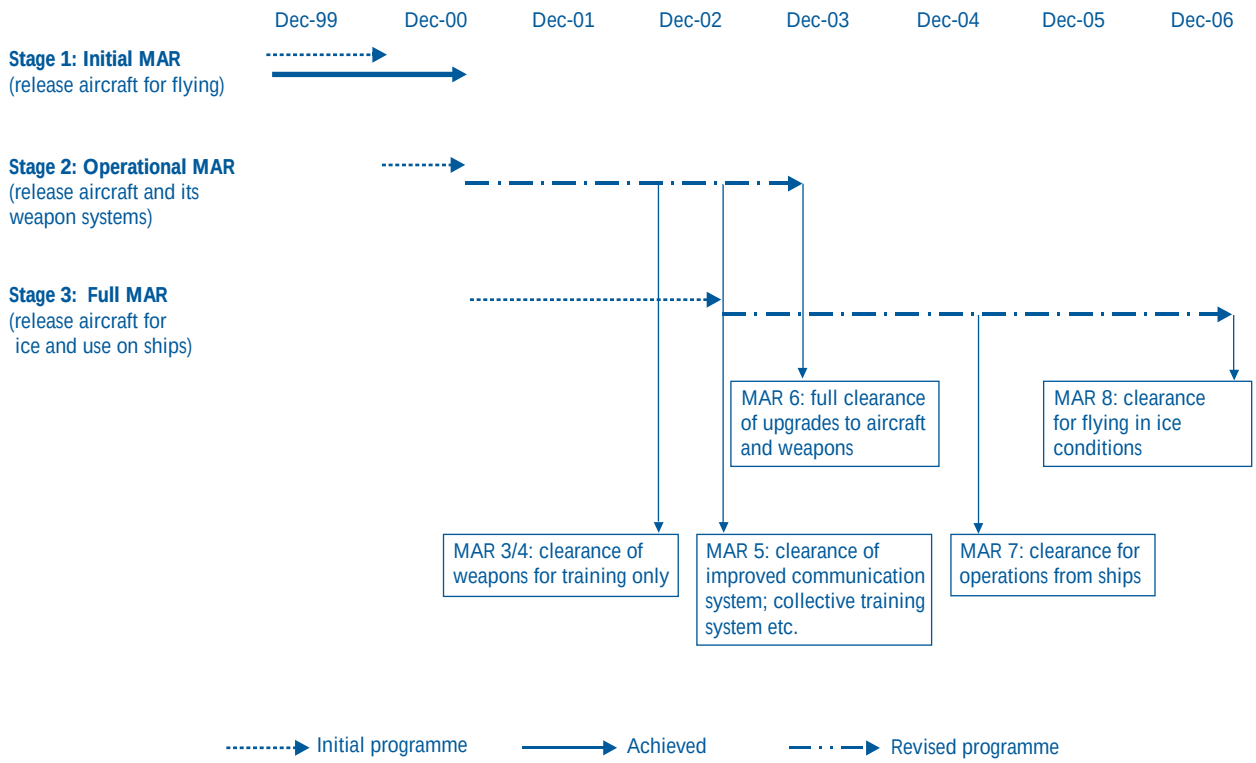
1.10 Before a military aircraft can be accepted into service in the United Kingdom, it must receive a Release to Service certificate. The certificate includes a Military Aircraft Release (MAR) which provides independent certification of the Design Authority's declaration that the equipment and its weapon systems have performed to an adequate standard and are safe to use.

The Department has adopted a staged approach to achieving Military Aircraft Release

1.11 For the Apache, the MAR programme is being staged to reflect the gradual build up in the capability of the aircraft delivered. In September 1998, the Department produced its initial plan for the Apache's introduction into service with the MAR programme planned in three stages. Under this programme, the Initial Military Aircraft Release, required to begin flying the aircraft for testing purposes, was achieved seven months late in December 2000. The Department has subsequently revised its plans and the latest MAR, issued in December 2001, has been extended to a 6-stage programme **(Figure 8)**. Clearance of the aircraft and its upgraded systems (MAR 6) is now scheduled for August 2003. Whilst this is some two and a half years later than

8 The Military Aircraft Release Programme

The original three phase programme has been extended to six phases.



Source: National Audit Office

originally planned, it is only eight months later than required by the contract amendments that introduced the latest enhancements. Given that the Department has decided that all its pilots will be trained on the upgraded aircraft, achievement of the August 2003 target date will be critical to starting pilot conversion training in September 2003 as planned.

1.12 Figure 8 also shows that clearance for the Apache to operate in conditions of snow is planned for August 2003 and to operate in ice conditions is targeted for December 2006. This timescale means there will initially be some restrictions on the environments in which the aircraft can operate when it is introduced into service in 2004.

There were differences in the MAR taskings placed on Westland and Boscombe Down

1.13 At each stage of the MAR process, the prime contractor is required to certify the design against a detailed range of parameters contained in the prime contract. The aircraft is also independently tested by the Trials and Evaluation Organisation at Boscombe Down (part of QinetiQ plc - formerly part of the Defence Evaluation and Research Agency). The tasking that the Department placed on Boscombe Down to provide this independent analysis has meant that a second stage of testing, some of which has been conducted concurrently, has been required before each stage of the MAR programme has been completed.

Obtaining data from the United States has been a lengthy process

1.14 The original planning for the MAR programme assumed that there would be a significant read across of data from the United States Army's trials of its AH 64D version of the helicopter. This would have reduced the amount of testing performed on the WAH 64 version of the aircraft to United Kingdom-specific elements and to aspects such as software and fatigue testing where United Kingdom and United States testing approaches differed.

1.15 In practice, there have been problems securing the release of data. In part, the difficulties reflect the fact that the majority of United States overseas military sales are conducted under the Foreign Military Sales system which is based on government-to-government agreements. The United States' processes are therefore geared to releasing data directly to the purchasing government. The United Kingdom's WAH 64 Apache is being procured directly from the prime contractor, Westland, and there has been a delay in the release of timely and complete data. There have also been problems with the Department's acceptance of data due to differences between the United States' and United Kingdom's requirements. These problems were further exacerbated by the privatisation of the Defence Evaluation and Research Agency (DERA) and United States concerns about releasing data to the newly privatised QinetiQ.

1.16 The receipt of data from the United States has improved following the signing in May 2000 of a Memorandum of Understanding on the Apache between the United Kingdom and the United States. However, the Department has recognised that the different nature of the testing and evaluation regimes used by the United States and the United Kingdom means that it will have to take a different perspective on future similar procurements of equipment from the United States.

The Department has identified risks to the performance of key systems on the aircraft

Firing Hellfire missiles and the CRV7 rockets could damage the aircraft

1.17 The Department has contracted directly with InSys to supply the Hellfire missiles and other munitions for the United Kingdom's Apache helicopter. The decision to acquire the munitions through a separate contract resulted in the Department making an estimated saving of some £30 million. This saving was as a result of the Department assuming the risks inherent in integrating the munitions on the aircraft.

1.18 The contract requires Insys to supply the munitions to a design qualified to United States Military Standards. The warranty arrangements only compensate the Department for defective materials or workmanship, not for liabilities resulting from design defects. Although Westland is responsible for certifying munitions for carriage on the Apache, the prime contract specifically excludes liability for problems arising from the installed performance of equipment that is not supplied by Westland itself. As a result of the contract provisions, the Department cannot claim against either InSys or Westland for any problems with the performance of the munitions. In October 2000, the United States Army identified that debris from the Hellfire missile rocket motor could damage the tail rotor of the Apache aircraft and temporarily suspended firings of the missile. The same motor is fitted to all United Kingdom Hellfire missiles.

1.19 In addition to the Hellfire missile, the Apache will also be fitted with the CRV7 Rocket weapon system for use against non or lightly-armoured targets. During firing trials some damage was caused to the helicopter's horizontal stabiliser assembly.

1.20 The Department is considering three options for addressing the issue of damage caused by debris from the firing of these respective weapons:

- Modify the missiles and rockets so that they do not damage the airframe;
- Accept the risk of only firing from those stations which do not cause damage to the airframe;
- Modify the airframe to reduce the risk to an acceptable level.

The Department is working with Westland to resolve these issues but is confident that the shortcomings will be rectified in time for the introduction of the Initial Operating Capability in August 2004.

The Department is taking steps so that it can fully exploit the performance of the Longbow Radar

1.21 The distinctive antenna which sits at the top of the mast of the WAH 64 Apache helicopter is the Longbow Fire Control Radar. The system is designed to detect, locate, classify and prioritise tactical targets. The Department is currently working in conjunction with Longbow International, the manufacturer of the Fire Control Radar based in the United States, and with Westland to ensure that it can fully exploit the capability offered by the Fire Control Radar.

There is a problem supporting the operation of the Helicopter Integrated Defensive Aids Suite

1.22 The Apache is likely to be subject to a wide range of threats. The aircraft will be equipped with a Helicopter Integrated Defensive Aids Suite (HIDAS) which will provide the aircraft with an integrated suite of radar, laser and missile sensors to ensure that threats are detected and declared to the crew and where appropriate, the necessary countermeasures are automatically instigated. The HIDAS is being developed by BAE Systems and, when delivered, will be the first third-generation defensive aids suite in the world.

