The Navy's Technical History: Should the Past Guide the Future?

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On 3 June 2010, the Government of Canada announced the establishment of the National Shipbuilding Procurement Strategy (NSPS), a government-industry initiative designed to support Canadian marine industry, revitalize Canadian shipyards, and build ships for the Royal Canadian Navy and Canadian Coast Guard. Less than a year-and-a-half later, on 19 October, 2011, the government announced that large combat vessels would be built by Irving Shipbuilding Inc's Halifax Shipyard and that large non-combat vessels for both the Navy and the Coast Guard would be built by Seaspan's Vancouver Shipyards Co. Ltd., of North Vancouver, BC. Since this new approach will not only provide much-needed new ships, but is anticipated to revive and provide a degree of stability to Canada's moribund shipbuilding industry, it is timely now to examine some of the historical aspects of Canadian shipbuilding underlying the NSPS approach.

In this paper, the Canadian Naval Technical History Association (CNTHA) will examine the Navy's technical history associated with various naval shipbuilding programs, and ask whether the past should guide the future as the NSPS evolves. In answering this question, the evolution of naval ship procurement, shipbuilding practices, and platform systems development will be addressed. The CNTHA's mission is to capture and preserve Canada's oral and written naval technical history. Late in the 1980s, a small group of naval and industrial technical history enthusiasts, wanting to record the impressive technical history of the Canadian Navy, formed a working group to study the development of naval systems and equipment from the 1930s to the end of the millennium. In the 1990s this working group became the CNTHA. Under the chairmanship of Rear Admiral (Ret.) Mike Saker, the CNTHA began to explore and record the RCN's technical history, working closely with the Directorate of History & Heritage (DHH) in the Department of National Defence (DND). An offshoot of the CNTHA, known as CANDIB, was formed in 2002 to explore the contribution of naval construction and equipment programs to the Canadian industrial base. CANDIB has merged with the CNTHA to gather information in a variety of formats for use by historians, researchers and the casual reader alike. The CNTHA is targeting 2015 for the completion of its initial work, but may very well continue if other historical projects come to light.

The RCN and World War II

The RCN's technical history really begins as an outgrowth of World War II. At the onset of the war in 1939, the RCN consisted of 13 ships of which six were relatively new destroyers that had been built in Britain to Admiralty designs and fitted with British equipment common to the Royal Navy (RN), 145 officers and 1,674 men. With the Reserves, the navy could count 366 officers and 3,477 men.[1] Although it was formally created in 1910, the RCN both was seen and saw itself as an adjunct to the RN. Within its limitations, the RCN was operationally efficient, but relied on the RN for engineering and technical support. There wasn't any ship or system design capability inherent in the RCN and its ship repair organization's management and resources were very limited.[2]

During the war, the RCN expanded to almost 100,000 officers, men and women and 400 ships, making the RCN the third largest of the Allied Navies. The Navy's emphasis was on operations but it had to grow in ship repair due to battle and storm damage. The Navy did look ahead to its post-war structure and during the war began the construction of two Tribal class destroyers. These ships had priority neither for steel nor labour, so they and two others were completed after the war.[3] They were built to British design and standards. It was the late 1940s and the RCN still was not designing ships.

At the outbreak of WW II, the Canadian shipbuilding industry was virtually moribund for many historical reasons. Expansion to meet wartime warship and cargo ship construction needed an infusion of capital and modernization of shops and facilities. The steel industry needed to be developed, as did sources for manufacturing auxiliary machinery and equipment. From almost nothing, Canadian shipbuilding industry grew to become third among Allied shipbuilding countries, producing more than 1,000 warships and merchant ships as well as a multitude of other craft. It carried out more than 36,000 ship repairs. The shipbuilding industry at its peak in 1943 employed 126,000 men and women, which was about 15% of all labour involved in Canadian war production.[4] However, after World War II, our shipbuilding capacity quickly dwindled for many reasons, including lack of government support and uncompetitive costs. Despite the demise of the industry, WW II shipbuilding left a legacy. It had created a robust steel production industry, a machine tool industry and a cadre of trained industrial workers who went on to peacetime employment in other industries. Because ships had been built-to-print of offshore designs, there was no indigenous industrial engineering ship design capacity. The RCN had, however, developed a significant cadre of technical personnel and acquired a modest ship design and repair capability that left it well positioned for the future.[5]

Design and Construction of the DDE 205/257/261/265 Classes (20 Ships)

