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REVIEW OF THE SUBMARINE ACQUISITION/CAPABILITY LIFE-EXTENSION PROGRAM

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Canada 

SYNOPSIS

This report presents the results of an independent review of the Project to acquire four diesel-powered submarines from the United Kingdom.

The 1994 Defence White Paper noted the intention to explore the possibility of acquiring four conventional Upholder Class submarines from the UK to replace the aging Canadian submarine fleet. As the UK had decided to focus on a nuclear-powered fleet, it had placed all four of these diesel-powered submarines in preservation status in 1994, shortly after they had been commissioned. Known as the Submarine Capability Life-Extension (SCLE) Project, the contracts to purchase these vessels were signed on 2 July 1998, and the class was renamed the Victoria Class.

The principal aim of this review was to assess the management of the SCLE Project. It encompassed the two major components of the Project:

- a. the four submarines, simulators for training and the technical data package; and*
- b. the initial UK-based training, the subsequent relocation of the simulators to Canada, the Canadian modernization work effort, spare parts and contingency.*

The review did not assess the submarine's operational capabilities; i.e., the performance characteristics against operational requirements.

The approved capital budget for the Project was \$812M. This budget was \$54M less than the original programmed estimate, the result of financial pressures being experienced by the Department in 1998. One key strategy intended to manage within this budget was that the initial procurement of spare parts would be accomplished on a "just-in-time" basis.

Value-for-Money. Planned Project costs contrasted sharply with the projected costs of \$3B to \$5B for completely new submarines. The purchase price of the Victoria Class was no more than 30 per cent of the projected cost of new submarines, and the remaining operational life amounted to about 80 per cent. In view of the low usage rate by the Royal Navy, and the comparatively low purchase price, at the outset, the acquisition of these boats established a significant margin for value. This healthy margin began to erode as the Project schedule experienced delays.

Increased Capital Costs. We estimate that the capital budget must be increased to at least \$897M to account for all costs which fall within its scope. Otherwise, other budgets will continue to absorb the costs of Project-related expenditures, principally the operating budgets of Chief of Maritime Staff (CMS) and the Director General Maritime Engineering Program Management (DGMEPM). The expenditures involved pertain to such items as spare parts, test equipment and construction at Halifax and Esquimalt. A portion of the cost increase (\$15M) can be attributed to a recent decision to increase the project scope.



Downstream Costs. Logistics support for the Victoria Class has encountered significant difficulties. Parts cataloguing is lagging seriously and there are concerns that inventory holdings of spare parts, special tooling and test equipment, are inadequate. These shortfalls will be addressed by a one-time transition cost of to be paid from the DGMEPM operating budget. These one-time transition costs are required to kick-start inventories and equipment in order to support progress toward steady state.

Original (1996) departmental estimates of the annual Victoria Class Personnel, Operations and Maintenance (PO&M) costs were based on the expectation that the four newer boats could be operated for the same cost as the three Oberon Class boats that were being replaced. It is now apparent that these estimated costs would be exceeded by 25 per cent (i.e., \$121M versus \$97M at steady state), albeit they will support an increase in combat capability. The Navy O&M budgets are already experiencing considerable strain, due to the recent high tempo of operations. A review of the entire Victoria Class in-service support costs is recommended. We have noted the considerable justification for the extension of the current in-service support arrangement with the original equipment manufacturer out to the year 2007 and have recommended the rationale be captured in a business case.

Risk Management. Reactivation of the submarines to meet safe diving certification prior to acceptance by DND is the technical and financial responsibility of the UK. This has proven to be an important risk mitigation and cost avoidance strategy for Canada. However, schedule delays caused by the emergence of numerous technical difficulties during the reactivation remain problematic. Canadian modifications are also contributing to the length of time it will take to achieve an Initial Operational Capability. We have concluded that risks associated with this procurement have been under-estimated. Experience has shown that the procurement of a small production run of complex naval vessels will, in early days, involve technical difficulties and lessons learned; this is not an unusual occurrence.

Schedule. Technical difficulties have resulted in a delay of about two years in training. Simulators and training devices were moved to Canada, to commence training in 2003. This has meant that the boats themselves were the only way of conducting training in the interim. With the planned deployment of HMCS Victoria to the west coast in 2003, the training capacity on the east coast will be reduced even further.

Basing on the East & West Coasts. In 1999, the Navy decided that a balanced deployment of the fleet was the preferred option; i.e., two boats on each coast. Nevertheless, this option was thought to be too costly, and the Navy opted for a three-to-one split in favour of the east coast. Our analysis indicates, however, that incremental annual recurring costs for a second boat on the west coast would be about \$1.4M and the non-recurring costs would be \$4.8M. The advantages would be a better balance in training and operational capability on both coasts. Accordingly, to the extent that costs were a significant determinant in the decision-making process, we recommend that current deployment plans be revisited.

Savings Opportunities. It should be noted that potential exists to pursue/negotiate savings of as much as in the areas of contract management, logistics support and Oberon decommissioning. Additional opportunities exist to enhance the management of the spare parts inventory.



PRINCIPAL RECOMMENDATIONS & MANAGEMENT ACTION PLANS

Ser	CRS Recommendations	OPI	Action/OPI Comments
1	Monitor and routinely brief the Senior Review Board (SRB) on the risks and costs associated with the Canadianization Program.	PMO SCLE	The Project Manager will continue to brief the Canadianization Work Period (CWP) Engineering Change (EC) details to senior staff. Senior staffs were recently briefed on 17 September 2003. The next SRB is scheduled for January 2004.
2	Re-establish the total Project costs and bring them forward to Program Management Board (PMB) to clarify and adjust the SCLE Project funding to cover the costs of supporting infrastructure and equipment (\$85M). Risks affecting Project costs should be re-examined to ensure that remaining contingency funding will be sufficient.	PMO SCLE	The SCLE Project is scheduled to brief PMB in November 2003. Total Project costs for the SCLE have increased by \$85M after including the CRS identified requirements/projects now being funded by the Chief Maritime Staff budget and by National Procurement funding. SCLE has determined that \$47M, will be required to complete these “additional” projects. This will be cash-phased in the out-years of the SCLE, thus alleviating the current capital constraints.
3	Ensure a business case captures the rationale for amending the ceiling for the Engineering & Supply Management Contract.	DGMEPM/ DMCM Subs	Completed as part of approval documentation/submission 18 June 2003.
4	Evaluate and action, as practicable, in cost savings/avoidance and performance opportunities.	DGMEPM/ DMCM Subs	An evaluation is currently in progress.
5	To the extent that costs have affected the decision on the east/west coast distribution of submarines, this decision should be revisited.	CMS/ DGMFD	MARCOM Capability Planning Guidance 2004 notes the intention to place two submarines at each of east and west coasts.

Note: the above management action plans have been condensed and edited. The full set of recommendations and expanded text of management action plans are presented, commencing at report page 28.



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**HMCS Cornerbrook Acceptance Trials 1992
(all photographs courtesy of SCLE Project Office)**

RESULTS IN BRIEF

INTRODUCTION

1. Canada is currently in the process of accepting delivery of four used Upholder Class submarines, pursuant to a 1998 contract with the United Kingdom Ministry of Defence (UK MOD). Three submarines are not yet fully operational as they are being retrofitted with Canadian-supplied equipment and are undergoing preventive and corrective maintenance. The remaining boat is in the UK pending completion of reactivation and successful acceptance testing. The Project to acquire and put into service these submarines is referred to as the Submarine Capability Life-Extension (SCLE).

2. This review has taken place during the implementation phase of the Project; the observations and recommendations are based on the progress of the Project up to March 2003.

BACKGROUND

The remaining operational life of the four Upholder Class submarines is considered to be significant in view of the relatively short length of time the boats were in service with the Royal Navy.

3. Starting in the mid-eighties, the Department of National Defence (DND) began assessing several options for the acquisition of new submarines. The 1994 Defence White Paper reiterated the submarine requirement and acknowledged the possibility of purchasing used submarines from the UK. Given the fiscal constraints facing DND and the fact that new submarines were projected to cost between \$3B to \$5B, the option to purchase used submarines was regarded as being both affordable and operationally acceptable. In 1994, as the result of a UK defence policy decision to concentrate on a nuclear powered submarine fleet, the UK offered to sell its four Upholder Class submarines to Canada. By July 1998, contracts had been signed for the acquisition of the four submarines, spare parts, support equipment and trainers.

The total budget approved for the SCLE Project was \$812M (BY).

4. The remaining operational life of the four Upholder Class submarines is considered to be significant in view of the relatively short length of time the boats were in service with the Royal Navy. It is expected that a submarine of this class would have an operational life of 30 years. The oldest boat was launched in 1986 and commissioned in 1990, while the newest was launched in 1989 and commissioned in 1993. In 1994, they were all decommissioned and placed in a custody, care and maintenance program at the builder's shipyard in the UK.



Upholder Class in Long Term Storage

5. In addition to the four submarines, the purchase includes simulators and other training devices that have been moved to Halifax so that training could begin in 2003.
6. After each submarine has been accepted, it sails to Halifax where the SCLE Project funds the installation of the CF combat systems and sensors at the Fleet Maintenance Facility Cape Scott. This phase of the Project is known as the Canadian Work Period (CWP).

AIM

7. The principal aim of this review was to assess the management of the submarine acquisition. The review did not assess the submarine's operational capabilities; i.e., the performance characteristics against operational requirements. As the review progressed, the review scope was expanded to include life-cycle cost estimates and certain program issues, such as the decision to base submarines on both coasts.

GLOBAL ASSESSMENT

The cost of these submarines, relative to that projected for the acquisition of new boats – \$3B to \$5B – established a significant margin for value.

8. **General.** Barring unforeseen technical problems, particularly in the reactivation of the last boat, which currently remains in the UK, the SCLE Project will deliver four operational submarines and attendant support requirements. The cost of these submarines, relative to that projected for the acquisition of new boats – \$3B to \$5B – established a significant margin for value.

