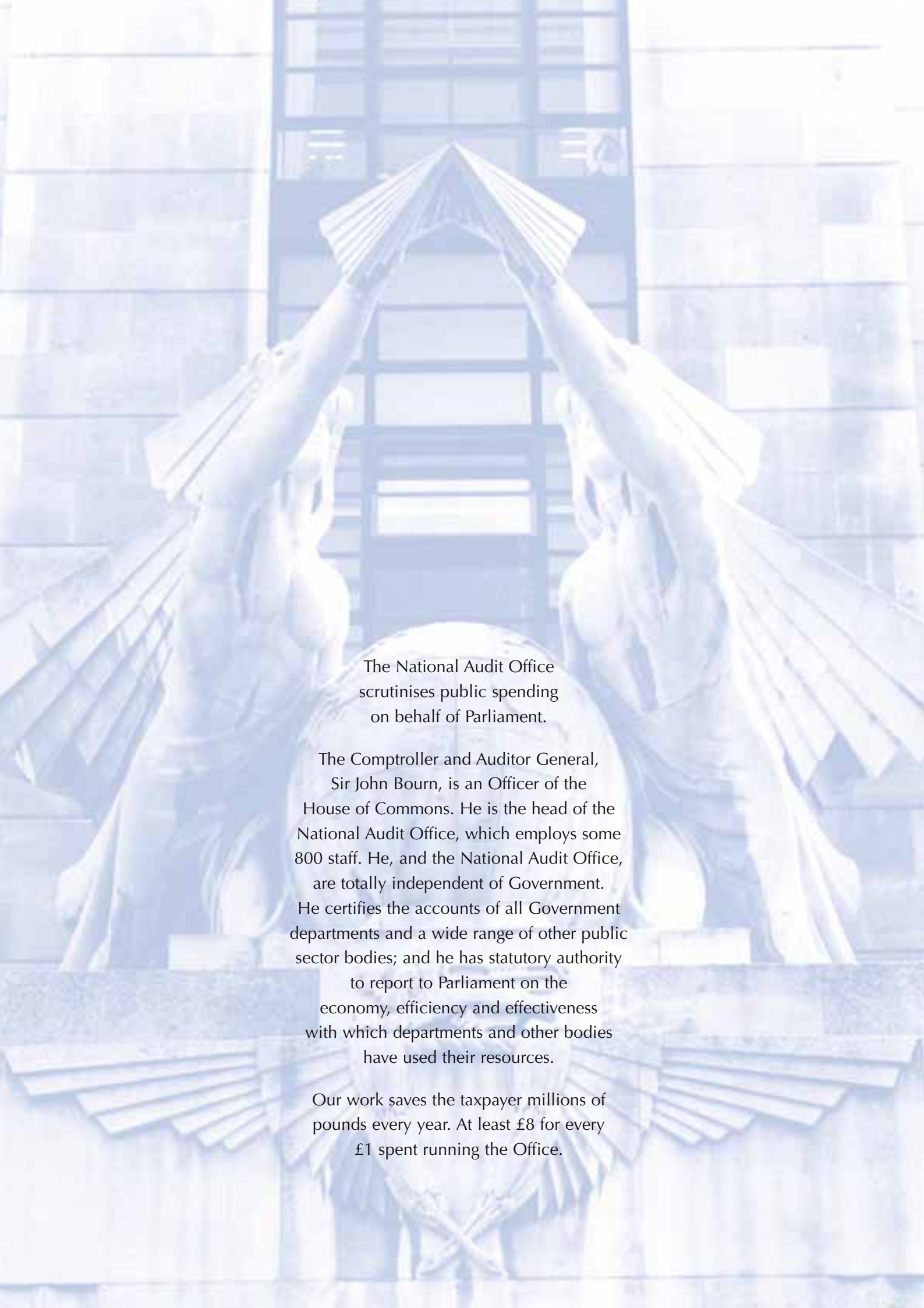


Ministry of Defence  
**Major Projects Report 2004**

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL  
HC 1159-I Session 2003-2004: 10 November 2004





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Ministry of Defence  
Major Projects Report 2004



REPORT BY THE COMPTROLLER AND AUDITOR GENERAL  
HC 1159-I Session 2003-2004: 10 November 2004

This volume has been published alongside a second volume containing the Project Summary Sheets for the 20 post-Main Gate and 10 pre-Main Gate projects included in this year's report -

Ministry of Defence: Major Projects Report 2004 - Project Summary Sheets,  
HC 1159-II, Session 2003-04.

**This report has been prepared under Section 6 of the National Audit Act 1983 for presentation to the House of Commons in accordance with Section 9 of the Act.**

***John Bourn*** National Audit Office  
**Comptroller and Auditor General** 8 November 2004

The National Audit Office study team consisted of:

Karen Jackson, Karl Hui, Teik Khow, Matt Ray,  
Liz Reeve, Rebecca Sheeran, Chris Steven and  
Anna Woodcock under the direction of Tim Banfield

This report can be found on the National Audit Office web site at [www.nao.org.uk](http://www.nao.org.uk)

**For further information about the National Audit Office please contact:**

National Audit Office  
Press Office  
157-197 Buckingham Palace Road  
Victoria  
London  
SW1W 9SP

Tel: 020 7798 7400

Email: [enquiries@nao.gsi.gov.uk](mailto:enquiries@nao.gsi.gov.uk)

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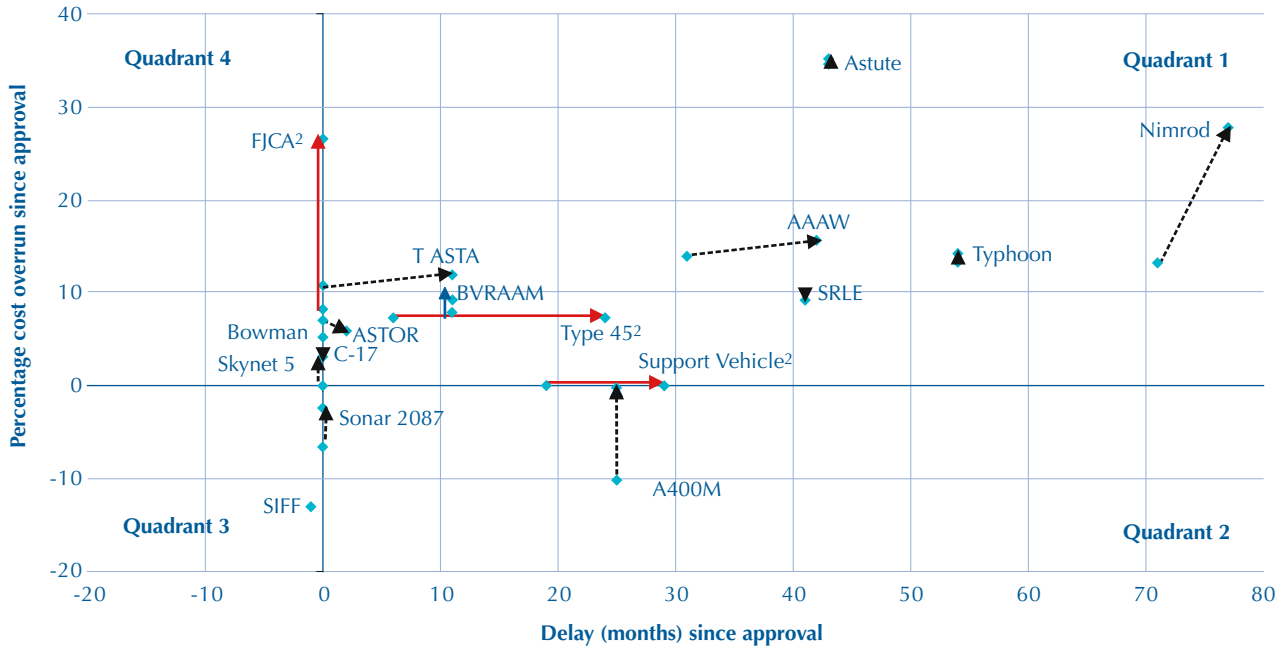
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# executive summary

- 1 The Ministry of Defence (the Department) has reported to Parliament on its progress in procuring major defence equipment every year since 1984. Prior to 1991, much of the data submitted to Parliament was classified and, hence, our analyses of the key themes and trends were not published. The Major Projects Report 2004 is the thirteenth that we have published since the level of classification was reduced.
- 2 The Major Projects Report 2004 covers cost, time and performance data for projects in the year ended 31 March 2004. We examined 30 defence equipment projects; 20 of the largest post-Main Gate projects (where the main investment decision to proceed had been taken by the Department) and ten projects still in the assessment phase. Seven projects are new to the Major Projects Report, three in the main phase of procurement and four in the assessment phase.
- 3 The Department expects its top 20 equipment projects will meet Key User Requirements but at a cost of £50 billion, some 14 per cent higher than the expected cost of £44 billion when the projects were approved. In the last year, forecast costs have increased by £1.7 billion, a four per cent increase, and projects have been delayed by an average of three months. The costs in the Major Projects Report are presented on a Resource Accounting and Budgeting basis, including interest on capital charges which will usually increase if there are delays. The £1.7 billion cost increase in the Major Projects Report 2004 includes £530 million of interest on capital, which is linked to the average three month delay on projects. **Figure 1** summarises cost and time performance changes in the last year on the top 20 projects.
- 4 As recent Major Projects Reports have shown, there is little evidence that project performance has improved in recent years, although there are examples of successful projects such as the C-17 aircraft and the Successor Identification Friend or Foe system. However, many of the projects begun under Smart Acquisition have not consistently applied the principles designed to underpin improvement in project performance. Consequently, we expect there to continue to be problems emerging on existing projects in future and it may be some years before any trend towards continuously improved performance on newer projects becomes apparent. The inconsistent application of the sensible acquisition principles enshrined in Smart Acquisition means that the split between Smart projects and older legacy projects is no longer a relevant distinction. For this reason, this and future Reports will focus on the Department's success in continuously improving its procurement performance.
- 5 Many of the difficulties arose from failure to spend sufficient time and resources in the assessment phase and failing to provide appropriate mitigation plans for the potential risks. As a result, unrealistic expectations have been set at Main Gate. Projects less than halfway through their procurement are already expected to be delivered later or to cost more than approved. It is of particular concern that the 15 most recent projects are progressing rapidly towards their 'not to be exceeded' approvals and six have already breached them.

**1 Analysis of project cost and time variance and movement since the Major Projects Report 2003**

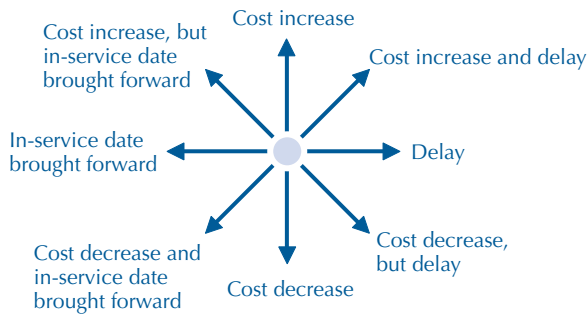
Of the projects which are common to the Major Projects Reports of 2003 and 2004, there have been further large cost increases and delays in the last year.\*



- Key:**
- AAAW - Advanced Air-Launched Anti-Armour Weapon
  - ASTOR - Airborne Stand-Off Radar
  - BVRAAM - Beyond Visual Range Air-to-Air Missile
  - FJCA - Future Joint Combat Aircraft
  - SRLE - Sting Ray Life Extension
  - SIFF - Successor Identification Friend or Foe
  - T ASTA - Typhoon Aircrew Synthetic Training Aids

**NOTES**

1 The direction of the arrows indicate the following:



2 Three of the projects do not have both cost and time parameters (indicated in red). Future Joint Combat Aircraft does not yet have an approved in-service date, therefore only its cost increase has been plotted. Costs on Support Vehicle are commercially sensitive, therefore only its delay has been plotted. Costs on Type 45 are commercially sensitive. The delay has been plotted from a starting point of the March 2003 position.

Source: National Audit Office

- 6 The Department is aware of these issues and is striving to improve acquisition performance. Sir Peter Spencer, the Chief of Defence Procurement, completed his review of the performance of the Defence Procurement Agency in implementing Smart Acquisition in January 2004. The review confirmed that the principles underpinning Smart Acquisition were sound but were not being consistently applied. The Department has introduced a continuous improvement programme to address the issues raised by the review, addressing skills, performance management, project review and assurance, financial management, commercial and supplier development, and joint working within the Department. Further details of these improvements, and how they will be measured, are set out in **Boxes 2 and 3** (pages 18 to 19). They came into effect on 1 April 2004. A particular issue raised by the review was that many parties are involved in the successful delivery of military equipment and that the Department must act more corporately to improve acquisition performance. To ensure this, the Department has established a Ministerial group to see that wider issues and necessary improvements, identified by the review, are given sufficient priority.
- 7 The Defence White Paper and the outcome of the 2004 Spending Review will have a major impact on the procurement of defence equipment. In the White Paper, the Government re-evaluated its strategic defence priorities in the light of current and future threats and demands. The Department has since identified the changes needed to force structures, planning assumptions and to the provision of capability of which the procurement of defence equipment forms a part. In July 2004, the Secretary of State for Defence made a statement about the need to transform the Armed Forces to deal with the challenges of the 21st Century. The Statement detailed changes to the Defence Equipment Programme which included continued commitment to many of the major projects but announced reductions in the required numbers of Nimrod MRA Mark 4 aircraft and Type 45 destroyers. There are likely to be further changes to the equipment programme.
- 8 We have also examined important developments on the delivery of the Carrier Strike capability. The Department has adopted relevant measures to manage the delivery of the capability, specifically:

  - The Department has extended the assessment phase for the Future Aircraft Carrier to allow for additional design work, risk-identification and to ensure that the contractual and industrial arrangements create the best opportunity for a successful acquisition.
  - On the Future Joint Combat Aircraft, the Department has allocated additional funding to reduce risk and cover studies on its integration with the Future Aircraft Carrier. Separately, a problem on meeting weight targets was identified, but this has not increased the Department's costs because, under the Memorandum of Understanding, the Department's contribution is capped.



# Conclusions

The prime objective of the defence procurement community is the delivery of military capability. For this delivery to be effective, there must be certainty as to when equipment will be ready for service and control of the costs. If not, capability gaps may result and some capabilities may have to be foregone or delayed to compensate for rising costs.

