THE PROBLEM WITH DEFENCE TECHNOLOGY

by Graham Jordan

Graham Jordan is a former S&T Director in the MoD and is now Senior Science Advisor at RUSI. He explains what MoD's real spend on research and development is, at what stage of the acquisition cycle it is spent and how current practice leads to inadequate de-risking of technology and subsequent cost and time overruns.

MoD has had a recurring problem for half a century with acquisition projects that overrun on time and cost. During this time there have been at least five major reports that diagnosed the cause of the problem and recommended solutions.[1,2,3,4,5] Mostly these have rightly focused on changes to the acquisition process and to MoD cultures, and mostly the MoD has implemented or tried to implement these. But there is another theme that has run though most of the reports, which is to do with the way MoD matures the technology on which its equipment projects depend. This article argues that the MoD has never implemented the main recommendations in this area, and that its failure to do so is a major cause of time and cost overrun.

The Research and Development Spend

The process that starts with new technology in the laboratory and ends with reliable equipment in production for the Armed Services is usually called Research and Development (R&D), and this is how it is described in official statistics. MoD spends about £2.5Bn on R&D each year.[6] Compared with the £6Bn a year that is spent on new defence equipment,[7] that is a lot of money – especially as much of it actually comes out of this £6Bn sum.

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To many people, the term R&D is associated with the programme funded by the Chief Scientific Adviser (CSA) and managed through the Defence Science and Technology Laboratory (Dstl). But this accounts for only about £0.5Bn of the total,[8] and is mostly focused at the laboratory end of the R&D spectrum, although it tries to mature particularly promising technology as far as funds allow.

Most of the R&D is actually funded by integrated project teams (IPTs) in the Defence Equipment and Support (DE&S) organisation – about £2Bn a year.[9] This is not money spent on routine, risk-free design work, but on what is termed 'Experimental Development'. In other words, 'build a bit, try it, improve it as necessary, and try again'. This is a key part of the process that delivers reliable equipment, but it is also necessarily slow and expensive. The question of whether it is being done at the right point in the UK's CADMID cycle is one that has raised concerns for decades and, as we shall see, still looks to be a major problem. The easiest way to explore the issues is to follow the money.

When the R&D Spend Occurs

MoD publishes no breakdown of how and when its R&D spend occurs, but the £2Bn spent by the IPTs comes out of the £6Bn spent each year on new equipment. From the Gray report we know that only about 5% of the equipment spend occurs before Main Gate.[10] If we assume that every penny of this goes on R&D, and we add the £0.5Bn spent by the CSA, then simple arithmetic shows that nearly 70% of the equipment R&D spend is occurring after Main Gate.

In fact, this figure is too optimistic. A substantial part of the pre-Main Gate spend actually goes on paper studies to define the required capability, rather than on maturing particular technologies. And a substantial part of what the CSA spends necessarily goes on maintaining the MoD's ability as an intelligent customer for equipment that it buys off-the-shelf, and on exploring the potential of new technologies that eventually fail to make the grade. If instead we assume that only half of these two expenditures are applied to maturing technology for equipment, the proportion of R&D spend that occurs after Main Gate rises to well over 80%.

Common sense suggests that leaving 70% to 80% of R&D until after Main Gate is unlikely to be right, but before jumping to conclusions we need to see what MoD's own reports and those by the National Audit Office (NAO) have said, and what is currently happening in the US.

MoD Acquisition Reports

MoD reports on acquisition since the 1960s have repeatedly made the point that there can be no hope of making reliable time and cost estimates unless the underlying technology (including the technology of systems integration) has been de-risked. The same reports have also provided indicative figures for what the MoD ought to expect to spend before Main Gate (or other project milestones) if it is to de-risk the technology enough to make this possible (the 'up-front spend'). As we shall see, the MoD has consistently failed to spend enough 'up-front'.

Successive reports have raised the recommended figure for up-front spend. MoD has always accepted these figures, and then failed to follow the recommendation. The most recent report to name a figure is the Smart Procurement report of 1998.[11] This set the MoD a formal target: to spend at least 15% of the acquisition cost of a project on risk reduction before giving Main Gate approval. As we have already seen,

the actual spend is only about a third of this. In fact, the actual figure (of 5% of total expenditure) probably falls short of the figure that was recommended back in the 1960s, and which has been raised twice since. This is a big shortfall. But is there evidence to link it to the timescale and cost escalation that actually occurs?