9. It is not unusual for a small production run of complex naval vessels to experience early technical difficulties and fixes. Accordingly, strategies were employed to contractually mitigate the financial impact of the many risks involved. Significant schedule delays (currently more than two years) in accepting the boats are substantially attributable to extra time required for the UK to fulfill its contractual obligations relative to the reactivation of the submarines. Indications are that the delivery of the last boat will not occur before Summer 2004; the original schedule called for this last boat to be reactivated by the UK by October 2001. Further, work to *Canadianize* the submarines has yet to complete a full conversion of the first boat; this continues to be an area of relative risk warranting concentrated attention. All things considered, a principal shortcoming relative to the objectives of this procurement is the substantial slippage in the delivery schedule.



To date the impact of these difficulties has been felt most noticeably on crew training and the delayed operational deployment of the boats.

Schedule Delay

Submarine	Delivery Date Planned	Actual/Revised Delivery	Operationally Ready Planned	Operationally Ready Revised (1)
HMCS Victoria	April 2000	October 2000	January 2001	Spring 2005
HMCS Windsor	October 2000	October 2001	July 2001	Fall 2004
HMCS Cornerbrook	April 2001	March 2003	January 2002	Spring 2005
HMCS Chicoutimi	October 2001	June 2004	July 2002	Winter 2005

Note (1): Dates reflect Project office schedule as of March 2003.

Costs

10. **Capital Costs.** We estimate that the approved budget of \$812M will be exceeded by about \$85M. Given that the SCLE Project budget was constrained at the outset, it became necessary to limit Project scope through interpretation. The approved budget was more than \$50M less than original estimates. Recently, the scope of the project was increased by \$15M to include training simulation and magnetic/noise signature reduction. However, we conclude that excluded requirements amounting to an estimated \$85M, now being absorbed by other budgets, should be addressed within the Project. The addition of these costs would bring the Project capital costs to \$897M, representing a 10 per cent increase over the currently approved budget.

... it became necessary to limit Project scope through interpretation.... However, we conclude that excluded requirements amounting to an estimated \$85M, now being absorbed by other budgets, should be addressed within the Project.

11. In addition to the current SCLE Project, there are a number of submarine-related acquisitions that will be initiated by the Department prior to the Victoria Class mid-life refit in 2010. These capital procurements would have been required had the old Oberon Class submarines been retained. The estimated cost of these acquisitions amounts to \$107M. These were originally programmed to support the Oberon Class boats and do not represent additional costs associated with the Victoria Class. All but three projects worth \$8M have had visibility outside of DND.

Capital Cost Summary	Approved Project Budget/Estimate (\$M)	CRS Estimate (\$M)	Variance (\$M)
SCLE Capital Project (BY \$)	\$812M	\$897M	\$85M
Associated Capital Projects (BY \$)	\$99M	\$107M	\$8M

At the same time, the additional boat will provide the Navy with more combat capability.

12. **Support Personnel, Operations & Maintenance (PO&M) Costs.** Once all four boats have been delivered, the annual steady-state PO&M costs for the Victoria Class submarine are estimated by CRS to be about \$121M (2002/03 \$), based on the most current data available to DGMEPM. This exceeds the original estimate of \$97M by \$24M per annum, or 25 per cent.

The original estimate was based on the premise that four newer Victoria Class boats could be operated at the cost of three older Oberon Class boats. At the same time, the additional boat will provide the Navy with more combat capability. We found that the downstream annual impact on National Procurement expenditures will be roughly comparable to those for other Canadian Forces combat systems of like complexity.

13. Transition to the in-service phase for the Victoria Class submarines will now include a one-time infusion of, to be funded as O&M. This is comprised of: \$68M in initial provisioning of spare parts; in potential intellectual property; \$16M for other services; and, \$38M for refit (repair & overhaul) materiel. The refit materiel has been purchased as a special buy to take advantage of a contractor initiative to dispose of inventory. A previous contract submission identified \$66M for the procurement of this material, but the final negotiated price was actually \$38M. The additional initial provisioning and intellectual property costs can be characterized as unanticipated. Had the just in time spare parts philosophy proven to be effective, the spares procurement of \$66M would have been phased over a number of years.

Personnel, Operations & Maintenance Cost Summary	Approved Project Budget/Estimate (\$M)	CRS Estimate (\$M)	Variance (\$M)
Steady State PO&M (2002/03 \$)	\$97M per year	\$121M per year	\$24M per year
One Time Transition O&M (BY\$)	\$38M

14. **The Engineering & Supply Management (ESM) Contract.** The ESM contract is the means of procuring O&M support for the Victoria Class submarines. The ESM contract costs are a subset of the PO&M costs. The chart at Annex C provides a multi-year view of the estimated PO&M costs beginning in 1998.

15. The proposal to extend the existing six-year ESM contract will increase the ceiling from the current \$192M to This increase is substantially attributable to the previously-mentioned one-time transition costs of, an original under-estimation of ongoing costs, and extension of the contract to It is our view that the proposed ESM contract ceiling should be to reflect the deferred support costs up to associated with the delayed delivery of the fourth boat. We have conducted several rough-order tests which have not refuted the reasonability of the ESM contract costs.

From the start, the project leader and manager have been forthright and open in their explanations of what can and should reasonably fall within the scope of the project. Concern was expressed early on regarding budget constraints facing the Project.

16. **Project Management.** We encountered a professional Project staff, dedicated to delivery of an effective submarine capability. Based on the concept of life-extending an existing capability, there have been gray areas relative to the Project scope and the corresponding demands on the approved Project budget. From the start, the Project leader and manager have been forthright and open in their explanations of what can and should reasonably fall within the scope of the Project. Concern was expressed early on regarding budget constraints facing the Project. Our review has now shown that certain currently excluded capital costs (at least \$85M) should be accounted for within the Project's budget. The Project also defined a just-in-time strategy for the initial provisioning of spare parts. This

proved unworkable and has necessitated a \$68M supplemental purchase of spares (these form part of the one-time O&M transition costs to which our comments on costs refer). These costs aside, the Project office has demonstrated control of its financial resources.

17. We have also observed that vigilance will be required to ensure a successful work program for the Canadianization of the submarines; our experience has shown that this type of customization and integration work holds particular challenges. Technical obstacles invariably arise as work progresses. To date, estimated costs for this Canadianization have grown from \$58M to \$71M (part of the Project budget), an increase of 22 per cent, and the work program has yet to be completed for the first submarine delivered.

Principal Concerns and Issues

18. This section is presented in two parts, the first dealing with the submarine acquisition and the second dealing with the associated program issues, the latter having implications beyond the responsibility of the Project office.

Submarine Acquisition

19. **Risk.** The challenges associated with the UK submarine reactivation and the Canadianization Work Period (CWP) were under-estimated. An assumption was made that off-the-shelf procurement is generally low risk in nature. Under-estimating the technical risks may have contributed to the overly optimistic schedule for conducting submarine operations. Originally planned for 2002, an operational capability may not be achieved before fiscal year 2004/05. Furthermore, the Navy will absorb additional training and CWP costs totalling approximately \$8M.

20. **Acquisition Costs.** At the outset, the SCLE Project office faced the challenge of an approved capital budget which was roughly \$50M, or 7 per cent, less than originally estimated requirements. This constrained budget, attributable to Departmental financial pressures, led, at least in part, to a interpretations which limited the Project's scope. It has also contributed to a situation whereby costs of about \$85M were being covered by other budgets. Although these costs were not accounted for as capital acquisition expenditures, they were disclosed as submarine expenses in the other Navy operating budgets. In addition, there are five other



programmed capital projects and miscellaneous requirements associated with the submarine program that are expected to be implemented prior to the Victoria Class midlife upgrade in 2010 in order to provide for a complete submarine capability.

21. **Life-Cycle Support Estimates.** Shortfalls in submarine maintenance funding can reduce the operational effectiveness of a submarine as well as reduce the number of days of safe operation at sea. A 25 per cent increase in steady-state annual PO&M costs may result in a reduction of the number of available operational sea days from 220 to 167 per year, unless additional O&M funding resources can be found. The available sea days may be reduced further if the Navy NP apportioned account allocation is not able to fund the one-time O&M transition costs necessary to reach steady state by 2005/06.

Associated Program Issues

With respect to the distribution of the CF's submarine capability, the documentation we reviewed referenced a permanent west-coast presence for the Victoria Class.

22. **West-Coast Basing.** With respect to the distribution of the CF's submarine capability, the documentation we reviewed referenced a permanent west-coast presence for the Victoria Class. A brief historical record of the events that lead up to the decision to deploy submarines on the east and west coast is provided at Annex A. It is our understanding that, in 1999, the Navy considered it operationally advantageous to base two boats on the west coast but in view of the perceived high costs involved, had opted for a single boat. Our analysis has shown that the incremental costs of placing a second boat on the west coast would be marginal (\$4.8M non-recurring and \$1.4M recurring annual).

23. **Manning/Training.** Due to the delays in the submarine reactivation schedule and their adverse impact on the Navy's capacity to train submariners, the required manning levels for the Victoria Class fleet will not be achieved before the year 2007 – a delay of at least one year.

Opportunities For Cost Savings and Other Improvements

24. Potential cost savings totalling and opportunities to improve materiel management have been identified during the course of the review. They are as follows:

- Victoria Class
 - Engineer and Supply Management contract
 - Contract management (\$8.2M)
 - Initial support contract (\$7.6M)
 - Supply arrangement for spares (\$1M to \$1.5M)
 - Cataloguing of spares (improved effectiveness)
- Oberon Class
 - Inventory disposal (\$9M)
 - Inventory management (improved effectiveness)



PRINCIPAL RECOMMENDATIONS

25. To ensure complete and clear accounting and accountability for the activities and costs of the SCLE Project, we recommend that action be taken to clarify and amend the Project's approval documentation to fund those items/requirements that should fall within its scope. At a minimum, this would include the \$85M in Project-related costs. Risks associated with these Project related costs should be re-examined as well to ensure that remaining contingency funds are sufficient.
26. To the extent that costs have affected the decision on the east/west coast distribution of submarines, it is recommended that CMS revisit the options.
27. We also believe there is considerable justification for increasing the ESM contract ceiling and extending its length beyond six years. A business case should fully capture the rationale for this contracting strategy.
28. Opportunities for savings and performance improvements identified by CRS should be evaluated and pursued as appropriate. We acknowledge that some opportunities will be subject to contract negotiation.
29. Risks relative to the *Canadianization* program should be carefully monitored and routinely briefed to the Senior Review Board.



