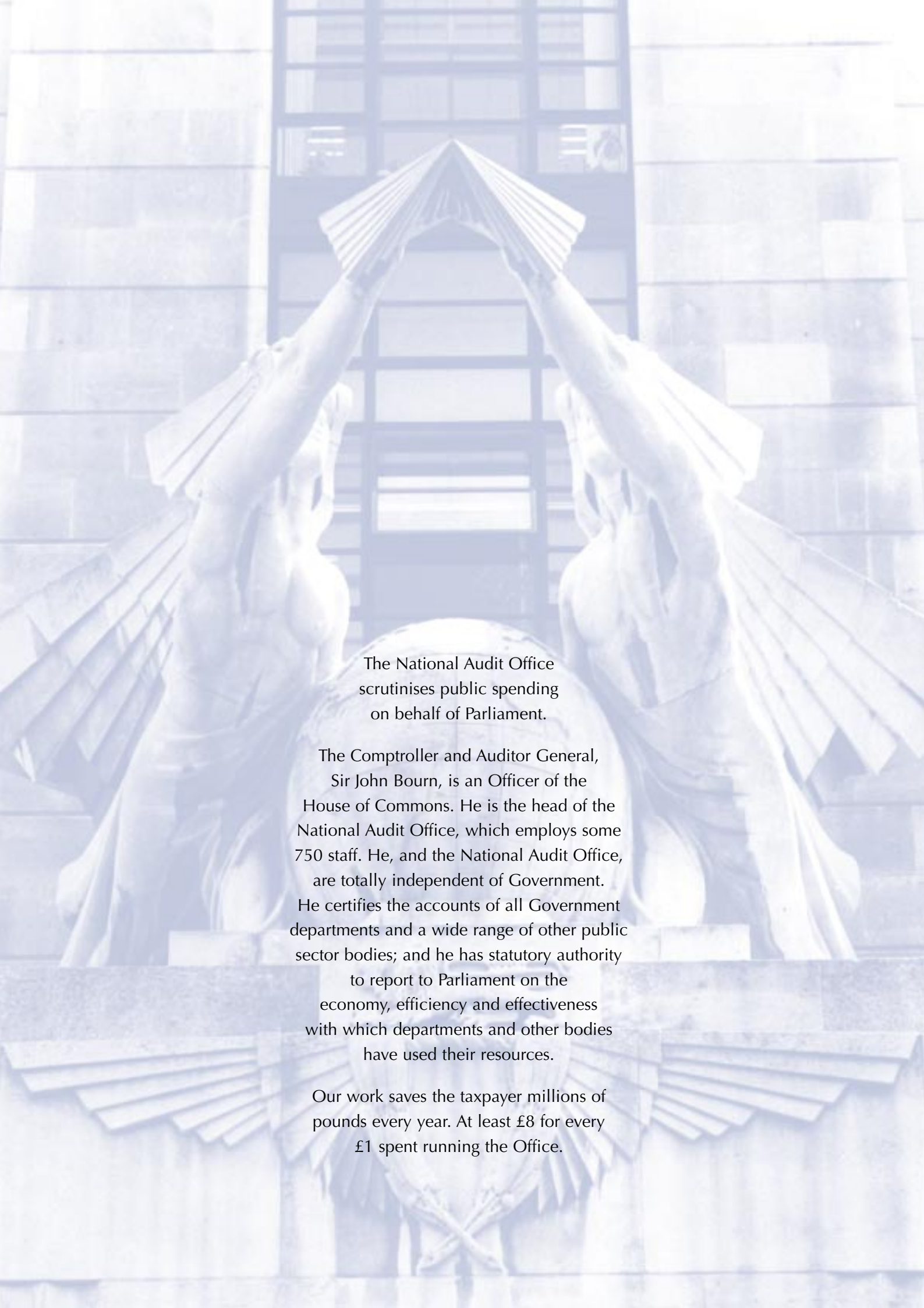
NATIONAL AUDIT OFFICE

Ministry of Defence

Major Projects Report 2000

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
HC 970 Session 1999-2000: 22 November 2000



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LONDON: The Stationery Office
£0.00

Ordered by the
House of Commons
to be printed on 20 November 2000

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 **10 November 2000**

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Cover Photograph: Artist's impression of Meteor fired from Eurofighter Typhoon

executive summary

In this summary

1 Each year since 1984 the Ministry of Defence (the Department) has reported to Parliament on its progress in procuring major defence equipments. Prior to 1991, the Department classified much of the data submitted to Parliament and our analyses of the key themes and trends emerging were therefore not published. The Major Projects Report 2000 is the ninth that we have published since the level of classification of the data was reduced.

2 The Major Projects Report 2000 covers the period to 31 March 2000. It is the first to be produced in a new format which was agreed by the Committee of Public Accounts earlier this year and reflects the changes in project accounting and approvals brought about by the introduction of Smart Procurement and Resource Accounting and Budgeting. Notable changes are:

- the inclusion of data on 30 rather than 25 projects split, in accordance with Smart Procurement principles, between the 20 largest projects on which the main investment decision has been taken and the 10 largest projects yet to reach that point;
- the inclusion of data on the technical performance of projects, as well as their cost and time performance; and
- that costs are reported on a resource basis at outturn prices rather than on a cash basis at constant prices.

3 The changes to the reporting format mean that it is not possible to directly compare the data contained in the Major Projects Report 2000 to that reported in earlier years. We have, however, reconciled the data in this year's report with that in the Major Projects Report 1999 and this reconciliation is shown in Appendix 2. Our Report this year analyses changes in the Department's cost and time performance between 31 March 1999 (the datum of the last Major Projects Report 1999) and 31 March 2000. In future years we will build on this analysis to track the Department's progress over time. Future reports will also include a wider range of analyses as the data submitted to Parliament by the Department increases. In particular, Appendix 7 reports the Department's progress towards being able to provide data on whole-life costs.

4 The main purpose of this report is to present current information on progress with these important projects. The report also throws some light on whether the Department is getting better at delivering major equipments to cost and time, and which meet the needs of the Armed Services. In presenting information on each project we have therefore sought to focus so far as possible on changes occurring during 1999-2000 rather than on the position prior to that year.

5 The report does present some evidence to judge whether the disciplines of Smart Procurement are beginning to lead to improved performance. It is, however, very early to expect to see any major impact of Smart Procurement on the projects in this report, all of which were begun before the introduction of Smart Procurement, in some cases, many years before.

6 Our overall conclusion is that the Department is meeting the technical requirements of customers but not always within approved time and cost. There is evidence that the Department has begun to control costs better during the demonstration and manufacture stage. Control of time remains a problem. As regards the assessment phase, Smart Procurement places great stress on using that phase of projects as a means of defining and managing the risks of the subsequent demonstration and manufacture phase. Successful exploitation of the assessment phase to reduce and manage risk better during the subsequent demonstration and manufacture stages will be critical to the success of Smart Acquisition. Our examination of the 10 largest projects in the assessment phase highlights that some projects approved before 1995 are showing substantial variation in time and cost since their approval. This suggests that the assessment phase is needed but that there is scope for improvement in performance which the Department believes will come about partly through better prediction of cost and time parameters.

7 Our more specific conclusions are summarised below:

For projects that have passed the main investment point and are in the demonstration and manufacture phase:

i) There are signs that the Department is getting better at controlling project costs during demonstration and manufacture of the equipment, but most of the new cost reductions and cost increases reported in 2000 relate to future expenditure;

ii) the average project delay is getting longer and slippage will increase if the risks that the Department have allowed for in approvals materialise;

iii) most projects are expected to meet the military requirement; and

iv) delays have led to capability shortfalls on many projects.

For projects that have yet to reach the main investment point and are in the assessment phase:

v) targets for the assessment phase are not yet in place; and

vi) on some projects there are substantial cost and time variations from approval which leaves scope for improvement.

Part 1

Performance during the Demonstration and Manufacture phase

1.1 Under Smart Procurement[1] Main Gate approval is the main investment point and normally signals the start of demonstration and manufacture of the equipment being procured (see Appendix 1). The Ministry of Defence (the Department) should have a high degree of confidence that it can meet the cost, time and technical performance parameters approved at Main Gate after having reduced risk during the preceding assessment phase. We should, therefore, see less cost variation and less delay on projects under Smart Procurement.

1.2 All of the post-Main Gate projects featuring in the 2000 Major Projects Report were conceived prior to the introduction of the Smart Procurement Initiative and were approved under the old Downey procurement Cycle. For each project, the Department has identified and agreed with us a Downey Cycle approval which best approximates to a Main Gate approval in order to establish the baseline against which performance has been measured. It should, however, be noted that these approvals were not set with the same degree of confidence used under Smart Procurement, and legacy projects are likely to continue to show slippage against the approval baseline. Appendix 2 summarises how performance reported this year reconciles to that reported in the 1999 Major Projects Report.

1.3 In the first part of the Report, we examine progress on the Department's 20 largest post-Main Gate procurement projects against the cost, time and technical targets set at Main Gate approval. We look at the causes of any variation from these targets, identify any indications of improvements in cost and time performance during the financial year 1999-2000 and examine the operational impact of project performance. We found that the Department is meeting the technical requirements of customers but not within approved time and cost. There is evidence that since 1997 the Department has been controlling costs better but average project delays are getting longer.

There is evidence that the Department is getting better at controlling project costs, but most new cost reductions and cost increases relate to future expenditure

1.4 Cost control is about minimising the variation between costs actually incurred and those approved in advance. It is measured in the Major Projects Report by comparing the current forecast cost, made up of the costs incurred to date on the project and those forecast to be incurred in the future, against the approved cost at Main Gate. We found that:

- forecast costs are 0.2 per cent down since last year and 5.7 per cent higher than at approval (paragraphs 1.5 -1.10);
- newer projects show less cost overrun per year than older projects (paragraph 1.11); and
- most new cost variations relate to future expenditure (paragraph 1.12).

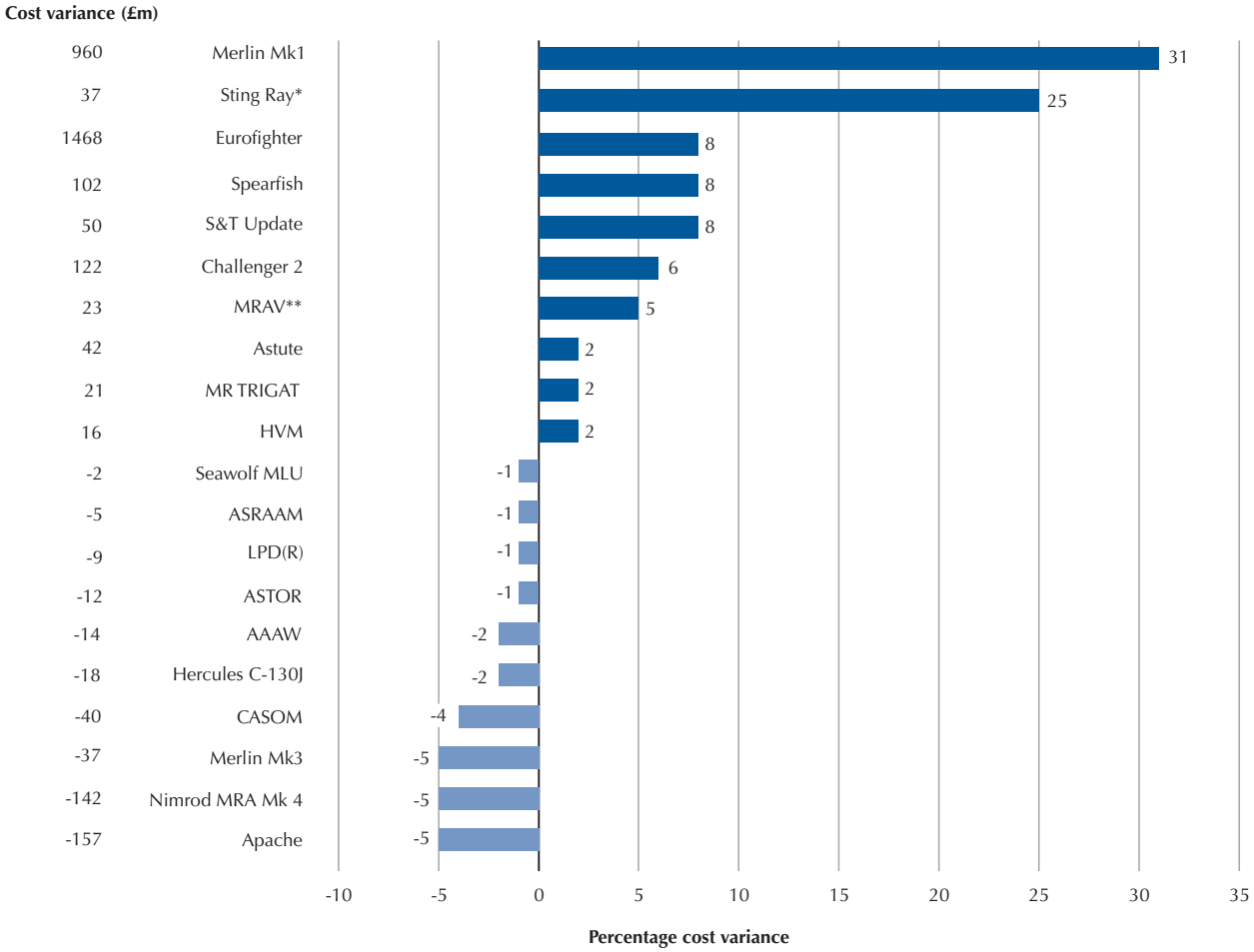
Forecast costs are 0.2 per cent down since last year and 5.7 per cent higher than at approval

1.5 The 20 post-Main Gate projects in the 2000 Major Projects Report are currently forecast to cost a total of £44.7 billion compared to £42.3 billion approved at Main Gate, a net increase of £2.4 billion or 5.7 per cent. Ten projects are forecast to exceed their Main Gate cost approval while the remaining ten are expected to be under budget. **Figure 1 (overleaf)** shows the cost variance on each of the 20 projects and the percentage variation against the cost approved at Main Gate. Eighteen projects are expected to be delivered within ten per cent of the cost approved at Main Gate.

