National Defence / Défense nationale

Chief Review Services / Chef - Service d'examen

CRS / CS Ex

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information withheld in accordance with the AIA under sections 20 Third Party Information, 21 Advice, etc. and 69(1) Confidences of the Queen's Privy Council for Canada of the AIA. Information UNCLASSIFIED.

Review of the Canadian Search and Rescue Helicopter Acquisition (Cormorant)

July 2007

7050-11-23 (CRS)



Canada

CAVEAT

This document reports the results of an independent review. While sufficient to provide a reasonable level of assurance relative to the defined objectives and scope, and to support the formulation of recommendations for action by management, the review assessments and conclusions are not based on the rigorous inquiry or evidence required of an internal audit. Accordingly, they are not represented as such.

It should be noted that this review is not intended to assess the performance of contractors; rather, it is an internal review of processes and practices within the Department of National Defence/Canadian Forces. Contractors have not been interviewed or otherwise asked to provide comment or feedback.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

TABLE OF CONTENTS

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

LIST OF ACRONYMS

ADM(Mat)	Assistant Deputy Minister (Materiel)
AETE	Aerospace Engineering Test Establishment
AOG	Aircraft-on-ground
BOC	Basis of Certification
CDR	Critical Design Review
CF	Canadian Forces
CFLA	Canadian Forces Legal Advisor
CFM	Cost Factors Manual
COTS	Commercial off-the-shelf
CRS	Chief Review Services
CSH	Canadian Search and Rescue Helicopter
DAOD	Defence Administrative Orders and Directives
Dep COS	Deputy Chief of Staff
DFPPC	Director Force Planning and Program Coordination
DGAEPM	Director General Aerospace Equipment Program Management
DG Fin Mgt	Director General Financial Management
DGMPD	Director General Major Projects Delivery
DGMSSC	Director General Materiel Systems and Supply Chain
DMG Compt	Director Materiel Group Comptrollership
DMPP	Director Materiel Policies and Procedures
DMPS	Director Major Project Services
DND	Department of National Defence
DSFC	Director Strategic Finance and Costing
DTA	Director Technical Airworthiness
FH	Flying hours
FMAS	Financial Managerial Accounting System
GoC	Government of Canada
IOC	Initial operating capability
ISS	In-service support
ISSCF	In-Service Support Contracting Framework
MA&S	Materiel Acquisition and Support
MASIS	Materiel Acquisition and Support Information System
Mat KNet	Materiel Knowledge Network

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

MMH/FH	Maintenance man-hours per flying hour
MOTS	Military off-the-shelf
NP	National Procurement
PAM	Procurement Administration Manual
PCRA	Project Complexity and Risk Assessment
PDR	Preliminary Design Review
PIP	Project Implementation Plan
PMO	Project Management Office
PMPD	Policy and Major Projects Directorate
PO&M	Personnel, Operations and Maintenance
PPRA	Project Profile Risk Assessment
PWGSC	Public Works and Government Services Canada
QETE	Quality Engineering Test Establishment
RFP	Request for Proposal
SAR	Search and rescue
SCLE	Submarine Capability Life Extension
SMRR	Scheduled Maintenance Resources Report
SOR	Statement of Requirements
SOW	Statement of Work
SRB	Senior Review Board
SS(EPA)	Synopsis Sheet (Effective Project Approval)

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

RESULTS IN BRIEF

Introduction

In response to a request from the Director General Aerospace Equipment Program Management (DGAEPM), Chief Review Services (CRS) conducted an independent review of specific aspects of the project for the acquisition of the new search and rescue (SAR) helicopter. Through an examination of the conditions associated with the delivery of the helicopter, and its sustainment, relative to established acquisition project criteria, the review findings provide lessons that should be of benefit to future acquisitions.

Background

In 1998, a contract was awarded to an overseas consortium to provide a new fleet of SAR helicopters. This new fleet of 15 Canadian SAR helicopter (CSH) aircraft, known as the CH149 Cormorant, was intended to replace the fleet of Labradors. The aircraft was to be non-developmental in nature, building on a foundation of existing models and variants. Delivery dates were planned to take place between February 2001 and October 2002. In July 2000, a separate contract was awarded to a Canadian company to provide the full range of in-service support (ISS) for the CSH, replacing the need for in-house maintenance.

Overall Assessment

Overall, the CSH Project fulfilled its mandate within its original budget allocation of $779M, despite difficulties that resulted in delays in delivering the aircraft and attaining operational capability. The Project Office closed in 2004, approximately one year later than scheduled. Shortening the period of project funding for ISS of the aircraft was, however, necessary to avoid over-expenditure.

The single most significant issue affecting this acquisition project was the early and unchallenged assumption that the procurement was essentially *off-the-shelf*, contradicting current views that the aircraft now has less than 30 percent commonality with the *off-the-shelf* version. This assumption diminished attention to risks, some of which proved to be high/significant. A rigorous front-end risk assessment did not take place to isolate and appropriately mitigate risks over the life of the project. As such, the level of complexity was not anticipated and the procurement/contracting strategy proved problematic. Recognizing and understanding the circumstances that led to the difficulties experienced by this project can provide insights to reduce risks for future acquisition projects.

Principal Observations

Off-the-Shelf Assumption. Many of the difficulties experienced during this acquisition project resulted from the assumption that a product corresponding to the CSH Statement of Requirements (SOR) could be acquired "off-the-shelf." There was no formal and critical evaluation to test what proved to be a substantially incorrect assumption considering the extent of modifications needed to any of the existing models in order to produce the required aircraft. The lack of a common understanding of what constitutes an *off-the-shelf* product contributed to this situation and acted to the detriment of the project.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

A significant negative effect of the *off-the-shelf* assumption was evidenced as it affected the execution of the airworthiness certification of the CSH. Based on this assumption, the effort required to meet this legal requirement, mandated through the *Aeronautics Act*, was not sufficiently defined from the earliest stage of the project. Without sufficient and active participation of the mandated authorities, the planning and formulation of the certification requirements were lacking in the official documentation and the project schedule. This resulted in misinterpretations of the requirements, delays in the aircraft delivery and in the awarding of certification, as well as an excusable delay claim against the Crown.

Procurement Concept and Process. The procurement concept (establishment of accountability, delivery schedule, contract terms and conditions, Project Office staffing, ISS arrangements, etc.) did not reflect the scope and effort associated with the introduction of a largely "developmental" aircraft (i.e., an aircraft that had never been assembled with the particular components and characteristics required by the specifications). In particular, the certification or airworthiness requirements, as well as the technical risks, proved to be severely underestimated. Additionally, the selected ISS concept was not fully suitable for the introduction phase of a newly developed aircraft. Further, the onset resourcing of the Project Management Office (PMO) was not adequate for the level of complexity associated with its mandate.

