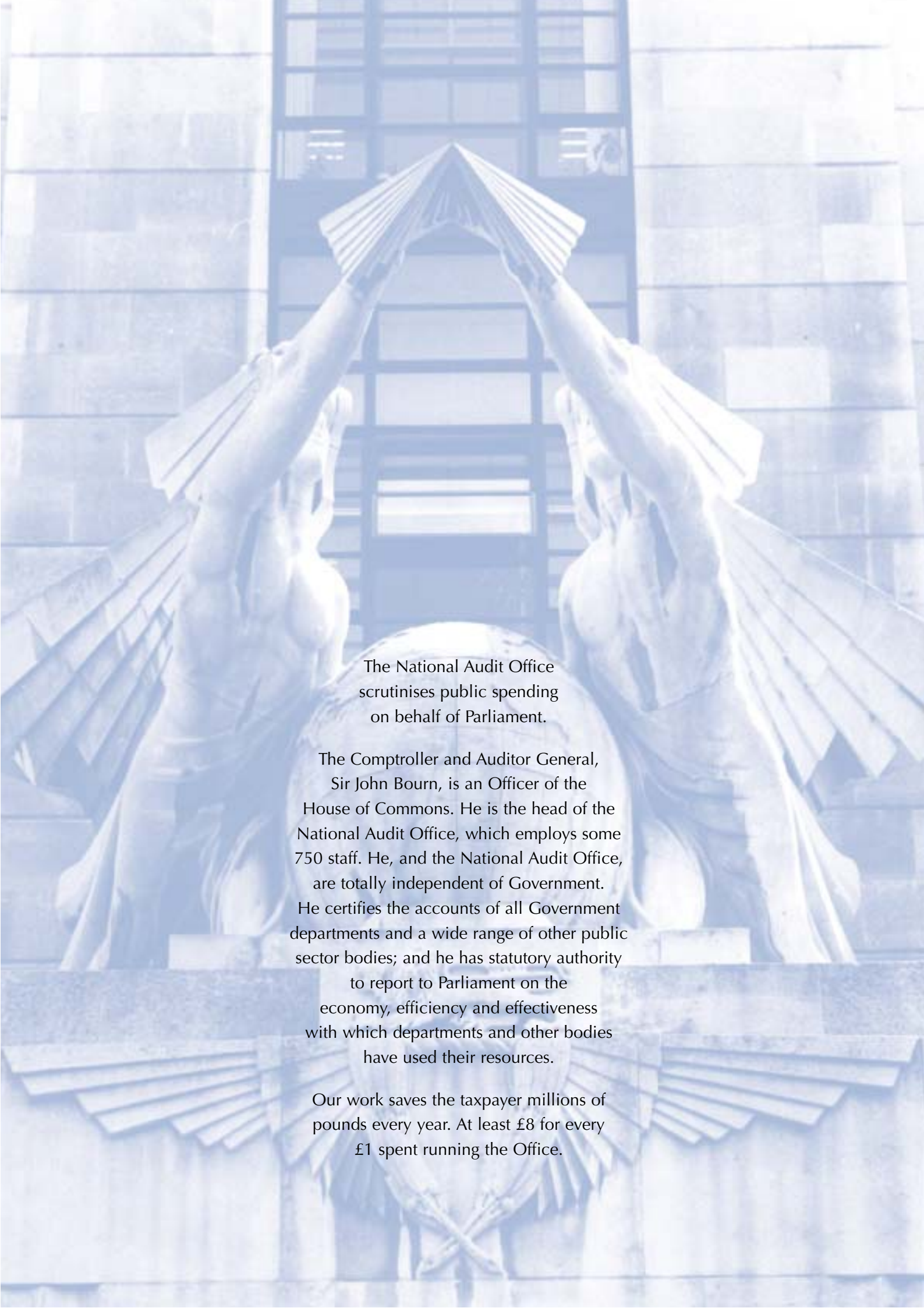


Ministry of Defence
**The construction of nuclear
submarine facilities at Devonport**

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
HC 90 Session 2002-2003: 6 December 2002





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This report has been prepared under Section 6 of the National Audit Act 1983 for presentation to the House of Commons in accordance with Section 9 of the Act.

John Bourn National Audit Office
Comptroller and Auditor General 29 November 2002

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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.

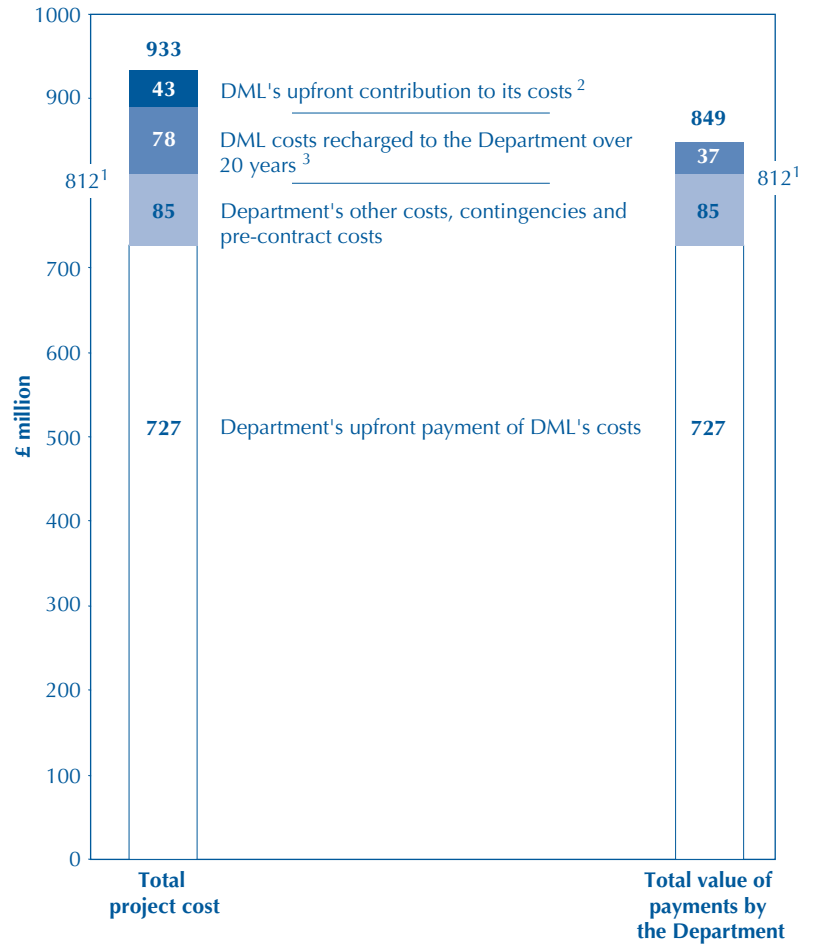
- DML contended that, where it had substituted different design solutions, the resulting costs of over £100 million should be borne by the Department. Again the Department disputed this and the contract was unclear.
 - While DML was responsible for obtaining approval from the nuclear regulators, the 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 renegotiated 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 liaise 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.





Part 1

Key facilities were ready for the submarine refit programme but completion of others is very tight

- 1.1 The Department required new and upgraded facilities at Devonport for the refitting and refuelling of its nuclear-powered submarines. As part of the sale of Devonport dockyard in 1997 the Department agreed to fund the provision of these facilities which, when completed, would then be owned and operated by the new dockyard owners, DML. The provision of these facilities by the Department, together with the guaranteed submarine refitting workstream, underpinned DML's business case for its purchase of the dockyard.
- 1.2 To ensure the delivery of these facilities, at the same time as the sale of the dockyard and after four years of negotiation, the Department entered into a Prime Contract with DML for the design, construction, commissioning and licensing of the facilities in accordance with nuclear safety requirements. For its part, to ensure the project's successful delivery, DML adopted partnering arrangements⁵ with its key sub-contractors (Figure 3). The Department was not part of these arrangements and kept its relationship with DML on a more traditional, contract-orientated basis.
- 1.3 The construction of the new facilities was covered in our 1998 report. This found that there had been delays and cost increases on the project. However, on the award of the contract the Department considered that it had teased out the cost increases before construction began, and was confident that the project would be delivered within the target cost. In 1999 the Committee of Public Accounts expressed its concerns over the previous delays and cost increases. It noted that the Department's latest estimate of the most likely contract cost was less than the maximum contract cost, and that the Department would have to bear the costs of completing the facilities in the event of DML breaching this contract.⁶
- 1.4 This Part of the report considers the Department's progress in delivering the facilities to the required timetable. On this time-critical project key facilities were completed on time, thereby allowing the

programme of submarine refit work to be maintained, after delays on their construction were recovered. The timetable for the completion of other facilities remains very tight.

The project is complex and time critical

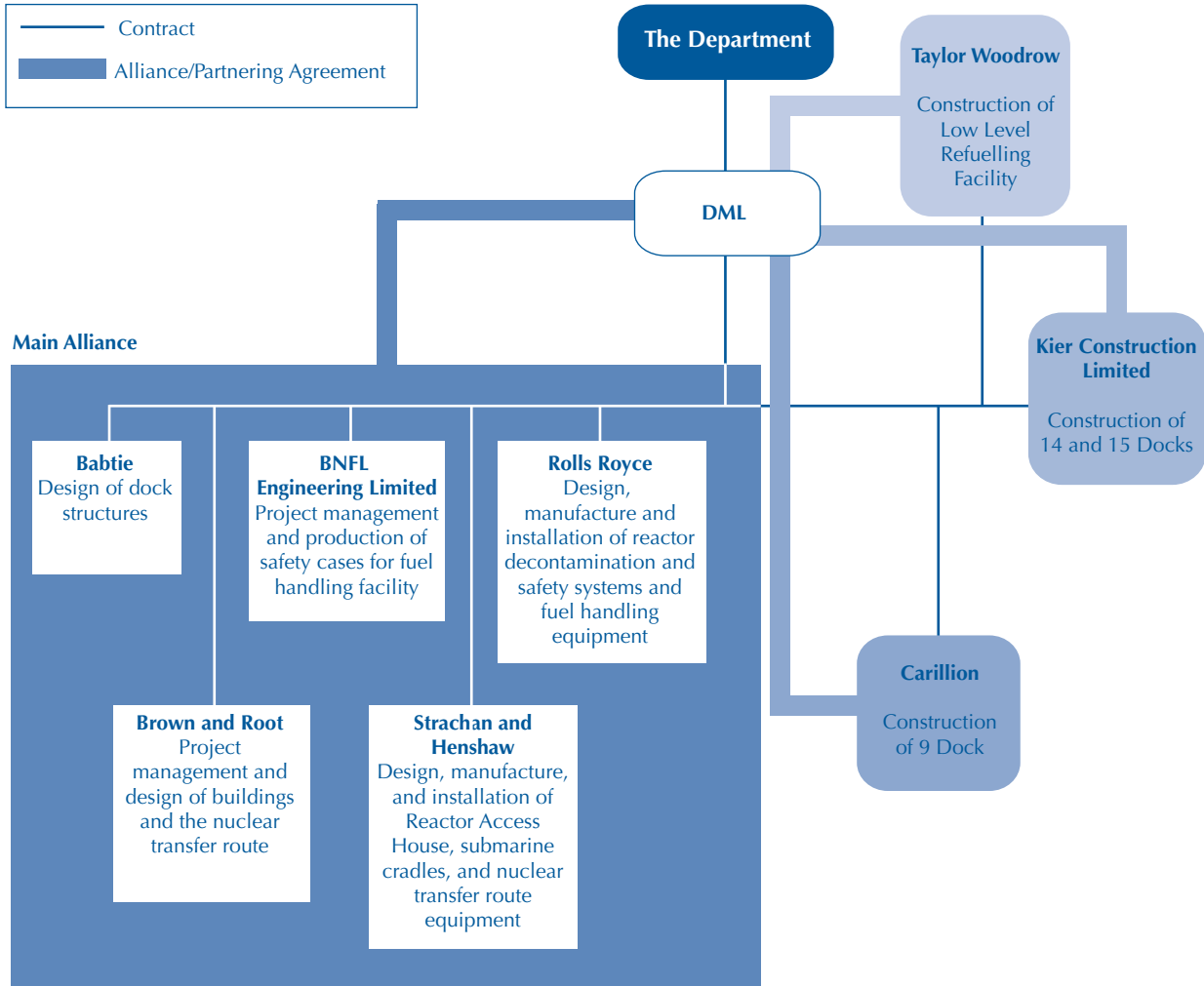
- 1.5 The project effectively consists of a series of individual projects which are of a significant size in their own right, all with their own challenges. It involves the construction of new facilities for the Royal Navy's Vanguard submarines at 9 Dock, the significant upgrade of the facilities for the Royal Navy's attack submarines at 14 and 15 Docks, and the provision of common facilities supporting the refitting of both the Vanguard and attack submarines (Figure 4 throughout overleaf). The project is probably the largest nuclear construction project in Europe in recent times. Over 100 separate contractors have undertaken work on the project and, at the peak of construction, almost 2,700 personnel were on site. At one point the project was taking more than the United Kingdom's annual production of the largest type of concrete-reinforcing steel bars.
- 1.6 Construction has taken place in a working dockyard and naval base. The new Vanguard facilities have been constructed at the same time as DML has been undertaking major refits of surface ships and dockings of nuclear-powered submarines in adjacent docks. DML has also had to schedule its upgrade of the facilities for attack submarines around its continued use of these facilities for submarine refit work. For its part, the Royal Navy has continued to operate the Naval Base, which shares the Devonport site with the Dockyard, providing operational support to Devonport's home-based fleet, as well as visiting Royal Navy and other countries' ships.