1 *The momentum generated by the Smart Procurement Initiative is now being sustained and reinforced throughout the Ministry of Defence 'acquisition community' under the new heading 'Smart Acquisition'. The 'acquisition community' comprises the Equipment Capability Customer, the Defence Procurement Agency, the Defence Logistics Organisation and the Service end-user of the equipment.*

1 **Percentage cost changes since Main Gate approval**

Eighteen projects are forecast to be delivered within nine per cent of the cost approved at Main Gate



* Cost overrun on Sting Ray is expressed as a percentage of full development and initial production approval only. Approval for further production is expected in 2002.

** Cost overrun on MRAV is expressed as a percentage of the cost of development and production of a first batch of 300 vehicles. The United Kingdom expects to procure more than 1000 vehicles.

Source: *National Audit Office*

1.6 Over half of the total cost overrun is due to the £1,468 million increase since Main Gate on the Eurofighter programme. If this exceptionally large project is excluded from the analysis, the remaining 19 Projects are expected to exceed the sum of their Main Gate approvals by £937 million (3.8 per cent). Most of the cost overrun on the Eurofighter programme occurred during the earlier stages of development and the rate of cost increase has slowed markedly as the development programme has matured.

1.7 Since 1997, a downward trend has been established across the majority of projects on cost, excluding Merlin Mk 1 and BOWMAN. **Figure 2** shows the in-year cost change for projects which featured in Major Projects Reports up to 1999, excluding Merlin Mk1 with large historic overruns and Bowman, a pre-Main Gate project with substantial cost increases in the assessment phase. Cost variances caused by changing project populations are excluded. On this basis, there is a decrease in cost between 1997 and 1998 and again between 1998 and 1999.

1.8 The £2.4 billion net cost increase since Main Gate approval on the top 20 projects is largely historic. **Figure 3** shows that between 31 March 1999 (the datum of the 1999 Major Projects Report) and 31 March 2000, the total forecast estimate of the cost of the 20 projects decreased by £78 million (0.2 per cent). For the 16 projects common to both the 1999 and 2000 Major Projects Reports, the total cost overrun against Main Gate approval has reduced from 6.5 per cent to 6.0 per cent in the last year, on a resource cost basis at outturn prices.

2 **Trend in cost variance since 1997**

Since 1997, a downward trend has been established across the majority of projects on cost if Merlin Mk 1 and BOWMAN, are excluded from the analysis

	Cost change on previous year (£m at 1999/00 prices)		
Project population analysed	**1997**	**1998**	**1999**
All projects except Eurofighter which is excluded because this exceptionally large programme distorts the analysis	214	-328	354
Excluding Merlin Mk 1 and BOWMAN in addition to Eurofighter.	104	-369	-164

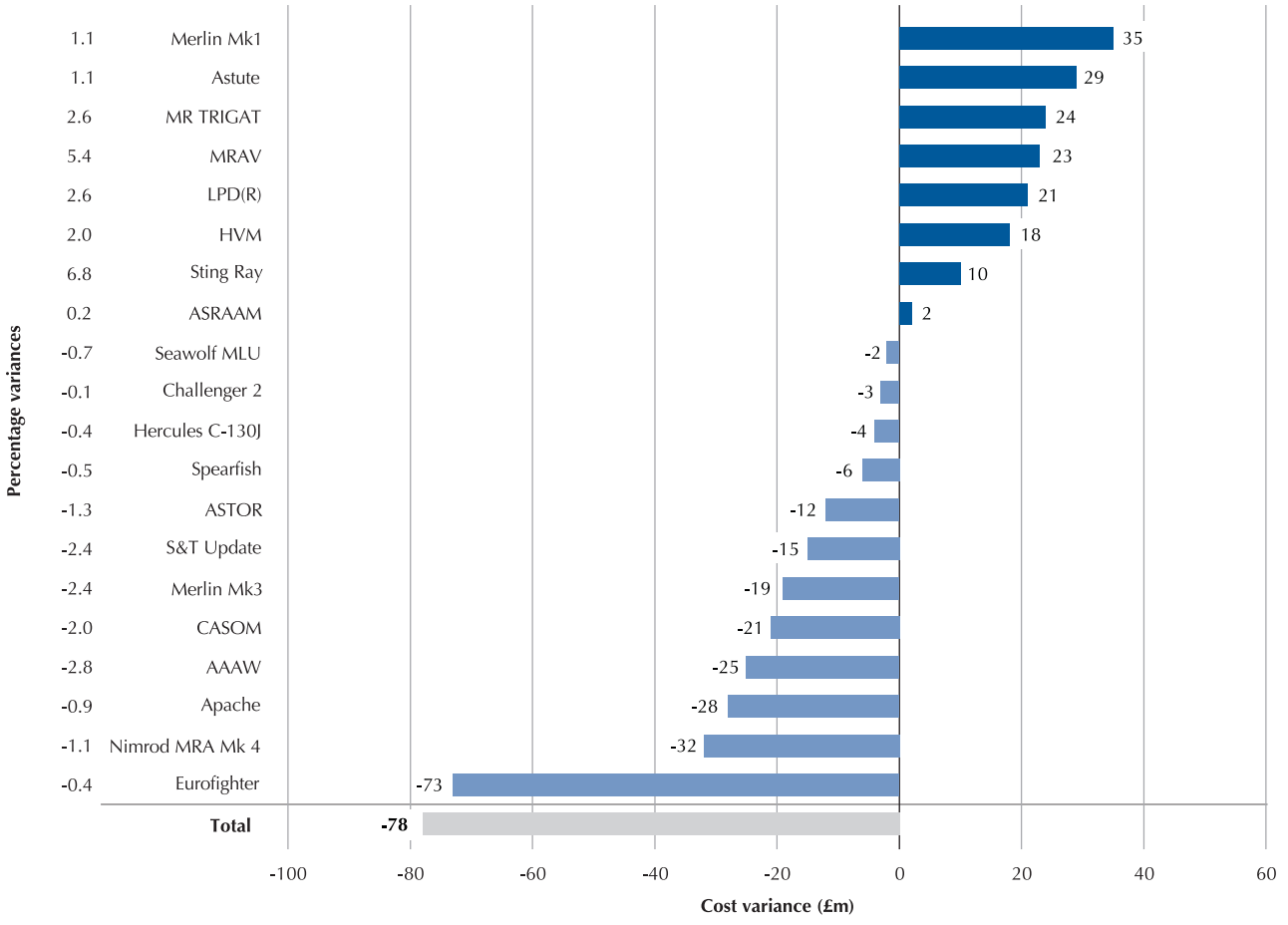
Note: This data includes projects at all stages of the acquisition cycle.

Source: Defence Procurement Agency analysis

1.9 The Major Projects Report breaks the reasons for cost variance down into ten categories, listed at Appendix 6. In revising the format of the Major Projects Report, we and the Department have reviewed the categories for both cost and time variance to ensure consistency between the Project Summary Sheets and our analysis, and to make the explanations clearer. The new categories are therefore not directly analogous to those in the 1999 Major Projects Report. The overall cost of any project in the Report may be affected by more than one cause of variation, and may reflect both cost increases and cost decreases. **Figure 4 (overleaf)** shows the amount of cost change due to each cause. Cost variances on Eurofighter and Merlin Mk 1 are excluded since increases on these projects together account for over 70 per cent of cost overruns and obscure the more general messages emerging from the other 18 projects. For example, technical factors have increased costs on the Merlin Mk 1 by £513 million compared to a total increase of £174 million on the other 18 projects.

3 **Cost changes between 31 March 1999 and 31 March 2000**

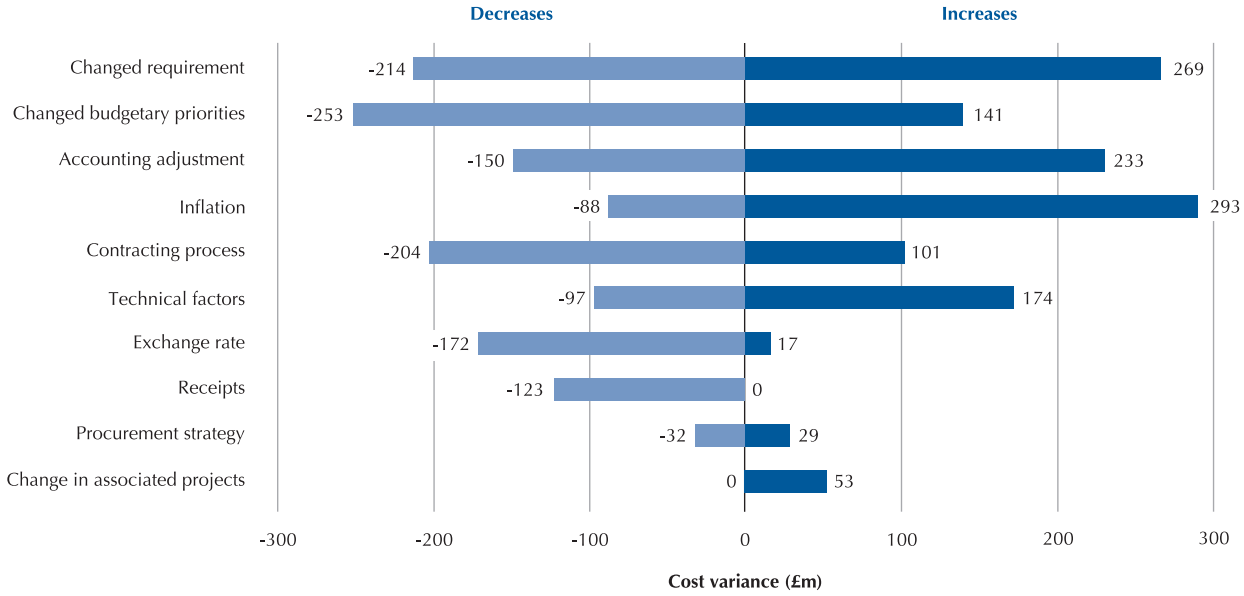
In the last year, forecast project costs have decreased by £78 million



Source: National Audit Office

4 **The causes of changes to project costs since Main Gate approval**

Changed requirements, changed budgetary priorities, accounting adjustments and inflation, are the four biggest causes of cost variance since Main Gate approval



Notes: 1. See Appendix 6 for an explanation of the categories.

2. The total of these variances equals the sum of the cost variances shown in Figure 1, excluding Eurofighter and Merlin Mk1.

Source: *National Audit Office*

1.10 Changed requirements, changed budgetary priorities, accounting adjustments and inflation are the four biggest causes of cost variance since Main Gate approval:

- **Changes in the customer's requirement** which account for £269 million of cost increases on twelve of the 18 projects and cost decreases of £214 million on seven projects. For example, new requirements on the Challenger 2 programme have included £23 million for desert modifications and £8 million for an air conditioning coolant to comply with the Montreal protocol. The bulk of the reduction occurred on the Apache programme where costs have decreased by £137 million through changed requirements and by £72 million in the last year, mainly through deletion of funding for the generic air-to-air missile.

- **Changes in budgetary priorities**, which have resulted in cost reductions totalling £253 million on ten of the 18 projects. Such changes occur when the military customer re-assesses his priorities in terms of the level of funding he considers he needs to commit to a particular activity. For example, there has been a £83 million reduction on the Merlin Mk 3 programme where it has been possible to allocate less funding to Integrated Logistic Support than previously planned and to reduce the number of Initial Provisioning spares required.

- **Accounting adjustments** which have led to cost increases of £233 million on 11 programmes. Some of these variations do not reflect any substantive change and are the result of imported costs arising from changes in accounting rules. For example, the incorporation of the cost of work by the Defence Evaluation and Research Agency that was previously treated as intramural expenditure and excluded from project approvals. The Accounting Adjustment variations also include variance resulting from derivation of the approved cost on a resource basis; the origin of this variance is explained in Appendix 2.

- **Inflation** has resulted in a total cost increase of £293 million on nine of the 18 projects. Inflation variations have also led to large cost increases on the Eurofighter (£378 million) and Merlin Mk 1 (£281 million) projects that are excluded from Figure 4. These variations have arisen in the past because the defence specific indices used in many of the Department's contracts to establish actual and forecast costs at current prices have tended to escalate more rapidly than the Gross Domestic Product index used to uplift approved costs to current prices for comparison. These cost variations have been preserved in the transition to reporting project costs at outturn prices for the Major Projects Report 2000 and will continue to be reported while legacy projects remain in the population. Now that costs are reported at outturn prices, inflation variances will arise in the future if the inflation the

Department has assumed for converting approved costs this year, or for new approvals the inflation assumed at the time, differs from actual or assumed inflation in the future. An explanation of how inflation variations will be calculated in future Major Projects Reports is given in Appendix 2.