In addition to the expectation that the equipment could be acquired *off-the-shelf*, the procurement process overlooked the impact of purchasing a product that was neither made nor used in Canada. ……. ……. …… There was no established history of use, and resulting maintenance for, this helicopter, which would correspond directly with the intended Canadian Forces (CF) utilization.

The procurement concept impeded the possibility of establishing clear lines of responsibility between the manufacturer and the ISS company vis-à-vis the operational availability of the aircraft during its introductory phase. This shortfall was rooted in the notion that a second contractor could be inserted into the aircraft's support regime at a time when it was still experiencing a number of initial adjustment problems. …… …… Consequently, the Department finds itself disadvantaged in trying to enforce a number of contract clauses related to the performance of the contractor providing ISS.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

Project Management. There were also difficulties in the early stages of the project with respect to …….. and a significantly incomplete assessment of risks. The scope of the project was increased with the project absorbing the corresponding infrastructure funding implications of about $10M. This affected the availability of the contingency funding for unexpected costs relative to the original scope. Although the project delivered within its overall budget, tracking of expenditures did not always provide complete visibility through the Financial Managerial Accounting System (FMAS). As well, the process for capturing and sharing project management lessons learned was not timely.

Main Lessons/Recommendations

In view of the maturity of the CSH Project, this report is mainly concerned with the documentation of lessons learned. CRS continues to perform audits of major contracts and will make more specific recommendations through related reporting.

Insights gained through this review of the CSH highlight the importance for all project stakeholders, including representatives from Public Works and Government Services Canada (PWGSC), to participate in an up-front risk/opportunity assessment that addresses time, budget/cost, and performance over the life of major new equipment acquisitions, including the initial in-service period for the equipment. Key to this would be consideration of the risk mitigation strategies built into the procurement and contracting approach. Experience with the CSH Project has, for example, illustrated risks around coordination and accountability when there is a handover from an original equipment manufacturer to a contracted maintainer. When devolving total system support responsibility, the Department also needs to determine the level of visibility it requires from the contractor's system to ensure fulfilment of the operational and contract management responsibilities. Lastly, this report recommends strengthening some aspects of project management control such as processes for estimates preparation, timely sharing of lessons learned, and financial recording and reporting procedures.

It should be noted that a number of the recommendations will have implications for engaging PWGSC in the development of timely risk management strategies and plans.

Note: For a more detailed list of CRS recommendations and management response, please refer to Annex A—Management Action Plan.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

INTRODUCTION

Objectives

The objective of this review was to assess the effectiveness of the control framework for the delivery and sustainment of the new CSH—the CH149 Cormorant.

Scope

The review was initiated at the request of DGAEPM in view of the difficulties experienced during the implementation phase of the CSH Project. DGAEPM's main areas of concern were the following:

- Certification of airworthiness process and delay;
- Delayed operational capability;
- Availability rates;
- ISS costs; and
- Spares shortages.

The review focused on the following three specific aspects of the CSH acquisition project:

- Certification of airworthiness;
- ISS; and
- Management of the two main contracts, i.e., the acquisition contract and ISS contract.

The scope of this review did not include detailed analysis of the SOR, technical aspects of the aircraft, or financial transactions.

The observations from this review led principally to lessons that can be used to improve future major capital acquisition and ISS procurement.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

Criteria

The following criteria, applicable to acquisition projects, guided the activities of this review:

- The procurement strategy is based on validated requirements and verified information;
- The contracting strategy complies with governmental and departmental regulations;
- Effective risk management practices are in place;
- Cost estimates are based on validated information and reliable sources; and
- Effective control and reporting systems are implemented.

Methodology

The methodology used to attain the objective of this review included the activities listed below:

- Review project documentation;
- Interview staff from the PMO, the Director Technical Airworthiness (DTA), and the Aerospace Engineering Test Establishment (AETE);
- Review correspondence and minutes of meetings, SITREPS, etc.;
- Site visit (4 Wing Cold Lake);
- Analyse financial, inventory and maintenance data; and
- Perform benchmarking research on comparable acquisition projects.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

Project Mandate

- The mandate of the PMO as stated in the CSH Acquisition Project Charter included the following responsibilities:

  - Deliver a fleet of 15 new Cormorant SAR helicopters at four locations (Comox, Gander, Greenwood and Trenton);
  - Identify and acquire an initial package of publications, technical data, spare parts, support equipment and training services/aids;
  - Establish and maintain during the helicopter delivery period and beyond (FY 2000/2004), a support program consisting of:
    - equipment program management,
    - aircraft maintenance/supply support,
    - initial repair and overhaul services,
    - engineering/technical support services; and
  - Transfer the responsibility for the management of the support program to the Department of National Defence (DND) Equipment Program Manager.

- The Project Charter (second amendment dated December 2001) specified that the CSH Project was not responsible for managing or funding the ISS contract beyond 31 January 2003, or funding major facility improvements not directly related to the acquisition of the CSH.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

Overall Project Performance

- Overall, the CSH Project has fulfilled its mandate within its original budget allocation of $778.8M, albeit with a delay of approximately 20 months in attaining initial operating capability (IOC) at the last location. The Project Office closed at the end of July 2004. As of 31 March 2004, 95.3 percent of the budget allocation had been spent, and the PMO predicts that the project allocation will be 99.5 percent spent by its completion time.

Delivery Delays

	Planned	Actual
Delivery of the first helicopter	February 2001	October 2001
Delivery of the last helicopter	October 2002	July 2003
IOC at last location (Trenton)	November 2002	July 2004

- The project also established and maintained the support program for the CSH, which entailed managing the ISS contract ($184M over seven years) in addition to the aircraft acquisition contract (awarded for $580M in April 1998). The PMO ceased funding the ISS contract in April 2002, which contributed to the project staying within budget.

- Throughout the implementation phase of the project, the PMO was able, with the cooperation of the two contractors, to lessen the challenges that were causing aircraft delivery delay and the reduced operational capability and availability rates.

