Ministry of Defence

The construction of nuclear submarine facilities at Devonport

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
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executive summary

1 In 1997 the Ministry of Defence (the Department) contracted Devonport Management Limited (now known as DML) to design and build new and upgraded facilities for the refitting and refuelling of the Royal Navy's submarines, including the Vanguard class submarines which provide the United Kingdom's nuclear deterrent.[1] The main elements of the project are expected to be completed in 2004, with a key milestone being the need to have HMS Vanguard in dry dock by February 2002. Design work for the last part of the project is ongoing and so final completion remains uncertain. In 1997 the Department obtained Treasury approval for funding of £650 million and estimated that the project's most likely costs would be £576 million.[2]

2 This report sets out how the project is progressing. It follows up our 1998 report on the Sales of the Royal Dockyards, which included coverage of the original contract for the submarine facilities, and the related 1999 report from the Committee of Public Accounts (Appendix 1).[3] The Committee expressed its concerns over the possibility of cost increases during construction, and noted that, because there were limits to DML's liabilities under the contract, there was a risk that the Department would have to bear the costs of completing the facilities. The methodology we adopted is set out in Appendix 2. The report does not address the extent to which the regulatory application of nuclear safety standards increased the technical challenges on the project and was reasonable, and does not conclude on the extent to which DML's solutions to those challenges were the most economical.

3 The report shows that the project has proved to be exceptionally complex, involving a number of technically challenging components whilst needing to meet exacting nuclear safety standards. Delays in design and construction work occurred, and concerted action was required to recover these. Thus it was a major achievement that key facilities were ready for HMS Vanguard to enter the dock on time whilst the planned refits of submarines and surface ships for the Royal Navy continued in neighbouring docks. But speeding up work and resolving other design, safety, and construction aspects has resulted in significant cost increases. Total project costs are estimated to be £933 million. The Department agreed to fund most of the cost increases, and will consequently pay £849 million at 2001-02 prices, £199 million (31 per cent) more than the budget of £650 million originally approved by the Treasury. There is little scope for delaying future submarine refits so facilities have to be available on time but completion of remaining facilities remains very tight. Lessons for future projects have been identified by the Department and in this report.

1 *The Royal Navy has four Vanguard class submarines which provide the United Kingdom's nuclear deterrent through the Trident missile system. There are currently 12 Swiftsure and Trafalgar class attack submarines, reducing to 10 in 2006, which will be replaced progressively by the Astute class. The attack submarines provide a capability against surface ships and other submarines, and some are being fitted with Tomahawk cruise missiles for land attack. The Vanguard and attack submarines are all nuclear powered, requiring special facilities for refitting and nuclear fuel handling.*

2 *All figures at 2001-02 prices and inclusive of VAT.*

3 *'Ministry of Defence: Sales of the Royal Dockyards' (HC748 1997-98) and Committee of Public Accounts 8th Report 'Ministry of Defence: Sales of the Royal Dockyards' (HC96 1998-99).*

Key facilities have been ready on time to support the submarine refit programme

4 The project has proved to be exceptionally complex, involving a series of major upgrades to docks together with the development of nuclear fuel handling facilities. All project components must meet exacting modern standards in line with the 1992 safety assessment principles issued by the Health and Safety Executive's nuclear regulator, the Nuclear Installations Inspectorate, and the requirements of the Department's own regulator for its nuclear submarines, the Chairman of the Naval Nuclear Regulatory Panel. As this is the first time the civil and internal regulators have been intimately involved in a defence project of this scale where the Department did not own the site, the project has been a learning experience for all. It has highlighted the difficulties faced in attempting to specify at the outset of a contract with any measure of certainty a scope of work that is subject to subsequent nuclear regulation.

5 In addition the project has been undertaken in a confined working dockyard. Throughout the project DML has operated the dockyard, which it purchased in 1997, undertaking planned refits of submarines and surface ships for the Royal Navy, and its other commercial work. The Department has also continued to operate the adjoining Devonport Naval Base, providing operational support to the Royal Navy.

6 The project incorporates critical milestones. To ensure the effectiveness of the United Kingdom's nuclear deterrent, facilities had to be available for the refitting of the first Vanguard submarine. HMS Vanguard's successful entry into dock in February 2002 was a major achievement and to date facilities have been made available to support the refitting programme. However, successful achievement required the Department to fund the recovery of delays of 23 weeks, which had arisen, in part, from the Department's own delays in supplying data essential for DML's design work and preparation of safety cases. Some facilities were not ready by the due date. Although these were on the critical path, their late completion has not yet affected the completion date of HMS Vanguard's refit as the Department and DML have been able to reschedule the refit activities. Upgrades of other docks have been completed to support the refits of attack submarines. However, there is little slack in the refit programme and completion of all outstanding facilities remains very tight.