In the postwar years the RCN made a conscious decision to design and build ships tailored to Canadian naval roles, requirements and operating areas. Around 1946, the Naval Staff evinced an appreciation of the Soviet submarine threat which likely underlay the decision to create an anti-submarine warfare navy. Given this threat, it was acknowledged that with the fleet-in-being being so small, there was a need for shipyard capability to produce vessels rapidly if the need arose.[6] Subsequently the newly-formed NATO alliance provided the occasion and impetus for the inception of the ST. LAURENT type ships.[7] These 20 ships were to be destroyer escorts, with an emphasis on Anti-Submarine Warfare (ASW) and close-in Anti-Air Warfare (AAW). They were highly maneuverable and could maintain their top speed of 28+ knots under all sea conditions up to sea states 5 or 6.

Constructor Commodore Rowland Baker, RCNR, proposed a shipbuilding plan that would use UK machinery, US weapons/electrics/electronics and his proposed naval architecture design concepts. This departed from the previous practice of reliance on the RN approach, but

American standards of drawings and construction, particularly of electrical power systems, were now becoming generally accepted. Political considerations demanded that the ships and as much of their equipment as possible be built in Canada.[8]

In 1949, the RCN began design of the 205 Class with United Kingdom (UK) industrial assistance. A Naval Central Drawing Office (NCDO) was established at the Canadian Vickers facility in Montreal for detailed design and in-service drawings. The design was innovative. It included pre-wetting for removing Nuclear, Biological, and Chemical (NBC) fallout and a rounded hull for NBC wash down and for easy removal of ice loosened by steam heating under the decks. Vital compartments were contained within a gas-tight citadel (an RCN idea). Air conditioning was provided for both electronic equipment and habitability. Where weapon and operations system integration in WW II ships had basically been by sailors manning sound-powered telephones, the 205 Class contained the first steps in weapon system integration through an analog fire control system. The degree of integration grew as the follow-on classes evolved.

The major systems and equipment were designed and built in the UK or US. The propulsion system was the highly successful British Y-100 design but which was manufactured in Canada. The propeller drive was through MAAG double-reduction gearing initially manufactured in Switzerland but subsequently manufactured in Canada by Dominion Engineering. The main sonar set was the AN/SQS-502, which was a Canadianized version of the British Type 170 sonar to run on AC power. Some equipment was built-to-print in Canada, such as the American 3 inch- 50-calibre gun, and there was a plethora of minor equipment, such as gyro compasses and communications sets, that was built in Canada. The Naval Engineering Test Establishment (NETE) was set up in Montreal to test the main and auxiliary machinery systems.

While the Navy designed the ships, the procurement strategy was to have cost-plus contracts with a lead yard and designated follow yards. Because the government wanted all yards to have a share of the work, the first seven ships were built in seven yards from coast to coast. The construction was fairly reasonably priced at about $23 million per ship. In his paper “Naval Procurement 1950-1965,” Commodore (later Rear-Admiral) S.M. Davis, writes that there existed a Naval Shipbuilding Central Procurement Agency adjunct to the NCDO, and that in June 1956 the Defence Supply Naval Shipbuilding Panel was formed, comprising members of the RCN, DND, Treasury Board (TB) and the Department of Defence Production (DDP), presumably to exercise oversight of the programs.[9] The CNTHA does not have detailed information on these organizations and their time spans.

The original seven ships (205 Class) were all modernized early in their operational life to become helicopter-carrying destroyers (DDH). The final two ships of the 20 (ANNAPOLIS and NIPIGON) were built as DDHs.

Four of the seven RESTIGOUCHE Class ships were modernized in the late 1960s and early 1970s. These Improved RESTIGOUCHE (IRE) Class were fitted with the Anti-Submarine Rocket (ASROC) weapon system and the AN/SQS-505 Variable Depth Sonar (VDS) but not a helicopter. Command and Control System integration was improved when 16 of the ships were outfitted with the Canadian-designed and manufactured Automatic Data Link Plotting System (ADLIPS), and also when they underwent their Destroyer Life Extension (DELEX) refits in the 1980s.
The first of these ships was under construction around the same time as the Korean War was ending, and the last of them participated in Gulf War operations forty years later. They proved to be a very good design with a reserve for growth that was successfully exploited. They formed

the basis of the fleet from their arrival in the mid-50s until they were all paid off by the mid-90s. They served Canada well.