PART I – INTRODUCTION

BACKGROUND

1.1 In 1990, given the perceived threat and the ageing nature of the existing fleet, DND acknowledged the need to replace its submarines. By 1993, a Program Development Proposal had been prepared for a submarine acquisition Project and submitted to the Program Control Board for approval. This document outlined several options, including the acquisition of used submarines; even though none were available at that time. In 1994, the situation had changed and the option of acquiring used vessels from the UK had materialized. As a result of a decision on the part of the UK to standardize their submarine fleet on nuclear powered submarines, four unique, conventional, diesel-electric boats named the Upholder Class, became available. These boats, while described as used, had in fact little operational time at sea before being put in storage in 1994. The oldest, for example, had been launched in 1986 and commissioned in 1990 while the newest was launched in 1989 and commissioned in 1993. The anticipated operational life cycle of this submarine class is 30 years.

These boats, while described as used, had in fact little operational time at sea before being put in storage in 1994.

... the Defence White Paper ... stated the government's intention to explore the possible acquisition of the four conventional Upholder submarines from the UK.

1.2 In 1994, the Special Joint Committee (SJC) on Canada's Defence Policy reinforced the requirement for submarines. It concluded that a balanced force of surface ships, three to six submarines, aircraft and fixed surveillance systems was the most efficient and cost-effective means for protecting Canada's maritime interests. Shortly after the release of the SJC's report, the Defence White Paper was published. It reiterated the SJC position and stated the government's intention to explore the possible acquisition of the four conventional Upholder submarines from the UK.

1.3 In the four years that followed, Canada and the UK embarked upon an intense period of negotiation, culminating in July 1998 with the signing of contracts to purchase the four submarines. These Upholder Class submarines were to be renamed the Victoria Class and re-christened HMCS Victoria, HMCS Windsor, HMCS Cornerbrook and HMCS Chicoutimi.

1.4 The scope of the submarine Project, officially referred to as the Submarine Capability Life Extension (SCLE) Project, included the acquisition of the boats, their on-board spares, crew training, the Canadianization work period (CWP), and the delivery of on-shore spares and training simulators to Halifax. As portrayed in Table 1, the acquisition was subdivided into two separate contracts and other Project costs that totalled \$812M. This figure was not to be exceeded and, while considerable, it was more affordable than a \$3 to \$5 billion estimated acquisition cost for new submarines.

Cost Description	(\$M) BY
Main Contract	\$501
Initial Support Contract	\$160
Other Project Costs	\$151
Total Project Cost	\$812

Table 1 – Project Capital Costs and Contracts

1.5 The \$501M main contract consists of an eight-year, interest-free, lease-to-buy agreement at a fixed price in Canadian dollars for the submarines, technical data package and the training simulators. A nominal sum of one-pound sterling is then paid at the end of the lease to acquire the submarines.

1.6 The \$160M Initial Support Contract is also fixed-price and includes training, the acquisition of initial spares, special tools and support equipment. The remaining Project costs, amounting to \$151M, include contingency, relocation of simulation trainers to Canada, infrastructure, and the Canadian modifications carried out during the CWP.

1.7 An in-service support contract was also arranged at the time of the acquisition. This \$86M contract, not included in the Project’s capital cost, was awarded to the submarine Original Equipment Manufacturer (OEM). Known as the Engineering and Supply Management (ESM) contract, six-years of support services such as provision of spares, maintenance and technical expertise were to be provided for from 1998 to 2004. A \$36M ceiling price was specified in the contract for evolved work including engineering services, spare parts as well as repair and overhaul (R&O). The remaining \$42M (plus \$8M reserved for economic price adjustments) represented firm fixed-price payments for core services such as configuration control and inventory management provided by 31 full time OEM staff. In April 2002, the ceiling of the contract was raised to \$192M to accommodate an increase in evolved work. At the time of our review, the Navy intended to seek the option to extend the ESM contract year-by-year, as necessary,

... any safety-critical problems discovered during reactivation were to be corrected at the UK’s expense.

1.8 The main contract stipulated that the responsibility for reactivating the submarines rested with the UK. Safe-to-dive certificates were to be issued for each vessel prior to acceptance by Canada. Furthermore, any safety-critical problems discovered during reactivation were to be corrected at the UK’s expense. Once accepted, it became Canada’s responsibility to upgrade the boat and fit it with Canadian supplied equipment. This responsibility was to be executed by the Fleet

Maintenance Facility (FMF) in Halifax, funded by the SCLE Project. We noted that at the time of acceptance, operations and maintenance responsibility was transferred from the Project Office to CMS.

1.9 Payments were to be made to a bank account in Canada, in Canadian funds. Under the terms of the agreement, these funds could be used to repay Canada for various items, such as UK training in the Goose Bay, Wainwright and Suffield facilities. Payments were to be made as specific submarine reactivation milestones were met.

AIM AND METHODOLOGY OF THE REVIEW

1.10 The principal aim of this independent review was to assess the management of the submarine acquisition Project. The review did not assess the Victoria Class submarine's operational capabilities; i.e., the performance characteristics against military requirements. As the review progressed, it's scope was expanded to include life-cycle cost estimates and certain program issues, such as submarine basing.

1.11 The criteria used for the review, outlined in Annex B, were derived from the Office of the Auditor General guide, Auditing Capital Asset Projects, as well as the US DoD Inspector General's, A Guide to Auditing Defence Acquisition Programs.

1.12 The report is provided in four parts with all recommendations appearing in Part IV. Part I is the Introduction. Part II addresses our principal concerns. Part III discusses opportunities for cost savings and performance improvements. In Part IV, recommendations are grouped under the respective Offices of Primary Interest (OPI).

1.13 The specific methodology used by the review team was to examine files and documents, conduct interviews with key personnel, conduct a site visit, perform financial analysis for comparative purposes against Project estimates, and analyze data from finance, maintenance and supply information systems. This report presents the status of the Project as observed up to March 2003.



HMCS Victoria Arrival in Halifax October 2001

PART II – PRINCIPAL CONCERNS

SUBMARINE ACQUISITION

2.1 The following are the significant observations with respect to the submarine acquisition. They concern risk management, financial management, and the PO&M estimates for in-service operating costs.

Risk Management Strategy and Practices

Observation. *The challenges associated with the UK submarine reactivation and the Victoria Class Canadianization Work Period were under-estimated. An assumption was made that off-the-shelf procurement is generally low-risk in nature. Under-estimating these technical risks may have contributed to the overly optimistic schedule for conducting submarine operations. Originally planned for 2002, an operational capability may not be achieved before fiscal year 2004/05. Furthermore, the Navy will absorb additional training and CWP costs totalling approximately \$8M.*

Risks to Reactivation

2.2 The main contract included safeguards that made the UK responsible for risks associated with the reactivation of the submarines. However, detailed inspections and technical investigations during reactivation revealed some faults; such as cracks in the diesel exhaust valves. These faults, for those boats still in UK possession, were to be corrected at the vendor’s expense. Faults discovered on the boats already accepted by Canada (cracks have been found in Victoria’s valves) became a matter of contract interpretation and negotiation.

Submarine	Delivery Date Planned	Actual/Revised Delivery	Operationally Ready Planned	Operationally Ready Revised (1)
HMCS Victoria	April 2000	October 2000	January 2001	Spring 2005
HMCS Windsor	October 2000	October 2001	July 2001	Fall 2004
HMCS Cornerbrook	April 2001	March 2003	January 2002	Spring 2005
HMCS Chicoutimi	October 2001	June 2004	July 2002	Winter 2005

Note (1): Date revised by Project office as of March 2003

Table 2 – Schedule Delay

2.3 For the Navy, these technical problems have had a troublesome domino effect. As portrayed in the table above, additional work resulted in the delayed delivery of the first three boats by six months to two years. The anticipated delay for the fourth boat is two and one half years. Consequently, the initial conversion training for the crews has been prolonged and thus been more expensive than originally expected. At the time of our review, these extra expenses had amounted to about \$9M and were paid out of the Project’s contingency funds. These delays

will also result in training transition costs of \$5M, to be absorbed by CMS. The schedule has now been reclassified as high risk. More details on Project costs are discussed in the observation concerning Financial Management.

Risks in the Canadianization Work Period (CWP)

2.4 The Project office has completed a Risk Management Plan for the CWP in accordance with a Software Engineering Institute guideline. Risks have been identified, codified in terms of probability of occurrence, assessed for impact and assigned a mitigation strategy. The plan is being applied across all disciplines and is shared with all stakeholders, including the contractors.



The SCLE Project Manager, team leaders and members meet at least weekly to review, discuss and adjust the plan. The plan also provides a detailed strategy for communicating the Project's progress to both senior management and other stakeholders.

work holds particular challenges. Technical obstacles invariably arise as work progresses and numerous unforeseen technical difficulties occur. For example, a significant delay in the CWP arose due to the need to convert British design specifications to Canadian standards and yet another delay was experienced when some hazardous material was discovered that required special procedures for removal.

2.5 Our experience in auditing and reviewing equipment acquisitions has shown that this type of customization and integration

2.6 The CWP for each boat was originally scheduled to be accomplished in six months after their arrival in Halifax. This schedule had to be significantly adjusted after the commencement of the CWP for HMCS Victoria. The lessons learned from the first submarine are being applied to planning the CWP for the remaining three submarines. It is unlikely, however, that more than marginal gains can be made through the application of these lessons. The full impact of schedule

Further slippage in the UK reactivation and delays in the CWP will likely consume the remaining amount of contingency funds.

slippage and cost escalation remains unclear and is therefore a concern. Our work on a prior review of the Canadian Patrol Frigate found that the larger production run allowed for lessons learned in the first vessels to be applied to the last. With only four submarines, it is not likely that the schedule will be significantly improved after the CWP learning curve is completed.

2.7 At the time of the review, \$32M of the \$42M in Project contingency funds had been released to address the effects of both the CWP and the reactivation slippage. Further slippage in the UK reactivation, and delays in the CWP, will likely consume the remaining amount of contingency funding. The decision to delay the completion of the CWP on the first boat until it has been moved to the west coast has introduced additional risks. We are concerned that the Fleet Maintenance Facility (FMF) on the west coast will be expected to complete the CWP with no prior work experience on Victoria Class. As well, the second boat's CWP will commence before all of the lessons learned on the first boat CWP have been finalized.