1.23 There are risks to the timely delivery of the HIDAS capability. In part these reflect the complexity of the system but they also arise from the security and commercial sensitivities surrounding the project, which meant that not all parts of the Department with a role in the operation of the HIDAS were closely involved in the selection of the equipment. The result has been that not all of the equipments necessary to support the operation of the HIDAS are included in the existing procurement. Without these equipments, the Air Warfare Centre (responsible for generating the pre-flight messages that configure the system for specific operational theatres) will not be able to guarantee the correct response of the HIDAS to all potential threats. The Department is currently exploring how to address these shortfalls. An interim solution will be available in December 2002 and the Department is considering whether to contract for a fully automated version of the same equipment.

There will be secure voice and data communications shortfalls when the Apache enters operational service

1.24 When the capability is first introduced it will have the capacity for secure voice communications with a range of United Kingdom aircraft and helicopters, with United Kingdom ground troops equipped with Clansman or Bowman NATO Appliqué radios and with all United States ground troops. Because of the limited capability of other equipment the Apache will not, however, have the capacity for secure voice communications with the United Kingdom's Gazelle, Lynx, Sea King Mark 4 and Puma helicopters, nor will it be able to exchange data securely with most of the United Kingdom's military aircraft or the other battlefield helicopters or with United Kingdom ground forces.

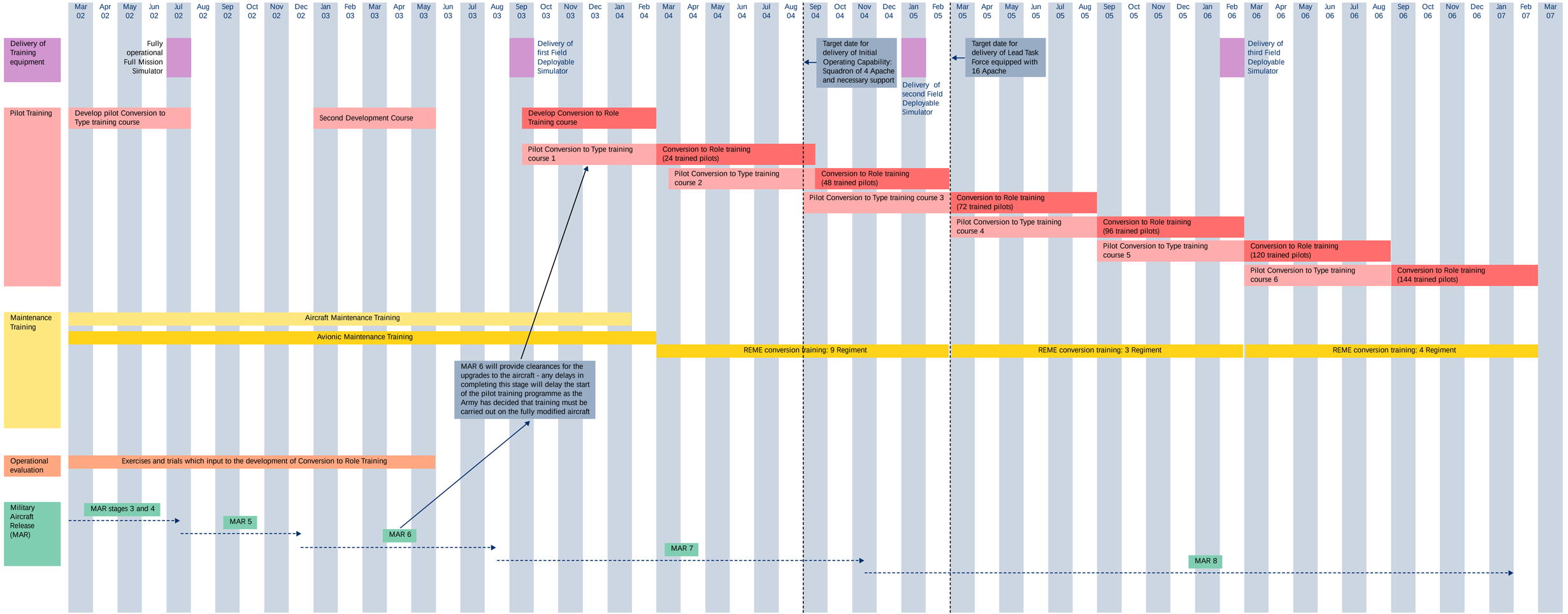
1.25 The Department has set up a working group to examine requirements for information exchange between different platforms and to improve situational awareness. One key equipment programme for the United Kingdom's armed forces is the Bowman radio system. Bowman is a secure digital voice and data communication system that is already available to individual soldiers through the Bowman Personal Role Radio and will be progressively fitted to a range of combat vehicles, ships and aircraft between 2003 and 2007. The Bowman prime contractor has proposed options for providing a secure data capability between Bowman-equipped ground troops and the Apache. The Department is currently examining which is the most cost-effective option and expects to make a decision before the end of 2002.

The Department is addressing the capability gap caused by a delay in introducing the Apache but further slippage will result in a significant capability gap

1.26 The Apache will replace the existing Army Lynx helicopters (first introduced in 1978) fitted with Tube-launched Optically-tracked Wire-guided (TOW) missiles. The TOW missile was due to go out of service in December 2003 to coincide with the Apache's expected introduction to service.

1.27 With the delay in the Apache's introduction to service to 2004-05 the Department has recently approved expenditure of £13.9 million which will enable it to provide an operational fleet of 24 Lynx helicopters fitted with TOW missiles until early 2005. This will deliver an interim capability to the Lead Aviation Task Force of 16 Air Assault Brigade, and to 3 Commando Brigade of the Royal Marines. Any further delay in introducing the Apache into service after 2005 is likely to produce an overall capability gap, as the life of the TOW missile cannot be extended further beyond 2005 and the Department is finding it increasingly difficult to maintain the availability of the ageing Lynx/TOW system. The Lynx /TOW fulfils a wide range of roles but does not provide the same capability as the Apache in the crucial armed-action and intelligence, surveillance, target-acquisition and reconnaissance provision roles. The Battlefield Light Utility Helicopter which is expected to enter service in 2005 will deliver the roles that the Apache will not fulfil.

9 The schedule of key activities and targets for the delivery of the Apache capability



Source: Ministry of Defence

Part 2

The Department is working hard to deliver the other key components of the Apache capability but risks remain

2.1 To deliver a new capability, the Department needs to undertake much more than buying the necessary equipment. Since 1998, when the Army introduced a new process for delivering the Army of the 21st century, it has used an approach to introducing a capability based on the six Lines of Development. Part 1 of this report covered the first of these - the delivery of the necessary equipment and technology. This part of the report considers whether the other five Lines of Development required for the programme's successful introduction are going according to plan.

2.2 We identified that risks remain to be overcome on a number of Lines of Development before the Apache can be successfully introduced into service. The necessary structures are in place and the infrastructure should be in place for delivery of the initial capability. The conceptual framework for how Apache will be used to support Land operations is well developed, although there are issues to resolve concerning its use to support Maritime operations. However, the delivery of Apache training has been delayed which has in turn delayed introduction of the capability. The Department is addressing the human resource implications of introducing the Apache, although some of these resources have still to be agreed. Finally, the through-life management strategy for the Apache is still developing. The Department is confident that an Initial Operating Capability (consisting of four Apache and required support) can be delivered in August 2004, and a Lead Aviation Task Force, consisting of one Regiment of the 16 Air Assault Brigade equipped with 16 Apaches, in February 2005. Achieving these dates depends on resolving a number of issues over the next few years. The key activities leading to delivery of these two milestones are shown in **Figure 9** opposite.

Structures and infrastructure: Likely to be in place

2.3 We examined whether the Department is delivering the necessary organisational structures and infrastructure to support delivery of the Apache. We found that the main structure, 16 Air Assault Brigade, is in place and the necessary infrastructure works were either complete or due for completion by the time the capability is introduced.

2.4 In September 1999, the Army formed 16 Air Assault Brigade following the amalgamation of 24 Air mobile Brigade and 5 Airborne Brigade. It consists of three Attack Aviation Regiments, and four-Air Assault infantry Battalions of which three are parachute Battalions. Operationally, 16 Air Assault Brigade can be deployed under the command of a number of different formations. It can operate in a Divisional context with 1 (UK) Division or 3 (UK) Division or in support of NATO as part of Multinational Division Central, which is to form part of the Allied Command Europe Rapid Reaction Corps. It could also be deployed in an expeditionary role under a joint Headquarters. As a dedicated first echelon Joint Rapid Reaction Force, the Brigade is remitted to provide a number of key elements, including a Lead Aviation Task Force, and an Airborne Task Force.

2.5 Each Regiment of the Air Assault Brigade will have two Squadrons (16 aircraft) and will therefore deploy 48 of the Apache aircraft between them. The first Regiment to be converted to the Apache is expected to be 9 Regiment, followed by 3 Regiment and finally 4 Regiment. A further nine Apache helicopters will be used for training; one will be retained for trials; and the remaining nine aircraft will form the attrition reserve. Peacetime command and control of the Brigade is provided by the Joint Helicopter Command under the control of HQ Land Command.