Newer projects show less cost overrun per year than older projects

1.11 **Figure 5** shows that there is a strong correlation between the average percentage cost overrun per year and the amount of time elapsed since Main Gate approval, with newer projects incurring less cost overrun per year than older projects. This analysis suggests that projects that passed the equivalent of Main Gate approval more recently are performing better than older projects, assuming that the average cost variance is even throughout the Demonstration and Manufacture phase.

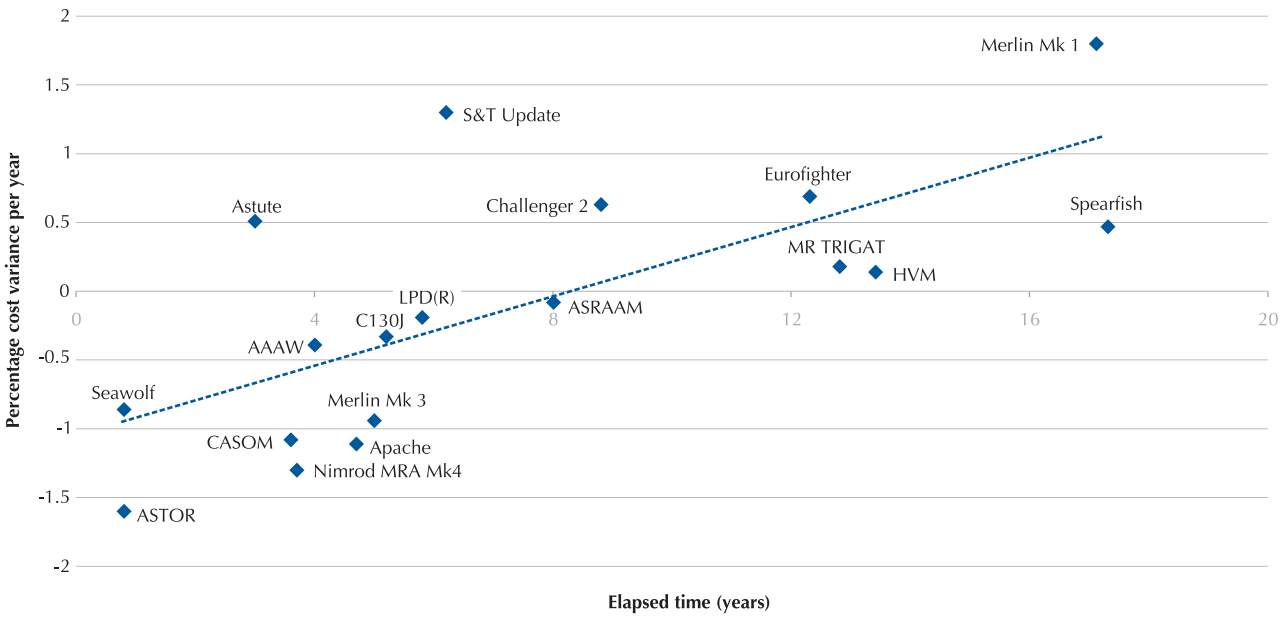
Most new cost variations relate to future expenditure

1.12 In the last year cost savings of £78 million have been identified across the 20 projects. While the cost savings and overruns have been identified between March 1999 and March 2000, the variance is against future expenditure in the equipment plan rather than on expenditure incurred during the financial year. The variance is the net of increases and decreases and **Figure 6 (overleaf)** shows that since 31 March 1999 the main causes of variance have been:

- **Changes during the contracting process** which have resulted in both an increase of £189 million on seven programmes and a decrease of £189 million on four programmes. The majority of both the cost increases and the cost decreases are on the Eurofighter programme. The Department expects to achieve a reduction of £165 million through the application of Smart Procurement principles during negotiation of the supplements to the Production contracts for the second and third tranches of aircraft. However, in doing this they will have to re-profile their future funding resulting in additional costs of £103 million. The net saving of £62 million is dependent on successful contract negotiations.
- **Changes in budgetary priorities** which have led to increases of £108 million on six programmes and decreases of £136 million on ten programmes. For example, the Conventionally Armed Stand-Off Missile (CASOM) project is reporting an in-year decrease of £21 million. During the Smart Procurement breakthrough process, the Department identified scope to make major savings over the next ten years in Defence Evaluation and Research Agency costs and Service Evaluation Trials costs.

5 **Analysis of percentage cost overrun per year against elapsed time since Main Gate approval**

New projects are showing less cost overrun per year than older projects



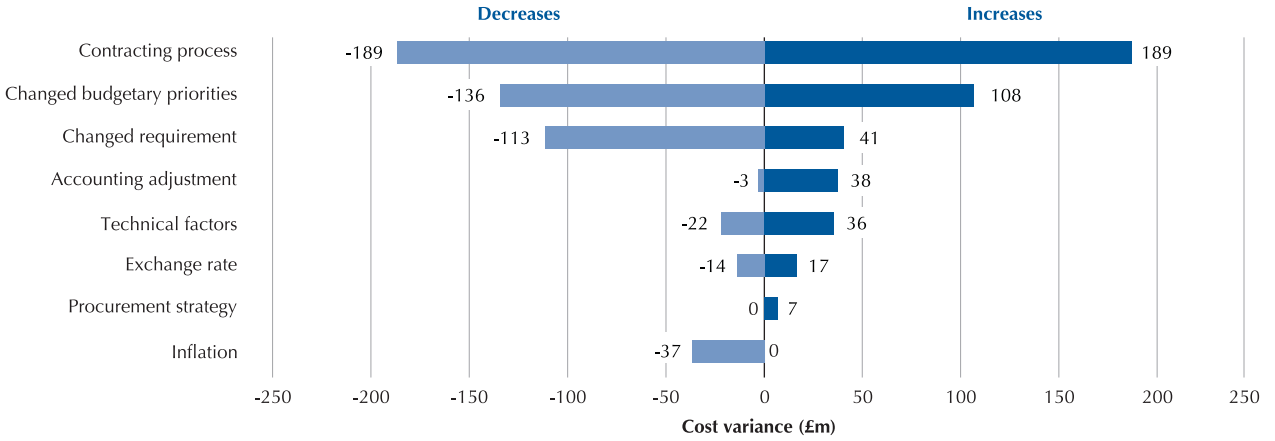
Notes: 1. MRAV and Sting Ray have been excluded from this analysis. Both programmes have incurred exceptionally large cost overruns per year (MRAV = 2.69%, Sting Ray = 5.24%) in the relatively short periods of time since each project passed Main Gate approval. In the case of MRAV, increased forecast project costs of £ 23 million have resulted in a high percentage overrun because there is currently only approval for development and initial production. Similarly, cost overrun on Sting Ray is expressed as a percentage of full development and initial production rather than the total procurement cost.

2. The equation of the linear trend line is y = 0.1262x -1.0492. The correlation co-efficient, R^2 = 0.4912. The closer that R^2 is to 1, the better the correlation. R^2 = 0.4912 suggests a good correlation.

Source: National Audit Office

6 **The causes of cost changes between 31 March 1999 and 31 March 2000**

The main causes of cost increases and cost decreases are changes in the contracting process, changed budgetary priorities and changed requirements



Source: National Audit Office

- **Changes in the customer's requirements** have resulted in cost decreases of £113 million on four programmes and increases of £41 million on two programmes. For example, the cost of the Eurofighter programme reduced by £32 million after the military customer decided that the gun was no longer required.

The average project delay is getting longer and will increase if risks taken into account in setting approvals materialise

1.13 Timescale control is about bringing equipment into service as close as possible to the approved date, agreed with the military customer. Following changes to the approval process associated with Smart Procurement, where the Department perceives risks affecting timescales it takes these risks into account. The Department approves the in-service date of equipment which it is 90 confident of achieving, while basing current plans on an earlier date which it is 50 per cent confident of achieving. Both of these dates fall within a timescale acceptable to the customer. Timescale performance is measured in the Major Projects Report by comparing the current forecast in-service date underpinning the Department's plans (the 50 per cent date) with the in-service date set at approval (the 90 per cent date). What this means for individual projects approved under Smart procedures is that reported slippage will be negative unless all of the risks allowed for in the 90 per cent approval materialise. The average slippage across the Major Projects Report population will be greater if the risks do materialise. We found that:

- most post-Main Gate projects have slipped (paragraphs 1.14 -1.15); and
- the average project delay is getting longer (paragraphs 1.16-1.20).

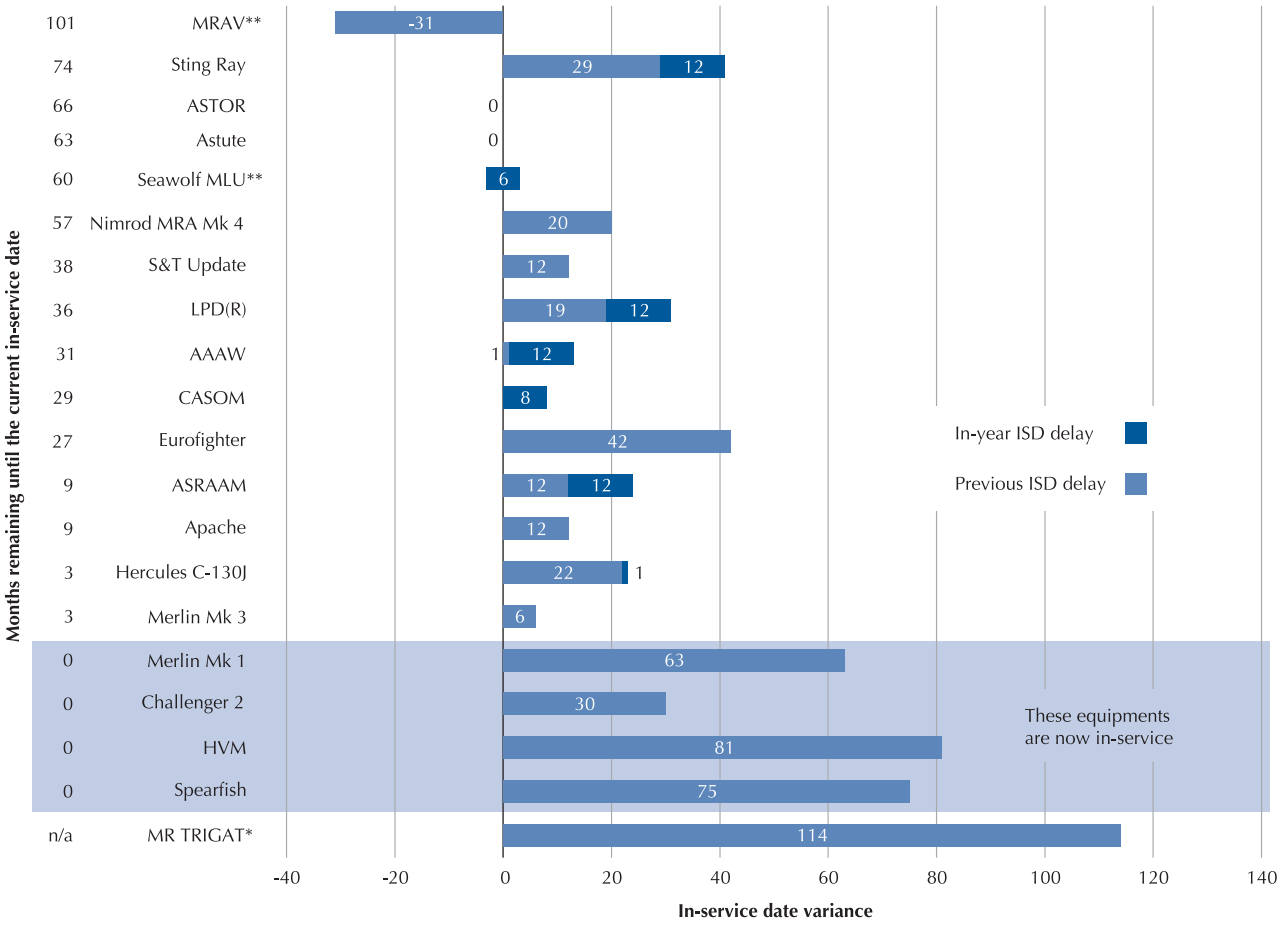
Most projects have slipped

1.14 **Figure 7** shows that 17 of the 20 projects have slipped, two are forecast to achieve the in-service dates originally planned and one collaborative project (the Multi-Role Armoured Vehicle) is recording a negative variation where the approval made some allowance for risks (see paragraph 1.18). Overall, the 20 post-Main Gate projects have slipped by a total of 567 months against their in-service dates set at Main Gate, an average of 28 months slippage per project. This equates to a 26 per cent extension of the period from Main Gate approval to the date the equipment is currently expected to enter service.

1.15 In Figure 7, the projects are arranged in order of time remaining before the current forecast in-service date. Of the four worst performing projects, three have now entered service (High Velocity Missile, Spearfish and Merlin Mk 1) and the United Kingdom announced their intention to withdraw from the fourth, the collaborative Medium Range TRIGAT project, in July 2000. Four projects (Apache, ASRAAM, C130-J and Merlin Mk 3) are due to enter service within the next twelve months and none of these have accrued more than 24 months slippage since Main Gate approval. One project, the Sting Ray life extension programme, has already experienced 41 months delay and has over 74 months to go before it enters service. The Department expects to incur additional support costs totalling £1.4 billion as a result of in-service date delay on twelve projects, and to save £1.04 billion through not having to support new equipment on seven projects during the period of slippage.