⁵ Partnering is a management technique embracing a range of practices designed to promote more co-operative working between contracting parties. The objective is to align and unite the parties with a shared goal of completing the scope of work in a cost effective and timely manner which is mutually beneficial. Alliancing incorporates these principles but takes co-operative working a stage further as there is greater sharing of risk between the partners.

⁶ PAC Report paragraph 6 (xvi).

3 The contractual framework for the project

DML entered into an alliance with its team of design consultants and separate partnering agreements with each of its construction contractors.



NOTE

The contract with DML was procured and initially managed by the Ships Support Agency, an Executive Agency of the Department. In April 2001 this Agency merged with the majority of the Naval Bases and Supply Agency to form the Warship Support Agency within the Defence Logistics Organisation (itself recently established in April 2000). This new Agency is now responsible within the Department for managing the contract with DML.

Source: The National Audit Office

1.7 The project involved the first application by the Health and Safety Executive's Nuclear Installations Inspectorate of the civil nuclear regulatory regime to the construction of new submarine refitting facilities under a civil licensee/prime contractor arrangement. Because of the potential consequences of any accident, the regime is necessarily rigorous. The modern standards applied to the design of new nuclear installations are technically demanding, especially in respect of withstanding

earthquakes. The Department's own regulator for its submarine reactors, the Chairman of the Naval Nuclear Regulatory Panel, was intimately involved and hence there was dual regulation (Figure 5). The Department also played a role as it was responsible for supplying DML with data on the submarines' nuclear reactors for incorporation in the nuclear safety cases. The Department commissioned Rolls Royce to provide this data through a separate contract.



Figure 4 overleaf

4 The scope of the project

The project consists of a series of individual projects which are of a significant size in their own right.



Shared facilities

The project included the construction of new facilities to support both the Vanguard and attack submarine docks.

Nuclear transfer route

The construction of a seismically qualified rail route linking Vanguard and attack submarine facilities to the Low Level Refuelling Facility and the provision of two rail tug units and two low level transfer rail trolleys.

Low Level Refuelling Facility

The construction of facilities for the temporary storage of used nuclear fuel prior to its departure off site for long-term storage, and of new fuel prior to its installation on the submarines.

Power Range Testing Berth

The upgrade of the berth used for the power range testing of submarines at the end of their refit.

Common facilities

The provision of cross-site services (gases, chilled water, heat and power), and the construction of office and mess accommodation for Ships' company, workshops and storage of refit equipment.



Attack submarine facilities

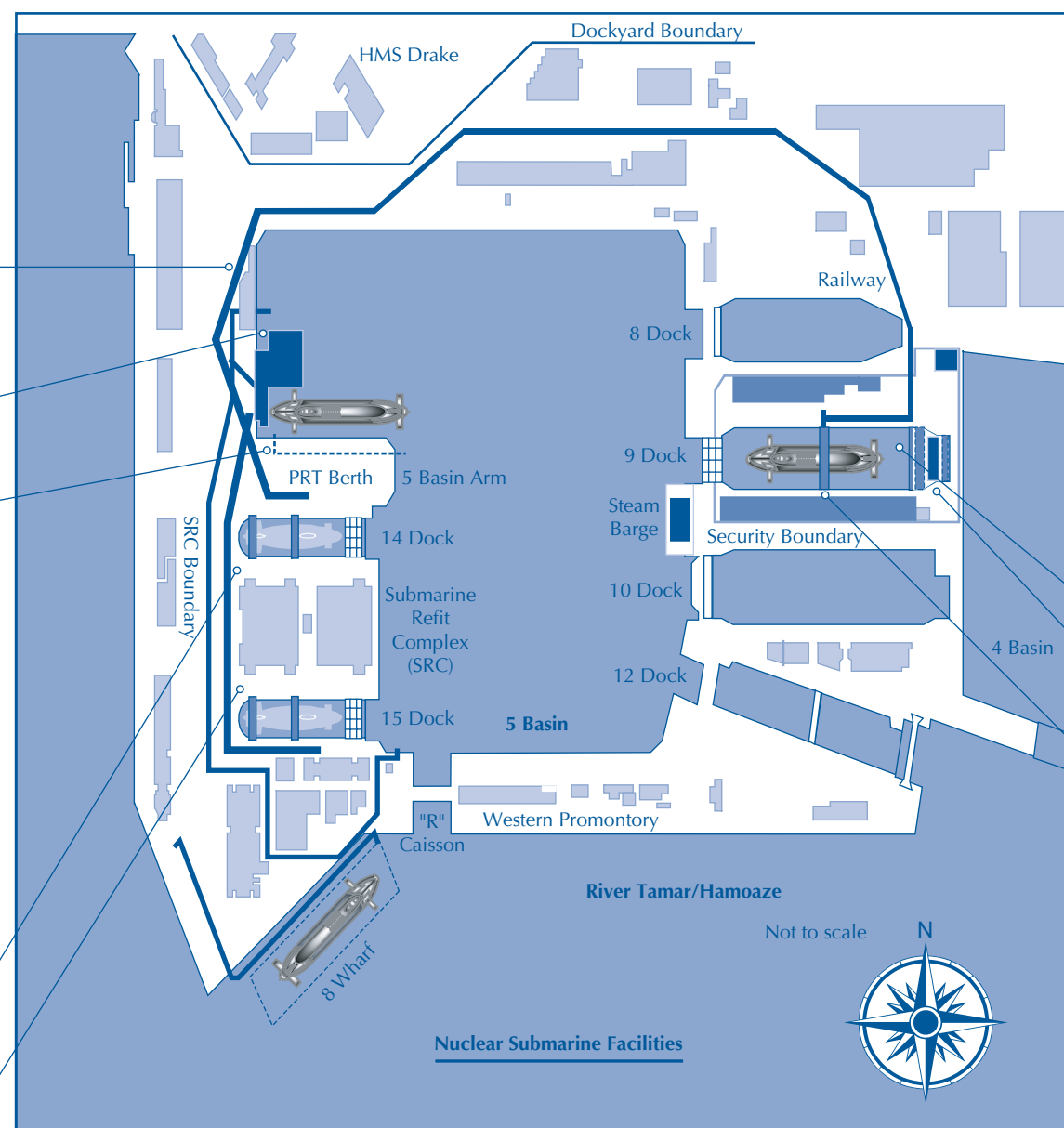
The project involved the upgrading of existing facilities for the refit and refuel of attack submarines, to meet demanding nuclear standards.

14 and 15 Dock structures

The construction of seismically qualified dock structures, caissons, cradles for the submarine to sit in, and dockside cranes. 14 Dock has been adapted to accommodate the new Astute Class of submarines.

Submarine Refit Complex

The construction of low level fuel handling capability for 14 and 15 Docks, and upgrade and decommissioning of the nuclear support facilities currently serving 14 and 15 Docks.



Vanguard facilities

The project included the construction of new facilities for the refuel and refit of Vanguard nuclear submarines on the site of existing non-nuclear facilities.

9 Dock structures

The construction of a seismically qualified dock structure, caisson, cradle for the submarine to sit in, and dockside cranes.

Primary Circuit Decontamination building

The construction of facilities for the decontamination of submarine reactors to allow work on their refit and refuelling.

Reactor Access House on 9 Dock

The construction of a capability for the low level transfer of fuel between the submarine and dockside.

5 The regulatory regime for nuclear safety

The project is subject to a complex regulatory regime to ensure nuclear safety.