CSH expected availability rate/Status at Comox* (January–October 2003)

First aircraft	99.5 %	generally met
Second aircraft	95 %	met 3 months out of 10
Third aircraft	75 %	never met
Fourth aircraft	48 %	never met

* Comox was the first location to reach operational capability

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

Observations and Recommendations

- Based on the established criteria, the review of the documentation and activities of the CSH acquisition project identified concerns with respect to the procurement strategy (concept and process); the CSH acquisition contract; ISS services; and project management, specifically in risk management, control procedures and sharing of lessons learned.

- The observations identify the conditions that eventually led to the issues of concern on the part of DGAEPM, while also reporting on shortcomings in management and control aspects. At the same time, this review concludes that the overall positive outcome of this Project was due, in no small measure, to the constructive approach and dedication of the people involved in its delivery.

The performance of the CSH during exceptionally harsh operational conditions has received the praise of the SAR community.

The Procurement Strategy

The procurement concept was based on the assumption that the helicopter being purchased was *off-the-shelf*

- We found no evidence of a formal and critical evaluation process to determine if a product that would satisfy the SOR and the Statement of Work (SOW) existed as fully developed *off-the-shelf* equipment. The assumption that such a product existed proved inappropriate given that:

  - Extensive modifications were required to the basic, certified version of the EH-101 aircraft to obtain the defined CSH (DTA staff estimated that the CSH retains approximately 20 percent commonality with its original 510 version).
  - No acceptable Basis of Certification (BOC) document was available until November 2002.
  - As of May 2002, there were still 366 items awaiting Logistic Support Analysis because they were considered CSH-specific items i.e., they had not been installed previously on other EH101 variants, or being developmental for the CSH.
  - ……
  - Several technical problems, defined as initial adjustment problems, were experienced during the early introduction phase.

The availability of a BOC should be considered essential when evaluating the suitability of *off-the-shelf* aircraft projects presented by different bidders.

- The *off-the-shelf* assumption influenced the following five aspects of the procurement process, which resulted in several of the difficulties experienced by the project:

  - *The scope and effort requirements for awarding a certificate of airworthiness for the CSH were under-estimated.*

    - The certification approach, relying on previously generated certification data, could not be applied successfully.
    - DTA, AETE, and Quality Engineering Test Establishment (QETE) staffs were not involved in the early stage of the project to confirm the certification needs.
    - The acquisition contract did not clearly define the certification requirements and each party's responsibilities in conducting certification of the complete helicopter.
    - The assessment process at the Critical Design Review (CDR) was not comprehensive enough to identify areas of concern that could affect certification/airworthiness and operational requirements.
    - Specific information concerning the certification issues is detailed at Annex B to this report.

  - *The scheduling of the CSH's delivery and timeframe for achieving operational capability was overly optimistic.*

    - There was no allocation of time for correction of initial glitches expected in the introduction of a new helicopter.
    - Insufficient time was allocated in the delivery schedule to permit completion of the certification process and the modifications required to obtain certification, causing an eight-month delay in the delivery of the first aircraft.

  - *The assessment of risks was incomplete.*

    - The Project Profile Risk Assessment (PPRA) did not identify technical elements of risk associated with the initial assembly of the new CSH.
    - The extent of modifications required to the existing version of the helicopter to satisfy the Canadian requirements was not recognized.
    - Risk factors were not evaluated as a basis for planning mitigating actions.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

- *The contingency funding (2.3 percent of the total project value) was not adequate given the developmental aspects of the CSH.*

  - The basis for establishing the contingency requirements became skewed as the cost for the helicopters themselves was excluded from the total project value when calculating the contingency funding.

- *From the earliest stages of the project, the number and the expertise of staff assigned to the PMO were not sufficient.*

  - Specific technical expertise (e.g., DTA, Canadian Forces Legal Advisor (CFLA)) was not immediately assigned to the CSH PMO.
  - The PMO had limited available resources to deal with the complexity of the Project (e.g., a main contractor operating overseas from two distant locations, the introduction of a new ISS concept, two major contracts, a third-party contractor operating at four locations across the country).

The use of formal structures for the review of the documentation at the Preliminary Design Review (PDR) and the CDR stages should be enforced to ensure thorough evaluation and to reduce the need for engineering changes.

The procurement process did not account for the absence of validated information on the ISS requirements for the CSH

- The procurement process included the awarding of a performance-based maintenance contract with a third party …… …… …….. ……

  - ……..
    …….
  - ……..

The procurement process did not allow for the fact that the helicopter being purchased was not built or in use in North America

- The introduction of a helicopter not previously available in Canada affected certain aspects of the ISS; however, the procurement process did not make specific allowances for:

  - The impact of the familiarization period for the new helicopter on the effectiveness of the maintenance labour; and
  - The constraints affecting the provisioning of spare parts:
    - Spare parts and items usually considered standard in the country of origin were not commonly available in Canada;
    - The acquisition of CSH-specific spare parts was subject to a foreign production system, to customs formalities, and to complex and extended supply lines – transatlantic, trans-national and trans-carrier (i.e., air, rail and sea)[1]; and
    - Shortage of spare parts was frequently the cause of aircraft-on-ground (AOG) as reported in minutes of regular teleconference-meetings and PMO Situation Reports[2].

The procurement process needs to take into consideration the conditions specific to the acquisition project.

The procurement concept impeded the establishment of clear and enforceable accountability between the main supplier and the ISS contractor

- The procurement concept assigned the responsibility for maintenance of the CSH to a third party immediately upon its delivery.

  - As a newly assembled aircraft, the CSH initially required maintenance related to its early stage, and maintenance that was subject to warranty under the acquisition contract. Therefore, two contractors (the producer of the aircraft and the ISS contractor) were involved in ensuring the operational status of the CSH during its early introduction phase. Attributing the reduced operational status to the performance of one of the contractors becomes a very speculative undertaking.
  - While the ISS contract is performance-based and linked to availability rates, the aircraft acquisition contract did not include aircraft performance standards, or contractual obligation for turn-around-times for repairable spares and for procurement lead times (including delivery) for spare parts.

[1] CRS observed difficulties with longer procurement lead time in the Submarine Capability Life Extension (SCLE) Project.
[2] Shortage in initial provisioning of spare parts was also experienced in the SCLE Project.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

Recommendations/Lessons Learned:

Approval authorities and Senior Review Boards (SRB) should require up-front risk/opportunity analysis which is sufficiently developed to provide a view of the acquisition lifecycle—through early in-service. This should include specific attention to the procurement concept and conditions relative to the product being acquired. Some of the conditions and characteristics to be assessed and evaluated include:

- The extent of required product development and Canadianization;
- The availability of validated data on performance and maintenance;
- The geographical characteristics of the supplier(s);
- The impact of introducing a third party; and
- The certification/airworthiness requirements.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

The Aircraft Acquisition Contract

The main acquisition contract contained certain ambiguous terms and statements subject to interpretation

- Examples of contract content that led to misinterpretation:

  - Steady state;
  - "Type Certification of the CSH will be facilitated if the type design has previously been type approved;" and
  - The limited description of the expected content of the publications to be provided by the contractor.