Linking Spend to Cost and Time Overruns

The MoD records the reasons for cost escalation and timescale slip and reports them to the NAO for use in its Major Project Report (MPR). An analysis based on MPR 2008 and earlier MPRs shows that technical problems were reported by MoD as causing 60% of timescale slip.[12,13] The percentage for cost growth was less, but technical problems were still the main cause.

There is some anecdotal evidence that IPT leaders attribute time and cost slip to technical problems whenever there is room for ambiguity, because slippage from this cause is 'not their fault' – an important consideration within MoD's blame culture. So the absolute figures need to be treated with caution. But there would have to be misreporting on a massive scale to avoid the conclusion that lack of de-risked technology is a major cause of timescale and cost increases.

Comparison with the US

Now let us look at what is happening across the Atlantic. Similar concerns about the link between technology maturity and time and cost escalation have been circulating in Congress for some time. The Government Accountability Office (GAO) has produced a series of reports on the topic, with two prominent conclusions. First, those projects that pass through Milestone B (the nearest equivalent to Main Gate) with substantially mature technology, suffer from significantly less timescale and cost growth than those with less mature technology.[14] Second, that civil sector best practice (for example at Boeing Commercial Airplanes) is not to allow a technology to be adopted for use in a product (the nearest civil equivalent to a Main Gate decision) unless it is fully mature.[15]

These reports and GAO testimony to Congressional Committees, led to it becoming a statutory requirement in the US from 2006 that a defence project may only pass through Milestone B when it has been independently verified that all relevant technologies have reached well-defined (and high) levels of maturity. (There are also arrangements for ensuring that system integration is mature well before Milestone C is reached.) Unfortunately, too few projects have progressed under this new legal requirement for the outcome to be clear.[16]

The Way Forward for MoD

The way forward ought to be clear and simple – the MoD should actually implement the recommendations of the multiple reports that have stressed the need for sufficient up-front spend – in order to mature technology (including the technology for systems integration) and so lay the foundations for stable time and cost estimates. In doing this, the UK would align itself with what is already a legal requirement in the US.

The problem is that the MoD is very good at promising to do things and then not doing them. But for optimists, there are some intriguing hints in the recent Green Paper and in the associated paper on acquisition that the MoD is thinking again. For example we have:

> *"We might create greater agility in the equipment programme through… increasing our use of mature technologies when setting requirements. This would reduce the risk that research and development could lead to delays and cost increases…"*[17]

And:

> *"We will... examine the scope for managing technology and innovation better so that we can provide and update defence equipment more quickly….* A key aspect of technology management is separating technology development from product development…"[18]

Is it too much to hope that the MoD will at last do the right thing? ■

NOTES

1 Downey Report 1966, quoted in the report at endnote 2
2 Jordan, Lee and Cawsey, *Learning From Experience*, MoD 1987, HMSO 1988
3 Smart Procurement, McKinsey, 1998
4 McKane et al, *Enabling Acquisition Change*, MoD, June 2006
5 Bernard Gray, *Review of Acquisition for the Secretary of State for Defence*, MoD, October 2009
6 MoD, *Maximising Defence Capability through R&D*, October 2007
7 MoD, *The Defence Strategy for Acquisition Reform*, Cm 7796 Feb 2010
8 See 6 above
9 Ibid
10 See paragraph 7.3.1, page 122, of 5 above
11 See 3 above
12 *MoD Major Project Report 2008*, NAO, 2008
13 Graham Jordan, *Research & Development and Overrun*, Paper presented to RUSI Programme Management Conference, 29 September 2009
14 See, for example, *Assessments of Selected Weapon Programs*, GAO-07-406SP, March 2007
15 Stronger Practices Needed to Improve DOD Technology Transition Processes, GAO-06-883, September 2006
16 GAO Testimony to HASC 30 April 2009, GAO-09-663T; GAO Best Practices GAO-06-883, September 2006; GAO Selected Weapon Programs GAO-07-406SP, March 2007
17 MoD, *Adaptability and Partnership: Issues for the Strategic Defence Review* (Green Paper), paragraph 3.7, Cm 7794, February 2010
18 MoD, *The Defence Strategy for Acquisition Reform*, Paragraph 2.7 and endnote 19, Cm 7796, February 2010