2.6 A range of capital works are required at the Army bases that will accommodate and operate the Apache. These include hangars for storage and improved security arrangements at Dishforth (Yorkshire) where 9 Regiment are based and at Wattisham (Suffolk) where 3 and 4 Regiments are based. The budgeted cost of the capital works at Wattisham was £29.5 million, and at Dishforth £15 million. Overseen by Joint Helicopter Command, the works were completed at Dishforth in December 2001 and are due to be completed at Wattisham in June 2003 in time for delivery of the Initial Operating Capability, although the cost has risen to £37.6 million. Dedicated facilities for training are being funded and constructed under the training contract with Aviation Training International Limited (ATIL) at Middle Wallop, Dishforth and Wattisham and at the REME base in Arborfield to accommodate the hardware training devices.

Concepts and doctrine: How the Apache will be used is not fully decided

The framework for support of Land operations is well developed

2.7 We examined whether the Department had developed a clear conceptual and doctrinal framework for the Apache in support of Land operations. Military concepts and doctrine describe the principles by which military forces guide their actions in support of objectives, provide the framework for how the military deliver and measure military capability, and exist at a number of levels, including detailed tactical doctrine. Within the Army, the Director General Development and Doctrine is responsible for developing concepts and doctrine. The Joint Doctrine and Concepts Centre, which was established in September 1999, is reviewing emerging concepts and doctrine to ensure they are sufficiently joint and combined and tie in with the overall joint framework.

The high-level framework has been developed and endorsed

2.8 We found that the concepts and doctrine that will govern how the Apache will be used have largely been developed since the decision was taken in 1996 to procure the Apache, although the importance of the manoeuvrist approach to war-fighting, and the role of the Attack Helicopter in this approach was already recognised in 1996. The Apache will be the cornerstone of the United Kingdom's future Air Manoeuvre capability although the full capability will not be delivered before 2010 **(Figure 10)**. The concepts and doctrine underpinning the new Air Manoeuvre capability have also developed in parallel with the Strategic Defence Review, produced in 1998.

2.9 The Army has developed a high-level concept for the Air Manoeuvre capability based on five generic Concepts of Operation (CONOPS), representing the potential employment of the capability by the Army and jointly with other Services. The CONOPS represent the command framework within which the Air Manoeuvre capability would be delivered. The Army Doctrine Committee endorsed this high-level concept in November 1999. In November 2000 the same committee endorsed guidance on how the capability should be delivered, and priorities and milestones for its delivery (Figure 10). The first goal was to deliver an Air Manoeuvre capability that could be employed in United Kingdom Divisional-level operations by December 2006 (CONOP 1). The targets for delivering an Initial Operating Capability and Lead Aviation Task Force are intermediate steps in achieving this goal (paragraph 2.2). The capability should then be developed to operate in non-United Kingdom led operations, and subsequently as an integral formation within NATO. These goals reflect the desired "end state" for the Air Manoeuvre capability that was endorsed by the Army Doctrine Committee, "An expeditionary Air Manoeuvre capability; supporting the United Kingdom's lead-nation status within an Alliance/Coalition context; structured nationally within the wider Land Manoeuvre framework, and although optimised for war-fighting, useable in other operations; delivering tactical success and contributing towards strategic significance to the nation".

Priority will now be given to supporting small detachments of Apache

2.10 Although operations involving the capability's deployment in support of Land forces (CONOPS 1 to 3) were originally given priority, the focus has now shifted to supporting other operations requiring a smaller force. The Air Manoeuvre Policy Group, which now oversees the introduction of the Apache platform and the wider Air Manoeuvre capability, decided in October 2001 that, in terms of delivery of the various CONOPS, support to small detachments of forces should take priority. This is in line with the development of Defence policy, as expressed in the New Chapter of the Strategic Defence Review, following the terrorist attacks of 11 September 2001.

2.11 Following approval of the high-level concept, the Army's Development and Doctrine branch has developed the detailed tactical concepts and doctrine, initially concentrating on doctrine at battlegroup level for the Lead Aviation Task Force, and subsequently on doctrine at Brigade or Division level, for deployment within the Joint Rapid Reaction Forces.

10 Endorsed Concepts of Operation for the deployment of the Apache in an Air Manoeuvre capability

The first goal is to deliver an Air Manoeuvre formation capable of operating under the command of a United Kingdom Division by December 2006

Concept of Operations		Goals set for delivery of capability
1	United Kingdom Divisional level operations[1]	Delivery of an Air Manoeuvre formation capable of operating in a United Kingdom Divisional context by December 2006.
2	Non-United Kingdom led operations. Within a coalition with the main effort being a United Kingdom Land Component force package within, or alongside, a digitised Corps from the United States	Delivery of an Air Manoeuvre capability able to operate direct to formations other than United Kingdom Divisions by December 2008
3	United Kingdom led operations within NATO at Land Component/Corps level[2]	Delivery of a capability able to act as an integral formation within NATO by December 2010
4	The support of Maritime and Air components, using the Royal Navy and Royal Air Force for national and multi-national operations[3]	
5	Use in other, non war-fighting operations	

NOTES

1. A Division is a tactical grouping of two or more Brigades.
2. Land Component/Corps level is the optimum level of command for Air Manoeuvre, giving access to all necessary enabling capabilities. Britain's main commitment to NATO is as the lead and framework nation in the Allied Command Europe Rapid Reaction Corps (ARRC), which is under British command. The United Kingdom is committed to provide one armoured and one mechanised Division, and an airmobile Brigade (16 Air Assault Brigade). The contribution of a United Kingdom Air Manoeuvre formation is seen as a key part of the United Kingdom's continued framework nation status for the ARRC.
3. No target dates were set for the achievement of CONOPS 4 and 5.

Source: National Audit Office

The framework is consistent with joint doctrine

2.12 Although the Army has taken the lead in developing concepts and doctrine, the Joint Doctrine and Concepts Centre, established in April 2000, has reviewed the doctrine to ensure it is sufficiently joint and ties in with the overall joint framework. The paper on how the Air Manoeuvre capability should be delivered was endorsed by the Army Doctrine Committee in November 2000 and subsequently by the Joint Doctrine and Concepts Centre, as well as the Maritime Warfare and Air Warfare Centres.

There are unresolved issues on the use of the Apache to support the Maritime Component

The Apache's role in supporting operations at sea has developed since the procurement was approved

2.13 We examined whether the Department had developed a clear conceptual and doctrinal framework for the Apache in support of joint operations and other components, including Maritime operations. We found that although it had always been the intention to provide Apache support to other components, there had been considerable change in the requirement. The Army had signed an agreement with the Navy in 1995 to provide a squadron of eight Apache to support the Royal Marine's 3 Commando Brigade, replacing its existing Lynx/TOW in providing an airborne anti-tank capability for amphibious operations. However, the Strategic Defence Review changed the nature of the defence mission, and the requirement for "Littoral Manoeuvre" (sea-to-land operations) was subsequently developed. Consequently, in August 2001 the Navy refined its requirement for Apache operations at sea.

2.14 The Apache's ability to meet the Navy's requirements for Littoral Manoeuvre has been the subject of considerable work. A Maritime risk-assessment study carried out in October 2001 determined that the identified risks do not prevent Apache from operating at sea. The Air Manoeuvre Policy Group decided in October 2001 that an intermediate level of Maritime capability would be acceptable to meet the August 2004 target for the introduction of the Initial Operating Capability. This intermediate level will allow the Apache to be transported and embarked on ships, although only a limited range of littoral operations will be possible. The Department is aiming to deliver at this point a capability that will allow the Apache to be re-fuelled and re-armed at sea and then fly to operations on land. There are some issues to be resolved if this requirement is to be met, including the aircraft's high centre of gravity and interference from ships' electronic emissions. There are

also currently challenges with operating some armed helicopters from ships. The full capability - a true integrated and joint capability that would allow the Apache to be based and supported at sea with an Amphibious Task Force for extended periods and in more demanding sea conditions - remains the final objective.

Final decisions on Apache support to the Maritime Component are unlikely to be taken before 2004

2.15 Further evidence is required from United Kingdom sea trials, which will not take place until early 2004, before the full risks of operating at sea can be determined. However, in the Department's view, evidence from the recent sea trials of the American Apache fitted with munitions raises cautious optimism for this capability's operation at sea. HMS Ocean, which can embark up to a squadron of eight Apache, is the most likely platform for Apache operations.

2.16 The additional cost of providing eight embarked Apache for Littoral Manoeuvre operations is estimated at £30 million. Although the prime contract had included requirements for the Apache to operate in a maritime environment and be capable of transportation at sea, this falls short of the Navy's emerging requirements for embarked operations. The additional £30 million expenditure required to send the Apache to sea is therefore unlikely to be covered under the prime contract. There will also be costs associated with further training requirements for support to amphibious operations.

