National Audit Office

MINISTRY OF DEFENCE

Major Projects Report 2008

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL | HC 64-I Session 2008-2009 | 18 December 2008

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Major Projects Report 2008

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11 December 2008

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Cover photograph courtesy of Thales, "Watchkeeper UAV takes off". Photograph on page 3 courtesy of BAE Systems. Photograph on page 10 courtesy of Thales. Photograph on page 18 courtesy of Lockheed Martin.

SUMMARY

1 The Major Projects Report 2008 covers cost, time and performance[1] data for military equipment projects in the year ended 31 March 2008. For the main report, we examined[2] 20 of the largest projects (shown in Figure 3 on page 8), where the main investment decision has been taken by the Ministry of Defence (the Department). The Report also covers ten projects, which are still in the Assessment Phase, where the main investment decision has not yet been taken (only limited performance data is reported for these projects, which are detailed in Appendix 2). Six projects are new to this year's Report. Future Lynx, Modernised Target Acquisition Designation Sight/Pilots Night Vision Sensor, Naval Extremely High Frequency/Super High Frequency Satellite Communication Terminals and Typhoon Future Capability Programme projects are all new in the post-main investment decision population, as well as the Advanced Jet Trainer project, which has previously featured as an Assessment Phase project. Project Eagle, to upgrade the mission system of the E-3D Sentry aircraft, is new in the Assessment Phase project population. Project Summary Sheets, on which our analysis is based, are compiled by the Department and summarise progress to date for each of the 30 projects. These are contained in Volume II of this Report.

1 Performance in this context refers to whether a piece of equipment is expected to meet all of its Key User Requirements, which are defined by the User, and are approved when the project receives the main investment decision.
2 Our methodology is described in Appendix 1.

2 The Department has reported to Parliament on its delivery of major defence equipment projects for over 20 years. Over the last 10 years the Department has introduced a number of major reforms of defence acquisition. While progress has been made, performance remains variable, partly reflecting the complexity of defence acquisition and rapidly changing operational requirements. To deliver battle-winning advantage defence equipments are often based on advanced technologies and have complex delivery arrangements which bring together a range of commercial partners and/or involve co-operation with other countries. In part, the performance shown in the Major Projects Report also reflects the inclusion of some projects which pre-date these reforms and, therefore, do not fully reflect the improvements which the Department expects to achieve.

Findings

3 For the period of the Report, the forecast aggregate costs of the projects[3] increased by £205 million[4] and there was an additional 96 months aggregate slippage **(Figure 1)**. The forecast cost increase is largely as a result of growth in the Beyond Visual Range Air-to-Air Missile project and Nimrod Maritime Reconnaissance and Attack Mk 4 aircraft, both of which were initiated before the most recent procurement reforms by the Department. Nine projects have experienced slippage over the past year with three, Terrier, Naval Extremely High Frequency/ Super High Frequency Satellite Communications Terminals and Soothsayer, accounting for around two-thirds of this delay. Of the 20 projects, 15 are currently forecasting to meet all of their Key User Requirements, compared to 17 last year. Sixteen individual Key User Requirements are reported as 'at risk' on six projects, compared to 12 Key User Requirements across seven projects last year, but there is mitigation action in place that is intended to address these risks.

1 Headline figures for cost, time and performance

	Major Projects Report 2008	Major Projects Report 2007
In-year cost increase	£205 million	–
In-year slippage	96 months	38 months
Number of projects to meet all Key User Requirements	15 out of 20	17 out of 20
Key User Requirements "at risk"	16, across six projects	12, across seven projects

Source: National Audit Office analysis of Departmental data

NOTE

The Major Projects Report 2007 was unable to comment on the overall in-year cost changes because of the reallocations of budgets and costs which took place.

4 The total forecast costs for all projects is £28 billion, an increase of 12 per cent (£3 billion) compared with the budgeted cost when the main investment decision was taken. Ninety three per cent of the £3 billion is historic cost growth and reported in previous Major Projects Reports, with £205 million added in-year. In aggregate the projects are now predicted to achieve their In-Service Dates 483 months later than predicted when first approved. This slippage represents a 36 per cent increase in their expected timescales since the main investment decision, four-fifths of that is historic slippage reported in previous Major Projects Reports.

Programme and project management decisions

5 Changes to the perceived threat, and the desire to achieve a more cost-effective integration on to the Typhoon aircraft, led the Department to review the Beyond Visual Range Air-to-Air Missile project. The Department has chosen to introduce the Beyond Visual Range Air-to-Air Missile capability for Typhoon three years later in July 2015, when the threat could be expected to have materialised. This decision is seeking to create a more cost-effective integration programme for the United Kingdom, by aligning the integration of the Beyond Visual Range Air-to-Air Missile and the Typhoon with both the planned delivery of a major enhancements package to the aircraft and the missile integration timescales of the other Eurofighter Nations. This rescheduling of the integration will, however, result in a number of additional short-term cost increases, contributing to an overall in-year cost growth of £111 million.

3 Typhoon has been excluded from the analysis because the numbers are commercially sensitive.
4 The forecast costs for projects already include an assumption for inflation.

6 On two projects, the Department has worked with its industrial and international partners to deliver urgently needed operational capabilities:

a **Watchkeeper** is an unmanned aerial vehicle that is designed to provide significantly improved intelligence, surveillance, target acquisition and reconnaissance capabilities from 2010. With an urgent operational need in Iraq and Afghanistan, the Department worked with the Watchkeeper contractor, Thales, to deliver the Hermes 450 system by mid-2007. The air vehicle and sensors of Hermes 450 have similarities with those used for Watchkeeper and have delivered essential capability as well as helping mitigate risk to the final delivery of Watchkeeper. A six month in-year slippage on Watchkeeper has principally been caused by a delay in the availability of a suitable trials site.

b **Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals** is a communications project mainly designed for submarines. Satellite capacity and the necessary equipments are being sourced through the United States' Department of Defense. The project is running 31 months behind schedule because of delays to United States' projects still in development, which the Department cannot directly influence. The Department has developed low cost interim solutions for both the existing Trafalgar Class submarines and the new Astute Class submarines which will mitigate the most significant effects of the potential capability gap.

Problems on projects

7 Five projects have suffered significant cost or schedule problems in the last year. The specific issues affecting the Beyond Visual Range Air-to-Air Missile are covered in paragraphs 5 and 2.32-2.38. There are a number of issues related to the remaining four projects – the Nimrod Maritime Reconnaissance and Attack Mk4 aircraft, Terrier armoured engineering vehicle, Soothsayer electronic warfare system, and Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals. Some examples are outlined below and summarised in **Figure 2**:

a **Industry project management shortcomings and the Department acting as an intelligent customer (four of the four projects).** On Soothsayer the technical immaturity and late delivery of components, together with problems identified during trials, have resulted in 16 months slippage with five Key User Requirements "at risk". The problems reflect shortcomings in Lockheed Martin's management of the project, in particular underestimating its scale and technological complexity. The Department could have done more to monitor progress and work in concert with Lockheed Martin when problems were identified.

2 Common issues emerging from our analysis of four projects with significant cost or schedule developments

Theme	Nimrod Maritime Reconnaissance and Attack Mk4	Terrier	Soothsayer	Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals
Industry project management shortcomings and the Department acting as an intelligent customer	X	X	X	X
A lack of realism from the outset		X	X	
Failure to identify the key dependencies			X	X
Under-estimating costs and timescales to resolve emerging problems	X			

Source: National Audit Office analysis of Departmental data

b **A lack of realism at the outset (two of the four).** In response to normal competitive pressures and to keep costs down, industry bidders for the Terrier contract included only one prototype vehicle. When the steering was shown to be unreliable on the prototype it took four months to resolve and meant that the later demonstrator vehicles had to be used more intensively to demonstrate reliability. The overall effect of these problems and quality issues with components has been to delay the forecast In-Service Date by 27 months.

c **Failure to identify the key dependencies (two of the four).** Significant elements of the Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals project are sourced from the United States. On the Soothsayer project, as agreed with the Department, the project managers for the contractor were originally based in the United States, which compounded the difficulties involved in resolving technical problems when they emerged. In both cases this dependency has caused slippage. The Department has a long experience of the risks associated with having very little real power to influence United States' projects. This key dependency was not identified as one of the top risks when the main investment decision was taken for the Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals project. Similarly the difficulty of managing a project from a distance was not recognised when the main investment decision was taken for Soothsayer.

d **Under-estimating costs (one of the four).** On the Nimrod Maritime Reconnaissance and Attack Mk4 aircraft project, the cost of bringing the trials aircraft up to full production standard was under-estimated, resulting in additional conversion costs which have been provisionally estimated at £50 million. Similarly, the Department made a provision of £5 million to address the impact of an issue that emerged during the flight test programme on the production aircraft. This amount proved to be an under-estimate, with a £20 million cost increase being identified this year.

8 We have analysed the projects in the current Major Projects Report population to identify the main causes of cost increases and time delays in these. This analysis is against four broad categories – changed customer requirements, associated projects, procurement management and technical factors. The analysis only includes projects on which the main investment decision has been taken, the point at which the Department considers risk has been reduced to the extent that the project should be delivered within narrowly defined time, cost and performance parameters.

9 For the projects analysed, procurement management issues and changed customer requirements are the principal causes of both slippage and cost growth in the earlier period after the main investment decision has been taken. From the middle half of the procurement lifecycle, technical factors become the main reason for cost increases and slippages to In-Service Dates. The impact of these problems suggests that the risks associated with the technical challenges of these projects are under-estimated when the main investment decisions are being made. From 2009 it is planned that the Major Projects Report will analyse in more detail the level of project maturity at the point at which the main investment decision is taken.

Overall conclusion

10 The Department has taken reasonable decisions to either accelerate the delivery of urgently needed capabilities or re-programme individual projects to reflect current defence priorities: we address some examples in this Report. While progress has been made, it is too early to judge whether the lessons from past projects are feeding through into consistently improved performance. The Department has worked closely with commercial partners on the delivery of Urgent Operational Requirements, and needs to examine what lessons might be applied to the more demanding projects that feature in the Major Projects Report. Meanwhile, best value for money is still not consistently being achieved on the Department's most complex equipment. Figure 2 identifies some of the underlying issues emerging from our review, on which the Department and its commercial partners need to increasingly focus if the performance of newer projects is to provide a more affordable and timely enhancement of capability than has been the case in the past.