7 In-service date variation since Main Gate approval

Three projects are expected to enter service early or on time.



* The United Kingdom withdrew from the Medium Range TRIGAT programme in July 2000

** MRAV and SeaWolf MLU have been approved since the introduction of Smart Procurement and include provision for risk within their approved in-service dates (see paragraph 1.18)

Source: National Audit Office

The average project delay is getting longer

1.16 **Figure 8 (overleaf)** shows that six of the 18 projects that were approved pre-Smart Procurement have slipped by 57 months during the last year and there has been no recovery of slippage on the remaining 12. In particular, the in-service dates of the Landing Platform Dock (Replacement), Sting Ray, Air-launched Anti-Armour Weapon and Advanced Short Range Air-to-Air Missile programmes have been delayed by a year. In addition, on one of the two projects approved post-Smart Procurement (the SeaWolf Mid-Life Update) the in-service date has been delayed by six months in total, but has slipped by only three months beyond its approved in-service date taking into account the allowance made for risks (see paragraph 1.18). Overall, the total additional delay (63 months) equals an average increase of just over three months on each of the 20 projects.

1.17 For the 16 projects common to both the 1999 and 2000 Major Projects Reports, the average in-service date delay since Main Gate approval has increased from 28 months to 31 months over the last year. Unlike the analysis of cost variance per year, an analysis of in-service date slippage per year against elapsed time since Main Gate approval for each of the twenty projects gave no clear indication[2] that newer projects are delayed any more or less than older projects.

1.18 The approval for the SeaWolf Mid-Life Update project includes an allowance of three months for technical risk which the Department recognised could materialise. Since approval, that allowance has been consumed by a deferral of the planned in-service date by six months because of budgetary constraints. As a result, the project is now reporting a three month slippage against approval. The Multi-Role Armoured Vehicle programme includes a total of 31 months risk provision reflecting anticipated technical difficulties as well as the perceived

2 *The graph of in-service delay per year vs. elapsed time since Main Gate approval showed a very poor correlation ($R^2 = 0.09$).*

8 **Breakdown of in-year delays**

57 months of the in-year delay is beyond the approval band

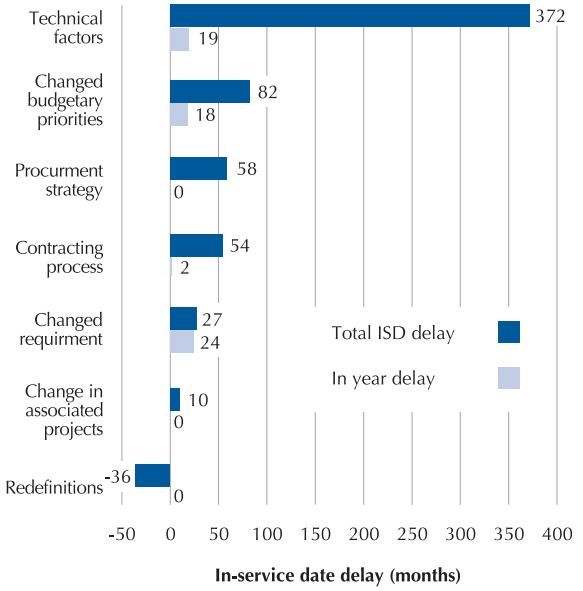
	Extent of delay		
	Variation within approval band[1]	Slippage beyond approval band[2]	Total Delay
Projects with pre-Smart approvals	-	57	57
Projects with post-Smart approvals	3	3	6
Total all projects	3	60	63

Notes:
1. Under Smart Procurement, where the Department perceives risks affecting timescales it takes these risks into account in approving the in-service date of equipment which it is 90 confident of achieving, while planning to achieve an earlier date which it is 50 per cent confident of achieving. Variation within approval band refers to delays between the 50 per cent and 90 per cent dates.
2. Slippage beyond approval band refers to delays beyond the 90 per cent date.

Source: National Audit Office

9 **Causes of in-service date delay since Main Gate approval and since 31 March 1999**

The main causes of in-service date delay are technical factors, changed budgetary priorities and procurement strategy



Source: National Audit Office

risk in participating in a collaborative programme. Overall, this risk provision totals 34 months across the two projects or, an average of nearly two months per project across the 20 post-Main Gate projects.

1.19 The Major Projects Report breaks the reasons for in-service date delay down into seven categories, listed at Appendix 6. As with cost, these categories have been reviewed for the 2000 Major Projects Report following the change in format since the 1999 Report. **Figure 9** shows that the main causes of in-service date delay have been:

- **Technical factors** leading to a total of 372 months delay on 11 programmes, some two thirds of the total delay recorded. For example, all of the 75 month delay on Spearfish, 69 months of delay on High Velocity Missile and all of the 23 month delay on Hercules C-130J was caused by technical problems;
- **Changes in budgetary priorities** resulting in a total of 82 months of slippage on six programmes. This reflects the effect of deferring individual projects to address problems of affordability across the procurement budget as a whole; and
- **Procurement strategy** leading to a total of 58 months slippage on three programmes. Eurofighter and Medium Range TRIGAT were delayed by 22 months and 24 months respectively due to collaborative difficulties and the Landing Platform Dock(Replacement) programme was delayed by 12 months because of the need to revise the procurement strategy following loss of competition.

1.20 **Figure 9** also shows the causes of the 63 months in-service date delay during the last year. In particular:

- **Changes in the customer's requirement** have led to a total of 24 months of the delay on the Conventionally Armed Stand-Off Missile, the Air-Launched Anti-Armour Weapon and the Advanced Short Range Air-to-Air Missile systems. In each case, the delays are the consequence of the need to align the delivery of the weapons with the availability of the aircraft to which they will be fitted. In the case of the Conventionally Armed Stand-Off Missile and Air-Launched Anti-Armour Weapon programmes, this is to align with package 2 of the Tornado GR4/GR4a update. The Advanced Short Range Air-to-Air Missile in-service date has been delayed to align with the Tornado F3 programme. The decision to put back the in-service dates of these systems is reasonable. It does not alter the date when the Services will receive that capability and the funding deferred on the weapon projects can be used for other purposes in the meantime. Nevertheless, the Services will receive the capability they require later than planned.

- **Technical factors** have led to a total of 19 months of delay on three programmes including the Advanced Short Range Air-to-Air Missile where missile hardware and software difficulties resulted in six months delay, and the Landing Platform Dock (Replacement) programme where a 12 month delay followed industrial loading difficulties at the Barrow Shipyard.
- **Changes in budgetary priorities** have led to a total of 18 months delay on two projects, Sting Ray and the SeaWolf Mid-Life Update programme.

Most Key User Requirements are expected to be met

1.21 Under Smart Procurement, Key User Requirements are agreed at Main Gate and form a contract between the Integrated Project Team and the equipment capability customer. The new format of the post-Main Gate Project Summary Sheets in the 2000 Major Projects Report includes, for the first time, a section on technical performance which reports whether projects currently expect to meet the Key User Requirements specified by the military customer. Since all projects in the Major Projects Report pre-date Smart Procurement, Key User Requirements have been defined retrospectively. They are based on the original Staff Requirement that was endorsed at the equivalent of Main Gate approval.

1.22 The Department are forecasting that the equipment being procured will meet or exceed all of the minimum Key User Requirements specified by the equipment capability customer on 17 out of the 20 post-Main Gate projects. The remaining three projects are forecast to miss one Key User Requirement each due to technical difficulties:

- In 1994, refined modelling demonstrated that, in the most adverse conditions, Eurofighter will not achieve the landing distance capability originally required by the equipment capability customer;
- Spearfish entered service in March 1994, having failed to meet part of the radiated noise performance specified by the customer.
- As a result of a change in requirement after approval, Medium Range TRIGAT was forecast to exceed the weight specified for the firing post and munition although overall crew portability would be achieved.

Delays on 13 projects have led to capability shortfalls

1.23 Although 98 per cent of the Key Requirements are forecast to be met, the average delay of 28 months per project, mostly caused by the time taken to resolve technical difficulties, means that most of these requirements will be met later than planned at time of approval. This can have adverse implications for operational capability. The nature and scale of any impact will, in practice, depend upon a range of factors such as the use that would have been made of the equipment during the period of slippage and the comparative capability of the equipment it is replacing. Slippage on 13 projects has led to capability shortfalls. These projects, the extent of the delay and the nature of the capability shortfall, are listed in **Figure 10 (overleaf)**.

10 The operational impact of in-service date delay

In-service date delay since Main Gate approval on 13 projects has led to capability shortfalls

Project	**ISD delay** (months)	**Excerpt from the operational impact statement** (Section 3e of the Project Summary Sheet as agreed with the customer)
MR TRIGAT	114	The operational life of MILAN has been extended by five years and the possibility of a further five year extension is under consideration. Such measures are of only finite military utility since the system has limited ability to defeat modern tank armour. See Part 3 for further information
HVM	81*	The delay in HVM ISD from December 1990 to September 1997 resulted in the 1st (UK) Armoured Division having no specific Very Short Range Air Defence capability. A lesser capability was provided by Tracked Rapier and the man-portable Javelin systems.
Spearfish	75*	The delay to Spearfish ISD from 1987 until 1994 resulted in a significant and extended capability gap in anti-submarine warfare and anti-surface warfare.
Merlin Mk1	63*	There are capability shortfalls in the Sea King when compared with the performance levels expected from the Merlin particularly in the area of Anti Submarine Warfare.
Eurofighter	42	Key improvements in capability not realised until revised ISD: agility and altitude performance; autonomous detection, identification and multiple engagement of air-to-air targets; human-computer interface; multi-role capability; survivability; mean time between failure.
LPD(R)	31	The new ships will provide capability improvements in 3 key areas: improved communication system; faster tactical offload of vehicles, troops and stores; increased range, payload and offload performance of the new Mk 10 Landing Craft Utility.
ASRAAM	24**	The RAF plan to continue to use Sidewinder stocks for their short range air-to-air missile capability. The consequence is continued use of a lesser capability for longer.
Nimrod MRA Mk4	20	This slip will delay introduction of the improved Anti-Submarine and Anti-Surface Unit warfare capability.
AAAW	13**	The ISD delay results in the lack of a fully effective anti-armour capability and the run on of RBL755. See Part 3 for further information.
S&T Update	12	The enhancement in the capabilities…needed to fill the capability gap to provide improved effectiveness of submarines in demanding missions will be unavailable for a further year.
CASOM	8**	The operational impact of the delay is that the enhanced stand-off precision attack capability to be provided by CASOM will be achieved 8 months later than planned.
Merlin Mk 3	6	The delay to the ISD has reduced the Joint Helicopter Command's operational capability and flexibility for moving troops and stores. Joint Helicopter Command are currently reviewing their plans to manage this capability gap.
SeaWolf MLU	3	Type 22 and Type 23 platforms will have to support the existing system for longer, resulting in a decreased capability against the evolving threat from sea-skimming missiles and other anti-ship missile threats in all environments for the period of ISD slippage.

* While delay to High Velocity Missile, Merlin Mk1 and Spearfish programmes had significant operational impact in the past, these equipments are now in service.

** Six months of delay on ASRAAM, 12 months delay on AAAW and six months delay on CASOM were the consequence of aligning missile deliveries with availability of the platform. Therefore, this does not represent an additional delay to capability.

Source: National Audit Office

Part 2

Performance during the Assessment phase

2.1 Under Smart Procurement, Initial Gate approval signals the start of the assessment phase during which the Department aims to assess the options available to meet the military requirement and reduce risk before reaching Main Gate (see Appendix 1). As a guide, the Department may typically commit up to 15 per cent of procurement costs before reaching Main Gate to enable it to then set cost, time and technical performance parameters for delivery of the project with a high degree of confidence. At Initial Gate approval, the Department sets objectives and cost and time parameters for completion of the assessment phase. Under Smart Procurement, we should see minimal variation against the cost and time parameters set for the assessment phase and evidence that the assessment phase is successful in reducing risk.

2.2 In this part of the Report we assess the Department's progress in setting appropriate targets to measure project performance during the assessment phase and examine the current performance of projects. All of the ten assessment phase projects featuring in the 2000 Major Projects Report were conceived prior to the introduction of the Smart Procurement Initiative and received their first approval under the old Downey procurement Cycle rather than receiving an Initial Gate approval. We have examined the performance of these projects against the equivalent of Initial Gate, agreed with the Department. We found that among the ten largest projects in the assessment phase, some projects approved before 1995 are showing substantial variation in time and cost since their approval. This suggests that the assessment phase is needed but that there is scope for improvement in performance which the Department believes will come about partly through better prediction of cost and time parameters.

Targets for the assessment phase are not yet in place

2.3 At Initial Gate, a business case seeking approval to undertake assessment phase work is put to the Equipment Approvals Committee. This business case, which is subject to independent review by technical and financial scrutineers within the Department, states the expected and highest acceptable cost of the assessment phase and the target date for Main Gate approval by which the assessment phase is expected to have been completed. The business case also gives three-point estimates for the cost of the demonstration and manufacture phase and for the in-service date of the equipment. At Initial Gate, these estimates may cover a broad band but by Main Gate the band is expected to be narrower as a result of risk reduction work during the assessment phase.

