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THE TYPE 45 *DARING*-CLASS DESTROYER

How Project Management Problems Led to Fewer Ships

Ben Lombardi and David Rudd

In 1998, the British government led by Prime Minister Tony Blair released the Strategic Defence Review (SDR), in which it identified a requirement for twelve state-of-the-art warships for the Royal Navy (RN) to be configured for anti-air warfare.¹ This new naval platform was conceived as a replacement for the Type 42 destroyers, which had first entered service in 1978; its development was initially associated with the Anglo-French-Italian Horizon project that had replaced the NATO Frigate Replacement, from which Britain withdrew in 1989. That vision, however, had a very short shelf life. Some months after the SDR's release, Britain

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withdrew from the Horizon project and launched an indigenous Type 45 destroyer program. Production of the first ship, HMS *Daring*, began in 2003.

From the outset, the Type 45 suffered from repeated changes in government direction. Six years after the Blair government identified the requirement for new air-defense frigates, the number of warships to be acquired was revised downward. In 2004, the Ministry of Defence (MoD) announced that "the reduced conventional threat, our revised concurrency assumptions and improved network capability" meant that only eight ships were required.² Two years later it was decided to build only six Type 45s, while reserving a decision on the acquisition of the seventh and eighth ships.

When Gordon Brown, Blair's Chancellor of the Exchequer (i.e., finance minister), took over as prime minister in 2007 that position was maintained, but the pressing exigencies of government finances began to assume greater prominence. "Six Type 45 destroyers are currently on order," a government minister at the time observed, adding that "further orders will depend on the affordability of industry proposals, value for money and the wider implementation of the maritime industrial strategy by industry and the Ministry of Defence."³ In early 2008 the MoD informed a parliamentary committee that only six Type 45s had been ordered and that "anything beyond that is subject to the review process now going on."⁴ Four years later, and with a new government (the Conservative–Liberal Democrat coalition under David Cameron) slashing defense spending as part of an austerity program, it is certain that only six of these ships will ever be acquired.

Characterized by cost overruns, delivery delays, and, initially, reduced capabilities, the Type 45 program has become a symbol in the United Kingdom for mismanagement of procurement. The 2009 Gray Report, which examined defense procurement, noted that the reduction in the number of Type 45s was in part linked to the soaring costs of each ship: "HMS *Daring* and her sisters will cost £1 billion each, a price so high the United Kingdom can only afford six ships. This level of expenditure is well beyond any other current navy in the world barring the US and France."⁵ That argument is shared by many members of the British parliament who reviewed the program on several occasions. In early 2008, for example, the House of Commons Defence Committee assessed the Type 45 program as the third worst of the major naval programs, behind the Nimrod MRA4 maritime patrol aircraft and the *Astute*-class nuclear-powered attack submarine, with *Daring's* delivery three years behind schedule and costs nearly £1 billion over budget (at £6.45 billion). Perhaps even more disturbing, the capability set that had been used by MoD officials to justify the scaling back of the numbers from the original twelve has also been reduced. Looking back, it is arguable that however capable the Type 45 class is, the impact of its procurement (on the defense budget and on fleet size) has been anything but strategic, underscoring the Gray Report's suggestion that the acquisition of such expensive platforms "may seem bizarre."

What went wrong? Testifying before a parliamentary committee in March 2009, Sir Bill Jeffrey, then the Permanent Under-Secretary in the MoD and the department's most senior civil servant, stated that "it is clear that what principally went wrong was that we were substantially overoptimistic about the time it would take to deliver this, about the technical challenge it would represent and about what it would cost. . . . We underestimated the degree of technical risk we were taking on."⁶

That assessment is, however, so sweeping that it obscures a real explanation. Jeffrey never discussed the renegotiation of the original contract two years earlier (in 2007) or how a new project-management framework had been put in place. The new framework, in fact, brought the spiraling costs of the program under control, and HMS *Daring* was commissioned a few months later. It was nonetheless recognized that the Type 45s would not be able to do all that had been originally promised. Given that Jeffrey had described the ships as “a capability that we will be using for several decades,” those limitations represent a potentially serious shortfall.⁷

This article will attempt to answer questions regarding how and why a key component of Britain’s surface fleet has been scaled down to its current size. It highlights some of the uncertainties that can affect fleet size even when the near completion of high-profile procurement programs suggests that such concerns have been satisfactorily addressed. The reduced number of Type 45s will challenge the Royal Navy’s ability to maintain a sustainable hold on full-spectrum operations; as a consequence, there are very few naval analysts who believe that the RN will be able (as it claims) to make available five of the six *Daring*-class ships for operational tasking.⁸ Coming on top of other decisions already taken to downsize Britain’s maritime capabilities, that constraint is pregnant with implications for national strategy.

More generally, these developments are relevant not only to Great Britain and the Royal Navy. Many governments are currently engaged in major naval capitalization programs, and they could well confront the same problems that distracted the Type 45 program or similar ones. Given the tight defense budgets that characterize the age in which we are living, the strategic impact of such difficulties could be all the more significant.