Auxiliary Oiler Replenishment Ships (AOR)
HMCS PROVIDER

HMCS PROVIDER was the RCN's first dedicated Auxiliary Oiler Replenishment ship. She was built by Davie Shipbuilding and Repairing Company Limited of Lauzon, Quebec. She was laid down in July 1961, launched in July 1962 and commissioned in September 1963.

The ship was designed by the Davie shipyard, mainly by ex-UK personnel working in close collaboration with DND. The design was innovative and went well beyond the traditional "oiler" concept to provide for replenishment at sea (RAS) in all its forms (another RCN concept). The ship was built to commercial standards and fitted with commercial equipment. The shipyard was unfamiliar with RAS equipment, so this had to be reworked after the ship was accepted from the yard. The propulsion machinery was steam-driven, but the ship was designed to accommodate nuclear propulsion, should that ever have been considered a future enhancement. At full load the ship displaced 22,700 tons, was capable of 21 knots, and could carry three helicopters.

HMCS PROVIDER was initially assigned to operations on the East Coast but her open deck made her vulnerable to the heavy Atlantic weather. She was reassigned to the West Coast where she served until she was paid off in 1998. Overall, PROVIDER was an excellent ship that served the RCN well, providing valuable experience for the construction of other AORs.

HMC Ships PROTECTEUR and PRESERVER

PROTECTEUR and PRESERVER — the two follow-on ships to PROVIDER — were commissioned in 1969 and 1970 and have been deployed on both coasts. Displacing 24,700 tons fully loaded, their design took into account the problems experienced with PROVIDER. The ships were built with larger bridges, paired funnels to permit a much wider hangar door, and were designed to accommodate the Canadian-designed and built AN/SQS-505 sonar as well as an M22-based fire-control system and guided missile launcher system. The missile and fire-control systems were never fitted, but for self-protection the ships were outfitted with a 3–inch 50-calibre gun on the bow. The gun has since been replaced with a Phalanx anti-missile close-in weapon system (CIWS).

The preliminary design of the two PROTECTEUR-class ships was carried out in-house by the Navy through the Naval Central Drawing Office (NCDO). The contract for both ships was awarded by the DDP to Saint John Shipbuilding in New Brunswick. The ships were built to commercial standards, with the Navy managing the technical aspects of the contract and providing oversight. Both ships were laid down in 1967, and launched in 1969. PROTECTEUR commissioned 30 August 1969, and PRESERVER commissioned 30 July 1970.

Both ships are still in service today after more than 40 years, but are hard to maintain and are manpower intensive.

Construction to commercial standards is reported to have caused significant problems and strain between the Navy and the contractor. Construction initially started out for commercial vessels built to Lloyd's standards, for which the ships would be inspected and approved by Lloyds. The Navy did not want Lloyd's approval and really wanted Navy standards, which would have been more stringent and costly than the commercial ones. This disagreement was a "very, very serious problem".[10]

The problem of naval versus commercial standards requires careful consideration in setting up a ship acquisition project. Naval standards are much more stringent than commercial standards, and the management and documentation requirements of the Navy are far more demanding and expensive. A culture attuned to naval construction is really necessary. It is noted that the approach of the National Shipbuilding Procurement Strategy may significantly mitigate or avoid this problem. Time will tell. The ships to be built in Vancouver, including the naval replenishment vessels, will be built to commercial standards. The naval combatants will be built in Halifax to naval standards.

HMCS BRAS D'OR Hydrofoil FHE 400

In the Cold War climate of the 1950s and 1960s the RCN was principally an anti-submarine navy, and with vast ocean expanses to patrol it needed to be able to cover long distances quickly. The Canadian Forces thus embarked on a hydrofoil development program motivated by the need to develop the smallest and least costly vehicle that could conduct ASW operations in the open ocean reliably and with adequate habitability for the crew. This called for an unusual ship. Anti-submarine search ops require slow, quiet speeds, while interception and attack require short bursts of high speed, coupled with endurance and good manoeuvrability. Following studies and experiments on hull forms by the Canadian Defence Research Board, the development program entered into a comprehensive study of the potential usefulness of hydrofoils in ASW. This study concluded that within the then predictable state-of-the-art hydrofoil systems, a hydrofoil of about 200 tons displacement with a surface-piercing foil system and a 50-60 knot speed capability would satisfy their requirements. A proposal based on these specifications and using aircraft technology was "blessed" by the British and US navies as complementing their own R&D programs. The British were developing a hovercraft, while the Americans were developing a hydrofoil with a fully submerged foil system and electronic height sensing. The "blessing" came via a Canada-UK-US Tripartite Technical Cooperation Program working group that met in Dartmouth, Nova Scotia at what was then the Naval Research Establishment. There existed an unofficial agreement among the three research organizations to do complementary work on hydrofoils and hovercraft.