- Under the Nuclear Installations Act 1965, apart from certain exemptions no site may be used for the purpose of installing or operating any nuclear installation unless a licence has been granted by the Health and Safety Executive. The facilities for nuclear submarines at Devonport have been subject to regulation by the civilian authorities, the Health and Safety Executive's Nuclear Installations Inspectorate, since 1987 when the Department contracted out the management of the dockyard under a Government Owned Contractor Operated regime. Since 1987 the Inspectorate's regulation has been concerned with the operation of the existing facilities. The significant upgrade of these facilities and provision of new nuclear submarine refitting facilities to meet modern safety standards, as required under this project, had no direct precedent. There was, therefore, an inevitable learning process as the interpretation and understanding of safety principles in the context of a major construction project and the relationship between the various parties developed.
- Under the 1965 Act submarine reactors are specifically excluded from the requirement to be licensed by the Nuclear Installations Inspectorate. Instead, regulation of the Department's naval nuclear propulsion programme rests with the Department's own nuclear regulator, the Chairman of the Naval Nuclear Regulatory Panel. Where elements of this programme, such as this project, are undertaken on a site licensed by the Inspectorate, there is a degree of dual regulation by the regulatory bodies. To minimise the impact of such dual regulation, the Nuclear Installations Inspectorate and the Chairman of the Naval Nuclear Regulatory Panel effectively license DML in a similar manner. Both operate within a non-prescriptive regime which places much reliance on self-regulation by the licensee. The regulators also seek to co-operate to avoid placing conflicting requirements on the licensee and meet regularly.
- It is a condition of the licence for a site that the licensee demonstrate in safety cases that the facilities' design and commissioning are adequate and that the risk posed by operating the facilities is as low as is reasonably practicable. On this project, DML was required to produce separate safety reports for each of the main elements of the facilities at each main stage (prior to the start of construction, commissioning and operation). These individual safety cases also needed to be integrated into an overall Site Safety Case. The potential consequences of nuclear accidents are such that very high standards of design are expected and this is rigorously demonstrated in these safety cases. For example, buildings, structures and plant in a nuclear installation should be designed to withstand an earthquake with a probability of occurrence of once every 10,000 years.
- While neither regulator prescribes the standards of safety a licensee is expected to follow, both use certain safety principles when assessing the safety cases submitted by a licensee - the Nuclear Installations Inspectorate's Safety Assessment Principles (last issued in 1992) and the Chairman of the Naval Nuclear Regulatory Panel's Safety Principles and Safety Criteria. These assessment principles are broadly similar and indicate the issues that the regulators would expect to see addressed in the safety reports. The regulators' involvement in a project becomes increasingly intrusive in the event that shortfalls in standards or a lack of substantiation in the safety cases is identified.
- In assessing safety cases both regulators look for some degree of diversity¹, redundancy², and segregation³ within the design of the facilities. However, there are differences as to what can be achieved within submarines, the Chairman of the Naval Nuclear Regulatory Panel's main area of concern, and on the shore, the Nuclear Installations Inspectorate's main area. For example, the limited available space on submarines cannot always allow for the degree of diversity, redundancy, and segregation which would be sought in the design of land-based facilities.
- The interaction of these two regulatory bodies is governed by the 1996 revised general agreement between the Department and the Health and Safety Executive and associated protocols. Under this the Department agreed that it would provide the site licensee with all adequate and timely information it needed to obtain and maintain its licence with the Nuclear Installations Inspectorate. This information would include data on the design of submarines' nuclear reactors. The intention was that the Nuclear Installations Inspectorate would not 'look into' a reactor's design. Instead it would gain an understanding of the reactor's safety related matters and how these interacted with shore based facilities, but without seeking to influence the reactor's design.

NOTES

1. Dissimilar means of achieving the same objective. Diversity usually refers to the use of different methods, components, materials, etc, in redundant safety systems to minimise the chances of simultaneous failure from the same cause.
2. The provision of alternative (identical or diverse) elements or systems, so that any one can perform the required function regardless of the state of operation, or failure, of any other.
3. The physical separation of components, systems, circuits, etc, to reduce the probability of failures arising from a common cause.

Source: The National Audit Office

1.8 The work on the facilities was scheduled to take place over a number of years until 2005. While there was some flexibility over the upgrade of the attack submarine facilities, there was an immovable completion date for the Vanguard facilities. For the United Kingdom's nuclear deterrent to remain effective, the refitting of the Vanguard submarines had to begin in February 2002. To maintain at least one Vanguard submarine at sea, all four submarines must begin their refit on time as there is very little 'slack' over the next eight years. Each submarine will require two years in refit, followed by extended trials and training, before returning to operations. DML also had an incentive to start the Vanguard refit work on time as its decision to buy Devonport dockyard in 1997 was underpinned by the fact that it would start to earn income from this work in 2002. The income for the refitting and refuelling of a Vanguard submarine is between £200 million and £250 million.

Key facilities were ready in time for the submarine refit programme after the recovery of delays in their construction

1.9 The Vanguard dock was ready in time to allow HMS Vanguard's successful dock down in February 2002 - a major achievement - and DML has completed the upgrade of other docks to accommodate attack submarines. This success has allowed DML to make facilities available to support the Department's submarine refitting programme. However, the timely delivery of the Vanguard dock required the Department to fund the recovery of delays of 23 weeks.

The Vanguard dock was ready on time after delays to it had been recovered

1.10 The contract required the construction of all the new Vanguard facilities to be completed by 31 January 2002, in time for the start of the refit of HMS Vanguard in February 2002 (**Figure 6**). Certain of the Vanguard facilities, including 9 Dock itself and the cross-site services, were completed, as planned, by the end of January 2002. However, this was only achieved after the Department agreed to fund extra measures in 2000 to recover a 23-week delay in construction. This delay arose, in part, because the Department was late in supplying DML with information on the process to be used for the decontamination of the reactors in the Vanguard submarines. This information was vital to DML's design of the facilities for the decontamination of the submarine's reactor prior to its refuelling. The Department had commissioned Rolls Royce to generate this information under a separate contract.

Some attack submarine facilities have been completed

1.11 Attack submarine facilities were to be upgraded in stages, in tandem with the submarine refit work. The contract required completion of all the upgrade work by 9 April 2004 (**Figure 6**). DML completed the construction of the first phase of 15 Dock's upgrade in July 1999, 17 months later than originally planned. DML and the Department applied the lessons learned from their experiences on 15 Dock to the second phase of 14 Dock's upgrade, the phase involving the majority of upgrade work for that Dock. Consequently DML met the revised date of March 2002 for the completion of this phase. Despite these rescheduled construction completion dates, DML has always provided facilities to support the Department's submarine refit programme.

The programme of submarine refit work has been maintained

1.12 DML has maintained the programme of submarine refit work during the construction work. The timely completion of 9 Dock allowed HMS Vanguard to enter the dock in February 2002 and begin its refit as scheduled - a key milestone for the Department (paragraph 1.8).

1.13 As for the attack submarines, despite the upgrade of 15 Dock taking longer than planned, DML was able to reschedule the submarine refit work between 14 and 15 Docks to ensure the refit programme was broadly maintained (**Figure 7 on page 16**). In the period from March 1997 to September 2002 DML has refitted one less attack submarine than originally planned. However, this was mainly due to the Royal Navy's operational requirements where the refit of one submarine was delayed, and an increase in the extent of refit work undertaken on each attack submarine.

The timetable for completion of other facilities remains very tight

1.14 Some facilities were not ready by their due date and are still under construction or are being commissioned. Although these are on the critical path, their late completion has not yet affected the completion date of HMS Vanguard's refit as DML and the Department have been able to reschedule refit activities. There is little scope to accommodate any further slippage.

6 Project progress

The project was to be completed in phases, with final approval from the nuclear regulators due by March 2005. Key facilities have been completed, while work is still underway on others.

| | Dates | |
|--|---|---|
| | Target | Achieved |
| <ul style="list-style-type: none"> ■ Refit and refuel facility for Vanguard class submarines <ul style="list-style-type: none"> □ 9 Dock □ Reactor Access House □ Low Level Refuelling Facility □ Primary Circuit Decontamination building ■ Power Range Testing Berth for Vanguard and attack submarines | 31 Jan 2002 | 9 Dock completed by 31 Jan 2002. New completion dates agreed for other facilities |
| <ul style="list-style-type: none"> ■ Refit and refuel facilities for attack nuclear submarines <ul style="list-style-type: none"> □ 14 Dock □ 15 Dock □ Submarine Refit Complex | All upgrade work complete by 9 Apr 2004 | First part of 15 Dock upgrade completed in June 1999 and all 14 Dock's by March 2002. New dates set for outstanding 15 Dock work only |
| <ul style="list-style-type: none"> ■ Consent from the Nuclear Installations Inspectorate for the continued operation of the facilities ■ Approval of facilities' safety case by the Department's regulator | 28 Mar 2005 | |

Source: The original Prime Contract

Some facilities are still under construction or being commissioned

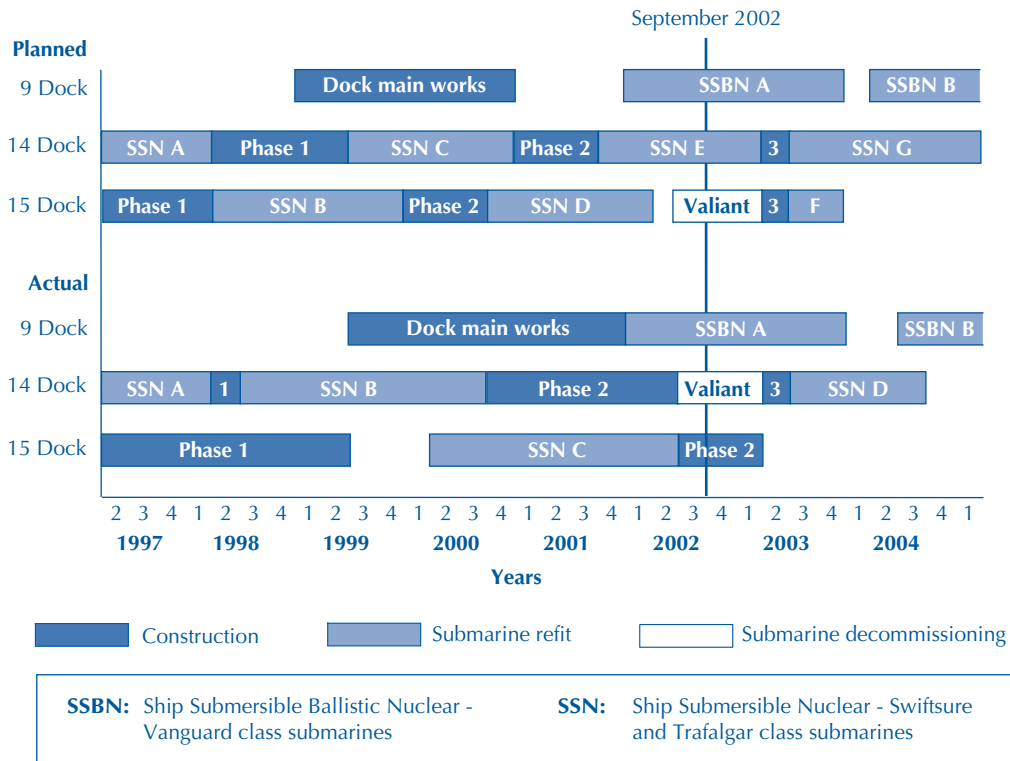
- 1.15 Some crucial Vanguard facilities, such as the Reactor Access House facility for transferring nuclear fuel from a submarine to the dockside and the Primary Circuit Decontamination building for the decontamination of a submarine's reactor, have not been completed by the original contractual deadline of 31 January 2002. Project management and technical difficulties have meant that these facilities are still under construction or are being commissioned, and DML has not yet sought the agreement of the regulators to their operation. The Department and DML have agreed new contractual dates for the phased completion of these between August 2002 and May 2004 (Figure 8 overleaf).
- 1.16 The upgrade of some attack submarine facilities, mainly the Submarine Refit Complex, is still to be completed. The Department and DML have yet to agree a new completion date for the upgrade of the Complex, but have done so for the work on the remainder of the attack submarine facilities (Figure 8).

There remains a risk that the outstanding facilities will not be completed by the new due dates

- 1.17 Design and safety case issues are ongoing, increasing the risk of further delays while any regulatory concerns are addressed. On the unfinished Vanguard facilities, the Nuclear Installations Inspectorate and the Chairman of the Naval Nuclear Regulatory Panel have yet to receive all information necessary to give their final agreement to all aspects of the Reactor Access House and Primary Circuit Decontamination building. Additional delays have occurred, resulting in the forecast completion dates for the Reactor Access House and the next section of the Primary Circuit Decontamination building slipping from the revised contractual date of August 2002 to September/October 2002. The nuclear regulators also intend to review the applicability of the safety cases before the next Vanguard submarine arrives in light of DML's actual experience of operating the facilities during the refit of HMS Vanguard.