The project performance recorded in the Major Projects Report 2003 was among the most disappointing in the history of the Report. The majority of the problems related to four older projects, but there were also worrying signs that the performance of newer projects begun since the introduction of Smart Acquisition was starting to deteriorate. Many of the problems on these newer projects were caused by the failure to apply consistently the sensible principles underpinning Smart Acquisition in both the way the projects were planned and have subsequently been progressed. The Department recognises these problems and the new Chief of Defence Procurement, Sir Peter Spencer, is seeking from April 2004 to apply Smart Acquisition principles, as modified by his review, more consistently.

Applying the sensible principles which underpin Smart Acquisition by the Defence Procurement Agency will not be sufficient on its own to deliver more successful project outcomes. Other parts of the Department also play a central role in successfully planning for and co-ordinating the delivery of new equipment capabilities. Over the last two years we have been working with the Department and industry to identify these broader success factors and are conducting a range of studies to identify good practices which, taken together with the other work which the Department has in hand, can help to improve acquisition performance continuously.



*Typhoon*



*Light Forces Anti-Tank Guided Weapon System*



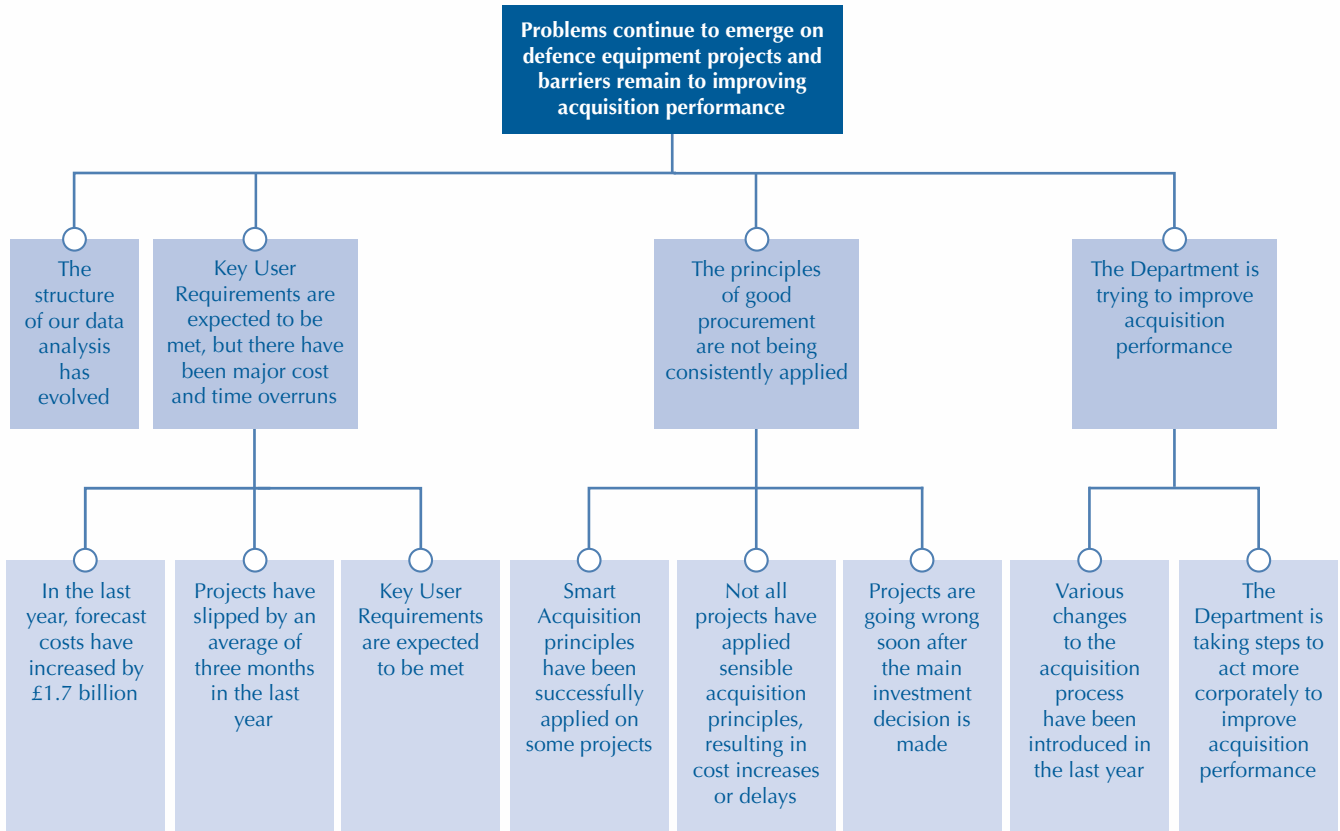
*Artist's impression of an Astute Class submarine*



*Artist's impression of Skynet 5*







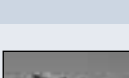
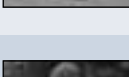
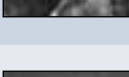

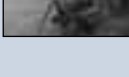
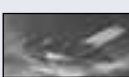


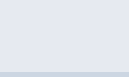

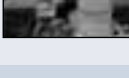

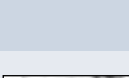



*Bowman*



Artist's impression of an Astute Class submarine



Project	Description	Basis of Approval		In-year change on costs to completion (£millions)	In-year change on in-service date (months)	In-year change on Key User Requirements	Current Forecast Costs to completion (£millions)	Most Likely Costs to completion at Approval (£millions)	Current Forecast In-service date	Most Likely In-service date at Approval
 A400M	Heavy transport aircraft	✓		+258	0	No change	2,619	2,628	March 2011	February 2009
 Advanced Air Launched Anti-Armour Weapon (AAAW), also known as Brimstone	Anti-armour missile		✓	+14	+11	No change	941	814	March 2005	September 2001
 Airborne Stand-Off Radar (ASTOR)	Long-range surveillance and targeting system		✓	-10	+2	No change	968	914	November 2005	June 2005
 Astute Class Submarine	Attack submarine		✓	+10	0	No change	3,484	2,578	January 2009	June 2005
 Bowman	Tactical voice and data communications system	✓		-1	Met in-service date in March 2004	No change	1,991	1,893	March 2004	March 2004
 Beyond Visual Range Air-to-Air Missile (BVRAAM), also known as Meteor	Air-to-Air missile	✓		+17	0	No change	1,355	1,240	August 2012	September 2011
 C-17 (Short Term Strategic Airlift)	Heavy transport aircraft	✓		-2	Met in-service date in September 2001	No change	769	746	September 2001	September 2001
 Combat, Infrastructure & Platform BISA (CIP)	Bowman-related software and hardware systems	✓		-3	+4	No change	340	343	July 2004	March 2004
 Future Joint Combat Aircraft (FJCA)	Fighter/attack aircraft	✓		+372	In-service date not yet approved	No change	2,573	2,034	In-service date not yet approved	In-service date not yet approved
 Light Forces Anti-Tank Guided Weapon System (LFATGWS)	Anti-armour firepower system	✓		+3	0	No change	318	315	November 2005	November 2005
 Nimrod Maritime Reconnaissance and Attack Mk4	Reconnaissance and attack patrol aircraft		✓	+408	+6	No change	3,593	2,813	September 2009	April 2003
 Next Generation Light Anti-Armour Weapon (NLAW)	Short range anti-armour weapon	✓		-22	0	No change	355	377	November 2006	November 2006
 Successor Identification Friend or Foe (SIFF)	Identification Friend or Foe system, allowing swift and accurate identification of friendly forces	Smart for Cost	Legacy for Time	0	Met in-service date in March 2004	No change	464	534	March 2004	April 2004
 Skynet 5	Satellite communications systems	✓		+96	0	No change	2,775	2,679	February 2005	February 2005
 Sonar 2087	Sonar system for detection of submarines	✓		+15	0	No change	357	366	May 2006	May 2006
 Sting Ray Torpedo Life Extension	Life extension and capability-enhancement for Sting Ray Lightweight Torpedo	Smart for Cost	Legacy for Time	-4	0	No change	794	727	May 2006	December 2002
 Support Vehicle (Cargo & Recovery)	Cargo and recovery vehicles, and trailers	✓		Commercially sensitive	+10	Missed two	Commercially sensitive	Commercially sensitive	February 2008	April 2006
 Type 45 Destroyer	Anti-Air warfare Destroyer	✓		Commercially sensitive	+18	No change	Commercially sensitive	5,000	May 2009	May 2007
 Typhoon, formerly known as Eurofighter	Fighter aircraft		✓	+130	Met in-service date in June 2003	No change	19,014	16,671	June 2003	December 1998
 Typhoon Aircrew Synthetic Training Aids (ASTA)	Ground-based aircrew training equipment for Typhoon	✓		+2	+11	No change	207	185	May 2005	June 2004

**NOTE**  
 There has been an accounting change in the last year (see paragraph 1.7 for further details) which means that cost estimates cannot be directly compared to those published in previous reports. All cost estimates in previous years, as well as costs set at approval, have been rebased in this report to allow a direct comparison.

# Part 1

## Problems continue to emerge on defence equipment projects and barriers remain to improving acquisition performance

- 1.1 In the first part of this Report, we examine progress on the Department's 20 largest post-Main Gate<sup>1</sup> procurement projects against cost, time and the achievement of the Customer's Key User Requirements. Our analysis also covers the top ten projects still in the Assessment Phase. In the Major Projects Report 2003, we reported major in-year cost increases of £3.1 billion and in-year delays totalling 144 months. This year our analysis shows that problems have emerged with forecast costs increasing by a further £1.7 billion and further delays of 62 months in the last year. The Department is forecasting that equipments will meet the Key User Requirements. The Department recognises the challenge of limiting further cost and time slippage, and is continuing to introduce initiatives to improve performance.
- 1.2 **Figure 2** summarises the 20 post-Main Gate projects in the Major Projects Report 2004. Three of the projects are new to this year's Report: they are the Light Forces Anti-Tank Guided Weapon System, Next Generation Light Anti-Armour Weapon and the Combat, Infrastructure and Platform BISA projects (known as CIP - and covering a number of software and hardware systems building on the Bowman communications project). Appendix 1 details the ten Assessment Phase projects, four of which are new to the Assessment Phase population (Falcon, Surface Combatant Maritime Rotorcraft, UK Military Flying Training System and Watchkeeper).
- 1.4 This report shows that many of the projects which began under Smart Acquisition, and which are still in the early stages of the procurement lifecycle, have not followed the principles designed to underpin continuous improvement in acquisition performance. Many of the projects in the Major Projects Report have long timescales. There will therefore probably continue to be problems emerging on these projects in future. It may therefore be some years before any trend towards continuously improved performance driven by the changes introduced by Sir Peter Spencer becomes apparent in the overall numbers recorded in the Major Projects Report.

### 3 The principles underlying Smart Acquisition

- A whole-life approach, covering the total resource costs of assembling, equipping, sustaining, operating, and disposing of a specified military capability.
- The establishment of Integrated Project Teams with clearly identified customers.
- A better, more open relationship with industry.
- More investment during early project phases.
- Effective trade-offs between cost, time and performance.
- New procurement approaches, including incremental acquisition.
- A streamlined process for project approvals.

#### NOTE

These principles were first set out by the Defence Procurement Agency in 1998, when Smart Acquisition was launched.

*Source: Ministry of Defence*

### The structure of our data analysis has evolved

- 1.3 In previous years, we have split our analysis of the top 20 post-Main Gate projects to differentiate between projects begun since Smart Acquisition was introduced in 1998 and older legacy projects commissioned under the previous procurement rules. This split is no longer a relevant distinction because, as our analysis shows, many so called Smart projects have failed to apply Smart Acquisition principles consistently, thus they have failed to deliver the expected benefits of Smart Acquisition. The Smart Acquisition principles are set out in **Figure 3**. The Department's intention is to improve its procurement performance continuously and this and future Major Projects Reports will focus on the Department's success in achieving this goal.
- 1.5 Given the revised focus of our analysis we have made two important changes to the form of the Major Projects Report this year. First, we have concentrated our analysis of the performance of the ten Assessment Phase projects to focus attention on the quality of work performed in this phase and how this affects the performance of projects when they proceed into Demonstration and Manufacture phases. It is at this point when the bulk of the money is spent, and when the substantial procurement problems have tended to arise.

<sup>1</sup> See Appendix 2 for a description of the project lifecycle, and the distinction between the pre-Main Gate and post-Main Gate phases.

- 1.6 The second major change we have made is that, whilst our principal analysis of cost and time continue to focus on in-year movements, we have this year compared the Department's current "most likely" cost and time forecasts against the equivalent figures that were forecast at the time of Main Gate approval, rather than against the upper limits of cost and time approved at Main Gate, as was previously the case. We have made this change to maintain consistency with the Department's own approach. When Smart Acquisition was first introduced, it was anticipated that individual projects would be managed taking into account both the most likely and upper limits of cost and time parameters endorsed at Main Gate. Our analysis in the Major Projects Report reflected this intention. In practice, Smart Acquisition requires projects to be managed within forecast upper and lower limits for time and cost, with the forecast "most likely" outcome of the project lying between the two. The Department's overall programme is also managed on the basis of "most likely" forecasts, and projects should therefore be managed to achieve or better those estimates. This has recently been re-emphasised by Sir Peter Spencer and is reflected in changes to the Defence Procurement Agency's Key Targets that have applied since 1 April 2004. Further details of how project approvals are set are provided in Appendix 2.
- 1.7 One further change to this report, which is an accounting change rather than reflecting a change in the performance of projects, has been caused because costs in the Major Projects Report are presented on a Resource Accounting and Budgeting basis - which includes interest on capital. The interest on capital charge is an internal resource cost to the Department. Increases in interest on capital reflect the opportunity cost to the Government of the capital resources tied up. Delays on projects will increase the interest on capital charge, which reflects the Departments inability to spend that money elsewhere including the provision of equipment to the armed forces. Effective from 1 April 2003, HM Treasury changed the rate of interest on capital from six per cent to 3.5 per cent<sup>2</sup>. For the Department, the change means that costs are not directly comparable to those as published in previous reports. To counter this problem for our analysis in the Major Projects Report 2004, where we have made comparisons between current costs and those in previous years or to costs set at approval, we have rebased earlier costs to enable a like-with-like comparison.