There have been significant cost increases but quantification of the reasons for the cost increases has proved difficult

7 Under the original contract, costs were handled in two ways, with cost increases being shared between the Department and DML depending on their cause:

- The Department was responsible for those aspects it directly managed, for example funding its own nuclear advisers and providing information on reactor design to DML. At the time the contract was placed, the Department estimated its costs to be £145 million, including its contingencies for cost increases in the contract.

- The Department would reimburse any legitimate costs incurred by DML as prime contractor for the project's design and build, up to a target level, together with a fee (profit). This target level and fee amounted to £431 million. Should DML's costs exceed the target, then the Department would reimburse the costs up to a maximum price of £505 million but DML's fee would fall and would be zero at the maximum price. Beyond the maximum all costs had to be met by DML without reimbursement. Both the target and maximum could, however, be increased if cost increases resulted from elements that were the Department's responsibility, for example if the Department were to change its requirements.

8 In 1997 the Department therefore estimated total project costs of £576 million based on the target contract cost, potentially rising to £650 million at the maximum price. The Department was confident that costs would be contained within the £576 million target but to be prudent sought Treasury approval for the project at £650 million. The latest forecast is that project costs are likely to be £933 million. As the main elements of the project are expected to be completed in 2004 and design work continues on the last part of the project, the final outturn costs remain uncertain.

9 The Department and DML have different views as to the reasons for cost increases. The Department considers that the main reasons for the increases are poor performance by DML and its subcontractors and the impact of nuclear regulation **(Figure 1)**. The Department itself was responsible for the late delivery of information which was critical for the design of the new facilities. The need to fund the extra design costs incurred as a result by DML, and the recovery of this delay, contributed in large part to £38 million additional costs.

10 Costs may also have been affected by a possible fraud by one of the many sub-contractors not contracted directly to DML. The Department's fraud unit and police are presently investigating.

1 Cost increases on the project

The Department has identified broad cost estimates for the reasons for the increase in the project's costs.

	£ million
Total project budget (at March 1997)	**650**
Higher construction sub-contracts and staff costs	107
Additional work to meet the requirements of the nuclear regulators	106 [1]
DML and its sub-contractors project management difficulties	86 [2]
Late delivery of information by the Department and acceleration work needed to recover delay caused in part by this	38
Increase in other Department costs	28
Department changes	6
Reduction in Department's contingencies	(88)
Forecast outturn (August 2002)	**933**

NOTES

1. The Department's estimate of the cost impact of the regulation problems is a balancing figure with a range of between £82 million and £106 million.
2. The Department estimated that poor performance by DML and its subcontractors accounted for between £86 million and £110 million of the total cost increase.

Source: The Department

11 The Department's analysis of the reasons for cost increases has been constrained for a number of reasons. The Department's contract strategy was for DML to manage the project as the design and build prime contractor in accordance with the incentivised pricing arrangements. The Department monitored historic spend and forecasts for project completion but DML had difficulties in forecasting project costs. The evolving approach to nuclear regulation, together with weaknesses in the performance of DML and its subcontractors, contributed to these difficulties. When it became clear that there were significant cost increases that would breach the maximum price, the Department and DML undertook a number of joint forecasting exercises. Between February and December 2000, forecasts increased by £145 million, some 25 per cent.

12 DML disagrees that poor performance by itself or its sub-contractors was a major cause of the cost increases as it estimates that such poor performance only increased costs by £20 million. In its opinion the cost increases have been driven by the need to meet nuclear regulatory requirements, and the work required being substantially greater than previously experienced. DML had to undertake a large amount of expensive redesign and reworking in response to concerns raised by the Nuclear Installations Inspectorate. DML told us that, in responding to these concerns, it may have implemented higher cost design and construction solutions than it would otherwise have. There was insufficient time to cost all options and thus identify the most cost effective and elegant technical solution, and attempts to prove the original safety case without amending it in response to the regulators' queries would have taken significantly more time and added risk to the project and the submarine refit programme. DML had assumed that the Inspectorate would not be closely involved in the detailed regulation of the facilities, in line with experience on other projects. However, in DML's opinion the 1996 Ministry of Defence/Health and Safety Executive Agreement, which governed the relationship between the Inspectorate and the Department's own nuclear regulator, the Chairman of the Naval Nuclear Regulatory Panel, resulted in a sea-change in nuclear regulation and established the Inspectorate as the primary regulator. As there was some uncertainty in 1997 over how this Agreement would operate in detail, DML and the Department had negotiated a pricing exclusion in respect of its operation. DML considered that, because of this pricing exclusion, the additional costs from the redesign and reworking were the Department's responsibility.