- Misinterpretation due to the lack of details in the acquisition contract resulted in unclear expectations of the roles of key players, and of deliverables acceptable to DND, eventually leading to an excusable delay claim.

  - The contractor and the PMO did not expect extensive procedures for awarding certification; and
  - Maintenance manuals that would meet the standards expected by DND ……..

The acquisition contract did not clearly specify requirements for certification of the assembled CSH version

- The contract did not specify the extent and methods for certifying the assembled CSH—it instead emphasized the aircraft systems (Annex B provides details). Assumptions were made that

  - CSH unique specifications would not impact on previous certifications; and
  - Derogations against regulations granted by authorities for previous certifications were acceptable for the CSH.

Even in the case of an *off-the-shelf* product, the contract needs to clearly specify the certification requirements and process, and the authorities' roles.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

……
……

- ……..
  ……..
  ……..

- …….

  - ……..
  - ……..
  - …….

The acquisition contract did not provide adequate consideration for the provisioning of spares

- Although the Department moved towards commercial practices in terms of re-provisioning and inventory management, the acquisition contract did not establish the conditions necessary to ensure effectiveness of the commercial concept or contract conditions:

  - It was silent on the issue of future pricing for spares and maintenance support equipment.
  - It did not specify performance standards on issues such as:
    - delivery time and/or use of geographically suitable supply points;
    - specific period of time for responding to an order for spares; and
    - timely availability of all spare products including those from sub-contractors.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

- Consequences of these omissions from the contract included:

  - ……
  - …… ……
  - Reduced ability of the ISS contractor to meet the conditions of the ISS contract; and
  - Reduced operational availability.

Recommendations/Lessons Learned:

ADM(Mat) should establish mandatory procedures for initiating contracts for major capital acquisitions such that technical, legal, and project management experts are formally engaged in the preparation of the acquisition contract. They should confirm the contract's clarity and completeness in view of the requirements resulting from the particularities of the procurement concept and product being acquired, especially for:

- Clearly defined terms and phrases used in the contract;
- Clear accountability and responsibility; and
- The provision of validated technical data.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

In-Service Support Services

The uncertainties associated with the introduction of the new CSH aircraft were incompatible with the selected ISS concept

- The pre-existing conditions to the ISS contract led to a third-party contract for which the Department's ability to enforce performance standards was limited, therefore increasing the risk to DND. These conditions were:

  - ……..
  - ……..…
  - ……
    ……

- ……
  ……
  ……
  ……

The manner in which the total responsibility was devolved to the ISS contractor reduced DND's capability to analyse possible causes of operational difficulties and contractor performance

- DND has very limited access to the ISS contractor's inventory system:

  - The system is not accessible through DND database management; and
  - A request for data information from the inventory system could not be satisfied during this CRS review (it would have served to analyse ordering and receiving of spare parts that had caused AOG).

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

- DND does not have direct access to the ISS contractor maintenance database:

  - Systematic provision of data and regular reporting on the maintenance activities of the CSH are not contractually required, and they were not available to DND during the early introduction of the CSH; and
  - ……
    ……

The PMO's mandate concerning the procurement of spares was not clear and may have been unrealistic

- The mandate states that the PMO will provide "two-year steady-state operations consumable spares" and "sufficient repairable spares to fill the Repair and Overhaul pipeline." However,

  - Steady state has not been defined; and
  - These statements assumed that "steady state" would be reached soon enough during the existence of the PMO to permit the capture of validated data during normal operational activities. This has proven unrealistic.

- The mandate statement has led to different interpretations of the PMO's responsibilities:

  - Provision of spares for two years from the time "steady state" would be reached, consequently delaying the use of the National Procurement (NP) funding; or
  - An initial provision of spares and consumables (the Project Implementation Plan (PIP) states that "initial provisioning" was due on the main operating bases two months prior to the delivery of the helicopter), therefore allowing time for the organization responsible for the ISS to put in place its provisioning system.

The lack of clarity of the PMO's mandate could have resulted in inappropriately low estimated requirements and funding for NP.

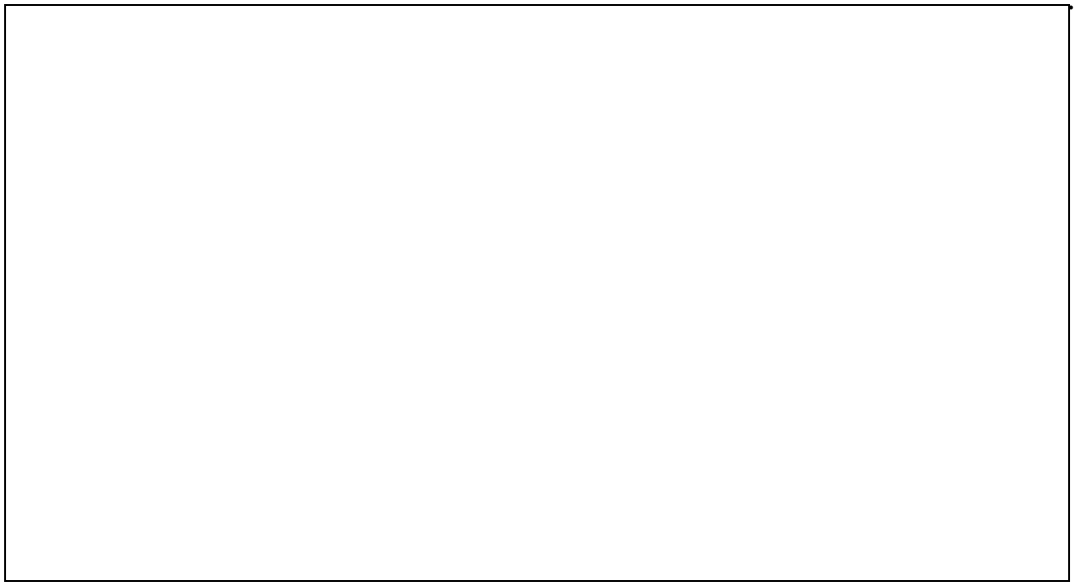
At the time of the review, actual and projected costs for contracted ISS remained within estimates

- Caution needs to be exercised when comparing maintenance costs incurred through the ISS contract versus those for the in-house concept:

  - The costs incurred through the ISS contract include expense elements that were not previously funded through the NP account such as military technicians' pay and occupation training costs;
  - The figures in the Cost Factors Manual (CFM) did not include all the expenses that are now part of the ISS contract such as travelling, training, and publications costs; and
  - Some expenses incurred in relation to the maintenance of the CSH fleet are funded outside of the ISS contract.