3 Major Projects Report Summary of Post Main Gate Projects

Project	Description	In-year change on costs to completion (£m)	In-year change on In Service Date (months)	In-year change in Key User Requirements	Current forecast cost to completion (£m)
A400M	Heavy transport aircraft	+3	+9	No change	2,632
Advanced Jet Trainer	Fast Jet element of the wider UK Military Flying Training System programme	+3	+4	-1	467
Astute Class Submarine	Attack submarine	+8	+6	No change	3,806
Beyond Visual Range Air-to-Air Missile (Meteor)	Air to air missile	+111	In-Service Date re-defined	No change	1,279
Falcon	Deployable communication system	-1	0	No change	291
Future Lynx	Small helicopter	+2	-3	No change	1,911
Future Joint Combat Aircraft	Fighter/attack aircraft	-24	In-Service Date excluded from analysis	No change	1,834
Merlin Mk 1 Capability Sustainment Programme	Update of helicopter avionics	0	0	No change	832
Modernised Target Acquisition Designation Sight/Pilots Night Vision Sensor	Update of Apache Army Helicopter Mark 1 systems	0	0	No change	228
Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals	Highly protected, high data rate satellite communication capability	-9	+19	No change	200
Next Generation Light Anti-Armour Weapon	Short range anti armour weapon	-8	+9	No change	310
Nimrod Maritime Reconnaissance and Attack Mk 4	Reconnaissance and attack patrol aircraft	+102	+3	No change	3,602
Soothsayer	Integrated land electronic warfare system	+7	+16	No change	202
Sting Ray Life Extension and Capability Upgrade	Life extended and enhanced lightweight torpedo	-1	In service	No change	576
Support Vehicle	Cargo and recovery vehicles and trailers	+9	0	No change	1,272
Terrier	Armoured engineering vehicle	+14	+27	No change	313
Typhoon	Fighter aircraft	Commercially sensitive	In service	No change	Commercially sensitive
Typhoon Future Capability Programme	Enhancements to Typhoon aircraft	-8	0	No change	436
Type 45 Destroyer	Anti-air warfare destroyer	0	0	No change	6,464
Watchkeeper	All weather 24-hour intelligence, surveillance, target acquisition and reconnaissance capability	-3	+6	-1	898
Totals		£205 million	+96 months	-2	£27.55 billion

Source: National Audit Office analysis of Departmental data

Budgeted cost to completion at Approval (£m)	Total (historic plus in-year) Variation (£m)	Current forecast In-Service Date	Expected In-Service Date at Approval	Total (historic plus in-year) Variation (months)	Main Gate approval	Key Developments in 2007-08
2,628	+4	December 2011	February 2009	+34	May 2000	Contractor delay to aircraft delivery
490	-23	November 2009	July 2009	+4	August 2006	First year that progress on project is reported
2,578	+1,228	May 2009	June 2005	+47	March 1997	Delay due to technical problems
1,240	+39	In-Service Date redefined	September 2011	–	May 2000	Significant in-year cost growth In-Service Date definition redefined
307	-16	June 2010	June 2010	0	March 2006	Increment C approved
1,901	+10	January 2014	January 2014	0	June 2006	First year that progress on project is reported
2,034	-200	–	–	–	January 2001	_
837	-5	February 2014	February 2014	0	March 2006	_
245	-17	April 2009	December 2008	+4	September 2004	First year that progress on project is reported
269	-69	May 2012	October 2009	+31	August 2003	First year that progress on project is reported. Significant delay to In-Service Date
377	-67	April 2009	November 2006	+29	May 2002	Delay due to problems with final design qualification
2,813	+789	December 2010	April 2003	+92	July 1996	Significant in-year cost growth, delay to In-Service Date and six Key User Requirements 'at risk'
142	+60	June 2009	December 2006	+30	August 2003	Significant delay to In-Service Date and five Key User Requirements 'at risk'
727	-151	Met In-Service Date June 2006	December 2002	+42	May 1995	
1,367	-95	Met In-Service Date February 2008	September 2005	+29	November 2001	Project met In-Service Date in February 2008
295	+18	December 2011	September 2008	+39	July 2002	Significant delay to In-Service Date
(16,671) Excluded from Totals below	Commercially sensitive	Met In-Service Date June 2003	December 1998	+54	November 1987	_
444	-8	June 2012	June 2012	0	January 2007	First year that progress on project is reported
5,000	+1,464	November 2010	May 2007	+42	July 2000	_
907	-9	December 2010	June 2010	+6	July 2005	Slippage due to delay in selecting a suitable trials site
£24.6 billion	£2.95 billion	–	–	+483 months	–	

PART ONE

Cost and Timescale performance

1.1 In the first part of the Report, we examine the progress on the 20 largest equipment projects, where the Department has made the main investment decision to proceed. The current forecast aggregate cost of the 19 projects for which costs can be reported is £28 billion, which is an increase of £3 billion (or 12 per cent) compared to the total budgeted costs approved when the main investment decision was made. One project, the Typhoon aircraft, is excluded from the analysis of costs as the information is commercially sensitive. Appendix 3 provides further details of cost performance since the main investment decision. Of this cost overrun, £2.8 billion is historic; this year the overall forecast costs of the projects increased by £205 million. The majority of this increase is due to cost growth on two projects, Nimrod Maritime Reconnaissance and Attack Mk4, and Beyond Visual Range Air-to-Air Missile. Nine projects have experienced slippage to their forecast In-Service Date, with a total of 96 months of delays reported in-year. Around two-thirds of the delay occurred on three projects – Terrier, the Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals, and Soothsayer. Of the 20 projects, 15 are expecting to meet all of their Key User Requirements, compared to 17 in the previous year. Sixteen individual Key User Requirements are reported as 'at risk' across six projects, but there is mitigation action in place which is intended to address these risks.

Performance on cost

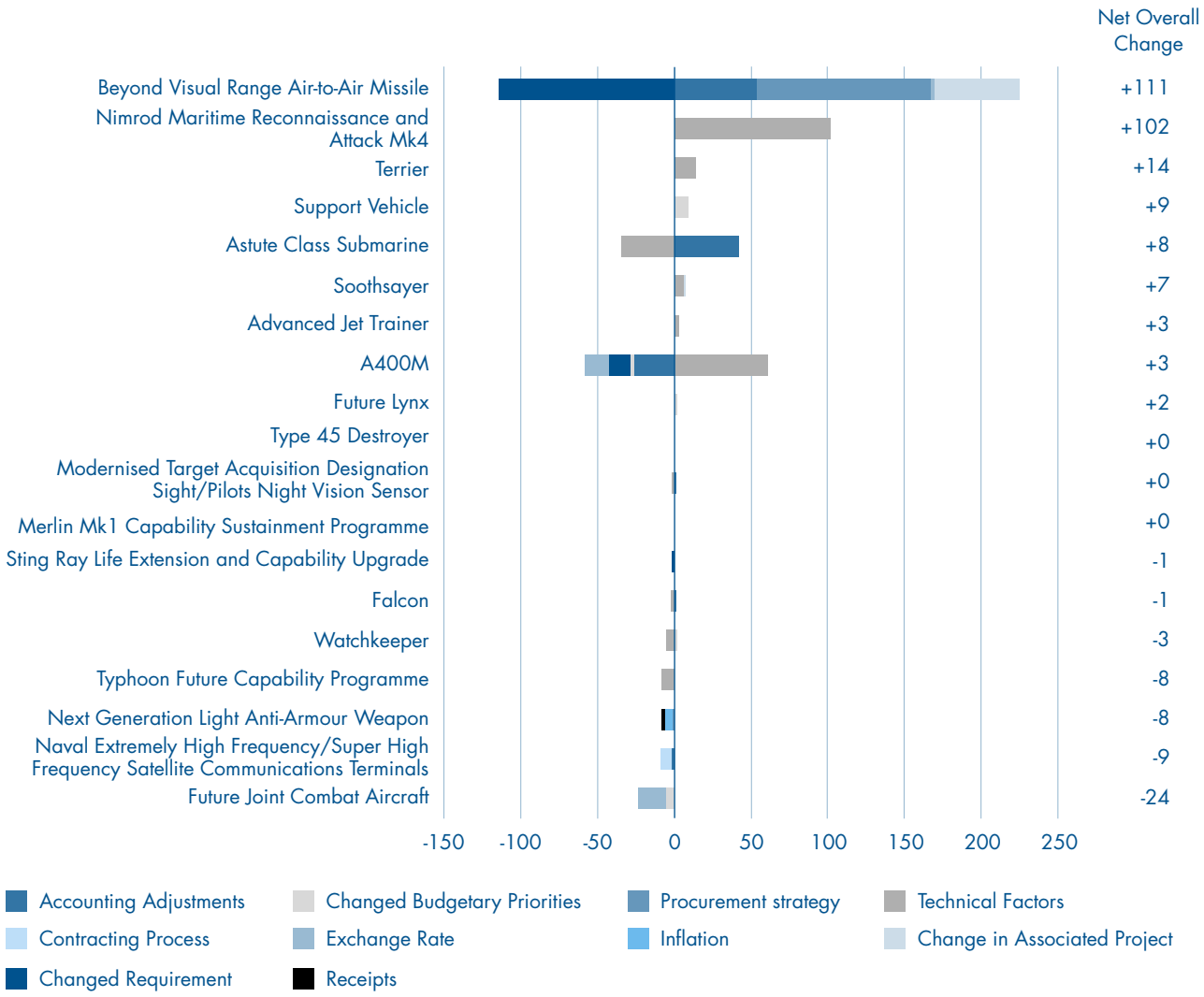
1.2 In the previous two years, the Department has reallocated £1 billion of budgets and costs beyond the scope analysed by the Major Projects Report to other areas of Defence spending. The rationale behind these moves was to enable the Department to control its costs better, by allocating budgets to those best placed to manage them. The Committee of Public Accounts, in its report on the Major Projects Report 2007, criticised the Department for continuing to reallocate budgets and costs, as this reduces transparency to Parliament of the full picture of the cost of bringing equipment into service. The Department has not reallocated money outside the scope of the Major Projects Report in 2007-08.

In-year cost changes

1.3 Forecast aggregate costs for the 19 projects have increased by a further £205 million in 2007-08, largely because of significant in-year cost growth on two projects. The forecast costs of the Beyond Visual Range Air-to-Air Missile project have increased by £111 million. This figure is made up of cost increases totalling £225 million, offset by reductions of £114 million, which includes a re-assessment of the cost of integrating the missile. The Nimrod Maritime Reconnaissance and Attack Mk 4 aircraft forecast costs have increased by £102 million this year. The reasons for the cost increases on both projects are explored in more detail in Part 2 of this Report.

1.4 **Figure 4** shows that, excluding the Beyond Visual Range Air-to-Air missile and the Nimrod Maritime Reconnaissance and Attack Mk4 aircraft, the Department has broadly kept costs under control. There have been small overall cost increases on seven projects because of technical factors and changes to procurement strategy (**Figure 5 on page 12** shows the main cost growth drivers). These cost increases are offset by seven projects which are reporting an overall decrease to their forecast costs. For the remaining three projects, there has been no overall change to forecast costs.

4 Changes to forecast costs of Major Projects in 2007-08



Source: National Audit Office analysis of Departmental data

1.5 The Department's performance in broadly balancing costs across 17 projects reflects two main aspects:

- In line with earlier recommendations by the Committee of Public Accounts, the Department has made trade-offs to reduce the impact of cost growth on some projects. For example, the Department has deleted the requirement for one of two training simulators on the A400M project to reduce the impact of cost growth in other areas and to live within its means. **Figure 6 overleaf** provides more details on developments in-year on this project.
- Some of the cost reductions on projects are due to factors that are outside the Department's control. Around £36 million of reductions are due to changes in exchange rate and inflation assumptions, which have worked predominantly in the Department's favour. The largest cost decrease has been on the Future Joint Combat Aircraft project, where the favourable rate of the pound against the dollar has resulted in an £18 million decrease to forecast costs. There is also a £16 million decrease on the A400M project (Figure 6).

Performance on time

Overall time changes

1.6 Our analysis of overall timescale performance is based on 18 projects. The remaining two are excluded for the following reasons:

- Future Joint Combat Aircraft is part of the United States' Joint Strike Fighter programme and is aligned with its acquisition lifecycle. The current approval is for the cost of the System Development and Demonstration phase only and further approval will be sought for the cost and In-Service Date of the main procurement phases.
- The Beyond Visual Range Air-to-Air Missile project is excluded from the analysis because of the changes that have been made to the definition of the In-Service Date. The changes are covered in detail in Part 2 of this Report.

Overall, the 18 projects for which time performance can be reported are now predicted to achieve their In-Service Dates in aggregate 483 months later than expected when they were approved, which is a 36 per cent increase in their expected timescales.

5 Main reasons for cost growth

Factor	Net in-year cost growth £ million
Technical Factors	+141
Procurement Strategy	+112
Accounting Adjustments	+65
Change in Associated Project	+56
Changed Budgetary Priorities	+4
Receipts	-2
Inflation	-5
Contracting Process	-7
Exchange Rate	-31
Changed Requirement	-128

Source: National Audit Office analysis of Departmental data

NOTES

These figures represent the net increase in-year by factor across all projects, and are the combined effect of increases and decreases in each category.

Accounting adjustments includes changes to cost of capital charges.

In-year time changes

1.7 Our analysis of timescale performance in-year is based on 16 projects, excluding a further two projects. Typhoon and Sting Ray Life Extension and Capability Upgrade have already entered service and are therefore excluded from any analysis of in-year trends. Historic delays to these two projects totalled 96 months.