THE *DARING*-CLASS DESTROYER

The Type 45 destroyer is one of the Royal Navy’s most important capability-enhancement programs. It represents a leap forward in Britain’s ability to monitor airspace in the vicinity of RN task groups and to track and prosecute “air-breathing” threats. Currently, the RN has four *Daring*-class destroyers, with another to be commissioned in March 2013 and the sixth and last of the class (launched in October 2010) expected to enter service in 2014. Three of this class have already been deployed. HMS *Daring* saw its first operational deployment when it was sent east of Suez in early 2012 as a demonstration of solidarity with the United States in upholding the Iranian-sanctions regime. Soon after that, HMS *Dauntless* was sent to the South Atlantic to signal resolve in the face of hostile rhetoric from Argentina concerning the Falkland Islands.⁹ HMS *Diamond* deployed to the Persian Gulf between June and December 2012.

Displacing up to eight thousand tons and with a speed of twenty-seven knots, the Type 45 is considerably larger than the Type 42, but with a smaller complement (187 personnel as opposed to 287).¹⁰ Designated as an air-defense destroyer, it is armed with the Sea Viper missile system—a more advanced, United Kingdom-only variant of the Principal Anti-Air Missile System (PAAMS) being deployed on the Horizon frigates.¹¹ It is expected that the Sea Viper will “form the backbone of the Royal Navy’s air defence capability for the next 30 years.”¹²

The heart of this system is the Sampson multifunction electronically scanned radar, which is capable of monitoring a thousand baseball-sized objects at a range of four hundred kilometers. Aerial targets are engaged by short-and-medium-range Aster 15 and long-range Aster 30 missiles fired from a forty-eight-round SYLVER 50 vertical launcher. Secondary armament consists of a 4.5-inch Mark 8 dual-purpose gun, and various smaller-caliber weapons are mounted for defense against asymmetric threats. Sea Viper is designed to be capable of defending against multiple incoming and maneuverable missiles, even those traveling at supersonic speeds. Perhaps just as significantly, the ship will be able to provide support to littoral operations, either by extending its air-defense shield over amphibious forces on land or by deploying up to eighty Royal Marines or special-forces personnel, for whom it has berths. In contrast to allied vessels of its type, the Type 45 will be able to support a large Chinook transport helicopter from its enlarged flight deck.

As HMS *Daring* and its sisters have proceeded through the build, trial, and acceptance phases, observers have noted that the project has come up short in several respects. Initial deliveries have lacked the Skynet 5 and Bowman communications systems—both of which are required to exchange information with other units. The ships also lack an antiship missile, and those delivered prior to 2011 a 20 mm Phalanx close-in weapons system as well. The latter represented a rather strange deficiency given the RN’s experience in the 1982 Falklands War, in which the task force suffered grievously from low-flying attack aircraft armed with free-fall bombs and Exocet missiles. It was also somewhat incongruous with the decision by most allied navies to install such weapons on comparable platforms (see figure).

According to reports, provision had initially been made for a 155 mm gun on the last four ships of the class (but development costs were too high, so it will not be installed), and all six ships are eventually to be fitted with the Phalanx, as well as two 30 mm guns to defend against high-speed threats that penetrate the outer defenses. The ship boasts a bow-mounted sonar to detect submarines but, in contrast to the Type 42 ships it is replacing, has no antisubmarine torpedo tubes. (The responsibility for prosecuting subsurface contacts rests entirely with an embarked Merlin or Lynx helicopter.) Also, while some air-defense vessels

AIR-WARFARE DESTROYERS

	<i>Daring</i> (Great Britain)	<i>Arleigh Burke</i> (USA)	<i>Horizon</i> (France/Italy)	F-124 (Germany)
Tonnage	8,000	9,000	7,000	5,690
Main gun	1 × 4.5-inch	1 × 127 mm	2/3 × 76 mm	1 × 76 mm
Antiship missile	Nil	8 × Harpoon	8 × Exocet/Teseo	8 × Harpoon
Helicopters	1 Lynx or Merlin	2 SH60R	1 NH90	2 NH90
Torpedo tubes	Nil	6	2	6
Cruise missiles	Launcher reqd	Yes	Launcher reqd	Possible
Close-in system	2 × Phalanx (post-2011)	2 × Phalanx	See main gun	2 × RAM
Med.-range SAM	32 × Aster 15	256 × ESSM	32 × Aster 15	64 × ESSM
Long-range SAM	16 × Aster 30	32 × SM-3	16 × Aster 30	16 × SM-3
Complement	191	276	195/200	255
Special forces	31	Nil	Nil	Nil

Note: SAM = surface-to-air missile.

Source: Adapted from "DDG Type 45: Britain's Shrinking Air Defense Fleet," *Defence Industry Daily*, 13 June 2012, www.defenseindustrydaily.com/, and *Jane's Fighting Ships, 2011–2012*.

currently in service or under construction in allied navies have a built-in capability to launch land-attack missiles to engage targets well inland, the Type 45 design does not. As with the Phalanx system, this deficiency may be addressed in the future, although at the time of writing there are no firm plans to pursue either of two options that could address the issue. The first would be to replace the existing vertical launcher with the longer SYLVER 70 launcher, which is suitable for carrying the naval variant of the SCALP cruise missile; the other would add a Mark 41 vertical launcher abaft the SYLVER 50 for the Tomahawk cruise missile.