## Key User Requirements are expected to be met, but there have been major cost and time overruns

In the last year, forecast costs have increased by £1.7 billion

- 1.8 The 20 post-Main Gate projects are now forecast to cost £50 billion against an expected cost of £44 billion when the projects were approved, an increase of some 14 per cent. **Figure 4** shows that forecast costs have increased by £1.7 billion in-year across the 20 projects. This represents a 4 per cent increase over the total forecast costs as at 31 March 2003. Not all of the cost increases reflect extra payments to industry; some £530 million (31 per cent) of the in-year variation is an interest on capital charge which reflects the additional length of time for which money will be tied up because of delays or revised deliveries on projects. Some of these delays and revised deliveries may result from deliberate Departmental planning. On the Advanced Air-Launched Anti-Armour Weapon (Brimstone), for example, there was in 2002/2003 a 12 month delay relating to the provision of trials aircraft. The Tornado GR4 was to be used as trials aircraft for three different programmes - Brimstone, the Reconnaissance Airborne Pod Tornado (RAPTOR), and the Conventionally-Armed Stand-Off Missile (CASOM, also known as Storm Shadow). The delay in the provision of Tornado GR4 for Brimstone development was due to the Department's decision to prioritise the testing of the Storm Shadow missile to enable it to be used in operations in Iraq.

### 4 Summary of overall cost performance against forecasts, and in-year variation

*There have been further cost increases this year, totalling £1.7 billion.*

All 20 projects	
Total of 'Most Likely' costs at Approval	£44 billion
Total forecast costs at March 2004	£50 billion
Difference from 'Most Likely' costs at Approval <sup>1</sup>	£5.9 billion
In-year variation	£1.7 billion
Average in-year cost variation	£87 million (3.6%)

#### NOTE

- 1 The basis of approvals is covered at Appendix 2.

*Source: National Audit Office*

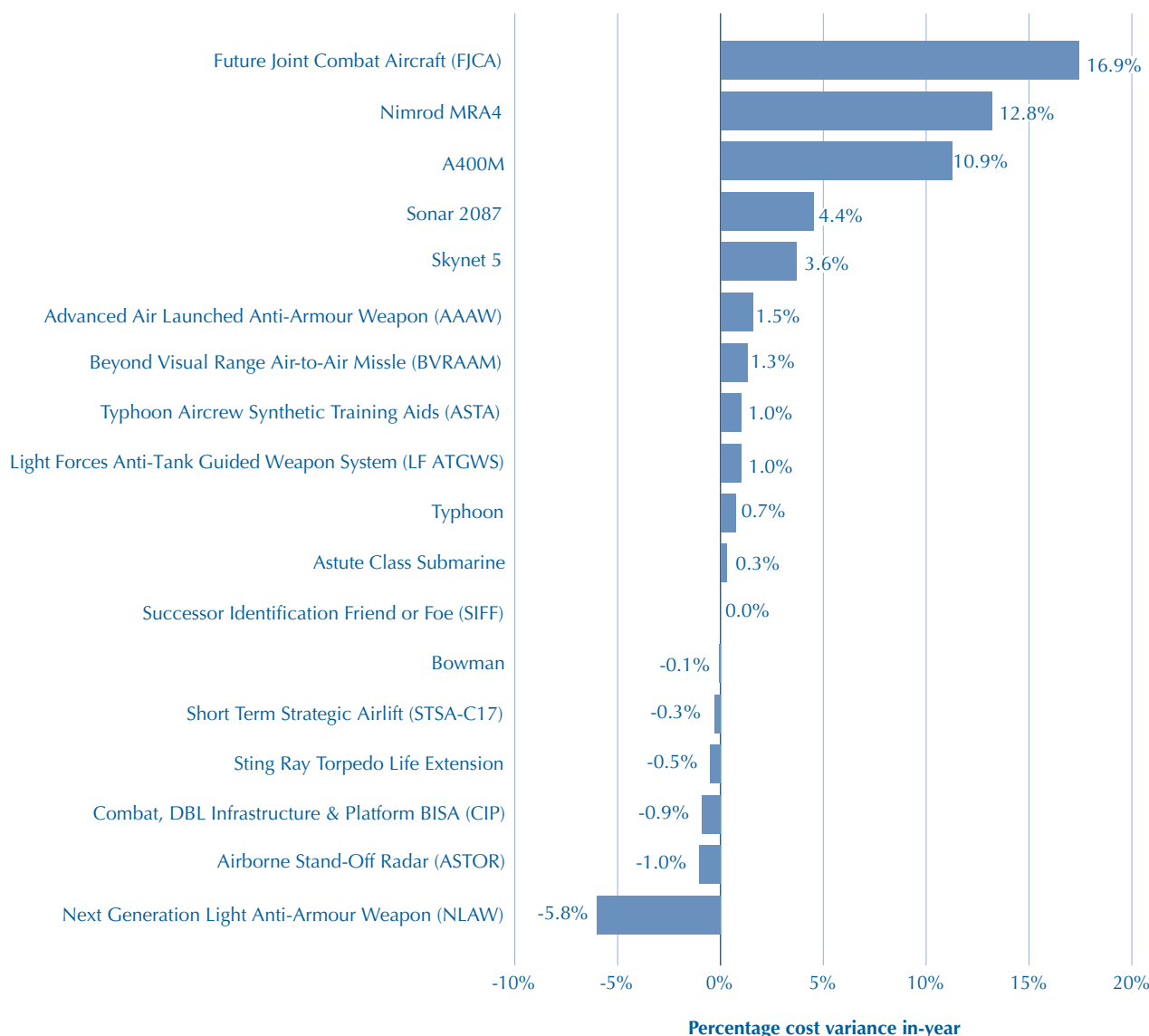
2 *The cost of capital charge and discount rates are two different concepts. The cost of capital charge is included in government accounts as the opportunity cost of capital tied up in net assets; discount rates are the estimated interest rates used in evaluating investment decisions. The reduction of the cost of capital charge, by itself, has no effect on the Net Present Value of projects (which is determined by the discount rate). Therefore, in terms of investment decisions, a reduction in cost of capital alone will not result in investment opportunities created or foregone, or changes in the equipping of the armed forces. But Departmental decisions may be affected by the change in cost of capital charge: decisions such as on holding assets may be affected by the long term costs of holding them being reduced by the change.*

1.9 **Figure 5** shows the in-year cost variations by project. Two projects, Support Vehicles and the Type 45 destroyer, have been excluded as the information is commercially sensitive due to ongoing negotiations. There have been in-year cost increases on 11 projects with three projects having cost increases in excess of 10 per cent. Developments on two of these projects, the Future Joint Combat Aircraft and Nimrod MRA4 aircraft, are

discussed more fully in Part 2. The forecast cost of the third project, the A400M aircraft has increased by £258 million (11 per cent). Some 85 per cent of this cost increase (£222 million) is due to exchange rate fluctuations<sup>3</sup>. We will report on the conclusions of this review next year. There have been forecast cost decreases on six projects. Appendix 3 provides further details of total cost variations since approval.

**5 Cost variation in-year by project**

*Costs have increased in-year on 11 projects, and decreased on six projects. The magnitude of some increases are particularly worrying.*



**NOTE**

Percentage cost variance in-year is calculated against a baseline of forecast costs as at 31 March 2003.

*Source: National Audit Office*

<sup>3</sup> The Department is reviewing the means available to it to mitigate the effects of exchange rate variations.

Projects have slipped by an average of three months in the last year

1.10 **Figure 6** shows that there is expected to be a 62 month delay on 18 projects. The average project delay is three months. We have excluded two projects from our analysis: the Future Joint Combat Aircraft, which does not yet have a time approval, and C-17 aircraft which met its in-service date in 2001.

1.11 **Figure 7** shows the in-year time variation by project. Appendix 3 provides further details of total time variations against approved in-service dates. There have been in-year delays on seven projects, of which four have had delays of at least 10 months:

- Type 45 destroyer had an 18 month slippage due to a prolonged design phase, extra time to set up the industrial arrangements and to obtain integration data. Some of this slippage is due to the lack of realism on the original in-service date. Further background on the definition of the in-service date is provided in Box 6 on page 24. The time taken to manage this complex programme, which involves the integration of many component parts, was underestimated;
- Typhoon Aircrew Synthetic Training Aids had an 11 month delay due to technical problems in the integration of sub-systems, and an underestimation of the time required for formal acceptance;
- Advanced Air-Launched Anti-Armour Weapon (Brimstone) suffered a further 11 month delay (in addition to the 18 month delay reported last year) and is now 42 months late. The latest delays are due to a continuation of earlier safety problems and modification of software. The problems related to a perceived safety issue encountered during aircraft integration activities, where a risk of potential missile collision with the aircraft after launch was identified;
- The reasons for the latest 10 month delay (in addition to the 19 month slippage reported last year) on the Support Vehicle project are explained in **Box 1** on page 12.

Key User Requirements are expected to be met

1.12 Eighteen projects are expected to meet their Key User Requirements. One project, Support Vehicle, is forecast to miss two Key User Requirements. Further details are provided in Box 1. The other missed Key User Requirement is historic and relates to landing distance of the Typhoon aircraft.

**6 Summary of overall time performance against forecasts and in-year variation**

*There have been further delays this year, totalling 62 months.*

All projects <sup>2</sup>	
Difference from 'Most Likely' forecast at Approval <sup>1</sup> (months)	362
In-year variation (months)	62
Average in-year variation (months)	3.4

**NOTES**

- 1 The basis of approvals is covered at Appendix 2.
- 2 The average in-year time variation is calculated across 18 projects. Two projects are excluded: C-17 aircraft met its in-service date in 2001; FJCA does not yet have an approved in-service date.

*Source: National Audit Office*

The principles of good procurement are not being consistently applied

1.13 As recent Major Projects Reports have highlighted, there is little evidence to indicate that defence acquisition performance has been improving, largely because the sensible acquisition principles which underpinned Smart Acquisition have not been applied. Where they have been applied, Smart Acquisition has led to good progress on projects.

Smart Acquisition principles have been successfully applied on some projects

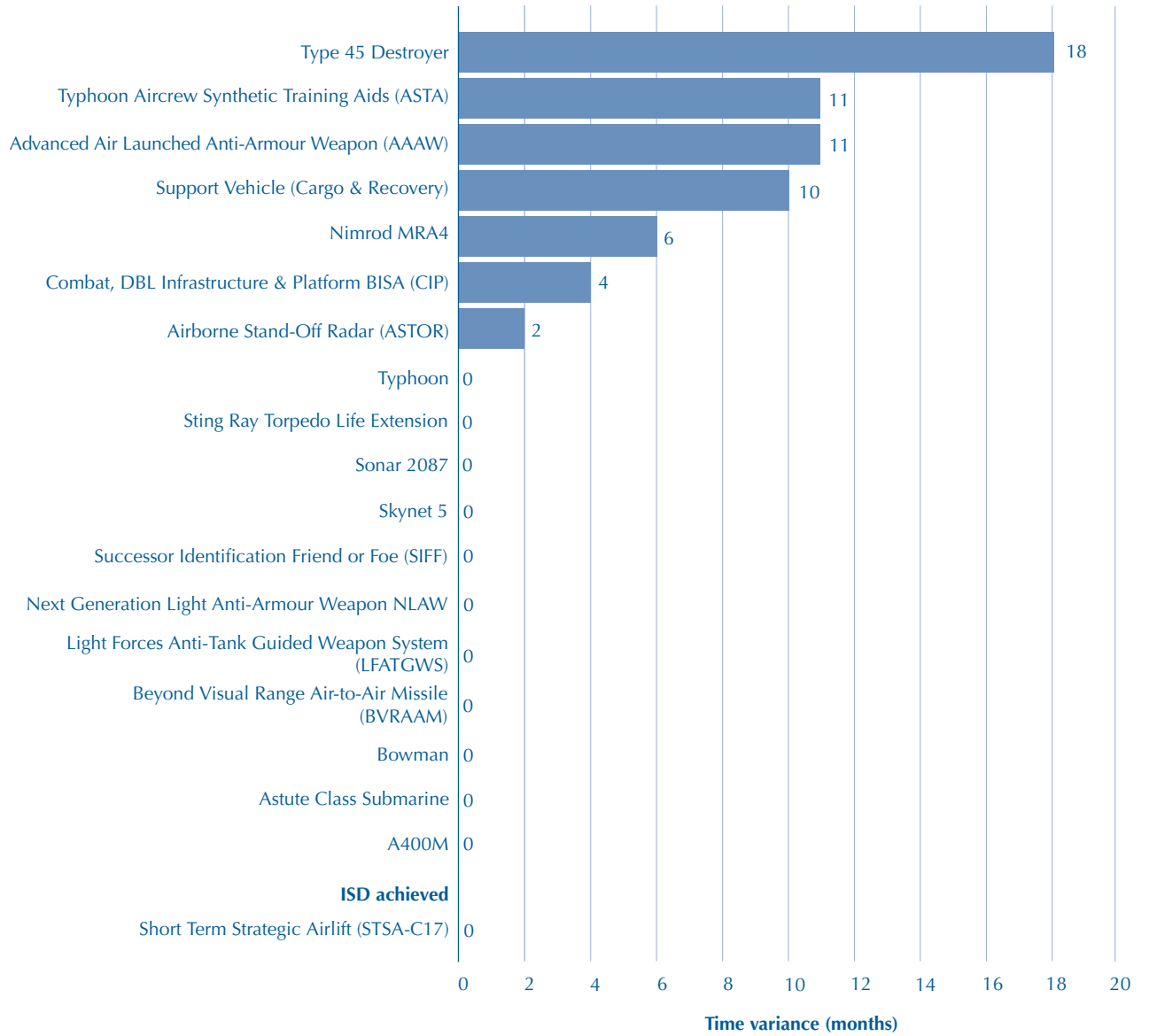
1.14 As noted above, there are some instances where the principles underpinning Smart Acquisition have been applied successfully:

- In May 2000, the Department announced that its Short Term Strategic Airlift solution would be provided by leasing four C-17 aircraft from the United States. The lease of the C-17s was to run for seven years with two options to extend by one year each. The first aircraft was delivered in May 2001 and the In-Service Date was declared in September 2001. Both the leasing deal itself and the way in which the lease has been funded are significant innovations and illustrate the scope for innovation and well managed risk-taking encouraged by Smart Acquisition.



**7 Time variation in-year by project**

Further delays have occurred on seven projects, totalling 62 months. The scale of some individual slippages are particularly worrying.



**NOTE**

FJCA is excluded as it does not yet have a time approval.

Source: National Audit Office

## BOX 1

### Developments on the Support Vehicle project

The Support Vehicle project is the provision of recovery and cargo vehicles and trailers to support all three Armed Services. The Department had originally intended to acquire the vehicles under a Private Finance Initiative deal. In March 2001, the Department decided to opt for a conventional procurement believing that the work carried out in the three year concept phase had given them a sufficient understanding of the requirement and the risks to waive an Assessment Phase. This issue was covered in more detail in the Major Projects Report 2003.