2.17 The Department is currently reviewing the appropriate structure to provide support to Maritime Forces. The Air Manoeuvre Policy Group agreed a paper at its meeting in September 2002 which will provide the basis for introducing an initial Maritime Operating Capability once the sea trials timed for early 2004 have been completed.

Training: Has been delayed

Conversion of aircrew, groundcrew and maintenance crew to Apache is being carried out under a separate PFI contract

2.18 We examined whether the training programme for the Apache had been planned effectively. We found that the Department had intended to procure training services through the prime contractor, but on the grounds of affordability had let a separate contract for Apache training. While the aircraft are being delivered mainly according to plan, the delivery of training services has been delayed. The misalignment of deliverables under the two separate contracts is one of a number of contributing factors that has led to the Department having to store surplus aircraft because the trained pilots are not available to fly them. Because of the unavailability of courseware the Department has also had to pay for training for groundcrew which it has not received. As a result the Department has lodged a claim against Westland.

The training requirement was initially included in the competition for the prime contract

2.19 The Department included the provision of all Apache training services and related equipment in the competition for the prime contract. However, it decided in March 1996, before awarding the contract, to remove the training element from the contract on the grounds of affordability and because contractual terms could not be agreed. The training package was then identified as a potential candidate for a contract under the Private Finance Initiative, but discussions with industry did not identify any other potential bidders. The Department intended to hold a separate competition for the training package but McDonnell Douglas' ownership of the design rights, and the tight timetable made the competition unattractive to other bidders.

2.20 In April 1997 a PFI proposal was submitted by Westland, teamed with Boeing in a joint venture company (ATIL). The bid's value for money was tested against a Public Sector Comparator, which was based on a bid for a conventional fixed-price procurement of the equipment from Westland and delivery of training services over a 20-year period. The Department's evaluation showed a price advantage to the PFI proposal of £23 million in net present value terms over 20 years, and a contract was let to ATIL in July 1998. The contract for the delivery of training services will run for 30 years, with a break point at 2017 to allow the contract to be renegotiated. The contractor will make available a range of training equipment including the Full Mission Simulator, used to convert pilots to the Apache, three further flight simulators that will be based with units of 16 Air Assault Brigade and used for continuation training, and other training equipment for groundcrew and maintenance training.

2.21 We found that the late decision to select a PFI route may have reduced the scope for potential PFI benefits. The benefits of the PFI approach are maximised when the contractor can offer innovative solutions to the requirement, which is presented as an output specification. Because the delivery of Apache training services began as a conventional procurement, the benefits from PFI have in this case been limited. For example, ATIL inherited detailed equipment specifications against which the contract was let which has restricted the scope for innovation.

Separation of training services from the prime contract late in the procurement has caused problems

2.22 Although ATIL has overall responsibility for the delivery of training services, the prime contractor, Westland, retained responsibility for some training tasks including production of the Training Needs Analysis, and development of training courseware and electronic technical publications. These items must be delivered before training courses run by ATIL can start. A delay in the production of acceptable courseware and/or publications has meant that ATIL has been unable to start maintenance training courses on the dates specified in the contract, although the company has met its contractual requirements for the delivery of the training service.

2.23 Although the financial impact of delay to the Full Mission Simulator has fallen on ATIL, the Department has paid ATIL £34 million for maintenance courses which could not be run in the period from August 2000 to March 2002, because the courseware and or publications were not ready. The Department has submitted a claim to Westland for repayment of some of these costs, but Westland has rejected the claim. The maintenance training is now underway.

The PFI deal is delivering facilities of a high standard, but late, causing additional cost and delay to introduction of the capability

2.24 ATIL is delivering a training service employing high class training facilities and advanced simulator technology. The use of such advanced technology and the tight timetable meant the programme carried considerable risk. Delivery of the Full Mission Simulator fitted with the specified standard of software by the contractual date of July 2000 carried the highest risk and was not achieved. The Full Mission Simulator was accepted as ready for training by the Department in December 2001, subject to resolution of a small number of software problems and successful fitting of the high resolution visual system specified in the contract. The simulator is now in use and is currently working well, although the main pilot training is not yet underway as the training course first has to be developed and then the helicopter instructors have to be trained. The impact of the simulator delay has been that the start of the main pilot conversion-training programme has been put back from September 2001 to September 2003. The Army took the view that, as is the case with all twin-engined aircraft, the main programme for training pilots could not start until the simulator was available. In Westland's view pilot training could have started without the full simulator capability being available although this approach would have required an element of re-training.

2.25 A further impact of the delays in training will be the need to maintain and support helicopters which have been delivered by Westland until trained crews are available to fly them from February 2004. A large number of Apache will be held in reserve, maintained and supported at RAF Shawbury between July 2002 and January 2006, at an estimated cost of £6 million over the contract period. The costs associated with maintenance and support will fall on the Department, though liquidated damages of £2 million are available to compensate the Department for delays under the PFI contract. The Department has received these damages, but has used them to offset the cost of training aircrew in the United States while the United Kingdom simulator was unavailable.

2.26 A further issue which the Department will have to tackle is the development of training "gaps" between the upgraded aircraft and the training service, including the simulators. Upgrading the simulator in line with enhancements to the aircraft is not covered by the PFI contract and extra funding will have to be found.

16 Air Assault Brigade is expected to complete Conversion to Role training nearly three years later than planned

2.27 The main training priority is to convert the existing pilots in the Air Assault Brigade, currently flying Lynx and Gazelle helicopters, to the Apache. This will then be followed by training new pilot recruits. There are two main elements to pilot training - Conversion to Type training (how to fly the aircraft) mainly carried out by ATIL using the Full Mission Simulator, and Conversion to Role training (how to fight the aircraft) carried out by Joint Helicopter Command. The contractor's initial analysis of training needs estimated that Conversion to Type training would take 15 weeks, and the Department's assumption, contained in the Fielding Directive for the Attack Helicopter produced in May 1998, was that conversion of the three Regiments of pilots in 16 Air Assault Brigade would be completed by April 2004. The assumption concerning course duration was based on the equivalent United States Army course lengths, which proved to be a considerable underestimate for the United Kingdom approach to conversion training. The course duration has now increased to 26 weeks. The target dates for delivering training and other activities are shown in Figure 9.

2.28 Because the number of simulator hours available for training is fixed under the ATIL contract, the main impact of the course extension has been that fewer pilots will undergo conversion training each year. The current projection is that 48 pilots will undergo conversion training each year rather than the 72 originally estimated, so extending the duration of operational conversion. The Department forecasts that

pilots in all three Regiments in 16 Air Assault Brigade should have undergone their Conversion to Type and Conversion to Role training by February 2007 (Figure 9).

2.29 We found that there was some doubt in Land Command over whether the expected level of pilot throughput makes enough allowance for factors such as sickness, failure rates or reduced flying due to weather conditions, and so will produce enough trained pilots to deliver the Lead Aviation Task Force in Feb 2005.

Further Conversion to Role training to deliver fully combat ready aircrew will be required

2.30 The delivery of Conversion to Role training was not included in the ATIL contract. It will be developed by a team drawn from the Air Manoeuvre Training Advisory team and elements of 9 Regiment between April and September 2003. The main risk to the successful development of Conversion to Role training is the availability of personnel, given the present level of operational commitments.

Recruitment and retention: The issues are being addressed

The Department has identified the manpower needs associated with introducing the Apache capability

2.31 We examined whether the Department had addressed the human resource implications of introducing the Apache. Introduction of the Apache will require a significant increase in Army Air Corps manpower, including around 40 extra maintenance staff; 100 extra groundcrew and around 50 additional posts in the School of Army Aviation. Initially existing Lynx and Gazelle pilots from the Army Air Corps will be retrained to fly the Apache. There is currently an excess of aircrew in the Army Air Corps, so the Department does not anticipate a shortage of pilots entering the training programme. However, the United States Army has experienced problems in retaining aircrew because of the high level of night flying required for the Apache, and this may become an issue for the United Kingdom Army once the initial capability has been delivered.

2.32 The Army has reviewed the Army Air Corps trade structure in parallel with the tri-Service project to converge the aircraft engineering trades, and has actions underway to ensure it will meet the needs of the Apache. Further manpower issues will undoubtedly emerge as Operational Evaluation of the Apache progresses, training is further developed and an Air Manoeuvre Human Resources Strategy is developed.

Some of the manpower resources have still to be agreed

2.33 Funding the additional manpower has been difficult and some but not all the identified requirements have been endorsed. The requirement for 40 additional maintenance staff and 50 additional posts in the School of Army Aviation has been approved, but the requirement for 100 additional groundcrew for manning refuelling points and forward operating bases will be considered later this year. In addition a requirement for Air Manoeuvre Planning Teams to plan operations when the Apache is employed in support of other components or non United Kingdom headquarters has been identified but not approved yet. Given the recent decision that support to Maritime operations should be given priority this needs to be addressed by the Department.

Support: The through life management strategy is still developing

Support requirements are being translated into a Through Life Management Plan

2.34 We examined whether the Department had planned effectively for the support of the Apache after it entered service. Effective support has a number of elements - the provision of spares and consumables; repair of aircraft components; and repair of whole airframes following serious damage to the aircraft. We also examined whether the Apache support requirements had been translated into a Through Life Management Plan, which projects cost of ownership data over the expected life of the equipment.