2.4 **Figure 11 (overleaf)** shows the three internal measures approved by the Defence Procurement Agency (DPA) for monitoring the performance of pre-Main Gate projects. The DPA is working to establish appropriate targets for each of these measures and expect to have these in place early in 2001. They are also developing an additional measure to assess the success of the assessment phase in reducing risk by comparing the cost and timescale band estimates at Initial Gate with those at Main Gate. The Agency have not yet decided what form this measure will take. At this stage, the Agency do not have clear expectations on how wide the cost and timescale bands at Main Gate may acceptably be, and believe that this will vary with and depend on the nature of individual projects.

2.5 The Defence Procurement Agency has also developed and approved a performance indicator that is the percentage of the total procurement cost falling before Main Gate. In the longer term, the Defence Procurement Agency plans to monitor the trend in the performance indicator over time to place emphasis on spending more in the earlier stages of projects and to

11 Measures and performance indicators for monitoring performance on pre-Main Gate projects

Approved Measure

The proportion of submissions to be satisfactory in enabling the Approving Authority to make a decision at Main Gate on whether to proceed or to stop. (Target yet to be decided).

The average forecast/achieved cumulative cost variation against the approval for the assessment phase. (Target yet to be decided).

The average forecast/achieved time variation during the assessment phase. (Target yet to be decided)

Source: Defence Procurement Agency

assess what effect this has on the cost, time and technical performance of projects in future. Therefore, this performance indicator could be used to investigate whether increased spending during the assessment phase leads to a better outcome and a more successful procurement.

2.6 For example, the analysis in Part One showed that although most technical requirements are forecast to be met and the Department is beginning to control costs better, project delays are getting longer. If Smart Procurement works, committing more effort to early assessment work should help equipment enter service within the timescales agreed at Main Gate. Since projects in the Major Projects Report population can typically take some 10-15 years from initial approval to operational service, it will be some time before it is possible to confirm this trend in the Major Projects Report.

2.7 The Department considers that the key indicators of a successful assessment phase are: whether risk has been sufficiently reduced and enough work done on the possible procurement options to enable a sound decision to be taken at Main Gate; and whether the time, cost and performance parameters estimated at Main Gate subsequently prove to be reliable. The Department proposes to test the first of these using the risk reduction measure that it is developing and the first of the measures listed in **Figure 11**. Since the risk reduction measure is not yet in place and none of the projects in the Major Projects Report have yet reached Main Gate, neither of these measures can be analysed. We have, however, analysed project performance against the measures of time and cost for the assessment phase.

2.8 Although it is not currently possible to confirm that improvements during the assessment phase are reducing delays post-Main Gate, we have examined in-service date movement during the assessment phase on the ten pre-Main Gate projects in the Major Projects Report 2000. For these projects, the in-service date is currently forecast to move back by an average of 32 months on seven of the ten projects and the worst movements are on Bowman (96 months) and the Type 45 Destroyer (59 months). This movement may be reasonable and reflect the Department's revised judgement as a result of assessment phase work in accordance with Smart Procurement principles. It is not clear how much movement in in-service dates during the assessment phase is expected. This will depend in part on what trade-offs are made between time, cost and performance during the assessment phase. As with cost and time in Part 1, we analysed in-service date movement per year by the date each project received Initial Gate approval. No trend was discerned.

Overall performance leaves scope for improvement

2.9 In establishing targets for the assessment phase, the Department will need to have regard to the current performance of projects. We have examined the performance of the ten projects in the 2000 Major Projects Report during the assessment phase. We found that:

- the average cost variation is 13 per cent (paragraphs 2.10 - 2.12);
- the average variation from the approved assessment phase timescale is eight months (paragraphs 2.13 - 2.14);
- some projects do not have reliable three-point risk estimates to enable risk reduction to be measured (paragraphs 2.15 - 2.16); and
- for most projects assessment expenditure is much less than the guide threshold recommended under Smart Procurement (paragraphs 2.17 - 2.18).

The average cost variation is 13 per cent

2.10 The Defence Procurement Agency's measure of assessment phase cost performance is the average percentage variance from the approved assessment phase cost. The average forecast variation from approved cost across the 10 projects is 74 per cent. However, this overall picture is adversely affected by the very large variations on two of the 10 projects, BOWMAN and MLS (see paragraph 2.11). Excluding these two projects, **Figure 12** shows that the average variation across the remaining eight projects is 13 per cent. The DPA has not yet assigned a target level of performance against which to assess this measure, however, the 13 per cent average cost variation suggests that there is scope for improvement.

12 Cost variance during the assessment phase

Excluding BOWMAN and MLS, the average cost variation is 13 per cent

Project	Initial Gate	Cost variance (£m)	Cost variance as a percentage of approved assessment cost
GMLRS	1998	0	0%
NLAW	1997	0	0%
FTA	1997	-0.6	-30%
FCBA	1996	-8	-5%
CV(F)	1998	-22	-19%
BVRAAM	1995	6	43%
TRACER	1992	1	1%
Type 45 destroyer	1991	21	10%
Sub-total		**-2.6**	**Average inaccuracy from approval 13%**
BOWMAN	1998	206	159%
MLS	1993	66	471%
TOTAL		**269.4**	**Average inaccuracy from approval 74%**

Source: National Audit Office

2.11 The above analysis excludes the BOWMAN and MLS projects where the performance skews the analysis. The reasons for these variances are:

- The 159 per cent cost increase on the BOWMAN project includes £185 million due to the extension of risk reduction work prior to the award of the supply contract. The Department funded this work, known as Package 0 and which is essentially bringing forward expenditure originally planned for future years, by cost saving measures elsewhere. The increased spending on Package 0 early in the project is intended to better define the system and reduce risks before the main investment decision, and increases the planned spend before Main Gate approval to 15 per cent in line with Smart Procurement principles. In October 2000, the Department approved a further £69 million on BOWMAN risk reduction work. This takes the proportion of spending before Main Gate to 17 per cent, and the Department cannot confirm an in-service date for BOWMAN with confidence until Main Gate approval which is planned for July 2001 (see paragraph 3.28); and
- The Microwave Landing System (MLS) project aims to procure a new Precision Approach Landing System, facilitating safe runway approaches in adverse weather and at night. Forecast pre-Main Gate expenditure rose by 471 per cent when in 1999, in the light of conclusions emerging from project definition studies, it was decided during the assessment phase to procure 28 replacement Precision Approach Radar systems for non-MLS equipped aircraft. When the programme was first approved in 1993, the need for these Precision Approach Radar systems to complement MLS was not anticipated and their availability will provide an earlier enhancement of capability.

2.12 The position on BOWMAN and MLS contrasts with the five projects which have received Initial Gate approval since 1996. These are the Next Generation Light Anti-Armour Weapon, the Guided Multiple Launch Rocket System, the Future Transport Aircraft programme, the Future Carrier Borne Aircraft programme and the Future Carrier programme. As Figure 12 shows, all of these projects are forecast to either meet their approved costs or to underspend with an average forecast cost variation of -11 per cent.

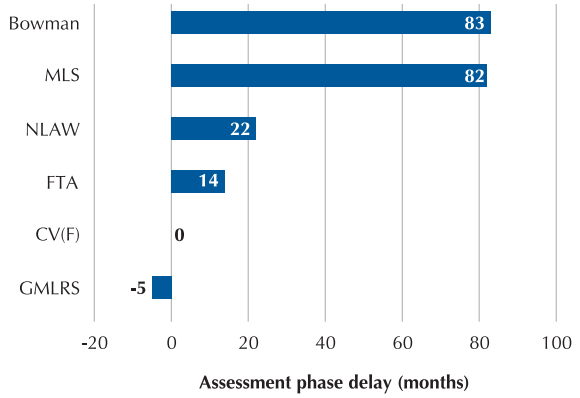
The average variation from the approved assessment phase timescale is eight months

2.13 Not all of the pre-Main Gate projects in Major Projects Report 2000 included a milestone equating to Main Gate in their original approval. Most of these original approvals pre-dated Smart Procurement and a match with Smart Procurement principles through our analysis cannot, therefore, be expected. **Figure 13 (overleaf)** shows variation of the assessment phase timescale on the six pre-Main Gate projects for which comparative data is available. The average forecast variation from the approved timescale is eight months if BOWMAN and MLS are excluded. Since the programme was approved in 1988, BOWMAN has been delayed for various reasons including technical difficulties, budgetary constraints and changed procurement strategy. The delays on MLS are mainly the result of changes in available technology and international standards which led to a revision of the assessment phase objectives.

2.14 It should be noted that the variation of eight months has been calculated from the average of only four projects, most of which were approved relatively recently. In particular, the two most recently approved projects, the Guided Multiple Launch Rocket System and the Future Carrier, are forecast respectively to reach Main Gate approval five months early or at the time originally planned.

13 Assessment phase delay

Excluding BOWMAN and MLS, the average forecast variation from the assessment phase approved timescale is 8 months



Source: National Audit Office

Some projects do not yet have reliable three-point risk estimates to enable risk reduction to be measured

2.15 The project summary sheets contain information on current three-point risk estimates for the cost of demonstration and manufacture and in-service date of equipment and on the estimates set at Initial Gate approval. For projects approved before 1997, although the Department did conduct some risk analysis, such estimates were not set at the original approval which has been taken as the equivalent of an Initial Gate approval. Of the ten projects in the Major Projects Report 2000, four were approved in 1997 or later. Two of these had current and Initial Gate cost estimates at 31 March 2000 and two had current and Initial Gate in-service date estimates at 31 March 2000. Based on this limited data no meaningful analysis is possible of the success or otherwise of the assessment phase in reducing risk. However, as more recently approved programmes replace legacy ones in the Major Projects Report population it will be possible to use the extent to which the three-point estimates converge as a measure of the Department's achievement in reducing uncertainty and understanding risk during the assessment phase.

2.16 In response to our enquiries following validation of the project summary sheets, the Department has provided current two or three-point cost estimates for all but three of the ten projects and current two or three-point in-service date estimates for all but one of the ten projects. Three-point estimates are a requirement for all newly approved projects and the Department is also working towards establishing them for all legacy projects.

For most projects, assessment expenditure is much less than the guide threshold recommended under Smart Procurement

2.17 The Strategic Defence Review suggested that up to 15 per cent of the total procurement cost of a project be spent before Main Gate. However, this 15 per cent guide is not a key determining factor in deciding how much is required to be spent on individual projects. Instead, the approved assessment phase cost will depend on factors such as the nature of the equipment being procured (for example, new capability or upgrade of existing equipment), the maturity of the technology involved and the likely procurement strategy (for example, collaborative procurement, non-competitive procurement, purchase of commercially available off-the-shelf equipment, Private Finance Initiative or Public Private Partnership).

2.18 The ten pre-Main Gate projects in Major Projects Report 2000 include five collaborative programmes and one off-the-shelf buy. Approved assessment phase cost is never more than six per cent on any of the ten projects, although two of the projects, BOWMAN and MLS were forecast at 31 March 2000 to spend 15 per cent and 19 per cent respectively of their total procurement costs on assessment work. Nor is there any indication that more recently approved projects which have yet to pass Main Gate are forecast to spend a higher proportion during the assessment phase. However, on average the percentage spend for projects currently in the assessment phase is 5.6 per cent compared to 2.4 per cent spent on the 20 projects in the Major Projects Report which have passed Main Gate.

Part 3

Case studies of the impact of project slippage on operational capability and costs

3.1 In the Major Projects Report 1999, we examined the operational and cost effects of delays on four case study projects - the Air-launched Anti-Armour Weapon, the Medium Range TRIGAT anti-tank weapon system, the BOWMAN communications system and the Common New Generation Frigate. Since our earlier report, there have been significant developments affecting these projects. This Part of our Report examines the operational and cost impacts of these developments.

The Air-launched Anti-Armour Weapon (known as Brimstone)

Brimstone's in-service date has been put back by 12 months to better align its availability with that of the Tornado GR4/GR4a package 2 update

3.2 Brimstone will replace the BL755 cluster bomb and will be carried on Tornado GR4/GR4a, Harrier GR9 and Eurofighter. Since the Major Projects Report 1999, the in-service date of Brimstone has been put back by an additional 12 months to October 2002, bringing it more into line with the planned date for the Tornado GR4 package 2 update. Although the missile could potentially be deployed and used on the aircraft without the package 2 update, the missile's full capability cannot be realised and the Department therefore decided to bring the two more into alignment.

The Department has decided to buy Maverick missiles to fill the capability gap created by the delays to Brimstone

3.3 The unavailability of Brimstone has had an adverse effect on the ability of the Royal Air Force to prosecute operations against armoured threats in operations during the 1990s. The additional 12 months delay before Brimstone will be available in-service extends this capability gap. BL755 is a much less effective anti-armour weapon and its effectiveness in comparison to Brimstone is decreasing. Operational analysis reported by the Department in February 2000 showed that BL755 is now assessed as having less than 5 per cent of the capability against modern tanks that Brimstone will have when it enters service, lower than when previously assessed by the Department in 1996.

3.4 Pending Brimstone's entry into service, the Department has enhanced the capability of some stocks of BL755 by fitting radar proximity sensors to enable the bombs to be delivered from a higher altitude. The Department raised an Urgent Operational Requirement for modification kits for the Kosovo conflict, which was delivered seven months later than planned. The seven-month delay was caused by technical difficulties with the proximity sensor and by prolonged consideration by the Department of the number of kits required.

3.5 The Department placed an order in September 2000 for an off-the-shelf buy of AGM-65 Maverick G missiles, which will partially fill the capability gap that remains. The Department considers that Maverick G is ideally suited to the attack of point targets, particularly in situations where there is a high risk of collateral damage and hence tight Rules of Engagement. The Department believes that it therefore provides a capability complimentary to that of Brimstone, which is designed for attacks on massed armoured formations reducing their fighting capability before they engage our land forces.