13 The Department does not share this view. It considers that the 1996 Agreement formalised the existing regulatory arrangements whereby the Nuclear Installations Inspectorate was already the prime regulator. The benchmark for the Inspectorate's approach to regulation had been set in the 1980s and its Safety Assessment Principles had not changed since 1992. It was therefore clear to the Department that the nuclear safety requirements on this project would, from the outset, be stringent. The Department considers that DML was slow in putting in place the management processes needed to demonstrate its compliance with these Principles and in producing good quality safety cases for the Inspectorate, resulting in less time for the consideration and resolution of issues raised.

14 We have not assessed the extent to which the regulatory cost increases could be attributed to the main parties or were reasonable. However, in our opinion, all the main parties have contributed to the regulatory problems, and thus to much of the total cost increase, encountered on this project. The practical implications, technical challenges, and subsequent cost effects of how the nuclear regulation regime would impact on this project were not fully appreciated by any party. This project was the first occasion where the regulation of such a project had been undertaken under a civil licensee/prime contractor arrangement. The imperative to meet milestones to support the submarine refit programme also contributed to cost increases and the facilities' design evolved to take account of the regulators' observations, requiring additional design and construction work.

Renegotiating the contract was the best option although the Department had to meet most of the cost increases

15 There have been significant cost increases but the Department and DML disagreed about who was responsible for funding these increases. A number of factors pointed to the Department having to fund these cost increases and the Department concluded that renegotiating the contract was the best option.

16 Under the contract DML was to bear the risk of meeting additional costs over and above the maximum price. There were, however, a number of factors that increased the risk that the Department would have to pick up the bulk of any substantial cost increases instead:

- The Devonport facilities, owned by DML, are unique and the Department had nowhere else to go. If DML were not able to continue with the project, there would be insufficient time for the Department to find an alternative contractor to complete the facilities. Similarly, seeking a contractual remedy was not open to the Department if the legal process were to result in a delay to the facilities.
- DML negotiated a £35 million maximum liability in the event of its breaching the contract, and a maximum of £10 million liquidated damages in the event of delayed completion of the facilities. These limits capped DML's exposure and limited risk transfer.
- Very substantial cost increases might have been too much for DML to bear. It had available to fund such increases its net assets, valued at £60 million in June 2002, and a parent company guarantee of £35 million from its major shareholder. As a rule of thumb the Department would tend to limit the value of contracts to one third of the company's net assets.

17 There were factors that pointed to a risk that substantial cost increases might arise:

- The Department had concerns about DML's ability to manage the project. Initially DML had no experience of managing a major construction project that was subject to civil nuclear safety standards. Before placing the original contract with DML, the Department undertook three evaluations of the company and the final evaluation called for DML to put in place a number of actions. While the Department was sufficiently satisfied with DML's progress that it entered into the Prime Contract with DML, the existence of these concerns highlighted a need for subsequent close monitoring by the Department of DML's performance as Prime Contractor.
- Projects for the construction of nuclear-related facilities had a history of cost increases, and, although lessons from previous projects had been learned, the fact that this was the first new construction project that would also be subject to civil safety standards added uncertainty.

18 In practice, significant cost increases did arise. DML sought to recover these costs and lodged a series of claims against the Department:

- The Department shared design risk with DML as it was responsible for providing DML with information on the design of the nuclear reactor decontamination system. The information was late and the Department agreed to fund the additional time-related costs (paragraph 9).
- The prices of construction subcontracts, when let by DML, were much higher than DML had allowed for. DML considered that the additional costs, amounting to over £100 million and, in its view, mostly driven by nuclear safety requirements, were the Department's responsibility. The Department disputed this but the contract provisions were unclear.

- DML contended that, where it had substituted different design solutions, the resulting costs of over £100 million should be borne by the Department. Again the Department disputed this and the contract was unclear.
- While DML was responsible for obtaining approval from the nuclear regulators, the Department retained the financial risk of changes in the regulatory regime. The parties disagreed on the amount of extra costs arising from such changes.