- ……
  ……..

  - ……
    ……
    ……..……



……
……
……
……

……
……
……
……
……....

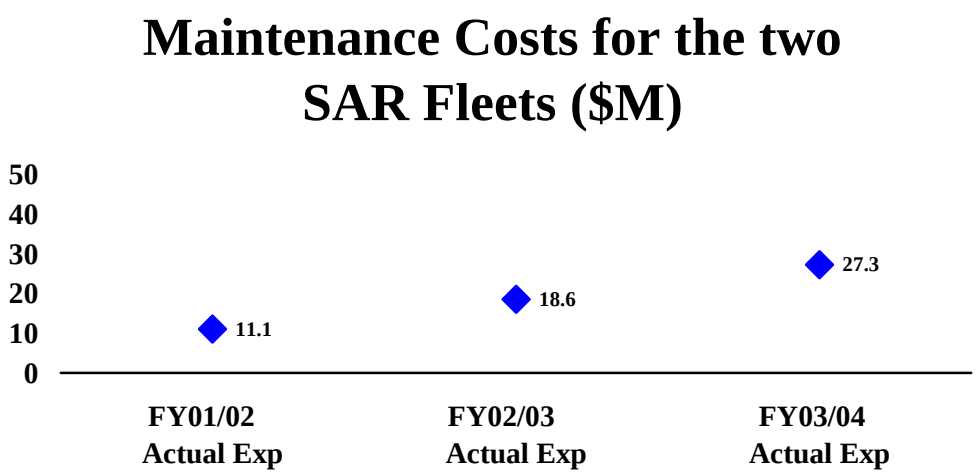
- Earlier and current estimates for maintenance costs do not vary significantly:

  - ……
    ……
    ……

- The actual expenditures from the NP account for maintenance of the two SAR fleets are lower than the estimated costs for the CSH maintenance:

  - The FY 2003/04 NP expenses for the two fleets were $27.3M, which is less than the cost to maintain the Labrador fleet in 1997/98 according to the CFM ($36.9M), which would represent $45.2M in 2003/04 dollars; and
  - It is to be noted that the warranty clause in the CSH acquisition contract contributed to lower ISS expenditures to date.

- Future maintenance costs will be affected by the end of the warranty period. ……
  ……
  ……



NOTES:

- These figures are from reported NP expenditures. They do not include the cost of military pay related to the maintenance of the Labrador.
- Third Line maintenance on the Labrador was reduced while consuming remaining aircraft life.
- Until March 2002, the PMO covered the CSH ISS expenses.

- Actions associated with the planned military personnel savings resulting from the change of maintenance concept from in-house to an ISS contract require follow-through:

  - The planned military personnel savings are not totally realized. Between April 2001 and December 2003, the four SAR Squadrons and their respective Wings eliminated 99 positions in three military air technician occupations (Aviation System, Avionics System and Aircraft Structures) plus an additional nine as of 30 June 2004 in 424 Squadron, for a total of 108. The PIP stated that 140 positions would be deleted. Trenton will likely see additional deletions having only achieved IOC in July 2004;
  - The current reduction represents a saving of approximately $7.2M per year in the military pay envelope, which is, however, at least partially offset by the personnel costs incurred by the ISS contract; and
  - There is no evidence to suggest that the NP account baseline was increased to accommodate this transfer of financial responsibilities.

Recommendations/Lessons Learned:

The appropriateness and contractual effectiveness of the proposed ISS concept for the CSH Project should be assessed by technical and contract experts. The assessment should be documented, and it should specifically examine how the proposed concept is affected by the specific conditions of the acquisition project including the terms of the manufacturer's warranty and the availability of validated performance and maintenance data.

The CSH in-service cost estimates should be prepared according to an established methodology, and their validation by subject matter experts documented.

When total responsibility is devolved to an ISS contractor, ADM(Mat) should ensure that contractual arrangements contain clauses that provide DND with access to the information required to fulfill its operational and contract management responsibilities.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

Project Management

Significant risks associated with the developmental aspects of the helicopter model being acquired were not identified in the planning and introductory phases of the CSH acquisition project

- The original and amended versions of the PPRA did not document risk factors such as:
  - Technical difficulties related to the introduction of a new version of aircraft[3];
  - The possibility of delay in reaching operational readiness, and the consequences of such delays (e.g., additional costs incurred for the Labrador fleet, impact of the ISS contract timelines); and
  - The impact of the lack of validated performance and maintenance data for the helicopter model being acquired.

In its April 2000 report, the Office of the Auditor General had commented favourably on the risk management plan for the CSH acquisition project. Its implementation, however, turned out to be deficient.

- The project did not document the consequences of using unproven maintenance data when:
  - Tendering for the ISS contract;
  - Establishing the spares requirements; and
  - Assessing the achievable availability rates of the helicopter.

- The involvement of subject matter experts on the technological and project management aspects of acquiring a newly assembled helicopter was not evident in the planning stage of the CSH acquisition project, or for the preparation of the PPRA[4].

[3] The CRS review on the SCLE Project reported similar weaknesses concerning the assessment of technical risks.
[4] The CRS review on the Fragmentation Grenade, Armoured Vehicle Acquisition reported on the importance of the role and responsibilities of technical specialists.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

The Project scope was increased

- In May 1999, SRB approved that the CSH Project undertake the construction of the new Comox hangar, which represented an additional expenditure of nearly $10M. The construction was first reported in the annual progress reports in 2002. Documented approval was not found, and the Project Charter was not amended. This increase in scope represented approximately one-third of the already limited contingency funds. It negatively affected the Project's mandated activities as follows:

  - When the project faced an unexpectedly high requirement for spare parts, this increase in scope lessened the possible funding through the contingency. It is estimated that the project will fund approximately $4M less than originally budgeted for spares, which will result in a lower level of spares in the inventory at the time of project closure or greater costs to NP; and
  - To remain within its allocation (having used all its contingency funding), the Project had to cease funding support to the ISS contract in March 2002, approximately four months prior to completing the first IOC, and ten months earlier than stated in the latest Project Charter. The NP Account became responsible to fund the ISS of the CSH early in the introduction process.