3.6 Successive generations of Maverick have been in-service with the United States Air Force since 1972. In 1982, when seeking potential solutions to the Royal Air Force's anti-armour requirement, the Department had considered Maverick, but it did not meet the requirement for a weapon at least ten times as effective as BL755, as it was then assessed as being only about twice as effective. Maverick also did not have the autonomous target detection and recognition capability

sought and the Tornado and Harrier could not carry enough of the missiles to provide the required capability to defeat massed armour. The Department, therefore, decided to seek more technologically advanced solutions and, in 1996, placed a production contract for Brimstone, which was assessed as providing the highest level of capability of all the options considered.

3.7 The Maverick G missiles now on order are expected to be available for operational use by the end of 2000. Maverick G is around one third as effective as Brimstone will be against main battle tanks deploying modern countermeasures but some seven times more effective than BL755. In particular, Maverick G will provide the Royal Air Force with better capability to attack solitary armoured targets in an environment with a high risk of collateral damage; similar conditions to those encountered on operations over Kosovo. The Department considers that Maverick is a proven missile ideally suited to such situations where the limitations on the number of weapons that can be carried is not such a serious handicap.

The delays to Brimstone will cost the Department around £48 million in total, if the purchase of Maverick G missiles is included

3.8 The Department is buying the Maverick G missiles under Urgent Operational Requirement procedures at a whole-life cost (including all procurement and support costs) of £57 million. This will be funded from a Strategic Reserve allocated to the Department by the Treasury to address lessons learned from Kosovo. In summer 2000, as part of a general capability review, the Department separately decided to reduce the number of Brimstone missiles required by 25 per cent. Brimstone is being procured under a fixed price contract and the Department is in discussions with industry over the level of savings that might be realised from this reduction in numbers.

3.9 Modifications to BL755, including an Urgent Operational Requirement raised for the Kosovo conflict, have also cost the Department £19 million. However, the Department has saved £28 million due to the cheaper support costs of BL755 compared to Brimstone. Overall, the cost impact of the delays to Brimstone, if the purchase of Maverick G is included and excluding any savings arising from the reduction in numbers (outlined in paragraph 3.8), is a cost increase to the Department of around £48 million.

The Type 45 Destroyer

The Department has revised their strategy from a collaborative to a national procurement (the Type 45 Destroyer)

3.10 In April 1999, the Defence Ministers of the United Kingdom, France and Italy decided not to proceed with the collaborative Common New Generation Frigate programme and the Department is now procuring the Type 45 Destroyer as a national solution to the United Kingdom requirement. The Type 45 Destroyer programme will build on the assessment work carried out for the Common New Generation Frigate and the new ships will be equipped with the Principal Anti-Air Missile System (PAAMS), which is being procured collaboratively with France and Italy. BAE SYSTEMS Electronics will be the prime contractor for the Demonstration and First of Class Manufacture contract expected to be awarded towards the end of 2000 and covering the first three vessels. The vessels will be constructed under sub-contract with two expected to be assembled by BAE SYSTEMS Marine and one by Vosper Thornycroft.

The in-service date has been re-defined but the ship delivery schedule has not changed

3.11 The Type 45 Destroyer is currently forecast to enter service in November 2007, almost five years later than the date forecast for its predecessor, the tri-national Common New Generation Frigate. Since the Major Projects Report 1999, the in-service date has been re-defined from September 2007 to November 2007 to include two months Operational Sea Trials but the programme for delivery of the ships has not changed.

The Type 45 Destroyer and PAAMS will markedly improve the Navy's anti-air warfare capability, which is currently limited against emerging threats

3.12 The Type 45 Destroyer's principal role will be anti-air warfare and, equipped with PAAMS, the Department and the Navy believe that the ship will be a world leader in its Class, capable of meeting both existing and emerging threats. The new ship has also been designed to contribute to a wide range of other operational scenarios ranging from humanitarian relief to anti-drug and embargo operations and incorporates significant margins of growth to facilitate future upgrades and added capability. Based on the current assessment of the threat, the Equipment Capability Customer has

identified a requirement for a Class of up to 12 Type 45 Destroyers. However, this assumption can, and will, be subject to continuing critical operational analysis, taking into account up to date intelligence about the future threat.

3.13 The Type 45 Destroyers equipped with PAAMS will replace the current Type 42 Destroyers fitted with the Sea Dart anti-air warfare system. Designed in the 1960s, Sea Dart provides limited effectiveness against emerging stressing 21st century threats. A programme of modifications to upgrade Sea Dart so that it can deal more effectively with modern threats such as sea-skimming and high-diving missiles is underway. The upgrade equipping Sea Dart with infrared fuses was originally forecast to come into service in 1993 but is running eight years late, primarily due to technical difficulties. It is currently forecast to come into service in mid-2001 at a cost of £43 million. This delay has contributed to the anti-air capability shortfall.

The first three ships will enter service with some capability shortfalls and required operating capability will be achieved through an Incremental Acquisition Programme

3.14 The first three Type 45 Destroyers will enter service with some capability shortfalls because some capabilities, such as a sonar, have been traded-off to make the ships affordable and to enable them to be brought into service sooner. The lack of sonar could impose operational and ship scheduling constraints on the initial ships until it is fitted. For example, without sonar it is unlikely that the Type 45 Destroyers would be deployed alone to theatres where a significant submarine threat is perceived. To address the shortfalls, the Department has planned an Incremental Acquisition Programme whose priorities are the fitting of sonar and improved command and control, situational awareness and interoperability functions.

3.15 In addition to these priority needs, the Navy sees some other equipment as desirable and provision has been made in the ships' design for fitting this equipment to the Type 45 Destroyers in future, if the need arises. For example:

- an Inner Layer Defence System is considered desirable to combat the threat from Fast Inshore Attack Craft;
- the First of Class will have no on-board torpedo launch capability but, as the Type 45 Destroyer will not be a dedicated Anti-Submarine Warfare platform, this is not regarded by the Navy as a critical shortfall. Provision has been made for extra helicopter launched torpedo storage; and
- the Type 45 Destroyer's main gun armament meets some, but not all, of the Navy's requirements and is not seen as a long-term solution.

Running on the Type 42 Destroyers will cost the Department an additional £565 million in operational and support costs

3.16 The Department estimate that, in net total, it will cost an additional £565 million to run-on, and operate and support, the existing Type 42 Destroyers because of the delay to the original forecast in-service date of their replacement. This cost reflects the change required to the schedule for retiring the Type 42 Destroyers and commissioning their Type 45 replacements. The new Type 45 Destroyers are expected to be cheaper to operate and support than the Type 42s, although the cost of individual spares are likely to be slightly higher. For example, the compliment anticipated for each Type 45 is 79 fewer than for the Type 42, an annual cost saving of £2.9 million per vessel.

Medium Range TRIGAT (MR TRIGAT)

The United Kingdom has withdrawn from the collaborative MR TRIGAT project

3.17 The United Kingdom withdrew from the collaborative MR TRIGAT project on 28 July 2000 in the face of significant uncertainty surrounding the future of the programme. For example, Belgium, after much delay, had announced their intention to sign the Memorandum of Understanding but the Netherlands had not and had not indicated any positive intentions. All nations, except France, had indicated a desire to reduce the number of MR TRIGAT systems they would buy but reductions had not been agreed by the nations. Although it was possible that these issues could, with goodwill, have been resolved, the United Kingdom believed that the risks were such that there remained considerable uncertainty that the programme would ever go ahead. Also if it did proceed, the United Kingdom considered that the risks involved would mean that there would likely be significant and unacceptable further delays in achieving the in-service date.

The Department is reviewing its anti-armour system requirements and the future of the medium-range anti-tank guided weapon requirement is as yet unclear

3.18 The requirement for a medium-range anti-tank guided weapon has not been cancelled but following the United Kingdom's withdrawal from MR TRIGAT, the Army is conducting an Anti-Armour Balance of Investment study. This study will establish the capability required from short, medium and long-range anti-

armour systems in updated operational scenarios for the Army's mechanised and armoured battlegroups. The Department considered the possibility of conducting the study before approval was given to join the industrialisation and production phase of MR TRIGAT in June 1999. However, at the time the Department considered that this was unnecessary as, in its view, there was a clear prospect of MR TRIGAT moving forwards quickly to meet its planned in-service date, which had already been considerably delayed. The Balance of Investment study is due to report in September 2001 and until then the future of the medium range anti-tank guided weapon requirement and its in-service date will be unclear.

3.19 The Balance of Investment study will review the anti-armour requirement but will not include the Light Forces since this requirement has been defined and received Initial Gate approval in July 2000. Assuming that the requirement for an anti-armour capability in armoured and mechanised battlegroups still exists, the study will need to establish the mix of short, medium and long-range systems that are required. The short-range requirement will be met by the Next generation Light Anti-armour Weapon (NLAW), which received the equivalent of Initial Gate approval in September 1997. The Department considers that the key issue, therefore, is the relative mix of medium and long-range systems and how these requirements will be met. One option is that any medium-range requirement may be met by an additional quantity of the solution chosen for the Light Forces (either the United States JAVELIN or Israeli GILL/SPIKE).

3.20 The Balance of Investment study is due to report in time to inform the Main Gate submissions for both the Light Forces' solution and NLAW in 2002. This will enable the submissions to reflect any changes to the required quantities of these equipments. The in-service date for the Light Forces' solution is currently forecast at June 2005 based on an off-the-shelf procurement. If the Balance of Investment study concludes that the Light Forces' solution should be extended to meet the medium-range requirement for the mechanised and armoured battlegroups then the approved in-service date is likely to be June 2005, assuming the same in-service date acceptance criteria. This would be the same as the forecast in-service date for MR TRIGAT at the time of the United Kingdom's withdrawal from the programme and there would, therefore, be no time-related penalties arising from the withdrawal. If the study recommends an alternative solution, a later in-service date is likely.

The Army's current medium-range anti-tank capability is limited and sustaining this capability is dependent on extending the shelf-life of the current weapon

3.21 The Army's current medium-range anti-tank weapon is MILAN which first entered service in 1979. MILAN has an increasingly limited capability against modern armour threats and has a limited shelf-life. The originally planned shelf-life of each MILAN missile was ten years. This has already been extended to 15 years and a further extension to 20 years is now being investigated to ensure that in-date MILAN missiles are available to cover the current delay to its successor. Reserves of MILAN are declining as a result of ongoing training requirements. The number of missiles used in training has been reduced to the lowest sustainable level, bearing in mind the rudimentary nature of the MILAN simulation system, but War Stocks will breach the minimum acceptable level by 2002, unless the missile's life is further extended.

3.22 The Department expects to get approval from the Ordnance Safety Group in November 2000 to extend the MILAN missile-life to 17 years which would allow minimum War Stocks to be sustained until 2005. Approval to fully extend its life to 20 years is dependent on the outcome of ageing trials due to be completed in 2002. If a 20-year missile-life is possible, minimum MILAN War Stocks should be sustainable until 2008. Failure to extend the life of MILAN would mean that the Light Forces' solution would be the infantry's only medium-range anti-armour weapon.

The Department will write-off £115 million following the United Kingdom's withdrawal from MR TRIGAT and there are considerable costs to industry

3.23 Following withdrawal from the MR TRIGAT programme, the Department will write-off the United Kingdom's share of the development costs, estimated at £115 million. This includes some £9 million outstanding on MR TRIGAT development work, which will complete in 2001. Against this cost, the United Kingdom is no longer committed to spending some £40 million on buying more MR TRIGAT weapons than required. United Kingdom industry own some of the Intellectual Property Rights from the development of MR TRIGAT which the Department has rights to use. The impact of withdrawal on United Kingdom industry equates to a loss of some £300 million over the next 13 years. The programme would have created or maintained 300 jobs, but the long-term impact of withdrawal on employment could be balanced by potential United Kingdom Industrial Participation resulting from the Anti-Armour Balance of Investment study.

BOWMAN

The Department have re-opened the competition to seek a cost-effective and timely solution to the BOWMAN requirement

3.24 In mid-1999, the Department conducted a major review of the BOWMAN programme with the prime contractor, Archer Communications Systems Limited (ACSL) because it considered that ACSL's proposal was too expensive and carried too much risk. Following the review, the Department agreed on a number of cost and risk reduction measures and approved capability trade-offs which reduced the functionality of some of BOWMAN's component parts. For example:

- acquiring ruggedised computer terminals off-the-shelf rather than designing them to military specifications;
- certifying BOWMAN to United States military standards, which are less stringent than the Department's standards, which were originally intended to be used for certification; and
- reducing equipment numbers.

3.25 At around the same time as the Department's review, management of ACSL was taken over by BAE SYSTEMS who committed to a radical reinvigoration of the company. The Department assessed that the resulting change programme was vigorous, well focused and likely to be very effective given time. However, the Department remained concerned that ACSL's ability to produce an acceptable solution to the BOWMAN requirement depended, in part, on efficiencies being achieved by the company. In December 1999, concerned at ACSL's lack of progress, the Department agreed to reduce the outputs required under the risk reduction contract. By June 2000, the Department assessed that ACSL's progress against the reduced outputs had been unsatisfactory despite a nine month extension. ACSL had achieved 80 per cent of the reduced major outputs but two remained outstanding. The system design specification was expected to be completed in April 2001 but the Department did not know from ACSL when the basic system test bed part of the systems integration work would be completed.