7 The timing of the construction of the refit facilities and the submarine refit programme

The submarine refit programme has not been adversely affected by the construction work. However, the Department has had to make certain pragmatic changes to this programme.



NOTE

- The defuelling and decommissioning of Valiant began in May 2002. Valiant is the sole remaining Valiant class attack submarine. It was decommissioned from service in 1994, thereby losing the designation "HMS", and has been tied up in Devonport, awaiting defuelling, since then.

Source: The Department

8 Revised timetable for construction

The Department and DML have agreed new completion dates for the unfinished facilities, apart from the Submarine Refit Complex.

| | Available for use ⁽¹⁾ | Fully commissioned |
|--|----------------------------------|----------------------|
| Reactor Access House | August 2002 | |
| Power Range Testing Berth to support the refit of HMS Vanguard | March 2003 | All by February 2004 |
| Third phase of 14 Dock upgrade ⁽²⁾ | April 2003 | |
| Second phase of 15 Dock upgrade ⁽²⁾ | April to May 2003 | |
| Primary Circuit Decontamination building | August 2002 to December 2003 | February to May 2004 |

NOTES

- The facilities will be available for use after completion of all construction and initial commissioning work, to the satisfaction of the nuclear regulators.
- Work involved includes the installation of dockside cranes and the nuclear transfer route from the docks to the Low Level Refuelling Facility.

Source: The revised Prime Contract

1.18 Similarly, the nuclear regulators intend to revisit the safety cases for the attack submarine facilities in light of their operation. In addition, the exact scope of the remaining Submarine Refit Complex work is yet to be determined. According to the Department, there are still significant challenges to be overcome in the preparation of a plan for the Complex's upgrade which is acceptable to the nuclear regulators. For example, the Nuclear Installations Inspectorate is concerned about the existing 80-tonne refuelling crane in the event of an earthquake. Possible options for addressing the Inspectorate's concerns include the demolition, or strengthening, of the crane. The Department will approve the Complex's upgrade only when all parties, including the Inspectorate, have agreed on this. To this end the Department and DML have set up a joint design team and agreed a joint approach to gaining the regulators' approval. They have also established close links with both nuclear regulators to involve these at an early stage.

If the new due dates are not met, there may be delays to the programme of submarine refit work

1.19 In agreeing the revised completion dates for the Vanguard facilities, the Department took account of the programme of submarine refit work. If completed by the revised dates, the majority of the facilities will be delivered in time to support the refit of HMS Vanguard.

1.20 The one exception is the final part of the Primary Circuit Decontamination building which will not be substantially completed until December 2003. This will not be in time for the refit of HMS Vanguard, but in time for that of the second Vanguard class submarine in 2004. The delayed delivery of these facilities is only acceptable because HMS Vanguard has low radiation levels. DML is therefore able to use an alternative method, involving the use of lead shielding, to allow work on the submarine to proceed. This alternative method will not be available for work on the next submarine of the class. Surveys have shown that this submarine will require a fully-functioning Primary Circuit Decontamination building.

1.21 There is little slack in the revised completion dates for the incomplete Vanguard facilities. The Department and DML have rescheduled refit activities so that the additional construction delays encountered (paragraph 1.17) have not affected the completion date for HMS Vanguard's refit. However, further delays to the incomplete facilities could result in delays to the programme of submarine refit work. This programme is itself tight. Although it contains some float, the Department requires this for any possible problems or delays to the refit work itself. The refit work is all novel as it involves the use of new facilities for the first refit of a Vanguard class submarine with a type of reactor which is facing its first on-board refuelling. Delays in completing the refit work could affect the effectiveness of the United Kingdom's nuclear deterrent (paragraph 1.8). However, DML has a financial incentive to complete refit work on time since its profits on this work are reduced if it fails to do so.

1.22 On the attack submarine facilities, the upgrade of the Submarine Refit Complex cannot proceed until the completion of the decommissioning of Valiant. Valiant's now unique configuration dictates that it can only be defuelled using the Complex's existing fuel handling facilities, while the upgraded facilities will be specifically designed to handle the current and future classes of attack submarine. Any delay to the work on Valiant will impact on the timetable for the Complex's upgrade and could thus disrupt the future refit programme for attack submarines.



Part 2

Costs have increased significantly but quantification of the reasons has proved difficult

2.1 This Part of the report considers the Department's progress in delivering the facilities to budget. The cost of the facilities has increased significantly, mainly due to the cost of the contract with DML, and the final cost is still uncertain. The Department cannot quantify exactly the reasons for the increase in costs.

DML considered it highly unlikely that DML's costs would reach £505 million. The Department estimated that the most likely works cost would be £394 million, the Lower Target Cost, and was confident that the project would be delivered for a total cost of £576 million, including contingencies for the risks it retained (**Figure 9**).

The cost of the facilities has increased significantly, mainly due to the cost of the contract with DML

2.2 The 1997 Prime Contract set a Maximum Price of £505 million⁷ on the payments that the Department would make towards DML's costs under the contract. However, in agreeing to this, both the Department and

2.3 To be prudent, with Treasury's approval the Department set a total budget for the project of £650 million which contained sufficient funding should DML's costs reach £505 million. The £650 million included all the Department's non-DML costs such as professional fees for its Nuclear Works Adviser, Allott & Lomax.

9 The Department's budget for the project

The Department had to increase its original budget for the project.

| | Original budget | | Current forecast outturn | Difference between current forecast and original budget | |
|---|--------------------------------|---------------------------|--------------------------|---|---------------------------|
| | Lower target cost £ million | Maximum cost £ million | | Lower target cost £ million | Maximum cost £ million |
| DML's works costs on main contract | 394 | 505 | 727 | 333 | 222 |
| DML's profit and project management costs | 37 | 0 | 0 | (37) | 0 |
| Total payable to DML under the contract | 431 | 505 | 727 | 296 | 222 |
| Pre-contract work | 24 | 24 | 24 | 0 | 0 |
| Other Department costs | 15 | 15 | 43 | 28 | 28 |
| | 470 | 544 | 794 | 324 | 250 |
| Department contingencies | 106 | 106 | 18 | (88) | (88) |
| Total project cost | 576 | 650 | 812 | 236 | 162 |

NOTE

All figures are at 2001-02 prices and include VAT - see Appendix 3.

Source: *The Department*

⁷ Unless otherwise stated, all figures are at 2001-02 prices and include VAT (Appendix 3).

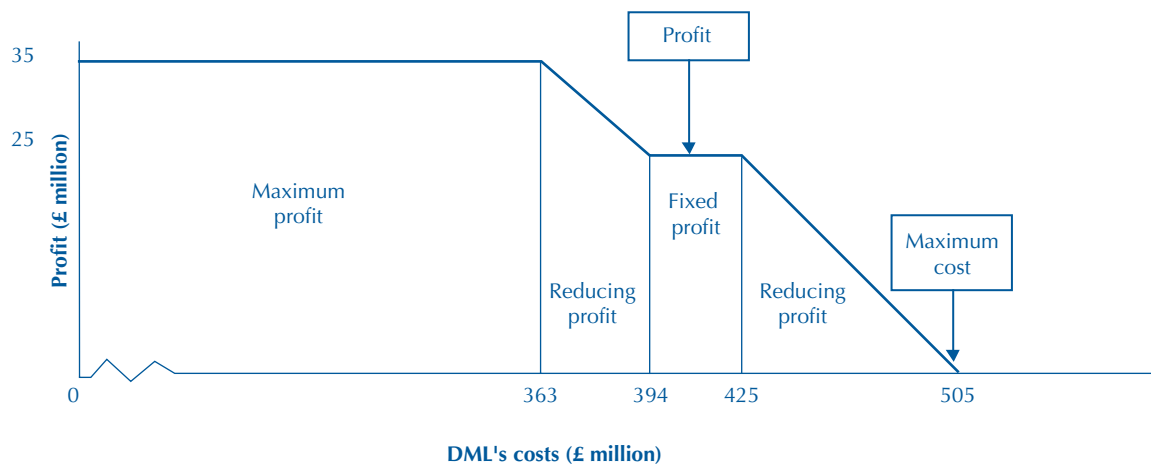
- 2.4 The budget included £106 million contingencies as the Department was liable for a number of potential cost increases, such as the extra costs of any variations it required or any increases in its non-DML costs. It would also meet the costs of the risks which it retained under the contract with DML, should these materialise. These risks included aspects of regulation risk, changes in statutory requirements, and the timely supply to DML of key information on the design of the submarine reactors.
- 2.5 In the Department's opinion all other cost increases were to be borne by DML. The 1997 Prime Contract provided DML with an incentive to control the increases in its costs in that the higher its costs under the contract, the lower the profit it earned. Initially set at a maximum of £35 million, the profit reduced to zero if DML's costs reached the Maximum Price (Figure 10).
- 2.6 The original budget proved insufficient, mainly because DML's costs were much higher than expected (Figure 9). There was also an increase of £28 million in the Department's non-DML costs, which are now forecast at £43 million. The costs of the Department's Nuclear Works Adviser, Allott & Lomax, were higher than planned because of the problems on the project. Also, to meet the modern standards expected of a new facility and its safety case, the Department contracted Rolls Royce, the designer of the submarines' nuclear reactors, to provide more information on the reactor design than had been expected (paragraph 1.7). The £43 million also includes a ring-fenced allowance for the upgrade of the Submarine Refit Complex (paragraphs

1.16 and 1.18). This allowance is equivalent to the sum originally provided for the Centre's upgrade in 1997 as part of DML's works costs, uplifted to 2001-02 prices and now included among the Department's other costs.

- 2.7 Because of the significant cost increases, in December 2001, the Department agreed to pay more of DML's costs but to limit its upfront payment to a maximum of £727 million. For its part DML agreed to contribute a maximum of £43 million to its costs up to £770 million, and to give up its possible profit on the project. DML will capitalise its costs over £770 million and recover these over 20 years as part of its charges for the submarine refit programme.
- 2.8 The Department's upfront payment of £727 million was significantly more than it had expected to pay in 1997. Part of the increase was met from the Department's existing contingencies. The rest the Department funded by increasing its budget, with Treasury approval, by £162 million from £650 million to £812 million (Figure 9).
- 2.9 In August 2002 DML estimated that its total costs on the contract would be £848 million, £78 million over the agreed figure of £770 million at which the capitalisation of DML's costs would begin. Given the Department's own costs of £85 million, the latest estimate of the total cost of the project is therefore £933 million (Figure 2). However, the Department's payments will total an estimated £849 million; £812 million during project construction and a further £37 million (£78 million over 20 years discounted back to 2001-02 prices).

10 Original structure for DML's profit

Under the contract the extent of DML's costs determined the level of profit payable to DML.



NOTE

Figures are at 2001-02 prices and include VAT.

Source: The Department

The final cost of the facilities is still uncertain

2.10 The final cost of the facilities is still uncertain. The construction of some of the facilities is still on-going, certain regulatory issues remain to be resolved, and the final scope, and therefore cost, of the upgrade of the Submarine Refit Complex has yet to be determined (paragraphs 1.17 to 1.18), although the Department has made an allowance for the Complex work in its revised budget of £812 million (paragraph 2.6). In addition, certain pricing exclusions remain in the revised contract. Thus, for example, the Department will meet any costs arising from changes to the 1996 Ministry of Defence/Health and Safety Executive agreement or the Department's alterations to the planned programme of submarine refit work. The Department has made allowances for these eventualities in its contingencies.