Before embarking on the actual design and construction of a prototype ASW hydrofoil system to examine the engineering premises and acquire the necessary data required for full design purposes, a preliminary feasibility evaluation contract was let in March 1961 to De Havilland Aircraft of Canada, Ltd. This work included ship design studies with an extensive model test program and an ambitious analog computer simulation of the foil borne behaviour of the ship in regular and random seas.

In September 1963, when confidence in the feasibility of the proposed design had been reached, a contract was awarded to Canadian Westinghouse Company to design and build an appropriate hydrofoil weapon system. The management of this contract ushered in a new area of government acquisition management that would affect not just the hydrofoil and future naval ship acquisitions, but all major government acquisition programs.

In 1960, recognizing that it needed to be more effective and efficient in its management and administrative processes, the government called a Royal Commission, under prominent businessman Mr. J. Grant Glassco, to inquire into the organization and methods of its own departments and agencies. The Glassco Commission eventually reported in 1962, and the government adopted its recommendations.[11] Prior to the Glassco Commission, the Department of Defence Production (DDP) had the role of procurement agency for the Canadian Armed Forces and was responsible for the maintenance of the Canadian Industrial Defence Base. Following Glassco, DDP was given responsibility as the sole procurement agency for all civilian departments, to set up a nationwide agency to supply all ongoing common items used by civilian agencies. It was also charged with centralizing all common technical activities such as quality assurance, transport management and the regulation of all technical specifications and standards. Moreover DDP was assigned the task of creating the Department of Industry (DOI) from within its ranks to foster Canadian industry (military and commercial) and help these industries achieve their export potential.[12] It was left to DDP to work out the management and administrative processes it needed to fulfill its expanded roles.

In 1965 the Department of Defence Production proposed the setup of a joint DND-DDP Hydrofoil Project Office, the first of its kind under a new model of project management aimed at getting rid of the rivalry and non-sharing of information between the two departments.[13] DND was the one footing the bill; it was responsible for the ship requirements and knew what it wanted, and ultimately might be required to fight and possibly die in the machine. The concept of the project manager being drawn from the funding department prevails until this day.[14]

HMCS BRAS D'OR became the first Canadian warship to be designed for an automated *digital* command and control and weapon system. This system was built, but never installed in the ship. Canadian Westinghouse also built the AN/SQS-507 Variable Depth Sonar, which too was never installed in BRAS D'OR, but was loaned to the US and Swedish navies for experiments and evaluation in US hydrofoils and Swedish small ships.

The contract for the construction of the hydrofoil was awarded to De Havilland and HMCS BRAS D'OR was built under subcontract at Marine Industries Limited, Sorel, Quebec. She was commissioned into the Canadian Navy in July 1968, whereupon she was used to conduct experiments as a potential operational ASW platform. HMCS BRAS D'OR achieved a foil borne speed of 63+ knots, and was reportedly the fastest warship of her time. The hydrofoil was paid off in May 1972, a victim of cost overruns due in large part to a disastrous fire. The resulting cost escalations contributed to the cancellation of the project. Today, this great example of pioneering naval technology is on display at the Musée Maritime du Québec at L'Islet-sur-Mer, Quebec.

The legacy of the hydrofoil project is significant. Although the hydrofoil was never used operationally, the complex technical developments were very successful. As noted, a new model of project management through a joint inter-departmental project management office led by the client department was established and continues today, although the detailed processes have evolved. The fire that damaged the ship engendered future considerations of risk management and insurance during ship construction.

