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Ministry of Defence

The cost-effective delivery of an armoured vehicle capability

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The cost-effective delivery of an armoured vehicle capability

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Amyas Morse
Comptroller and
Auditor General

National Audit Office

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This report considers what factors have contributed to the current situation through a review of the way in which the Department has approached the acquisition of armoured vehicles using both its standard and Urgent Operational Requirements processes.

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Summary

1 Armoured vehicles comprise a range of military platforms including tanks, reconnaissance, engineer and personnel carrying vehicles. They permit military forces to manoeuvre while offering protection from a wide range of threats, and additionally provide platforms for mounting weapons and other military systems. Armoured vehicles are therefore a critical asset when undertaking a wide range of military tasks, from delivering humanitarian aid through to high intensity war-fighting operations.

2 To acquire armoured vehicles, the Ministry of Defence (the Department) has utilised two acquisition processes to procure all military equipment:

- For its 'core' equipment, intended to generate the defence capabilities required to carry out the military tasks set out by high level Defence Policy, the Department uses its **standard acquisition process**. This is a comprehensive approach which includes all elements that combine to create military capability, including personnel, training and logistics support. The process also addresses equipment interoperability, which ensures that the various sub-components, such as radios and sensors, operate as expected when integrated into the same equipment. It also covers how the equipment itself operates alongside other vehicles, aircraft, and systems to ensure it can work effectively as part of a wider military force.

- For additional equipment – or to modify existing equipment – required in response to conditions on specific operations, not catered for by the standard acquisition process, the Department can use the **Urgent Operational Requirements process**. This process can deliver equipment rapidly for specific operations, such as Afghanistan. However, the speed at which Urgent Operational Requirements are delivered means this equipment is often introduced before full support in terms of trained personnel and logistics can be put into place and with limited time to consider full interoperability. Such equipment is often specific to a particular need and may not necessarily be as suitable across the whole range of military tasks as equipment purchased through the standard acquisition process.

3 In the period since the 1998 Strategic Defence Review, a number of significant armoured vehicle projects procured through the Department's standard acquisition process have not been brought to fruition. **Figure 1** provides details of a number of these projects where no vehicles have been delivered despite spending £321 million on projects that have been cancelled or suspended. The Department has spent a further £397 million funding on-going, but delayed, projects that are not currently planning to deliver any vehicles before 2013. Since 2003, the Department has also spent approximately £2.8 billion buying and upgrading vehicles, using the Urgent Operational Requirements process, for operations in Iraq and Afghanistan.

Figure 1

Overview of armoured vehicle projects and Urgent Operational Requirements in the period since the 1998 Strategic Defence Review

Project	Date project commenced	Status and Expected In-Service Date	Number to be procured	Sunk Cost (£m)	Forecast cost remaining (£m)
Projects cancelled, suspended or delayed in the period					
Tactical Reconnaissance Armoured Combat Equipment Requirement (TRACER)	May 1992	Cancelled: Oct 2001	335	131	–
Multi-Role Armoured Vehicle (MRAV)	Mar 1998	Cancelled: Jul 2003	775	57	–
Future Rapid Effect System – Utility Vehicle (FRES UV)	May 2004	Suspended: Dec 2008[2]	~3000[3]	133	–
Future Rapid Effect System – Specialist Vehicle (FRES SV)	June 2008	Delayed: In-service from 2017	~1300[3]	142	7,586
Warrior Capability Sustainment Programme (CSP)	June 2009	Delayed: In-service from 2017	550+	38	1,418
Terrier armoured engineer vehicle	July 2002	Delayed: In-service from 2013	60	217	101
Subtotal				**718**	**9,105**
Projects delivered in the period					
Viking All Terrain Vehicle (Protected)[4]	June 1997	In-service April 2006	100+	60	–
Titan and Trojan armoured engineer vehicles	May 1996	In-service Oct 2006	66	347	–
Subtotal				**407**	**–**
Total expenditure on armoured vehicles				**1,125**	**9,105**
Urgent Operational Requirements spending on vehicles				**2,813**	**N/A**

NOTES

1 Costs shown are for procurement only and exclude in-service support costs.

2 The current planned in-service date for the Future Rapid Effect System – Utility Vehicle (FRES UV) is 2022.

3 The FRES UV figure represents the total number of FRES vehicles which were expected to be bought. This would therefore have included the ~1300 FRES SV vehicles currently planned.

4 Costs shown for Viking exclude the purchase of additional vehicles under the Urgent Operational Requirements process.

5 Costs shown were reported as at: TRACER – 2002, MRAV – 2003, FRES UV & SV – November 2010, Terrier – March 2011 and Warrior – December 2010.

Source: National Audit Office analysis of Departmental data

4 The list of armoured vehicles projects cancelled, suspended or delayed in Figure 1 suggests that – given the expenditure of over £1.1 billion since 1998 without the delivery of its principal armoured vehicles – the Department's standard acquisition process for armoured vehicles has not been working. This report considers what factors have contributed to the current situation through a review of the way in which the Department has approached the acquisition of armoured vehicles using both its standard and Urgent Operational Requirements processes. In particular, it considers the following aspects:

- **Part One: Defence policy and the role of armoured vehicles** – The stated Defence policy of the United Kingdom regarding the use of Armed Forces, and the role of armoured vehicles in helping to deliver these objectives.
- **Part Two: Acquisition strategy and requirements setting** – Examining the strategy for acquiring armoured vehicles and the detailed performance requirements drawn up by the Department.
- **Part Three: Resource management** – The means by which the Department makes resources available to support implementation of its policies, including procuring armoured vehicles.

5 The detailed consequences of the failure to deliver armoured vehicles are set out in **Part Four** of this report.

Key findings

On Defence policy and the role of armoured vehicles

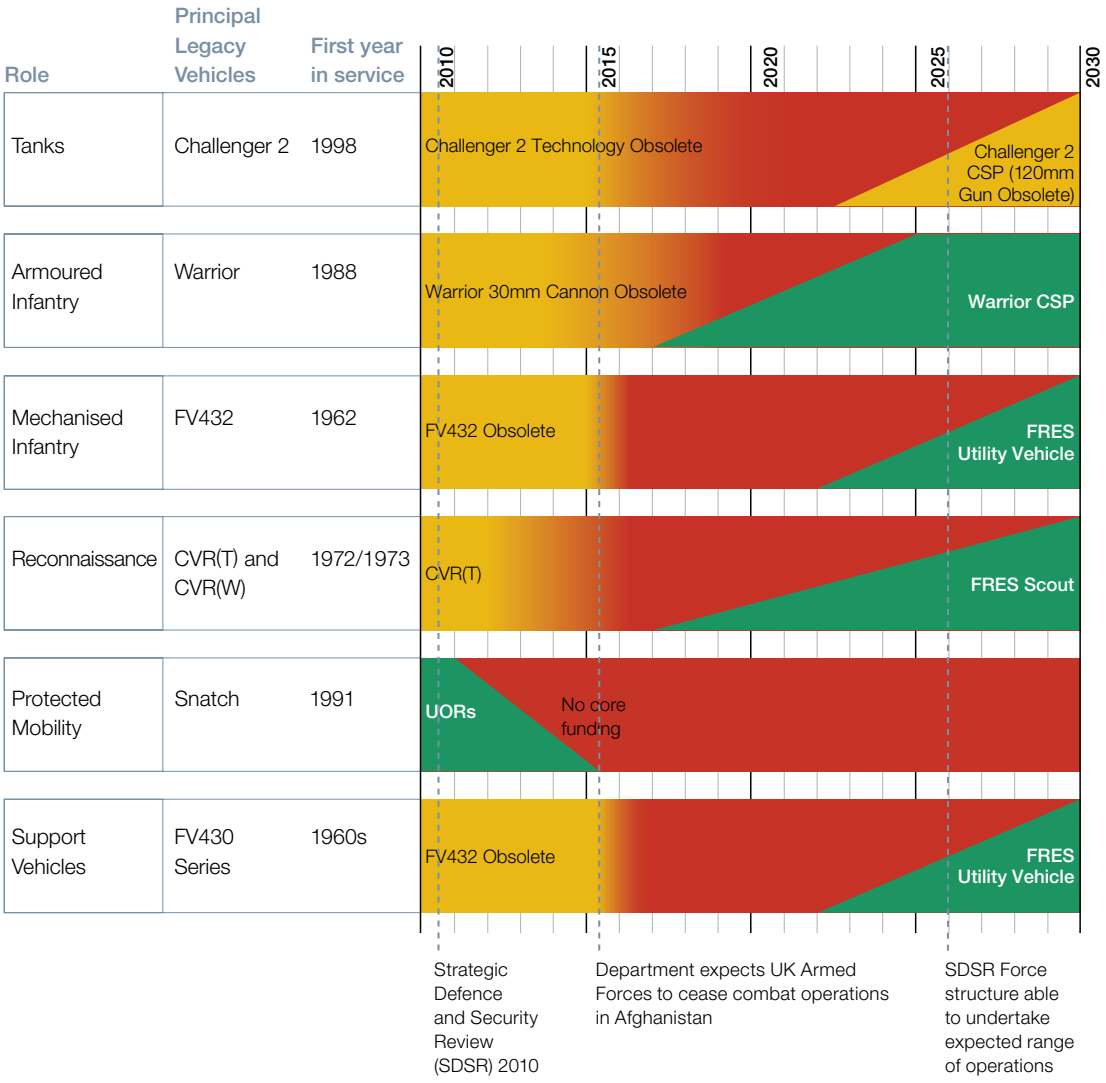
6 The failure to deliver key armoured vehicle programmes under the standard acquisition process will delay the implementation of the Department's policy for sufficiently capable, flexible, mobile land forces. The delays which have arisen from cancelled or suspended armoured vehicle projects will result in the Armed Forces not being fully equipped with the vehicles identified as top priorities in the 2010 Strategic Defence and Security Review, until at least 2024-25 (**Figure 2**).

On acquisition strategy and requirements setting

7 The Department's reluctance to compromise in setting technologically demanding requirements under its standard acquisition process has put the timely and cost-effective delivery of equipment at risk. Complex requirements have been set which rely on technological advances to achieve a qualitative advantage over the most demanding potential adversaries. However, for vehicles procured using the standard acquisition process there has not been an effective means to assess the costs, risks and amount of equipment needed to meet these requirements in the early stages. These demanding requirements often reduce the scope to maximise competition which in turn can lead to cost increases, delays to the introduction of equipment into service and reductions to the numbers of vehicles bought to stay within budgets.