The Department cannot quantify exactly the reasons for the increases in DML's costs

2.11 The Department has had difficulty in quantifying the causes of the increases in DML's costs above the maximum price. It has only been able to provide broad estimates for some of the causes. In particular, it has not quantified - other than in broad terms - the cost impact of meeting the requirements of the nuclear regulators, one of the major reasons, according to the Department and DML, for the cost increases.

The Department has provided broad estimates for some of the reasons for the increases in DML's costs above the maximum price

2.12 At our request the Department undertook a further exercise to analyse the reasons for the increase in DML's costs. It had not previously undertaken an analysis in this form, although it was aware of the general reasons for the cost increase and had analysed the project costs in other ways. For example, it had analysed the costs for each main building structure. In our opinion, the preparation at an earlier stage of an analysis of the reasons for the cost increase would have helped the Department with its management of the project and with resolving the problems that occurred. The Department would have been better placed to take corrective action against those factors identified by this analysis as the major causes of the cost increases, and to learn the appropriate lessons for the later stages of the project.

2.13 The Department told us that, as the original contract included incentivised arrangements to contain costs, monitoring did not focus on the reasons for cost increases. The Department's analysis therefore involved an element of judgement and contained only broad estimates of the cost impact. The Department took the Maximum Price of £505 million as its baseline, rather than the Lower Target Cost of £394 million which it expected to pay in 1997, and has not analysed why DML's costs increased up to the maximum allowed under the original contract.

2.14 The Department's analysis showed that one of the reasons for the increase in DML's costs was the inaccuracy of initial estimates. The construction sub-contracts, when awarded, cost £92 million more than had originally been allowed for, even after taking account of inflation (Figure 11). Similarly, staff costs for members of the Main Alliance (Figure 3) were £15 million more than expected.

11 Cost increases on the DML contract

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

| | £ million |
|--|------------------|
| Maximum price (at March 1997) | 505 |
| Additional work to meet the requirements of the nuclear regulators (paragraphs 2.19 to 2.25) | 106 |
| Higher cost of construction sub-contracts on award (paragraph 2.14) | 92 |
| DML and its sub-contractors project management difficulties (paragraphs 2.15 to 2.16) | 86 |
| Acceleration work needed to recover delay on the Vanguard facilities (paragraph 2.18) | 28 |
| Firming of staff rates for members of Main Alliance (paragraph 2.14) | 15 |
| Late delivery of required information by the Department (paragraph 2.18) | 10 |
| Department changes ¹ | 6 |
| Forecast outturn (August 2002) | 848 |

NOTE

1. Department changes included £2 million for modifications to 14 Dock to handle Astute class submarines.

Source: The Department

2.15 Poor performance also contributed to the cost increases.

Before awarding the contract, the Department was concerned about DML's ability to manage a project of this kind. Consequently it conducted three pre-contract award evaluations to satisfy itself that DML had the capability to manage the project. After the third evaluation the Department concluded that DML had made adequate progress, but required DML to undertake further action before the contract could be signed.⁸ The Department was sufficiently satisfied with DML's further action that it entered into the Prime Contract with DML. However, the existence of these concerns highlighted a need for subsequent close monitoring by the Department of DML's performance as Prime Contractor.

2.16 The Department estimated that poor performance by DML and its sub-contractors after contract signature accounted for between £86 million and £110 million of the increase in DML's costs. Examples of poor performance identified by the Department included:

- On 9 Dock DML failed to take account of a revision to the building codes. This had a major impact on the concrete structures, leading to significant additional design and installation effort.
- There were problems with the management and performance of the subcontractors working on the Primary Circuit Decontamination building. Significant extra costs arose because of poor scheduling of installation activities. Also, late changes to design drawings caused much reworking, and poor control and incorrect component specifications resulted in it taking longer than planned to flush out and clean the building's pipework systems. The Department estimates that such poor performance increased the cost of this building by £50 million to £65 million.
- The design of the Reactor Access House on 9 Dock did not comply with required standards and a component of the lifting apparatus was found not to function correctly. To address these weaknesses, major reworking of the design and structure, and some reworking of the nuclear safety case, was necessary, resulting in cost increases and delays to the project. These, and other instances of poor performance, resulted, in the Department's opinion, in cost increases on this facility of about £11 million to £17 million.

- The original design for 15 Dock did not meet safety requirements. This necessitated substantial redesign and re-working and delayed construction by approximately one year. Extra costs were also incurred as a result of the need to keep the construction contractor, who had already been appointed, on site for longer than planned. The Department estimates that the extra costs arising from poor performance on this Dock totalled about £10 million.

2.17 Costs may also have been affected by fraud. The Department's fraud unit and police are presently investigating allegations of fraudulent billing for labour by one of the many sub-contractors not contracted directly to DML.

2.18 The Department analysed its own contribution to the cost increases. The Department was late in supplying DML with information on the process to be used for the decontamination of the reactors in the Vanguard submarines (paragraph 1.10). As a result, DML incurred extra design costs of £10 million which the Department agreed to meet. The late supply also contributed to construction progressing more slowly than expected and thus to the Department's need to agree acceleration measures to recover this construction delay, and others, at a cost of £28 million. The Department had separately contracted with Rolls Royce to provide the decontamination process. Under this contract, Rolls Royce was liable to pay the Department a maximum of £500,000 as liquidated damages in the event of late delivery, and the Department therefore recovered this £500,000 in full.

The Department has not quantified - other than in broad terms - the cost increase for meeting the requirements of the nuclear regulators

2.19 According to the Department and DML, interpreting what was necessary to meet nuclear safety regulations in respect of meeting environmental threats such as earthquakes, and proving this to the satisfaction of the regulatory authorities, was more involved than expected.

2.20 In 1994 DML submitted the first safety case for the project, the preliminary safety report, for consideration by the nuclear regulators. At this stage the Nuclear Installations Inspectorate was recruiting more staff to extend its expertise in facilities for nuclear submarines. In response to the safety report the Inspectorate drew DML's attention to a number of instances where the report had not satisfactorily addressed its safety assessment principles, many of which it considered could have had significant implications for the design. DML assured the Inspectorate that such detailed design

issues were to be clarified in the next set of safety cases, the pre-construction safety reports. DML submitted these next reports for the 9 Dock facilities later than originally planned in late 1998. The late submission left the Nuclear Installations Inspectorate with little time to review these reports before the planned start of construction in February 1999. On reviewing the reports, the Inspectorate did not consider that they contained sufficient information for it to be reasonably confident that the design and operation of the facilities would be acceptable once the facilities began to operate in 2002. It therefore did not agree to the start of construction until June 1999 after DML had addressed its concerns.

2.21 Prior to June 1999, the Nuclear Installations Inspectorate had dealt mainly with DML as the nuclear licensee for the site, in line with its usual approach to regulation (Figure 5). It declined attempts by the Department's project sponsor⁹ at a working level to engage directly with it on the project. In June 1999 the Nuclear Installations Inspectorate met DML, the Department and the Chairman of the Naval Nuclear Regulatory Panel to discuss the regulatory regime. At this meeting the Inspectorate stated that, in order to facilitate the project's progress, the Department and the Chairman of the Naval Nuclear Regulatory Panel should become more closely involved in DML's development of the facilities' design and safety cases.

2.22 The Nuclear Installations Inspectorate also stated that safety cases should contain more information on the design of the submarine reactors. This was necessary as DML needed to demonstrate that the dock facilities, as designed and operated, were adequate to handle the reactor and that the radiological risk was as low as reasonably practicable. The Inspectorate would seek assurances from the Chairman of the Naval Nuclear Regulatory Panel regarding the reactor data but such assurances would need to be based upon data from the Department.

2.23 In practice providing the reactor data proved challenging. In some instances the existing data proved to be insufficient for inclusion in the dock facilities' safety cases. This data had originally been generated for inclusion in the safety cases for the reactors themselves, and the primary focus of these cases had been to demonstrate to the Chairman of the Naval Nuclear Regulatory Panel the safety of the reactors' operation at sea. The Department contracted Rolls Royce, the reactor designers, to provide the additional data required. While the new data was generated, the Department and DML agreed that the safety cases should contain initial data on the reactors and systems, which set the design boundaries

for the facilities concerned. The cases could then be amended when the more refined data was produced.

2.24 In other areas DML began manufacture and construction before it had completed or submitted the relevant safety cases at its own risk. Consequently, when the Nuclear Installations Inspectorate found deficiencies in the cases and asked for a better justification of the proposed design, DML had to undertake expensive reworking. The imperative to deliver the project on time also contributed to cost increases. When its design proposals were challenged by the regulators, DML told us that it may have implemented higher cost design and construction solutions than it would otherwise have. This was because there was insufficient time to cost all options and thus identify the most cost effective and elegant technical solution, and attempts to prove the safety case to the regulators 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.

2.25 The Department has not quantified - other than in broad terms - the cost impact of the regulation problems. In its analysis of cost increases the cost impact of these problems is only a balancing figure with a range of between £82 million and £106 million (Figure 11). Further, in addition to the £82 million to £106 million, the regulatory problems also contributed to some of the other cost increases given in the Department's analysis. For example, the £92 million cost increase in construction sub-contracts (paragraph 2.14) arose in part because design solutions which were acceptable to the regulators cost more than the sub-contract estimates. It is also likely that the £111 million cost movement from the £394 million Lower Target Cost to the £505 million Maximum Price (paragraph 2.13) arose in part due to the extra costs of meeting the requirements of the nuclear regulators.

DML and the Department have different views as to the reasons for the cost increases

2.26 DML considers that poor performance by itself or its sub-contractors was not a major factor in the cost increases, resulting in extra costs of only £20 million. These extra costs were more than covered by its £43 million contribution to project costs (paragraph 2.7). In DML's opinion, the fundamental cost driver on the project was the need to meet the requirements of the nuclear regulators. DML considers that many of the examples of poor contractor performance identified by the Department (paragraph 2.16) actually arose from the evolving nature of nuclear regulation on this project.

⁹ The project sponsor is the named individual within a department who is responsible for acting as the single focal point for the day to day management of its interest in a project.

Large cost increases arose from the considerable amount of re-design and reworking that DML had to undertake in response to the concerns raised by the Nuclear Installations Inspectorate. In assessing whether DML's plans for the facilities reduced the level of risk involved to "as low as was reasonably practicable"¹⁰, the Inspectorate had taken a different view as to what constituted reasonably practicable than DML expected. For example, the Inspectorate required more diversity, redundancy, and segregation than DML had originally designed for. Thus, DML had to incorporate into its designs at a late stage a second, back-up reactor cooling system in 9 Dock in response to the Inspectorate's concerns.

2.27 DML told us that it had not expected this since, prior to this project, the Nuclear Installations Inspectorate had not been as closely involved in the regulation of the dockyard. Instead it had been content to take an overview and leave the detailed regulation to the Department's nuclear regulator. DML therefore had no experience of detailed regulation by the Inspectorate. DML's Chief Executive told us that, based on his previous experience of nuclear submarine construction at Barrow, the work needed to meet the regulatory requirements on this project was substantially greater. In DML's opinion, the 1996 Ministry of Defence/Health and Safety Executive Agreement (Figure 5) resulted in a sea-change in the regulatory regime. It allowed the Inspectorate to become much more closely involved in the regulation of the dockyard and to become, in effect, the primary nuclear regulator. It also fundamentally altered the means of dealing with the interface between the submarine's nuclear reactor and the dockyard facilities, requiring substantial extra work and cost on DML's part.