19 The Department looked at a number of options but, in view of the factors set out at paragraph 16, had little choice but to renegotiate the contract. Under the re-negotiated contract, the Department will meet the majority of the estimated £933 million project costs. Its total payments for the project will amount to £849 million at 2001-02 prices; £812 million during construction and £37 million over 20 years **(Figure 2)**. This represents an increase of £273 million (47 per cent) over the target level of £576 million and £199 million (31 per cent) over the maximum price of £650 million (paragraph 8).

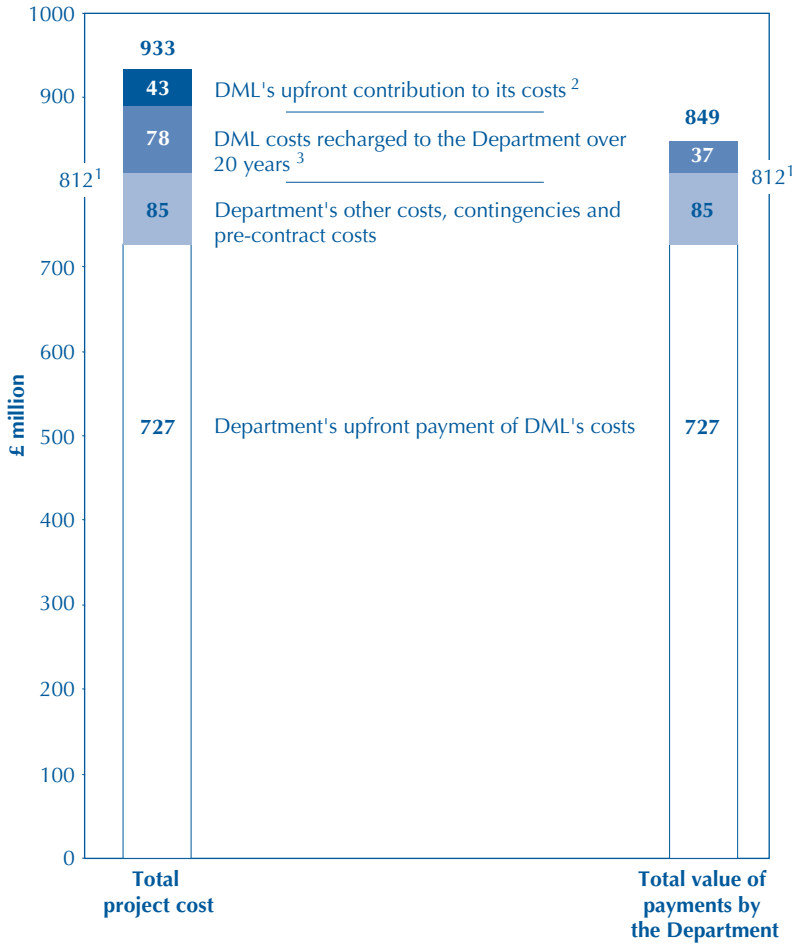
20 Under the new agreement DML will fund £43 million itself (Figure 2). In addition, DML will not receive any profit; in the original contract at the target cost DML would have received profit of £30 million. As the Department assessed that poor contractor performance accounted for £86 million to £110 million (Figure 1), this means that, based on its own estimates, the Department has partly funded poor contractor performance and met the cost of all the other risks that it considered that it had originally transferred to DML. However, DML's own contribution of £43 million is greater than its maximum liability under the original contract and more than twice its own estimate of the extra costs of its poor performance (paragraph 12).

21 Currently £78 million will be funded by DML and capitalised, and then recovered over the next 20 years from the Department (Figure 2). At the time of the new agreement, the Department had a low expectation of the need for such capitalisation and there is no limit on the extent to which DML's costs can be capitalised, in line with the 1997 sale agreement. DML's capitalised costs are not included in the project's budget of £812 million and there is therefore potential for reduced visibility of the total project cost when reporting this to Treasury or Parliament.

22 The principal lessons from the project arise from the fact that the Department found that the cost increases were too large to be handled within the framework of the original contract. The Department was therefore responsible for risks it thought it had transferred to the private sector but on which the contract subsequently proved to be insufficiently clear. The Department had not, however, factored this eventuality into its risk management arrangements. The Department was exposed to this eventuality to an unusual degree on this project, and there was a case for its adopting a more 'hands-on' approach from the beginning, particularly in addressing how nuclear safety standards should be met. Because the Department considered that it had transferred the risk to DML, as prime contractor, and this aligned with DML being the licensee of this site, the initial interaction on regulatory issues was between DML and the Nuclear Installations Inspectorate. The Department's early attempts at a working level to engage directly with the Nuclear Installations Inspectorate were unsuccessful. By 1999 all parties realised that there was need for a change. The situation is now much improved with a close liaison being maintained between all parties. The Department now takes an active part in discussions with the nuclear regulators on the design of the final element of the project and is ensuring the design is complete before construction commences.