Figure 2

Armoured Vehicle forecast capability 2010-2030



CSP Capability Sustainment Programme
FRES Future Rapid Effect System
UORs Urgent Operational Requirements
CVR(T) Combat Vehicle Reconnaissance (Tracked)
CVR(W) Combat Vehicle Reconnaissance (Wheeled)

Source: National Audit Office analysis of Department data

8 Faced with rapid changes to equipment requirements driven by operational experience, these unwieldy processes have contributed to a number of armoured vehicle projects being delayed or abandoned. This has led the Department to place greater reliance on the Urgent Operational Requirements process to provide equipment for recent operations in Iraq and Afghanistan.

9 The Department has shown that it can make effective compromises to rapidly buy equipment specifically for operations. Urgent Operational Requirements are based on the principle that equipment only has to satisfy the current operational need – and be better than what is currently in service – to deliver equipment to the front line quickly; this generates realistic and deliverable requirements. The Department's recent progress on the FRES reconnaissance variant and Foxhound project has reflected this principle. This in particular should enable rapid deployment of the latter into Afghanistan.

10 The Urgent Operational Requirements process is not a substitute for the standard acquisition process, but lessons can be applied from the former to accelerate delivery of equipment through the latter process. The rapid delivery of Urgent Operational Requirements is necessarily often at the expense of fully developed support and training solutions which cause longer-term problems. The equipment is usually tailored to one particular military operation which can make it unsuitable to meet a wider range of military tasks.

On resource management

11 The Department's poor resource management has destabilised the standard acquisition process. As we reported in our *Strategic Financial Management of the Defence Budget* report, the cycle of unrealistic planning followed by cost overruns has led to a need to regularly find additional short-term savings. Areas of the Defence budget where there have been lower levels of long-term contractual commitment, such as armoured vehicles, have borne the consequences of decisions to fund large scale and long-term projects in other sectors.

12 The Department's requirement to identify significant savings in order to live within its means has led to equipment gaps appearing in some areas, such as armoured vehicles. While the decision to make savings in these areas may have been founded on an evaluation of short-term priorities, the deferral of successive programmes has created a shortfall against the Department's policy goals for Land Forces in the longer term.

13 Urgent Operational Requirements have been used to address shortfalls in equipment for current operations. As the purchase costs of equipment bought through the Urgent Operational Requirements process are normally fully funded by the Treasury, outside of the Defence Budget, these procurements are not affected by the destabilising effects of short-term savings. Consequently, they can, to some extent, be seen to partly compensate for the consequences of delays in procuring equipment through the standard acquisition process.

On the consequences of the issues identified with the Department's standard acquisition approach and resource planning for armoured vehicles.

14 In the period since 1998, the Department's standard acquisition approach has failed to deliver armoured vehicle projects on a consistent basis in line with plans. While the Department has delivered a number of smaller projects worth £407 million, it has spent £718 million on projects that have yet to deliver, some of which have been cancelled or suspended indefinitely. In practice, however, this is a relatively small fraction of the £14 billion the Department intended to spend on the Future Rapid Effect System project alone. The result is that the Armed Forces have not received much of the equipment they expected to have over the last decade.

15 The Department spent over £2.8 billion in the same period on upgrading and buying new vehicles through the Urgent Operational Requirements process. While much of this expenditure would probably have been necessary due to the specific nature of the threats faced in Iraq and Afghanistan, it would have been lower had more armoured vehicle projects from the Department's core programme been delivered as originally planned.

16 Based on current resource plans, the Department will have a gap between the armoured vehicles it says it needs now and those it will have at least until 2025, although this gap will start to decrease from 2017 as new vehicles begin to enter service. While the Department expects to bring some of the Urgent Operational Requirements vehicles into its core fleet, there will still be significant shortfalls in the equipment needed to undertake the full spectrum of potential future military operations. Without both significant additional investment and a greater focus on maintaining the level of investment in armoured vehicles currently planned, the Department's ability to carry out the range of tasks expected of it is likely to be reduced.

Conclusion on value for money

17 Despite the commitment of considerable resources over more than a decade the Department still faces significant shortfalls against its plans to equip its Armed Forces with more mobile and flexible forces and is likely to continue to do so until at least 2025. The Department's standard acquisition process is undermined by a combination of over-ambitious requirements and unstable financial planning. While we acknowledge events in Iraq and Afghanistan have required changes to the Department's original plans and the purchase of specialist vehicles, we do not assess that its approach over the last decade to renewing its core armoured vehicle fleet represents value for money.

18 The Department's approach to the purchase of specialised vehicles under the Urgent Operational Requirements process has been more successful. A total of £2.8 billion has been spent to date. The Armed Forces are now better equipped with vehicles suitable for current operations in Afghanistan with significantly improved protection levels against today's threats. While it is expected that some of these vehicles will be brought into the core fleet following the end of operations in Afghanistan, they are not suitable for the full range of potential military tasks. Consequently, further expenditure will be needed to recover and refurbish these vehicles and to provide a long-term solution. The Taxpayer can only have confidence that future investment plans will deliver value for money if they are made on the basis of stable and sustainable budgets however.

Recommendations

19 In future, the Department must exhibit greater pragmatism in its acquisition of armoured vehicles to ensure that some of the lessons learned from buying Urgent Operational Requirements are embedded into core projects. Specifically, it must make realistic compromises between performance, time and cost at an earlier stage. We therefore make the following recommendations:

a **Repeated cancellations, suspensions and delays of armoured vehicles projects indicate that the current standard acquisition process has been unsuccessful.** The Department has told us that it intends to put in place a medium-term strategy for the armoured vehicle sector. If so, this strategy should be consistent with Defence policy goals; consider other acquisition strategies for delivering armoured vehicles; and ensure sustained investment in the sector provides sufficient capability to respond to future military requirements.

b **The Department has repeatedly destabilised acquisition activity through poor resource management.** It should ensure greater coherence between Defence plans and resources over longer periods. Where gaps in the structure and capabilities of the Armed Forces arise as a consequence of resource management decisions, those should be reported to Parliament in its annual performance report.

c **The requirements the Department has sought from armoured vehicles procured through the standard acquisition process have been demanding, and frequently depended on integrating advanced, but immature, technologies from the design stage.** Where there is no clear and compelling requirement for these technologies to be integrated during vehicle design, the Department should have a default position of purchasing off-the-shelf equipment which can be incrementally upgraded in the future, if necessary.

d **The Department has learnt lessons from previous armoured vehicle acquisition projects, but more can be done.** The Department has learnt lessons from both the Urgent Operational Requirements and standard acquisition processes, and applied these to current armoured vehicle projects. Firm delivery deadlines and budgets could further ensure realism in setting requirements. This could be achieved by engaging more closely with industry to assess vehicle requirements, based on mature technology, that are initially sufficient – and better than vehicles already in service – but having the potential for future development. The Department should consider buying vehicles in batches, with each subsequent batch offering improved capabilities within a lower initial budget approval, but based on a common vehicle design to minimise any differences in logistic support and training requirements.

e **The Department has chosen international competition as its preferred route for acquiring armoured vehicles, whilst retaining some specific capabilities on–shore.** We support the principle of competition as a means of acquiring armoured vehicles, and this can effectively be achieved by accepting requirements based on minimum modification to existing vehicle designs. By procuring vehicles in successively more capable batches, and modifying them over the vehicles life, the United Kingdom can retain key technologies and the ability to design, manufacture and overhaul vehicles at levels the Department deems critical to hold on-shore.

Part One

Defence policy and the role of armoured vehicles

Introduction

1.1 The role of the British Armed Forces has been defined by the Department as being able "…to deter and defeat threats to the United Kingdom and its allies, as well as to promote its interests and act as a force for good in the wider world." The October 2010 *Strategic Defence and Security Review* re-affirmed the policy of retaining "a significant, well-equipped Army", and included a commitment to the introduction of new armoured vehicles as part of a number of measures to make "…the Army more mobile and more flexible.[1]"

1.2 Recent high level statements of policy continue to emphasise flexibility and the need for the Department to maintain a broad range of land-based capabilities. For example, the October 2008 *Future Land Operational Concept* paper states:

> "…Land forces will need to project suitably configured, scaled and trained forces at appropriate readiness, in order to intervene at a time and place of choice…. Land forces need to confront opponents and situations with a broad range of capabilities that retain the ability to conduct sustainable and protracted major combat operations after the required preparation period…. Land forces must be capable *of* major combat, yet be optimised for simultaneous or discrete stabilisation tasks.[2]"

1.3 If the Department is to be capable of operating across the range of military tasks envisaged by Defence policy then the acquisition and maintenance of an effective, balanced and flexible armoured vehicle capability is likely to remain a priority for defence planners.

1 Ministry of Defence, *Future Land Operational Concept, 2008*, page 3.
2 Ministry of Defence *Future Land Operational Concept, 2008*, Pt2-2.

1.4 Defence policy envisages land forces that fall into three broad categories:

- **Heavy forces:** These are based around large tracked vehicles such as tanks. They offer the highest levels of firepower and protection with weights generally in excess of 45 tonnes. They have good cross-country mobility but their weight and size preclude rapid deployment over great distances.
- **Medium-weight forces:** These are based on a mixture of tracked and wheeled armoured vehicles. Current medium-weight vehicles can weigh up to 45 tonnes but are easier to deploy over large distances than heavy forces and offer a balance of firepower, protection and mobility.
- **Light forces:** These tend to be based on lightly armoured or soft-skinned vehicles, such as trucks and Land Rovers. They can offer high mobility and are quick to deploy but provide much lower levels of protection and firepower.

There is a long-standing requirement for more mobile and flexible medium-weight forces

1.5 The current policy of increasing the mobility and flexibility of the Armed Forces first arose following the end of the Cold War. The 1998 Strategic Defence Review assessed that the nature of the threat faced by the United Kingdom had changed from the need to conduct large scale military operations against the Warsaw Pact to prevention of global instability by intervention in trouble spots worldwide. Accordingly, the United Kingdom's Armed Forces were to be restructured to improve their ability to deploy, increasing the quantity of medium-weight forces and reducing the numbers of heavy forces.