Much of the work which would usually be undertaken in the Assessment Phase - such as defining the requirement, identifying the risks, choosing the procurement strategy and agreeing a support strategy - has been performed in the post-Main Gate phase. As part of this work, the Department has traded-off some capability against cost meaning two Key User Requirements will not now be achieved:

- It was originally intended that the vehicles would be able to operate in world-wide climatic conditions. Affordability considerations mean that the Department is now prepared to accept that some auxiliary equipment will not be able to operate below -35°C. The Department is satisfied that this will not significantly limit winter warfare capability.

- The number of Recovery vehicles being procured has been reduced from 389 to 314. This means that the vehicles will not now be able to support a large scale operation concurrently with a small scale one, as originally planned. It will, however, be able to deliver on two medium and one small scale conflicts. This is the current requirement determined by Departmental planning assumptions.

One effect of the decision to reduce the procurement of recovery vehicles has been to delay the achievement of the overall in-service date by 10 months. The overall in-service date comprises two component in-service dates - one for the Cargo vehicles and another for the Recovery vehicles and Recovery Trailers. Both must be achieved before the project can declare it has met its overall in-service date. The in-service date for the Cargo vehicles (which represents 95 per cent of the programme by vehicle numbers) remains unchanged. The latest delay is because the Department has delayed the first receipt of the Recovery vehicles.

The Department announced MAN ERF as its preferred bidder for the project in October 2004.

- Trojan and Titan are new armoured engineer vehicles replacing the Chieftain engineer vehicle and bridge launcher. The project was included in the Major Projects Report 2002, and is still an important project. It was approved in January 2001 with an in-service date of October 2005 and costs of £328 million. It is now more than two-thirds into its procurement and it has no forecast cost overruns. The project has been able to incorporate five months of delay (with a current forecast for March 2005) without jeopardising its latest acceptable in-service date. Two months of the delay reflect a customer decision to enhance the vehicles by equipping them with the new Bowman communication system and three months are due to technical difficulties. The successful progression of the project to date is attributable in large part to good industrial relations and open and regular communications with the contractor, Alvis-Vickers, in line with Smart Acquisition principles.
- Sonar 2087 is more than halfway into its demonstration and manufacture phase and is currently within its 'most likely' cost and time parameters set at Main Gate approval. This performance reflects extensive assessment phase work involving acceptance of performance trade-offs and a realistic plan for achieving the in-service date. In-year, the defence capability customer has accepted

a part delivery of the Key User Requirement relating to active detection in deep water. This was to be delivered at the current forecast in-service date of May 2006, but has been delayed by technical difficulties. Had the customer insisted on delivery of the full capability as a condition of formal acceptance of Sonar 2087, there would have been a delay to the in-service date. The remainder of the capability will be delivered before Sonar 2087 is used operationally, currently forecast for January 2007.

### Not all projects have applied sensible acquisition principles, resulting in cost increases or delays

- 1.15 Where the Department has not fully applied sensible acquisition principles, cost increases and delays have often resulted. The aim of the Assessment Phase is to spend the right amount of time and money before the main investment decision to reduce project risks to an acceptable level. In practice, the right proportion to be spent will be determined by factors such as the nature of the equipment (such as an upgrade or a completely new capability), the maturity of the technology involved, the scale and length of production, and the likely procurement strategy (collaborative, non-competitive or off-the-shelf, Private Finance Initiative or Public Private Partnership).

1.16 As a guide, successive studies by the Department over the last 40 years have suggested, depending on the nature of the equipment, around 15 per cent of the initial procurement cost of a system should be spent before reaching Main Gate. In some cases, spending more money or time in the Assessment Phase than originally planned may be the correct thing to do if it results in better risk mitigation for the post-Main Gate phase of the project, when most money is spent. Calculating the average Assessment Phase expenditure as a percentage of the total procurement expenditure for the non-Private Finance Initiative projects in the Assessment Phase this year, the average is 5 per cent.

1.17 **Figure 8** highlights the linkage between cost and time problems on the 20 post-Main Gate projects in the Major Projects Report 2004 and the level of Assessment Phase expenditure. On projects such as the C-17 aircraft, the Light Forces Anti-Tank Guided Weapon System and Next Generation Light Anti-Armour Weapon projects (all off-the-shelf procurements), it is not surprising that Assessment Phase expenditure is relatively low. On the Successor Identification Friend or Foe project, five per cent was invested in the assessment phase. This was sufficient to understand and mitigate the risks which were largely around the integration of off-the-shelf equipment onto a wide variety of platforms. The project has been delivered within its 'most likely' cost and time parameters set at approval.

1.18 On other projects which incorporate untested technology, have a high integration risk, long timescales and complex commercial arrangements (often involving international collaboration) the level of Assessment Phase expenditure has been surprisingly low. On the Typhoon, Astute, and Nimrod projects Assessment

Phase spending was less than one per cent. Even on more recent high risk projects such as the Type 45 destroyer, Beyond Visual Range Air-to-Air Missile and A400M, Assessment Phase spending was less than four per cent. And the Support Vehicle project skipped the Assessment Phase completely.

1.19 We reported in detail on the problems on the Astute and Nimrod programmes in the Major Projects Report 2003 but all of the other projects listed above have also suffered difficulties recently which can, in large part, be traced back to not undertaking sufficient work in the Assessment Phase to identify and mitigate risks or to set realistic cost, time and performance parameters for the Demonstration and Manufacture phase:

- The Typhoon Aircrew Synthetic Training Aids project has been delayed by 11 months in the last year. The delays were due to technical difficulties in integrating sub-systems and to an underestimation by industry of the time needed in the formal acceptance process.
- The Type 45 destroyer has been delayed by 18 months in the last year because of the longer than expected time to set up the correct industrial arrangements and obtain integration data.
- The Beyond Visual Range Air-to-Air Missile suffered an 11 month slippage in the two years up to March 2003 because the time taken to complete the Memorandum of Understanding negotiations with other nations was underestimated.
- Nineteen months of the delay to the Support Vehicle project are directly attributable to the decision to bypass the Assessment Phase.



Sonar 2087

## 8 The linkage of assessment phase spending to performance in the Demonstration and Manufacture phase

Risk-identification undertaken in the assessment phase is key to successful cost and time performance. The amount spent should be commensurate with the level of risk in the project. Overall, project teams have spent far too little in this area - and have consequently suffered cost and time problems.

Project	Assessment Phase spend as a percentage of total procurement spend	Risks				Performance in the post-Main Gate phase
		Commercial risk <sup>1</sup>	International collaboration	High technical risk	Integration risk	
A400M	0.1%	✓	✓	✓		Cost increases and delays due to Contracting Process and Procurement Strategy.
Advanced Air Launched Anti-Armour Weapon (AAAW)	2.4%	✓		✓		Large cost overrun and delay of 42 months, mainly due to Technical Factors.
Airborne Stand-Off Radar (ASTOR)	1.3%	✓		✓	✓	Cost overrun largely due to adverse exchange rate movements, over which the Department has no control.
Astute Class Submarine	0.8%	✓		✓	✓	Large cost overrun and delay of 43 months, mainly due to Technical Factors.
Bowman	16.6% <sup>2</sup>	✓		✓	✓	Met its in-service date in March 2004 - as per its 'most likely' forecast at Main Gate.
Beyond Visual Range Air-to-Air Missile (BVRAAM)	1.5%	✓	✓	✓		Cost increases mainly due to Changed Budgetary Priorities. Delays due to Contracting Process.
Short Term Strategic Airlift (STSA - C17)	0.1%					Met its in-service date in September 2001 - as per its 'most likely' forecast at Main Gate.
Combat, DBL Infrastructure & Platform BISA (CIP)	3.7%	✓		✓	✓	Small delay due to Technical Factors.
Future Joint Combat Aircraft (FJCA)	5.3%	✓	✓	✓	✓	Large cost overrun largely due to exchange rates (which are beyond the Department's control), Technical Factors, and Changed Budgetary Priorities.
Light Forces Anti-Tank Guided Weapon System (LF ATGWS)	2.8%					No cost or time problems so far.
Next Generation Light Anti-Armour Weapon (NLAW)	4.6%					No cost or time problems so far.
Nimrod MRA4	0.1%	✓		✓	✓	Large cost overrun and delay of 77 months, mainly due to Technical Factors.
Successor Identification Friend or Foe (SIFF)	4.7%	✓				Met its in-service date in March 2004, one month before its 'most likely' forecast at approval, and within cost.
Skyenet 5	4.2%					Cost increase due to Contracting Process.
Sonar 2087	12.1%	✓				No cost or time problems so far.

## 8 The linkage of assessment phase spending to performance in the Demonstration and Manufacture phase - *continued*

Project	Assessment Phase spend as a percentage of total procurement spend	Risks				Performance in the post-Main Gate phase
		Commercial risk <sup>1</sup>	International collaboration	High technical risk	Integration risk	
Sting Ray Torpedo Life Extension	0.3%	✓				Overrun largely due to Changed Budgetary Priorities. Delay of 41 months largely due to Changed Budgetary Priorities, and Contracting Process.
Support Vehicle (Cargo & Recovery)	0% <sup>3</sup>	✓				Delay of 19 months due to a premature Main Gate decision, and a further delay of 10 months due to change in budgetary priorities.
Type 45 Destroyer <sup>4</sup>	3.8%	✓	✓	✓	✓	Total delay of 24 months due to Procurement Strategy.
Typhoon	0.4%	✓	✓	✓	✓	Large cost overrun and delay of 54 months - mainly due to Technical Factors and Procurement Strategy.
Typhoon Aircrew Synthetic Training Aids (ASTA)	1.8%	✓	✓			Cost increases mainly due to Contracting Process. Delays due to Technical Difficulties.

### NOTES

- 1 Ways in which the Department may share or transfer risk include off the shelf, Private Finance Initiative, Public Private Partnership, and alliances.
- 2 Bowman had a prolonged assessment phase in the 1990s, and this is reflected in its assessment phase spend as a proportion of total procurement spend.
- 3 The delays on Support Vehicles are largely due to a decision to bypass the formal assessment phase, proceeding directly to Main Gate. As a result, much of the work performed now (in the post-Main Gate phase) is in the nature of assessment phase work.
- 4 The Type 45 project consists of warships and the Principal Air-to Air-Missile System which it will carry. The warship is being procured nationally, and the missile system collaboratively.

Source: National Audit Office

1.20 There are examples of good practice among the Assessment Phase projects in the Major Projects Report 2004 where the Department is more completely examining the options and identifying risks and mitigating actions. The Falcon project will provide a tactical secure communications system and will operate in conjunction with other communication and information systems. Expenditure on the assessment phase is currently running at 11 per cent of total procurement costs. This has enabled the Department to demonstrate components and subsystems; refine Whole Life Costs; and develop an incremental acquisition strategy.

### Projects are going wrong soon after the main investment decision is made

1.21 At the main investment decision (Main Gate), projects are approved on the basis of a maximum acceptable level of costs and a latest acceptable in-service date - these are not to be exceeded values representing the manifestation of all identified risks and are based on risk simulation techniques (known as the 90 per cent confidence level). Forecasts of the 'most likely' costs and in-service dates are also calculated (known as the 50 per cent confidence level) and it is against these figures that the Department plans its programme and monitors project progress. Further details are provided in Appendix 2. The difference between the 'most likely' forecasts and highest acceptable costs and latest in-service dates (which are determined by the project

teams as a measure of all identified risks materialising) is called the 'risk differential'. The risk differential is consumed when risks for which a contingency has not been made materialise after approval, driving the forecasts beyond the most likely estimates.

1.22 **Figure 9** shows the consumption of risk differential by project ranked according to how far the projects have progressed through the procurement lifecycle. If risks have been successfully identified and mitigated during the Assessment Phase the diagram should show projects expecting to complete either just above or below their 'most likely' cost and time parameters as set at Main Gate. **Figure 8** shows that, in practice, project performance is also some way short of this ideal situation with the majority of projects expecting to spend more than their 'most likely' costs and achieve their in-service date after the 'most likely' date set at approval. Of particular concern is that:

- four of the 15 projects have now used up all of their cost risk differentials (and two have breached their approvals);
- a third of the 15 projects have used up all of their time risk differentials (and three have breached their approvals);
- five projects not halfway through their procurement lifecycle have used up either their cost or time risk differentials or both of them.

## The Department is trying to improve acquisition performance

Various changes to the acquisition process have been introduced in the last year

1.23 In the Major Projects Report 2003, we reported on a stocktake of Smart Acquisition which was taking place in the Defence Procurement Agency, which Sir Peter Spencer, the incoming Chief of Defence Procurement, had initiated. The results of the stocktake were reported in January 2004 following consultation within the Department and with industry. The stocktake concluded, as noted above, that the principles underlying Smart Acquisition were sound but had not been fully implemented. It also recognised that the Defence Procurement Agency needed to work with the rest of the Department to ensure that external constraints would not prevent the achievement of improved acquisition performance. Following the stocktake, the Chief of Defence Procurement introduced a continuous improvement programme. **Box 2** summarises the key changes which have been implemented or are planned

as a result of the stocktake and **Box 3** summarises how the Department intends to measure the success of the changes following the stocktake.

1.24 The change programme arising from the stocktake has been running since April 2004, so there has not been time to see its effects. In June 2004, following accepted good practice, the Department undertook an independent peer review of the change programme based on the Office of Government Commerce gateway process. The Review Team included participants from the military, from the Defence Logistics Organisation and from a major contractor. The Team consulted a wide range of internal and external stakeholders across the acquisition community. The Review concluded that the new programme was well founded and had progressed well to date. To maintain momentum, it recommended a deeper engagement with the programme at project team leader and below; and more formal management of the contribution of external stakeholders. A further review of the changes following the stocktake is planned for April 2005. By the time of this review, the Department should have firmer evidence of the success of the change programme using the measures listed in **Box 3**.