1.8 One project, the Support Vehicle (Cargo and Recovery), met its In-Service Date during 2007-08, and the vehicles are now entering service in Iraq and Afghanistan. Appendix 4 provides further details on time variations against approved In-Service Dates.

6 Developments on the A400M project

A400M is an air transport plane designed and manufactured by Airbus Military Sociedad Limitada. The aircraft is designed to provide mobility to all three Services, meeting the requirement for an airlift capability to move large single items such as attack helicopters and large engineering equipment, which was first identified in the Strategic Defence Review of 1998. A400M is a collaborative programme involving Germany, France, Turkey, Spain, Belgium, Luxembourg and the United Kingdom. A total of 180 aircraft are planned to be procured through a contract with Airbus Military, and the United Kingdom's planned share is 25 aircraft. The project has been delayed subsequently by a variety of contractual and budgetary difficulties affecting all partner nations. The project has slipped by a further nine months in 2007-08, as the contractor is unable to deliver the aircraft when originally planned, and the Department now expects to achieve the In-Service Date (delivery of the seventh aircraft) in December 2011, with the final aircraft delivered four years later. The Department plans that the A400M fleet will deliver the full range of operational benefits by 2018.

The additional delays to A400M have led to an increase in forecast costs of £13 million because of an increased cost of capital charge. An additional £61 million of cost growth is due to higher estimates for training and other facilities that the Department is responsible for providing. These cost increases are offset by a number of savings, which means that the net in-year cost growth is only £3 million. Examples of savings are £26 million by deleting the requirement for one of two training simulators, and another £16 million through favourable exchange rates.

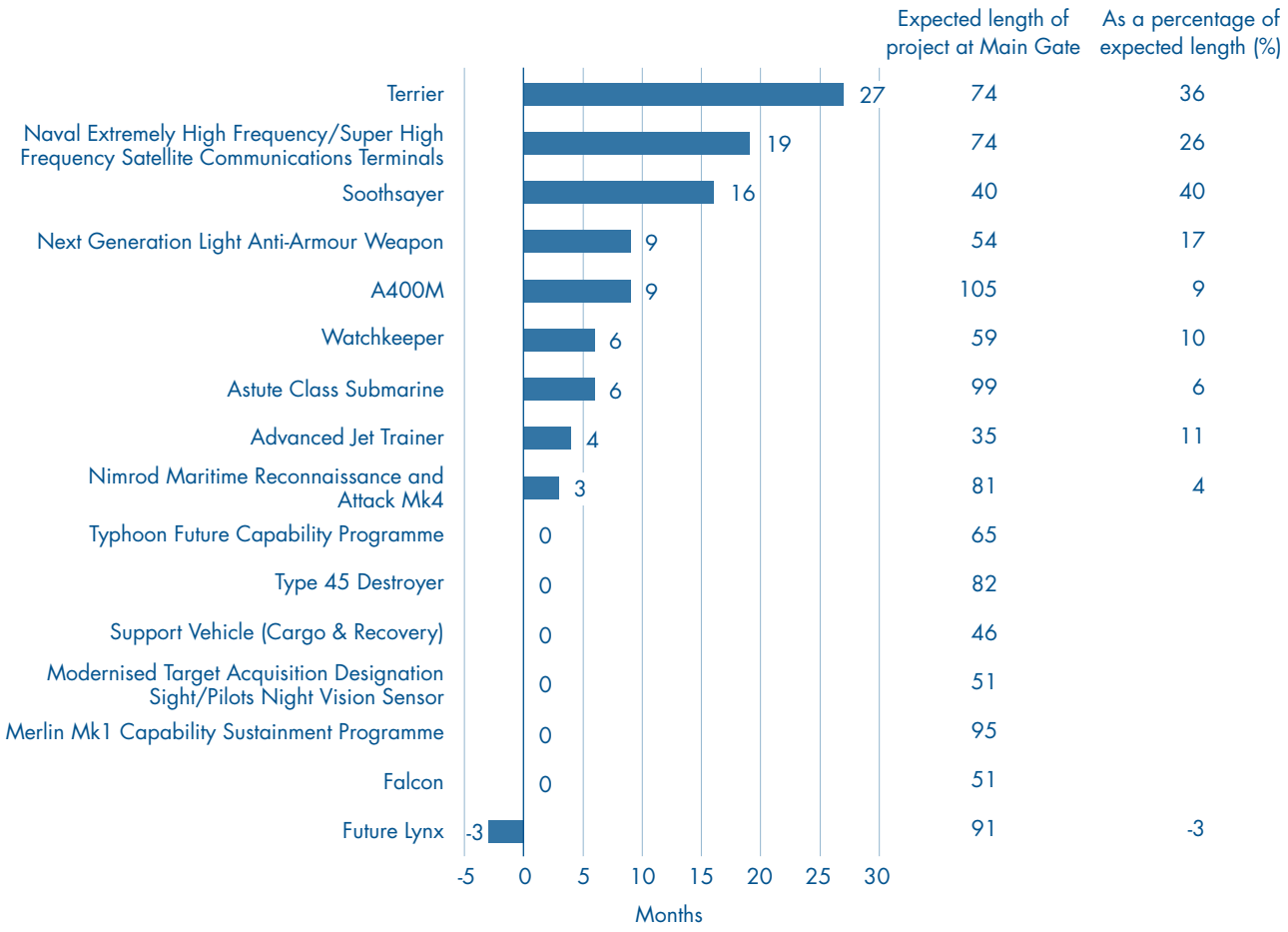
The A400M will replace the current capability provided by the Hercules C130K aircraft. The Department will incur an additional £41 million of expenditure on life-extension of the C130K as a result of the delays to A400M. £15 million of this was newly identified in 2007-08, and includes the costs of re-winging five Hercules C130K aircraft.

Source: National Audit Office analysis of Departmental data

1.9 **Figure 7** shows the time performance in-year for those projects which are not yet in service, or which entered service during the year. More than half of the projects (nine out of 16) have been further delayed in year, with a total of 96 months of in-year slippage; around two-thirds of this is attributed to three projects. This compares to overall in-year delays of 38 and 33 months reported in the Major Projects Reports 2007 and 2006, respectively. One project, Future Lynx, has recovered three months against the schedule. A potential slip to the In-Service Date for which the project had made provision in a previous year will no longer materialise following approval of the Future Lynx Training Services' Initial Gate Business Case.

1.10 **Figure 8 overleaf** shows that the main cause of delays continues to be unforeseen issues with the technology required to deliver these projects. The largest delay, 27 months on the Terrier project, was caused by the late delivery of the demonstrator vehicles, combined with failure of the prototype vehicle to reach its reliability target, requiring longer reliability trials in the Demonstration Phase.

7 Change to forecast project length in 2007-08



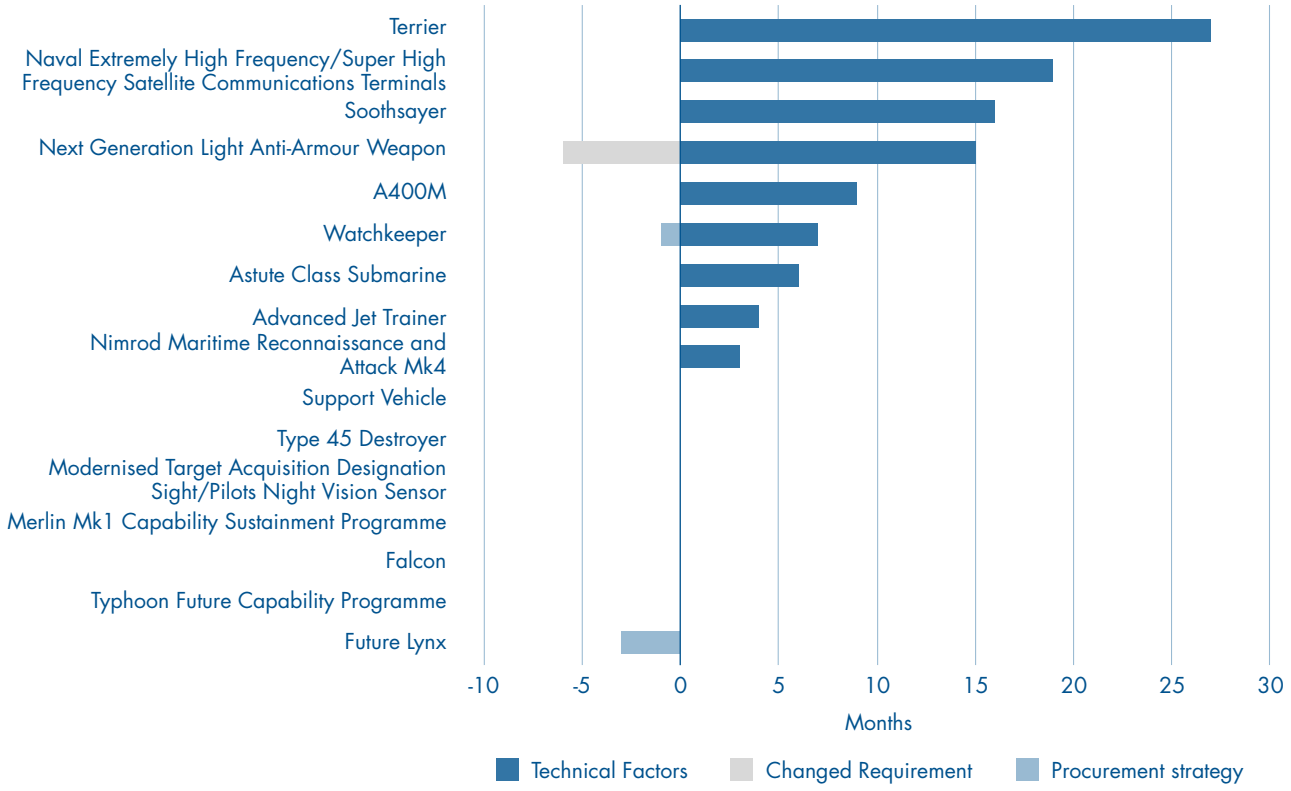
Source: National Audit Office analysis of Departmental data

NOTES

The reasons for the delays on the Terrier, Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals, Soothsayer and Nimrod projects are covered in more detail in Part 2, page 18.

The reasons for the delays on the Next Generation Light Anti-Armour Weapon, A400M, Watchkeeper and Astute Class Submarine projects are covered in more detail in paragraphs 1.13–1.14, Figure 6, 6a and 1.11–1.12, respectively.

8 Main reasons for delays to projects in 2007-08



Source: National Audit Office analysis of Departmental data

1.11 During the reporting period, the Astute Class Submarine has suffered a further six months delay in-year, caused by technical problems arising during testing. The Astute Class Submarine is the replacement for the existing Swiftsure and Trafalgar classes of nuclear attack submarine. The Department originally approved three boats, and a fourth was placed on contract in May 2007 (the Major Projects Report only reports progress for the first three boats). It is expected that there will be a class of seven. Four boats are currently under construction. The First of Class was launched in June 2007 and has begun commissioning. Sea trials are due in 2009.

1.12 The project has a history of cost overruns and delays. At the start of the reporting year these totalled £1.2 billion and 41 months, respectively. The project has slipped by a further six months in 2007-08, giving a total overall delay of 47 months, due to technical problems which have arisen during testing. It is too early to say exactly what the effects of the technical problems will be and the Department is examining how to minimise the effect of the delay. The delays have not yet resulted in any increase to forecast costs or any Key User Requirements being declared "at risk" and the existing Swiftsure and Trafalgar classes continue to operate to cover any potential gaps in capability. Since March 2008 there has been a further slippage to the Astute Class Submarine project and the Department and BAE Systems are working together to determine how best to minimise the impact on the project.