1.6 A new family of armoured vehicles, known as the Future Rapid Effect System (FRES), was envisaged to deliver the medium-weight capability and provide the Department with a force more deployable than heavy forces but have greater firepower and protection than light forces. Coincidentally, there was also a need to replace the existing equipment, including the FV430 and Combat Vehicle Reconnaissance (Tracked) platforms, which were suffering from increasing obsolescence.

1.7 The Department has initiated a number of projects since 1985 to replace its existing vehicles, and from the 1998 Strategic Defence Review, to implement its medium-weight policy objective (**Appendix Three**). Despite the expenditure of considerable resources over more than a decade, the Department has not met its objective of fielding a more mobile, flexible fleet. The only exceptions have been the acquisition of relatively small numbers of specialist vehicles including the Titan and Trojan engineering vehicles and Viking All Terrain (Protected) vehicles.

Part Two

Acquisition strategy and requirements setting

2.1 In this Part of the Report we examine the Department's approach to acquiring medium-weight armoured vehicles between the 1998 Strategic Defence Review and the 2010 Strategic Defence and Security Review. In particular, we examine how the Department determines its requirements for armoured vehicles; the acquisition strategy for the Future Rapid Effect System; and what procurement lessons can be learnt from recent military operations.

A reluctance to compromise in setting armoured vehicle requirements puts delivery at risk

2.2 Ensuring realistic requirements are agreed at the outset of a project's development is critical in delivering capable military equipment on time and within budget. Where requirements are not realistic in terms of technical feasibility or are unlikely to be affordable, then the military and commercial consequences are increased risk to delivery and added expense.

2.3 During the Cold War, equipment was designed against a clear threat which evolved slowly over time. The primary focus of the Department was on meeting the technical requirement in full to achieve a qualitative advantage over potential adversaries. This focus drove a demanding set of requirements and unwillingness to trade-off between competing demands. Delivering equipment rapidly into service became a secondary consideration. For example, research into the Warrior armoured infantry vehicle began in the late 1960s, but the first British Army units were not equipped with it until 1988.

2.4 The absence of a clearly defined threat in the immediate post-Cold War era did not lead to any changes in this behaviour. In 1997, the Department agreed a joint requirement with the United States for a new reconnaissance vehicle known in the United Kingdom as the Tactical Reconnaissance Armoured Combat Equipment Requirement (TRACER), which depended upon the successful exploitation of some very advanced technologies. These included: hybrid electrical drives, to offer near silent vehicle movement; 'band track' technology, offering lighter, quieter movement with a longer operational life; sophisticated sensors; and a 40mm cannon. Fourteen years later many of these technologies have still to enter service on an armoured vehicle; for example, the 40mm cannon is only now regarded as sufficiently mature to be fitted onto the next generation of armoured vehicles.

2.5 TRACER was required to replace the Combat Vehicle Reconnaissance (Tracked) family of vehicles which entered service in 1972. The Department noted in 1999 that the Combat Vehicle Reconnaissance (Tracked) had: "…proved to be inadequate during the Gulf War (in 1991) in the areas of sensors, stealth, survivability, mobility and lethality.[3] However, the project became unaffordable when the United States withdrew its share of the funding in 2000, due to it being unlikely to deliver the necessary vehicle in the required timescale. The Department subsequently cancelled its work on TRACER in 2001.

2.6 The Department had a further requirement for an armoured vehicle to carry infantry into combat, to replace the FV430 family of vehicles which has been in service since 1962. In the mid-1990s, after a number of unsuccessful attempts to procure a replacement (Appendix Three), the Department entered into a joint development with Germany and The Netherlands for a Multi-Role Armoured Vehicle weighing around 33 tonnes. However, a further requirement emerged from operations in Kosovo in 1999 and Sierra Leone in 2000-01, that to support swift intervention armoured vehicles should be rapidly deployable by air, leading to a vehicle weight limit of 17-25 tonnes. As a result, the Multi-Role Armoured Vehicle project was cancelled in 2002.

2.7 The Department then embarked on an ambitious project called the Future Rapid Effect System. This £14 billion project was intended to replace over three quarters of the Department's existing armoured vehicles with up to 3,700 air-transportable vehicles. Plans were for up to 16 different role-specific types intended to operate across the full range of military tasks, from peacekeeping to combat operations.

2.8 To meet the necessary protection levels within tight weight constraints much faith was placed in advanced armour, sensor and defensive systems technology, designed to provide greater protection at lower weight. The overall complexity of the programme increased the time the Department spent refining exactly what the vehicle was designed to do. As the Department noted to the Defence Committee in 2007:

> "We accept that the Future Rapid Effect System concept phase was too long, primarily due to inability to refine and stabilise the requirement quickly enough and failure to adopt early the most appropriate procurement strategy.[4]"

2.9 There was also the question of whether the protection levels could be delivered within the 25 tonne weight limit at all. While the Department's internal review forum considered the requirements to be deliverable, with some 'trading', the House of Commons Defence Select Committee was more sceptical, noting in early 2007 that the Future Rapid Effect System requirement was "…unachievable without a major technological breakthrough.[5]" The Department's internal processes had also identified tensions between the policy requirements for mobility, protection and the timescale for entry to service.

3 House of Commons Defence Select Committee, *Major Procurement Projects Survey: The Common New Generation Frigate Programme*: Report and Proceedings of the Committee with Minutes of Evidence and Appendices HC544 Session 1998-99, Written Evidence: The Tactical Reconnaissance Armoured Combat Equipment Requirement (TRACER).

4 *The Army's requirement for armoured vehicles: the FRES programme: Government Response to the Committee's Seventh Report* of Session 2006–07, HC511, Ninth Special Report of Session 2006-07, p5.

5 *The Army's requirement for armoured vehicles: the FRES programme, Seventh Report of Session 2006-07*, HC159, 6 February 2007, Paragraph 93.

2.10 In practice, technology demonstration programmes funded by the Department proved that these new technologies were not sufficiently mature to deliver the necessary protection levels, and by early 2006 this weight limit had been revised. A 'fleet review' concluded that to meet protection levels the weight limit needed to be in the range of 25-30 tonnes.

2.11 The weight limit, and the emphasis on air-portability, was further relaxed in 2008. Paradoxically, this allowed the Multi-Role Armoured Vehicle, which by then was undergoing final testing in The Netherlands and Germany, to re-enter the Future Rapid Effect System Utility Vehicle design competition.

The armoured vehicles' requirements setting process has proved insufficient in a rapidly changing operational environment

2.12 The consequences of not delivering suitable equipment rapidly into service when forces are fighting a war can be severe. Success on operations in Afghanistan remains the Department's top priority. Although the Government is fully committed to ensuring that the campaign is properly resourced, funded and equipped, faster entry into service is a critical objective.[6] The examples we have considered demonstrate a pattern of setting ambitious requirements based on emerging technologies, which take a relatively long time to mature into systems capable of being used on vehicles ready for service.

2.13 The Department responded to the need for faster entry into service by trying to increase the pace of the Future Rapid Effect System programme. It was still unwilling in early 2006 however, to compromise on protection requirements to reduce weight, and so the requirement for air portability by C-130 was traded to reflect that the A400M would be the principal air transport capability with a correspondingly greater payload capacity.

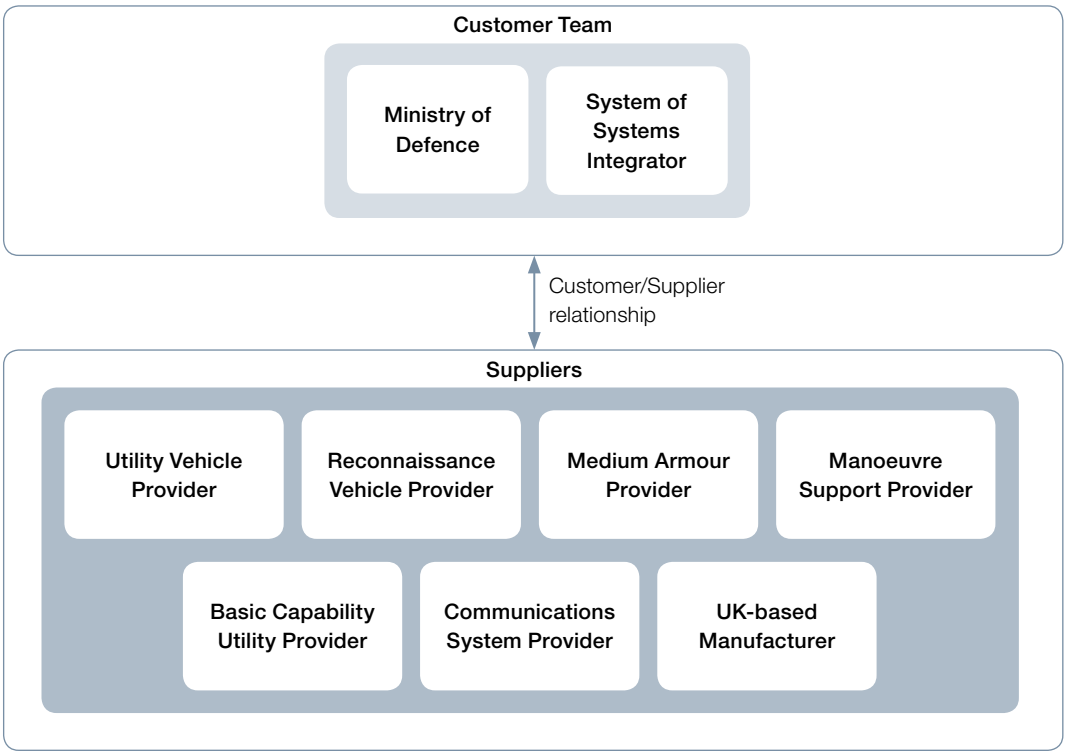
2.14 Changing requirements slowed vehicle development further, rather than accelerating it, as the acquisition process was unable to respond with sufficient agility. The original aspiration for the Future Rapid Effect System was an in-service date of 2008. By the time of the 2006 Utility Vehicle competition, this had been revised to 2012, followed by further slippage to 2015.

The Future Rapid Effect System acquisition process was complex

2.15 As noted above, the demanding requirement to keep the Future Rapid Effect System as light as possible but with good levels of protection delayed the acquisition process. When the latter was finally launched in 2006 it had a complex strategy which required the involvement of multiple industry parties in an alliance-type structure. A series of international competitions were held to select partners for a number of roles. These included a 'Systems House' (selected in 2004 during the initial Assessment Phase), a 'Systems of Systems Integrator', a designer for each vehicle, 'integrators' for each vehicle type, and a United Kingdom-based manufacturer (**Figure 3**).