Project Profile and Risk Assessment (PPRA)

2.8 This Project illustrates the importance of rigorous risk analysis and the articulation of corresponding mitigation strategies.

For future projects, an independent, third-party analysis may help to better define risks.

2.9 The Project PPRA showed both the technical risk of reactivation and the schedule risk as "low", due to the *off-the-shelf* nature of the procurement and the fact that these vessels had already demonstrated operational capability with the Royal Navy over the course of four years (1990 to 1994). As described in this section, the technical risks have proven to be under-rated. For future projects, an independent, third-party analysis may help better define risks.

... even for what might be considered a straight-forward procurement, greater rigour was required in assessing and analyzing risks areas.

2.10 The occurrence of these problems has demonstrated that, even for what might be considered a straight-forward procurement, greater rigour was required in assessing and analyzing risks areas. Experience has shown that relatively limited production runs of complex naval equipment, offer relatively fewer opportunities for reworks and problem resolution during production. Accordingly, there will be greater likelihood that problems may only become apparent during equipment operation. It is acknowledged that more guidance in risk analysis is now available within the Materiel Group and was used in the preparation of the CWP. However, unforeseen risks have also occurred. For example, the original drawings and specifications lacked sufficient detail for the CWP engineering changes.

2.11 **Recommendations.** *It is recommended that the Project Office:*

- a. *re-examine the reactivation risks and quantify their impacts in terms of cost and schedule by mid-Fall 2003, and*
- b. *carefully monitor and routinely brief the Senior Review Board on risks and costs relative to the Canadianization Program.*

Financial Management

Observation. *We estimate that the total capital cost of the SCLE Project will be at least \$897M, an increase of 10 per cent, or \$85M, over the authorized budget of \$812M. Other operating budgets are funding this variance. Therefore, the definition of total SCLE Project capital costs has not been sufficiently inclusive and, consequently, total capital costs are not readily identifiable. In addition, there are other non-SCLE capital projects in the submarine program, totalling \$107M, that are expected to be implemented prior to the Victoria Class mid-life upgrade due to commence in 2010.*

2.12 Relative to acquisition of a complete Victoria Class submarine capability, the review team found a number of costs that were outside the scope of the SCLE Project. Most of these submarine capability costs were disclosed in Navy business plans and the Departments capital acquisition program. Our estimate of additional costs related to the submarine capability was confirmed by a CMS comptroller financial report presented to the Submarine Program Committee in February 2002.

2.13 **Approved SCLE Project Budget.** Due to financial pressures in the Department in 1998, the approved funding for the submarine Project was less, by about \$50M, than the originally estimated requirement. Given the funding situation, the Project Scope was limited by interpretation to exclude those costs associated with the west coast capability and some of the infrastructure costs for the east coast (see Annex A). Additional related costs amounting to \$85M have been, or will be, absorbed by the CMS and DGMEPM operating budgets. Normally associated construction, initial provisioning of spare parts, conversion training, tools and test equipment costs would be included in a capital acquisition project. In fact, departmental expectations/guidance relative to the treatment of project infrastructure costs have been clarified since the inception of this particular acquisition.

2.14 As of March 2003, the Project had spent 63 per cent of the approved funding - \$513M as shown in the table below. Although the Project office predicted an under-expenditure of \$5M at the time of the review, we concluded (see paragraph 2.7 of this report) that expenditure of all contingency funds will likely be necessary. By March 2003, 76 per cent of the Project's contingency funds (\$32M of the \$42M) had already been released. Contingency expenditures were required for: CWP \$13M, temporary duty \$12M, infrastructure \$5M, and Project office costs \$2M.

Activity	Project Budget	Actual To Apr 03	Estimate to Completion	Variance
Main UK Contract (Subs, TDP, Trainers)	502	246	490	-12
Initial Support Contract	160	157	160	0
Other (Project office, Trg, Infrastructure, CWP)	108	78	120	12
Contingency	42	32	42	0
Total Capital	812	513	812	0
Project Related Costs	0	44	85	85
Total Project Costs	\$812	\$557	\$897	\$85

Table 3 – Estimated Total Project Costs (\$Millions/Budget Year)

2.15 **SCLE Project Related Costs.** Not all of the uncaptured SCLE Project-related costs, amounting to \$85M, have been accounted for as capital expenditures (Vote 5). Up to \$27M of the additional costs will be Vote 1 or O&M expenditures, understating the true investment in the Department’s overall capital program. Table 4 below describes in detail the additional SCLE Project-related costs that have been, or will be, absorbed by DGMEPM, CMS and other Navy budgets, such as Maritime Pacific (MARPAAC) and Maritime Atlantic (MARLANT) formations. As these capital costs are not reported in a single budget, it is difficult to capture the complete acquisition value. At the time of the review, \$38M of these Project-related costs had already been spent. Up to \$33M of these additional related costs can be attributed to the west coast capability. The three projects shaded in grey, totalling \$15M, are unique Victoria Class projects that ADM(Mat) has recently decided to include in the SCLE Project scope.

Related Project Cost Summary	Spent as of March 2003 (\$M)	(1) Estimate at Completion (\$M)
MARLANT Combat SPTATE (2)	0	10.0
MARLANT Construction	10.1	10.6
MARLANT Initial Provisionings	5.7	5.7
MARLANT Fleet Maintenance Formation Trg	1.4	1.4
East Coast Capability Subtotal	\$17.2	\$27.7
MARPAAC Fleet Maintenance Formation Trg	0.9	0.9
MARPAAC Construction	4.1	7.6
MARPAAC Combat SPATE	0	5.0
MARPAAC Spares/Ancillary Support Eqpt	12.5	16.8
MARPAAC Sound Range	0	2.0
MARPAAC Heavy Weight Torpedo Crane	0	0.5

Related Project Cost Summary	Spent as of March 2003 (\$M)	(1) Estimate at Completion (\$M)
MARPAC Battery Maintenance	0	0.5
West Coast Capability Subtotal	\$22.5	\$33.3
Canadian Work Period Over-run	0	3.2
PWGSC Revenue Dependency Charges	2.6	3.2
Engineer & Supply Management Activation Costs	0.5	2.4
Victoria Class Common Fleet Trainer	0	8.0
Victoria Class Deperming	0	4.0
Victoria Class Noise Control/Monitoring	0	3.0
Total	\$37.8	\$84.8

Notes (1): Source CRS

(2): Special Purpose Tools and Test Equipment (SPTATE)

Table 4 – SCLE Project Related Costs (\$M BY)

2.16 Spares/Ancillary Support Equipment – National Procurement (NP). One of the Project objectives was to procure sufficient spare parts for the first year of the in-service life of the submarines. To this end, the Initial Support Contract (ISC) provided an initial provisioning of 7,824 line items. In fact, over 8,800 line items were needed, but there were insufficient Project funds to meet this requirement. As a consequence, the Navy found it necessary to procure these additional items at a cost of \$23M, using its NP allocation (O&M funds).

2.17 Minor Construction. Only \$2.4M was designated for infrastructure improvement in the original SCLE Project budget. The review team observed that the CMS operating budgets have had to, and will continue to, absorb additional minor construction costs amounting to \$20M for east and west coast jetty improvements, building renovations, a sound testing range, battery maintenance, and a heavy weight torpedo crane. We acknowledge that, in some cases, the Project office did offer a lower cost infrastructure solution, but this proved to be unsatisfactory as it failed to meet the Navy’s full requirement. A case in point is the simulation training facility in Halifax where MARLANT agreed to absorb the additional infrastructure costs in order to meet their needs.

2.18 Special Tooling & Test Equipment (SPTATE). The SCLE acquisition did not include the necessary tools and test equipment for those combat systems that are unique to the Victoria Class. Until these SPTATE items are procured, the Navy will have to rely heavily on both the Field Service Representatives (FSRs) and their existing SPTATE to do the necessary testing and repairs. It is estimated that the SPTATE acquisition, to support the east and west coast submarine fleet, will amount to \$15M and is seen to be necessary if maintenance delays and future FSR costs are to be avoided.

2.19 Canadianization Work Period (CWP) Cost Over-run. Project office cost estimates for the CWP have increased from \$58M to \$71M. From our analysis of the work that had been completed at the time of the review, we determined that the total cost of the CWP would be \$3.2M higher than the most recent Project office estimate. This increase was attributable to the additional labour costs that will be incurred for the installation of the engineering changes and the associated trials. Furthermore, we found that the full costs of the CWP labour performed on the first boat by FMF Cape Scott were not captured as Project office costs. Costs over and above the FMF's original estimates were being shared, by the Project and the FMF, meaning that not all CWP costs were being portrayed in a consolidated manner.

2.20 PWGSC Revenue Dependency Charges. The review team found that the Project Public Works Government Services Canada (PWGSC) revenue dependency charges are being paid by the Director Materiel Group Comptroller – not the Project office. It is normal procedure for project offices to bear these costs. It has been assumed that PWGSC personnel will no longer be required after 2004 although the original April 2006 close-out date will likely be extended by two years. By 2004 we estimate the revenue dependency charges will have amounted to \$3.2M.

2.21 ESM Activation Costs. Our review of ESM contract expenditures found a number of services that were directly related to the reactivation and Canadianization of the Victoria Class acquisition that had not been captured as Project costs. It is our view that these payments amounting to \$2.4M should be accounted for as SCLE Project costs rather than O&M expenses in the Navy NP account.

2.22 Fleet Maintenance Facility (FMF) Training. The FMFs on both coasts incurred training related costs amounting to \$2M to maintain the Victoria Class submarines. These costs included temporary duty in the UK, specialized welding tests, and labour resource losses while FMF personnel were receiving conversion training.

2.23 Associated Non-SCLE Capital Projects. There are a number of programmed capital investments to be made in the CF's submarine capability prior to the Victoria Class mid-life upgrade expected to begin in 2010. These investments total \$107M. As stated in the Defence Management System (DMS) manual, all associated capital projects must be included in project approval documentation wherever a capability deficiency is being addressed. The review team found five projects in the capital program, totalling \$87M in value that were linked to the SCLE Project, but were not identified in the SCLE Project documentation. The remaining \$20M in investments (highlighted in grey in the table below) will be undertaken as part of the miscellaneous requirements program.