1.13 The Next Generation Light Anti-Armour Weapon project has been delayed by a further nine months in-year because of continuing problems with the Design Qualification Trials of the missile. The project is designed to provide a man-portable, short range weapon for use against armoured targets. It is an enhanced off-the-shelf procurement, developed in collaboration with Sweden. The project includes delivery of the weapons, training systems and equipment support. It is on budget, but has experienced delays. The Major Projects Report 2007 reported that the weapon had failed its Design Qualification Trials, delaying the project by 20 months in total.

1.14 The Department has experienced further problems with the trials in 2007-08, meaning extra testing has been required so that the weapon can demonstrate all the requirements for reliability. These problems have led to further in-year slippage totalling 15 months. At the same time, the Department has reduced the number of weapons required to meet the In-Service Date, as it has revised its assessment of the number of weapons needed to equip a brigade. The redefinitions mean that overall there has been an in-year delay of nine months. There is no impact on current operations as there is no armour threat.

1.15 The continued delays to projects may result in the Department needing to extend the Out-of-Service Dates of other equipment, purchasing additional equipment to address a potential capability gap, or accepting a capability gap until the replacement is ready. For example, the Department has a potential capability gap in combat engineering because the Terrier's predecessor vehicle, the Combat Engineer Tractor, was withdrawn from service in March 2008. Were Terrier to be available at its original In-Service Date it would be expected to be deployed on current operations. The Department does not believe the delay to Terrier will have an operational impact in the short-term because to meet the specific requirements of current operations it has procured 13 High Mobility Engineer Excavators from JCB for £6.2 million and is adding protection to a range of engineering plant, including the Medium Wheel Tractor. The Department believes that each of these platforms provides some "special-to-role" engineering capabilities, but that they do not provide the degree of tactical mobility, protection and thus operational flexibility afforded by Terrier.

1.16 The Department is currently responding to a high level of Urgent Operational Requirements, which has influenced at least one project, the Watchkeeper unmanned aerial vehicle. Watchkeeper is designed to provide a 24 hour, all weather, intelligence, surveillance, target acquisition and reconnaissance capability supplying accurate, timely and high quality imagery. This project is not due to come into Service until 2010, but the Department had identified an urgent operational need for the capability that this aircraft will provide. The Department worked with the contractor, Thales, to fast track the delivery of an interim capability, Hermes 450, by mid-2007. The air vehicle and sensors of Hermes 450 have similarities with those to be used for Watchkeeper but have less overall capability. Through Hermes 450 the Department and its contractor, Thales, have delivered badly needed capability to Iraq and Afghanistan. The work that has been completed on Hermes 450 will also help de-risk the final delivery of Watchkeeper.

Performance on Key User Requirements

1.17 Fifteen of the 20 projects on which the main investment decision has been taken are expected to meet all of their Key User Requirements, compared to 17 reported in Major Projects Report 2007. As reported previously, the Department does not expect to meet one Key User Requirement on the Sting Ray torpedo, one on the Typhoon aircraft, and three for Support Vehicle. Two additional projects are reporting this year that a Key User Requirement will not be met. The Advanced Jet Trainer project is not expected to meet a Key User Requirement relating to the detection range of the radar on the training aircraft simulator, and the Watchkeeper project is not expected to meet a Key User Requirement relating to data exchange. In both cases, the original Key User Requirement has been redefined as the Department has assessed it is no longer necessary to meet the original high standard and performance at a lower standard is acceptable. Both projects are expecting to meet their revised Key User Requirements.

Key User Requirements "at risk"

1.18 Declaring a Key User Requirement "at risk" does not necessarily mean that it will not be met. The majority of Key User Requirements previously declared "at risk" are now back on track following actions to mitigate the risks. For example, risks to two Key User Requirements on the Type 45 Destroyer, which were reported last year, have been mitigated by a decision to upgrade the Combat Management System software, which will provide the required functionality.

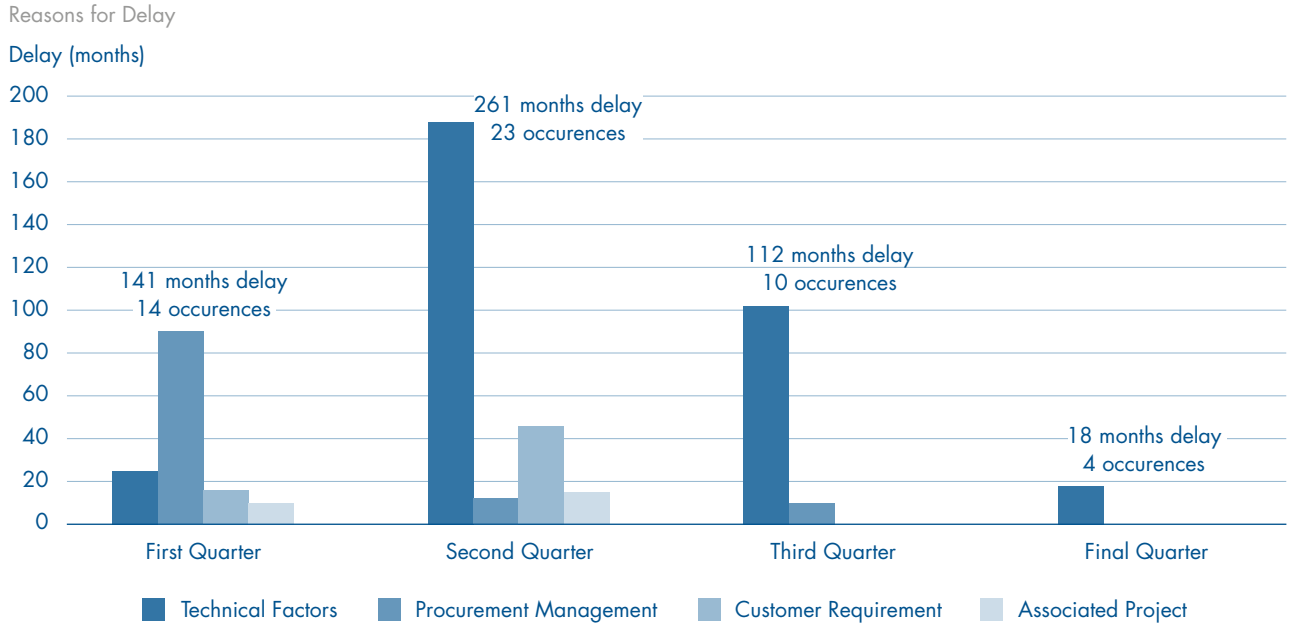
1.19 Sixteen Key User Requirements on six projects (eight per cent of the total number) are considered to be "at risk", which means there is a possibility that the Key User Requirement will not be met, but there is mitigation action in place to address this risk. Of the 16, two on the Future Joint Combat Aircraft, one on the Nimrod Maritime and Reconnaissance Mk 4 aircraft, and one on the Typhoon project were reported in the Major Projects Report 2007. Twelve Key User Requirements have been declared "at risk" on four projects for the first time this year. All of these problems are due to technical factors. Five new Key User Requirements have been declared at risk on the Nimrod Maritime Reconnaissance and Attack Mk 4 aircraft, and five on the Soothsayer project. These projects are examined in more detail in Part 2. The other two Key User Requirements at risk are on the Future Lynx helicopter, where there are concerns about one aspect of the performance of the radar, and the Watchkeeper unmanned aerial vehicle electro-optical/infra-red sensors. Although the electro-optical/infra-red sensors meet the original contract, operational experience has changed the requirement, which is currently subject to contract negotiation.

Problems and the project lifecycle

1.20 **Figures 9 and 10** assess the principal causes of cost increases and slippage to projects in the Major Projects Report 2008 across four broad categories – changed customer requirements, associated projects, procurement management and technical factors. We looked at 92 recent occurrences of cost increases across 15 projects and 51 recent time delays across 16 projects after the main investment decision had been taken. This represents the point at which the Department considers risk has been reduced to the extent the project should be delivered within narrowly defined time, cost and performance parameters. We used either the actual In-Service Dates for projects or, where the project has yet to enter service, the currently planned In-Service Date, and divided the actual or forecast project length into quarters to analyse where and what type of cost increases and slippages occur during each segment.

1.21 Procurement management issues and changed customer requirements were the principal causes of both slippage and cost growth in the early part of the procurement cycle after the main investment decision has been taken. For example, Terrier reported a 12-month slippage in the Major Projects Report 2007 because of a changed customer requirement for fitting the Bowman communications system. Associated projects have also been a factor in slippage and cost increases in the earlier part of the procurement cycle. These have relatively less impact on slippage and cost growth than procurement management and changed customer requirements issues, although in 2005 Soothsayer reported a £55 million increase in costs because of a change in the vehicle designated to carry the equipment. From the middle half of the procurement lifecycle technical factors become the main reason for cost increases and slippages to In-Service Dates. For example, in 2006 the Panther Command and Liaison Vehicle reported a six-month slippage to its 2007 In-Service Date because of reliability issues.

9 Profile of delays to In-Service Dates by project length

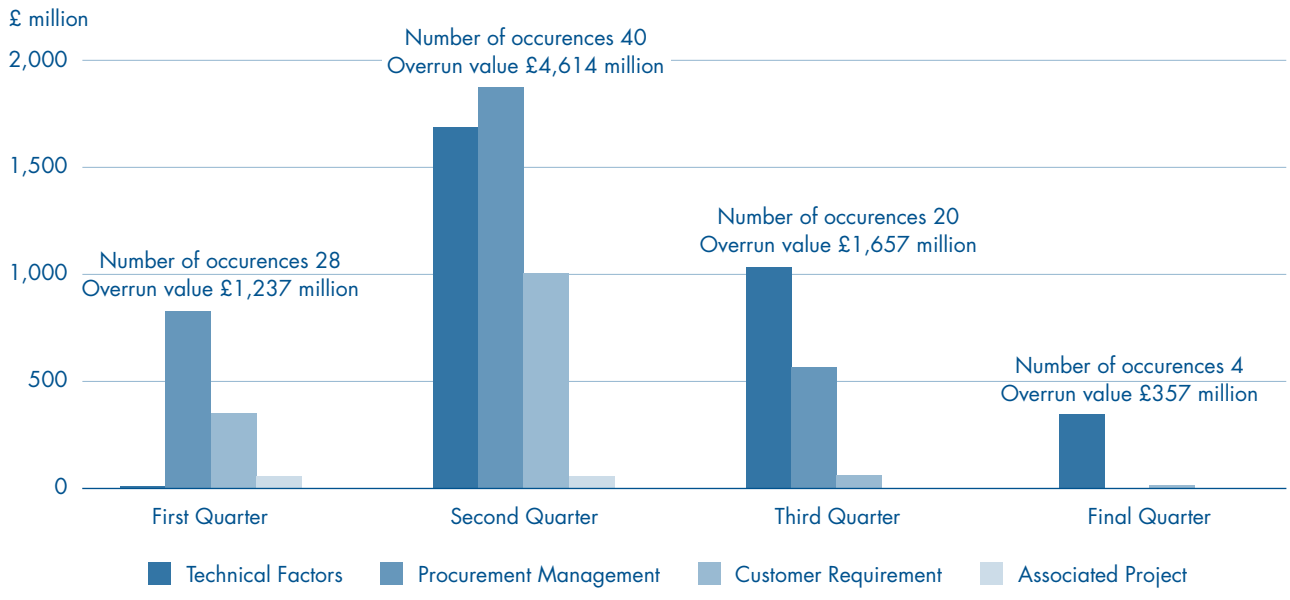


Source: National Audit Office analysis of Departmental data

NOTE

Population based on 51 recent occurrences of time delays across 16 projects from Major Projects Report 2008, which have suffered slippage to their In-Service Dates.

10 Profile of cost increases by project length



Source: National Audit Office analysis of Departmental data

NOTE

Population based on 92 recent occurrences of cost increases across 15 projects from Major Projects Report 2008, which have suffered cost increases.