DDH 280 Class

In the late 1950s and early 1960s as the missile age was dawning, the Navy began work on a concept design for a general purpose frigate to complement its ASW fleet. The projected costs were seen as very high and the government advised that such an expensive program would not be acceptable. The RCN therefore made a decision to acquire a "Repeat ANNAPOLIS", this being the lead ship of a two-ship class, the last of the 20-ship ASW ship program. This approach was

taken initially, but the requirements grew and the Navy ended up designing and acquiring a very different and very capable ship that would usher the RCN into the guided missile era.
The DDH-280 project actually began before the concept of a joint DND/DDP project office had been established. While DDP (later the Department of Supply and Services) issued the contracts for construction of the ships to the shipyards, the project was managed by a DDH-280 project manager within the Navy's headquarters engineering division in Ottawa. A project systems engineer (PSE 280) from the same engineering division acted as the central technical officer for the project. The preliminary ship design was performed under the direction of PSE 280, who also exercised technical control throughout the project.[15] Individual sections in the engineering division developed the sub-systems and acquired the equipment, which was then supplied to the shipbuilders as Government Furnished Equipment (GFE). This resulted in a piecemeal procurement that saw many design changes throughout the acquisition, resulting in design creep. This was later construed, rightly or wrongly, by senior government officials and ministers, as staff in DND attempting surreptitiously to add features and equipment that they would not necessarily have had, had they been up front about the total costs.[16] A management review of the DDH 280 acquisition would affect future ship programs.

The Contract Design was carried out by the Naval Central Drawing Office in Montreal in response to PSE 280.[17] NCDO prepared the working and "as fitted" drawings. The whole ship was an innovative design. It used gas turbines for main propulsion, for which one shaft line was tested in the Philadelphia Shipyard in the USA. The main propulsion was pneumatically controlled from the bridge by a Bailey Meter system, but had a digital gas turbine sequencing system to operate the marine-purposed aero engines with controllable pitch propellers, and a digital "health monitoring" system to give instant display of system performance. The gearing arrangement involved the innovative use of self-shifting synchronous clutches. A sophisticated fuel purification system was also developed. The ship would carry two Sea King helicopters and the flight deck was fitted with the world-leading, Canadian designed "Beartrap" helo hauldown and traverse system.

The ship's combat system was a major advance in complex system integration. The Command and Control System (CCS) used a central computer in a federated architecture that polled peripheral systems such as sonar, fire control and electronic warfare for information. Communication from ship to ship was by digital data link. The ship had a 5-inch gun and the NATO Sea Sparrow anti-air missile which was launched from a Canadian designed and manufactured launcher. The sonar system used both the hull-mounted and variable depth (towed) variants of the AN/SQS-505 sonar.

A large proportion of the combat and propulsion equipment and systems were Canadian designed and manufactured. The ships were built in two designated shipyards: Marine Industries Limited, Sorel, Quebec, was the lead yard, while Davie Shipbuilding in Lauzon, Quebec was the follow-yard. Construction began in 1968, with MIL following a unit-based modular construction process that greatly facilitated construction in a yard that had only a marine railway to launch ships. Davie Shipbuilding followed more traditional practices. Three of the ships were commissioned before the end of 1972 and the fourth entered service in 1974. While still in the hands of the shipbuilders, the initial sea trials of the DDH-280 proved the ship's propulsion system and met the requirements to be safe to go to sea and transit to Halifax. Once the ships were in Halifax, the Navy directed and oversaw the set-to-work and trials of the weapon systems with the assistance of the equipment manufacturers. While the ships were at sea on trials, they were available to conduct various activities for the Commander, Maritime Command, but "belonged" to the Assistant Deputy Minister (Materiel) until the systems were fully operational, a process that took from two to four years. This delay in achieving full operational capability, along with a management review of the DDH-280 project to investigate the "design creep", would colour future acquisition projects.

At the time, the DDH-280s were the best warships ever designed and built in Canada, and in hindsight we should have built more of them. They were highly capable, world-class ships, and at about $256 million for the four ships, were excellent value. Today, some 40 years after being commissioned, the three remaining ships continue to provide excellent operational performance and capability. Operationally, they are not "old".

Canadian Patrol Frigate (CPF)

The Canadian Patrol Frigate (CPF) Project was a procurement project undertaken by DND beginning in 1975 to find a replacement for the steam-powered ST. LAURENT, RESTIGOUCHE, MACKENZIE, and ANNAPOLIS Classes of ST. LAURENT Class destroyer escorts. To reflect the changing long term strategy of the Navy during the 1980s and 1990s, the frigates were designed to be general purpose warships with a focus on anti-submarine capabilities. The acquisition strategy and project management of this project was to be very different from that of the DDH 280 Project. A review of the DDH 280 Project by the Management Review Group (MRG) under Mr. John Pennefather had examined the cost overruns and creeping requirements of that project, and in effect considered that the Navy had exceeded its mandate for those ships even though the results were most impressive. Another result of the Pennefather Commission's look at the structure of DND was the development of the procurement side of ADM(MAT) and the concepts of Major Crown Projects (MCP), Total System Responsibility (TSR) and joint management on major projects through Boards of Directors from various government departments.[18] The acquisition of the CPF therefore was to be an MCP under the new concept in which the shipbuilder was to be given Total System Responsibility. Management of the CPF Project would be by Joint DND/DSS/DOI Project Office. DND as client department would provide the Project Manager. DOI was included to promote Industrial Benefits.