Associated Capital Projects	\$M BY
Submarine Escape and Rescue	25.0
Command Team Trainer	22.0
Naval Combat Operations Trainer	17.0
Submarine Life Support	13.0
Ozone Depleting Substance Replacement	10.0
Towed Arrays *	6.0
Link/Global Command and Control System	4.8
Mk 48 Torpedo Upgrade	4.5
Data Collection System *	2.5
Communications Intercept/Direction Finding *	2.2
Total	\$107.0

Table 5 – Programmed Associated Submarine Projects

2.24 The associated projects listed in Table 5 above, represent new capabilities that did not exist in the Oberon Class and, therefore, were deemed to be outside of the SCLE Project scope. Had the Oberon Class been life extended, these projects would have been required. As all of these projects are necessary to enhance the submarine capability, it would make sense to treat them as an omnibus project, at least for reporting purposes, to improve the visibility of all submarine-related costs. Recent submissions for in-service support contract amendments did not include the three projects marked with an asterisk. These three projects total \$8M in value (only 50 per cent of the Towed Array project value).

2.25 **Recommendation.** *We recommend that:*

- a. *The Materiel Group re-estimate the total Project costs and bring them forward to PMB in order to clarify and adjust the SCLE Project funding to cover the costs of the supporting infrastructure (\$85M). Consideration should also be given to ensuring that remaining contingency funding will be sufficient.*

- b. *By December 2003, CMS consider the merits of creating an omnibus project for aggregate associated programmed submarine capital projects (\$107M), if for reporting purposes only.*



Arrival of HMCS Windsor in Halifax October 2001

Personnel, Operations and Maintenance Costs

Observation. CRS analysis shows an increase in steady-state annual Personnel, Operations & Maintenance (P O&M) costs of \$24M (CY 2002/03) to support the four Victoria Class submarines. This represents a variance of 25 per cent from the original estimates that were based on three Oberon Class submarines. As a consequence, available operational sea days may have to be reduced from 220 to 167 per year, without the identification of additional O&M funding sources. As well, there will be one-time transition costs amounting to that will cause additional financial pressures over the next two years. This could further reduce the Victoria Class availability to 116 sea days per year.

2.26 Our review of projected Victoria Class life-cycle costs indicates that the original annual PO&M steady-state cost forecast of \$97M (CY 2002/03) was underestimated by \$24M. Original Project office estimates in 1996 incorrectly assumed that the four newer Victoria Class submarines could be operated at the same cost as the three Oberon Class boats. This assumption was based on a reduction in crew size and a lower maintenance workload for each boat. While the PO&M costs for each Victoria Class boat may be less, the total fleet costs will be 25 per cent higher. Our roll-up of the most recent Project office estimates has determined that annual Victoria Class PO&M costs will rise to \$121M (CY 2002/03) at steady state. The table below provides a detailed cost comparison.

PO&M Element	Project Office \$M (2002/03\$)	CRS \$M (2002/03\$)	Variance \$M (2002/03\$)	Annual NP \$M (2002/03\$)
Ship Crew	15.9	17.2	1.3	0
In Service Maintenance	40.2	17.2	-23.0	0
Spares/Materiel	9.2	17.3	8.1	17.3
Repair and Overhaul	9.5	27.7	18.2	27.7
Engineer Services	2.3	11.2	8.9	11.2
Base Support	19.6	20.2	0.6	0
Fuel	0.6	1.1	0.5	0
Core ESM		9	9.0	9
Total	\$97.3M	\$120.9M	\$23.6M	\$65.2M

Table 6 – Steady State PO&M Costs for Victoria Class

2.27 **Steady-State Annual PO&M Costs.** The PO&M cost estimate contained in the Project approval documentation, forecast an annual expense of \$84M (CY 1996/97). Escalated to CY 2002/03 dollars, this original estimate equates to \$97M. This estimate was derived from the 1996 Cost Factors Manual (CFM) for three Oberon Class boats at sea 121 days. As seen in Table 6, the main cost driver for the Oberon Class was the FMF in-service maintenance cost - \$40M per year. As the Navy's annual in-service maintenance costs decline by \$23M in the years ahead, it's contracted O&M costs (shaded areas) are expected to rise by \$45M. This transfer of costs from the CMS operating budget to the NP apportioned account is necessary to accommodate the Victoria Class maintenance strategy; a strategy that relies more heavily on the private sector. Evidence of this transfer was found during our assessment of FMF Cape Scott labour costs. Since the Oberon Class refits were cancelled in 1995, FMF labour costs have declined by \$18M per year.

2.28 As seen in Table 6, increases in annual NP funding will be required to support the outsourced maintenance strategy. Once the submarine operations have reached steady state in 2005/06, annual submarine NP support costs are estimated to be \$65M per year. Based on our findings in the 2002 CRS NP Assessment Study, we consider this estimate to be comparable to other combat systems of like complexity. Normally, the annual NP demand is about 2 per cent of the total acquisition value. Had the Navy procured the equivalent of new Victoria Class submarines, ranging in cost from \$3B to \$5B, the annual NP costs would have ranged from \$60M to \$100M.

2.29 **One-Time Transitional O&M Costs.** Annex C provides a multi-year view of the PO&M costs for the submarines over a commencing in 1998. These costs are estimated to be and include six years of on-going costs, a one-time transitional cost, and of steady-state costs once all four submarines have been delivered.
..... Prior to reaching steady state in 2005/06, the one-time O&M transitional costs are expected to amount to A detailed breakout of the one-time transitional O&M costs is portrayed in the table below.

Transition Activity	\$M
Unforeseen Initial Provisioning of Spare Parts	67.6
Unforeseen Intellectual Property
Residual Asset Materiel (RAM)	38
Engineer Services	10
Repair and Overhaul	6
Total Transition Cost

Table 7 – Breakout of One-Time O&M Transition Costs

2.30 Unforeseen Initial Provisioning. The unforeseen initial provisioning costs of \$68M are attributable to a ‘just in time’ sparing concept that proved to be unworkable. Although it is the departmental norm for a capital acquisition project to include three years of spare parts for initial provisioning, the SCLE Project approval included only a one-year supply. Under the auspices of the ESM contract, the contractor was required to perform a follow-on logistic support analysis to determine the appropriate levels of inventory. The contractor was then to procure sufficient stock to satisfy those levels on a ‘just in time’ basis. Unfortunately, the procurement lead times were longer than expected and resulted in a significant short fall. As a consequence, it will now be necessary to procure \$68M of additional spare parts to *kick-start* the mandatory stock levels. This doesn’t mean that more spare parts will be required; it does mean that they will be procured earlier than anticipated. For combat systems with components that are unique to the military, a just-in-time inventory policy must take into account longer procurement lead times.

2.31 Unforeseen Intellectual Property. It was thought that all intellectual property would be acquired as part of the main contract with MOD UK for the Victoria Class acquisition. However, the contract did specify that a portion of the \$36M technical data package would be categorized as ‘information only’, thereby preventing the CF from conducting repairs, maintenance, refit, overhaul and manufacturing work. As well, the contract specifies that the technical data for equipments/subsystems do not contain the details needed to perform repairs and overhaul (R&O). This limitation was the result of the original UK maintenance concept that outsourced the R&O function to the OEM. The Project office estimates that will be required to procure the necessary intellectual property rights.

2.32 **Residual Asset Management (RAM).** RAM is R&O materiel that is currently being warehoused in the UK by the OEM. Needed by the Victoria Class for both on-going corrective maintenance and the mid-life refit scheduled for 2010, the RAM materiel was offered to the CF in 2002 for the sum of \$66M. In March 2003, an opportunity presented itself to buy all this materiel at a reduced price of \$43M – a potential saving of \$23M. By applying a \$5M spare parts credit from the SCLE Project, the net cost became \$38M. This \$5M credit had accrued to the Project as each submarine was accepted with missing on-board spares that are normally included as initial provisioning in a capital acquisition project. However, it should be noted that the use of capital acquisition project credits as offsets for O&M expenditures is contrary to normal accounting practice. It is our view that the \$5M credit should have been retained in the SCLE Project.

2.33 In conducting a risk analysis associated with the procurement strategy for the RAM materiel, the following two options would undoubtedly have been considered. The first would have been: maintain the status quo, whereby the contractor warehouses the RAM materiel and makes it available to the Navy for purchase on an as-required basis, and the second would have been: exercise the option of an all-inclusive one-time buy. If the first option had been pursued, the Navy would have run the risk of having the RAM materiel sold for scrap, if and when the contract expired. For the second option, the risks involved with the one-time buy would have been twofold: the cost of \$14.7M (\$2.1M per year over seven years) to the Navy to warehouse the inventory and the loss of \$25M in interest income had the declining unpaid balance for the \$43M in RAM materiel been invested over seven years. A detailed option analysis was not evident in our review of the documentation.

2.34 The remaining \$16M in transition costs are necessary engineer services for design change/rate increases and corrective maintenance. Submissions for the ESM contract amendment thus far have not provided a detailed breakout of the transition costs.

2.35 **NP Allocations.** We are concerned that there are insufficient funds in the Navy NP apportioned account to finance the one-time transition costs. The Navy 2003/04 full demand for NP submarine O&M costs was \$113M. By deferring \$28M of Victoria Class work, the NP demand was scrubbed down to \$85M. However, the final NP allocation for 2003/04 forced the Navy to reduce the scrubbed-down demand by a further 32 per cent. This represents a proportional reduction of \$25M, from \$85M to \$60M for the submarine O&M funding level. The deferral of submarine maintenance will directly impact the submarine safety program and reduce the availability of submarines. The impact on operations and training of funding only 53 per cent of the submarine transition year costs could reduce the number of available sea days per year from 220 to 116 days per year.

2.36 **Engineering and Supply Management (ESM) Contract.** The ESM contract is the means to procure in-service O&M support for the Victoria Class Submarines. The original six-year \$86M contract ceiling was approved in 1998. The ceiling was raised to \$192M in March 2002 in order to procure the above-mentioned \$66M in refit materiel, \$31M in additional spares/equipment and \$9M for engineer services to provide design changes and technical studies for the new submarines.

2.37 A recent proposal has been made to extend the ESM contract and to raise the contract ceiling to The extended timeframe is considered to be necessary to address the time lost due to schedule delays and to provide sufficient lead time for the award of a new contract We recommend a reduction in the proposed contract ceiling to This reduction reflects in deferred support costs for the delayed delivery of the 4th boat (i.e., to summer 2004). The proposed increase less \$192M) in the ceiling is attributable to the extensions of the contract, amounting to, and additional non-recurring costs of \$96M for spares, engineer services, repair and overhaul.