PART TWO

Key developments on specific projects

2.1 This Part of our Report provides further details of five projects which have suffered the most significant cost or schedule problems in this year's Report. The projects are:

- Nimrod Maritime Reconnaissance and Attack Mk4 aircraft (paragraphs 2.2-2.8);
- Terrier armoured engineering vehicle (paragraphs 2.9-2.17);
- Soothsayer electronic warfare system (paragraphs 2.18-2.25);
- Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals (paragraphs 2.26-2.31); and
- Beyond Visual Range Air-to-Air Missile (Meteor) (paragraphs 2.32-2.38);

Nimrod Maritime Reconnaissance and Attack Mk4 aircraft

2.2 The Nimrod Maritime Reconnaissance and Attack Mk4 aircraft is planned to replace the Mk2 aircraft currently in service. It will enter service in 2010 and is designed to deliver significantly enhanced Anti-Submarine and Anti-Surface Warfare capability. A contract for 21 aircraft was originally awarded to BAE Systems in 1996, although the number of aircraft to be acquired has subsequently been reduced to "about" 12 following a reassessment of the threat. The project has had a long history of delays (a total of 89 months was reported in Major Projects Report 2007) and cost increases (£687 million reported in Major Projects Report 2007, a 24 per cent increase over approved costs) reflecting a mixture of technical problems, resourcing shortfalls and the need to incorporate the cost increases within the constrained defence budget.

2.3 In the last year the project has slipped by a further three months and costs have increased by £102 million, including a cost of capital increase of £12 million.

The costs of converting the development aircraft

2.4 When the Department placed the production contract in 2006, it included an option to convert the three development aircraft used for the trials programme to the same standard as the production aircraft. More detailed work on this option has indicated that the cost of bringing the trials aircraft up to full production standard was under-estimated, resulting in additional conversion costs which have been estimated at £50 million (reported in 2007-08).

Cost and performance implications of technical problems

2.5 Flight testing identified problems with the stability of the aircraft in flight. To address these issues a combined Stability Augmentation System/Stall Identification Device (SAS/SID) has been developed and is undergoing flight testing on one of the development aircraft. The Department had already made a provision of £5 million in the forecast costs of the project to embody the solution to these problems in the production aircraft, but this proved to be an under-estimate; an additional £20 million of cost increase is being reported this year.

2.6 The technical issues that have arisen during the flight testing programme have led the Department to categorise six Key User Requirements as being "at risk", of which five are new this year. The Department and BAE Systems have already developed mitigating actions for a number of these issues, although these are being tested. Following the outcome of the testing, the Department will have a clearer idea of when these Key User Requirements will be met.

Problems with the Flight Test Programme

2.7 The flight test programme is running behind schedule. In part the flight test programme delay reported this year reflects the technical problems that have emerged and which have required additional flight testing, but there have also been shortcomings in planning and executing the flight testing itself. There have been problems with aircraft ground maintenance, modification and turn-around procedures. The extension to the flight test programme has resulted in a £20 million cost increase.

2.8 The Department is working closely with BAE Systems to limit the delays to the flight test programme. The flight test programme has been reviewed to make more intensive use of the trials aircraft by, for example, scheduling weekend flights and ensuring that the project has priority access to BAE Systems' mechanics. BAE Systems has also introduced additional incentives for its staff to meet challenging milestones.

Terrier

2.9 Terrier is a mobile armoured engineering vehicle which is designed to be used for operations ranging from warfighting to peace keeping. Terrier will replace the Combat Engineer Tractor, and is designed to provide more capability. In 2002, the Department placed a contract for the Demonstration, Manufacture and initial logistic support of 65 Terrier vehicles with BAE Systems Land Systems. The project is currently in the Demonstration Phase, having previously suffered a delay of 12 months because of a contract amendment to modify the Bowman radio installation on the Terrier vehicles.

2.10 In the last year the project has slipped by a further 27 months and costs have increased by £14 million.

Problems demonstrating Terrier's reliability

2.11 The Department used competition to ensure value for money. The winning bidder proposed the use of one prototype vehicle and four demonstrator vehicles. The level of risk associated with this approach was more than was appreciated during the bid evaluation. The prototype is used to prove the performance and reliability of the vehicle as changes and improvements are made to the product design. Opting for just one prototype vehicle introduced additional risks on the project. Since the reliability trials were on the critical path for project delivery, these risks materialised when the steering was shown to be unreliable. The Department had limited ability to influence resolution of the problem given the fixed price contract it had agreed with BAE Systems, which theoretically passed the risks to the company. Failures on the vehicle reduced its availability to such an extent that the expected level of reliability improvement was not demonstrated within the planned timescales.

2.12 A knock-on effect of the problems with the prototype was that the demonstrator vehicles (used to prove the performance and increasing reliability of representative manufacturing vehicles) started the next phase at a lower level of reliability. They therefore had to be used to prove a higher level of reliability growth than originally planned and to do so at a later stage of the project. Both factors meant the Department had to take on increased risks and meant extra time would be required for the contractor to demonstrate the required reliability growth. For example, the number of completed battlefield missions needed to prove reliability increased by 75 per cent compared to the original plan for the demonstrators.

2.13 The risk associated with the increased reliance on the demonstrator vehicles was compounded by problems with the poor quality of some of the components being delivered to BAE Systems by other companies in their supply chain and poor control of the build process. Resolving these issues meant that the first demonstrator vehicle was completed four months behind schedule.

Resolving the problems

2.14 The full extent of the problems on the project became apparent in September 2007 when BAE Systems declared that it would miss one of the programme's key milestones, the Release for Production, placing the company in default of the contract. Under the terms of the contract the company submitted a rectification plan and BAE Systems and the Department have been working together to examine how best to deliver the project. The project has been reviewed by the Project Rehabilitation Unit, an independent team within Defence Equipment and Support whose role is to intervene when there are problems with projects and provide a diagnosis and recommended treatment.

2.15 The first major milestone in the formal trials programme, required for the Release for Production, was completed in August 2008. The forecast In-Service Date has, however, slipped by a further 27 months, which is the Department's assessment of the additional time needed for the project to meet all the requirements to declare the In-Service Date given the increased time needed to prove reliability.

2.16 The Department and BAE Systems are in discussions around commercial settlement as a result of BAE System's default but the Department is confident that it will not incur any additional cost beyond the £14 million additional cost of capital charge and increased project support costs as a result of the extended length of the project. These costs may be offset if the Department recovers liquidated damages payable by BAE Systems under the contract.

The effect of the delays on capability

2.17 Terrier will replace the Combat Engineer Tractor that was withdrawn from service in March 2008 because of concerns about the safe integration and operation of the Bowman communications system, reliability and obsolescence problems. The delays to Terrier will extend this capability gap; but users have been willing to accept that the vehicles will not be available to support operations until 2012 rather than risk a lower level of reliability. The Department does not believe that the delays will have an operational impact in the short term because of Urgent Operational Requirement action to purchase alternative engineering vehicles for current operations, including the JCB High Mobility Engineer Excavators.

Soothsayer

2.18 Soothsayer is a ground-based, electronic warfare system which detects, locates and identifies radio and radar signals. It is designed to provide 24 hour, all weather intelligence for commanders on operations. Some of the specific details of the project are classified and our analysis therefore contains some generalised comments.

2.19 A contract for the Demonstration and Manufacture of Soothsayer was awarded to Lockheed Martin in August 2003. Soothsayer will be delivered in three phases. The first and second phases involve installing the equipment on a "soft skinned" vehicle called Meonic. The third phase will install the equipment on to an armoured vehicle platform. There have been difficulties with both vehicles. There have been problems with the reliability of the Meonic vehicle which have caused a 10-month delay and a £14 million cost increase. These problems have now been resolved. Cancellation of the original project to provide the armoured platform (the Multi-Role Armoured Vehicle) led to a £41 million increase in forecast costs. The current plan is to deliver the armoured platform as part of the Future Rapid Effect System programme.

2.20 In the last year the project has slipped by a further 16 months and costs have increased by £7 million because of the increased cost of capital charges caused by the system production and test delays.

Technical and delivery problems

2.21 There have been problems with the technical maturity and timeliness of delivery of some of the components being supplied to Lockheed Martin by both other companies in their supply chain and as Government Furnished Equipment (e.g. Bowman equipment). For example, one component, which the Department and prime contractor believed was technically mature, was nine months late because of software problems. In total, the technical and delivery problems have resulted in 16 months of slippage and the Department is currently working with Lockheed Martin to develop a joint risk analysis and agree new target delivery dates, although the contract will only be amended once the outstanding technical issues have been resolved.

2.22 The problems with the delivery of technically immature components, together with issues identified during acceptance trials concerning some limitations in the performance of the equipment and problems with interoperability, mean that the Department assesses that five of the nine Key User Requirements on the project are "at risk". The Department is currently assessing the cost and timescale impact of fully meeting all the Key User Requirements.

2.23 The Department and Lockheed Martin consider that the fact that the project managers and key subcontractors were originally located in the United States made it more difficult for the Department to oversee progress once technical problems arose with elements on the critical path of the project. This risk was not specifically reflected in the Business Case against which the project was approved.

Resolving the problems

2.24 The Department believes that the problems on the project reflect in part shortcomings in Lockheed Martin's management of the project. In particular the company underestimated the scale and technological complexity of the project, so the schedule and technical risk assessments were over-optimistic. For its part, the Department has recognised that it should have done more to monitor progress and work in concert with Lockheed Martin when problems became apparent. The Department is now working with Lockheed Martin to develop a joint risk analysis and to improve the customer-supplier relationship. Internally, the project is also being monitored more actively and a dedicated delivery manager has been appointed within the project team.

The effect of the delays on capability

2.25 The existing Odette electronic warfare system is not due to go out of service until 2010 and is assessed as being sufficient to meet the needs on current operations, albeit that it has mobility limitations and is suffering from obsolescence. Military users have confirmed they are willing to wait longer to benefit from the improved capability that the full Soothsayer capability will provide rather than trading performance to bring Soothsayer into service earlier. As such, there will only be a capability gap if there are further delays to Soothsayer, taking it beyond the planned Out-of-Service Date for Odette.

Naval Extremely High Frequency/ Super High Frequency Satellite Communications Terminals

2.26 Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals is a communications project mainly for submarines. The ability to communicate at Super High Frequency will enable high capacity information exchange, but it does not offer the required levels of performance in all environments. The Extremely High Frequency element of the project satisfies all the Key User Requirements by enabling the exchange of large volumes of information whilst protecting against jamming and ensuring a submarine remains hard to detect. The system is designed to be interoperable with the United States and with other allies. Some of the specific details of the project are classified and our analysis therefore contains some generalised comments.

2.27 During the Assessment Phase it was determined that developing and integrating Extremely High Frequency capability on United Kingdom satellites would have been disproportionately expensive. To achieve value for money, the Department therefore negotiated a Memorandum of Understanding with the United States' Department of Defense to have use of a small share of the capacity on the satellites being developed under the United States Advanced Extremely High Frequency satellite project. Terminals, submarine masts and antennas for ships and shore stations are being sourced through Foreign Military Sales agreements with the United States' government. The approved cost of the programme is £290 million. Once delivered, the equipment will be supplied by the Department to its existing commercial partners. They will install it on the various United Kingdom platforms for which they are already contractually responsible.

Technical problems

2.28 Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals is running 31 months behind schedule. The delays reflect technical problems on the United States Advanced Extremely High Frequency satellite project and United States' contracting delays to the Navy Multiband terminals (required to operate the Advanced Extremely High Frequency capability). The United Kingdom's financial contribution under the Memorandum of Understanding with the United States is fixed, so the problems have not affected project costs, with a forecast in-year decrease of £9 million.

Resolving the problems

2.29 As a minority customer on a United States-led development project, the Department has only limited ability to influence its progress; this key dependency on the United States was not identified as one of the top 12 risks in the Business Case against which the main investment decision was taken.

2.30 The Department has responded to the delays with interim solutions for both the existing Trafalgar Class submarines and the new Astute Class. For the Astute Class Submarines that are planned to enter service from 2009, the Department has negotiated the early release of modified Super High Frequency terminals with the United States' Department of Defense, and will operate these using capacity on the United Kingdom's Skynet 5 satellites.