2.35 The decision was made to procure Apache before the introduction of Smart Acquisition. However, the Department set itself an objective of producing a through life management plan for the Apache by April 2002, including information on its cost of ownership. Cost of ownership is an estimation of the resources consumed directly in the procurement, operation, support, maintenance and disposal of military equipment at all stages of its life, on an annual basis. The aim is to get a better picture of the full costs and consequences of decisions at key points. By the target date of April 2002 the Integrated Project Team had produced a "first cut" of a Through Life Management Plan including a Modernisation Plan, and it is now further developing this Plan. The Department has also made some progress in compiling cost of ownership data for the Apache though it is not complete yet. It estimates that the annual cost of ownership for the Apache will be accurately estimated by January 2003. Under the auspices of the Memorandum of Understanding with the United States the Department is also exploring the potential for aligning both nations' Apache support programmes

The Department tried an innovative approach to spares procurement to overcome problems with traditional methods

2.36 With the Apache procurement the Department used an innovative approach to procuring spares for the equipment during the period it was brought into service. Rather than procuring a set of spares with the equipment at the outset, as in traditional spares provisioning, it agreed a price of £120 million with Westland for the company to provide core spares for the 30 months following delivery of the first aircraft. Westland was required to provide the required spares within 48 hours, under a service arrangement known as the Contractor Spares Package. The arrangement transferred the risk associated with supporting the Apache to the contractor. The price was based on the assumption that the Apache would fly 15,500 hours over this period. The Department considered that this arrangement would provide data on the type and number of spares required as a basis for spares provisioning at the end of the period. In the event the aircraft flew approximately 5,000 hours in this period - a third of those forecast. As a result, the need for spares during this period has been significantly reduced.

There has been a delay in letting the spares contracts

2.37 The Contractor Spares Package will terminate in October 2002. Because flying rates were lower than expected Westland still holds some spares procured for the Contractor Spares Package, and the Department intends to procure this stock of risk items. Although a joint Westland/Department team was set up in May 2001 to negotiate replacement spares contracts, progress has been slow because of difficulty in agreeing prices. Replacement contracts for aircraft and radar spares have recently been let, though spares contracts for the Target Acquisition and Designation Sight/Pilot Night Vision System and aircraft transmissions are not yet in place. Where it is not able to obtain spares from other sources, the Department may have to source these items from stored Apache helicopters.

The support arrangements need to reflect changes in assumptions about the size of deployments

2.38 The initial support arrangements were drawn up on the assumption that the minimum unit to deploy would be a whole Aviation Regiment of the Air Assault Brigade. The quantities of support equipment ordered reflected this assumption. In October 2001, however, the Air Manoeuvre Policy Group decided that priority should be given to supporting smaller detachments (paragraph 2.10). The issues involved in supporting small detachments are being addressed by the Department's Air Manoeuvre Sustainability Working Group, set up in March 2002. It has identified the deficiencies in current support arrangements and work is in hand to ensure that smaller detachments can be supported.

2.39 Sustainability planning guidelines are under development for Air Manoeuvre. They will define the levels of ammunition, missiles, rations and fuel that will be required to sustain operations involving the Apache once the capability is introduced in 2004/2005, and are informed by Operational Analysis and Operational Evaluation. Draft sustainability guidelines were noted by the Army Policy and Resources Committee in December 2000, but were not at that stage fully developed. The Air Manoeuvre Policy Group are due to consider revised guidelines in Autumn 2002. Some key issues, including flying rates and munitions consumption rates, are currently being addressed. The Air Manoeuvre Sustainability Working Group is working on developing the guidelines.

Arrangements for repair and overhaul of aircraft components are mainly in place

2.40 The prime contract put in place a contractor-based maintenance policy, which was to be confirmed after the prime contract was let, and will remain in place until 2005. The support aspects of the prime contract are based on the concept that defective equipment would be either repaired in the field (first-line repair) or returned to industry for repair, rather than using in-house Army second- and third-line repair facilities. Most of the repair subcontracts for aircraft components have now been let, with the exception of transmissions and hydraulic components. Discussions are under way with subcontractors for both of these elements.

2.41 The prime contract also included the establishment and maintenance for a year of a special repair facility in the United Kingdom for high-value components, including the Target Acquisition and Designation Sight and Pilot Night Vision System; the Longbow Fire Control Radar; the Radar Frequency Interferometer and the Hellfire missile launcher (Figure 4). The contract placed the risk of the volume of repairs on the contractor, in return for a firm price of £55 million. As with the Contractor Spares Package the risk to the contractor has so far been less than envisaged. The level of usage of the facility has been low because of the reduced flying rates. However, the current contract provides this special repair facility for a further two and a half years.

2.42 The Department has still to take decisions on how and where major airframe repairs will be undertaken. There are three options, including the establishment by Westland of an on-shore airframe repair capability. This is the option currently preferred by the Department, which is commissioning a feasibility study into the

option from Westland. The other two options are using the United States Army's repair facility, which would avoid capital costs but could involve long turn-around times, and using the facility that Boeing is setting up in the United States for Apache airframe repair, which could also involve long turn-around times. Because of the numbers of aircraft that will be in store, the Department does not expect that there will be a need for major airframe repair before 2006. It considers that if the option of constructing an on-shore facility proves to be affordable, it could be in place by 2006.

Progress is being made with the Support Reappraisal Strategy

2.43 The Apache contract was innovative in setting out to give a prime contractor responsibility for all aspects of the programme, including support. When the contract was let, it was agreed that the contractor-based maintenance policy proposed by Westland was to be reviewed and confirmed after the contract was let. An analysis of the most cost-effective repair level for all Apache components therefore took place in 1996, after the contract was let. This identified that, for the majority of components, the agreed policy was the most cost-effective. But potentially significant whole-life cost savings can accrue from adopting a different maintenance policy for around 10 per cent of components. These are mainly high-value components contained in the Target Acquisition and Designation Sight and the Pilot Night Vision System. The alternative approach involved providing Automated Test Equipment to second- and third-line facilities owned by the Department. The Department estimated at the time that continuing with the agreed contractor-based maintenance policy was likely to cost £5.1 billion over the life of the Apache, while using second-line (REME workshops) and third-line (Defence Aviation Repair Agency) repair facilities would cost an estimated £3.6 billion.

2.44 In September 2001, the Department established the Support Reappraisal Project, which is now reviewing the main drivers in Apache support costs, including the potential for savings from investing in more reliable components that are being developed for the Apache programme in the United States. This is being taken forward by a joint Ministry of Defence/industry team. One of its key objectives is to identify savings of between £730 million and £1 billion in Apache through-life costs. Savings of this magnitude are contingent upon investment of approximately £100 million in spend-to-save measures. The Support Reappraisal Project is aiming to complete its analysis of the options by December 2002 and make the key Main Gate submission on how Apache support will be delivered in the future by October 2003. Any changes to the existing repair and maintenance policy put in place under the prime contract could then be put in place from 2006.

The requirement to upgrade and modernise the Apache is being examined, although upgrades are currently unfunded

2.45 The Apache is expected to be in service until 2030, and will need to be modernised at several points between delivery of first capability in 2004 and its out-of-service date. The term "modernisation" includes all those modifications and enhancements to the aircraft required to ensure that the aircraft is capable of fulfilling its role as envisaged within current and future doctrine, including capability enhancements and activities to tackle obsolescence. The United Kingdom has already commissioned a number of enhancements to the basic United States aircraft, including the Defensive Aids Suite, a Low-Height Warning System and communications systems (paragraph 1.7). We found that, although the funding had been made available to deliver the initial Task Force capability, there was no funding provision currently in the Defence Equipment Programme for future upgrades to the Apache.

2.46 A paper on modernisation of the Apache produced in March 2002 identified that the modernisation requirements in the period 2005 to 2010 were likely to focus on: achieving compatibility with Bowman-equipped forces; achieving secure voice communications; further investment in collective training; and further improvements to the Defensive Aids Suite. The next phase of modernisation to 2015 is likely to take place in the context of much improved situational awareness, requiring an increase in the processing power and capacity of the Apache and improvements to its sensors and weapon ranges. The requirement to modernise the Apache has not been costed at this stage. Obsolescence will also become an issue and the Integrated Project Team is currently preparing an obsolescence plan. A joint Ministry - of Defence/industry team with representation from Westland and ATIL is being established under the direction of a Modernisation Steering Committee. The Committee will draw on a range of sources including Operational Analysis, Operational Evaluation and capability audit to identify future capability shortfalls. This work is expected to inform future bids for resources in the annual Equipment Programme exercise.

2.47 The United States has a major programme underway for converting its Apache A models to the more advanced D models, and has a funded strategy for future modernisation of its Apache fleet. There will be opportunities for the United States and the United Kingdom to harmonise their requirements for upgrades to the aircraft, its sub-systems and weapon systems and achieve cost reductions. A Modernisation Working Group has been set up under the Memorandum of Understanding signed on 22 May 2000 to examine potential for joint development or production with the United States.