2.38 Our review of the proposed increase to the ESM contract noted the considerable justification, particularly the rationale for extending the contract term. Outlined in Annex D are four different rough-order tests by the review team to assess the reasonableness of cost estimates for contracted maintenance. We determined that:

- a. the projected steady-state maintenance cost per submarine for the Victoria Class is similar to that of the Oberon Class submarine (\$20.6M vs \$20.4M); the steady-state annual contracted maintenance estimates of \$65.2M (of which is ESM) are within the norm for similar complex weapon systems;
- b. the cumulative total of the annual work/cash flow over, adjusted to the actual delivery of the submarines, amounts to a ceiling price of; and
- c. a linear projection of ESM contract costs, based on submarine years in service, also amounts to an ESM contract ceiling of

2.39 ***Recommendation. The Materiel Group/DGMEPM:***

- a. ***review and refine the O&M estimates to be reflected in the CMS 2004/05 business plan;***
- b. ***in consultation with ADM (Fin Cs) and DGSP, document the rationale for treating estimated initial provisioning (\$68M) and intellectual property costs as O&M; and***
- c. ***ensure a business case fully captures the rationale for amending the ESM contract ceiling.***

ASSOCIATED PROGRAM ISSUES

2.40 There are two key program issues related to the deployment of a submarine capability. They address subjects that are beyond the mandate of the Project office. They concern the basing/location of submarines and the training/manning arrangements necessary for the transition to the new boats.



West Coast Basing

Observation. *The incremental cost of placing a second boat on the west coast is considered to be marginal (\$4.8M one-time and \$1.4M annually as estimated by CRS), particularly if it offers distinct operational advantages.*

2.41 Plans to place one submarine on the west coast and three on the east coast were based on a July 1999 options analysis by the Navy. This analysis included an examination of operational, quality of life and cost criteria. Although the option of locating two submarines on each coast scored higher overall, this distribution was rejected on the grounds that the cost was too high. Even though the weighting of the selection criteria was clear, the review team found it difficult to understand the comparative analysis between each of the options, especially given the fact that there was little to no cost data available to substantiate the recommended option. Using the cost data contained in the MARPAC Submarine Implementation Plan, the review team conducted its own comparison and concluded that the cost of the two-two split was not unreasonable, particularly when viewed in the context of the operational advantages to be gained.

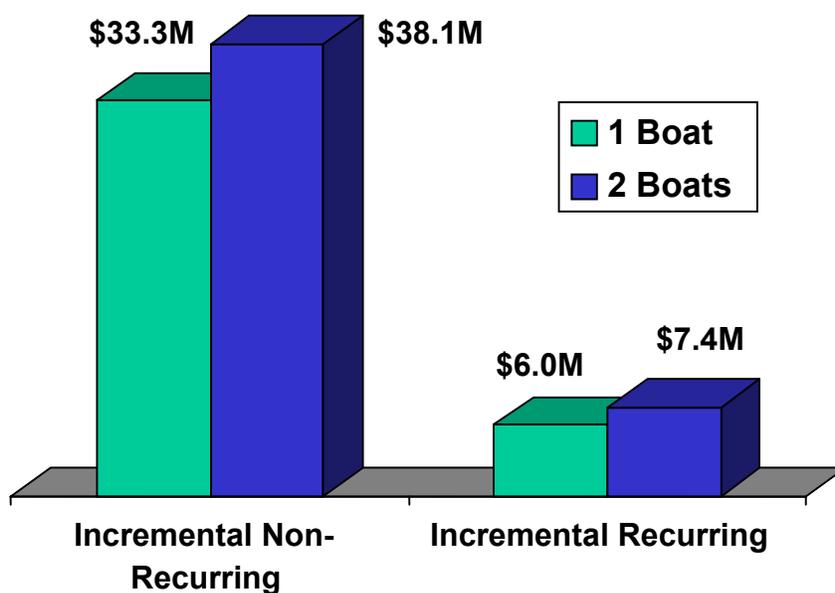


Figure 1 – Incremental Costs of Submarines on West Coast

2.42 Our assessment of the incremental **non-recurring** (meaning one-time) costs shown in Figure 1 compares the cost of deploying one boat, versus two, on the west coast. The cost for one boat would amount to \$33.3M. A non-recurring incremental cost of \$4.8M would enable two boats to be deployed to the west coast.

2.43 Similarly, the **recurring** (meaning annual) costs for two, versus one, submarines on the west coast were analysed and depicted in Figure 1. While it cost \$6.0M per year to establish the first submarine on the west coast, it would cost substantially less to establish a second – estimated to be \$1.4M per year. The reason for the marginal increase was the result of simply transferring the costs associated with a portion of the east-coast headquarters staff, FMF staff, and the Submarine Personnel List establishment to the west coast.

2.44 The two-two-split option offers a better balance of operational capability and training capacity between both coasts. Given that the responsibility for the high readiness naval task group rotates between the east and west coast on an annual basis, it would seem to be more operationally efficient and cost effective to have a balanced force structure. Under the original plan, the ratio of submarine days per year/per coast is three-to-one in favour of the east coast or 450 to 105. Additionally, having two submarines on the west coast reduces the possibility of having to cease training should one become unserviceable. (Other personnel implications weigh heavily on the timing of a second boat deploying to the west coast.)

2.45 ***Recommendation.*** *To the extent that costs have affected the decision on the east/west coast distribution of submarines, it is recommended that CMS revisit the options by Fall 2003.*



Victoria Class Submarine in Dry Dock During UK Reactivation

Transition – Manning and Training

Observation. *Due to schedule delays and the adverse impact on the CF's capacity to train submariners, the required manning levels for the Victoria Class submarines will not be achieved before the year 2007 - a delay of at least one year. As well, the record of submariner qualifications in the human resource (HR) information system does not accurately identify the gap in training requirements.*

2.46 The review team assessed the likelihood of sufficient personnel being trained to meet and sustain the crew requirements for the four Victoria Class submarines. The SCLE Project was to provide conversion training for up to 350 personnel in the UK on simulators and on the submarines. This training has been completed. The follow-on conversion and refresher training that was to be done in Canada has been adversely affected by schedule delays.

CMS staff have rightly expressed concern about the ability of the training system to sustain a cadre of qualified submariners, a problem that is unnecessarily magnified by a HR information that is not being kept current.

2.47 To operate the four new boats, the Navy determined in July 2000, that it would need 389 submariner positions. By January 2002, only 311 positions had been established or designated as submariner qualified positions in the Human Resource (HR) management information system (People Soft) and, of those, only 230 had been filled. The crewing of submarines is the Navy's second highest manning priority. CMS staff have rightly expressed concern about the ability of the training system to sustain a cadre of qualified submariners, a problem that is unnecessarily magnified by an HR information system that is not being kept current.

2.48 While good progress has been made in completing the initial conversion training, problems have been encountered with refresher training. Schedule delays have unduly complicated the Navy's efforts in this regard. Until all four vessels have been delivered, undergone CWP, and the training simulator has been relocated to Canada, the training shortfall cannot be remedied. Our analysis, as shown below in Figure 5, would indicate that a full training capacity will not be achieved before mid 2005 and, therefore, the required manning level will not be reached until 2007.

2.49 **Simulation Training.** The work to dismantle the simulators for shipment to Canada began in January 2002. The new facility construction in Halifax is complete so that simulation training can commence as scheduled in May 2003. Therefore, for an 18-month period, conversion and refresher training could only be conducted on submarines.

2.50 **Training Capacity.** Once the training system is fully established in Canada, it will be able to produce a maximum of 60 submariners per year. Until all four submarines have completed the CWP program in 2005, a steady state training capacity will not be achievable. To qualify as a trained submariner, an individual must complete six weeks of training at sea on an operational submarine.

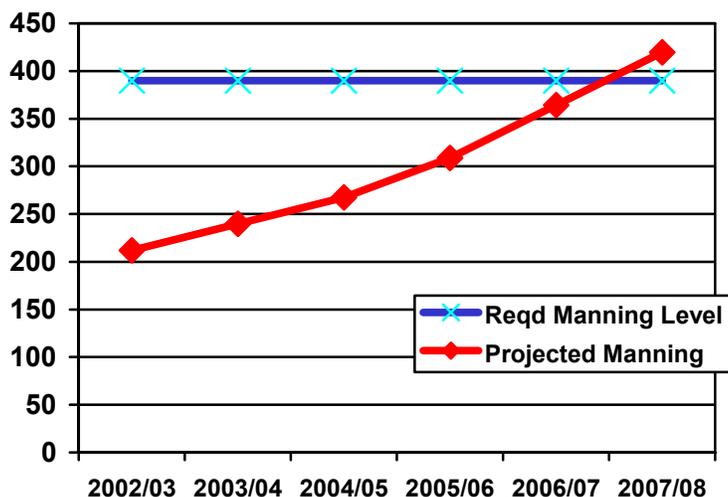


Figure 2 – Submarine Position Manning Capacity

2.51 **Training Assets.** HMCS Victoria was not available to return to sea until approximately 20 months after entering the CWP in November 2000, a year behind schedule. This meant that the original crew had to undergo refresher training. In fact, refresher training has been mandatory for all crews that have been trained in the UK. To maintain currency, refresher

It is this lack of operational submarines that is driving the training issue.

training will likely become the norm until at least 2005 when all the boats are expected to become operationally ready. It is this lack of operational submarines that is driving the training issue. This will be further complicated by the move of the

HMCS Victoria to the west coast.

2.52 **Recommendation.** *Particularly in view of the impending move of HMCS Victoria to the west coast, CMS should formulate contingency plans to ensure that training backlogs are addressed in the most effective way possible. To manage the training requirement, the HR information systems should be regularly updated with the establishment, training and qualification data on submariner personnel by the Fall of 2003.*

PART III – OPPORTUNITIES FOR COST SAVINGS

Observation. *Potential cost savings, totalling at least, and other improvement opportunities related to the submarine program have been identified during the course of our review. They pertain to the following areas:*

- **Victoria Class**
 - *Contract management (\$8.2M)*
 - *ESM contract*
 - *Initial Support Contract (\$7.6M)*
 - *Supply arrangement for spares (\$1M to \$1.5M)*
 - *Cataloguing of inventory*

- **Oberon Class**
 - *Inventory Disposal (\$9M)*
 - *Inventory Management*

In a number of instances, the realization of savings will be contingent on negotiation.