3.26 After considering ACSL's bid for the BOWMAN supply and support contract, the Department announced in July 2000 that it was not convinced that ACSL could deliver a system that met the requirement in the time required or represented value for money. Achieving an early in-service date was key to the Department's decision. The Department was planning towards an in-service date of late 2003 or early 2004 but ACSL's proposed in-service date was July 2005 and was not supported by reliable data. Based on the available data, the Department believed that the ACSL date could slip to 2006.

3.27 In early 2000, as a fallback measure, the Department placed contracts with Computing Devices Canada, now known as CDC, and Thomson CSF to ascertain whether alternatives to the ACSL solution might be possible. As a result of these studies, the Department is confident that viable alternatives to ACSL's solution exist so long as potential contractors have some relevant working knowledge of the technology required. It believes that re-opening the competition offers the best prospect for delivering the best value for money and lowest risk solution to the BOWMAN requirement. The Department is reviewing the original BOWMAN requirement to remove equipment specific details and allow a more open competition, and intend to issue invitations to tender in November 2000.

The in-service date for the main BOWMAN system is uncertain although a small part of the requirement (the Personal Role Radio) is due to enter service in 2002

3.28 The Department has decided that it cannot confirm a revised in-service date for BOWMAN with confidence until Main Gate approval which is planned for July 2001. Until this time, the in-service date for BOWMAN will remain uncertain, although the Department is hoping to maintain the current planned date of late 2003 to early 2004. To help achieve this goal, and to deliver early operational capability, the Department announced in December 1999 that it planned to deliver the BOWMAN system incrementally and that initial deliveries of the stand-alone Personal Role Radio part of the requirement should be possible earlier than previously planned. The Department expects to award a contract for around 45,000 Personal Role Radios by February 2001. Initial deliveries are expected at the end of 2001 with an in-service date of March 2002.

The current tactical communications system for land forces is insecure and becoming increasingly obsolescent

3.29 BOWMAN will replace the increasingly obsolescent CLANSMAN combat radio, which has been in-service since the mid-1970's. The limitations of CLANSMAN in Kosovo meant that units deployed there were unable to communicate secure messages throughout the chain of command except by employing cumbersome paper codes for encryption that are slow to compile and prone to error and inaccuracy in use. If BOWMAN is delayed

beyond 2004, it is likely that problems arising from obsolescence, such as unreliability and lack of availability owing to repairs, will increasingly affect CLANSMAN.

3.30 The non-secure Personal Role Radio will offer improved capability at the lowest command and control level. It is envisaged that the radio will be deployed primarily in operations where the value of intercepted data fades quickly and its lack of encryption is not expected to be a hindrance. The Department considers that the Personal Role Radio will vastly improve communications within sections or small teams of soldiers on the move. At higher levels of command and control, the capability gap caused by the absence of the main BOWMAN system will remain.

The delays to BOWMAN have postponed the introduction of digitised battlefield command and control systems and the benefits they are expected to bring

3.31 Basic operational analysis conducted by the Centre for Defence Analysis in the Defence Evaluation and Research Agency between 1996 and 1999 predicted that deploying digitised battlefield command and control systems may reduce the time taken to seize an objective by as much as 75 per cent. The secure radio communications capability that BOWMAN will provide is critical to the introduction of digitised battlefield command and control systems. The continuing absence of BOWMAN has meant that the Department has had to postpone this stage of the digitisation programme until BOWMAN's initial operating capability is in place. Until this time, forces conducting and supporting land operations cannot reap the significant benefits expected from digitisation.

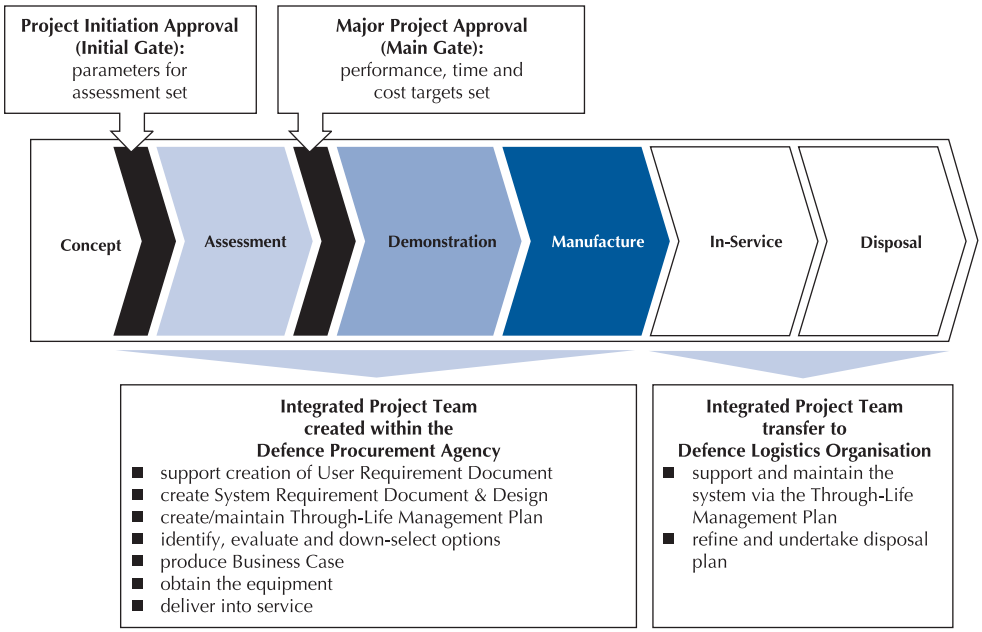
The Department will need to write off development costs of between £35 million and £102 million following their decision not to proceed with the ACSL solution

3.32 As a result of its decision not to proceed with the ACSL solution, the Department will need to write-off some of the development costs it has incurred so far. The Department calculates that £183 million has been invested in ACSL under the 'Package 0' risk reduction programme of which £52 million was assigned directly to ACSL, and £131 million to sub-contractors for the development of sub-systems and services that may still form part of the eventual solution. The Department currently estimate that the maximum possible amount to be written off would be £144 million, but that the actual figure is likely to be between £35 million and £102 million depending on the outcome of the new competition and the solution chosen.

Appendix 1 The Smart Acquisition Cycle

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 1 outlines the acquisition lifecycle and the responsibilities of integrated project teams at each stage.

1 The Smart Acquisition cycle showing the role of Integrated Project Teams



Source: National Audit Office

Appendix 2

Reconciliation of the 1999 and 2000 Major Projects Reports

1 The 1999 and 2000 Major Projects Reports are very different. The 2000 Report reflects the following developments since the 1999 Report:

- the implementation of Smart Procurement, which has changed the way that the Department approves and manages procurement projects;
- the introduction of Resource Accounting and Budgeting, which will change the way that the Department accounts for project finances;
- changes to the population of projects covered by the Report; and
- new approvals on projects since 31 March 1999.

2 In order to compare performance between the 1999 and 2000 Major Projects Reports we have quantified the impact of these developments to separately identify the real in-year variation between the two reports. The effect of each of the developments is outlined below and quantified in cost (Table 1) and timescale terms (Table 2).

The implementation of Smart Procurement

3 Under Smart Procurement, the Department clearly distinguishes between initial concept and assessment work and the main investment in demonstration and manufacture of equipment. Demonstration and manufacture follows Main Gate approval and this is the baseline against which post-Main Gate projects are now measured. In the 1999 and previous Major Projects Reports the first Downey Cycle approval was used as the baseline against which project performance was measured.

The introduction of Resource Accounting and Budgeting (RAB)

4 In the 1999 and previous Major Projects Reports costs were reported on a cash basis at constant prices. The Defence Procurement Agency introduced RAB on 1 April 1999. In line with this government-wide change, costs in the 2000 and future Major Projects Reports include all resource elements such as interest on capital, government furnished equipment and investment in capital assets. They are also at forecast outturn prices and reflect the amount that is forecast to be spent in each year that it is to be spent, including the forecast impact of inflation.

5 A lot of the projects in the Major Projects Report began many years ago and data was not available to reconstruct costs on a RAB basis from a zero baseline. Costs reported in previous Major Projects Reports have, therefore, been converted to a RAB basis. For each project in the 2000 Report the conversion process used preserved the proportional variation between approved costs and current forecasts as at 31 March 1999. This enabled a new overall cost variation for each project to be derived on a resource basis and ensured that no project gained or lost in cost performance terms as a result of the conversion.

6 Even though costs are now reported at outturn prices, inflation remains as a cause of cost variance on projects. Under the previous format of the Major Projects Report, project approvals were brought to current prices using the Gross Domestic Product index and compared with forecast costs brought to current prices using contract specific Variation of Price formulae. This variance, attributed to inflation adjustments, has been preserved by the methodology described above for converting approvals to a resource basis. Starting with the Major Projects Report 2000 inflation variances relate to:

- inflation identified before the conversion to outturn prices based upon the difference between the contract specific inflation indices which applied when the money was spent and the Gross Domestic Product index used to bring the approval to outturn prices; and
- inflation identified since the conversion process based upon the difference between the current assumptions used to forecast future costs and the inflation assumed at conversion, or for new projects at approval to outturn prices.

7. The lack of historic data has meant that it has not been possible to reconstruct the individual causes of cost variations on a resource basis so that they account for the new total resource variation. Any balance arising because of this is real cost variance, but it is not possible to identify it to specific causes. The balance has been separately identified for each project as an accounting adjustment shown as 'derivation of the approved cost on a resource basis'. In validating the Project Summary Sheets, we have ensured that this balancing figure has been minimised and does not disguise any unexplained additional causes of cost variance.

Changes to the population of projects

8 The 1999 and previous Major Projects Reports showed the performance of the Department's top 25 major procurement projects by value. From 2000, the Major Projects Report shows the performance of 30 projects - the top 20 post-Main Gate projects by value and the top 10 pre-Main Gate projects by value. The specific differences in population between the 1999 and 2000 Reports are:

- Sixteen of the 25 projects from the 1999 Report feature as post-Main Gate projects in the 2000 Major Projects Report;
- five of the projects from the 1999 Report feature as pre-Main Gate projects in the 2000 Major Projects Report. These are BOWMAN, Type 45 destroyer, Future Carrier Borne Aircraft, Beyond Visual Range Air-to-Air Missile and Tactical Reconnaissance Armoured Combat Equipment Requirement;
- the remaining four projects from the 1999 Report have been replaced by four new post-Main Gate projects in the 2000 Major Projects Report. Skynet 5, Sonar 2087, Successor Identification Friend or Foe and Future Offensive Air System have been replaced by Multi-Role Armoured Vehicle, SeaWolf Mid-Life Update, High Velocity Missile and Advanced Short Range Air-to-Air Missile; and
- there are five new pre-Main Gate projects in the 2000 Major Projects Report. These are Future Aircraft Carrier, Future Transport Aircraft, Guided Multiple Launch Rocket System, Microwave Landing System and Next Generation Light Anti-Armour Weapon.

New project approvals

9 Two of the projects in the 2000 Major Projects Report have had additional approvals since 31 March 1999, the position reported in the 1999 Major Projects Report. ASTOR has passed Main Gate and Medium Range TRIGAT received approval for production under the old Downey Cycle. The 2000 Major Projects Report includes these additional approvals.

Real in-year variations

10 Taking into account all of the above developments, forecast project costs reduced by £78 million and there was an additional 63 months slippage between 31 March 1999 and 31 March 2000.

T1 Reconciliation of project cost data reported in the 1999 and 2000 Major Projects Reports

Population	Accounting basis	Baseline	Reporting Date	Approval (£m)	Forecast (£m)	Variance (£m)
MPR99 projects	Cash	First approval	31 March 1999[1]	34822[1]	37553[1]	2731 (7.8%)[1]
Change = projects leaving the population						
16 common projects	Cash	First approval	31 March 1999	33877	36423	2546 (7.5%)
Change = reporting costs on a RAB basis						
16 common projects	**RAB**	First approval	31 March 1999	38605	41090	2485 (6.4%)
Change = reporting against a new baseline						
16 common projects	RAB	**Main Gate approval**	31 March 1999	38128	40620	2492 (6.5%)
Change = projects entering the population						
MPR 2000 projects	RAB	Main Gate approval	31 March 1999	40554	43037	2483 (6.1%)
Change = further approvals since 31st March 1999						
MPR 2000 projects	RAB	Main Gate approval	N/A	42278	44761	2483 (5.9%)
Change = in-year variations against approval						
MPR 2000 projects	RAB	Main Gate approval	**31 March 2000**	42278[2]	44683[2]	2405 (5.7%)[2]

1 Data reported in the 1999 Major Projects Report

2 Data reported in the 2000 Major Projects Report

T2 Reconciliation of project in-service date data reported in the 1999 and 2000 Major Projects Reports

Population	Baseline	Reporting Date	Total slippage (months)	No of projects	Average (months)
MPR99 projects	First approval	31 March 1999	1125[1]	24	47[1]
Change = projects leaving the population					
16 common projects	First approval	31 March 1999	835	16	52
Change = reporting against a new baseline					
16 common projects	**Main Gate approval**	31 March 1999	445	16	28
Change = projects entering the population					
MPR 2000 projects	Main Gate approval	31 March 1999	504	20	25
Change = in-year in-service date variance					
MPR 2000 projects	Main Gate approval	**31 March 2000**	567[2]	20	28[2]

1 Data reported in the 1999 Major Projects Report

2 Data reported in the 2000 Major Projects Report

Appendix 3

Ministry of Defence: Project Summary Sheets 2000

Post-Main Gate Projects

Pre-Main Gate Projects

Appendix 4

Post-Main Gate Projects

ADVANCED AIR-LAUNCHED ANTI-ARMOUR WEAPON (AAAW)
Air-launched missile with a limited stand-off capability to attack armoured vehicles, that will be carried by Harrier GR7, Eurofighter and Tornado GR4 aircraft.