TSR was instituted to avoid the repeated design changes and related cost increases that had affected many previous DND procurements. Without TSR and a Total Project Management basis, the CPF Project likely would not have been approved.[19]

The CPF project was to be carried out in two phases, the first being the preliminary design phase. A request for expressions of interest resulted in the formation of four consortia that were interested in building the ships under the TSR concept. Each consortium would submit its approach to the project, after which two consortia would be contracted to conduct a preliminary design that would result in a contractable design. The Navy needed both designs to be acceptable as it was likely that government interests would affect the award of the production contract.

In 1980, SCAN Marine Incorporated and Saint John Shipbuilding and Dry Dock Company Limited (later Saint John Shipbuilding Limited (SJSL)) were selected by the government as the two competing companies which, along with their industrial partners as subcontractors, would enter into the competitive CD phase. In this stage, each company was to draw up a proposal on the ship design, construction plans, management plans, software and support plans for the implementation of the project. At the same time they were to establish definitive costs of their proposals. The Department received the two proposals in October 1982. Following evaluation of the proposals and intense negotiations with each company, the Government selected Saint John Shipbuilding and Dry Dock Company Limited to be the prime contractor for the implementation of the project.[20]

Detailed design work for the CPF began in 1985 after the original six-vessel contract was awarded to Saint John Shipbuilding Ltd. (SJSL) as a Target-Ceiling-Incentive contract. The CPF contract was awarded to SJSL despite the fact that there were arguably more qualified overseas shipyards capable of performing the work. This was attributed to the Government's desire for the CPF Project to provide industrial and economic benefits to Canada's shipbuilding industry. On the intervention of Government, DND subsequently requested that SJSL construct three vessels itself and sub-contract three vessels to MIL-Davie Shipbuilding. It is understood that this splitting of the contract had to be done at no increase in contract price but caused SJSL to expend an additional eight or nine million man hours of work for which the company had to absorb the cost.[21]

In 1987 the contract was amended to include an additional six ships, all of which were to be built by SJSL to take advantage of cost savings through economy of scale and experience. It is believed that the first and last ships were understood to require about 5.6 million and 2.4 million man-hours, respectively.

The design of the CPF reflected many advances in ship construction, such as a move to a prefabricated unit construction method in which, rather than build from the keel up, the ship is assembled from prefabricated units in a dry dock. The design also incorporated many new technical improvements and an increase in system integration over the DDH-280. For example, these vessels were the first in the world to be equipped with the Canadian-designed and manufactured Integrated Machinery Control System (IMCS), which allows for a very high degree of digital computer control for the propulsion and auxiliary machinery plant. The Command and Control System (CCS) was a distributed architecture system based on the Navy's Shipboard INtegrated Processing and Display System (another RCN concept) known as SHINPADS. It was the first warship in the world to use a distributed architecture command and control system, and its development was followed with much interest internationally. Competitors involved in bidding on the CPF incorporated as much Canadian technology as they could to improve their chances of winning. This added an element of risk as much of this equipment was in a prototype stage, but it was proven worthwhile in the long run.

While the ships were being built, SJSL expanded its shipyard modular construction capability and ended up becoming, probably, the best medium-sized shipyard facility in the world. This was subsequently lost when follow-on government shipbuilding work did not materialize, and that yard has now been closed.

The first CPF, HMCS HALIFAX, was commissioned 29 June 1992 and the last ship, HMCS OTTAWA, was commissioned 28 September 1996. The CPF Project provided within budget 12, fully-supported ships that met the requirements. They have proven very flexible, capable and effective in a variety of roles. Today, the HALIFAX Class ships are going through a mid-life update.