2.31 For the three existing Trafalgar Class submarines the Department procured an interim solution called the Enhanced Ship Submersible Nuclear Information exchange. The system cost £5 million (£3 million for procurement and £2 million for support) and entered service in January 2007 to address what would otherwise have been a critical capability gap. Compared to Naval Extremely High Frequency/Super High Frequency Satellite Communications Terminals the system offers lower rates of data exchange and is less covert, reducing the submarine's ability to contribute to some military tasks.

Beyond Visual Range Air-to-Air Missile (Meteor)

2.32 The Beyond Visual Range Air-to-Air Missile (Meteor) will be launched from the Typhoon aircraft, and is designed to have the ability to chase and destroy highly agile manoeuvring aircraft, therefore helping to sustain air superiority. The missile is being procured through a collaborative programme with Germany, Spain, Italy (all for launch from Typhoon), France (launch from Rafale aircraft) and Sweden (launching from the Gripen aircraft). A contract was placed with MBDA UK Ltd in December 2002 and the project is currently in the Development Phase. So far only the United Kingdom has exercised its option to commit to production of the missile. In the last year the cost of the project has increased by £111 million (made up of cost increases totalling £225 million offset by reductions of £114 million including a re-assessment of the cost of integrating the missile).

The lack of availability of Typhoon aircraft for trials

2.33 The project schedule was predicated on a Typhoon aircraft – to be provided by the four Eurofighter partner nations – being available for missile test firings during the development phase. The Eurofighter nations and the NATO Eurofighter and Tornado Management Agency were unable to reach agreement with Eurofighter GmbH (the manufacturer of the Typhoon) on allocation of an aircraft, so the Typhoon aircraft fleet used for testing remained focused on other aircraft development work. As a result, no Typhoon aircraft was made available within the required timescales, causing a 15-month slip to the end of the Beyond Visual Range Air-to-Air Missile development phase.

2.34 In 2007, the Department provided two Tornado F3 aircraft to act as the primary trials platform, supported by a Gripen aircraft supplied by Sweden. At the time the Department's plan was to re-introduce the Typhoon as the missile development matured. The Department's liability to fund a share of the additional development activity on the Tornado and Gripen aircraft has resulted in increased costs on the project in the last year of £55 million.

The evolving strategic environment

2.35 In 2007, the Department reviewed the likely environment in which the Typhoon (and its existing and planned armaments, including the Beyond Visual Range Air-to-Air Missile) would be required to operate in future. This work concluded that Typhoon's existing Advanced Medium Range Air-to-Air Missile would provide sufficient capability out to 2015, albeit at an additional cost of £5 million to extend the life of these missiles for another year.

2.36 As part of its assessment, the Department also considered the number of Beyond Visual Range Air-to-Air Missiles it would need to buy. In-year, the Department is showing a £57 million increase to the price of the missile project, offset by a £53 million saving. The assumptions underlying these numbers are changing as negotiations continue.

Review of Beyond Visual Range Air-to-Air Missile In-Service Date

2.37 In the light of its review, the Department took the opportunity to review the Beyond Visual Range Air-to-Air Missile programme to ensure it best delivered the required capability when it was needed and at the lowest cost. The Department has therefore decided to adopt a two-stage approach which splits the missile's development and integration stages:

- The first stage – Platform Ready – is when missile development is complete and it is fully demonstrated that the missile is ready to put on an aircraft, but before the missile is integrated onto a specific aircraft type. The Platform Ready In-Service Date is August 2012. The project is on track to complete missile development by this date.
- The second stage – Typhoon Beyond Visual Range Air-to-Air Missile Capability – will see the weapon integrated with the Typhoon aircraft and will offer the full operational capability equivalent to the original In-Service Date definition. As at 31 March 2007 the missile was forecast to achieve its In-Service Date in August 2013, one year after the approved date of August 2012. The current forecast for the Typhoon Beyond Visual Range Air-to-Air Missile Capability In-Service Date is now August 2015.[5]

2.38 The decision to delay integration of the weapon with the Typhoon until 2015 – the earliest point at which the Department now expects to need the capability – will reduce the costs of integration by aligning the United Kingdom's requirements better with the other Eurofighter nations and allowing integration to take place as part of the Typhoon Future Capability Programme. The increased length of the project has, however, resulted in a £51 million in-year increase in cost of capital charges.

5 The revised In-Service Dates are not directly comparable to the original In-Service Date of 2012, so we have excluded Meteor from our timescale analysis in Part 1, although in future years the revised two-stage dates will enable comparative analysis.

APPENDIX ONE

Methodology

Volume II of the Major Projects Report 2008 is the twenty-fifth to be produced by the Department. The Committee of Public Accounts requested it after its 9th Report, Session 1981-82, which noted the absence of any requirement for the Department to inform Parliament about the costs of its major military projects. Until 1991 both the Major Projects Statement and the associated National Audit Office Memorandum were provided to the Committee on a confidential basis. Another significant amendment to the information available to both Parliament and the public came in 1999, when the Department introduced major changes in its organisation and procedures, generally described as Smart Procurement, and the Treasury required all of central government to budget and account on the basis of resources and not cash.

Project population

Projects qualify for inclusion in the Major Projects Report if their forecast of future expenditure is among the 20 largest, for those that have achieved approval at the main investment decision, and the 10 largest for those projects still in the Assessment Phase. They are replaced when, as they progress through the procurement process, estimated forecast costs still to be incurred reduce below the level of the top projects, although their total costs may nonetheless be very high.

There are five new post-main investment decision projects in this year's Report – Advanced Jet Trainer, Future Lynx, Modernised Target Acquisition Designation Sight/Pilots Night Vision Sensor, Naval Extremely High Frequency/ Super High Frequency Satellite Communications Terminals and Typhoon Future Capability Programme all feature for the first time. Eagle (upgrade of mission system on E-3D Sentry aircraft) is new to the Assessment Phase population.

Scope of validation

The Major Projects Report is not a statutory account and we do not offer a formal audit opinion on the accuracy of data contained within it. The Department compiles the Project Summary Sheets according to the guidelines, to which we have agreed, and the figures are calculated on a different basis to the Department's Resource Account. The draft summary sheets are also made available to the industrial prime contractors for comment and amendments are incorporated as appropriate.

Our validations confirm that the Project Summary Sheets conform to the guidance and we check that they have been accurately and consistently applied. Each year Integrated Project Teams build up detailed forecasts on costs and time to completion for the equipments. These are subject to Departmental scrutiny for inclusion in its Planning Round. The Department conducted a Planning Round in 2008 which resulted in a final agreed Plan. However, we received much of our information before the Planning Round was finalised and therefore have agreed the data supplied to the latest scrutinised position as at 31 March 2008. Each Integrated Project Team was required to substantiate changes to that position by providing a detailed audit trail. We do not question the forecasts or assumptions of the Department's long-term costings unless better information subsequently becomes available.

Other test checks on the data confirm In-Service Dates to project plans and the likely achievement of their Key User Requirements with the Equipment Capability Customers.

Outcome of validation

All the draft Project Summary Sheets were amended following validation. The incidence of significant errors has declined, and for the majority the adjustments were minor to improve clarity. In particular, the Future Integrated Soldier Technology, Typhoon Future Capability Programme, Merlin Capability Sustainment Programme and Search and Rescue Helicopter projects provided draft summary sheets that required few revisions.

Analysis

We considered whether the Department is currently forecasting to procure major equipments within time, to budget and to meet Key User Requirements. Our examination of time and forecast cost is based on the most likely estimates, but when a project has been approved under Smart Acquisition, there will be a 'not to exceed' value as well. As a consequence, some of the in-year variations represent movement within this difference (the risk differential).

The analysis involved using both quantitative and qualitative sources of information. We focused on those projects showing the greatest cost or time variances and the factors that caused them to change, with particular attention being paid to the method by which they are being procured. Case examples of a few key projects illustrate our findings.

This year's Part Two consists of five case studies, looking in more detail at projects where there have been significant developments in year. Beyond Visual Range Air-to-Air Missile, Nimrod, Soothsayer, Terrier and Naval Extremely High Frequency/ Super High Frequency Satellite Communications Terminals were chosen as they have experienced significant changes in one or more of forecast cost, time, or performance. We have analysed the developments on these projects to pick out key themes in project delivery.

APPENDIX TWO

Assessment Phase projects as at 31 March 2008

Figure 11 shows the forecast costs for the Assessment Phase projects. Costs for the Demonstration and Manufacture Phase and In-Service Dates are not set until the main investment decision is made at Main Gate approval. Forecasts prior to this Approval are for internal planning purposes only and publicly declaring these limit the Department's ability to make trade-offs and to conclude satisfactory commercial arrangements. Therefore in the Project Summary Sheets in Volume II of this Report, the envelopes for time and cost are classified for commercial reasons. However, to maintain transparency and public accountability, the Department will continue to provide a range for the cost of the Demonstration and Manufacture Phase and In-Service Date for the Committee of Public Accounts.

11 Cost of the Assessment Phase

Project	Description	Approved Cost at Initial Gate (£m)	Forecast Cost of Assessment Phase (£m)
Eagle[1]	Upgrade of E-3D Sentry aircraft mission system	17	4
Future Aircraft Carrier[2]	Aircraft Carrier	118	297
Future Integrated Soldier Technology	Fighting system for dismounted close combat	26	142[3]
Future Rapid Effect System	Medium weight armoured vehicle	113	319[4]
Future Strategic Tanker Aircraft	Tanker aircraft providing air-to-air refuelling capability	13	38
Indirect Fire Precision Attack	Munitions	24	212[5]
Maritime, Airborne, Surveillance, and Control	Airborne surveillance and battle management capability	13	7
Military Afloat Reach & Sustainability	Auxiliary Ships	44	***[6]
Search and Rescue Helicopter	Search and Rescue Helicopter	1	11[7]
UK Military Flying Training System	Flying training system	39	32

Source: National Audit Office analysis of Departmental data

NOTES

1 This project is new to the population.

2 Assessment Phase scope extended to cover design and risk reduction work prior to incremental Main Gate Approvals

3 This is the total forecast cost for Assessment Phases 1-3. The Approved Cost is for Assessment Phase 1 only.

4 Includes the costs of the Assessment Phase for the Initial Operating Capability roles and also the Assessment Phase for the Specialist roles which the Approved Cost did not.

5 Includes costs for Assessment Phase 2, Loitering Munition Capability Demonstration of £49m which was approved in June 2006 review note, and costs resulting from the Complex Weapon Assessment Phase. This is not included in the Approved Cost as Initial Gate approval only covers Assessment Phase 1.

6 The forecast cost of the Assessment Phase for the MARS project has been classified as the information is commercially sensitive.