A possible explanation for these absent capabilities is that the RN requirement—insofar as it can be discerned using open sources—was for an air-defense vessel only and that the ship's apparent shortcomings (i.e., antisubmarine and antisurface warfare) could be made up by other vessels in a task group. Another is cost—by virtue of their elaborate radar arrays and missile batteries, air-defense ships are typically more expensive to design and build than general-purpose vessels. In addition, there seems to be a great deal of faith placed in "spiral development" and in "fitting for but not with," in which additional equipment is installed later as budgets permit. Indeed, the MoD has indicated on several occasions its intent "to fit a number of equipments incrementally on ships after they have come into service."¹³ In a resource-constrained environment, this seems entirely rational—so long as the overall size of the RN does in fact permit the deployment of additional

units in an accompanying role. However, doubts have emerged in recent years as to whether this will be the case.

KEY QUESTION 1: WHY THE REDUCTION IN NUMBERS?

The first question that has to be addressed is why the original requirement for twelve ships of the *Daring* class changed a decade later to only six. The Type 45 program had been originally presented in the 1998 SDR as necessary for Britain's naval requirements in the first half of the twenty-first century. Fourteen years on, the ship remains an important naval platform, much touted by British politicians as one of the most powerful vessels afloat. However, alongside the cancellation in 2011 of Nimrod and lingering uncertainty about the future of the second *Queen Elizabeth*-class carrier, the reduced number of escorts (including Type 45s) is perhaps the most significant change in the Royal Navy's fortunes. It was always assumed that the entry into service of the *Daring* class would accompany some reduction in destroyers and frigates, but the halving of that particular program has greatly exacerbated the situation. How did that happen? There are, essentially, three reasons: a revised strategic assessment, the availability of new technology, and the high cost of each ship.

Strategic Change

The 2004 defense white paper—*Delivering Security in a Changing World: Future Capabilities*—gave the first indication that the number of Type 45s would be reduced. In contrast to the SDR, the planning assumptions in the new document stated that the United Kingdom would reorder its military posture so as to be able to undertake “the more likely multiple, concurrent, small to medium-scale operations over wider geographical areas” than had previously been the case.¹⁴ It is plausible, albeit uncertain, that this strategic decision was informed by operations in the Balkans, Afghanistan, and Iraq, which had placed heavy demands on Britain's land (versus maritime) defense capabilities.

The focus on small-to-medium-sized contingencies was significant in that it prompted the MoD to observe that frequent operations of that kind possessed certain common characteristics. Among them was the notion that the (re)imposition of stability by a joint force could be followed by the deployment of lighter forces to ensure that gains were not reversed. This, it argued, had “particular implications for the levels of maritime sea control, air and heavier offensive land forces required on an enduring basis.”¹⁵ In essence, this reflected the belief that fewer sophisticated naval vessels would henceforth be required in the expected strategic environment. By way of “proof,” one senior MoD official stated that a reduction in the RN's task list would include “a particular standing NATO task” — a likely reference to the long-established practice of deploying a single ship with

Standing Maritime Group 1 in the eastern Atlantic.¹⁶ Given the subsequent observation that the submarine threat had also diminished in the post-Cold War era, it is evident that policy makers had concluded that a reduction in the surface combatant force from thirty-two to twenty-five major units was justified.¹⁷

It was clear that for the British government maritime ambitions were changing. A reduced conventional threat to the United Kingdom, along with the increased salience of international terrorism and failing states, called for a capable but smaller Royal Navy—a “versatile and expeditionary force with an increasing emphasis on delivering effect *on land*.”¹⁸ This view envisioned the retention of the carrier strike capability (i.e., ships and aircraft), submarines armed with land-attack cruise missiles, and amphibious shipping necessary to deploy Royal Marines. While an air-defense vessel would be an integral part of a surface task force, the stage was clearly being set for a devaluation of the Type 45. Thus it should have come as no surprise that the document confirmed the reduction in the build program from twelve to eight hulls.

Technological Change

The Royal Navy’s intent is to have up to five Type 45s available at any given time for sea duty, albeit at varying levels of readiness. With a reduced buy, such a high level of readiness is extremely ambitious. But by 2009 a departmental consensus had emerged, grounded on a belief that by harnessing technology and optimizing support arrangements, ships can be made so reliable that they will spend 35 percent of their lifespans at sea and be available for sea another 35 percent if required.¹⁹ At the time of writing it is unclear whether these expectations can be met over a protracted period of time.