6 HM Government, *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review*, Cm 7948, October 2010, p15.

Figure 3
Future Rapid Effect System Utility Vehicle commercial construct – The FRES Alliance



NOTE
1 An explanation of the key terms is provided in the Glossary at Appendix Two.

Source: Ministry of Defence

2.16 The plan was for these parties to first be selected and then come together in combination to deliver the project. As each party was selected, it was expected to agree to commercial terms requiring it to conform to the 2005 Defence Industrial Policy; and the plan was designed to preserve a level playing field for bidders for the remaining roles. As the need for the Future Rapid Effect System Utility Vehicle was assessed by the Department as the most pressing, it was chosen as the first type of vehicle to be procured. The intention was that the first vehicles would be delivered into service in 2010. This was delayed to 2012 however, as a result of savings measures. This remained a demanding deadline, given the technical and commercial complexity of the programme. At first the Department made rapid progress in appointing some of the parties required under the acquisition strategy, having selected the 'Systems House', 'System of Systems Integrator' and a designer for the Utility Vehicle by early 2008.

2.17 However, the Future Rapid Effect System Utility Vehicle acquisition strategy embodied a number of tensions. The acquisition strategy needed commercial commitment early in the procurement process and before all of the parties had been selected or had an opportunity to settle terms. Further, of the three candidate vehicles assessed, the Department chose the least mature design. This decision was made because even with modification, neither of the more mature designs was assessed by the Department as being capable of meeting the demanding requirement throughout the service life of the vehicle.

2.18 A consequence of the selection of the least mature design was that the Department embarked on a programme of 'risk reduction' work with the selected bidder to demonstrate that their design could be delivered within the time constraint of the project. Ultimately, however, progress slowed due to an inability of the Department to agree satisfactory commercial terms with the selected designer consistent with the stipulations of the acquisition strategy.

2.19 In combination these factors increased the level of project risk to unmanageable levels and this appears to have been a significant factor in the suspension of the project. In late 2008, the acquisition process for the Utility Vehicle was halted after spending £133 million. The competition has yet to be re-launched and the projected in-service date for the Utility Vehicle is now 2022 at the earliest.

The Urgent Operational Requirements process enables a timely response to operational demands but presents its own challenges

2.20 The principal aim of the Urgent Operational Requirements process is to provide enhanced equipment as soon as possible to the front line user, and often within twelve to eighteen months of identifying a requirement.[7] Rather than listing a demanding set of requirements, the focus is on delivering equipment that is better than that already deployed. Equipment procured through this route is predominantly funded by the Treasury Reserve rather than from the Defence budget.

2.21 The Department has been increasingly effective in responding to equipment requirements for current operations through the Urgent Operational Requirements process. Trade-offs between competing requirements are often agreed early in the acquisition process to provide equipment that is 'good enough', and written to ensure equipment can reasonably be deployed on operations within a tightly defined timeframe. For example, the Mastiff Protected Patrol Vehicle, ordered in July 2006, was undergoing testing in Iraq by the end of the year, and entered operational service in 2007.

7 Our 2004 report on Urgent Operational Requirements stated that "Normally, any capability taking more than six months to enter service would be procured through the normal procurement process." However, the Department has informed us that more recently this timeline has increased to 12-18 months to reflect the more complex capability requirements in support of current operations and to counter technically advanced theatre specific threats. See *Ministry of Defence: The Rapid Procurement of Capability to Support Operations*, HC1161, Session 2003-04, p7.

2.22 A key benefit of the Urgent Operational Requirements process is the ability to improve equipment on an incremental basis. As equipment is deployed onto operations, and lessons are learnt, vehicles can be further improved in subsequent batches. Changes in the threat faced by the user also provide strong incentives to further improve equipment design. For example, the Mastiff has been procured in three, increasingly effective, variants and numerous minor and major modifications have been made to existing vehicles, such as the Warrior armoured vehicle.

2.23 Compromises are accepted in order to meet immediate operational requirements within a tight timeframe however. Some of the early Protected Patrol Vehicles were bought in insufficient numbers to be able to train soldiers before deploying on operations, and many vehicles lacked adequate training and repair manuals. The off-the-shelf nature of the Urgent Operational Requirements purchases has led to bespoke support solutions and disparate fleets with the attendant operational and logistics implications. This puts additional pressure on the supply chain into Afghanistan, complicates and lengthens the time taken to train forces before deploying, and makes it more challenging to maintain equipment availability in theatre. For example, there are currently some 22 different variants of Protected Patrol Vehicles operating in Afghanistan. Integration testing of an increasingly complex range of communications and sensor devices on vehicles is also conducted at rapid pace, which invariably results in equipment performance being sub-optimal when the vehicles are delivered to the front line. Our recent report *The use of information to manage the logistics supply chain*[8] considers in more detail how the Department manages its supply chain to ensure equipment is delivered where and when it is required.

8 *The use of information to manage the logistics supply chain*, HC 827, Session 2010-2011.

Part Three

Resource Management

3.1 Good resource management is an essential prerequisite in translating strategic policy objectives into the cost-effective delivery of military capability. This Part of the Report examines the impact of resource management decisions on the planned procurement of defence equipment; the factors and criteria which drive those resource management decisions and the consequences of those decisions on current operations and future plans.

Defence planning at the strategic level has not been underpinned by effective financial plans

3.2 As we reported in our recent review of *Strategic Financial Management of the Defence Budget*[9] strategic decision-making in Defence has not always been underpinned by an explicit financial plan to ensure the strategy can be delivered in an affordable and cost-effective manner. This is not a new phenomenon however; the detailed work to cost the outcomes of the 1998 Strategic Defence Review was undertaken after the Review's strategic objectives had already been agreed.

The Department's poor resource planning leads to frequent cuts

3.3 Prior to the 2010 Strategic Defence and Security Review, the Department's planned expenditure over the next 10 years exceeded anticipated funding by between £6 billion (assuming a 2.7 per cent increase in the Defence budget per annum over ten years) and £36 billion (assuming no increase in the Defence budget over the same period).[10] Prior to the review, the Department's own estimate of the gap was £38 billion.[11]

3.4 In addition, significant in-year cost overruns on a few major equipment projects, including the Astute Class submarine, the Nimrod Anti-Submarine Warfare aircraft, the Typhoon combat aircraft and the Queen Elizabeth class aircraft carriers have also required the diversion of funding from other equipment projects.[12]

9 *The Strategic Financial Management of the Defence Budget*, HC 290, Session 2010-2011, p21.
10 *The Major Projects Report 2009*, HC 85-I, Session 2009-2010.
11 HM Government, *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review*, Cm 7948, October 2010, p15.
12 *The Major Projects Report 2010*, HC 489-I, Session 2010-2011.

3.5 As we have previously reported,[13] this cycle of systematic over-planning of future expenditure against expected resources and in-year cost overruns has resulted in the need to annually re-prioritise forecast spending on a large scale.

3.6 As a consequence, in recent years the Department has regularly had to find savings in excess of those planned to prevent budget deficits in the short term. In 2010, for example, the Department had to find additional savings of £880m from its planned 2010-11 budget.

Spending on equipment is often reduced to generate short-term savings for Defence

3.7 When faced with cost growth in its budget, the Department's Equipment Plan is one of the few areas where there is sufficient short-term flexibility to generate significant savings.[14] Savings tend to be generated by either deferring or cancelling the expected signature of contracts or re-negotiating existing contracts to defer expenditure or reduce order sizes.

3.8 Such savings measures have repeatedly been made to equipment projects across Defence. **Figure 4** overleaf shows the effect that each annual planning round since 2004-05 has had on the overall equipment programme. In total, this amounts to a net reduction of approximately £21 billion in planned expenditure over the period 2005 to 2010.

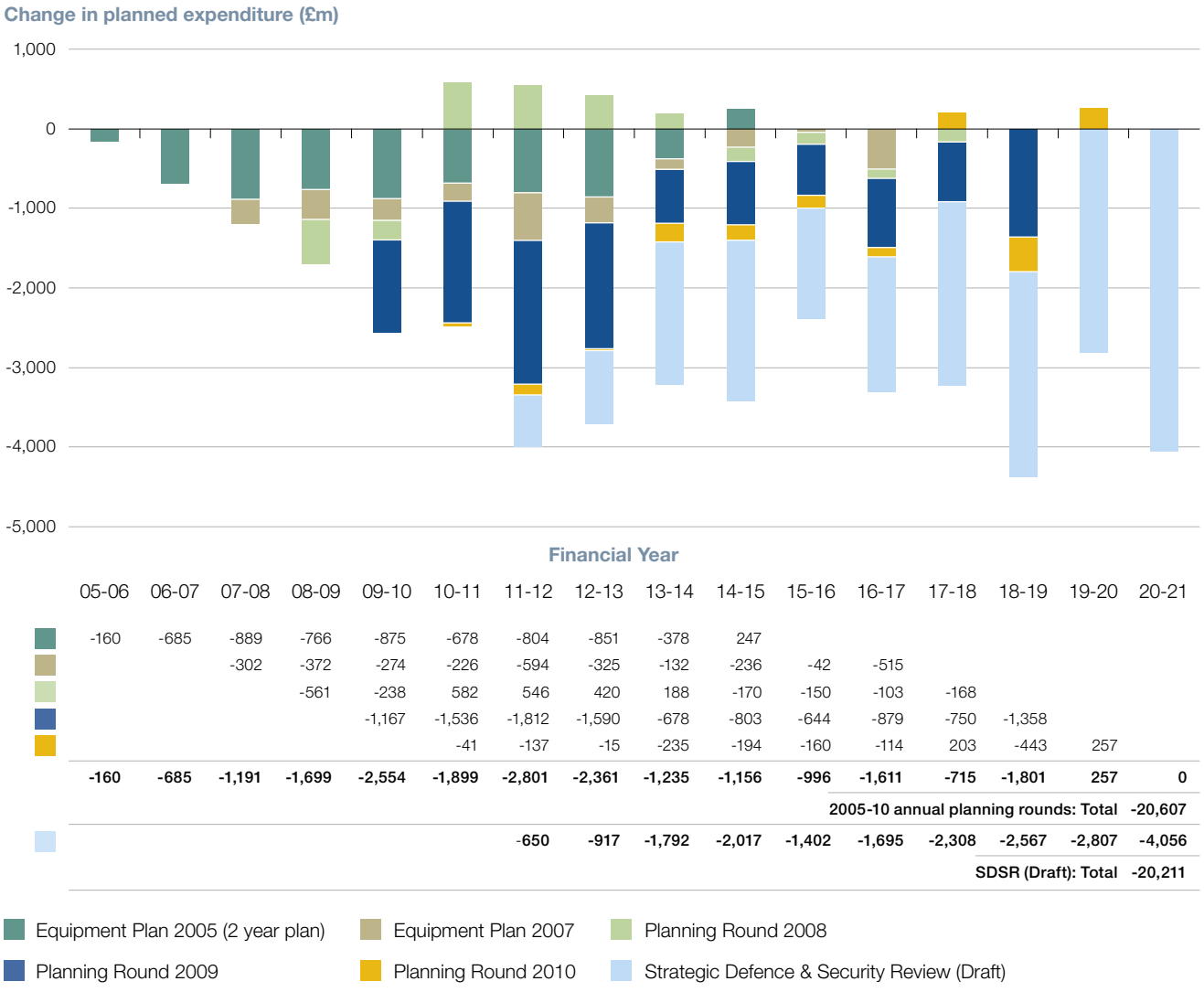
3.9 The Department is in the process of attempting to bring its anticipated funding and expenditure into closer alignment. Figure 4 illustrates that additional savings in excess of £20 billion were taken from forecast spending on the Equipment Plan by the 2010 Spending Review and Strategic Defence and Security Review. Looking ahead, the Department faces a continuing challenge to live within its budgetary settlement, and it is considering additional savings measures to remain within its budget for 2010-11 and beyond.

