The Cost of Delay

by Professor David Kirkpatrick

David Kirkpatrick is Emeritus Professor of Defence Analysis, University College London, and an Associate Fellow of the Royal United Services Institute. *Here he estimates that the cost of delay in procurement is likely to amount to at least £1Bn per year, which is about one-sixth of total procurement expenditure.*

Great military commanders abhor delay – Napoleon said, "Ask of me anything but time", and Nelson said, "Lose not an hour". The UK's Ministry of Defence (MoD) recognises the urgency of meeting emergent operational requirements from its armed forces when they are actually engaged in warlike operations, and within the last decade the MoD and its industrial suppliers have been praised[1] for the rapid delivery of Urgent Operational Requirements (UOR) to the UK armed forces deployed in Iraq and Afghanistan.

However, it has been noted[2] that the MoD, in its management of projects in the core programme of defence equipment procurement, appears virtually oblivious to the financial and operational penalties of delays. Even the large and important projects reviewed by the National Audit Office's latest Major Projects Report[3] include (in boxes C.3.4 and C.3.5) only incomplete (if any) assessments of the penalties of delay. In this situation it is impractical for project teams to make appropriate trade-offs between performance, cost and timescale (as recommended by the Smart Acquisition[4] reforms). The project teams can make trade-offs between system performance and unit cost using well-established procedures combining operational analysis and military judgement, but the methodology of trade-offs involving timescale is underdeveloped, and lacks an adequate supporting database.

A Policy of Delay

The failure of MoD project teams to quantify adequately the penalties of delay makes it all too easy for politicians and bureaucrats to delay projects for short-term budgetary convenience. The MoD's equipment procurement programme has been under increasing strain since the 1998 Strategic Defence Review (which decided the procurement programme before the budget was agreed and which incorporated unrealistic assumptions on productivity)[5] and the only antidotes available to the MoD have been to cancel projects, to degrade the performance demanded and/or to reduce the numbers to be procured, or to defer in-service dates.

The cancellation option is certain to provoke anguished outrage from the UK's armed forces, industrial companies, trade unions and Members of Parliament, and may incur substantial penalty costs on terminated contracts; Ministers and officials in the MoD generally shun such 'brave decisions'. Cuts in performance or numbers are also unpopular and generally represent poor value-for-money, but this option has sometimes been adopted in recent years in order to keep projects within their budgetary limits.[6] It is generally easier for officials who are trying to balance the MoD's budget to defer the in-service dates of some projects, and thus reduce the annual expenditure on the projects affected.

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Another plausible antidote to a budgetary crisis is to redistribute project expenditure by adopting a Private Finance Initiative (PFI) arrangement – analogous to rental or hire purchase, depending on who ends up owning the asset involved. This arrangement reduces expenditure in the early years but costs more later (and may reduce the total project cost through more expert management). However, the scope for PFI is limited, and the associated negotiations are often protracted and onerous.

The result is that MoD's preferred policy for managing an overstretched budget remains delaying ongoing projects.

The Costs of Delay

Last year the budgetary pressure was so severe that the MoD undertook an 'Equipment Examination' and made decisions which reduced the funding gap for the next decade from £21Bn to £6Bn, though the latter figure assumes, very optimistically, continued growth in the defence budget and no further growth of the cost of projects being procured. Two of those decisions deferred the in-service dates of the *Queen Elizabeth*-class aircraft carriers and *Astute*-class submarines, reducing expenditure over the next few years but increasing the total cost of these projects by over £1Bn. The NAO judged that these decisions give poor value-for-money on those projects,[7] and thus highlighted the importance of properly understanding the cost of delay.

A few months earlier the Gray Report,[8] as part of a much wider review of defence equipment acquisition, made a pioneering

estimate of the costs of delay. Gray and his team deserve great credit for using the scanty available evidence to formulate an estimate of between £0.9Bn and £2.2Bn per year for the 'unproductive costs' due to delay, and for enduring ill-deserved criticism because their estimate was inevitably imprecise. All good cost analysts know that it is better to be approximately right than precisely wrong, and the true cost of delay is certainly not zero. This paper reviews Gray's methodology and suggests some modifications to his estimate.