Another justification for a reduction in numbers was the government’s enthusiasm for Network Enabled Capability (NEC). Described as the coherent integration of sensors, decision makers, and weapons systems in a manner that allows for rapid information sharing, reduced decision-making times, and precise targeting, NEC quickly became a sort of panacea for budget-conscious planners. According to one analysis, “one of the main implications of a network-centric, rather than a platform-centric, focus for force composition is that the ability to respond more quickly and precisely will act as a force multiplier, thereby allowing the Armed Forces to achieve its intended effect through a smaller number of . . . linked assets.”²⁰

For the RN, this would entail participation in the U.S. Navy’s Cooperative Engagement Capability (CEC) program to enable ships to share a “picture” of the surrounding airspace. Instead of handling the entire detection/engagement cycle itself, an RN vessel could receive orders to fire from another ship—either British or allied—before its own sensors detected the threat. In material terms this would

require air-defense ships entering RN service to carry the necessary hardware to collect, process, and distribute information as part of a joint or multinational force. Initial operational capability of CEC on the Type 45 was to be achieved in 2014.

But if the capability of an individual ship was significantly enhanced by CEC, concomitantly fewer ships were required. In July 2004, Admiral Sir Alan West, the First Sea Lord, spelled out the implications of CEC for fleet size: “The potential gains to be realised from . . . network enabled capability, combined with the revised planning assumptions, result in all 3 services requiring fewer units than before. . . . By improving the quality of the networked capability of our major warships we will be able to deliver the desired military effects from a reduced number of platforms.”²¹

In subsequent hearings on the white paper before the House of Commons Defence Committee, Sir Kevin Tebbit, Permanent Under-Secretary at the MoD (1998–2005), provided further confirmation of the salience of NEC in the government’s planning assumptions. Responding to the concerns of members over the shrinkage of the RN, Tebbit testified that NEC “is genuinely networking ships more effectively so they can link together, acquire target effectively, exchange information, and engage targets. With that, again, we are able to cover a wider sea area with fewer ships.”²²

Five years later, following the 2008 defense review that reduced the number of Type 45s to six, and before the lead ship would even enter the water, the government was still putting faith in the ability of yet-to-be-acquired technology to compensate for lower numbers—so much so that the previous commitment to twelve hulls was a far distant memory. In a rather surprising, but nonetheless revealing, admission to the Defence Committee, Guy Lester, director of the MoD’s Capability Resources and Scrutiny, said:

I am trying to remember why the requirement was originally 12. The successive reductions we have had from 12 to eight and then eight to six reflected partly priorities in the program and partly an understanding of the capabilities of the ship, especially when we fit them with Co-operative Engagement Capability, the improved networking compared with what was originally envisaged, but the judgement is that with a fleet of six we can protect a medium-scale operation, which is two task groups, and that is what we need to do.²³

This argument was being maintained long before the installation of the appropriate hardware and software or conduct of a series of at-sea trials to confirm its functionality. In fact, when one member of Parliament expressed a concern that a reduction in the number of hulls was potentially “at the very highest end of risk that can be taken as far as the capability being available in adverse circumstances,”

it was summarily dismissed by the chief operating officer of Defence Equipment and Support (DE&S), the procurement agency of the MoD. “We have taken a carefully calculated risk,” Dr. Andrew Tyler stated, “and believe that we can live with that perfectly.”²⁴

Unfortunately for the RN, the claim made by MoD officials regarding the salience—to say nothing of the efficacy—of NEC was subsequently and decisively undermined by the decision taken in June 2012 to forgo the implementation of a £500 million program to acquire the CEC system. Soon after, in yet another stunning admission, a senior MoD official said, apparently without a trace of embarrassment, that “Cooperative Engagement Capability has not been cut; it was never in the committed core equipment program.”²⁵ That the MoD would abruptly reverse course on the issue despite repeated assurances to Parliament that acquiring CEC justified the reduction in the number of Type 45s is troubling. At the very least, it suggests that the initial commitment to CEC had been essentially virtual (i.e., political). The system would have significantly enhanced the class’s capabilities and value to the Royal Navy, but in fact it seems to have been largely intended to deflect criticism from the government’s decision to truncate an important build program.

Rising Costs per Ship

Both an updated appreciation of the international security situation and claimed capability trade-offs arising from new technology undoubtedly exercised some influence on the government’s decision to reduce the number of Type 45s that were to be acquired. However, it is also very clear that the “spiralling costs of the ship and the pressure on the equipment programme budget” were even more significant.²⁶ Indeed, an all-party investigative report prepared by the Defence Committee went farther, arguing that “the reduction in numbers was in fact primarily down to affordability.”²⁷ The Type 45 program was made more vulnerable to rising costs by the fact that the government was also at the time seeking to cut defense expenditure. In his February 2010 testimony before the Chilcot Inquiry into the Iraq War, Sir Kevin Tebbit stated that the unexpected reduction of a billion pounds from the defense budget in 2003 required the MoD to find savings in areas that did not affect ongoing operations in Afghanistan and Iraq, including in the numbers of destroyers and frigates.²⁸

This was the fiscal context of the announcement that followed in the 2004 white paper that the number of ships was to be reduced from twelve to eight. Annual budgets, however, continued to impact negatively the Type 45 program, for as the decade drew to a close both Parliament and the public became increasingly aware of the huge unfunded shortfall in the defense procurement program—a gap that was largely ignored by the Blair and Brown governments and that was

estimated, at the time the Gray Report was commissioned, to be about thirty-seven billion pounds.²⁹ Therefore, it cannot have come as a surprise to those tracking the Type 45 program that when, in June 2008, the government informed the House of Commons that it was declining the option to acquire hulls seven and eight, the entire armed forces equipment program was also being reviewed in light of new budget constraints.