## The Department is taking steps to act more corporately to improve acquisition performance

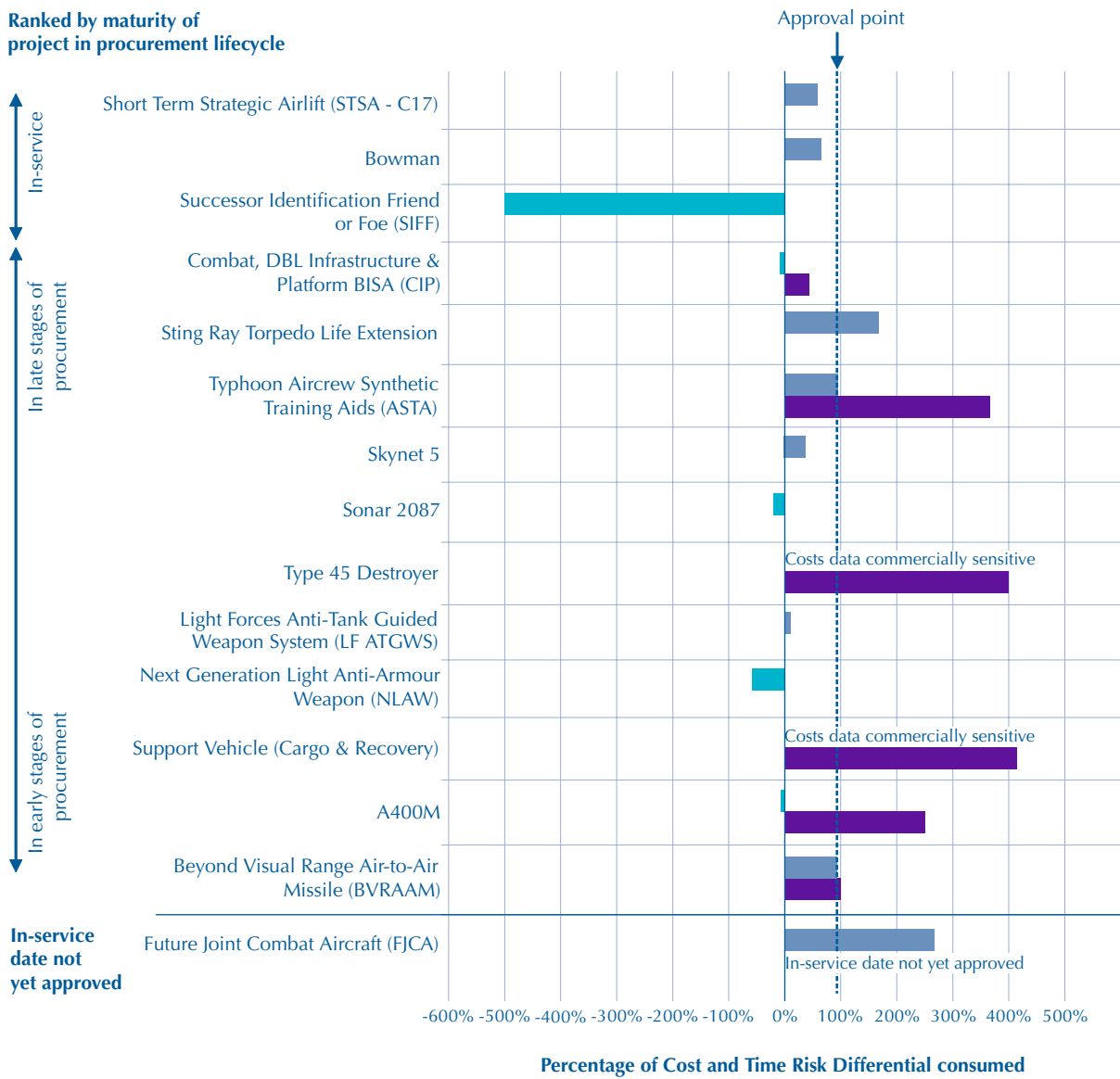
1.25 Consistently applying the sensible principles which underpin Smart Acquisition by the Defence Procurement Agency will not be sufficient on its own to deliver more successful project outcomes. **Figure 10** illustrates how other parts of the Department also play a central role. Recognising this inter-dependence, over the last two years we have been working with the Department and industry to understand better the factors which affect the ability of individual equipment procurement projects to deliver major defence equipments to time and cost and with the required performance. In March 2004 we published the first conclusions from our modelling<sup>4</sup>. **Figure 11** summarises the results of our work. The model re-affirms the themes identified by our analysis of the Major Projects Report, such as the effect of budgetary constraints and the importance of adequately funding assessment phase work to enable informed investment decisions to be made at Main Gate and realistic prime contracts agreed. The analysis also highlights a number of common factors (shown in the centre of **Figure 10**) which affect the ability of the Department and industry to deliver successful projects including governance, assurance, risk and estimating processes.

<sup>4</sup> For a more detailed explanation of these influences see our report on 'Driving successful delivery of major defence projects: drawing on wider practice in tracking the progress of major projects', published in March 2004.

**9 Percentage of Cost and Time Risk Differential consumed**

Seven projects have now consumed all their cost or time risk differentials or both.

**Ranked by maturity of project in procurement lifecycle**



- Cost RD used up
- Time RD used up
- Project costs below 'Most Likely' forecast at Main Gate

**NOTE**

Project maturity has been measured according to how progressed projects are on their timelines of Main Gate to current in-service date. This serves as useful approximation of maturity into procurement phase.

Legacy projects are not measured on this analysis, as their approvals did not include a risk differential - see Appendix 2.

Source: National Audit Office

## BOX 2

### Changes implemented in the Defence Procurement Agency to improve the application of Smart Acquisition

#### Skills

Increased focus on the skills and training within the Agency, by the introduction of a workforce planning process. This will be supported by senior staff representing key professional areas and working with stakeholders to identify training and development opportunities.

#### Performance Management

The Agency's Key Targets relating to cost growth and delays have been rebased to measure performance against the "most likely" rather than the maximum or latest acceptable parameters. There has also been an increase in the number of projects covered by these Key Targets to include all projects over £20 million, rather than just those covered in the Major Projects Report. A new Key Target measuring the Agency's performance against in-year delivery forecasts has also been introduced to provide a clearer focus on delivery of new equipment to the front line. The mechanism for providing information on project performance to the Agency Management Board has from 1 April 2004 been a new Corporate Management Information System, which provides more accurate information than was previously available on cost, time and performance estimates, overall project progress, and the achievement of key project milestones. The Board are able to review this information at any time and receive monthly summary reports and analysis of overall Agency performance. Coupled with a new project review and assurance process reported below, this reinforces the Board's ability to identify problems and take action to resolve them.

These modified targets take effect from the financial year 2004-05.

#### Project Review and Assurance

Project reviews have been revised and are now based around a standard format. Overall project performance and the status of the project against a series of key technical, financial and commercial indicators are assessed using a "traffic light" system that provides a summary of project progress at a glance, and enables detailed review to be focussed in potential problem areas. The traffic light assessments are scrutinised by relevant experts from outside the project team, to provide independent assurance. As the project approaches key decision points (e.g. Initial Gate or Main Gate), a special review will be held to determine whether the project has made sufficient progress to proceed to the next phase. This new project review and assurance process has also been adopted by the Defence Logistics Organisation for use in the projects that it manages.

The Department has also introduced Key Stage Peer Reviews to provide an independent, non-advocate assessment of major projects. These reviews are an approved variation of the Office of Government Commerce's Gateway review process and will be held at key points in the project lifecycle (at initiation and prior to Initial Gate, Main Gate and entry into service). The aim is to identify areas of concern and examples of good practice that might be adopted.

#### Financial Management

Financial Controllers are being placed at senior levels within project teams; they are qualified staff who will provide advice across a range of issues to project teams.

#### Commercial and Supplier Development

- Appointment of senior staff to act as focal points for Departmental business with the 18 prime key suppliers.
- Greater clarity about the stop/go stages between acquisition phases
- Contractual strategy has been restated, emphasizing:
  - a separate contracts for each acquisition stage
  - b clearer contractual exit points in the event of poor project progress
  - c the use of Earned Value Management and achievement of anchor milestones as a performance measurement tool
  - d Target Cost Incentive Fee as the preferred contract type for Assessment and Development contracts
  - e Contracts that incentivise contractors for good performance

#### Joint working within the Department

Alignment of the Agency's processes and those of the Defence Logistics Organisation to facilitate through-life management. This will include reporting, financial management and risk management. All project teams (exceptionally where otherwise agreed) are now dually accountable to the Defence Procurement Agency and to the Defence Logistics Organisation (hitherto, they were with the former for the procurement phase, and would transfer to the Defence Logistics Organisation after achievement of their in-service dates).



## BOX 3

### How the success of the changes following the stocktake will be measured

#### Improved Agency Performance

*Performance:* Percentage achievement of Key User Requirements.

*Time:* Average in-year time variation from 'most likely' forecasts of post-Main Gate projects over £20 million which are not yet in-service. Percentage of Anchor milestones achieved in-year, on or ahead of the 'most likely' forecasts.

*Cost:* Average in-year cost variation from 'most likely' forecasts of post-Main Gate projects over £20 million which are not yet in-service.

*Delivery:* Value of assets delivered in-year as a percentage of planned deliveries.

#### Improved People Management

- Match of people skills to requirements.
- Reward and recognition measures appropriately linked to Agency performance management.

#### Improved project maturity at Main Gate

- Average Technology Readiness levels at Main Gate of projects over £20 million.
- Average Through Life Management maturity at Main Gate of projects over £20 million.
- Average Project Risk Management maturity at Main Gate of projects over £20 million
- Time taken for Approving Authority to agree decision after submission of the Main Gate business case by the Customer and the project team.
- Supplier assurance at Main Gate.

#### Improved business processes

- Improved financial management.
- Proportion of demand led work by Support Groups
- Staff satisfaction with "learning from experience" mechanisms.
- Staff satisfaction with the Acquisition Management System.

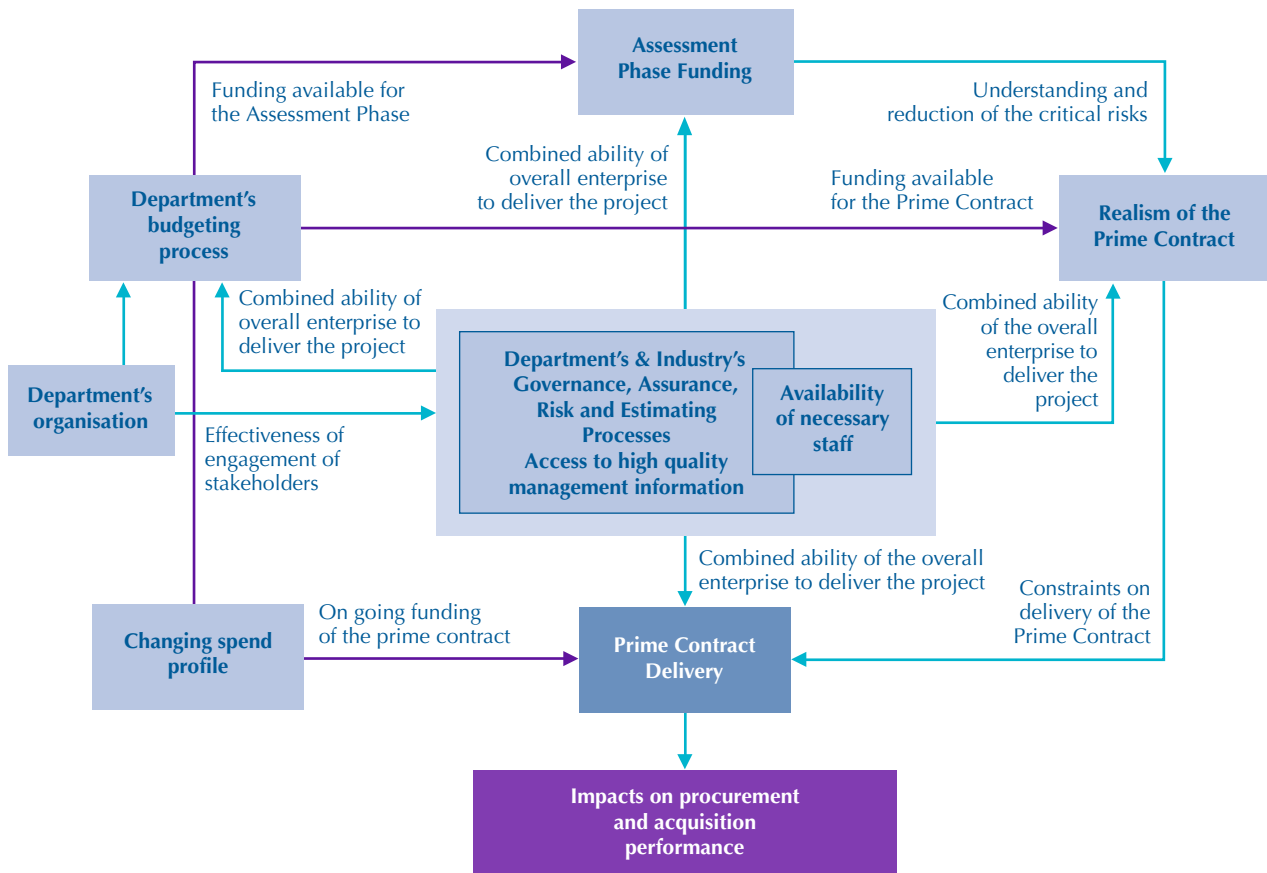
#### Improved organisational effectiveness

- Perception among project team leaders that Defence Procurement Agency Executive Board is effective in supporting the project teams and programme delivery.
- Perception among project team leaders that Defence Procurement Agency project clusters are effective in supporting the project teams and programme delivery.
- Perception among project team leaders that project teams and Support Groups work in a collaborative manner.

1.26 Both the stocktake and its Peer Review pointed to the need to solve many wider issues as critical to improving acquisition performance. **Box 4** summarises a number of the improvements taking place across the Department which should help to address some of the issues identified. The Department has established a Ministerial Group to ensure that these wider issues and improvements are given the appropriate priority across the Department.

1.27 Building on our model, and working closely with the Department, we are conducting a suite of studies to identify good practices which, taken together with the other work which the Department has in hand, can help to improve acquisition performance continuously. The first study, which will be published early in 2005, is investigating how the progress of major projects is tracked. Tracking progress is the link between management information, governance and assurance, risk and cost estimating and ultimately budgeting and funding and is central to informed and effective decision-making. The next study will examine how the Department plans for and co-ordinates the procurement of new equipment capabilities and covers much of the outer-ring of success drivers in Figure 10.

**10 The drivers of procurement performance**



Source: National Audit Office

**BOX 4**

**Improvements beyond the Defence Procurement Agency**

**Approvals process**

Smart Approvals Guidance has been revised to reflect the findings of the stocktake. In particular, projects are to be submitted for the main investment decision only when the project has been sufficiently de-risked to give greater certainty of proposed cost, time and performance and likely success of the project. Project teams will be expected to provide evidence of having delivered a measurable programme of risk reduction in the assessment phase.