Sources of Delay

Any defence procurement project may incur delays to its progress from approval at Main Gate to entry into service, and these delays arise for many reasons. Enhancement of the customer's performance requirement or unexpected technical problems may demand additional design and development work, which cannot always be done in parallel to pre-planned work packages. The customer may have difficulty in taking timely decisions, for reasons unrelated to the project itself. There may also be various random events (including accidents, bad weather or industrial disputes) anywhere in the supply chain which may cause delay depending on the events' severity and on whether they are on the critical path. Finally, the customer may deliberately decide to delay the project's entry to service and to reschedule the remaining work accordingly. All of these delays can increase the project's cost, depending on the nature of the delay and on the flexibility of the supplier.

During this period there may also be sundry variations in the cost of the project (due, for example, to fluctuations in input inflation and foreign exchange rates) which do not affect its timescale.

Few MoD project teams appear to know the cost of operating existing equipment and even fewer know the likely operating cost of the new equipment they are procuring

A project where the customer demands early delivery or downgrades the required performance, or where there are no adverse random events or administrative dithering, might (in principle) enter service ahead of its scheduled date. In practice, however, any acceleration of the schedule is generally precluded by limited resources of money, manpower and facilities available for the development of equipment and other lines of development. Time schedules appear to move only in one direction.[9]

Estimating the Procurement Costs of Delay

Appendix G of the Gray Report estimated the annual costs associated with delays to the MoD's equipment procurement programme in terms of:

- Increased MoD payments to its industrial suppliers.
- Additional costs borne by the suppliers themselves.
- Additional intramural costs incurred by the MoD.

For the first item, Gray's Figure G-1 used a sample of 29 projects to show that troubled projects which incur long delays also have large overruns in their payments to suppliers, according to the approximate equation:

% cost overrun since Main Gate = (0.3 to 0.7) x (months of delay)

Using this correlation, and the total approved cost of £70Bn of the MoD's equipment procurement programme, the report concluded that the 2.5-month average annual delay incurred by the projects in that programme would result in an annual increase in the extramural costs of the MoD's programme of:

Annual cost increase = 2.5 x 70 x (0.003 to 0.007) = £0.5Bn to £1.2Bn

Some of the additional costs of a troubled project may be borne by the industrial supplier, depending on the cause of the delay and the terms of the contract. Such costs to industry are generally hidden by commercial confidentiality, but the Gray Report identified three notorious examples, which suggest:

% cost overrun borne by industry = 0.20 x (months of delay)

However, this calculation is based on a very small sample of projects, where the suppliers' delays have been particularly large and MoD has thus a credible claim for compensation; the suppliers have accordingly agreed to accept some of the additional project costs. In most cases, however, the project delays are smaller and suppliers can avoid blame. Gray estimated that the suppliers' extra costs were:

Annual cost increase = 2.5 x 70 x (0.0006 to 0.002) = £0.10Bn to £0.35Bn

Whatever the actual level of these costs, they are not borne by the MoD's budget and therefore should not be added directly to the MoD's extramural cost.

In addition, the MoD incurs additional intramural costs on delayed projects from maintaining project teams for 80% longer than the planned schedule from approval at Main Gate to entry to service. DE&S spends some £0.42Bn per year on managing the delivery of new equipment, so delays might cause extra costs of 0.42 x 0.8/1.8 = £0.19Bn per year. Gray speculated that as delays occurred the project team might be scaled down to allow fewer staff to do the same work over a longer period, and thus incur only about half of that extra cost, but in practice the delays themselves would probably generate additional work (on mitigation actions,

renegotiation, etc.) and would therefore occupy the full team until the equipment enters service. In addition, the project delays complicate the annual budgetary planning process, and this probably adds another £15M to £30M to the MoD's internal costs.