Tribal Update and Modernization Project (TRUMP)

TRUMP was started in 1977 to give the DDH 280 class a mid-life upgrade and modernization. The requirement stemmed from the changing emphasis on ASW and the need to provide limited area air defence and task group command and control for a group of ships. TRUMP was considered the most ambitious Canadian warship conversion project in more than two decades. Even though at $1.2 billion (the final cost was $1.4 billion according to DND FY 2005 budget estimates) it was considerably more expensive than the Government's preliminary 1983 “design-to-cost” estimate of $650 million (in 1983-1984 dollars), the Navy's need for an area air defence capability was judged sufficiently pressing to justify the additional expenditure. Originally there was concern in some quarters that TRUMP might have to be scaled back, possibly by converting fewer than four ships or by adopting a less expensive update package (i.e. the older Standard 1 missile and Mk 13 launcher instead of the vertical launch variant) for all four ships. Some cost-saving measures were to update the ships' existing torpedo handling equipment rather than install an entirely new system and to retain the existing ASW fire control system. It was decided to discontinue the competitive bidding process and to sole source the modernization contract to Litton Systems Canada Limited of Toronto, partly on the basis of the urgent needs of the ship-building industry (Auditor General’s report 1987).

A contract was awarded to Litton in summer, 1985. As prime contractor, Litton acted as project manager and accepted total system responsibility to engineer, procure, construct and deliver the four converted vessels. For this project, MIL Systems Engineering Inc. (MSEI), took over the function of the Naval Central Drawing Office and did the ship design and drawings. The Government suddenly laid upon DND the requirement that one of the losers in the CPF bidding should get the shipbuilding portion of the TRUMP Project. As a result, the construction was awarded to MIL-Davie Shipbuilding, Lauzon, Quebec. This arrangement was to prove difficult for the prime contractor and is understood to have resulted in some delays and cost increases.[22]

From the major refits under TRUMP, the DDH 280s emerged as area air defence destroyers with state-of-the-art systems. The cruise gas turbine engines were replaced with a more maintainable engine, and a variant of the Canadian Integrated Machinery Control System (IMCS) replaced the obsolescent, original machinery control system. The “bunny ear" funnels were replaced by a single large funnel with a Canadian-designed IR suppression system, new search and fire control radars were added, the old 5-inch gun was replaced with a new super rapid 76-mm gun, and the Mk.41 Vertical Launch Missile System (VLS) was installed. There was a degree of equipment commonality with the CPFs, but the command and control software was different. Although hampered slightly by the lack of a 3D radar (cut as a cost-saving measure) the IROQUOIS Class tribals are nonetheless very effective area air defence destroyers with their Standard SM-2 (MR) missiles (the Block 2 Standard Missile System had not been exported to any other country at the time). The US government had confidence in Canadian industrial ability to integrate, trial and operate this top-of-the-line suite as it allowed Canada to purchase the US equipment as a direct industry-to-industry sale rather than as a Foreign Military Sale, which is their normal defence procurement export method.

All in all, TRUMP was a brilliant idea when first conceived, but it took a long time to complete and costs increased by $200 million. HMCS IROQUOIS returned to service in 1992. HMCS HURON was the last ship refurbished and was delivered in 1995, but five years later the ship was deactivated. The Navy didn’t have enough money and manpower to operate her. In November 2003 HURON’s fate was sealed when the Navy announced she was to be scrapped. DND had spent roughly $350 million in capital improvements alone on HURON so that she could serve a new role for less than five years. The ship ended her life as a “SINKEX” target during a live-fire event as part of Exercise Trident Fury involving a group of RCN and USN ships and submarines, along with CF-18 fighter aircraft. The ultimate irony was that, in the end, sister ship HMCS ALGONQUIN sank HURON with what had previously been HURON's own gun. HURON settled stern first into the Pacific about 150 kilometers west of Vancouver Island on 14 May, 2007.

Maritime Coastal Defence Vessels (MCDV)

In the 1980s the Navy embarked on a program to rejuvenate the Naval Reserve to give them a role that complemented the roles of the Regular Force. Elements of that role would be mine inspection, minesweeping, route survey and harbour defence. The Maritime Coastal Defence Vessel (MCDV) Project was a procurement project undertaken by DND beginning in the mid-1980s to find a replacement for the Anticosti-class, and Bay-class minesweepers and to provide modern ships that the Naval Reserve could operate and qualify to command.