Approvals will be couched in terms of 'most likely' estimates and not upper acceptable levels of project cost and time. Teams are also likely to be asked to strive for a demanding target. It is hoped that this will ensure that some projects are delivered below their 'most likely' approvals.

**Senior Responsible Owners**

Where projects involve the co-ordination of different programmes, Senior Responsible Owners will be appointed to ensure the delivery of the capability to cost, time and performance. See 'Carrier Strike' in Part 2 for further details. The Senior Responsible

Owner will normally be from the Equipment Capability Customer area and will work across boundaries including engagement with the Capability Customer, Defence Logistics Organisation, and Front-Line command.

**Joint working with the Defence Logistics Organisation**

To facilitate joint working, common finance reporting, management and planning have been introduced. All Defence Procurement Agency and Defence Logistics Organisation project teams (except where exceptionally agreed otherwise) are now dually-accountable to both, and there are now moves towards aligned corporate and project risk management, and the provision of expert advice to project teams from a single source.

**Funding to de-risk projects**

To ensure the right level of the provision of funding to ensure that resources are not diverted away from de-risking in the early stage of projects.

**11 The key stakeholders in the Department's acquisition community**

*Through-life management involves all the key stakeholders.*

**Equipment Capability Customer (1st Customer)**

The customer prior to the point when equipment becomes available to the user

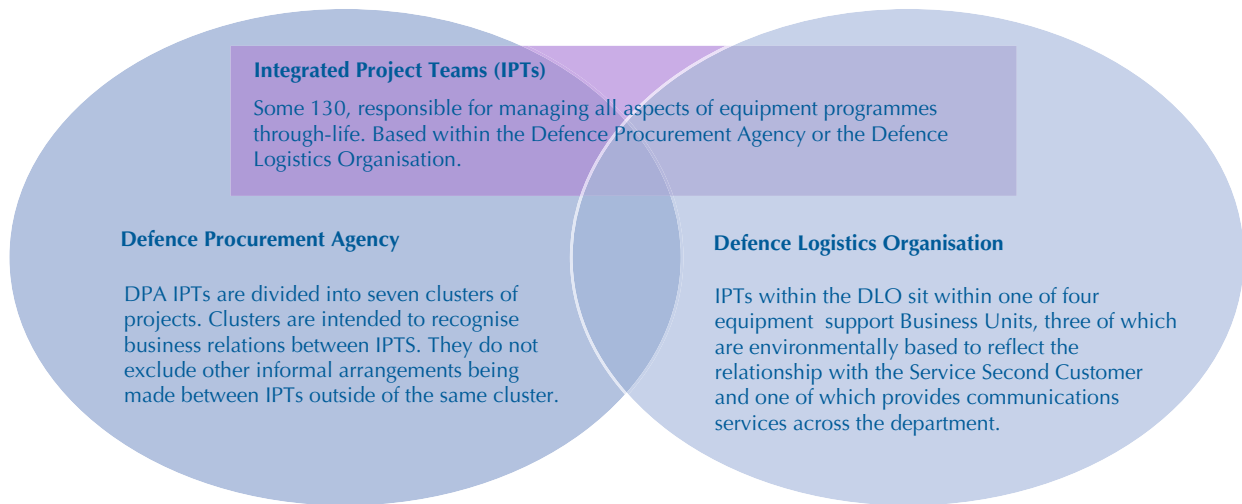
**Directors of Equipment Capability**  
Eleven, who act as the contact point between the IPT Leader and the Equipment Capability Customer.

**2nd Customer**

Responsible for user and in-service aspects of programmes. Two-fold role:

Core Leadership generating long-term Military capability, undertaken by the Single Service Chiefs; and

Pivotal Management specifying in-service outputs, negotiating Customer Supplier Agreements and monitoring IPT performance, undertaken by end users.



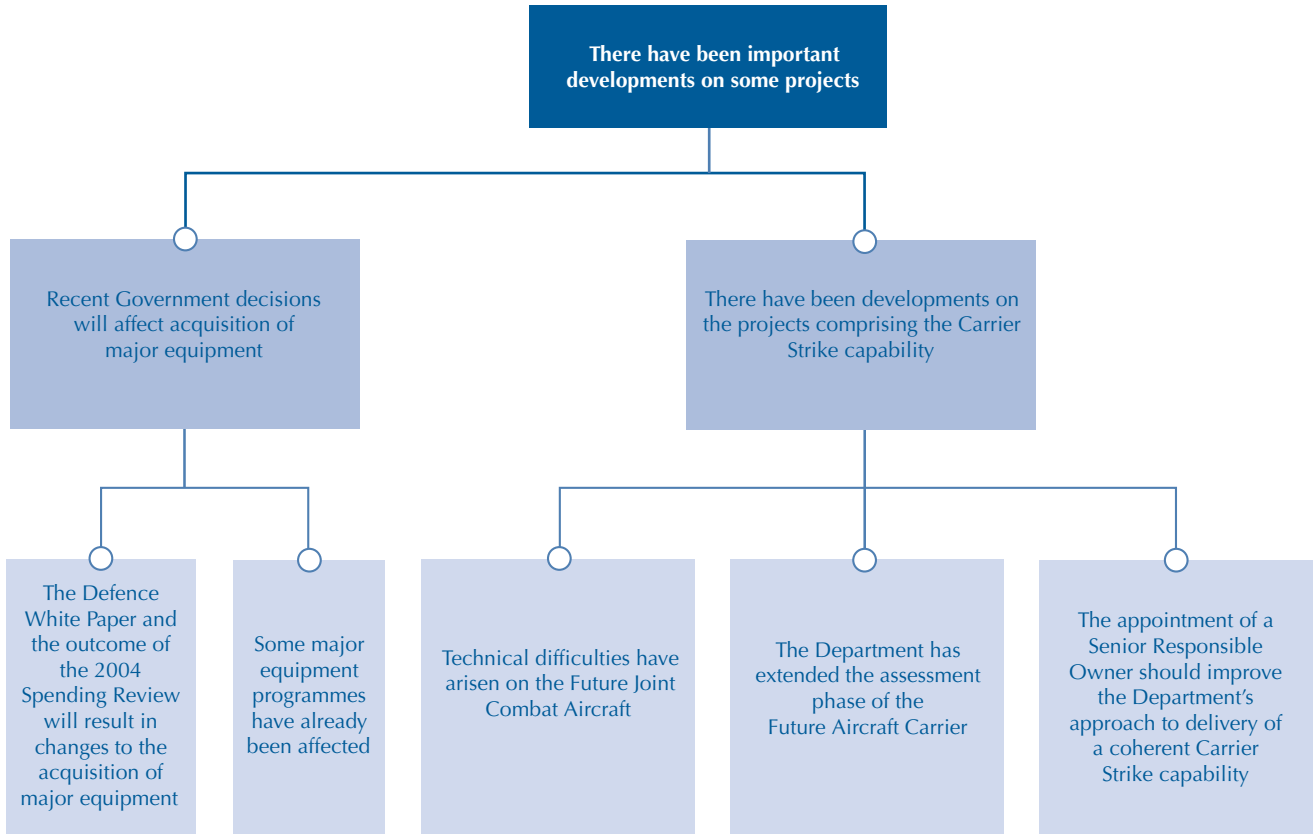
**Ministry of Defence Centre**

Includes the Investment Appraisal Board, scrutiny function and central finance. Responsible for overall management of departmental resources and the approval of major investment.

**Industry**

Membership of and involvement with IPTs aims to provide industry with a clear understanding of the required capability and allows early and positive participation in the key process of trading off time, performance and whole-life costs.

*Source: National Audit Office*



# Part 2

## There have been important developments on some projects

2.1 The December 2003 Defence White Paper and the outcome of the Spending Review 2004 will affect the Department's future acquisition plans for a number of major equipments. In this part of the report, we examine the impact of these decisions and also detail significant developments on the Carrier Strike programme since April 2004.

### Recent Government decisions will affect acquisition of major equipment

The Defence White Paper and the outcome of the 2004 Spending Review will result in changes to the acquisition of major equipment

2.2 In December 2003, the Government issued the Defence White Paper 'Delivering Security in a Changing World' containing an evaluation of the UK's strategic defence priorities. The White Paper set out the analysis of the future security environment, the implications for defence and the changes needed to force structures and planning to meet the potential threats. It found that many of the conclusions in the 1998 Strategic Defence Review remained valid but a rethink was needed to adapt to the many developments since 1998. These developments included:

- starker threats posed by international terrorism, the proliferation of weapons of mass destruction, and weak and failing states;
- changes to the shape of international collaboration, for example, the enlargement of NATO and the emergence of the European Security and Defence Policy;
- more numerous and diverse crises and the experience of dealing with them in places such as the Balkans, Afghanistan and Iraq.

2.3 The White Paper concluded that the focus must be on flexible forces able to deliver the right capability in a complex, unpredictable operational environment - "This will require a move away from simplistic platform-centric planning to a fully 'networked enabled capability' able to exploit effects-based planning and operations, using forces which are truly adaptable, capable of even greater levels of precision and rapidly deployable." The Paper also signalled the need to continue with the modernisation of the structure of the Armed Forces; to embrace new technology and to work with others to meet the threat of international terrorism and the forces of instability. It acknowledged the need for a redirection of resources to deliver the required capability and to dispense with other capabilities.

2.4 The 2004 Spending Review increased spending on defence by an average of 1.4 per cent a year in real terms over the three years to 2007-08. Defence planned spending should be £3.7 billion higher in 2007-08 than in 2004-05. The longstanding arrangements for central funding of military operations remain in place. The Department has also to realise annual efficiency gains of £2.8 billion by 2007-08, of which three quarters will be cash-releasing and re-invested in defence capability. There are no specific efficiency targets set for the procurement of military equipment but the Department is committed to ensuring that risks to major equipment projects are reduced as far as possible before significant financial commitments are made and that value for money from defence acquisition is maximised.

### Some major equipment programmes have already been affected

2.5 In July 2004, the Secretary of State made a statement about the need to transform the Armed Forces to deal with the challenges of the 21st Century after detailed work following the Defence White Paper and the outcome of the Spending Review. The statement detailed changes to the Defence Equipment Programme which included continued commitment to:

- Network Enabled Capability through communication systems such as Skynet 5, Bowman, Falcon and Cormorant;
- the introduction of two new large carriers and the use of two new assault ships;
- a new emphasis on medium weight forces, based around the Future Rapid Effects System vehicles;
- the role played by Storm Shadow, Brimstone, Advanced Medium Range Air-to-Air Missile and Advanced Short Range Air-to-Air Missile, and Maverick in precision weapon capability; and

- the importance of Typhoon and the Future Joint Combat Aircraft in the air combat and defence roles, C-130 and A400M in the heavy-lift aircraft role, and the purchase of four C-17 aircraft currently leased from Boeing, plus a fifth aircraft.

2.6 The Secretary of State also announced cuts to some major equipment already in service and some still being procured. The specific changes to the acquisition of two of the projects covered by this Report, Nimrod MRA4 aircraft and Type 45 destroyer, are discussed in **Boxes 5 and 6** below.

## BOX 5

### Nimrod Maritime Reconnaissance and Attack Mark 4 Aircraft

**The Nimrod MRA4** is a maritime patrol aircraft with anti-submarine and anti-surface warfare capability.

**The Project** has had a difficult history. The contract was placed with BAE Systems in 1996 and renegotiated in 1999 and again in 2002 when the number of aircraft was reduced from 21 to 18 resulting in a saving of £44 million. Following a further review in February 2003, the original fixed price contract for development and manufacture was converted to one for design and development and preparation for production on a target cost incentive fee and an option on production of 15 aircraft. The separation of development from manufacture was to allow for satisfactory de-risking and a proper understanding of the cost basis for subsequent production. That improved understanding has led the project to predict a further

cost increase of £408 million and slippage of six months bringing the total cost variation to some £780 million and in-service delay from April 2003 to September 2009. However, revised key contract milestones, such as the August 2004 milestone for first flight, have been achieved.

**Current capability** is provided by 21 Nimrod MR2 aircraft.

**On future capability**, the Secretary of State announced that, with reductions in the submarine threat, requirements could be met by 16 Nimrod MR2 aircraft to be replaced from 2009 by around 12 Nimrod MRA4 aircraft. The level of resources freed up by this change has yet to be determined and will depend on negotiations with BAE Systems.

## BOX 6

### Type 45 Destroyer

**Type 45** is an anti-air warfare destroyer.

**The Programme** appointed BAE Systems as Prime Contractor in November 1999 with a contract for the Demonstration and First of Class Manufacture of the first three ships placed in December 2000. Procurement of a further three ships was approved and a contract placed in February 2002. There is a related project for the procurement of a missile system for the destroyer; this is a collaborative venture with France and Italy. The current forecast in-service date (when the first destroyer meets the minimum operational requirement) is May 2009, some 18 months later than planned. This is due to a number of factors including delays in establishing the original industrial strategy, problems with aligning two parallel and dependent development programmes (Principal Air-to-Air Missile System and the warship) and a better assessment of the programme required to meet the in-service date. The in-service date is defined as the date at which the First of

Class will meet the Navy's minimum operational requirement. The previous planned for in-service date of November 2007 was based on an understanding that the contractor would deliver the First of Class in advance of the official contract delivery date of September 2008 - which was beyond the contract requirements. The revised in-service date is the combination of this lack of realism and industrial and integration issues. Costs are also likely to rise but current estimates are commercially sensitive at present.

**Current capability** is provided by 11 Type 42 destroyers.

**On future capability**, the Department decided that, by ensuring that warships are effectively networked and supported, more capability can be delivered from fewer platforms. Future air defence capability can be met by eight destroyers. Three of the Type 42 destroyers will be taken out of service by the end of 2005. The reduction of number of Type 45 destroyers from 12 to eight should free up funds of approximately £2 billion based on current unit costs forecasts.

## There have been developments on the projects comprising the Carrier Strike capability

2.7 The importance of the Carrier Strike capability was stated in the Strategic Defence Review. It should provide a rapidly deployable offensive air power in line with contemporary and future military operations. It comprises three main projects with very close operational links - the Future Aircraft Carriers, Future Joint Combat Aircraft, and Maritime Airborne Surveillance and Control platform. The Future Aircraft Carrier will be the platform from which the latter two will operate, and the Maritime Airborne and Surveillance and Control platform (still in the concept phase) will provide an early warning system for both the carriers and the aircraft. In recognition of the critical need for co-ordination between these projects, the Department appointed a Senior Responsible Owner in December 2003. This section of the Report examines developments on the Future Combat Joint Aircraft and the Future Aircraft Carriers, and the role of the Senior Responsible Owner.