3.10 While the effect of these savings measures at the Departmental level has been to reduce the budgetary over-commitment in the short term, across the equipment portfolio the continual re-profiling of budgets on an annual basis creates incoherence, uncertainty and delays for both the Department's equipment projects and industry. It also adds additional long-term costs to the procurement process.

13 *The Strategic Financial Management of the Defence Budget*, HC 290, Session 2010-2011.
14 *The Strategic Financial Management of the Defence Budget*, HC 290, Session 2010-2011.

Figure 4

Impact of the 2005-10 annual planning rounds and Strategic Defence and Security Review on planned expenditure within the Department's equipment programme



	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21
	-160	-685	-889	-766	-875	-678	-804	-851	-378	247						
			-302	-372	-274	-226	-594	-325	-132	-236	-42	-515				
				-561	-238	582	546	420	188	-170	-150	-103	-168			
					-1,167	-1,536	-1,812	-1,590	-678	-803	-644	-879	-750	-1,358		
						-41	-137	-15	-235	-194	-160	-114	203	-443	257	
	-160	**-685**	**-1,191**	**-1,699**	**-2,554**	**-1,899**	**-2,801**	**-2,361**	**-1,235**	**-1,156**	**-996**	**-1,611**	**-715**	**-1,801**	**257**	**0**
															2005-10 annual planning rounds: Total	**-20,607**
							-650	**-917**	**-1,792**	**-2,017**	**-1,402**	**-1,695**	**-2,308**	**-2,567**	**-2,807**	**-4,056**
															SDSR (Draft): Total	**-20,211**

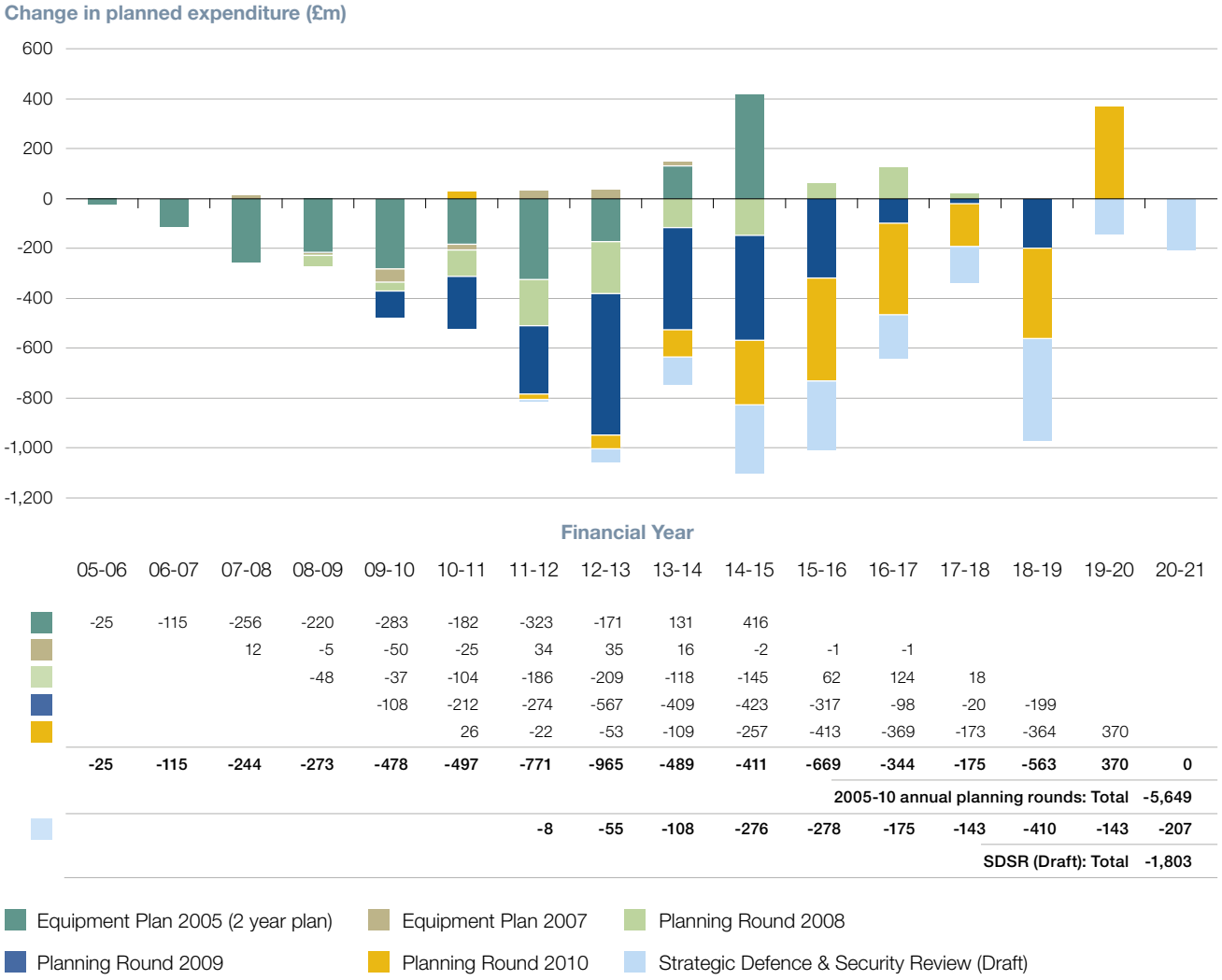
Source: National Audit Office analysis of Departmental data

Deliveries of armoured vehicle capabilities have been deferred as a consequence of financial instability

3.11 Armoured vehicle acquisition plans have experienced repeated savings measures in recent years. As illustrated in **Figure 5**, savings measures totalling approximately £5.6 billion have been taken specifically from armoured vehicle projects in the period from 2005 to 2010, with an estimated £1.8 billion more expected as a result of the Strategic Defence and Security Review. In absolute terms, this means that the armoured vehicle sector has had the largest amount of funding removed of any individual sector in the five planning rounds conducted between 2005 and 2010 (Figure 7 – Appendix One). The Department has not been able to provide us with sufficient data to make the comparison as a proportion of the original expenditure planned for each sector.

Figure 5

Impact of the 2005-10 annual planning rounds and Strategic Defence and Security Review on planned armoured vehicle expenditure



Source: National Audit Office analysis of Departmental data

3.12 One consequence of the removal of armoured vehicle funding has been to defer the introduction to service of a number of new armoured vehicle projects. These decisions have enabled the Department to meet cost growth in other areas of Defence, such as personnel costs[15], as well as address cost overruns in other equipment areas. In the absence of an explicit statement of the relative priorities of different capability areas, it is difficult to assess the criteria the Department has used to make these decisions, although we have identified a number of factors – considered below – which appear to influence where savings are taken. We consider that the correlation between these factors and the decisions taken provides an insight into the decision-making approach, criteria and priorities of the Department.

15 *The Strategic Financial Management of the Defence Budget*, HC 290, Session 2010-11, para 2.8.

The Department's resource management decisions are influenced by industrial considerations

3.13 Although the Department uses the annual planning round to set strategic priorities it does not routinely prioritise individual elements of its spending programme. Neither the 1998 Strategic Defence Review nor the successive reviews of capability in 2002 and 2004 set out the relative priorities of the different military capability areas.[16] As a result, in the period between the 1998 Strategic Defence Review and the 2010 Strategic Defence and Security Review, savings measures have often been taken against equipment procurement projects where funding had yet to be contractually committed with industry.

3.14 Given the considerable costs often involved in breaking contractual commitments, it is unsurprising that the Department has taken decisions on this basis. Such decisions may well represent value for money when considered in isolation. Over time, however, this has led to a pattern of resources being prioritised to those projects which have managed to reach the point of contract signature, or are well under way, at the expense of those which are not.

3.15 Different strategies for managing industrial capability across the aviation, land and maritime sectors have also had a significant impact on which short-term equipment savings have been taken. The Department has entered into long-term agreements with some companies in the aviation and maritime sectors. The objective of these contracts is to preserve industrial capabilities of strategic importance and to reduce overall costs by providing greater certainty of future revenue. Examples of such contracts include fast jet repair processes, with the Department signing partnerships with BAE Systems plc and Rolls-Royce plc[17]; and in July 2009, the Department signed a 15-year Terms of Business Agreement with BVT Surface Fleet, designed to manage the warship building industry at a sustainable level and reduce the costs of building and supporting warships by maintaining key areas of expertise.