Part 3

Managing all aspects of delivering Air Manoeuvre capability in a coherent manner is challenging

3.1 Parts 1 and 2 of our report have demonstrated that the successful introduction of the Apache requires that each of the six Lines of Development delivers what is required to time, to cost and to the necessary standard of performance. This part of our report examines how well the arrangements put in place for the programme's project management have worked in ensuring the successful introduction of all elements of the capability. It recognises that the Department's management of the programme has evolved significantly and that there is now clear corporate oversight.

Oversight of the Apache programme is now undertaken within the context of Air Manoeuvre and focuses on delivering the six Lines of Development

3.2 The management of the Apache programme has evolved over time. Initially, oversight was exercised by the Attack Helicopter Introduction to Service Group, chaired by the Assistant Chief of the General Staff (Land). At working level, a Director Attack Helicopter was appointed in April 1998, reporting directly to the Assistant Chief of the General Staff (Land), with responsibility for co-ordinating the Attack Helicopter's introduction to service.

3.3 The Attack Helicopter Introduction to Service Group was replaced in March 2001 by the Air Manoeuvre Policy Group (AMPG) tasked with delivering the Air Manoeuvre capability. The AMPG is chaired by the Assistant Chief of the General Staff (Land) and has a significantly greater tri-Service representation than its predecessor did. Within the AMPG, each of the six Lines of Development has a senior proponent who is responsible for delivery of that particular Line. The AMPG meets every six months. Reflecting its position as the cornerstone of Air Manoeuvre, the Apache has occupied the AMPG for much of its deliberations so far.

The introduction of Smart Acquisition has helped the Department to actively manage risks on the equipment

3.4 The Strategic Defence Review of 1998 acknowledged that the Department was not best structured to deliver the equipment needs of front-line users as its existing procurement strategies were centred on a single-service, equipment-based system. The structural changes that the Department underwent following the Strategic Defence Review were to a significant degree implemented to facilitate the introduction of Smart Acquisition, with its aim of acquiring and supporting defence equipment more effectively in terms of time, cost and performance. The changes resulted in the creation in April 1999 of the Defence Procurement Agency and the Defence Logistics Organisation to acquire and support defence equipment respectively. The changes also led in October 1999 to the establishment of the Equipment Capability Customer, who is charged with developing equipment plans based on what is needed to achieve a certain goal or capability.

3.5 Following the creation of the Equipment Capability Customer, responsibility for co-ordinating the Apache equipment programme moved to the Director of Equipment Capability (Indirect Battlefield Engagement). The Director Attack Helicopter post was deleted. Responsibility for Army-wide co-ordination of Air Manoeuvre has recently been allocated to the Directorate of Capability Integration (Army). This body is also tasked with developing an Air Manoeuvre Capability Integration Plan.

3.6 A further key player in the management of the programme is the Integrated Project Team (IPT) within the Defence Procurement Agency. Formed in 1999 as part of the re-organisation of the equipment function under Smart Acquisition, the IPT is responsible for managing the manufacture, in-service support and, ultimately, disposal of the equipment. The IPT is outside the Air Manoeuvre Policy Group although the IPT leader is a member of the Air Manoeuvre Policy Group.

3.7 In September 2001, the IPT set up a joint Ministry of Defence/industry Board to oversee progress on the programme. The IPT leader chairs the Board, which also includes other key Departmental stakeholders. The Board meets every three months and reports to the Air Manoeuvre Policy Group. The Board is already having a positive influence and is achieving progress in a number of the problem areas. One indication of the improved working practices being introduced is that all the main contractors for the programme are now more closely involved in managing the risks to the delivery of the Apache using a joint Risk Register.

Two individuals are responsible for day-to-day programme management of the delivery of capability

3.8 The Office of Government Commerce defines a programme management structure as "bringing together key roles, processes and management structures to deliver a programme's desired outcomes". Applying this definition to the Apache capability it is clear that, by placing emphasis on the delivery of manoeuvre capability and involving the wide range of stakeholders with a role in achieving this, the Department's approach compares well.

3.9 The Office of Government Commerce has published a guide to the management of successful programmes[3]. **Figure 11** shows how the Office of Government Commerce defines the requirements for effective programme management and the primary roles which are involved. **Figure 12a** shows its proposed good practice model for programme management organisation. **Figure 12b** shows that the Department's programme management structure compares well with this template. In particular, the creation of the Air Manoeuvre Policy Group is a significant step in taking forward the programme in a coherent way bringing together as it does key senior proponents for each of the six Lines of Development in one forum.

3.10 The one difference from the Office of Government Commerce model is that day-to-day programme management of the successful delivery of the Apache capability is split between two individuals. The Director of Equipment Capability (Indirect Battlefield Engagement) is responsible for declaring that all the necessary elements are in place to deliver the capability, but is only directly responsible for delivering the equipment component. The Director of Capability Integration (Army) fulfils the role of ensuring that the other five Lines of Development are in place and that they converge with the delivery of the new equipment. This reflects the organisation of the Department, which has two customers for each capability. The Equipment Capability Customer is responsible for developing and managing a balanced and affordable equipment programme to meet the current and future needs of the Armed Forces. The second customer is responsible for converting the capability provided by the Equipment Capability Customer into an operational military capability, and managing the equipment when in-service.

3 *"Managing Successful Programmes" - the Office of Government Commerce, 1999.*

11 Requirements for effective programme management and primary roles in managing a programme

Effective management of a programme requires:

- Empowered decision-making
- Leadership at a sufficiently senior level to:
  - Ensure resources are committed
  - Gain real commitment to the programme's vision and Blueprint
  - Influence the stakeholders
  - Ensure the programme's priorities are balanced with those of the ongoing business operations
- Active management of:
  - The programme's finances
  - The change in business operations
  - Realising the business benefits targeted by the programme
  - The co-ordination of the projects within the programme
  - Conflicting demand for resources
  - The integration of programme deliverables with the design of new or existing systems and processes
  - The transition to new operational services
- A flexible and responsive management structure that enables well-informed, top-down decision making
- Communication in a vocabulary understood by all
- Integrity and collaboration amongst all involved in the programme.

There are three primary roles in managing a programme:

1. Programme Director

   The Programme Director is ultimately responsible for enabling the organisation to exploit the new environment, meeting the new business needs and delivering new levels of performance, benefit, service delivery, value or market share, as appropriate to the particular programme. It may be necessary to establish a Programme Board in situations where a single Programme Director cannot be sufficiently empowered. The Programme Board members will then collectively take on the role of Programme Director.

2. Programme Manager

   The Programme Manager has responsibility for day-to-day management of the programme, its risks, issues, conflicts, priorities, communications, and ensuring delivery of the new capabilities. The Programme Manager ensures the coherence of the programme, and develops and maintains the appropriate environment to support each individual project within it - typically through the Programme Support Office.

3. Business Change Manager

   The Business Change Manager has responsibility for realising the benefits through the integration of the new capabilities into the business operations. The Business Change Manager role represents the Sponsoring Group's interests in the final outcome of the programme, in terms of measured improvements in business performance. As the programme progresses, the Business Change Manager is responsible for monitoring outcomes against what was predicted in the Business Case.

Source: Office of Government Commerce: Managing Successful Programmes 1999

12 How the Department's programme management structure for the delivery of the Apache capability compares with the Office of Government Commerce model

The Department's managerial structures compare well with best practice

Figure 12a The Office of Government Commerce Model[1]