2.28 The Department and the Nuclear Installations Inspectorate consider that the 1996 Agreement formalised the existing regulatory arrangements whereby the Nuclear Installations Inspectorate was already the prime regulator. The Inspectorate's more detailed regulation arose from the nature of this project which involved the major redevelopment and expansion of the nuclear facilities. The benchmark for the Inspectorate's approach to its regulation of such major projects had been set during the construction of Sizewell B in the 1980s. The Inspectorate had also given clear guidance on the safety standards against which such a project would be assessed in its Safety Assessment Principles which had remained unchanged since 1992 (Figure 5). Consequently, it was clear to the Department in 1995 that the nuclear safety requirements on this project would, from the outset, be stringent.¹¹ 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's consideration, resulting in less time for the consideration and resolution of issues raised (paragraphs 2.20 and 2.24).

2.29 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. Before the start of this project civil regulatory standards in the Department's dockyards had only been implemented under a Government Owned Contractor Operated regime (Figure 5). This project was therefore the first occasion where the regulation of such a project had been undertaken under a civil licensee/prime contractor arrangement.

¹⁰ It is a condition of the licence for a nuclear site that the licensee demonstrate in safety cases that the facilities' design and commissioning are adequate and that the risk posed by operating the facilities is as low as is reasonably practicable (Figure 5).

¹¹ House of Commons Defence Select Committee, Eighth Report (HC350 1994-95) page 34.

Part 3

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

3.1 This Part of the report considers the action taken by the Department in the face of the increases in DML's costs. These increases were too large to be handled within the framework of the original contract. The Department therefore had little option but to renegotiate the contract. Although the Department negotiated hard, in the end it inevitably agreed to meet the great majority of the cost increases.

The increases in DML's costs were too large to be handled within the framework of the original contract

3.2 Faced with significant increases in its costs, DML sought to recover these from the Department under the contract. The Department was not in a strong position. It had difficulty in monitoring the forecast costs of the project, and the meaning of certain contract clauses was also open to interpretation, thereby allowing the possibility of extra payments to DML. In certain areas of the project the Department had retained risk under the contract and was liable for some of the cost increases but the Department and DML disagreed over the amounts involved. The allowances in the Department's budget for its retained risks were insufficient, and there were certain high level risks to the Department's operations which it could not transfer.

The Department had difficulty in monitoring the forecast costs of the project

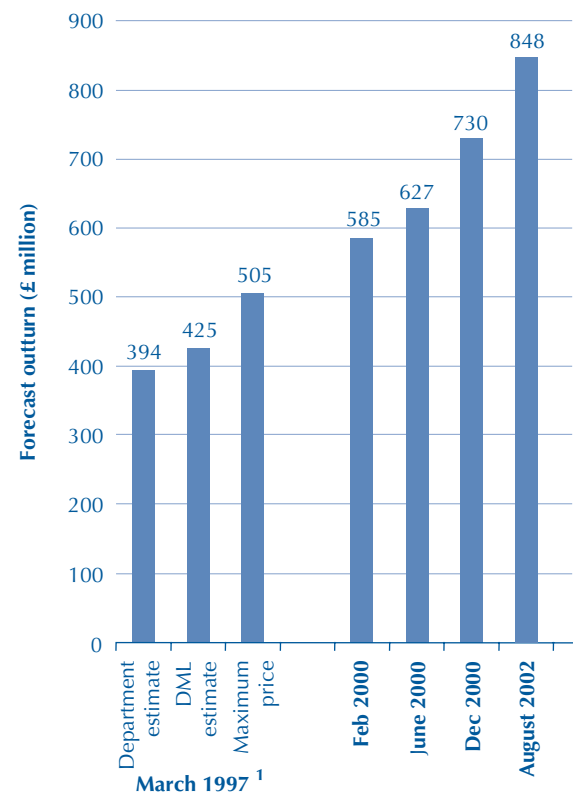
3.3 By early 1999 the Department was aware that DML was incurring extra costs as DML had submitted claims for extra payment under the contract. It was not until February 2000 that the extent of DML's cost problems became apparent when DML forecast a cost outturn of £585 million, £80 million in excess of the Maximum Price.

3.4 In the face of increasing costs, the Department and DML undertook a number of initiatives in 2000-2001 to identify a reliable estimate of the project's likely outturn cost. In June 2000 the Department and DML identified a forecast outturn cost of £627 million

(Figure 12). By the end of 2000 this had risen to £730 million, when it became apparent that the Department's £650 million budget would be insufficient to meet the cost overrun. By August 2002 there had been a further, significant increase as DML estimated that its total costs on the contract would be £848 million (paragraph 2.9).

12 DML's estimated outturn costs

The estimates for DML's costs increased significantly from 2000, with a 25 per cent increase in 10 months in 2000.



NOTES

1. The Department's and DML's estimates of the most likely works cost and the Maximum Price under the contract (paragraph 2.2).
2. These estimates exclude the Department's own costs which, by August 2002, were forecast at £85 million (Figure 9).

Source: The National Audit Office

- 3.5 The Department and DML had problems identifying the forecast total costs of the contract. This uncertainty arose as the extent of the work remaining to be undertaken was changing, due to the large amount of design changes and reworking in response to the regulators' observations and due to the correction of instances of poor DML and subcontractor performance.
- 3.6 Also, the Department's access to cost information had been limited under the contract. The basis of the Prime Contract had been to transfer maximum risk with DML incentivised to complete on time and within a target cost. The result of this arrangement was that the Department had stepped back from detailed involvement in the management of the facilities' construction. Consequently it had very little visibility of the Prime Contractor's or its sub-contractors' forecast of costs. The Department did have a right of access under the contract to DML's cost records but the main purpose of this was for the verification of historical costs. While the Department approved all tender lists and sanctioned the placement of all sub-contracts, it had no rights of access to the sub-contractors' records where the sub-contract had been awarded after competitive tender. The majority of sub-contracts on this project were awarded in this manner.

The meaning of certain contract clauses was open to different interpretation

- 3.7 In the light of its cost increases, DML sought to recover these under the contract. As is standard in construction contracts, certain provisions allowed for the recovery of extra costs by DML under defined circumstances. DML therefore submitted claims under these provisions, arguing that these circumstances now applied.
- 3.8 DML submitted claims in two main areas which overlapped. DML told us that its legal advice was that it would win on both points.
- Firstly, the original contract pricing had been set using estimates of what the construction costs might be. The Department understood that, should the actual value of the construction sub-contracts be different on their award, any resulting extra cost would be absorbed by DML. However, DML argued that the contract allowed for the recovery of these extra costs from the Department as provisional prices were replaced by firm prices. By 2000 it had claimed for over £100 million in extra costs in this area. The Department's legal advice was that, if the matter had gone to court, the argument was very clearly in the Department's favour and the Department had very good prospects of defeating DML's claim.

- Secondly, the contract allowed DML to suggest different design solutions or ways of working. DML considered that, under the contract, the Department would meet any extra costs arising as a result. By 2000 DML had claimed over £100 million in extra costs in this area, arising mainly from the changes it had made in response to observations from the nuclear regulators (paragraphs 2.26 to 2.27). While the Department disputed DML's interpretation, the relevant contract clauses were not sufficiently clear. The Department's legal advice was that, if the matter had gone to court, the argument was finely balanced.

- 3.9 Both the Department and DML independently concluded that resolution via the methods allowed under the contract, arbitration or adjudication or through a court settlement, would not achieve their respective aims and that commercial renegotiation was the best option. DML recognised that, if it did have recourse to the contractual remedies, the whole process could be lengthy and its success was not guaranteed. The Department was also concerned about further delays to the construction of the facilities, and the consequent risks to the submarine refitting programme. It also considered that, even if it had won a court settlement, there was a possibility that it would still have to meet the costs of completing the facilities, as well as the additional costs of the dislocation arising from DML's replacement as owner of the dockyard.

There was disagreement over the extent to which the cost increases were caused by risks which the Department retained under the contract

- 3.10 There were areas of risk where responsibility was not completely transferred under the contract to DML. For example, the contract made DML solely responsible for the design risk in respect of the refit and refuel facilities. However, DML's performance in meeting this design risk depended in some areas of the facilities' design on the provision by the Department, through its agent, Rolls Royce, of information on the process to be used for the decontamination of the reactors in the Vanguard submarines. Design risk was therefore partly shared by the Department. The Department was late in supplying some of the required information, resulting in extra costs (paragraph 2.18).
- 3.11 DML was also responsible for delivering facilities which met the requirements of the nuclear regulators, and for preparing all nuclear safety justification cases for the regulators and obtaining their approval. However, the Department retained under the contract certain of the risks involved in satisfying the regulators (**Figure 13**). Thus nuclear regulation risk was also shared.

13 Aspects of nuclear regulation risk retained by the Department

Under the contract the Department retained certain aspects of nuclear regulation risk.

DML was entitled to the reimbursement of its extra costs if these were due to:

- the adoption by DML of new methods or techniques for the nuclear safety justifications it needed to produce;
- the unreasonable refusal or delay by the Department's regulator, the Chairman of the Naval Nuclear Regulatory Panel, to approve or respond to the nuclear safety justifications; or
- the rejection, or failure to approve, by the Nuclear Installations Inspectorate or the Chairman of the Naval Nuclear Regulatory Panel of any nuclear safety justification where DML has used methods or techniques previously accepted by these regulators as being appropriate which results in the need for new methods or techniques not previously used, provided that such new methods or techniques could not have been reasonably foreseen by DML at the time of the contract's signature.

The contract also contained a pricing exclusion in respect of the operation of the 1996 Ministry of Defence/Health and Safety Executive agreement (Figure 5). This meant that DML had made no allowances for this in its pricing and therefore the Department would be liable to any extra costs arising as a result of this.

Source: The original Prime Contract

3.12 The Department considered that DML bore the majority of nuclear regulation risk. DML was the nuclear licensee and was legally responsible for the nuclear safety of the site. The Department therefore left DML to manage the relationship with the nuclear regulators in the early years. After 1999, the Department became more actively involved (paragraph 2.21).

3.13 In 2000 DML sought reimbursement of its extra costs under one of the risks retained by the Department, the pricing exclusion for the operation of the 1996 Ministry of Defence/Health and Safety Executive agreement. The Department disagreed over the extent of the cost increases involved but recognised that the Agreement's operation had caused DML difficulties in one area - the provision by the Department of data on the submarines' nuclear reactors (paragraphs 2.23 and 2.26 to 2.28).

3.14 The Department told us that, understanding what it now does about the expectations of the nuclear regulators, the project would have benefited from a closer working relationship between the Department, DML, the Nuclear Installations Inspectorate and the Chairman of the Naval Nuclear Regulatory Panel from the outset. Acting with DML the Department should have ensured from the start that there was clarity regarding the regulation regime, the relationship between the Nuclear Installations Inspectorate and the Chairman of the Naval Nuclear Regulatory Panel, and the Inspectorate's expectations as to what constituted an acceptable safety case. The Department and DML are now taking such an approach on the upgrade of the Submarine Refit Complex (paragraph 1.18). In our view, establishing such a joined-up approach from the start will necessarily involve participation by the senior management of the parties involved. Thus, for example, when attempts by the Department's sponsor at a working level to engage directly with the Nuclear Installations Inspectorate were unsuccessful (paragraph 2.21), the Department could have pursued this matter further at a more senior level.