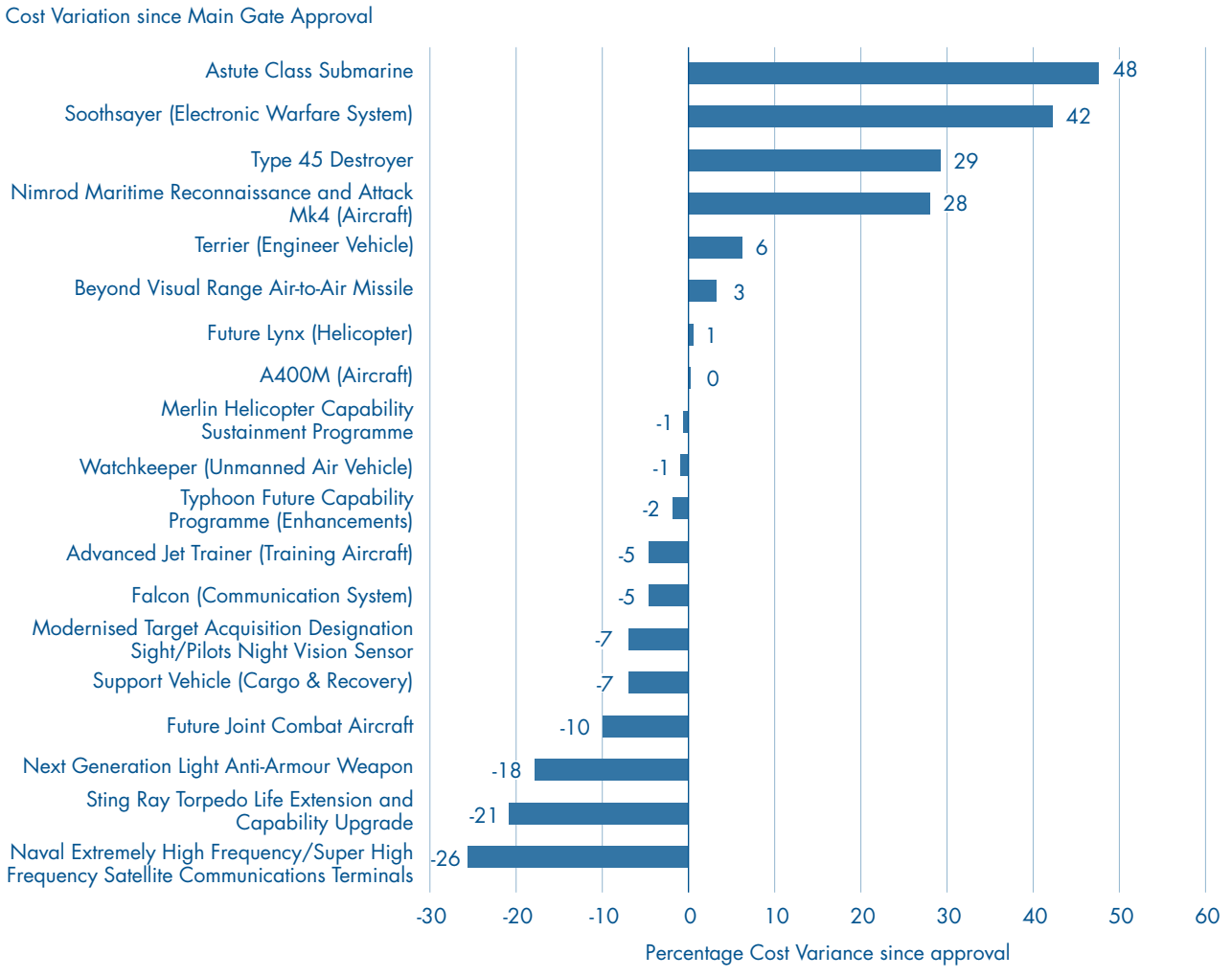
7 Represents total forecast cost for Assessment Phase 1 and Assessment Phase 2. Assessment Phase 1 approval £1.3m, Assessment Phase 1 actual spend £0.4m. Assessment Phase 2 Approval £9.9m, total forecast spend £10.8m. Initial Gate approval only covers Assessment Phase 1.

APPENDIX THREE

Cost performance since the main investment decision and in-year

Although individual approvals are set at the "not to exceed" level (that is the cost if 90 per cent of the identified risks were to materialise), the Department continues to plan on the basis of the most likely (50 per cent confidence limit).

12 Seven projects are forecasting overruns against their "most likely" costs at approval. Of these, five are also forecasting overruns against their "not to exceed" costs at approval

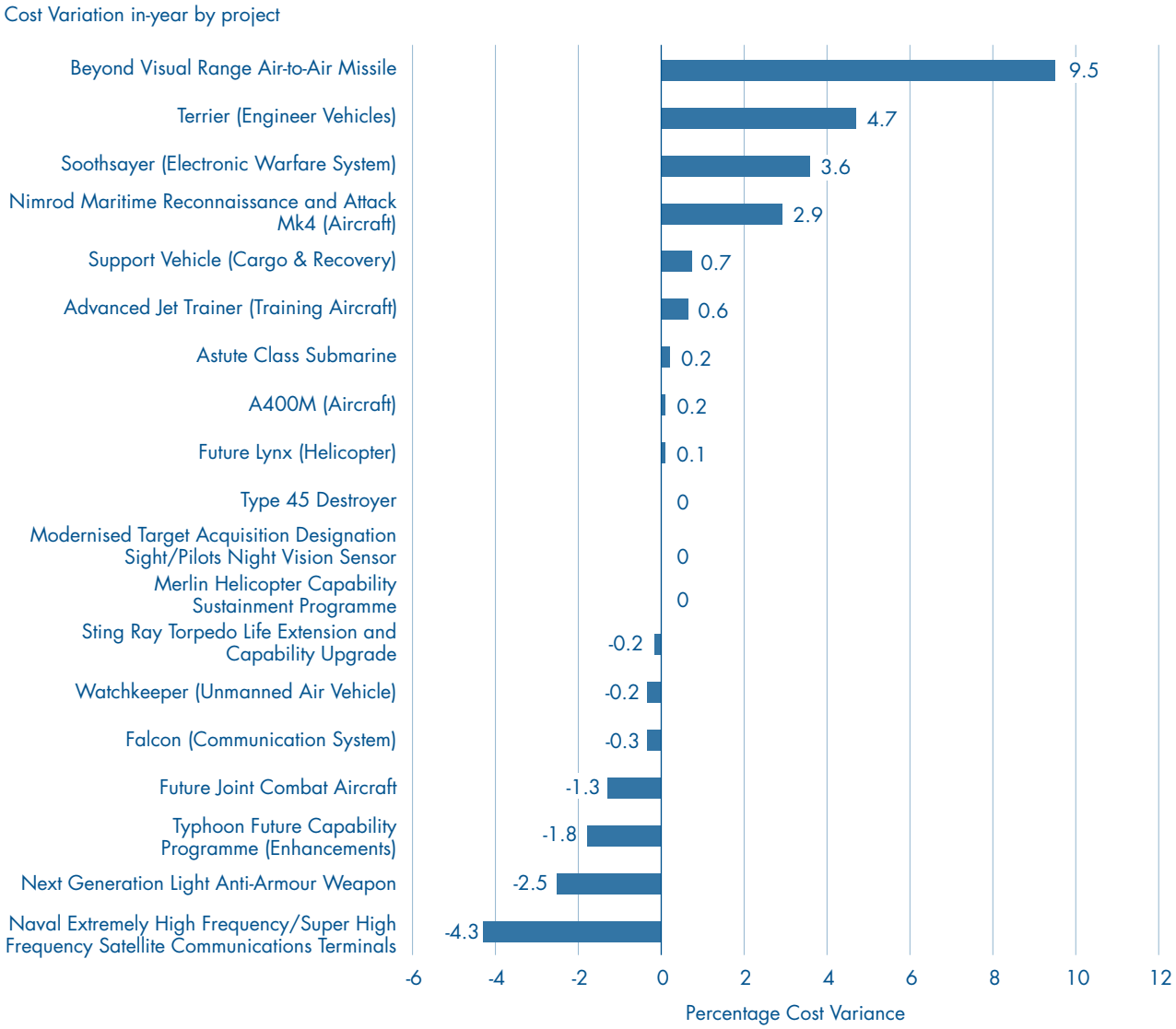


Source: National Audit Office analysis of Departmental data

NOTE

Typhoon is excluded from this analysis as the information is commercially sensitive.

13 Beyond Visual Range Air-to-Air Missile, Terrier, Soothsayer and Nimrod Maritime Reconnaissance and Attack Mk 4 showed the greatest in-year cost increases



Source: National Audit Office analysis of Departmental data

NOTE

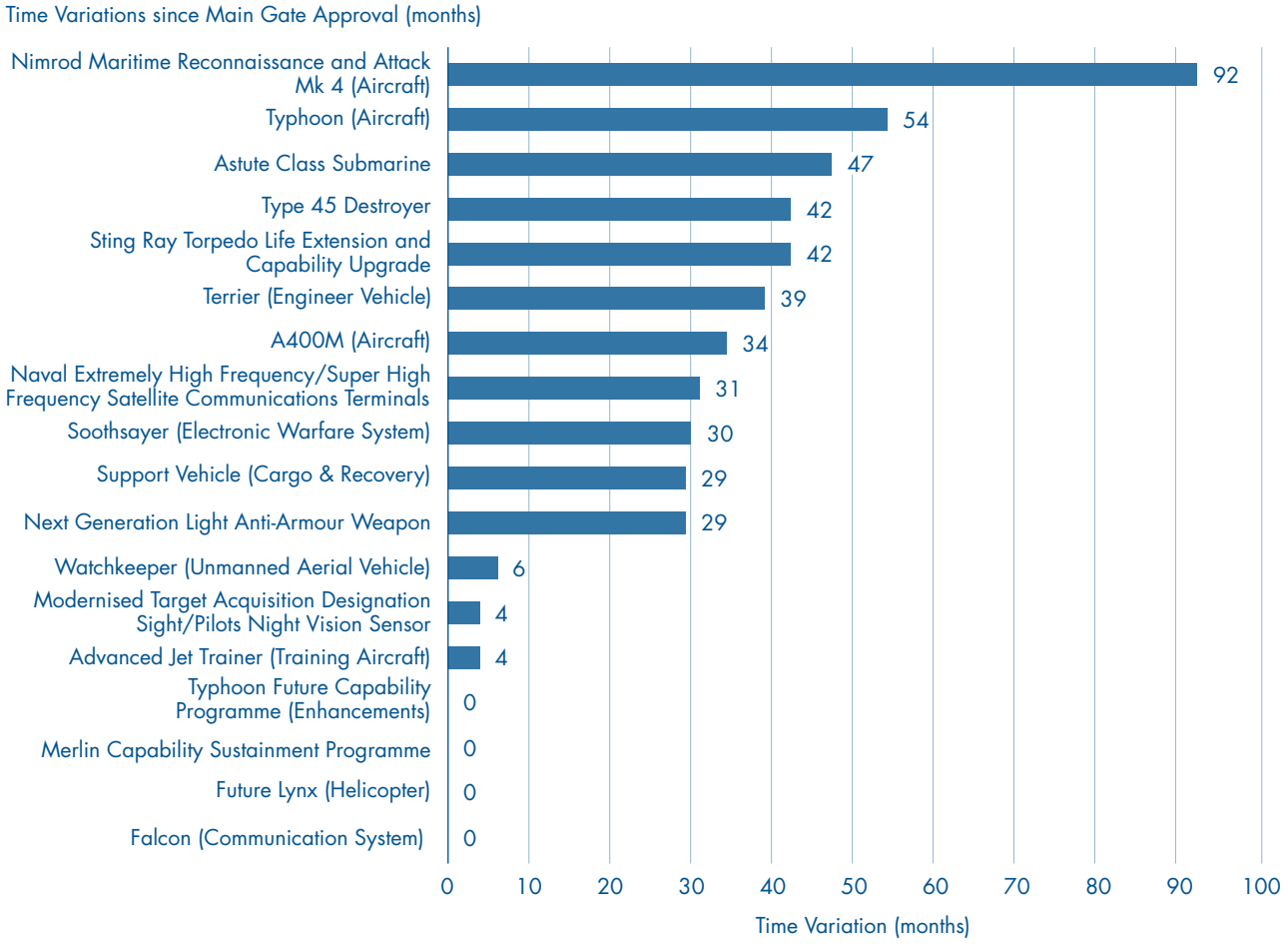
Typhoon is excluded from this analysis as the information is commercially sensitive.

APPENDIX FOUR

Time performance since the main investment decision

Although individual approvals are set at the "not to exceed" level (that is the cost if 90 per cent of the identified risks were to materialise), the Department continues to plan on the basis of the most likely (50 per cent confidence limit).