Caveat

It should be noted that both of the above correlations linking extra cost (to MoD and to its suppliers) with project delay are not causal relationships. The data includes the impact on cost (generally increases) of all factors affecting the projects including some which do not cause delay, so the coefficients probably exaggerate the particular costs of delay. However, the published data on project delays is generally far less extensive than data on cost overruns (reflecting the MoD's perception of their relative importance?) so it is impractical at present to improve on Gray's correlations.

It is misleading to label all the costs of delay as 'unproductive'. The cost of delays arising from ill-considered changes to a project's requirement or schedule after Main Gate approval, or the cost of delays arising from poor management, are certainly unproductive, but some other delays arise from work which is necessary to overcome technical and management problems which are intrinsic features of any large advanced project. These latter delays cannot be eliminated by better management organisation and procedures, but they should be minimised by appropriate technology demonstration, risk analysis and project planning before Main Gate approval (in accordance with the recommendations of Smart Acquisition and several earlier reforms). The potential cost savings from reductions in all these delays should make procurement reform a priority within MoD (although the impact of recent reforms has been disappointingly limited).[10]

The problem is that the MoD is very good at promising to do things and then not doing them

Estimating the Non-procurement Costs of Delay

The Gray report estimates the other costs (which fall outside the procurement budget) of delays to projects as the net cost of continuing to operate existing equipment including any necessary life-extension work (£100M to £130M) plus the cost of buying alternative equipment with broadly the same capabilities as the new, delayed equipment (£110M to £250M). The first estimate is derived from a sample of 14 projects which have cited the cost of continuing to operate existing equipment; however, only four of these also cite the saving from not operating the new equipment, and none consider the cost of disrupting the non-equipment defence lines of development. The second estimate is derived from recent capital expenditure on UOR and the proportion of that expenditure which is attributable to delayed projects.

Caveat

If new equipment is delayed in peacetime, the MoD generally prefers to ignore the resulting operational penalties and to continue operating existing equipment. This policy would incur:

(Costs of operating, support and life extension of existing equipment)
– (saving from not operating or supporting the delayed new equipment)

It is scandalous that, a dozen years after Smart Acquisition stipulated that defence projects should adopt a through-life approach, so few MoD project teams appear to know the cost of operating existing equipment and even fewer know the likely operating cost of the new equipment they are procuring. Until this situation is rectified, Gray's estimate of £100M to £130M should be accepted, *faute de mieux*.

Any delay in the delivery of new equipment also incurs a (non-financial) loss of national security through the period of delay. This loss can be valued at or above the through-life cost per year in service that the MoD would have paid to have the new equipment operational. If, for example, the average through-life cost of the equipment in the MoD's procurement programme were three times larger[11] than its procurement cost, and if its average service life were 30 years, the annual in-service cost of that equipment would be 3 x 70/30 = £7B. The annual delay in MoD procurement projects of 0.2 years would therefore incur a loss of security valued at £1.4Bn per year.

If the new equipment were delayed while the UK's armed forces are engaged in one or more expeditionary wars against guerrillas, the MoD generally offsets the operational penalties of delay by upgrading some existing equipment and by replacing some existing equipment with newer off-the-shelf equipment with broadly the same military capabilities as the corresponding delayed projects. This policy would incur:

(cost of procuring off-the-shelf equipment and modifying existing equipment)
– (revenue from resale of off-the-shelf equipment)
+ (cost of operating and supporting off-the-shelf and modified equipment
– (savings from not operating and supporting delayed new equipment)

The Gray estimate of £110M to £250M covers only the first of these costs, tacitly assuming that the operating and support costs of existing, modified and off-the-shelf equipment are not significantly different, and that the revenue from resale is negligible. However, if about half[12] of the off-the shelf equipment could be sold at half price when the delayed equipment is (eventually) delivered, the revenue

from resale would be £30M to £60M. Conversely, if the modifications to existing equipment and/or the procurement of off-the-shelf equipment could not be accomplished before the deployment of UK expeditionary forces, those forces in combat would suffer additional costs through casualties to personnel and losses of equipment. These additional financial losses – some (smallish?) fraction of the current annual £4Bn cost of operations in Afghanistan – would increase the cost of delay.