Visibility of actual expenditures through FMAS was negatively affected

- When expenditures were registered in the FMAS, they were not consistently linked to a Work Breakdown Structure element:

  - FMAS reports cannot be readily used to compare expenditure estimates with actual expenditures; and
  - The PMO budget sheet constitutes the most reliable source of information.

- Payments were not always reported against the appropriate budget elements or sub-elements.

  - In some instances, milestones led to payments against a number of deliverables that were related to different budget elements or sub-elements. The monetary values of each of the deliverables within a given milestone were very different.
  - The total amount of the invoice provided for a given milestone was not broken down against the different budget elements or sub-elements linked to the deliverables; it was rather reported against the element or sub-element that represented the higher financial value of the milestone. Therefore, minor financial elements or sub-elements were not credited with all their related expenditures. Although this practice does not significantly affect the reported cost of the high-value elements, it results in understating the cost of low-value sub-elements. This practice would be more misleading if the value of deliverables were relatively equal.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

Issues reported as lessons learned in previous projects recurred during the CSH Project

- Some of the difficulties encountered by the CSH Project were previously documented within the Department and by allied nations on the acquisition of other helicopters and *off-the-shelf* equipment:

  - The Light Support Vehicle Wheeled Project (Approval in 1992, last vehicle delivered in 1997) reported on difficulties related to the *off-the-shelf* assumption;
  - The CH 146 Griffon Project (Approval in 1992, final Griffon delivered in 1997) documented difficulties and delays with certification and publications; and
  - More recent United Kingdom reports (October 2002 and October 2003) on the acquisition of the Apache Helicopter detailed problems in attaining certification, resulting in operational delay; insufficient and untimely provision of spares by the overseas manufacturer; and difficulties in acquiring data on equipment from external sources.

- The process to collect the lessons learned and the best practices from the CSH Project did not allow for timely dissemination across the Department:

  - The entries recorded in the PMO internal lessons database were not found in the Materiel Acquisition and Support (MA&S) Desktop;
  - Only selected entries were registered into the Capability Investment Database lessons database in fall 2003; and
  - Personal communications between the PMO and interested parties from other projects appear to be key to sharing lessons learned from the CSH Project.

Recommendations/Lessons Learned:

The Material Group should require that completed risk assessments be certified by functional and technical experts. An integrated web-based listing of risk factors should be developed.

Project management control processes should be improved for:

- Reporting progress on the projected reductions of military personnel costs;
- Using the Department's financial system recording features; and
- Reviewing and reporting of lessons learned.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

ANNEX A—MANAGEMENT ACTION PLAN

Ser	CRS Recommendation/Lessons Learned	OPI	Management Action	Target Completion Date
1.	**Risk Analysis.** Prior CRS work has stressed the importance that approval authorities and SRBs require an up-front risk and opportunity analysis addressing the full lifecycle of acquisition projects—into the in-service phase. This provides a basis for customized guidance, resourcing and monitoring/oversight for individual acquisitions. Lessons from the CSH Project illustrate that this analysis should address the procurement and support strategy relative to the characteristics of the project being acquired. Pertinent considerations, relative to the procurement concept/strategy, would include: - The extent of product development or modification/ Canadianization; - The availability of validated data on equipment performance and maintenance requirements; - Foreign sourcing and the geographical characteristics of the supplier(s); - Flexibility, accountability and costs associated with warranties, initial and downstream options and strategies for equipment support; and - Certification requirements (e.g., airworthiness).	ADM(Mat) DGMPD/PMPD ADM(Mat) DGMSSC/ DMPP	ADM(Mat) is in the intermediate stages of developing a Project Complexity and Risk Assessment (PCRA) tool. More specifically, the tool has seven separate areas of evaluation, encompassing the entire lifecycle of a project, that assesses the complexity and risk dimensions of approved, and to be approved projects. The five bulleted areas of concern will be appropriately addressed in the tool in that they will have levels of risk/complexity ratings, which will then roll up into the project's risk/complexity rating. Policy guidance and documents may need to be updated to reflect the outcome of this exercise. PCRA Tool Implementation – Start October 2007, End March 2008; and Integrate PCRA results with Investment Plan – Start April 2008, end June 2008.	June 2008

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

ANNEX A

Ser	CRS Recommendation/Lessons Learned	OPI	Management Action	Target Completion Date
2.	**Off-the-Shelf.** Approval authorities should specifically challenge use of the term "off-the-shelf." This term requires qualification as to degree.	ADM(Mat)/ DGMSSC/DMPP	The COTS acquisitions are defined in the Acquisition Reform Guide located on the Mat KNet. It states that COTS is an existing capability that requires no development and only minor modification. Procurement strategy approval and challenge responsibilities in the Procurement Administration Manual (PAM) require formal review by the interdepartmental Senior Procurement Approval Committee for Major Crown Projects. The SRB checklist also prompts discussion of acquisition reforms as part of the procurement review. Appropriate amplifications will be made to KNet and the PAM.	January 2008
3.	**In-Service Costs.** Cost estimates for the in-service phase of equipment should be prepared according to an established methodology, and their validation by subject matter experts should be documented.	ADM(Mat)/ Dep COS(Mat)/ DMG Compt DG Fin Mgt	DMG Compt, in consultation with DMPP, DSFC and DFPPC will explore potential improvements for in-service costing and appropriate amplification will be made to KNet and the PAM.	January 2008
4.	**Contractor Information.** When a contractor has full responsibility for ISS, the Department should ensure that contractual arrangements provide DND with access to the information required to fulfill its operational and contract management responsibilities.	ADM(Mat)/ DGMSSC/DMPP	The draft ISS Contracting Framework (ISSCF) and associated draft DAOD (Procurement of In-Service Support for Canadian Forces Platforms) is currently being staffed for approval. It addresses the requirement for contractor information, and specifically calls on lessons learned from the CSH Project in its development. The draft DAOD includes the requirement for ISS contracts to "be executed within an integrated GoC/contractor information environment." Specifically, the ISSCF indicates that the Integrated Information Environment focus should be "real-time data access as opposed to data deliverables	December 2007