### Technical difficulties have arisen on the Future Joint Combat Aircraft

2.8 The future maritime force structure will be focused on the carrier and amphibious capabilities. In the short term, the strike capability will be built around the existing carriers and the upgraded Harrier GR9 ground attack aircraft until the Future Joint Combat Aircraft (also known as the Joint Strike Fighter) comes into service as a multi-role fighter/attack aircraft. Under this plan, the Sea Harrier air defence aircraft will be phased out by 2006 and air defence will continue to be provided by the Type 42 destroyer that will be replaced by the Type 45 destroyer planned to enter operational service from 2009.

2.9 The Future Joint Combat Aircraft is a USA-led project with the Department playing a major role in supplier selection and design. In January 2001, the Department approved the contribution to the development of the aircraft at a cost of £2,034 million with an upper limit of £2,236 million<sup>5</sup>. No in-service date was set because of the need to align all decisions with the US approvals process - including those on production, timing and design. The planning assumption was that the aircraft would be ready at the same time as the Future Aircraft Carrier in 2012. The final decision on when to proceed with production and to set a firm in-service date will not be made until 2006.

2.10 In 2003-04, the Department forecast an in-year cost variation of £372 million on the project bringing its forecast spend to £2,573 million and over its upper limit for the development of the aircraft. Of the £372 million, £87 million was as a result of a re-examination of risks within the overall programme and a further £384 million due to a better understanding of the costs of the aircraft systems and their integration into the UK operating environment. These increases were offset by favourable exchange rate variations. The Department is trying to reduce the overall cost of the Project and is examining possible trade-offs between cost and the additional capability planned to be fitted after the in-service date.

2.11 During the last year, the project has run into technical difficulties over weight targets that the aircraft must stay within in order to operate safely from the proposed carrier platform. On initial estimates, the aircraft was calculated to be approximately 3,300 lbs over its target weight. The problem was first discovered in December 2003, and has been followed by months of detailed assessment by the Government Joint Strike Fighter Joint Program Office (based in Washington DC and including UK representatives) and Lockheed Martin, the Prime Contractor. These negotiations led to a revised design which is being considered by the Department of Defense Acquisition Board following a review meeting in October 2004. In late autumn, the Department will also review the plans, including the impact, if any, on the United Kingdom's Key User Requirements.

2.12 The additional costs associated with tackling the weight problems are due to be borne by the United States Government because under the Memorandum of Understanding, the United Kingdom's contribution to the programme is capped at US\$2 billion for development. The Memorandum of Understanding includes a provision for the United States to request an extra contribution from the United Kingdom and other partners, although it is not compulsory for other nations to agree to pay this. At the moment, the United States has not asked for such a contribution.

2.13 On the basis of current evidence, the Department has no reason to believe that the weight issue will not be manageable. The Short Take Off and Vertical Landing variant of the aircraft remains the planning assumption and no re-evaluation of the Future Aircraft Carrier design has yet resulted from this.

<sup>5</sup> These figures are as rebased to take account of the change in the rate of cost of capital from six to three and a half per cent.

## The Department has extended the assessment phase of the Future Aircraft Carrier

2.14 The Future Aircraft Carrier project consists of two larger and more capable aircraft carriers to replace the current three Invincible Class carriers. The current class was designed for the Cold War era, and their replacements will better reflect the nature of military operations in the post Cold War era. Endorsed by the Strategic Defence Review in 1998, the project passed its Initial Gate in December 1998 with a target Main Gate date of December 2003. That was not met, and the current date is around spring or summer 2005.

2.15 The Assessment Phase has had a number of stages, the first two of which were competitive. Stage 1 examined carrier designs and was completed in June 2001. Stage 2 considered proposals from contractors, and led to a change in the assessment strategy (announced in November 2001) in which Stage 2 was shortened and a third stage was introduced. In January 2003, the Department announced that the assessment work in Stage 2 had concluded that the project would be best run under an alliance involving BAE Systems and Thales UK, with the Department taking a risk-sharing role.

2.16 The Future Aircraft Carrier is the first project which the Department plans to run under an alliance, of which the Department as the client will be a member. This procurement strategy has been used in the commercial sector (most prominently in the oil and gas industries), and by some overseas defence departments such as the Australian Department of Defence. Under this arrangement, parties in the alliance work together to achieve a common objective, with a collective sharing of risks and rewards. It allows the buyer to draw on the best skills and resources of the alliance members for different parts of the overall procurement. For alliancing to work, there must be:

- a good relationship between the parties with open and continuous communication;
- probity and transparency through processes such as open book accounting, joint governance and joint management boards; and
- a culture which incentivises all parties to ensure the success of the alliance.

2.17 Since January 2003, the Department has been in negotiations with BAE Systems and Thales UK. The principles for the alliance were agreed at Chief Executive level between the three parties in June 2004 - negotiations are continuing on the roles and responsibilities of the Alliance members; the development of time and cost estimates; and securing an agreement. These negotiations are taking longer than originally anticipated to settle, and Carrier design work is progressing in parallel to negotiations on the alliance structure, in order to minimise any delay to the in-service dates (which will not formally be set until the Main Gate approval). The original target Main Gate date (as set in December 1998) was December 2003 and at March 2004 (the reporting date for this report), the target date was December 2004. The Department now intends to proceed to Main Gate during 2005 and this extension to the Assessment Phase was confirmed by the Secretary of State's announcement on 19 July 2004, when he said:

"This extension will enable us to carry out further risk reduction work and increase the maturity of the design prior to making our main investment decision on demonstration and manufacture (D&M). In line with smart acquisition principles by spending the right amount of time and money in the assessment phase, we will gain a better understanding of the technical and supply-side risks before we make any major commitments. We had planned to complete this risk reduction work within the original demonstration phase. The underlying programme has not been adjusted, but rather the point at which we make the main investment decision has shifted."<sup>6</sup>

2.18 In the year ended March 2004, the forecast cost of the Assessment Phase increased by £26 million and now stands at £169 million, which represents 5.5 per cent of the expected costs of the Carriers at Initial Gate.

2.19 The most recent assessment phase work includes:

- continuing to develop the design through an integrated team involving the Department and industry;
- de-risking work on technology and supply-side arrangements (including the selection of suppliers for sub-systems and equipment);
- undertaking benchmarking activities to benefit from the experiences of other programmes including the commercial sector;
- consulting independent expert advisers on the proposed alliance and on commercial risks;
- establishing the appropriate contractual arrangements.



2.20 Building and physically integrating the carriers is one of the biggest challenges facing the project, and the role of Physical Integrator has been created to strengthen this aspect. In September 2004, the Department invited bids from six contractors to fulfil this role. The core responsibilities could potentially include innovation, prioritisation of design activities; block integration and management of the ship build strategy.

The appointment of a Senior Responsible Owner should improve the Department's approach to delivery of a coherent Carrier Strike capability

2.21 The coordination of the three projects within the Carrier Strike capability was reinforced in December 2003 with the appointment of a Senior Responsible Owner, Rear Admiral Nigel Guild. The role is modelled on best practice developed by the Office of Government Commerce. He is personally responsible for ensuring the Carrier Strike programme meets its objectives and delivers the projected benefits. His main responsibilities are to ensure that:

- the overall programme is coherent and has the right characteristics for success;
- the programme reflects departmental priorities and is worth pursuing;

- the programme is subject to review at appropriate stages;
- oversight of the programme business cases;
- monitoring and driving progress;
- problem resolution and referral;
- benefits are delivered; and
- there is a post implementation review.

2.22 To perform his role successfully, the Senior Responsible Owner must co-ordinate delivery across the six Lines of Development<sup>7</sup>. He does not manage the contracts or budgets on the projects, but works by close engagement with the project teams and by persuasion. He has the direct authority of, and reports to, the Defence Management Board chaired by the Permanent Under Secretary and the Chief of Defence Staff. As such, Rear Admiral Nigel Guild, the Senior Responsible Owner for Carrier Strike, considers himself to be "answerable but not accountable" for the delivery of the overall capability. Given the long timescales involved in the projects (with in-service dates in the next decade), the length of tenure of post is an important issue. The Department envisages the first post holder will be in post for four to five years. It is too early to see the impact of the introduction of this post.



Future Joint Combat Aircraft

<sup>7</sup> The six Lines of Development comprise the equipment; appropriate structures and infrastructure; concepts and doctrine for use of equipment; required training; recruitment and retention of manpower; and sustaining the new capability once the equipment is in service.

# Appendix 1

## Summary of Pre-Main Gate projects

Project	Description	Current forecast of Assessment Phase spend (millions)	Current forecast of 'most likely' demonstration and manufacture costs (millions)	Assessment Phase spend as a proportion of total procurement costs	Current target date for Main Gate approval	Current internal planning assumption for entry into service
Battlefield Light Utility Helicopter	Helicopter	44	969	4.3 %	December 2004	May 2008
Falcon <sup>1</sup>	Communication system	26	212	10.9 %	November 2004	December 2007
Future Aircraft Carrier	Aircraft Carrier	169	Commercially sensitive	Commercially sensitive	December 2004	Commercially sensitive
Future Integrated Soldier Technology	Fighting system for dismounted close combat	26	583	4.3 %	November 2006	August 2009
Future Strategic Tanker Aircraft <sup>2</sup>	Tanker aircraft providing air-to-air refuelling capability	24	12,300	0.2 %	September 2005	November 2011
Ground Based Air Defence	Integration and update of Air Defence systems	151	1,553	8.9 %	February 2008	August 2012
Indirect Fire Precision Attack <sup>3</sup>	Munitions	16	1,406	1.1 %	June 2005	December 2008
Surface Combatant Maritime Rotorcraft <sup>1</sup>	Rotorcraft	15	548	2.7 %	December 2004	April 2011
UK Military Flying Training System <sup>1 2</sup>	Training system	35	10,424	0.3 %	April 2006	April 2007
Watchkeeper <sup>1</sup>	Unmanned air vehicles, sensors and ground stations	54	Commercially sensitive	Commercially sensitive	December 2004	November 2006

### NOTES

- 1 These projects are new to the Major Projects Report.
- 2 These projects are expected to proceed as Private Finance Initiative projects, and the costs represent their whole-life boundaries, not just for Demonstration and Manufacture.
- 3 As a planned incremental acquisition programme, the Indirect Fire Precision Attack project will be seeking an increase in assessment phase spending at its first Main Gate (which will be for the first increment of capability).

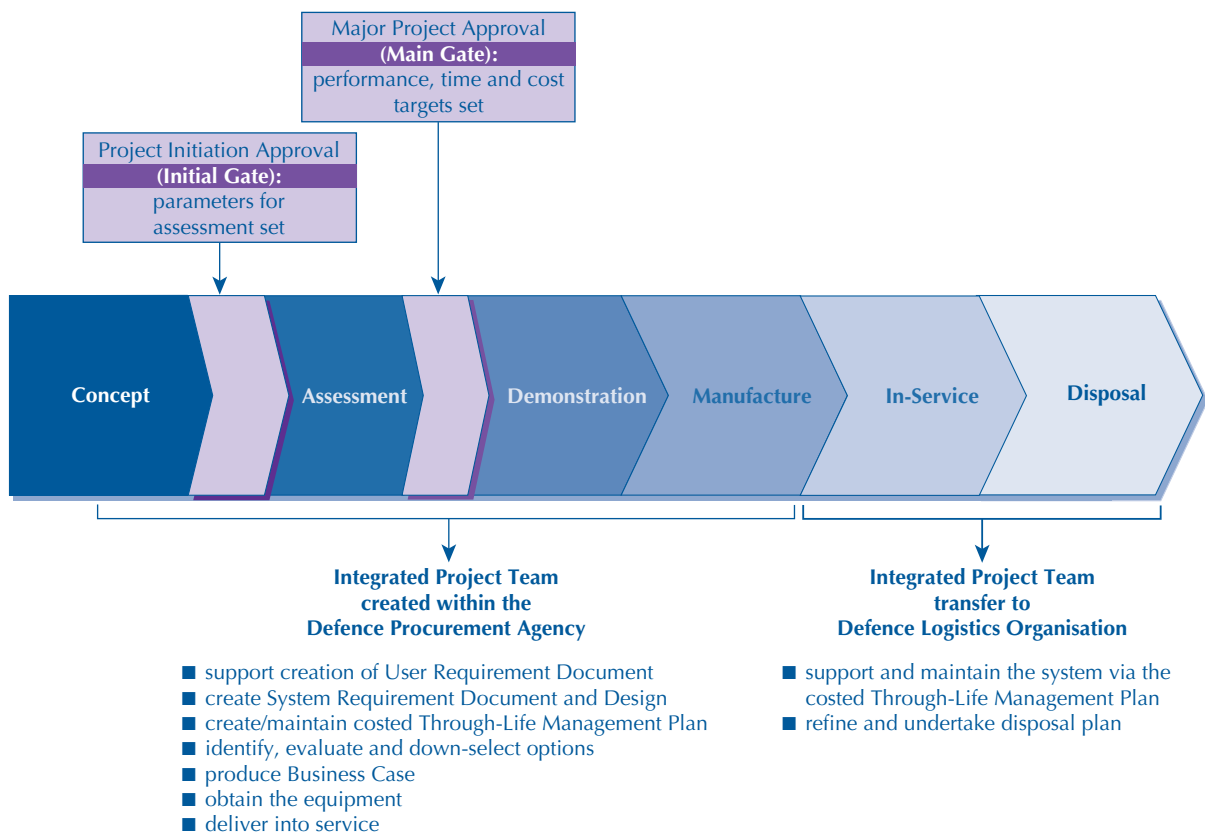
Source: National Audit Office

# Appendix 2

## The Smart Acquisition lifecycle and the different approvals for Legacy and Smart projects

- 1 Under the Smart Acquisition lifecycle, there are two key approval points, Initial Gate, at which parameters for the Assessment Phase are set, and Main Gate, at which performance, time and cost targets for the Demonstration and Manufacture Phase are set. **Figure 12** outlines the acquisition lifecycle and the responsibilities of Integrated Project Teams at each stage.
- 2 Legacy projects (those approved before 1998) and Smart projects (approved after the introduction of Smart Acquisition in 1998) are approved on a different basis of risk measurement:
  - Legacy projects were granted approvals against the Department's estimate of the 'most likely' costs, and of the 'most likely' in-service dates. Legacy approvals allowed a tolerance of 20 per cent of costs and two years beyond the approved parameters before project teams were required to seek re-approval.