Offsetting operational penalties in such expeditionary warfare requires modification or replacement of equipment which is relatively cheap (e.g. armoured patrol vehicles, not warships). But if the UK actually faced the imminent threat of a full-scale war, and chose to offset the operational penalties of delayed projects across the full range of military capabilities, the extra costs of off-the-shelf equipment would be similar to that of the delayed equipment at about £1.4Bn per year (see above), or even more since the off-the-shelf equipment can be presumed to be less cost-effective than that originally selected for procurement and buying it at short notice could incur extra costs. If off-the-shelf equipment were not obtainable, the absence of the delayed projects could cause penalties – from the losses in combat of military personnel and equipment, at worst from defeat – which could be incalculably larger.

Comparison

The discussion above suggests some amendments to Gray's estimates of the cost of delay, and the results in £Bn are shown in the table below. Most of the amendments are relatively small and do not significantly affect his conclusions, but including a valuation (in italics) for the operational penalties of delay would approximately double Gray's estimate. The MoD generally ignores these penalties (which are in peacetime non-financial) of delayed projects, using the convenient assumption that the prospect of full-scale war is real enough to justify the procurement of first-rate equipment, but is not sufficiently imminent to be greatly concerned about delays.

Conclusion

It seems likely that the penalties of delays in the MoD's procurement of defence equipment (arising from technical difficulties, friction in project management and random events) amount to at least £1Bn per year, which is about one-sixth of procurement expenditure. The MoD should take immediate action to identify more explicitly the relationship between delays and increased costs, the usual variation in the scale of project teams as their projects incur delay, the costs of continuing to operate obsolete equipment, the combat losses attributable to delayed projects, and other relevant data. The results of such analyses should be published within DE&S and beyond, and projects should be granted Main Gate approval only if their managers have formulated plausible estimates of the costs of delay. These estimates should then encourage MoD project teams to devote appropriate resources to increasing Technology Readiness Levels and managing risks, and should inculcate a fitting sense of urgency in the management of the MoD's core programme of defence equipment procurement. ■

NOTES

1 NAO, *Support to High-Intensity Operations*, HC 508 Session 2008-09, TSO London, May 2009

2 David Kirkpatrick, 'Lessons from the Report on MoD Major Projects', *RUSI Defence Systems*, June 2009, pages 102–6

3 NAO, *The Major Projects Report 2009*, HC 85-ii Session 2009–10, TSO London, December 2009

4 MoD, *The Strategic Defence Review*, Supporting Essay 10, Cm 3999, TSO, London, July 1998

5 Tom McKane, 'Conclusions of the Green Paper', RUSI conference presentation, 13 January 2010

6 David Kirkpatrick, 'Spurious Savings in Defence Acquisition', *RUSI Newsbrief*, January 2007, pages 6–7

7 NAO, *The Major Projects Report 2009*, HC85-ii Session 2009-10, TSO London, December 2009, page 4

8 Bernard Gray, *Review of Acquisition for the Secretary of State for Defence*, MoD, October 2009

9 John Dowdy, Predicting Acquisition Performance, *RUSI Defence Systems*, October 2008, pages 72–4

10 Warren A. Chin, *British Weapons Acquisition Policy and the Futility of Reform*, Ashgate 2004

11 MoD, *The Defence Strategy for Acquisition Reform*, Cm 7796, TSO London, February 2010, page 4

12 PAC, MoD, *The Rapid Procurement of Capability to Support Operations*, TSO London, June 2005

	Gray	Peace	Current estimate: expeditionary	Current estimate: full-scale war
Cost to MoD	0.8 to 1.8	0.8 to 1.6	0.9 to 1.8	2.2 to 3.0
Loss of security		*1.4*	*1.3 to 1.2*	

(All £Bn)