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

ANNEX A

Ser	CRS Recommendation/Lessons Learned	OPI	Management Action	Target Completion Date
5.	**Input to Risk Assessments.** Risk assessments for major capital acquisitions should be certified as being complete. Comptrollers should be tasked to validate that appropriate operational, engineering, contracting and financial expertise has been applied and that the technical representatives have signed off. An integrated, web-based listing of risk factors should be developed and maintained, capturing the contributions of functional and technical experts.	ADM(Mat)/ DGMSSC/DMPP DGMPD/PMPD	Policy and guidance are available through the Project Approval Guide, KNet and the PAM relative to the conduct of Project Risk Assessments. Project Managers, as opposed to Comptrollers, are central to ensuring that formal risk analyses are conducted and that all issues are characterized within assessments. Currently up-front project risk assessments are provided to approval authorities and SRBs through the review and approval of key project documents (PPRAs, Synopsis Sheets, Procurement Plans). The PAM outlines various types of procurement risks that must be considered, including those relative to the chosen procurement strategy. The value of an integrated web-based listing of risk factors will be examined and changes to KNet and the PAM will be considered, if appropriate.	January 2008
6.	**Project Management Control.** Processes should be improved for: - Reporting progress projected savings, particularly military personnel costs; - Taking full advantage of FMAS recording features; and - Sharing lessons learned.	ADM(Mat)/ DGMPD/PMPD DGMSSC/DMPP	The Deputy Minister endorsed the creation of a new division within the Materiel Group that will consolidate the management of several complex major capital projects and professionalize the project management cadre to ensure they possess the necessary education, qualification, and experience to meet future acquisition challenges. The new division will use scarce PMPR positions and focus attention on high priority equipment projects. The organizational change will leverage critical existing expertise within the Group under this Director General and consolidate common services such as project management, procurement, financial, administrative, human resource management under a central directorate (DMPS). The centralized control	June 2008

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

ANNEX A

Ser	CRS Recommendation/Lessons Learned	OPI	Management Action	Target Completion Date
	Project Management Control (cont'd)		will ensure the application of standards, measurement criteria, processes, and controls for monthly project performance management. It will support decision making with performance trend analysis; problem resolution action plans, and reports to senior management. In addition, the MA&S optimization initiative is streamlining and improving project management business processes, and leveraging the use of MASIS. This includes the process to collect, distribute, and review lessons learned; the process for project cost planning and expenditure; and the process for project performance management and reporting. Best practices identified by DMPS will be incorporated into policy and guidance documents.	

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

ANNEX B—AIRWORTHINESS AND CERTIFICATION ISSUES

Background

1. One key issue reviewed during the CRS review of the CSH acquisition project concerned the interplay between the acquisition of aerospace equipment and the DND technical airworthiness mandate. This annex provides CRS observations regarding this specific issue.

Discussion

The Commercial Off-the-Shelf Assumption

2. After reviewing CSH acquisition project documentation and discussing with project, technical and test personnel, both past and present, the following observation is made. In 1997, the assumption was made that the Cormorant existed as a COTS product in the form of the EH 101-510 variant. As noted in the project documentation though, "It was neither a Commercial Off-the-Shelf (COTS) product nor a Military Off-The-Shelf (MOTS) product." This was in part due to the modifications being requested by the Department and the fact that no military variant of the EH 101 was yet in full operational service even though it was being procured by other nations.

3. This COTS assumption led to a cascading sequence of developments that have proven to be quite challenging. For example, as a result of this assumption, optimistic delivery schedules were established and a relatively small PMO was created. In addition, the Project's technical risks were underestimated, and the basis for establishing contingency funding became skewed when the costs for the helicopters themselves were excluded from the calculations. As the cost of the helicopters represented approximately 66 percent of the total costs for the project, this exclusion removed potential financial flexibility in the project.

4. Because the COTS assumption proved to be incorrect, the originally estimated scope and effort required for certification proved to be severely underestimated and resulted in too few personnel being assigned from the airworthiness cell of the DTA to the PMO. Project documentation states "The CSH Vehicle Specifications were written assuming the production of a COTS product. The reliance on previously generated certification data had been the cornerstone upon which DTA had entered into the project…" It should be noted that this approach had been applied successfully on previous COTS certification efforts such as the Hawk and Harvard aircraft used for NATO Flying Training in Canada, but since CSH was not COTS, this approach could not work.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

5. The CSH specification called for the helicopter to be a derivative of the 510 modified to meet Canadian requirements, rather than for exactly the 510 with exact copies thereof. The result was that the Cormorant became a conglomeration of systems and subsystems from the several different variants, then in development. While these systems and subsystems may have been accepted for use in those other variants, they had never been integrated together in a single design. This is evidenced by the fact that an acceptable BOC document for the CSH was not delivered until November 2002. The BOC is a document itemizing the specifications and standards and their revisions, to which the aircraft has been or will be certified to. It should be one of the first documents produced, if not one used in the actual screening of bidders.

6. The notion of allowing for minor modifications in the definition of COTS also carried with it the need for analysis to determine the impacts of those modifications. With respect to CSH modifications, project documentation notes that there was an accepted assumption that 80 percent of the CSH was to have been considered COTS, with 20 percent allowed for modifications. These numbers were neither written into the contract, nor did they form part of a common understanding of exactly what was meant by them.

7. For future contract work and to avoid the problems caused by incorrect assumptions, all concerned must have a common and detailed understanding of what is meant by the COTS product in question. To this end, it is recommended that thresholds for COTS content and allowable deviations thereof be put in writing. In this way, if the modifications exceed the thresholds, then the product will switch from being considered COTS to being developmental, with all the implications regarding future progress within the project. In fact, even the simple process of trying to establish thresholds could prove valuable. It could initiate a critical rethinking of exactly what constitutes a COTS product, and could possibly force the requirement for rigorous testing of such products in a military environment before they are selected for acquisition. It should also help demonstrate that components or subcomponents deemed COTS might not necessarily provide for a non-developmental effort if they require integration for operation. Finally, through the establishment of impact assessments concerning each modification, it would help nail down at the outset the impacts to cost, schedule, performance, and life cycle support that any such modifications could have.

The RFP and the Contract

8. In keeping with the philosophy of purchasing a COTS, non-developmental vehicle, decisions were taken to accept certification data from other sources. Specifically, the RFP stated, “Type Certification of the CSH will be facilitated if the type design has previously been type-approved by a recognized airworthiness regulatory agency. The objective in DND accepting the approval by

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

another regulatory agency is to eliminate duplication of effort and give credit to the maximum extent for all previous findings." This approach was later reflected in the contract. According to project documentation though, the contractor and DTA both had "different interpretations of this statement" and this resulted in an unexpected length of time to document airworthiness compliance. As stated previously, while the different systems and subsystems may have been accepted by other nations for use in their variants, they had never been integrated as a whole. From DTA's perspective, this was an unacceptable situation. From the contractor's perspective, the previously agreed-to process of using systems and subsystems that had been accepted by others was being followed.