2 The project's estimated total cost and its financing

The Department will meet the great majority of the estimated total project cost of £933 million.



NOTES

1. The Department will pay upfront £812 million of the first £855 million expenditure incurred.

2. DML will pay upfront £43 million of the first £855 million expenditure incurred.

3. Costs above £855 million, currently estimated at £78 million, are to be met by DML in the first instance. DML will then capitalise these excess costs in accordance with the 1997 agreement for the sale of the dockyard, and recover these from the Department over 20 years as part of its charges for submarine refit work. Allowing for an assumed annual inflation rate of 2.5 per cent and using a real discount rate of 6 per cent, the payment by the Department of £78 million over 20 years is equivalent to £37 million at 2001-02 prices.

Source: National Audit Office

Recommendations

23 From our examination of the Devonport submarine facilities project, there are a number of general lessons:

a) Departments should consider the adoption of a partnering approach when planning a project.[4] With its promotion of co-operative working between the contracting parties, such an approach is likely to be of particular benefit on projects like this where there is a significant risk that the contractor will be unable to deliver, where the contract has an immovable delivery date, or where any failure by the contractor will have a significant impact on a department's operations.

b) When planning a project departments should aim to allocate risks to the party best able to manage these. They should develop a joint understanding with their contractor as to the allocation of these risks. Maintaining a joint risk register should help in working towards such an understanding. Departments should then ensure that the contract clearly sets out the risk allocation.

c) Where departments consider that there is a significant risk that a contractor might be unable to meet its contractual obligations, they should make adequate provision for this risk in their budgets and include some consideration of contract failure in their contingency plans. They should also take a more 'hands-on' approach to the management of the project.

d) Departments should identify key external stakeholders, such as regulators, who could have a significant impact on a project. Departments should take steps to ensure that all parties understand each other's requirements and agree at an early stage those factors which are likely to be crucial to a project's success.

e) On technically complex projects where there is a risk that the costs of design failure will effectively fall on a department, departments need to have confidence that the design is sufficiently robust before proceeding to construction. They need therefore to monitor closely the adequacy of the design solution produced. Where time permits a two stage prime contract may help, whereby the project does not progress to the construction stage until the design and any necessary safety cases are sufficiently mature. Whichever contract strategy is preferred, a department should ensure that its monitoring of the design and safety case work does not result in it unwittingly accepting back risks which were originally transferred to the contractor.

f) Departments should recognise the potential difficulties involved in capitalising overspends on capital projects. They should seek to place limits on capitalisation and ensure they maintain visibility of project costs.

4 *Guidance on the principles to be applied when implementing a partnering approach are contained in the Office of Government Commerce's "Best Practice: Managing Partnering Relationships".*

24 The Department should ensure that it applies the lessons from this project on its other prime contracts. More specifically, on its other nuclear infrastructure projects it should seek to liase closely at a senior level with the regulators and the site licensee to establish a common strategy for handling the requirements of the regulatory regime. This will help to ensure a joint recognition of what constitutes an acceptable safety case, and of the implications of the 1996 Ministry of Defence/Health and Safety Executive Agreement. The Department should then replicate the approach it has now adopted on this project and achieve effective working between all parties.

25 Construction projects in central government, but not in defence, are now subject to the Gateway Review Process. Under this process an independent team of experienced people, appointed by the Office of Government Commerce, carries out a series of reviews during the project at key stages. There is no guarantee that, if the Gateway Review Process had been applied to the Devonport project, cost overruns would have been avoided. However, experience to date has shown that Gateway Reviews have benefited the projects involved. The Department considers that its procurement processes are broadly similar to the Gateway Review Process in intent and scope as they involve rigorous scrutiny of a project by Department teams external to that project. However, the Defence Procurement Agency is currently piloting the use of the Office of Government Commerce to conduct Gateway Reviews on ten equipment acquisition projects. Defence Estates has also now modelled its own reviews of its construction projects more closely on Gateway Reviews. We welcome these developments and recommend that the Department should consider, in light of its experiences on these trials of the Gateway Process, extending the principles of reviews by experts external to the Department more generally to all its new major construction projects in future.