The issue of rising costs was exacerbated by two additional factors specific to the Type 45 program. The first was that while these ships were designed to be incrementally upgraded, the upgrade program itself was zero-funded. In other words, while government statements highlighted the fact that the Type 45 would, by virtue of its large size and design, be able to incorporate the very latest systems to maintain its usability, there was no room in the existing budget for the acquisition of any such systems. Second, when the development of some of the Type 45's specified equipment and weapons (such as the Sea Viper missile system) fell behind schedule—for which the government had declared responsibility—their unexpected cost increases had to be absorbed by the defense budget. As the time delays often lasted years, inflation and rising labor and material costs accruing to the shipbuilders (BAE Systems and Vosper Thornycroft), for which they claimed compensation, further contributed to overall unit-price escalation.³⁰

Consequently, throughout the decade that the ships were being constructed, the MoD engaged in a series of ad hoc cost/capability trade-offs. For example, just before the government's mid-2008 announcement, additional savings were found by reducing the number of missiles planned for each of the six remaining ships.³¹ It is also more than probable that the June 2012 decision not to purchase the CEC can be explained, in whole or in part, by the system's price tag of forty-five million pounds per ship.³² The reduction in the number of ships can, therefore, be seen as just another cost/capability trade-off (albeit the one with the largest profile), as was implied in testimony before the Public Accounts Committee given by Rear Admiral Paul Lambert, the deputy chief of the Defence Staff for Equipment Capability.³³

KEY QUESTION 2: HOW DID THE BRITISH GOVERNMENT LOSE CONTROL OF THE TYPE 45 PROGRAM?

In 2007, the original build contract for the Type 45s was renegotiated. In testimony before parliamentary committees, MoD officials have pointed to the new partnership with industry that followed the renegotiation as a turning point in the program. Spiraling costs were subsequently brought under control, and there were no longer unexpected delays in construction.³⁴ This turnaround followed recognition in late 2005 by the Blair government—five years after the build contract had been placed—that the program was significantly off course. The

driver for what followed was a growing awareness of (and perhaps the political danger associated with) escalating costs. Consequently, in 2006 the program was placed into what Sir Bill Jeffrey referred to as a “project rehabilitation unit within the Defence Procurement Agency.” The in-depth study that followed apparently yielded the general conclusions that he cited before the House of Commons Public Accounts Committee: “The risks were greater than had previously been acknowledged, [the study] identified the poor relationship with BAE Systems as being at the heart of the problem, and [it] recommended the kind of approach that we then followed through after a lot of detailed discussions with the industry in 2007.”³⁵

The project-management arrangements that had governed the Type 45 program prior to 2007 contributed to serious frictions with industry that had impacted negatively on construction.³⁶ Reflecting on the situation before the contract’s renegotiation, a senior British naval officer stated that there was a need to “get away from the culture of argument” that had characterized government-industry relations in the period prior to the contract being revised.³⁷

The “culture of argument” stemmed, one assumes, from testimony given before parliamentary committees and from the uncertainty surrounding the Type 45 platform at the outset of the program. The complexity of a modern warship requires that propulsion, communications, weapons, and support systems all be integrated. This demands a clear understanding of what types of technology are to be incorporated, when in the build process, and for what purposes. When questions dealing with these issues arise from either industry or government and cannot be met with precise responses, a common understanding of the project is likely to be absent. In such a situation, it is only logical that frictions will develop. In the case of the Type 45 program, that is what apparently happened. In addition to the internal MoD report (to which the authors of this article have not had access), a number of other studies have spotlighted several important problem areas. For example, a DE&S briefing in mid-2011 to a visiting delegation from the Royal Canadian Navy touched on several lessons related to the framing of the project itself, as well as to broader issues related to the government-industry interface.³⁸

Among open-source documents, however, the most detail concerning the Type 45 program appears in a March 2009 report prepared by the British government’s financial watchdog agency, the National Audit Office (NAO). It asserts that “the associated commercial arrangements did not reflect the risks and uncertainty remaining, project control and decision making were poor, governance structures were ineffective, and relationships between the Department and BVT [the industrial consortium building the ships] broke down.”³⁹ It also provides considerable insight into the overall impact of poorly conceived commercial

arrangements and project oversight. Generally speaking, these issues fall into four categories: commercial difficulties, oversight deficiencies, disproportionate distribution of risk associated with the build program, and technology risk.

Commercial Structure Undeveloped at Time of Initial Contract

According to DE&S's own analysis, the build contract for the Type 45s had been placed before a viable commercial structure to support it had been established. The NAO report notes that the government's original intent was to share the design and construction of the first three ships between two of Britain's largest shipbuilding firms, BAE Systems Marine and Vosper Thornycroft. Early efforts to construct a commercial "alliance" between the two firms failed, however, and the MoD was required to assume a larger profile in the design of the ship than had been intended, introducing delays from the outset and eliminating competition in the procurement process.