**12** The Smart Procurement acquisition cycle showing the role of Integrated Project Teams



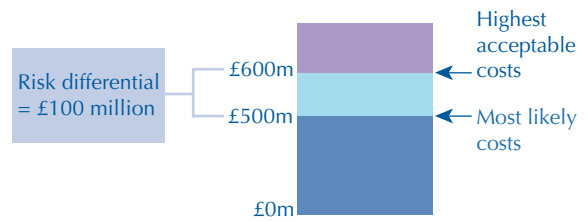
Source: National Audit Office

- In Smart Acquisition, projects are required to produce three-point estimates as part of their Main Gate business cases. Three-point estimates provide an estimate of costs and in-service dates at 10, 50 and 90 per cent confidence levels based on the likelihood of identified risks materialising and represent the lowest achievable, most likely, and highest estimate of costs (or most optimistic, most likely, and most pessimistic). Similarly for time, the three point estimates represent the earliest achievable, most likely, and latest estimate of in-service dates. Smart projects are approved on the basis of their 90 per cent confidence levels, but are managed and driven to meet their 50 per cent confidence levels. The 90 per cent confidence levels represent the manifestation of all identified risks and are the highest level of costs and latest in-service dates which the Department are prepared to accept - projects which exceed these parameters are required to seek re-approval from the Investment Approvals Board.

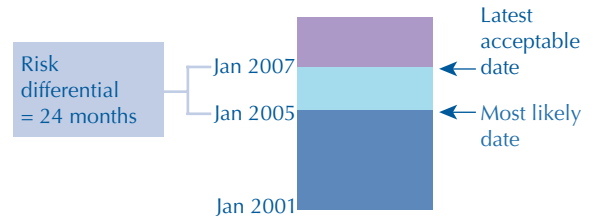
- 3 The difference between the forecast (50 per cent) for cost and time and highest acceptable (90 per cent) for cost and time at Main Gate is reported in the Major Projects Report as the Risk Differential. This is illustrated in **Figure 13**. If risk identification is performed effectively, there should be a similar number of projects delivered within, as projects delivered beyond, their most likely forecasts. There should be no projects exceeding their highest, or latest, acceptable parameters.

**13 Cost and time approvals under Smart Acquisition**

**Estimated costs to completion**



**Estimated in-service date**



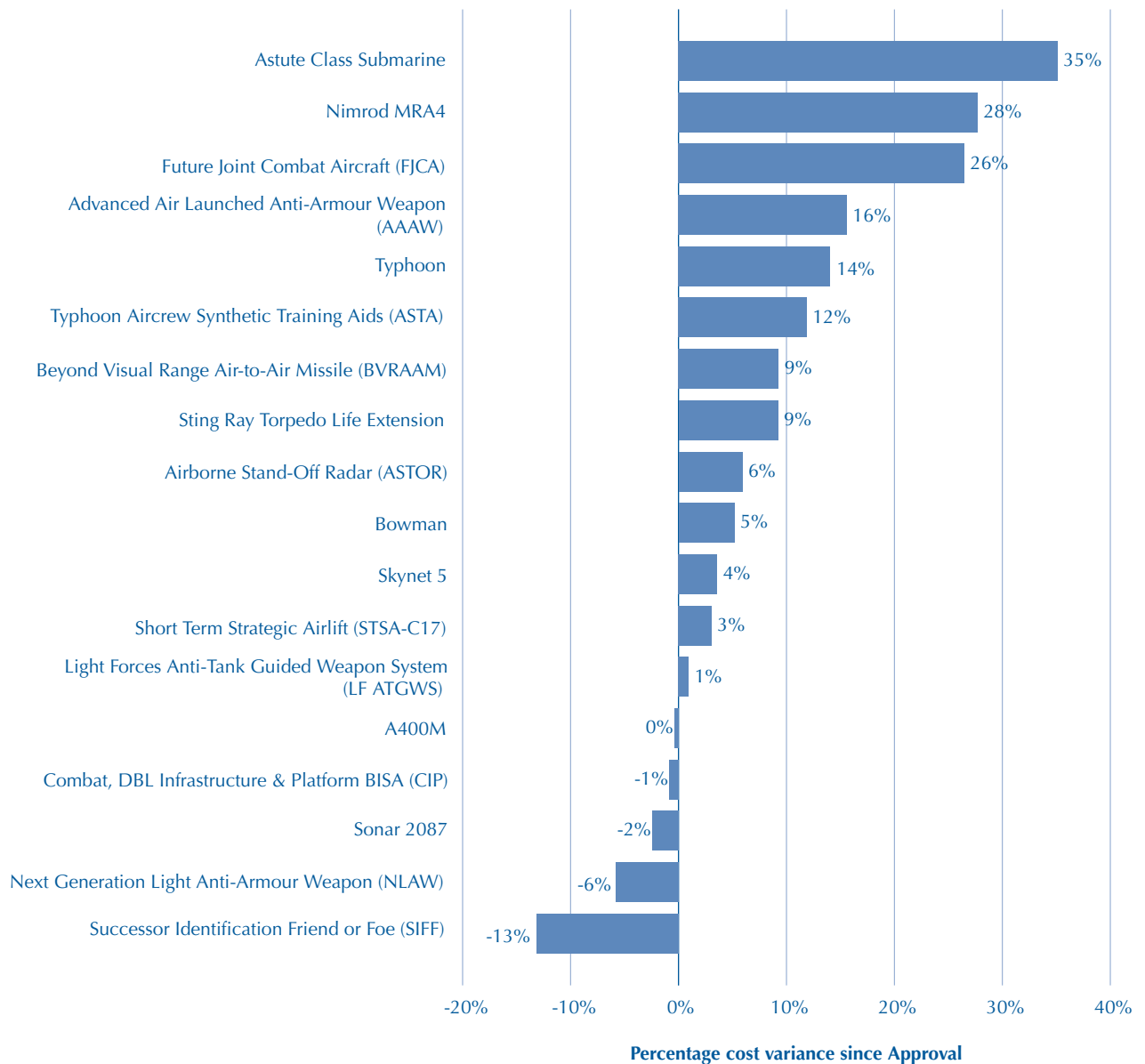
Source: National Audit Office

# Appendix 3

## Cost and time performance since Main Gate approval

### 14 Cost variation since Approval

Thirteen projects are forecasting overruns against their forecast of 'most likely' costs at approval.



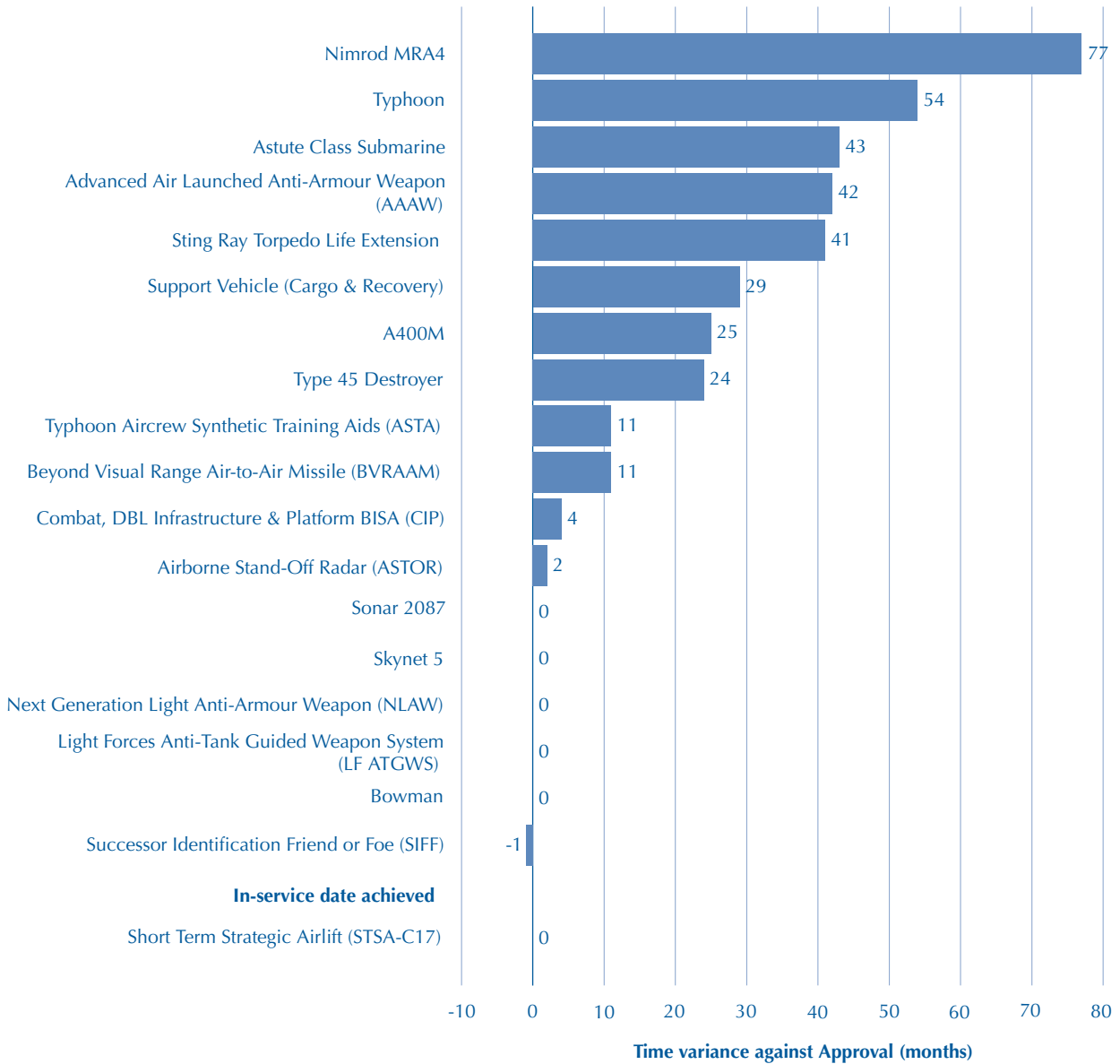
**NOTE**

Support Vehicle and Type 45 excluded from this analysis as the information is commercially sensitive. The Future Joint Combat Aircraft Main Gate was tailored for development only.

Source: National Audit Office

**15 Time variation since Approval**

Compared against their forecasts of 'most likely' in-service dates at approvals, twelve projects are forecasting delays.



**NOTE**

FJCA is excluded as it does not yet have a time approval.

Source: National Audit Office

# Appendix 4

## Glossary of contractual and acquisition terms

<b>Assessment Phase</b>	The second phase in the acquisition cycle beginning after the Concept Phase and Initial Gate Approval. During the Assessment Phase the Integrated Project Team (IPT) produces a System Requirement Document and identifies the most cost-effective technological and procurement solution. Risk is reduced to a level consistent with delivering an acceptable level of performance within tightly controlled time and cost limits. By the end of the Assessment Phase a Business Case will have been assembled for Main Gate approval.
<b>Business Case</b>	The documentation submitted to the Approving Authority at Initial Gate or Main Gate, making the case for proposed expenditure on the next phases of the project.
<b>Cost of Ownership</b>	An annualised representation of the resources consumed directly in the procurement, operation, training, support and maintenance of military equipment at all stages of its life. The Cost of Ownership statement is the costed element of the Through-Life Management Plan.
<b>Demonstration and Manufacture Phases</b>	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 within time and cost limits appropriate to this stage.
<b>Equipment Capability Customer</b>	The Customer with responsibility for developing and managing a balanced and affordable equipment programme; including requirements definition; equipment planning; seeking approvals; and authorising acceptance. The Equipment Capability Customer also has through-life responsibility for the equipment capability.
<b>Equipment Programme (EP)</b>	The Department's budgeting plan for expenditure on the equipment programme. It examines costs over the 10-year plan, and creates and considers options to match the required spend profile and Defence priorities.
<b>Fixed Price</b>	An agreed price that is subject to variation to take account of inflationary and/or exchange rate movements.
<b>Incremental Acquisition</b>	An approach to acquisition in which successive equipment increments, which are flexible in detail, are planned within a scheme of known overall capability requirement and affordability, with each increment providing quantifiable free-standing military capability.
<b>Initial Gate</b>	The approval point preceding the Assessment Phase. At Initial Gate, a Business Case is put to the Investment Appraisals 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 Customer has proposed.
<b>Interest on Capital</b>	The opportunity cost to the Government of employing money in capital expenditure instead of on alternative investment opportunities. For the public sector, Interest on Capital has been charged at six per cent of the average capital employed during each year until 31 March 2003, and at 3.5 per cent from 1 April 2003.
<b>Investment Appraisal</b>	A comparison of alternative investment options on a purely financial basis.
<b>Key User Requirements</b>	Requirements or constraints identified from within the wider set of user requirements, assessed as key to the achievement of the mission.

<b>Main Gate</b>	The approval point between the Assessment Phase and the Demonstration and Manufacture Phases. At Main Gate, a Business Case is presented, which should recommend a single technical and procurement option. By Main Gate, risk should have been reduced to the extent that the Director of Equipment Capability and IPT Leader can, with a high degree of confidence, undertake to deliver the project to narrowly defined time, cost (procurement and whole-life) and performance parameters.
<b>Prime Contractor</b>	A contractor having responsibility for co-ordinating and integrating the activities of a number of sub-systems contractors to meet the overall system specification efficiently, economically and to time.
<b>System Readiness Levels</b>	A means of assessing the readiness of the design, development and testing regime of systems or sub-systems to be integrated, and whether candidate systems or sub-systems represent a risk to timely integration.
<b>Technology Readiness Levels</b>	A structured means of measuring and communicating the maturity of technologies within acquisition programmes.
<b>Through-Life Management Plan</b>	The Through-Life Management Plan should bring together key themes of Integrated Project Teams, Systems Engineering and improved commercial practices. An outline Through-Life Management Plan should be produced in the concept stage and maintained throughout the procurement cycle. It will show the full resources needed to meet the objectives of the project and is recognised by all stakeholders.
<b>Whole-Life Costs</b>	The aggregation of the annual Cost of Ownership statements covering the total resource required to assemble, equip, sustain, operate, and dispose of a specified military capability at agreed levels of readiness, performance and safety.