3.16 The armoured vehicle sector is characterised by greater reliance on open-market competition than some other sectors. With the exception of some limited capabilities, Defence policy has not favoured the preservation of national industrial capacity in this sector. Furthermore, the repeated failures of the Department to deliver its acquisition strategies for a number of significant armoured vehicle procurements have led to there being relatively few large scale or long-term contractual obligations in this sector.

3.17 It is therefore apparent that areas, such as the armoured vehicle sector, which the Department considers either to have a lower priority with respect to industrial sustainment, or where there is not a long-standing contractual obligation, suffer disproportional impacts when decisions about in-year savings and resource prioritisation decisions are made. The Department has to live within its means on an annual basis, but we are concerned that its decision-making is based on cutting uncommitted funding as a reaction to cost growth rather than as a result of careful consideration of its needs. In the context of delivering overall Defence policy this is unlikely to represent value for money.

16 *The Strategic Financial Management of the Defence Budget*, HC 290, Session 2010-11, pp 20-21.
17 *Transforming Logistics Support for Fast Jets*, HC 825, Session 2006-07, July 2007, pp 4-6.

Part Four

There are significant consequences of the failure to deliver the Future Rapid Effect System

The Department has incurred additional expenditure to purchase Urgent Operational Requirements vehicles for current operations

4.1 In the period since 1998, the Department's core equipment programme has not delivered a number of key armoured vehicle projects. This has resulted in the Armed Forces not having a medium-weight fleet of armoured vehicles and consequently the Army deployed on operations in Iraq in 2003 and to Southern Afghanistan from 2006, reliant on either soft-skinned or armoured vehicles. Some of these vehicles, while subsequently upgraded for operations, entered service in the 1960s and early 1970s but also included Warrior and Challenger 2.

4.2 Armoured vehicles, such as Challenger and Warrior, were well suited to the initial conventional warfighting phase in Iraq in 2003. Suitably upgraded these provided a key initial capability during the follow-on phases against the ever increasing threat from roadside bombs – where soft-skinned vehicles and obsolete platforms, including Saxon, proved wholly inadequate – and until specialist Protected Patrol Vehicles could be deployed. **Figure 6** overleaf indicates that these additional vehicle purchases and upgrades by the Department amounted to approximately £2.8 billion of the £6.8 billion of Urgent Operational Requirements funding provided by HM Treasury since 2002.

4.3 This expenditure included protection related modifications to Cold War vehicles and the purchase of a range of Protected Patrol Vehicles such as Vector, Mastiff and Ridgback. The time and performance imperatives for delivering equipment to the front line when already engaged on operations means that these vehicles can come at a cost premium and there is less time available to consider the other aspects of operating vehicles such as cost-effective support solutions and potential efficiencies from ensuring commonality between different vehicle types. As a result, the cost of operating these vehicles can be significantly higher than that of vehicles delivered from the core programme.

Figure 6

Approved expenditure on Armoured and Protected Mobility Vehicles through the Urgent Operational Requirements process (millions)

Vehicle Type	Vehicle	Number of vehicles	2002 Q1	2002 Q2	2002 Q3	2002 Q4	2003 Q1	2003 Q2	2003 Q3	2003 Q4	2004 Q1	2004 Q2	2004 Q3	2004 Q4
Tanks	Challenger 2					12	9							
Armoured Infantry	Warrior													
Mechanised Infantry	Bulldog	900												
	Viking													
	Saxon													0
Reconnaissance	CVR(T)					5								2
	WMIK						1							
	Jackal	430												
PPVs	Snatch variants										4	23		
	Vector	180												
	Mastiff[1]	290+												
	Cougar	30												
	Warthog	115												
	Ridgback	177												
	Foxhound[2]	200												
	Counter-IED Task Force Protected Mobility[3]	100+					1							
Support and Specialist Vehicles	Panther													
	Wolfhound[4]	100+												
	Husky	315+												
	Coyote	75+												
	Talisman													
	EPLS													
	Support Vehicle													
	B-Class support vehicles													
Upgrades not attributable by platform	Armour enhancements												8	
	Ambulance modifications					12								
Classified Vehicles														

NOTES

1 Does not include Mastiff variants procured under Counter-IED Task Force Protected Mobility or Talisman.

2 The figure shown for Foxhound represents the contract value for the initial batch of 200 vehicles. The full approval has not been disclosed for commercial reasons.

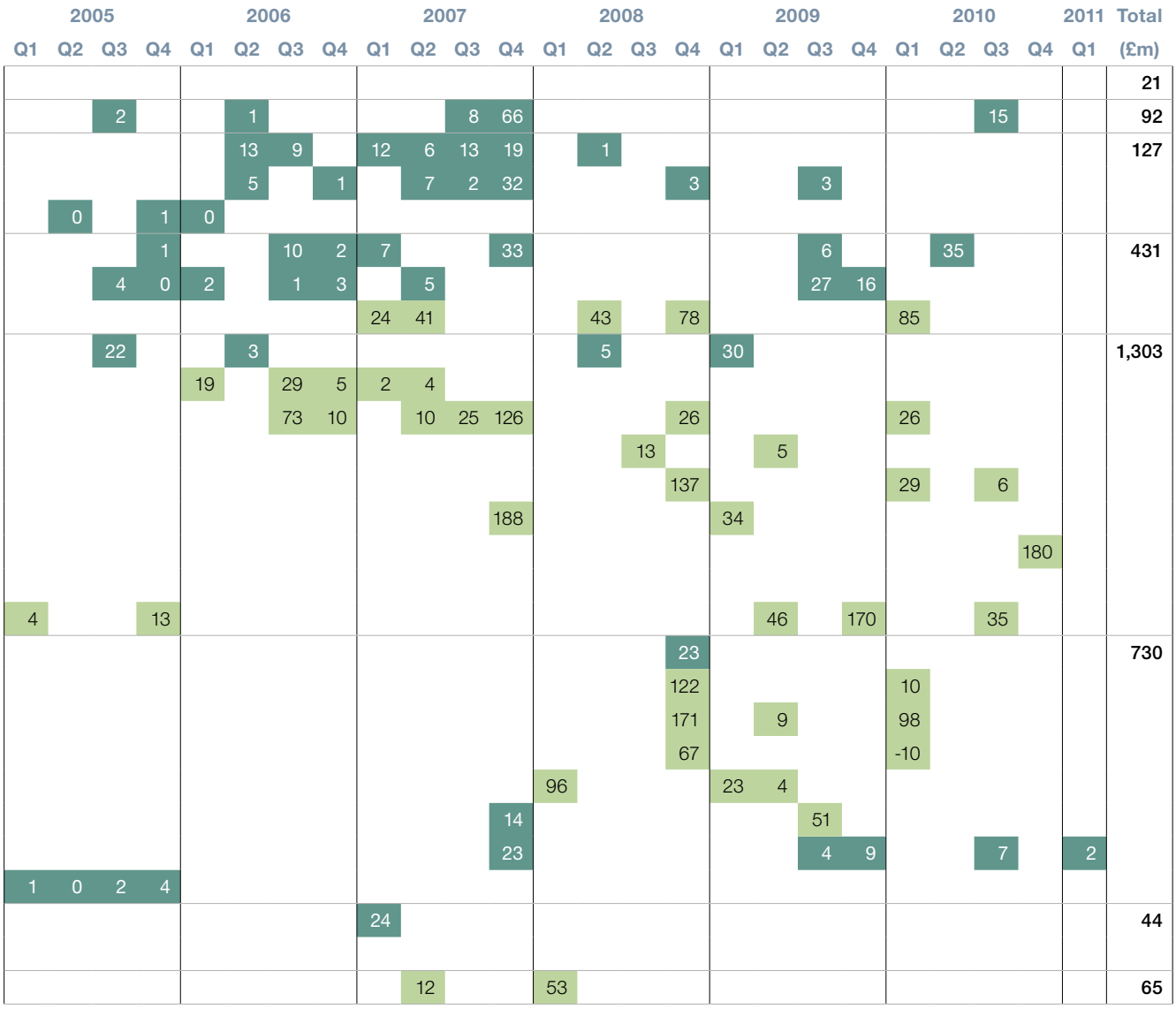
3 Mastiff and Wolfhound variants procured under the Counter-IED Task Force Protected Mobility cannot be broken down by platform. These figures include legacy Explosive Ordnance Disposal/Electronic Countermeasures vehicles purchased prior to the formation of the C-IED Task Force.

4 Does not include Wolfhound variants procured under Counter-IED Task Force Protected Mobility.

5 Although the above have been purchased as Urgent Operational Requirements, an element of the above expenditure comes from the Ministry of Defence's core budget. Since 2005, the Department has contributed £0.392 billion which included five tranches of Vector, two tranches of Mastiff and contribution to the original Protected Mobility package of 2008-09 which delivered Coyote, Husky, Wolfhound, Warthog and provided additional Jackal, Panther upgrades and Snatch upgrades.

6 Expenditure excludes additional purchases to replace/repair vehicles damaged on operations.

Source: Departmental data



UOR Urgent Operational Requirement
CVR(T) Combat Vehicle Reconnaissance (Tracked)
WMIK Weapons Mounted Installation Kit

UOR Procured Vehicles	2,128
Upgrades to Core Vehicles	685
Total	**2,813**

4.4 It is difficult to assess the extent to which expenditure on Protected Patrol Vehicles would have been lower if the Future Rapid Effect System Utility Vehicle project had been successful earlier. The types of armoured vehicles that would have been procured for the Future Rapid Effect System have better cross-country performance than Protected Patrol Vehicles so might have been able to avoid many threats by being less dependent on travelling by road. This would not, however, completely remove the need for some mine-resistant patrol vehicles as operations such as those conducted in Afghanistan require interaction with the local population and consequently a requirement to operate in urban areas. Furthermore, even had procurement activity started earlier, it is unlikely that Future Rapid Effect System vehicles would have entered service by the start of current operations in Afghanistan or have been quickly available in significant numbers. It is therefore reasonable to conclude that the £2.8 billion in Urgent Operational Requirements spend on vehicle protection could have been reduced, but not wholly avoided.