Allowances for risk in the Department's budget were insufficient

3.15 In line with good practice the Department had carried out risk analysis, with the help of its Nuclear Works Adviser, Allott & Lomax. This analysis included the identification of the risks that the Department retained, a strategy for the management of each of these risks, and the risk manager responsible for implementing this strategy. As a result of this work the Department made a provision of £106 million for the risks it retained within its March 1997 budget of £650 million.

3.16 The £106 million provision did not cover two significant risks retained by the Department under the contract with DML. The contract contained a pricing exclusion in respect of the operation of the 1996 Ministry of Defence/Health and Safety Executive agreement (Figure 13). The contract also allowed for the staff costs of the Main Alliance members, which had been included in the original contract pricing at provisional levels, to be increased to reflect the actual costs involved. The Department incurred extra costs under both provisions (paragraphs 2.14 and 3.13).

3.17 There were also other allowances for risk in addition to the £106 million within the Department's budget of £650 million. The budget contained an extra £111 million to ensure that there was sufficient funding should DML's outturn costs reach the Maximum Price of £505 million, rather than the Lower Target Cost of £394 million (paragraph 2.2). DML also included within its contract pricing an allowance of £45 million for the risks that it accepted under the contract. The £650 million budget therefore included £262 million for risks - 40 per cent.

3.18 According to the Department the risk allowances have not been sufficient as some problems, such as meeting the requirements of the nuclear regulators, have been significantly greater than expected. The Department has experienced cost overruns on previous nuclear projects. For example, on its projects for the upgrade of facilities for nuclear submarines at Rosyth, the Department experienced cost overruns of between 70 and 90 per cent, mainly as a result of the work necessary to satisfy nuclear safety requirements.¹² However, these projects were not as large and complex as the Devonport project.

The Department retained high level risks to its operations which it could not transfer

3.19 There were high level risks to the Department's operations which could not be transferred to DML but were retained by the Department. Because of the importance of these facilities to the maintenance of the effectiveness of the United Kingdom's strategic nuclear deterrent, the Department could not accept the contract's failure and the resulting late delivery of the facilities (paragraph 1.8). Prior to the award of the contract the Department had concerns about DML's ability to manage a project of this kind (paragraph 2.15).

3.20 If the project did run into significant problems, DML was not well placed to meet very substantial cost increases itself. 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 a contract placed with a company to one third of the company's net assets.

3.21 DML had negotiated limits on its liabilities under the contract. Its liability in the event of its breaching the contract was limited to a maximum of £35 million and its liability for delayed completion to a maximum of £10 million.¹³ Consequently there was always the possibility that, should significant problems arise, DML might choose not to honour the contract and thus limit its losses to £35 million. In this situation, the Department would have had to bear the cost of completing the facilities - a risk highlighted in our previous report and that of the Committee of Public

Accounts.¹⁴ Thus, despite the stated allocation of risk under the contract, the existence of these limits on DML's liability effectively limited the amount of risk transfer actually achieved.

3.22 The Department's original management arrangements tended to be 'hands off' as it had placed the Prime Contract with DML who were responsible for project management. The Department has now put in place revised arrangements that improve its project grip. It is more closely involved both in nuclear regulation and in determining the scope and design of the work for the Submarine Refit Complex (paragraph 1.18).

The Department had little option but to renegotiate the contract

3.23 The Department examined alternatives to renegotiating the contract but it had little room for manoeuvre. For example, the formal options available under the contract for the resolution of disputes were reference to arbitration or litigation. The Department's legal advice was that weaknesses in the contract made it likely that DML would be entitled to recover at least some of the cost increases and DML had submitted a series of claims (paragraphs 3.8 to 3.9 and 3.13). The timescales for the legal resolution of claims were also likely to be extended and therefore unacceptable. The contract did not contain the provisions for the use of alternative dispute resolution methods, such as mediation or expert determination, which are now standard in the Department's Prime Contracts and which allow for the speedier resolution of disputes.

3.24 The Department examined a number of other options but rejected these mainly on the ground that they would result in further delays to the facilities' completion (**Figure 14**). Delayed completion was unacceptable to the Department because of the implications for the UK's strategic nuclear deterrent (paragraph 1.8).

¹² C&AG Report paragraphs 3.18 and 3.19 and Figure 11.

¹³ If DML failed to complete the Vanguard facilities by the due date, after thirty days it would be liable to pay the Department liquidated damages of £50,000 for each day of delay, up to a maximum total of £5 million. Similar provisions applied for the late completion of the attack submarine facilities.

¹⁴ C&AG Report paragraphs 1.25 and 3.28; PAC Report paragraph 6 (xvi).

14 Options to the renegotiation of the contract

The Department examined and rejected a number of alternative courses of action to the renegotiation of the contract.

- Replacement of DML with another contractor to complete construction would have delayed the facilities' completion. There would also have been problems about negotiating the interface between the new contractor and DML who would continue to own and operate the rest of the dockyard and naval base on the site.
- Taking back in-house by the Department of the submarine refit facilities (and other dockyard facilities, if necessary) would have resulted in delays.
- Suspension of the contract, with a separate agreement and price being reached for the small amount of work to be carried out to complete 9 Dock, while the rest of the contract would have been held in abeyance and revisited at a later date to resolve the outstanding issues.
- Delaying the refit of HMS Vanguard would have adversely affected the effectiveness of the UK's strategic nuclear deterrent.
- Using US facilities for the refit of HMS Vanguard was not considered practical. The US facilities for refitting and refuelling were not compatible with the design of Vanguard submarines. An extension to the existing US/UK international agreement on nuclear propulsion technology would also have had to be negotiated. Such a negotiation would have been time-consuming and a successful outcome would not have been guaranteed.
- Using Rosyth for HMS Vanguard was not possible as the facilities there could not have been readied in time.

Source: The National Audit Office

The Department inevitably agreed to meet the great majority of the cost increases

3.25 The Department maintained pressure on DML during the negotiations and reviewed the value for money of the options open to it before agreeing to the revised contract. Under this contract the Department will meet the great majority of the cost increases that have occurred.

The Department maintained pressure on DML during the negotiations

3.26 In renegotiating the contract the Department's aim was to support the submarine refit programme while seeking to achieve best value for money, including the settlement of all extant claims and avoidance of exposure to further claims. It therefore wanted the refit programme to be protected, while at the same time placing a limit on its liability for the construction project and in a manner that disallowed costs unreasonably incurred by DML.

3.27 The Department recognised that there were pressures on DML to settle. DML was keen to complete the Vanguard facilities on time to allow the revenue stream from the contract for the refit of Vanguard submarines to commence (paragraph 1.8). To exert further pressure, the Department made it clear to DML that it had other options to the contract's renegotiation and would be prepared to use these if it were left with no acceptable alternative. For example, the Department threatened to suspend the contract.

The Department reviewed the value for money of the renegotiation before agreeing to the revised contract

3.28 Before agreeing to the revised contract in December 2001, the Department assessed the value for money of this negotiated settlement option by comparing its costs against those of other alternative courses of action, such as settling on DML's terms or resorting to arbitration. This comparison showed the proposed deal to be at least £57 million (7 per cent) cheaper than the alternatives. The Department also gained Treasury approval before signing the revised contract.

Under the revised contract the Department will meet the great majority of the cost increase

3.29 Under the revised contract costs in excess of £684 million are shared (**Figure 15**). If the eventual outturn reaches £770 million, the Department will pay £727 million, while DML will meet £43 million. DML will also not receive any fee. It was entitled, under the original contract, to a profit which could have been as much as £30 million¹⁵ if it had delivered the project at the Lower Target Cost. However, in its 1997 business case for buying the dockyard, DML had not included any profit from the contract for the construction of the facilities. Rather, its decision to purchase the dockyard and build the facilities was based on the income stream generated from refit work.

¹⁵ DML was originally entitled to a profit of £25 million (inc VAT) if it delivered the project to either the Upper or Lower Target Cost (Figure 10). This rose to £30 million to reflect the additional profit on the extra work arising from variations to the contract during construction.

15 Revised payment mechanism

Under the revised contract costs in excess of £684 million are shared between the Department and DML.

| Costs incurred | Department share | | DML share | |
|---------------------|--|-----------|-----------|-----------|
| | Per cent | £ million | Per cent | £ million |
| Up to £684 million | 100 | Up to 684 | Nil | 0 |
| £684 - £712 million | Nil | 0 | 100 | 28 |
| £712 - £741 million | 100 | 29 | Nil | 0 |
| £741 - £770 million | 50 | 14 | 50 | 15 |
| | | 727 | | 43 |
| Over £770 million | Costs above £770 million will be capitalised by DML over 20 years. DML will then reclaim these from the Department as overheads as part of its charges for submarine refit work. | | | |

Source: The National Audit Office

3.30 The payment of £727 million is greater than the amount the Department had initially been prepared to pay. It pitched its initial offer at £655 million and, at the start of negotiations, put a negotiating tolerance of up to £685 million on the amount it was willing to agree to. The Department based these figures on its own estimates of the likely total costs that DML would incur in completing the project, less certain costs that it disallowed as, in its opinion, DML had only incurred these because of its own or its sub-contractors' poor performance. However, the £727 million payment is less than the £813 million DML originally claimed. DML had also wanted to retain its entitlement to a profit.

3.31 DML's £43 million contribution to the cost increases is greater than DML's liability of £35 million under the original contract (paragraph 3.21) and DML's £20 million estimate of the extra costs arising from its own poor performance and that of its sub-contractors (paragraph 2.26). However, this contribution and DML's lost profit of £30 million are less than the Department's estimate of £86 million to £110 million for the extra costs arising from poor contractor performance (paragraph 2.16). Thus the effect of the re-negotiation is that, based on the Department's estimates, DML has only partly borne the risk of such poor past performance. The Department has met the cost of all other risks which had been transferred to DML under the original contract and then materialised, as well as some of the cost of the poor past contractor performance.

3.32 Under the revised deal, with the exception of a small number of pricing exclusions, all other risks borne by DML and the Department are included in the renegotiated model for calculating the DML costs payable by the Department. For example, extra costs arising from future poor performance by DML and its subcontractors, or the effects of late delivery of information by the Department, will be included as a

properly incurred cost. However, in our opinion, at this late stage of the project there is less scope for the Department's poor performance to have a significant impact on costs than DML's.

3.33 Costs above £770 million will be met by DML in the first instance. It will then, under the 1997 agreement for the dockyard's sale, capitalise these costs, recovering them from the Department over 20 years as overheads as part of its charges for submarine refit work. There is no limit on the costs above £770 million which can be capitalised. Such capitalisation will only occur after the Department has reviewed these extra costs to ensure they are allowable under the 1997 agreement. DML cannot capitalise its £43 million contribution to costs below £770 million.

3.34 Although the Department is continuing to monitor DML's costs on the project, the capitalised costs are not included in the Department's budget for the project of £812 million (Figure 9). The recovery of these costs over 20 years means that the Department could lose visibility over the total cost of the project when reporting this to Treasury and Parliament, compared to the more traditional funding option whereby the Department would have met the project costs as they occurred.