Contract Management

3.1 In reviewing the provisions of the main contract, we identified certain cost saving opportunities for consideration by the Project Office. A total of \$8.2M could be saved by taking advantage of delivery schedule incentives (\$7.1M) and spare parts credits (\$1.1M).

3.2 **Delivery Incentives.** The Procurement and Finance Manager is required to adjust the payment schedule to reflect the annual price adjustment rates stipulated in the main contract with UK MOD. Our analysis of the Project's financial records indicated there was the potential for the Project office to reduce the payments in total by \$7.1M due to the delivery schedule incentive clauses in the contract. For submarines that were over nine months late, the 1998/99 economic price adjustment base-line index could be deferred nine months. This deferment in the economic price adjustment calculation could be applied to the last three submarines and could amount to savings of \$7.1M if the planned payment schedule is followed. This observation was acknowledged by the Project Office and applied to subsequent payments.

3.3 **Spare Parts Credits.** A credit for missing spare parts was being accumulated by the Project office to be used as an offset for payments against the last submarine. They are expected to continue until at least 2006. This credit represents the value of "carry on board" (COB) spares missing at the time of the acceptance of each submarine. The Project office estimated the credit will total \$7.5M. A detailed accounting of the COB spares is done at the time of acceptance and provides an accurate offset that could be applied to the first payment for each submarine. If the credit is not accounted for until 2006, the Department's economic model for spare parts estimates a loss of \$1.1M in buying power. Note in paragraph 2.32 of this report, the Project office has already acted on this observation.



Engineer and Supply Management Services

3.4 Our review of the ESM in-service contract identified opportunities for savings amounting to These opportunities for savings are subject to successful contract negotiation.
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Initial Support Contract (ISC)

3.10 There may be an opportunity to gain consideration for \$7.6M in advance payments made for the initial provisioning of spare parts. The ISC with the submarine OEM provided the Navy with 7,824 line items of Victoria Class spare parts valued at \$129M. We observed that as of August 2002, there were still 4,010 line items worth \$90M that had not been delivered, although payments of \$119M had been made. It would appear that payments made for each of the twelve batches of deliverable materiel were not related to the value of the materiel in each batch. In effect, the Department had made an advance payment of \$80M prior to receiving the materiel. Had the payments been aligned with the value of goods, we estimate the future value of the payments would have been \$87.6M. In future contract negotiations with the submarine OEM, a consideration of \$7.6M may be sought accordingly. (As of September 2003, only 19 items remained to be delivered under the terms of the ISC contract. These items were identified as obsolete and will be substituted with a 2040 sonar dome.)

Supply Arrangement For Spares

3.11 There is a potential to save up to \$1.5M per year by modifying the spare parts supply arrangement for Victoria Class. Under the current arrangement spare parts price listings are provided to the Project office by the design agent, the submarine OEM. As portrayed in the figure below, there are three types of item listings; those with a fixed price but no discount (21 per cent), those with a fixed price and a discount (8 per cent), and finally, those with no fixed price and with no discount (71 per cent). The higher dollar value items are those in the last category. The review team found that as of December 2001, only 10 per cent of the total demands consisted of the fixed price items. The remaining 90 per cent were for the items that were neither fixed price nor discounted.

3.12 To achieve economies every effort should be made to increase the number of items that have a fixed price and a discount. If this were to be done, we estimate the Navy could generate savings ranging from \$1M to \$1.5M. Our estimate is based on converting the 9,516 high value items into discounted fixed price items. A shared cost saving arrangement would act as an incentive for the design agent. Incentives to increase the number of items with guaranteed delivery times should also be considered in order to improve procurement lead times.

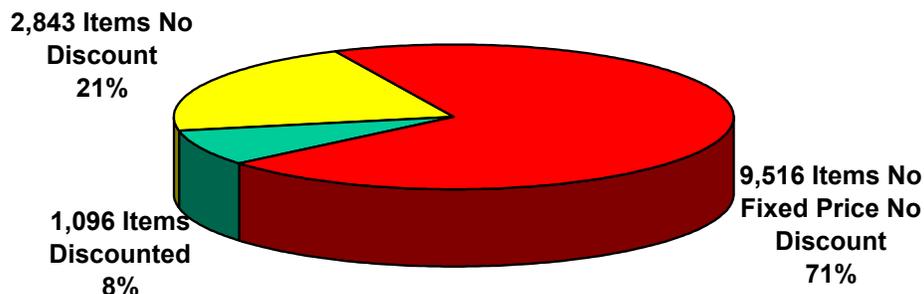


Figure 4 – Design Agent Inventory Price Listings

Cataloguing of Inventory

3.13 At the time of the review, the Project office expressed a concern with the significant backlog in Victoria Class inventory cataloguing. Up to 30 per cent of the demands for materiel had not been catalogued and procurement lead times exceeded four months. As a result, a shortage of repair parts caused delays in the maintenance work on HMCS Victoria. In March 2002, 66 per cent of the repair parts were on back order. The review team agreed with the Project office that there were significant opportunities for improved efficiencies in this regard.

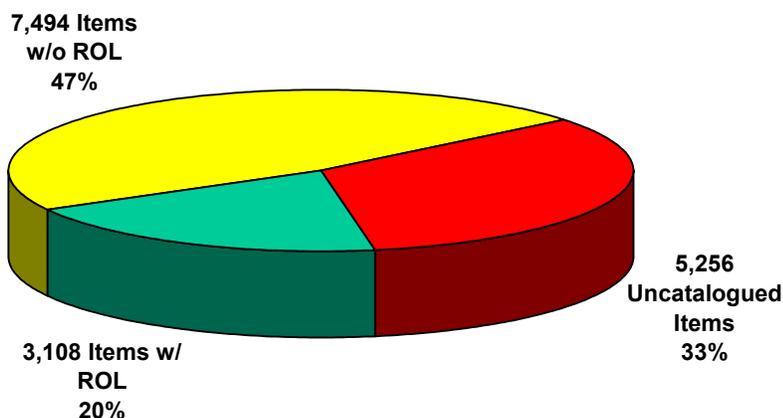


Figure 5 – Victoria Class Inventory - 15,858 Line Items

3.14 The review team examined the limitations of the cataloguing process that led to the backlog. The process began when the design agent, the submarine OEM, provided the Project office with quarterly reports of required line items. Once identified, the line items were catalogued in the Canadian Forces Supply System (CFSS) by the Directorate of Technical Information and Codification Services (DTICS). When catalogued, a re-order level (ROL) was to be set to automatically initiate procurement action. As shown, in Figure 5, we found only 20 per cent of the line items had ROLs set. This contributed to the backlog situation as the remaining 80 per cent were either without a ROL or uncatalogued. Further delays were caused because requirements were determined on a quarterly basis, rather than a ‘just in time’ basis.

3.15 It is our view that additional personnel are temporarily required in the cataloguing directorate to resolve the backlog in Victoria Class inventory. As well, the design agent could increase the frequency of reporting spare parts requirements to improve procurement lead times.

Oberon Class Disposal

3.16 Our assessment of the Oberon Class disposal process identified the opportunity to save up to \$9M by disposing of obsolete inventory (\$4.9M in annual carrying costs) and retaining only those items common to the Victoria Class (\$4.1M).

3.17 Currently, it is costing the Department \$4.9M per year to warehouse 25,371 Oberon Class line items (which represents a book value of \$98.3M) that became surplus when the last Oberon submarine was decommissioned in July 2000. This inventory is not visible in the CFSS as it was managed under a separate Submarine Inventory Control Point (SICP) in MARLANT Halifax.

The review team identified 740 line items (valued at \$4.3M) that match the Victoria Class line items that have been catalogued to date in the CFSS.

3.18 Some of this inventory could be utilized on the Victoria Class. The review team identified 740 line items (valued at \$4.3M) that match the Victoria Class line items that have been catalogued to date in the CFSS. As more Victoria Class line items are catalogued, there may be other SICP line items that should be retained. As well, there are 14 containers of materiel removed from HMCS Onondaga that have not been processed and may not be visible in the SICP database.

3.19 Outside of the SICP, we have identified a further 3,247 Oberon-unique obsolete items in the CFSS. It was found that most of these items were still classified as active items, and not designated for disposal.

Oberon Class Inventory Management

3.20 Our review of supply transaction history associated with the close-out of the Oberon boat accounts found opportunities to improve the management of submarine inventory. The removal of the CFSS inventory from the Oberon Class submarines involved a number of high-risk supply transactions that indicated poor control of the assets. For the most part, \$17.9M in stock value was appropriately receipted by a base supply account; but \$1.9M was not. The high-risk

transactions were the submarine supply account balances that were adjusted downwards (through Certified Issue Vouchers) without the rigor of a proper write-off transaction. These types of transactions merit increased study by Navy logistics staff.

3.21 ***Recommendation for Cost Savings Opportunities and Other Improvements.*** *EPM develop an action plan before December 2003 to address the cost saving opportunities and other improvements identified by CRS.*



Oberon Class – Decommissioned 1998 to 2000

PART IV – RECOMMENDATIONS

4.1 Recommendations have been grouped in terms of responsibility, according to Offices of Primary Interest (OPI). Each OPI is requested to develop an action plan to satisfy their respective recommendations.

4.2 We recommend that:

a. PM SCLE

- (1) Increase the scope of the Project risk management plan to include the UK reactivation and quantify the associated risk impacts in terms of cost and schedule slippage by mid-Fall 2003.
- (2) Monitor and routinely brief the Senior Review Board on the risks and costs to the Canadianization Program.

b. DGMEPM

- (1) By September 2003, re-estimate the total Project costs and bring them forward to PMB in order to clarify and adjust the SCLE Project funding to cover the costs of the supporting infrastructure and equipment (\$85M). Risks associated with the Project-related costs should be re-examined to ensure that remaining contingency funding will be sufficient.
- (2) In consultation with ADM(Fin Cs) and DGSP, document, the rationale for treating estimated initial provisioning (\$68M) and intellectual property costs as O&M.
- (3) Review and refine previous O&M estimates to be reflected in the CMS 2004/05 business plan.
- (4) Ensure a business case captures the rationale for amending the ESM contract ceiling.
- (5) Evaluate and action, as appropriate, the identified cost savings/avoidances and performance opportunities by December 2003.

c. CMS

- (1) To the extent that costs have affected the decision on the east/west coast distribution of submarines, review basing plans.