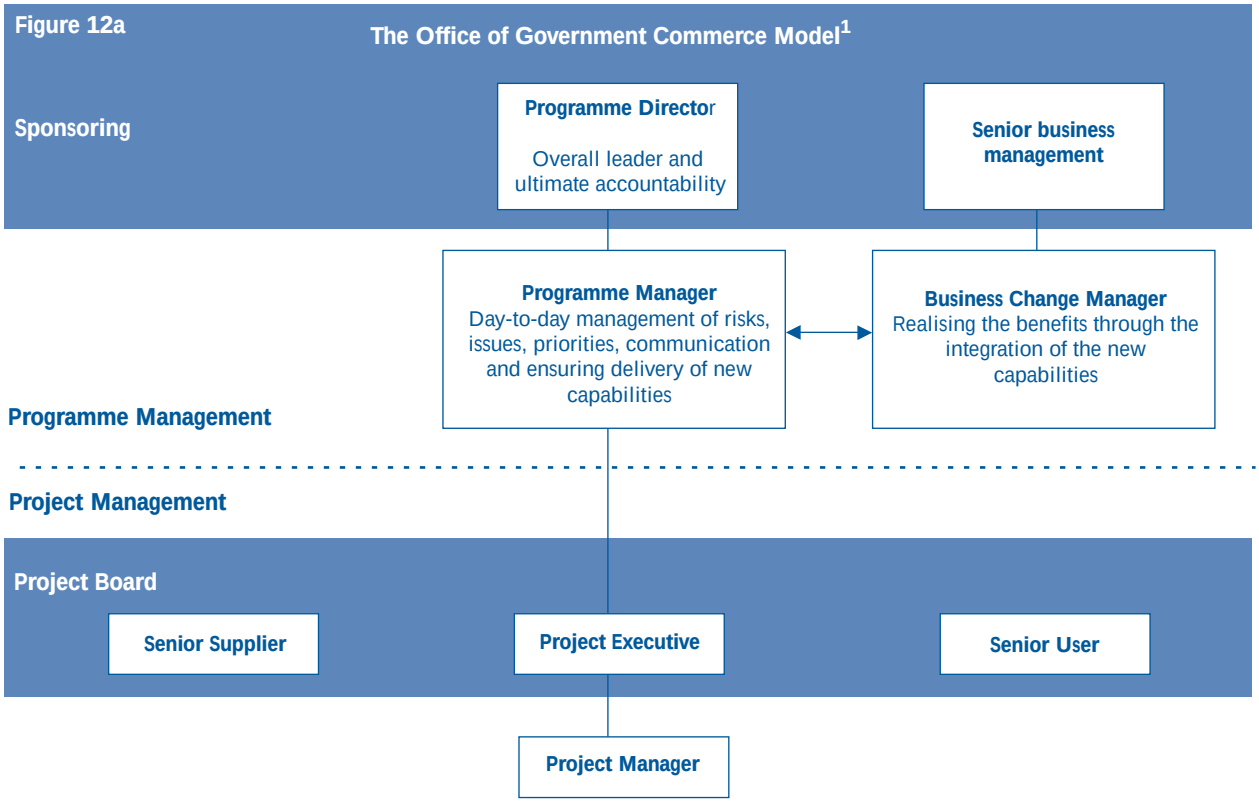
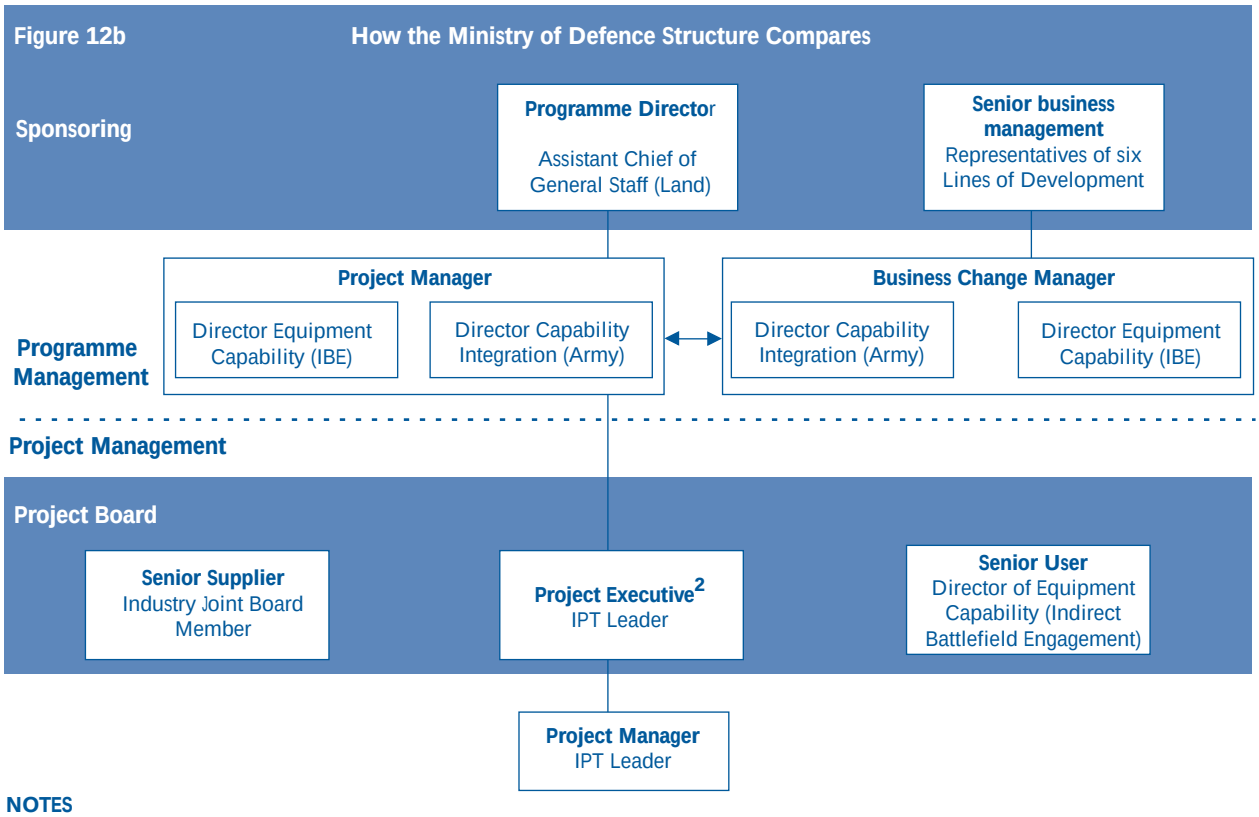


Figure 12b How the Ministry of Defence Structure Compares



NOTES

1. Office of Government Commerce "Managing Successful Programmes" 1999.
2. There are similar project-based arrangements for all Lines of Development.

Appendix 1 Methodology

1 The National Audit Office examined whether the Apache capability is being delivered in a timely manner and as a coherent package.

2 We used an issue analysis approach to identifying the scope and nature of the evidence required to complete the examination. This identified three main issues, namely:

i) whether the Department is making good progress on the programme to acquire the Apache;

ii) whether the other Lines of Development required for the successful introduction of the programme are going according to plan;

iii) how well the arrangements put in place for the project management of the programme have worked in ensuring the successful introduction of all of the elements of the capability.

For each of these main issues we devised a set of sub-issues in order to direct our detailed work and analysis and to allow us to answer the main issues set.

3 Our main evidence came from a programme of interviews with the main stakeholders in the Ministry of Defence. These stakeholders included the main proponents of each of the six Lines of Development or their representatives :

- Capability Manager (Manoeuvre) - Major General Figgures - Equipment;
- Assistant Chief of the General Staff (Land) - Major General Dannatt - Structures;
- Representative of the Director General Development and Doctrine - Lt Col Sharpe - Concepts and Doctrine;
- Chief of Staff Land - Major General Viggers - Training and People;
- Director of Army Aviation - Brigadier Folkes - People;
- Chief of Staff Adjutant General - Brigadier Brown - People;
- The Director General Equipment Support (Air) - Air Vice Marshall Liddell - Support.

4 In addition we interviewed the head of the Apache Integrated Project Team (Captain Reid) and members of his Team; members of the Support Reappraisal Project; members of the former Attack Helicopter Team; staff of the Director Naval Operations; the Joint Doctrine and Concepts Centre; the Equipment Capability Customer organisation and the Lynx Integrated Project Team. We also interviewed Commodore Parry, Director of Operational Capability, who had recently completed an operational audit of Joint Helicopter Command.

5 We also interviewed senior management responsible for the Apache programme at the prime contractor, Westland Helicopters Limited, and at the joint venture supplying training services for the Apache, Aviation Training International Limited.

6 We examined relevant papers produced by the Department. These included papers relating to the letting of the prime and training contracts; minutes and papers of the Attack Helicopter Introduction to Service Group and Air Manoeuvre Policy Group; Attack Helicopter and Air Manoeuvre Management Plans; and Fielding Directives for the aircraft. We examined the capability audits and risk assessment produced by the Equipment Capability Customer, and papers relating to the Maritime capability produced by Director Naval Operations branch.

7 We appointed a review panel, which contained experts in Defence and project management issues. The panel provided advice on the issues we should address and provided comments on our draft report. External members of the review panel were:

- Nigel Vinson - formerly Duke of Westminster Research Fellow at the Royal United Services Institute for Defence Studies , now Senior Auditor at the National Audit Office;
- Dr Matt Uttley, Deputy Dean of the Defence Studies Department, Kings College London and Joint Services Command and Staff College;
- Professor Peter Morris, Executive Director of INDECO Ltd;
- Professor Keith Hayward, Head of Economic and Political Affairs, the Society of British Aerospace Companies.

8 To assist with analysis of the Lines of Development approach used by the Department we employed Keith Milk and Martin Caunt of HVR Consulting Services Ltd. This work involved preparing a high level influence diagram for all the Lines of Development to help in understanding the dynamics of the process by which new capability is introduced. HVR are continuing to assist the NAO with further work to understand these processes.

Appendix 2 Glossary of Terms

This Glossary provides definitions of terms used in this report that reflect the National Audit Office's understanding. Where relevant Ministry of Defence definitions can be found in its United Kingdom Joint Warfare Publication 0-01.1, United Kingdom Glossary of Joint and Multinational Terms and Definitions, 3rd Edition 2001.