14 Fourteen projects are forecasting delays against their "most likely" In-Service Dates at approval. Of these, 11 are also forecasting delays against their "not to exceed" In-Service Date estimates at approval



Source: National Audit Office analysis of Departmental data

NOTES

1 Joint Combat Aircraft is excluded as its In-Service Date has not yet been approved.

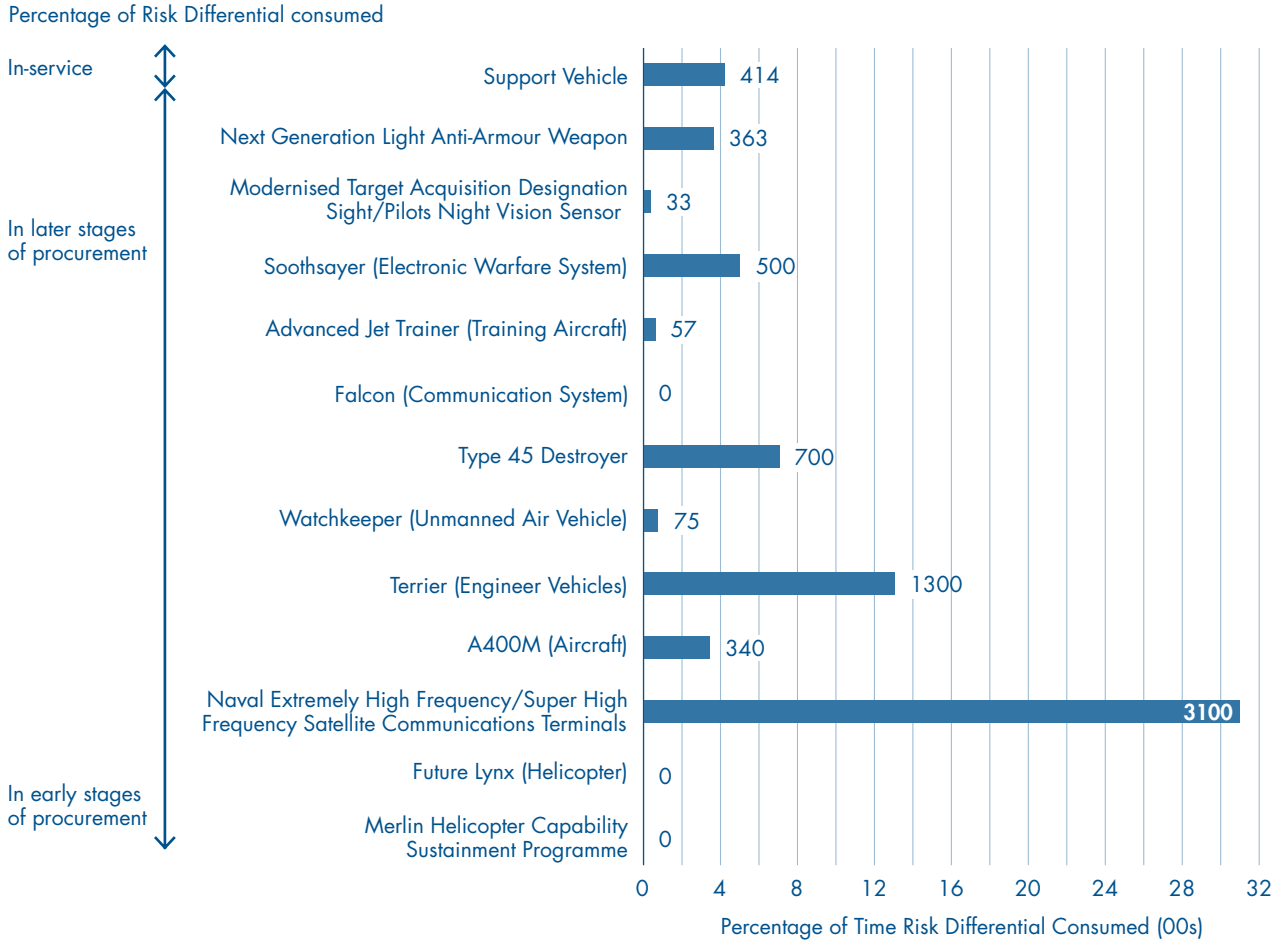
2 Beyond Visual Range Air-to-Air Missile has been excluded as its In-Service Date has been re-defined.

3 The Typhoon aircraft and Sting Ray Life Extension and Capability Upgrade had met their In-Service Date definition before 1 April 2007.

Risk differential represents the difference between the budgeted (that is "most likely") and the "not to exceed" time estimates approved at the main investment decision.

Figure 15 shows that seven projects are forecasting to exceed their time estimates, having consumed over 100 per cent of their risk differential.

15 Graph to show percentage of risk differential consumed



Source: National Audit Office analysis of Departmental data

NOTES

1 Future Joint Combat Aircraft is excluded as its In-Service Date has not yet been approved.

2 Beyond Visual Range Air-to-Air Missile is excluded as its In-Service Date has been redefined.

3 Astute Class Submarine, Nimrod Maritime Reconnaissance and Attack Mk4 aircraft, Sting Ray torpedo and the Typhoon aircraft are excluded because they are legacy projects and as such do not have risk differential in their approvals. Typhoon Future Capability Programme was approved more recently, but is also excluded as it does not have risk differential in the approval for time.

GLOSSARY

Acquisition Cycle (see also Assessment Phase and Demonstration and Manufacture Phase)	The Concept, Assessment, Demonstration, Manufacture, In-Service, Disposal (CADMID) cycle has been used by the Department since 1999, when it was devised as part of the Smart Procurement initiative to deliver equipment capability within agreed performance, cost and time parameters.
Approval	The formal decision by the Investment Approvals Board (and, dependent on the size of the project, HM Treasury) on the investment of funds in a project. Approval sets 'Not to Exceed' parameters for the project's cost and In-Service Date, which reflect the worst case scenario should all foreseen risks arise. The project cannot exceed these parameters without returning to the Investment Approvals Board for further approval. The Main Gate process also sets target 'Most Likely Estimate' figures for cost and In-Service Date. The difference between these targets and the approved not to exceed figures is known as a project's Risk Differential.
Assessment Phase	The second phase in the acquisition cycle after the Concept Phase and beginning with Initial Gate. The aim of the Assessment Phase is to develop an understanding of options for meeting the requirement that is sufficiently mature to enable selection of a preferred solution and identification, quantification and mitigation of the risks associated with that solution. At the end of the Assessment Phase a Business Case is submitted to the Investment Approvals Board for Main Gate Approval.
Business Case	The documentation submitted to the Investment Approvals Board at Initial Gate or Main Gate, making the case for proposed expenditure on the next phases of the project.
Cost of Capital	The opportunity cost to the Government of employing money in capital expenditure instead of on alternative investment opportunities. For the public sector, cost of capital is charged at 3.5 per cent of the average capital employed during each year. Prior to 1 April 2003 the rate was six per cent.
Defence Equipment and Support	Officially formed on 1 April 2007 from the merger of the Defence Procurement Agency and the Defence Logistics Organisation. It equips and supports the United Kingdom's Armed Forces for current and future operations, including equipment and services ranging from ships, aircraft, vehicles and weapons, to electronic systems and information systems.
Defence Industrial Strategy	The UK Defence Industrial Strategy was announced on 15 December 2005, and is aimed at ensuring that our Armed Forces are provided with the equipment that they require, on time, and at best value for money. Part of this is the requirement that we can procure from a sustainable industrial base that retains within the United Kingdom those industrial capabilities that are required from a national security perspective, to ensure our appropriate sovereignty.

Demonstration and Manufacture Phase	The third and fourth phases in the acquisition cycle, which begin after Main Gate approval, and continue until the equipment enters service. During the Demonstration and Manufacture Phases, development risk is progressively eliminated, the ability to produce integrated capability is demonstrated and the solution to the military requirement is delivered.
Equipment Capability Customer	Since the creation of the Defence Equipment and Support organisation, the Equipment Capability Customer has become responsible for leading the capability change planning process and identifying the equipment and support requirements to optimise the United Kingdom's Defence capability within allocated resources. In doing so the Equipment Capability Customer acts as the Sponsor for new and enhanced equipment and support programmes.
Government Furnished Equipments	Government Furnished Equipments are Department-owned assets supplied to Industry in support of Departmental contracts. Performance risk in that respect rests with the Department.
Incremental Acquisition	A procurement strategy which aims to reduce risk and spread costs by building up a required capability over time. Each increment offers additional capability.
Initial Gate	The approval point preceding the Assessment Phase. At Initial Gate, a Business Case is put to the Investment Approvals Board to confirm that there is a well-constructed plan for the Assessment Phase that gives reasonable confidence that there are flexible solutions within the time, cost and performance envelope the Equipment Capability Customer has proposed.
In-Service Date	The definition varies between projects. For example, Typhoon's In-Service Date is defined as the date of delivery of the first aircraft to the Royal Air Force. The Type 45 Destroyer's In-Service Date is defined as the date when the First of Class will meet the Customer's minimum operational requirement. It does not necessarily mean the capability is fully delivered.
Investment Approvals Board	The Departmental body responsible for the approval of investment in projects at Initial Gate and Main Gate. The Investment Approvals Board comprises the Vice Chief of Defence Staff, the Second Permanent Under Secretary, the Chief of Defence Materiel, the Defence Commercial Director and is chaired by the Chief Scientific Advisor. For projects with a value of less than £100 million, delegated representatives of Investment Approvals Board members may authorise approval.
Integrated Project Team	Each project within the Major Projects Report has its own Integrated Project Team that manages the funding of the project and engages with Industry in order to develop solutions to the necessary capability requirements and to drive the programme forward.
Key User Requirements	These outline the requirements that are considered to be key to the achievement of the mission and are used to measure project performance. The Department recommends up to ten be defined for each project.
Main Gate	The point at the end of the Assessment Phase when the decision to proceed with the project is made. At Main Gate the Business Case presented to the Investment Approvals Board recommends a single technical and procurement option. By Main Gate, risk should have been reduced to the extent that the Equipment Capability Customer and Integrated Project Team can, with a high degree of confidence, undertake to deliver the project to narrowly defined time, cost (procurement and whole-life) and performance parameters.

Planning Round	The Department's budgeting plan for expenditure on procurement of defence equipment, which runs across a ten year planning cycle.
Platform	A term in this instance which encompasses ships, submarines and specialist vessels, such as Landing Ship Dock (Auxiliary).
Smart Acquisition	Instead of approving each of four separate stages of a project, approval is given at two points. Major equipment projects are only to be submitted for the main investment decision once risks have been reduced and the most cost-effective solution identified. Approvals have no degree of tolerance and any breach of the approved figure for cost or time will necessitate a re-approval.

Definition of Cost growth and time delay causal factors

Technical	
Technical Factors	Variations which are due to changes in technical ability to deliver the project.
Customer Requirement	
Changed Requirement	Variations due to changes in the customer's requirement for the equipment, flowing from operational reassessment rather than budgetary priority.
Changed Budgetary Priorities	Variations due to changes in the customer's requirement for equipment, flowing from changed budgetary priorities.
Economic Conditions	
Inflation	Variations due to changes in inflation assumptions.
Exchange Rate	Variations due to changes in exchange rate assumptions.
Procurement Management	
Receipts	Variations due to changes in expectation of receipts, e.g. liquidated damages, commercial exploitation levy.
Contracting Process	Variations due to changes associated with the contractual process, including time taken in contract negotiations and placing contracts, international contract negotiations and effect of comparing contractor bids to estimates.
Procurement Strategy	Variations due to changes in overall procurement strategy, e.g. change to collaborative options, or from competitive to single source.
Reporting Conventions	
Accounting Adjustments and Re-definitions	Variations that do not reflect any substantive change, including imported or exported costs arising from changes to accounting rules, adjustments to reflect changes in the definition of terms.
Risk Differential (*post Main-Gate projects with Smart Approvals only*)	The difference between the 50 per cent most likely estimate and the Not to Exceed approval figure at the point of Main Gate approval. The amount of risk allowed for in the approval.
Associated Projects	
Change in Associated Project	Variations due to change in an associated project e.g. availability of equipment from another project for trials.

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