ADVANCED SHORT RANGE AIR-TO-AIR MISSILE (ASRAAM)
Air-launched missile with an infra-red seeker that will replace the Sidewinder AIM-9L missile and will be carried by Eurofighter, Harrier GR7/9, Tornado F3 and the Royal Navy's Sea Harrier FA2.

AIRBORNE STAND-OFF RADAR (ASTOR)
Long-range theatre surveillance and target acquisition system to detect fixed, static, and moving targets, in all weathers by day and night.

ASTUTE CLASS SUBMARINE
Nuclear-powered attack submarines to replace the Swiftsure class.

ATTACK HELICOPTER (WAH64 APACHE)
Version of the United States Army's AH-64D helicopter, equipped with Longbow radar, Hellfire missiles, ground suppression rockets, air-to-air missiles and powered by RTM322 engines.

CHALLENGER 2
The replacement for the Army's Chieftain and Challenger 1 Main Battle Tanks.

CONVENTIONALLY ARMED STAND-OFF MISSILE (CASOM)
Air-launched stand-off missile for precision attacks against strategic, tactical and infrastructure targets that will be carried by Harrier GR7, Eurofighter and Tornado GR4 aircraft.

EUROFIGHTER
Agile fighter aircraft with an offensive support capability.

HERCULES C-130J
Replacement fleet of transport aircraft for part of the existing Hercules fleet.

HIGH VELOCITY MISSILE SYSTEM (HVM)
Very Short-Range Air Defence weapon designed to attack armoured helicopters and low flying aircraft from the ground.

Project glossary

LANDING PLATFORM DOCK (REPLACEMENT) (LPD(R))
Replacements for the amphibious assault ships Fearless and Intrepid. LPD(R) will be used to launch and co-ordinate amphibious operations.

MEDIUM RANGE TRIGAT (MR TRIGAT)
Crew-portable laser beam riding anti-tank guided missile that uses a tandem charge warhead and a thermal sight.

MERLIN MK1 HELICOPTER
Anti-submarine warfare variant of the Anglo-Italian EH-101 helicopter, which will operate from Type 23 frigates, and Invincible class aircraft carriers.

MERLIN MK 3 HELICOPTER
Support helicopter based on the Anglo-Italian EH-101 utility helicopter. Designed to carry 24 troops or a range of vehicles or underslung loads.

MULTI-ROLE ARMOURED VEHICLE (MRAV)
Armoured utility vehicle that will replace the Fighting Vehicle 430 series, Combat Vehicle Reconnaissance (Tracked) and Saxon General War Role vehicles for use in high intensity conflict, rapid reaction peace support and humanitarian operations.

NIMROD MARITIME RECONNAISSANCE & ATTACK MK 4 (NIMROD MRA4)
Replacement for the current fleet of Nimrod MR Mk2 patrol aircraft, whose principal war roles are anti-submarine and anti-surface ship warfare.

SEAWOLF MID-LIFE UPDATE
Upgrade to the existing SEAWOLF system to maintain performance against the evolving Anti Surface Ship Missile threat.

SPEARFISH HEAVYWEIGHT TORPEDO
Submarine-launched heavyweight torpedo with both anti-submarine and anti-surface ship capabilities.

STING RAY LIGHTWEIGHT TORPEDO LIFE EXTENSION
Life extension and capability enhancement programme for the Sting Ray lightweight torpedo to allow it to remain in-service until 2020.

SWIFTSURE & TRAFALGAR CLASS SUBMARINE UPDATE (S&T UPDATE)
Update to Swiftsure and Trafalgar class submarines to improve the sonar, command and tactical weapons systems.

Pre-Main Gate Projects

BEYOND VISUAL RANGE AIR-TO-AIR MISSILE (BVRAAM)
Air-to-Air missile, to be carried by Eurofighter, for engagement of targets at beyond visual range.

BOWMAN
Combat net tactical communications system to replace the existing CLANSMAN radio and support battlefield digitisation.

FUTURE AIRCRAFT CARRIER (CVF)
Aircraft carrier capable of rapidly deploying forces with the reach and self-sufficiency to act independently of host nation support. The requirement for carriers with the ability to deploy offensive air power was endorsed in the Strategic Defence Review.

FUTURE CARRIER BORNE AIRCRAFT (FCBA)
Multi-role combat aircraft to replace Sea Harrier and, following the Strategic Defence Review announcement, Harrier GR7. A range of options are being investigated, including collaboration with the United States on the Joint Strike Fighter.

FUTURE TRANSPORT AIRCRAFT (FTA)
Transport aircraft providing tactical and strategic mobility to all three services to replace the remainder of Hercules fleet.

GUIDED MULTIPLE LAUNCH ROCKET SYSTEM (GMLRS)
Replacement for the unguided MLRS M26 bomblet rockets, which will increase range and be more difficult to detect that the current weapon.

MICROWAVE LANDING SYSTEM (MLS)
New Precision Approach Landing System (PALS) that will facilitate safe runway approaches during air operations.

NEXT GENERATION LIGHT ANTI-ARMOUR WEAPON (NLAW)
A short range anti-armour weapon which will replace LAW 80.

TACTICAL RECONNAISSANCE ARMOURED COMBAT EQUIPMENT REQUIREMENT (TRACER):
Manned, armoured reconnaissance vehicle, which is one of the options under consideration to meet information, surveillance, target acquisition and reconnaissance (ISTAR) requirements.

TYPE 45 DESTROYER
New class of Anti-Air Warfare Destroyer to replace the Type 42 Anti-Air Warfare Destroyer.

Appendix 5 Definitions of cost, time and performance variance categories

Category	Definition	Used to explain variations in
Technical		
Technical Factors	Variations due to changes in technical ability to deliver project	Time, Cost and Performance
Customer Requirement		
Changed Requirement	Variations due to changes in the customer's requirement for the equipment, flowing from operational reassessment rather than budgetary priority	Time, Cost and Performance
Changed Budgetary Priorities	Variations due to changes in the customer's requirement for equipment, flowing from changed budgetary priorities	Time, Cost and Performance
Economic Conditions		
Inflation	Variations due to changes in inflation assumptions	Cost
Exchange Rate	Variations due to changes in exchange rate assumptions	Cost
Procurement Management		
Receipts	Variations due to changes in expectation of receipts, e.g. liquidation damages, commercial exploitation levy	Cost
Contracting Process	Variations due to changes associated with the contractual process, including time taken in contract negotiations and placing contracts, effect of contractor bids compared to estimates	Cost and Time
Procurement Strategy	Variations due to changes in overall procurement strategy e.g. change to collaborative options, or from competitive to single-source	Cost and Time
Reporting Conventions		
Accounting Adjustments and Re-definitions	Variations that do not reflect any substantive change: including imported or exported costs arising from changes in accounting rules, adjustments to reflect changes in the definition of terms	Cost and Time
Associated Projects		
Change in associated project	Variations due to changes in an associated project e.g. availability of equipment from another project for trials	Cost

Appendix 6

Glossary of contractual and procurement terms

Assessment Phase

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 (SRD) and identifies the most cost-effective technological and procurement solution. Risk is reduced to a level consistent with delivering an acceptable level of performance to a tightly controlled time and cost. By the end of the Assessment Phase a business case will have been assembled for Main Gate Approval.

Commercial Exploitation Levy (CEL)

Payments made by the contractor to the Department for any commercial use made of a defence equipment's design where the Department originally funded the equipment's development.

Demonstration and Manufacture Phases

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.

Equipment Capability Customer

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.

Equipment Plan (EP)

The Department's budgeting plan for expenditure on the equipment programme. It examines costs over the 10 year plan, creates and considers options to match the required spend profile and Defence priorities.

Firm Price

An agreed price which is not subject to variation for inflation.

Fixed Price

An agreed price which is subject to variation to take account of inflationary and/or exchange rate movements.

Initial Gate

The approval point preceding the Assessment Phase. At Initial Gate, a Business Case is put to the Equipment Approvals Committee 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.

Investment Appraisal

A comparison of the alternative investment options on a purely financial basis.

Key User Requirements

Requirements or constraints identified from within the wider set of user requirements, assessed as key to the achievement of the mission.

Liquidated Damages

A contractually pre-agreed sum payable in the event of a specific breach of contract (e.g. late delivery) by way of compensation.

Main Gate

The approval point between the Assessment and Demonstration and Manufacture Phases. At Main Gate, a business case, which should recommend a single technical and procurement option, is presented. 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 (whole-life and procurement) and performance parameters.

NAPNOC (No Acceptable Price No Contract)

The Department's policy for non-competitive pricing which seeks to replicate the pressures of competitive procurement in which a price is secured at the outset through the tendering process. Under the NAPNOC policy, non-competitive contracts should only be placed when a price has been agreed which reflects what it would cost an efficient contractor to carry out the work. NAPNOC contracts should, therefore, be priced before a contract is placed.

OCCAR (Organisme Conjoint de Co-operation en Matiere d'Armement)

A quadrilateral agency for the management of co-operative acquisition programmes. The member nations are the United Kingdom, France, Germany and Italy.

Prime contractor

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.

Request for Proposals (RFP)

A request by the Department for the contractor to supply proposals on how it would meet the requirement.

Technology Demonstrator Programme

A programme designed to demonstrate unproven technology using practical demonstrations, prior to its incorporation into a defence equipment programme.

Whole-Life Costs

The total resource required to assemble, equip, sustain and operate a specified military capability at agreed levels of readiness, performance and safety.

Appendix 7

Progress on developing robust Whole-Life Costs

What is a whole-life cost?

1 Whole-life cost applied to military capability and defence equipment is how much it will cost the Ministry of Defence (the Department) throughout its entire life from concept to disposal, including all acquisition and in-service costs such as operation, maintenance, repair, training, modifications and disposal.

Why are whole-life costs important?

2 One of the key principles underpinning Smart Procurement is that equipment investment decisions should reflect the whole-life cost implications rather than focussing solely on the procurement cost. Resources consumed during the in-service phase represent a significant proportion of the whole-life cost.

3 The main benefits of developing and monitoring whole life cost forecasts are expected to be:

- to provide the Department with a better picture of the overall full cost of proposed solutions at the main investment decision point leading to more informed decision-making, for example about whether to retain or modernise existing equipment or to procure new equipment, and improved planning, budgeting and management of defence equipment;
- to enhance the Department's ability to make decisions trading-off cost and performance within individual equipment projects and between projects in a capability area; and
- to identify and increase the Department's understanding of cost drivers for equipment projects leading to target setting aimed at optimising the whole-life cost of equipment and inventory holdings.

How does the Department intend to measure whole-life costs?

4 The Department has chosen to use annual 'cost of ownership', as its preferred whole-life cost metric and this figure will be reported in the Major Projects Report. 'Cost of ownership' measures the cost of the resources directly and indirectly consumed through the life of equipment. The Department has chosen this measure because it allows an annual, comparable measure of performance as well as the construction of a lifetime cost figure.

5 By examining changes in annual cost of ownership over time, the Major Projects Report will show how successful the Department is in driving down costs and provide a baseline against which to assess performance on individual projects and the factors underlying particular successes or failures to reduce costs.

When will the Department have robust whole-life cost information available?

6 In theory, the Department have produced whole-life cost information for a number of years and used it to inform major equipment procurement decisions. However, the data produced has reflected only those costs closely associated with the equipment (for example, spares, maintenance and fuel consumption) and not all whole-life costs, such as training, in accordance with the definition given above.

7 The Department has therefore begun a 'Whole-Life Cost and Cost Of Ownership initiative' to ensure it can estimate/capture accurate and reliable whole-life cost data. The Department is facing a number of challenges to develop robust cost of ownership estimates for new equipment projects including:

- the Department's budget management is organisationally based. This means that costs are currently captured and monitored against budget holders, and not on an equipment by equipment basis; and
- the Department's Resource Accounting and Budgeting system (Project CAPITAL) is not configured to deliver whole-life cost information.

8 As a result, cost of ownership estimates are being developed 'off-line' and the Department are having to undertake extensive work to initially construct them for each equipment. To date, the Department:

- has issued guidance on its Acquisition Management System giving Integrated Project Teams access to a business process and template to gather cost of ownership information from all their stakeholders, enabling them to construct a costed Through Life Management Plan;
- has piloted the cost of ownership concept with several Integrated Project Teams preparing Main Gate business cases, using existing in-service equipment to put their cost of ownership predictions in context; and
- is developing training courses showing how cost of ownership provides a measure of affordability, and identifies the cost drivers once equipment enters service.

9 The Department anticipates that sufficient work has been completed to enable the Whole-Life Cost Steering Group it has set up to recommend that the Equipment Approvals Committee calls for cost of ownership data to inform its decision-making process for all Main Gate submissions from October 2000 onwards.

10 The Department will spend the next year refining the process and, in parallel, examining the information system requirements to support cost of ownership across the Department. The Department plans to roll-out the refined process incrementally with robust cost of ownership information established for all major equipments by April 2002. In terms of decision-making, the Department intends that all Main Gate decisions will be informed by cost of ownership data, with Main Gate approvals including targets for cost of ownership and whole-life cost from 2002 onwards.