A RAND Europe study commissioned by the MoD in 2002 opined that the "commercial structure" envisaged for the project was potentially problematic in terms of engineering. A block-building approach, in which different portions of a ship were built at different shipyards, was taken, ostensibly to reduce costs. It also ensured that any economic benefits were spread through an industry already affected by oversupply. However, block-building increased the complexity of the build process, especially as the shipyards involved had not worked together before, and that likely contributed to further construction delays.⁴⁰ Presumably the severity of these engineering concerns was mitigated, although they were probably never eliminated, when "BVT Surface Fleet," a joint venture, was created in 2008.⁴¹

That economic development concerns played a role in the too-hasty placing of the contract, when the design was still admittedly immature, cannot be verified. However, there is no question that block-building of the Type 45s garnered considerable political support in the House of Commons, where individual members eagerly and very publicly endorsed the early announcement of the program in 2000 on the basis of possible benefits for their constituencies.⁴² As in other countries, defense spending for reasons other than capability acquisition is very politically salable in the United Kingdom, where using naval procurement to support the shipbuilding industry and regional economies has never lost its appeal. In early 2012, one of the leaders of UNITE, Britain's largest industrial workers union, urged the government to "bring forward orders for a new generation of frigates" to preserve both the country's ship-making capabilities and an estimated six thousand engineering jobs. Indeed, given that a referendum on Scottish independence is slated for autumn 2014, the involvement of Glasgow yards and the associated economic benefits could also have a national political impact.⁴³

Oversight Deficiencies

The NAO having identified collocation of MoD personnel as part of the solution of the Type 45 program's problems, it seems likely that there was insufficient departmental on-site oversight of the project.⁴⁴ The Public Accounts Committee noted that the MoD's lead personnel assigned to the project did not stay at their jobs long enough to develop a complete understanding of developments;⁴⁵ in fact, the NAO observed that the MoD's project team lacked "suitably qualified staff and relied on consultants." As a consequence, the NAO concluded, the "department relied on BVT to provide data on project progress, costs and risks. BVT continued to be optimistic about project progress and the Department was therefore not well placed to challenge BVT's assumptions." It noted that the MoD did not have a "single high-level overview" of the whole project that would allow in-time assessments of the project's status. Further, the NAO reported that the project management team was unable to communicate problems up the chain within the MoD—suggesting an impervious bureaucratic structure or a senior management overwhelmed by operational requirements.⁴⁶

While the NAO's report does not provide much further detail, its conclusions suggest the existence prior to 2006 of a situation where the government did not have a full appreciation of what was happening during the initial build process. There is evidence that indirectly supports this interpretation and that, further, underscores the inference of a lack of transparency. In testimony to the Public Accounts Committee, the chief operating officer of DE&S observed, in reference to the years since 2007, "we now have an open book environment where we can see the progress the contractor is making. We have full visibility of their schedule, their costs incurred and, indeed, the profit made and we have an incentive scheme that incentivises the contractor to do well."⁴⁷ One can therefore surmise that for the first six years of the project the MoD did *not* have sufficient understanding of the builders' activities or of the costs in time and budgets of changes to an evolving build program. From the industry side, the absence of government oversight in conditions of limited commercial competition meant that there was no imperative to be either timely, efficient, or perhaps even transparent.

Disproportionate Distribution of Risk

The third major explanation for the loss of control of the Type 45 program relates to the government's use of a fixed-price approach that allowed (possibly even encouraged) the builder to submit bills for design changes and delays. According to one DE&S official, "fundamentally what happened was that the price was fixed while the design was still very immature." The usual practice of building the first of a class on a cost-plus basis to fix the price of subsequent ships was not followed.⁴⁸ In other words, the price established by the MoD for the Type 45 program,

though presumably based on expert analysis, was essentially notional and was quickly overwhelmed by contact with the real world of warship construction—particularly because many MoD-initiated design changes followed the signing of the contract.

The government had created a situation—a contract already signed with a private supplier, against an unrealistic program cost—in which design changes would rapidly lead to price inflation. According to the NAO, the government’s emphasis on a fixed-price contract brought many “undefined elements” that allowed industry to claim costs through compensation.⁴⁹ This became especially problematic when, as was shown by the delay in developing Sea Viper, the government became vulnerable to the costs associated with slippages in overall construction. The government might have believed that by fixing the price in the initial contract it had shifted the risk to the supplier, but the reality was exactly the opposite.⁵⁰

The Gray Report identified cost estimation as a problem area, particularly for an organization in which there has been an ingrained tendency to be overoptimistic about cost. The report suggested that “many participants in the procurement system have a vested interest in optimistically mis-estimating the outcome . . . [because] if the ‘true’ cost of acquiring a capability were stated . . . there is a danger that it might be thought too expensive to have at all.”⁵¹ This perversion of the procurement process is particularly likely where governments have track records of not canceling major equipment programs that run over budget but rather of persevering for politico-industrial reasons. As the history of the Type 45 program suggests, underestimating costs at the outset might well be a natural inclination if the armed forces doubt a government’s appetite for large-scale spending on defense over the long term. However, there are consequences: not exposing the government to sticker shock may have significant political and budgetary repercussions later on. It may also erode the leadership’s and the public’s confidence in the defense bureaucracy, as both may feel that the implications of departmental decisions are being concealed. For example, by Sir Kevin Tebbit’s own reckoning, there was recognition among MoD officials (of which he was the most senior) that the 1998 SDR, which had given birth to the Type 45 program, had underfunded the project by up to £500 million.⁵²