3.35 The Department considers that these provisions for capitalisation provide DML with an incentive to contain its costs. DML's scope for borrowing to fund its general business requirements will be restricted by the extent to which it needs to borrow to finance its work on this project. However, in our view, it may not be too difficult for DML to raise the necessary extra financing, provided it can demonstrate to prospective lenders a continuing order book for refit work with the Department and hence give assurance that the major part of any capitalised costs can be recovered, albeit over 20 years.

3.36 When it signed the revised contract, the Department had a low expectation that DML's costs would exceed £770 million and therefore that the provisions for capitalisation would be used. It therefore did not assess the value for money of entering into such an arrangement. By August 2002 DML's committed expenditure had exceeded £770 million. Also, DML's estimate of its total costs to complete the works had reached £848 million. DML will therefore, on current estimates, be seeking to capitalise expenditure of £78 million, resulting in extra payments by the Department over 20 years equivalent to £37 million at 2001-02 prices (paragraph 2.9).

3.37 As part of the settlement the Department and DML have agreed not to pursue any claim against the other, whether new or existing, in respect of any matter arising before the revised contract. They have also replaced the previous provisions for liquidated damages for late completion. If DML fails to meet the new completion dates through its own fault, it will spend up to £2 million for each submarine to ensure that the refits of the second Vanguard submarine and next Trafalgar class submarine due for refit are carried out on time.

Appendix 1

PAC recommendations

Treasury Minute on the Eighth Report from the Committee of Public Accounts 1998-99 - Ministry of Defence: Sales of the Royal Dockyards

This appendix details the Committee of Public Accounts' previous recommendations on the construction of the nuclear submarine facilities at Devonport.

| PAC Conclusion | Treasury Minute |
|----------------|-----------------|
|----------------|-----------------|

PAC conclusion (iv):

The Department are funding five projects to upgrade submarine dock facilities at Devonport and Rosyth for submarine refit work. In our judgement the cost increases on three of the five projects have been massive - almost £193 million in total, or 57 per cent. There have been lengthy delays too - more than six years on one project. As these are key facilities for the refitting, repairing and refuelling of submarines, there are operational implications.

The Department notes the Committee's concern and accepts that the increases and delays were substantial. The delays on the dock facilities at Rosyth were largely a result of the more stringently applied nuclear safety standards. However, the Department judges that there were no operational implications as a result of these delays. At Devonport, the D154 project work is scheduled to complete in stages such that the facilities will be available to support the planned submarine refitting programme.

PAC conclusion (xv):

We consider the £156 million (60 per cent) cost increase on the key D154 capital works project at Devonport spectacular and the reasons for it are unsatisfactory. That the Department failed to include in their earlier estimate some £70 million for profit and for management costs is wholly unacceptable and raises serious questions about their management of the project.

The Department notes the Committee's comments and regrets the omission of profits from the original estimate. Profit was excluded from the original proposals in 1993, but the companies were asked to provide indicative costs to upgrade facilities for purposes of comparison only. These proposals were not of contractual quality and were not expected to scope all aspects of the project but were intended to allow an informed decision to be made as to the preferred location for nuclear refitting. Project management costs were not given visibility in the original estimate because, at the time, they were included within nuclear refitting overheads; it was later decided that to ensure full visibility and better attribution of all D154 costs, they should be included in the project costs.

PAC conclusion (xvi):

The Department have assured us that they have now "teased out" the cost increases on the D154 project and that they are confident of the project being delivered within their latest estimate of £417 million.¹⁶ However, we note that this excludes the Department's contingencies, and is based on the Department's estimate of the most likely contract cost, which is £95 million lower than the maximum contract cost. And the Department would have to bear the costs of completion in the event of the company breaching the contract.

The Department notes the Committee's observations. The Department's liability is limited by a maximum contract price excluding contingencies. The contingency fund is held to cover risks which we retain and, to date, only a small percentage of this fund has been used. The Department would bear additional costs in the highly unusual event of the company breaching the contract; however this is considered unlikely as without the facility, the company could not undertake nuclear submarine refitting and would be deprived of their main source of income.

PAC conclusion (xvii):

We note the Department's assurance that the geological investigations at Devonport were thorough and indicate that the rock underlying the D154 complex provides adequate foundations for upgrading the docks for nuclear refitting and refuelling purposes.

The Department can confirm that the bedrock underlying the D154 complex has been subject to detailed geological survey and analysis and has been found to provide a satisfactory foundation for the facilities.

¹⁶ The £417 million is at 1996-97 prices and reflects the Lower Target Cost for DML's costs. It includes VAT and the Department's other costs but excludes the contingencies for the risks the Department retained. The equivalent figure at 2001 prices is £470 million (Appendix 3).

PAC Conclusion

Treasury Minute

PAC conclusion (xviii):

When examining the Trident Works Programme our predecessors emphasised the need to have a clear and early perspective of the overall scale and content of the programme, which should be managed as a strategic whole. However, we now find that there have been cost increases and delays on the D154 project at Devonport on a grand scale. These suggest once again a lack of strategic grip over major works projects. We are not convinced, therefore, that the Department have applied fully the lessons learned from Trident Works Programme, and we look to them to ensure that these expensive lessons are now fully learnt.

The Department has applied the lessons learnt from the Faslane Trident Works Programme in full to the D154 project and considers that D154 as a whole meets its strategic needs for nuclear submarine refitting and refuelling facilities for the foreseeable future. The elements that contributed to the cost escalation on the Trident Works are well documented and the Department has sought to avoid these on Project D154 by the implementation of firm control measures:

- the Trident Works suffered from dispersed management arrangements. On D154, the Department appointed an MOD project sponsor as a single point of contact. The project sponsor is supported by a specialist team, including experts from industry with appropriate nuclear works experience;
- construction of the Trident Works began before the design had been completed and many changes took place after contract placement. On D154, the Department placed a prime contract with the dockyard company for the design, construction, commissioning and acceptance of the facilities. The prime contractor must complete the design and safety case and gain consent from the nuclear regulator before starting construction;
- the contractors for the Trident works were not responsible for ongoing site operations which could affect, or be affected by, the nuclear works programme. On D154, the prime contractor is also the dockyard owner and site licensee and is wholly responsible for all interfaces between various elements of the work and between the project and the operating dockyard;
- minimal risk was transferred to the contractors under the Trident Works programme. On D154, the Department identified risks contained within the project before contract award and an appropriate level of risk was transferred to the prime contractor. The pricing arrangement for the contract reflects the risks held by the contractor, including the responsibility for ensuring the facilities are fit for purpose and meet the required standards of nuclear safety;
- stage payments for the Trident Works were made on the basis of measurement of work undertaken, leading to disputes between the Department and the contractor. On D154, the Milestone Payment Plan ensures that payments to the prime contractor are linked to the achievement of specific, key events that represent real measures of progress in the project; and
- the contractors on the Trident Works programme were not constrained by any pre-agreed maximum price. On D154, the Department has negotiated a maximum price contract.

Appendix 2

Methodology

Scope of this study

- 1 In undertaking this examination we were seeking to identify the contractual performance as regards the delivery of the key facilities to time and budget, to analyse the reasons for cost increases, and to review the Department's management of the renegotiation of the contract.

Methodology

- 2 We undertook an issue analysis examining:
 - Whether the project's performance had been adequate to date;
 - Whether the Department's project management had been adequate; and
 - Whether Parliament could take assurance that the facilities would now be delivered on time and to the new budget.
- 3 We collected the evidence in support of our findings under each of these issues from the information contained in the Department's records, and got the Department to undertake a special exercise to analyse the reasons for the cost increases on this project. We held discussions with the Department, Devonport Management Limited, the Nuclear Installations Inspectorate, the Department's nuclear regulator, CNNRP, and Rolls Royce, the Department's designer of the submarine reactors. We also reviewed our 1998 report on the Sales of the Royal Dockyards, which included coverage of the original contract for the submarine facilities, and the associated Committee of Public Accounts Committee report and Treasury Minute.
- 4 We held a focus group to identify the general lessons arising from the project for other construction projects and Prime Contracts. Attendees included Department staff involved in the management of the project and other users of prime contracting within the Defence Logistics Organisation and Defence Estates.
- 5 We used the following external consultants:
 - John Boulwood, BSc LLB(Hons) MRICS ACI Arb, and Derek Smith, FInstCES FIHT, of Turner and Townsend, a firm of construction consultants, to review the original and revised contracts and the Department's original risk management arrangements, and to identify lessons for the Department's future use of Prime Contracts; and
 - Frank Allen, MA, PhD, MBA, FSARS, Ceng, of Serco Assurance, a firm experienced in risk management in the nuclear sector, to act as the facilitator for the focus group and to provide an informed source of background advice on the regime for the regulation of nuclear safety.

Appendix 3

Inflation adjustments to the costs of the project

The cost figures contained in the previous reports of the National Audit Office and Committee of Public Accounts were based on the Department's original 1997 budget for the project. The majority of this budget was at 1996-97 prices to reflect the price base of the budget's largest element, the costs of the DML contract. However, although the prices in this contract were at 1996-97 levels, the contract allowed for increases in these costs using pre-agreed formulae to account for inflation during the life of the contract, 1997 to 2005. In line with its usual policy¹⁷, the Department uprated the approved budget figure each year by the GDP Deflator to reflect inflation. By 2001 the inflation adjustment had increased the original budget figure of £577 million by £73 million to £650 million (**Figure 16**).

In this Report we have used the inflation-adjusted figures for the original budget so that these are on a comparable price basis to the revised budget of £812 million that the Department set in December 2001.

16 The original and inflation-adjusted budget for the project

| | Original budget (1996-97 prices) | | | Original budget (2001-02 prices) | | |
|---------------------------------|-------------------------------------|-----------------------------------|---------------------------|-------------------------------------|-----------------------------------|---------------------------|
| | Lower target cost £ million | Upper target cost £ million | Maximum cost £ million | Lower target cost £ million | Upper target cost £ million | Maximum cost £ million |
| DML contract costs | | | | | | |
| Works costs | 315 | 339 | 399 ¹ | 355 | 382 | 449 |
| VAT on works costs ² | 35 | 38 | 50 | 39 | 43 | 56 |
| Total works costs | 350 | 377 | 449 | 394 | 425 | 505 |
| DML's profit | 20 | 20 | 0 | 23 | 23 | 0 |
| VAT on profit | 2 | 2 | 0 | 2 | 2 | 0 |
| Project management costs | 11 | 11 | 0 | 12 | 12 | 0 |
| Total payable to DML | 383 | 410 | 449 | 431 | 462 | 505 |
| Other costs | | | | | | |
| Pre-contract work ³ | 21 | 21 | 21 | 24 | 24 | 24 |
| Other Department costs | 13 | 13 | 13 | 15 | 15 | 15 |
| | 417 | 444 | 483 | 470 | 501 | 544 |
| MOD contingencies | 80 | 80 | 80 | 90 | 90 | 90 |
| VAT on contingencies | 14 | 14 | 14 | 16 | 16 | 16 |
| Total project cost | 511 | 538 | 577 | 576 | 607 | 650 |

NOTES

1. In its submission to Treasury in January 1997, the Department assumed a Maximum Price of £399 million which was reduced by negotiation to £394 million at contract signature in March 1997.
2. The Department assumed that it would recover some of the 17.5 per cent VAT charges it incurred.
3. The Department paid DML for design work prior to the contract's award. This payment was not included in the price of the contract. The figures include VAT.

Source: The National Audit Office