- (2) Develop contingency plans to address training backlogs. To manage the training requirement, the HR information systems should be regularly updated with the establishment, training and qualification data on submariner personnel by the Fall of 2003.
- (3) By December 2003, consider the merits of creating an omnibus project to aggregate the associated programmed submarine capital costs (\$107M), if only for reporting purposes.

MANAGEMENT ACTION PLANS

4.3 Below, in chart format, are the CRS recommendations and the management action plans:

Ser	CRS Recommendations	OPI	Action/OPI Comments
1	Increase the scope of the Project Risk Management plan to include the UK reactivation and quantify the associated risk impacts in terms of cost and schedule slippage by mid-Fall 2003.	PMO SCLE	SCLE Project staff will continue to update the Capability Initiative Database on a regular basis. Senior Review Boards will now include a Risk Assessment of reactivation.
2	Monitor and routinely brief the Senior Review Board on the risks to, and costs of, the Canadianization Program.	PMO SCLE	PM will continue to brief CWP Engineering Change (EC) details to senior staff. Senior staffs were recently briefed on 17 September 2003. Next SRB is scheduled for January 2004.
3	By September 2003, re-establish the total Project costs and bring them forward to PMB in order to clarify and adjust the SCLE Project funding to cover the costs of supporting infrastructure and equipment (\$85M). Risks affecting Project costs should be re-examined to ensure that remaining contingency funding will be sufficient.	PMO SCLE	SCLE Project is scheduled to brief November 2003 PMB. Total project costs for SCLE increased by \$85M after including the CRS identified projects originally funded by CMS and DGMEPM NP funds. SCLE has examined these projects and determined that \$47M, will be required to complete them. SCLE plans on absorbing the cash requirements associated with these additional projects within the current SCLE project cash-phasing envelope. The additional \$47M required, will be cash-phased in the out-years of the

Ser	CRS Recommendations	OPI	Action/OPI Comments
			SCLE project, thus alleviating the current capital constraints.
4	In conjunction with ADM(Fin CS) and DGSP, document the rationale for treating estimated initial provisioning (\$68M) and intellectual property costs as O&M.	PMO SCLE	This recommendation is not accepted by ADM(Mat); appropriate documentation already exists to support this decision.
5	Review and refine previous O&M estimates to be reflected in the CMS 2004/05 business plan.	DGMEPM	Currently part of the ship/class management planning process.
6	Ensure a business case captures the rationale for amending the ESM contract ceiling.	DGMEPM/ DMCM Subs	Completed as part of approval submission 18 June 2003.
7	Evaluate and action, as appropriate, the identified cost savings/avoidance and performance opportunities by December 2003.	DGMEPM/ DMCM Subs	An evaluation is currently in progress.
8	To the extent that costs have affected the decision on the east/west coast distribution of submarines, review basing plans.	CMS/ DGMFD	MARCOM Capability Planning Guidance 2004 notes the intention to place two submarines at each of east and west coasts. The VICTORIA-Class Submarine Transition Team (SMTT) has been charged with conducting a Submarine Sustainability of Operations Study (SSOS). The outcome of the SSOS will be a Concept of Sustainable Operations (CoSO) and, subject to approval of the CoSO, A Transition Plan (TP) with required level of detail including boat selection and transfer timing.

Ser	CRS Recommendations	OPI	Action/OPI Comments
9	Develop contingency plans to address training backlogs. To manage the training requirement, the HR information systems should be regularly updated with the establishment, training and qualification data on submariner personnel.	CMS/ DGMFD	The Navy has already reduced the training backlog by operating one of the submarines at sea in its post-acceptance but pre-Canadianization configuration. An in-house submarine training database, utilizing content of People Soft and ITMIS, has been developed and is being productively applied in submarine Personnel & Training (P&T) activity; as such, it is contributing to a clear appreciation of production requirements.
10	By December 2003, consider the merits of creating an omnibus project to aggregate the associated programmed submarine capital costs (\$107M), if only for reporting purposes.	CMS/ DGMFD	This recommendation is not agreed to by the Navy. The associated requirements and activities continue to be under normal capital project coordination.



ANNEX A

ANNEX A – WEST COAST SUBMARINE CAPABILITY

The table below provides a historical record of events that lead to a decision to base Victoria Class submarines on both the east and west coast of Canada. The trail of documentation and the SCLE Project approval briefings, note the requirement for a permanent submarine presence on the west coast. Accordingly, it would appear the original intent was to have the SCLE Project provide for this presence.

Ser	Reference	Policy/Decisions
1	January 1990 Statement of Capability Deficiency	A Canadian Patrol Submarine Project office paper expressed the concern over the lack of a west-coast capability.
2	1993 CFCD 117 Capability Element 402.2 – Submarine Operations	“ A national requirement exists for submarines to operate in all Canadian ocean areas of responsibility...” “In order to meet such a deployment concept it will be necessary to base submarines on both the east and west coasts of Canada...”
3	January 1995 DGMD Briefing Note	This briefing note made the case that acquisition of the 4 Upholder submarines would allow for a continuous west-coast presence.
4	6 April 1998 DND News Release 98.018	“ Submarines for the Canadian Navy. We will maintain the Canadian submarine presence in the Atlantic and re-establish a permanent submarine presence off the Pacific Coast after a 25 year absence.”
5	May 1998 Effective SCLE Project Approval Annex A	“The Upholder option would ensure a permanent submarine presence on the west coast, something that is not possible with three OBERONs...”
6	July 1999 Submarine Crewing And Basing Working Group (SCBWG)	CMS concurs with the SCBWG results. “Notwithstanding the relative ranking of the options in paragraph 16 of the service paper, I recommend that OPTION E (3 boats/3 crews in Halifax: 1 boat/1 crew in Esquimalt) be adopted for the crewing and basing of the Victoria-Class submarines. This option is deemed to be the most consistent with the imperative to establish a Canadian submarine presence in the Pacific...”

ANNEX A

Ser	Reference	Policy/Decisions
7	September 1999 SCLE Implementation Plan	<p>Project Scope/Objectives “Interpretation: The above statement of scope from approval documentation is broad and indefinite in several areas. Based on the limited funding level, the scope must necessarily be delineated more precisely. The following is proposed as an interpretation of the limitation intended in the original approval submission.</p> <ul style="list-style-type: none"> a. General: As a broad statement, this Project (as a capability life extension) differs from projects introducing a new capability in that it is not intended to cover the cost of full life-cycle support, but rather to exchange one capability close to life expiry (Oberon’s) for another (Victoria’s) with a longer life. Expenditures required to ensure that the initial operational capability of the latter is no less than the former are considered within project scope. Expenditures required to ensure the consequent life-extension of shore support facilities and activities are not included within project scope, but are considered to be a continuation of Navy O&M support infrastructure costs formerly devoted to OBERONS. b. Infrastructure: The notion of the project as an OBERON replacement project implicitly excludes any west coast infrastructure modifications that may be necessitated by any subsequent coastal redeployment...”
8	December 2000	At the second meeting SCLE Senior Review Board (SRB), the financial constraints on the project are recognized and endorsement was given to the scope interpretation issue.
9	MARCOM Capability Plan 2000	“the Submarine Capability Life Extension (SCLE) Project is in implementation and proceeding apace, with two submarines to be delivered next Fiscal Year (FY). However, there are numerous demands that are outside the scope of the project, which will tax my Operating Budget in the next three FYs. Examples include the infrastructure and personnel requirements to be satisfied in establishing a submarine capability in Maritime Forces Pacific, and the acquisition of a submarine command team training and weapon certification capability.”

ANNEX B – CRITERIA

Management Control Framework/Information for Decision Making

- roles and responsibilities are clearly defined as evidenced by a terms of reference, project charter or other
- regular and timely reporting at all levels combined with ad-hoc information exchanges and on-site visits as required
- effective use of committees for problem identification and resolution at project and program level

Risk Management Strategy and Practices

- identification of important internal and external factors and risks as evidenced in PPRA, approval submission docs, etc.
- disciplined approach to risk identification and management based on accepted criteria e.g., Software Engineering Institute, Project Management Body of Knowledge
- mitigation strategies such as test and evaluation are identified for each risk
- implementation and monitoring of risk factors and mitigation plans are ongoing
- risk manager appointed

Statement of Operational Requirements

- an SOR exists and follows the guidelines in the Materiel Acquisition and Support desktop
- a formal SOR does not exist but requirements have been agreed to and delineated in other documents

Options Analysis

- the cost-effectiveness and operational effectiveness of other options or alternatives have been analyzed before procurement methods are selected

Financial Management

- the process is managed and reported in accordance with accepted financial management control practices i.e., Financial and Managerial Accounting System (FMAS)
- financial arrangements between the UK and Canada are clear and unambiguous
- the project is keeping track of actual expenses versus planned and approved expenses and the reasons for any variance
- payments are related to contract clauses concerning progress and/or deliverables and penalties or standard withheld amounts are applied in accordance with terms of the contract

ANNEX B

Project Planning and Management

- cost and scheduling is being monitored

Schedule Variance and problem Tracking

- the project staff keeps track of actual versus planned target dates and reasons for slippage

Integrated Logistics Support

- configuration and technical data management is provided either by contract or within the EPM staff
- appropriate introductory training is being provided on time
- effective training devices and simulators for training and operational planning are provided at DND schools and user units
- initial provisioning of spares (usually two years) is based on estimates derived by some accepted methodology such as Logistics Support Analysis or by experience of other users or the manufacturer
- in-service support contracts for equipment in use and for repairable components are being arranged with performance incentives in the terms of payment
- obsolete inventory is disposed of with appropriate materiel accounting practices

Human Resources

- sufficient trained, experienced resources are available both internally and externally to manage this project
- the size and makeup of the project office is based on a methodological analysis of the anticipated work of the project



ANNEX C

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ANNEX D

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ANNEX D

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