Technology Risk

Technology risk is the fourth explanation worth noting. Modern naval platforms necessarily embrace new technologies, and the Type 45 was no exception. According to MoD officials, 80 percent of the equipment on the *Daring* class was new to service. This alone created enormous difficulties, as the systems the technology represented had to be integrated. Indeed, that task could not have been

accomplished without the creation of the Maritime Integration and Support Centre (MISC) at Portsdown Hill, which BAE Systems developed and constructed. However, the MISC was not operational until 2005, and as late as mid-2011, when HMS *Daring* was already in service with the RN, minor systems-integration issues were still being addressed.

However, technology risk was increased by the MoD's insistence on state of the art with its relative disregard of likely costs or realistic timescales for its development. Nowhere is this more evident than in the Type 45's principal air-defense system. Britain's exit from the trilateral Horizon program in 1999 stemmed in part from differences in requirements between the partner navies, with the Royal Navy looking for a more capable system. The Sea Viper missile system mounted on the Type 45 (which benefited from the research and development work done on the trilateral PAAMS) is more advanced and is touted as highly capable, but it has suffered from cost escalation and delay. This in turn enabled the prime contractor to claim compensation when the system was not delivered to it on time. The RN was put in the uncomfortable position of sending HMS *Daring* for sea trials in late 2009 without the ability to fire a missile—an outcome the House of Commons Public Accounts Committee called “a disgrace.”⁵³ A successful test firing from HMS *Dauntless* finally took place in September 2010. Still, the fact that by that time several captains and crews had served in the lead ship essentially unarmed illustrates the risks of striving for ultra-high-end technology solutions in a cost-constrained environment.

FAULTY EXPECTATIONS, DISPROPORTIONATE FAITH

The National Audit Office observed in its report that “the actual cost of the Type 45 destroyer, excluding development costs, is broadly in line with what could be expected for similar types of destroyer.”⁵⁴ Although the development costs per ship would have been significantly less had the build program been larger, the NAO's conclusion points to an important factor in any discussion of the Type 45—that the government lost control of a program in part because it had not presented (or perhaps did not even have) a realistic estimate at the outset of what an advanced warship of this sort would cost. The problem-filled management of the program in its first years was the product, it would appear, of faulty expectations about cost and timing. Given that such issues were to some degree the result of the MoD's lack of clarity as to what it wanted from the Type 45 (this being due in part to the changing strategic environment), it is far from certain that greater expertise within the project team would have solved the problem. What is certain, as DE&S acknowledges, is that a more effective project-management structure, necessarily involving industry and qualified government representatives at all levels, would have more rapidly and jointly identified the problems.⁵⁵

In the years since the initial contract was revised, the Type 45 program has seen no significant cost overruns and has been on schedule. There have been a number of technical problems associated with this class, but they have been quickly rectified, testifying to the positive relationship that industry and government have now created. Both MoD officials and the NAO credit the use of an incentive scheme, whereby greater industry efficiencies are rewarded, and a long-term maintenance arrangement as important factors in explaining this success. Also, clearly, many of the problems experienced in the Type 45 build are being taken account of as the Royal Navy moves toward the Global Combat Ship (Type 26 frigate) program.

The Type 45 program, which began with an initial requirement for twelve ships only to end up fourteen years later with six, was made vulnerable to truncation by a combination of factors: evolving perceptions of the strategic environment, disproportionate faith in technologies that planners were convinced would act as force multipliers, and, above all, faulty project management. The less-than-satisfactory outcome should give pause to decision makers elsewhere seeking to recapitalize their own fleets. If the above-mentioned problems befell a country with a long history of building sophisticated naval vessels, those with less experience and less money to correct programmatic errors may also see their naval construction projects and maritime security goals come to grief.

NOTES

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2. United Kingdom, Secretary of State for Defence, *Delivering Security in a Changing World: Future Capabilities* (London: HMSO, July 2004), p. 7.
3. UK Parliament, House of Commons, *Hansard*, 22 January 2007, col. 1125.
4. UK Parliament, House of Commons Defence Committee, *Defence Equipment 2010* (London: HMSO, March 2010), p. 27.
5. *Review of Acquisition for the Secretary of State for Defence: An Independent Report by Bernard Gray* (October 2009), pp. 20–21, available at www.bipsolutions.com/.
6. UK Parliament, House of Commons Public Accounts Committee, *Ministry of Defence: Type 45 Destroyer* (London: HMSO, June 2009), Q-1.
7. *Ibid.*, Q-78.
8. United Kingdom, National Audit Office, *Performance of the Ministry of Defence, 2008–09* (London: HMSO, 2009), p. 39.
9. United Kingdom, Ministry of Defence *Transformation Newsletter*, no. 3 (February 2012), p. 2.
10. *Jane's Fighting Ships, 2011–12*, p. 880.
11. Eric Wertheim, *The Naval Institute Guide to Combat Fleets of the World*, 15th ed. (Annapolis, Md.: Naval Institute Press, 2007), p. 844.
12. Public Accounts Committee, *Type 45 Destroyer*, p. 9.
13. See, for example, Defence Committee, *Defence Equipment 2010*, p. 28.
14. Secretary of State for Defence, *Delivering Security in a Changing World*, p. 3.
15. *Ibid.*
16. UK Parliament, House of Commons Defence Committee, *Future Capabilities*, vol. 2, *Oral*