The equipment procured for current operations is unlikely to meet long-term policy aims

4.5 Equipment bought through the Urgent Operational Requirements process is introduced rapidly into service to address specific operational requirements and often highly specialised. Consequently, the equipment may be ill-suited to undertake a wider range of military tasks once operations in Afghanistan cease. For example, the Mastiff vehicle suffers from relatively poor off-road mobility, and its protection is optimised on defeating threats specific to current operations, such as roadside bombs. The Department has stated that "…a vehicle such as Mastiff does not come close to meeting the Future Rapid Effect System requirement," which is designed to operate across all types of military operations.[18]

On the basis of current resource plans the Department will not be able to equip its new force structure until 2025-30

4.6 The Department's recent Future Character of Conflict paper[19], which seeks to identify strategic trends in warfare, makes it clear that the UK will continue to face an uncertain world, and that involvement in a range of conflicts cannot be ruled out. In this context, the Government has taken a policy decision to retain the capability to engage in a wide spectrum of conflict. To prepare its ground forces for the future operations that are envisaged, the October 2010 Strategic Defence and Security Review initiated the conversion of the existing armoured and mechanised formations into a new force structure known as Future Force 2020. Critical to this structure will be a range of balanced forces, including, reconnaissance forces, tanks, and infantry operating from a range of protected vehicles.[20]"

18 House of Commons Defence Select Committee, *Defence Equipment 2009*, HC107, Third Report of Session 2008-09, p36.
19 Ministry of Defence Development Concepts and Doctrine Centre, *The Future Character of Conflict*, February 2010.
20 HM Government, *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review*, Cm 7948, October 2010, p24.

4.7 Figure 2 on page 7 illustrates the key vehicle types the Department's future force structure requires. The Department is anticipating delivery of two of these from 2017[21] but on the basis of its current plans it will take up to a decade to fully equip the force structure envisaged in the Strategic Defence and Security Review. Considerable reliance will be placed on being able to run on Cold War vehicles for many years. There are no plans to begin to equip the mechanised infantry with the Future Rapid Effect System Utility Vehicle until at least 2022.[22]

4.8 It is clear that once the United Kingdom's Armed Forces cease operations in Afghanistan from 2014-15, a significant period of recovery and re-equipment will be required before the Department will be able to deliver Future Force 2020, the new Army force structure, complete with modern equipment. Without changes to plans for defence spending the likelihood of meeting the Strategic Defence and Security Review aspirations of making "…the Army more mobile and more flexible" appears to be remote until at least 2025.

The Department is beginning to learn lessons from previous armoured vehicle projects

4.9 A number of significant armoured vehicle acquisition projects of the last decade have been terminated or suspended by the Department, either because of difficulties meeting or agreeing vehicle requirements, or due to savings measures taken against projects. The Department has begun to respond to these twin challenges by buying vehicles in smaller batches to avoid large financial outlays, or by agreeing more achievable requirements that can be effectively traded to stay within budget and timelines.

4.10 On the Foxhound vehicle, the Department has utilised the rapid procurement lessons from the Urgent Operational Requirements process and financing to accelerate the purchase of equipment using a compressed standard acquisition process. The intention is to retain Foxhound after operations in Afghanistan cease, and therefore this vehicle will deploy with a robust training and support package. The Department's scientific community has also worked closely with industry to understand better the lessons from recent operations as regards defeating roadside bombs.

4.11 Based on operational experience the Foxhound has been designed with the capacity to accept at least 25 per cent growth in vehicle weight. Designed as a replacement for the Snatch Land Rover, the Department signed a £180 million contract with industry in 2010 for the initial batch of 200 vehicles. The Department intends to have the Foxhound available for training in 2011 and operations in early 2012. It is expected the Department will purchase further batches of Foxhounds in the future.

21 The Future Rapid Effect System – Specialist Vehicle, and the Warrior Capability Sustainment Programme are currently planned to begin entering service from 2017.

22 The fifth equipment is for a suitable vehicle for the Protected Mobility units. The Department expects to receive the first of 200 Foxhound vehicles in 2011, and if bought in sufficient numbers this may well be the vehicle chosen to equip the Protected Mobility units.

4.12 More recently, the Department has worked with industry on the Future Rapid Effect System reconnaissance variant to define a realistic set of requirements, and reduced some of the early development work from nine months to four. The vehicle has been based on a proven hull design, which will be used for all variants of the vehicle, although considerable modifications have been made to the turret. The hull is capable of upgrading from 32 tonnes to some 42 tonnes, and will have common electronic components to allow for further growth. The Department has also left responsibility for deciding between competing requirements to a small team, in order to deliver a realistic project to an agreed budget and in-service date, although the latter has been affected by wider Departmental savings measures. It is expected that lessons from developing the reconnaissance variant will be applied to the upcoming Warrior upgrade, and early engagement between the Department, the Army and industry has already begun to reduce risk in the project.

4.13 By procuring vehicles such as the Foxhound and the Future Rapid Effect System in smaller batches, rather than in a single, large contract, the Department may be capable of responding with greater effectiveness to the incoherent funding that has been available to armoured vehicle projects in recent years. Although having a number of smaller vehicle fleets can potentially lead to added complexity in vehicle design and support, managed correctly this should allow each follow-on batch of equipment to be upgraded incrementally so as to respond more rapidly to changing requirements. The Department has successfully demonstrated this with vehicles bought using the Urgent Operational Requirements process.

Appendix One

Methodology

1 This appendix sets out the key methodologies we employed during our fieldwork.

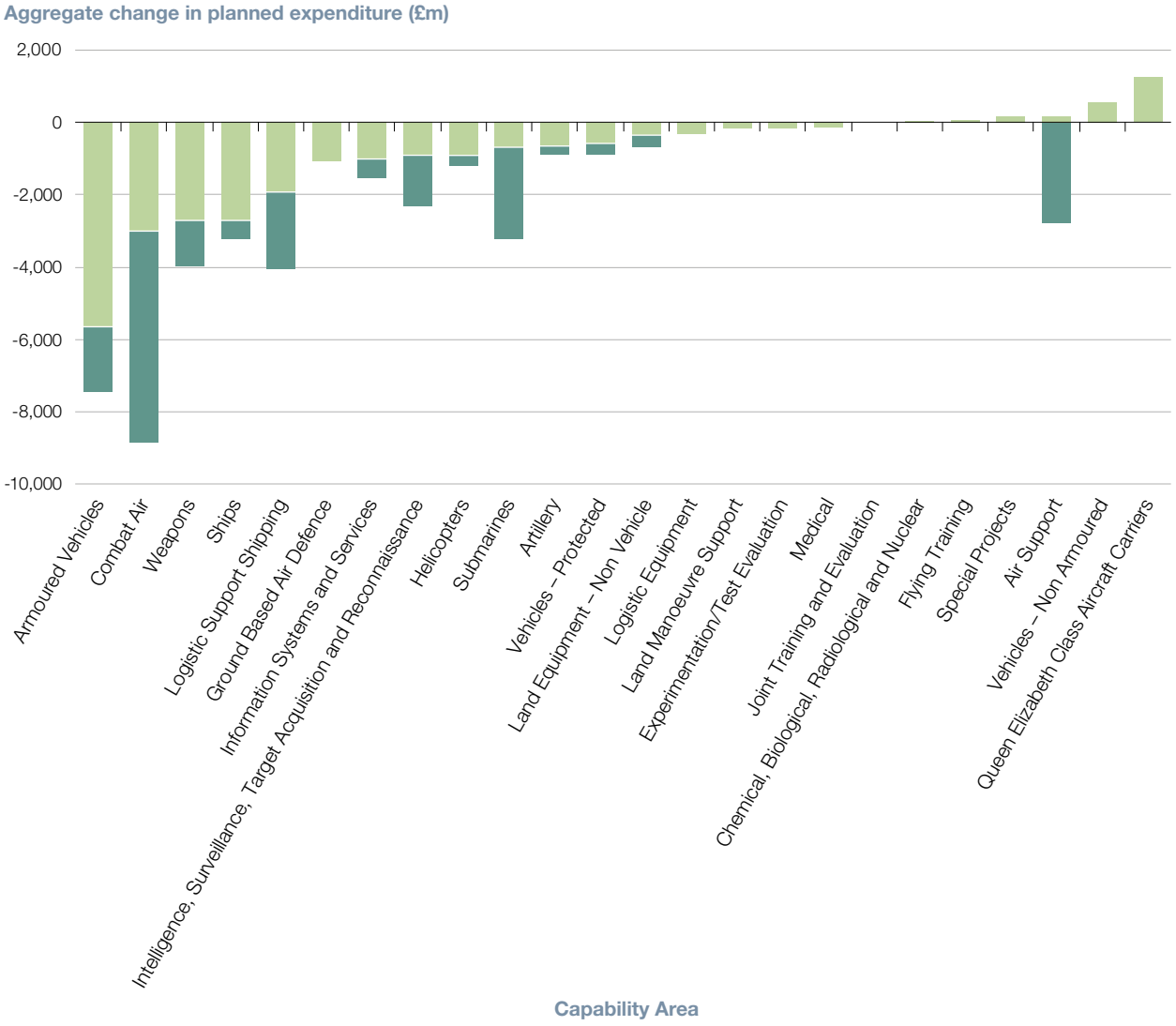
Selected method	Purpose
Semi-structured interviews	
We spoke to a range of staff in the Ministry of Defence, Defence Equipment and Support and the armoured vehicle industry.	To collect the views of those working in the area to identify the key issues, the basis for decisions and the key lessons that can be learnt.
Document Review	
We reviewed a range of key Departmental documents including Army Equipment Capability Board minutes, project diaries, business cases and other reviews.	To identify key issues, determine the Department's equipment requirements and priorities and forward plans.
Analysis of the Department's financial performance data	
We analysed the Department's financial planning data for the period since 2005.	To gain an overview of the impact of the annual planning round measures on individual capability areas over time.

2 This report highlights the impact of systemic issues in Defence acquisition and resource management by focusing on the failure to deliver a core armoured vehicle capability since 1998. Although armoured vehicles are not the only equipment that has been subject to savings measures, we have focused on these programmes as they have been subject to the largest reductions in funding over the 2005-10 period.

3 **Figure 7** overleaf also shows the Department's estimate of the impact of the Strategic Defence and Security Review on future equipment funding. This estimate indicates that Armoured Vehicles remain subject to further savings measures (Figure 7).