9. The single- vs. double-walled fuel system design is illustrative of the difficulties associated with the RFP and contract. A single-walled fuel system design was accepted by another nation on one of its variants, even though the system did not meet the airworthiness standard used by that nation. That single-walled approach was then incorporated into the Canadian design. While the contractor felt he had satisfied the requirement for airworthiness, the acceptance of a non-compliant design by the other nation did not imply read-across acceptance by DTA, and the latter rejected the design for safety reasons when the single wall was introduced into the unique Canadian configuration. DTA eventually obtained a redesign to a double-walled configuration. This, however, cost the project in terms of schedule, and was one of the key pillars upon which the contractor based its excusable delay claim against the Crown. Had the RFP and contract wording been more precise in terms of what was to be delivered, or had the BOC been decided upon early in the process, the situation could have been avoided.

10. Another example of misinterpretation is the recurring theme that documentation provided by the contractor, while perhaps meeting the letter of the contract as written, was in fact ……. It goes without saying that RFP and contract statements must be clear and not subject to interpretation or ambiguity. Even in the case of a COTS product, departmental expectations for certification, testing, performance, reliability, documentation, etc. must be clearly specified. As a minimum, the services of the CFLA, as well as the services of the departmental specialists and test establishments, should be engaged prior to contract award to help ensure the clarity and completeness of contractual statements.

Interplay of DTA and Other Specialists in the Acquisition Process

11. The contract and SOW show DTA as the authority for technical airworthiness. Despite this acknowledgement, we were advised that DTA was not engaged in the bid evaluation process or subsequent follow-on contract negotiation wherein it could help assess the impacts of any technical compromises that might be offered for consideration. Defence Administrative Orders and Directives (DAOD) 2015-0 and 2015-1 (not issued at the time of audit) delineate the role and function of DTA, but they do not make

specific mention of potential DTA involvement in the early phases of the acquisition process. DTA should be involved in all phases, and this should be considered for incorporation into the DAODs as appropriate. As a minimum, DTA could help ensure the BOC was established as early as possible by ensuring that proper standards be included in the RFP and eventual contract.

12. The early involvement of the specialists from the AETE and QETE could also prove beneficial. They should be engaged as early as possible in the acquisition process in order to provide specialist input to the SOR, the risk analysis and mitigation plans, and the options analysis. They can also be available to participate at senior review boards and the like. In fact, these agencies can assist in determining whether an assumption about COTS, in the face of anticipated modifications, will remain valid.

Design Reviews

13. After PDR and CDR, the Department accepted the contractor's CSH design. Problems such as that of ……. were recognized only after CDR, in manufacturing. It seems that at CDR, only a cursory discussion of ……. was provided by the contractor. In fact, according to the PPRA document, only, "an abbreviated critical design review" would be held.

14. Typically at CDR, the bulk of the design is frozen, with changes after that being submitted as engineering change proposals. In the case of a true COTS purchase, one would not expect to re-analyse detailed drawings at CDR, but as a minimum, expect a listing of the standards and their appropriate revision numbers applicable to the final design. This was not done for CSH, and the review itself was, at best, too abbreviated. In fact, given that there was not even a BOC, the CDR was probably premature.

15. The CSH CDR was not detailed enough to allow for a proper analysis and subsequent acceptance of the design. In future contracts, the CDR should be structured to ensure that enough detailed documentation is presented to demonstrate the maturity of the design is at the appropriate advanced stage of completion to allow for a proper assessment to be made.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

ANNEX B

Interaction with the Contractor

16. From interviews with both DTA staff and technical staff at AETE, it is clear that having the PMO act as an intermediary with the contractor sometimes left critical issues subject to interpretation. On the other hand, when both DTA and AETE staff were allowed direct involvement with the contractor, issues were more readily resolved and complications were understood and dealt with as they arose. Direct discussions between technical specialists and the contractor must be permitted from the outset, but in so doing, the roles and responsibilities of each group, PMO, DTA, AETE or others, must be clearly defined with each having the same information, interpretation and understanding of all the necessary contractual clauses, expectations and requirements.

Lessons to be Learned

17. From the above, a clear lesson to be learned is the pressing need for the Department to establish and promulgate a definition of what constitutes a COTS product, with consideration for inclusion of threshold levels that, if exceeded, turn the COTS into a developmental product. If a COTS modification is to be undertaken, the impact must be appropriately assessed and reflected in cost and schedule, and risk management.

18. RFP and contract statements should be clear and not subject to interpretation or ambiguity. DND expectations for certification, testing, performance, reliability, documentation etc. must therefore be clearly specified. The services of the CFLA as well as the services of the departmental specialists and test establishments should be engaged prior to contract award. This would help ensure clarity and completeness of contractual statements and specifications in order to define the nature of expected deliverables, as well as the role of the contractor in providing the necessary information for items such as the BOC.

19. In future projects, DTA and other specialists from the test establishments should be engaged in all technical and design aspects of the project from requirements definition and specification development through to bid evaluation, negotiation of technical compromises, contract award and participation at senior review boards. Consideration should be given to reflecting this requirement in the MA&S process.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.

ANNEX B

20. The specific roles and tasks of DTA and test agencies should be clearly defined and their expectations understood and considered in terms of cost and schedule impact and factored into contract statements accordingly. These same groups must then be allowed face-to-face contact with the contractors, to mitigate misunderstandings or interpretations of issues. For their part, these groups must maintain the requisite expertise and be appropriately staffed.

21. Airworthiness certification processes should not be up for negotiation once established. They should contain enough detail to avoid underestimating the level of effort required on the part of the contractor and that of the Department, in assessing the contractor's deliverables. DTA and test establishments must be engaged in their preparation. The BOC document should be available as early in the process as possible. Its delivery can be tied to screening criteria for potential bidders, or as a milestone payment after contract award.

22. PDR and especially CDR should be structured such that enough detail is presented by the contractor, for the Department to make an accurate assessment of the design and its state of maturity. Any changes or deviations occurring after CDR would then follow the normal process for engineering change proposals.

Reviewed by CRS in accordance with the *Access to Information Act* (AIA). Information UNCLASSIFIED.