- and *Written Evidence* (London: HMSO, 17 March 2005), Q-73.
17. Secretary of State for Defence, *Delivering Security in a Changing World*, p. 7.
 18. *Ibid.* [emphasis added].
 19. United Kingdom, National Audit Office, *Ministry of Defence; Providing Anti-Air Warfare Capability—The Type-45 Destroyer* (HMSO: London, March 2009), p. 15.
 20. Claire Taylor, *The Defence White Paper: Future Capabilities*, House of Commons Library Research Paper 04/72 (London: 17 September 2004), pp. 10–11.
 21. *Ibid.*, p. 17.
 22. Defence Committee, *Oral and Written Evidence*, Q-73.
 23. Defence Committee, *Defence Equipment 2010*, Q-207.
 24. *Ibid.*, Q-216.
 25. “Royal Navy: CEC a ‘Lesser Priority,’” DefenceManagement.com, 11 June 2012.
 26. Richard Norton-Taylor, “Ministers Face Tough Choices on Weapons Cuts,” *Guardian*, 1 February 2008.
 27. Defence Committee, *Defence Equipment 2010*, p. 28.
 28. See testimony of Sir Kevin Tebbit, 3 February 2010, before the Iraq Inquiry, p. 10, available at www.iraqinquiry.org.uk/.
 29. Matthew Bell, “UK Report Slams MoD Procurement,” *Jane’s Defence Weekly*, 10 March 2010. See Defence Committee, *Defence Equipment 2010*, “Memorandum from the Ministry of Defence,” Ev. 99.
 30. UK Parliament, House of Commons Defence Committee, *Defence Equipment 2008* (London: HMSO, March 2008), Q-127.
 31. *Ibid.*, “Memorandum from the Ministry of Defence.”
 32. See Thomas Harding, “Cutting Missile System Leaves Warships at Risk,” *Daily Telegraph*, 9 June 2012.
 33. Public Accounts Committee, *Type 45 Destroyer*, Q-92.
 34. National Audit Office, *Type-45 Destroyer*, p. 4.
 35. Public Accounts Committee, *Type 45 Destroyer*, Q-17.
 36. National Audit Office, *Type-45 Destroyer*, p. 6.
 37. Telephone conversation with author (Lombardi), 16 July 2012.
 38. Capt. S. Braham, RN, “Delivering Type 45” (presentation, Defence Equipment and Support [DE&S], n.d.).
 39. National Audit Office, *Type-45 Destroyer*, p. 6.
 40. These concerns are identified in John Birkler et al., *The Royal Navy’s New Type 45 Destroyer: Acquisition Options and Implications* (Santa Monica, Calif.: RAND Europe, 2002), pp. 105–106.
 41. It is not clear whether the BVT joint venture was created as a direct or indirect consequence of the renegotiation of the contract in 2007. However, testimony by a senior MoD official before the Commons Defence Committee suggests that the government did play some role. See Defence Committee, *Defence Equipment 2008*, Q-131.
 42. See UK Parliament, House of Commons, *Hansard*, 11 July 2000, cols. 701–12.
 43. Christopher Jasper, “BAE Naval Shipyards at Risk as U.K. Urged to Speed Frigate Order,” *Bloomberg News*, 30 January 2012.
 44. National Audit Office, *Type-45 Destroyer*, p. 21.
 45. Public Accounts Committee, *Type 45 Destroyer*, p. 12.
 46. National Audit Office, *Type-45 Destroyer*, p. 20.
 47. Public Accounts Committee, *Type 45 Destroyer*, Q-98, Q-99.
 48. *Ibid.*, Q-85.
 49. National Audit Office, *Type-45 Destroyer*, p. 19.
 50. Sir Bill Jeffrey makes this argument in UK Parliament, House of Commons Public Accounts Committee, *Ministry of Defence: Major Projects Report 2009* (London: HMSO, 23 March 2008), Q-117.
 51. *Review of Acquisition for the Secretary of State for Defence*, pp. 19, 29.
 52. For the comment on the SDR, Tebbit, testimony, 3 February 2010, p. 3. See also his testimony of 3 December 2009, p. 44.
 53. Public Accounts Committee, *Type 45 Destroyer*, para. 12.
 54. National Audit Office, *Type-45 Destroyer*, p. 19.
 55. Braham, “Delivering Type 45”