Figure 7

Impact of annual and Strategic Defence and Security Review (SDSR) savings measures on equipment areas



Source: National Audit Office analysis of Departmental data

Appendix Two

Glossary

Armoured Infantry	The Armoured Infantry are typically equipped with tracked, infantry fighting vehicles which offer higher levels of firepower and protection than mechanised infantry, while being more manoeuvrable and easier to deploy rapidly than tanks. The infantry can fight mounted or dismounted, utilising the vehicle's firepower and manoeuvrability.
Core programmes	Equipment projects procured as part of the Department's equipment plan and funded from the Defence budget.
Engineer vehicles	Vehicles which employ a range of heavy equipment to bridge gaps, clear obstacles and minefields on routes and to dig trenches.
Future Force 2020	The revised structure from around 2020 for the UK Armed Forces set out in the October 2010 Strategic Defence and Security Review.
Family of Light Armoured Vehicles (FLAV)/Future Family of Light Armoured Vehicles (FFLAV)	A 1980s programme intended to develop replacements for the CVR(T) and FV430 series vehicles.
Future Rapid Effect System	Programme envisaged to deliver a family of medium-weight armoured vehicles for a number of roles, providing the Department with a more deployable force than heavy forces but with greater firepower and protection than light forces.
Future Rapid Effect System – Specialist Vehicle (FRES SV)	Specialist Vehicle variant of the Future Rapid Effect System intended to deliver the next generation of reconnaissance and reconnaissance support vehicles.
Future Rapid Effect System – Utility Vehicle (FRES UV)	Utility Vehicle variant of the Future Rapid Effect System intended to deliver the next generation general mechanised infantry vehicle, including medical and command and control roles replacing vehicles such as the FV430 series and Saxon.
Mechanised Infantry	Mechanised infantry are equipped with lighter vehicles designed for improved tactical and cross-country mobility and provide protection against small arms and artillery fire. Saxon and Bulldog are examples of the vehicles that have been used in this role. Once in the combat area, the infantry generally operate on foot in close combat.

Multi-Role Armoured Vehicle (MRAV)	The MRAV programme was in collaboration with Germany beginning in 1999 with the intention to replace existing mechanised infantry vehicles. The United Kingdom withdrew in 2002 because it was not suited to emerging policy of being rapidly deployable.
Protected Mobility	Vehicles which provide the infantry with mobility but with enhanced levels of protection and survivability. These include Protected Patrol Vehicles.
Protected Patrol Vehicles	These are well protected vehicles designed to support patrolling infantry and are typically wheeled rather than tracked to give a less intimidating profile. They provide higher levels of protection against specific threats – particularly against mine blast – but do not offer the same all round protection and manoeuvrability as armoured fighting vehicles.
Reconnaissance	Reconnaissance forces gather information and battlefield intelligence by stealth utilising lighter, more manoeuvrable vehicles.
Soft-skinned vehicles	Non-armoured vehicles.
Strategic Defence and Security Review	Government document published in October 2010 which sets out the policy and objectives for Defence over the next decade.
Support Vehicles (Protected)	This refers to a range of specialist vehicles designed to provide protection to personnel in specific roles e.g. ambulances, load-carrying vehicles and engineering vehicles.
System of Systems Integrator (SOSI)	A role within the FRES UV Procurement Strategy intended to manage the FRES programme, ensure integration and interoperability between all FRES vehicle families and other UK armed forces systems. SOSI was awarded to Thales and Boeing in 2007.
Systems House	A role within the FRES UV Procurement Strategy to act as an independent expert adviser to the Department on detailed engineering and technical assessments. The Systems House role was undertaken by Atkins.
Tactical Reconnaissance Armoured Combat Equipment Requirement (TRACER)	The objective of the TRACER programme was to produce a land command vehicle fitted with reconnaissance equipment. The programme began in 1998 in collaboration with the USA. The programme was terminated in 2001 when the USA pulled out of the project.
Tanks	Heaviest class of armoured vehicle offering the highest levels of firepower and protection. They have good cross-country mobility but their weight and size preclude rapid deployment over great distances.

Treasury Reserve	A separate reserve maintained by HM Treasury to fund net additional costs of an international crisis.
Urgent Operational Requirements	A method of procurement adopted by the Department for acquisition of equipment required for current operations. If the requirement is theatre specific, unforeseen, and deliverable within 12-18 months it will qualify for funding from the HM Treasury Reserve. Where appropriate, the Department has contributed funding to Urgent Operational Requirements as well as fully funding equipment delivered through the Urgent Operational Requirements process from the core defence budget.
Vehicle Integrators	A role within the FRES UV Procurement Strategy responsible for integrating complex communication systems, electronics, command and control functions and Defensive Aid Systems into the vehicle chassis.
Warrior Capability Sustainment Programme	Project to upgrade the legacy Warrior Infantry Fighting Vehicle.

Appendix Three

Armoured Vehicle replacement projects: 1985-2030

Armoured Vehicle replacement projects: 1985-2030

Role	Principal Legacy Vehicles	First year in service	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030
Tanks	Challenger 1	1983					Challenger 2		Challenger 2 Technology Obsolete		Challenger 2 CSP (120mm Gun Obsolete)	
Armoured Infantry					WR MLI	WR IP	IFV Upgrade	WCSP	Warrior 30mm Cannon Obsolete			Warrior CSP
					Warrior (WR)	FIFV	FLCS FLCC FGMC					
Mechanised Infantry	FV432 Saxon	1962 1983	FLAV	FFLAV	MBAV	MRAV	MRAV	FRES	FRES UV	Bulldog		FRES Utility Vehicle
Reconnaissance	CVR(T) and CVR(W)	1972/ 1973	FLAV	FFLAV	TRACER		TRACER/FSCS	FRES	FRES SV	CVR(T)		FRES Scout
Protected Mobility	Snatch	1991								UORs	No core funding	
Support Vehicles	FV430 Series Saxon	1960s 1983	FLAV	FFLAV	MBAV	MRAV	MRAV (Boxer)	ABSV	ABSV modified spare Warriors FRES	FRES UV FRES SV	Bulldog	FRES Utility Vehicle

Strategic Defence Review 1998

Strategic Defence and Security Review (SDSR) 2010

Department expects UK Armed Forces to cease combat operations in Afghanistan

SDSR Force structure able to undertake expected range of operations

Fully meets requirements | Partially meets requirements | Doesn't meet requirements | Increasing obsolescence of existing fleet | Gradual introduction of new vehicles

ABSV	Armoured Battlegroup Support Vehicle
CVR(T)	Combat Vehicle Reconnaissance (Tracked)
CVR(W)	Combat vehicle Reconnaissance (Wheeled)
CSP	Capability Sustainment Programme
FFLAV	Future Family of Light Armoured Vehicles
FGMC	Future Ground Manoeuvre Capability
FLAV	Future Light Armoured Vehicles
FLCC	Front Line Command Capabilities
FLCS	Family of Land Combat Systems
FRES	Future Rapid Effect System
FSCS	Future Scout and Cavalry System
IFV	Infantry Fighting Vehicle
MBAV	Multi-Base Armoured Vehicle
MRAV	Multi-Role Armoured Vehicle
SV	Specialist Vehicle
TRACER	Tactical Reconnaissance Armoured Combat Equipment Requirement
UORs	Urgent Operational Requirements
UV	Utility Vehicle
WCSP	Warrior Capability Sustainment Programme
WR	Warrior
WR IP	Warrior Improvement Programme
MR MLI	Warrior Mid-Life Improvement

Source: National Audit Office analysis of Department data

Appendix Four

Glossary of Armoured Vehicles

Vehicles procured through the Department's core acquisition process

Vehicle Name	Key Facts	
Challenger 2	The Challenger 2 is the British Army's Main Battle Tank Maximum speed: 59kph. Crew: four.	
CVR(T) – Scimitar	Scimitar entered service in 1971 and is the British Army's principal reconnaissance vehicle.	
CVR(T) – Spartan	The Spartan is an armoured personnel carrier and has been in service since 1972. Other variants of the CVR(T) model include an ambulance, an armoured command vehicle and an armoured recovery vehicle. Crew: seven.	
FV432	FV432 is one of the FV430 family of armoured vehicles which entered service with the British Army in the 1960s. The vehicle has undergone an upgrade under the UOR process and is now known as 'Bulldog' (image shown is of upgraded 'Bulldog' vehicle).	

Panther	The Panther was introduced in 2007 as a command and control vehicle to replace the command and control variants of a number of legacy vehicles such as the CVR(T), FV432 and Saxon.	
Saxon	The Saxon was introduced in 1983 as an armoured personnel carrier and since 2009 is gradually being decommissioned. The Saxon has many variants including an ambulance, a recovery vehicle and a command post vehicle.	
Snatch Land Rover	The Snatch 1 was introduced in 1991 and has had several modifications to 'desertise' the vehicle and improve the armour protection. The Snatch is used as a patrol vehicle for peacekeeping missions and quick land transport.	
Warrior	The Warrior is part of the Armoured Infantry Battlegroup. Maximum speed: 75kph.	
Viking	The Viking was introduced in 2006 and acts as a protected patrol vehicle, consisting of two linked tracked units. Additional Viking vehicles have subsequently been purchased as Urgent Operational Requirements.	

Vehicles procured using the Urgent Operational Requirements process

Vehicle Name	Key Facts	
Mastiff	The Mastiff entered service in 2007 and is used as a Protected Patrol Vehicle. Crew: six.	
Foxhound	The Foxhound is a lightweight protected patrol vehicle designed to replace the Snatch Land Rover. The in-service date for a training capability is planned for late 2011 with the first vehicles due in Afghanistan during 2012.	
Warthog	The Warthog is a protected patrol vehicle and has four variants – a troop carrier, an ambulance, a command vehicle and a repair and recovery vehicle. Crew: three in the front and eight in the rear.	
Jackal	The Jackal was introduced to replace legacy Land Rovers in a reconnaissance role. Crew: three.	
WMIK+	Weapons Mounted Installation Kit variant of the Land Rover.	

Coyote	The Coyote is a 6x6 version of the Jackal and is utilised as a light tactical support vehicle acting in support of the Jackal 2 and allowing transportation of supplies and equipment over similar terrain.	
Ridgback	The Ridgback is a 4x4 variant of the Mastiff vehicle.	
Wolfhound	The Wolfhound is a six-wheeled version of the Mastiff and is used as a heavy tactical support vehicle used to accompany frontline patrols and carry essential combat supplies such as water and ammunition.	
Husky	The Husky is a medium tactical support vehicle, which provides protected mobility and flexible load carrying.	
Vector	The Vector is used as a Protected Patrol Vehicle.	

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