Term	Description
Airborne Task Force	A force composed primarily of ground and air units which is organised, equipped and trained for airborne operations.
Air Manoeuvre	Operations undertaken within the land component of Manoeuvre which seek a decisive advantage over the enemy primarily by using combined forces with rotary aircraft supported by a range of other components.
Allied Command Europe Rapid Reaction Corps (ARRC)	A combined military force drawn from all NATO nations.
Amphibious operations	An operation launched from the sea by naval and landing forces on a hostile, or potentially hostile, shore.
Automated Test Equipment	Any automated device used for the express purpose of testing specific equipment.
Battlegroup	A tactical grouping usually containing armour and infantry under its command which is based on the Headquarters of either an armoured regiment, an infantry battalion, an armoured reconnaissance unit or aviation regiment.
Break point	The PFI contract contains an option, in 2017, to extent the term of the contact with ATIL to September 2027.
Brigade	A unit size below that of a Division (see below) to which are added additional groups and battalions as required.
Collective Training System	The means by which all individuals, units and command formations are collectively prepared for military operations.
Combat recovery	Contacting, protecting and extracting personnel, small groups or units, or equipment from combat.
Concepts and Doctrine	Concept: A statement expressing how something might be accomplished that may lead to an accepted procedure. Doctrine: Fundamental principles by which military forces guide their actions.
Concepts of Operation (CONOPS)	A clear and concise statement of the line of action chosen by a commander to accomplish his mission.
Conversion to Role	Training which will enable the crew of the Apache to use the aircraft to fight in conflicts.
Conversion to Type	Training which will enable pilots to be able to fly the Apache.
Cost of ownership	An annual summary of all the resources used to procure, operate, support, provide training for and maintain a piece of military equipment throughout its life.
CRV7 Rockets	A system of (normally) 76 rockets carried in 19 launchers which can be equipped with a variety of warheads. These are attached to the outer pylons (see below) of the Apache.
Digitisation	The process by which advances in digital technology are incorporated into a warfighting capability.

Director of Equipment Capability	A member of the Ministry of Defence's Equipment Capability Customer organisation who is responsible for a defined area of capability.
Direction of fire	Control, by an operator, of fire from a platform other than his own.
Division	A tactical unit which for the land environment is a major unit or formation which contains the necessary arms and services required to undertake sustained combat usually composed of two or three brigades.
Double earmarked	A capability which has been allocated to perform two separate roles.
Embarked capability	A capability which in the case of the Apache can be operated from on board ship.
Fielding Directive	A military communication in which a policy is established or a specific action ordered.
Foreign Military Sales	A system established by the United States Government to manage the sale of military equipment to other governments.
Full Mission Simulator	A flight simulator developed as part of the package designed to enable pilots to be trained to fly the Apache.
Helicopter Integrated Defensive Aids Suite	A system designed to ensure that threats to the Apache are detailed, identified, declared to the crew and where appropriate countermeasures are instigated automatically.
Hellfire Missile Launcher	An anti-tank missile system. Normally eight, but up to 16, missiles will be carried on an Apache. The missiles have a range of eight km.
High resolution visual system	Refers to the screen and graphics of the Full Mission Simulator.
In Service date	The point at which the military capability provided by an equipment or system, is assessed as being available for operational use.
Initial Operating Capability	The first planned delivered Apache capability which will consist of four Apache aircraft plus support. The Department plans to have this capability available from August 2004.
Integrated Project Team (IPT)	A team responsible for delivering cost-effective equipment to meet requirements set by the Equipment Capability Customer. The IPT manages the assessment, demonstration and manufacturer, support and disposal of equipment.
Joint Helicopter Command	An organisation set up by the Ministry of Defence to facilitate the deployment of all battlefield helicopters on joint operations. It draws on helicopters from all three services.
Joint Rapid Reaction Force	A pool of forces drawn from all three services designed to meet at short notice, medium scale operations of all kinds.
Land Command	One of the three Defence Front Line Commands. Its mission is to deliver the Army's operational capability wherever required in the world. The Command comprises all operational troops in Great Britain, Germany, Nepal and Brunei.
Lead Aviation Task Force	A capability which will consist of one regiment of 16 Apache helicopters. It is due to be in place in February 2005.
Lines of Development	A tool for developing an overall capability by bringing together the six "lines" of concepts and doctrine, structures and infrastructure, equipment, training, people and support.
Liquidated damages	An agreed sum set in a contract which is payable as compensation in the event of a breach of that contract.
Littoral	Coastal sea areas and that portion of land which is susceptible to influence or support from the sea.
Littoral Manoeuvre	Littoral Manoeuvre will place joint forces into the littoral environment and in a position of advantage at sea with respect to the enemy, from which force can be threatened or applied ashore.

Longbow Fire Control Radar	This device locates, classifies and prioritises targets for the crew of the Apache up to a range of eight km.
Low Height Warning System	A system which warns the pilot of an Apache if they are flying too low.
Main Gate	The main approval point in the Department's acquisition of equipment. It takes place between the Assessment and Demonstration and Manufacture phases.
Manoeuvrist approach to war-fighting	An approach to military operations designed to shatter an enemy's cohesion and will to fight. It depends on doing the unexpected and requires a ruthless determination to succeed.
Military Aircraft Release	A series of tests which military aircraft in the United Kingdom have to undergo to check that the aircraft and its weapons can perform to an adequate standard and are safe to use.
Off-the-shelf	The acquisition of an existing equipment rather than the development of a new design.
Operational analysis	The use of mathematical, statistical and other forms of analysis to explore situations and to help decision-makers to resolve problems.
Operational evaluation	The test and analysis of an item of equipment or system, as far as possible under in-service conditions.
(Outer) Pylons	The elements of the Apache to which the Hellfire missiles are attached.
Pilot Night Vision System	A thermal imaging system that enables the Apache aircraft to be flown safely at night or in adverse weather conditions.
Public Sector Comparator	A term used in PFI deals as an estimate of what an item would cost if a traditional procurement method were used.
Radar Frequency Interferometer	This system identifies and locates radar systems normally associated with air defence systems.
REME	The Royal Electrical and Mechanical Engineers.
Regiment	The main administrative unit in the British Army which usually consists of about 650 troops.
Situational awareness	An operator's perception of what is happening around them in the battlespace.
Special repair facility	A facility constructed at RAF Wattisham designed specifically to facilitate specialist repairs on the Apache.
Squadron	The basic administrative unit of armed forces. In the case of the Apache this is part of the Army Air Corps.
Staff Target	A document formerly used by the Ministry of Defence to set the requirements for an equipment or system.
Structures and Infrastructure	The Line of Development which covers such items as the capital works required to support a new capability.
Support Reappraisal Project	A special project set up by the Ministry of Defence on the Apache programme to identify cost savings of up to £1 billion on supporting the aircraft over its lifetime.
Sustainability	The ability of a military force to maintain the level of combat power for the time required to achieve its objectives.
Target Acquisition and Designation Sight	This system provides thermal imaging, television and direct view optical systems as well as a laser range finder and laser designator to assist the crew of the Apache.
Tactical doctrine	Doctrine designed for the tactical level of warfare.
Tactical mobility	A military force which has the capability to move from place to place while retaining the ability to fulfil the primary mission.

Thermal sensors	A sensor which can identify sources of heat emanating from a range of sources including individuals.
Through Life Management Plan	This document is designed to show in detail the full resources needed to meet all the requirements of equipment.
TOW missile	A Tube-launched Optically tracked Wire-guided missile which is currently fitted to Lynx helicopters. This equipment is due to be replaced by the Apache and its weapons systems.
Whole Life Costs	The continuous process of forecasting, recording and monitoring the costs of an equipment throughout its life.

Appendix 3 Chronology of the Apache Procurement and Introduction to Service

June 1991	Staff Target for Attack Helicopter endorsed.
1993	Invitation to Tender issued for 91 aircraft. The requirement was then reduced to 67 aircraft.
April 1996	£2 billion prime contract for 67 Apache Longbow let to GKN-Westland Helicopters Ltd.
July 1998	£1 billion contract for training services let to Aviation Training International Limited. No competition was held. The contract runs to 2027, with a break point in 2017
September 1998	The Department produced its initial plan for introduction to service of the Apache.
September 1999	16 Air Assault Brigade formed.
May 2000	■ First aircraft delivered. ■ Memorandum of Understanding signed between United States of America and United Kingdom for co-operation on the future development, operation and support of the Apache.
July 2000	£64 million contract amendment for a collective training system awarded to Westland.
December 2000	Initial Military Aircraft Release achieved.
January 2001	In Service date for Apache was declared based on delivery of nine aircraft.
March 2001	Air Manoeuvre Policy Group established.
July 2001	Department undertook a risk assessment of the Attack Helicopter programme.
October 2002	Contractor Spares Package, for Apache spares, ends.
August 2003	Current target date for Military Aircraft Release of the upgraded aircraft and its weapon systems.
September 2003	Anticipated start of Conversion to Type training for the pilots in 16 Air Assault Brigade.
March 2004	Trials of Apache for Maritime capability due to begin.
April 2004	All 67 aircraft should be delivered under prime contract.
August 2004	Current target date for Initial Operating Capability (defined as the first operational Apache squadron of four Apache).
February 2005	Current target date for delivery of Lead Aviation Task Force (one Regiment equipped with Apache).
December 2006	■ Target date for delivery of an Air Manoeuvre formation capable of use in United Kingdom Divisional - level operations. ■ Target date for completion of Military Aircraft Release programme, including operation in ice and snow.
February 2007	Target date for completing retraining of pilots in 16 Air Assault Brigade.