In 1988, the Department of Public Works and Government Services Canada (PWGSC), placed a Request for Proposal to Canadian shipbuilders for the construction of 12 MCDVs. Five proposals were submitted, one each from Canadian Shipbuilding and Engineering Ltd (CSE), Fenco Engineers Inc., MSEI (MIL Systems Engineering) Naval Systems Inc., Saint John Shipyard Ltd., and Versatile Shipyard Ltd. Two competing 12-month Preliminary Design (PD) contracts were awarded to CSE and Fenco Engineers (a subsidiary of Lavalin). The Navy had a billion dollar "wish list" but only had a $750 million budget (total program cost), so a design-to-cost approach was necessary. The competing PD contractors determined what they could provide within the budget to meet the requirements. In theory the two competing designs could have differed widely, but they were actually rather similar.

In the responses to the PD contract, at the Government's request, the contractors were required to provide costs for building the ships in one, two, three or four yards. When the costs of splitting construction were revealed, the decision was to build all the ships in one yard. The negotiations on this point are reported to have delayed the program from May 1991 to May 1992 and presented staff retention problems for the contractors.[23]

In 1992, the Government awarded a $470 million ($650 million after escalation) Total System Responsibility (TSR) contract for the design and construction of the twelve new MCDVs to Fenco Engineers. Fenco was renamed Fenco MacLaren in 1993 and in 2001 to SNC-Lavalin Defence Programs Inc (SLDPI) of the SNC-Lavalin group of companies. Fenco then sub-contracted various portions of the project to first tier subcontractors Thomson-CSF Systems Canada, MacDonald Dettwiler & Associates, Tecsult Eduplus Inc and Halifax Dartmouth Industries.

Two years after Fenco sub-contracted the vessel construction to Halifax Dartmouth Industries, the shipyard was purchased by Irving Shipbuilding and renamed Halifax Shipyard Ltd. This change in ownership saw construction of the MCDVs modularized with some bow sections of the vessels being constructed at Irving's East Isle Shipyard in Georgetown, PEI, for later assembly in Halifax. The detail design was carried out by German Marine, Inc. (owned by Halifax Dartmouth Industries) to commercial standards and incorporating as much Commercial Off The Shelf (COTS) equipment as possible. By contract, Fenco was required to provide 85 percent Canadian content, which was achieved. There was frustration over the requirement for COTS equipment because if equipment is truly "off the shelf", probably it has been in use for about 10 years. This means that capability may well be on the road to obsolescence before the ship is in service. There is some risk in selecting systems that are not fully mature, but how to manage this to reduce obsolescence presents a challenge.

The first ship, HMCS KINGSTON was laid down 12 December 1994, launched 12 August 1995 and commissioned 21 September 1996. The twelfth ship, HMCS SUMMERSIDE was commissioned 18 July 1999. The ships were delivered on time, within budget and met the performance requirements of the contract.[24] They are reasonably capable ships given the cost constraints, and can be expanded by the addition of modular payloads for specific tasks. They have served well in Canadian and international waters in a variety of tasks including surveillance and drug interdiction in cooperation with allied navies.

Observations and Conclusion

The contracting environment for naval ships has changed over the years due to lessons learned from successive procurements. Lessons learned from past procurement strategies have been reflected in new project management and contracting approaches. Some of the changes can be considered improvements whereas others have not necessarily improved the process but have generated new types of problems that have resulted in overall higher cost to Canada.

Procurement reform initiatives are still developing as the National Shipbuilding Procurement Strategy approaches implementation.

A significant issue that still must be worked out is risk management. When total system responsibility was introduced in the CPF Project, the contractor was required to assume all the risk. A contractor naturally will want to minimize his risk. Under TSR, the Navy could not direct the contractor, but wanted to assure that it would get the ship capabilities for which it had contracted. In the CPF Project, a form of risk sharing known as "negative guidance" developed in which the Navy would not direct the contractor but could advise whether his proposed solution to a problem was or was not acceptable. This approach took time and effort and increased costs. An equitable method of Navy-contractor risk sharing is needed and it is hoped that this can be developed in the shipbuilding contracts under the National Shipbuilding Procurement Strategy.

Over the years the technical sophistication of Canadian warships has increased dramatically as each new class has been procured. Many of the technical advances were led by creative young naval officers who applied their operational experience and engineering creativity to develop new system and integration concepts. In 50 short years the Navy advanced from stand-alone equipment integrated by sailors talking on sound-powered telephones to the CPF's fully-automated, integrated command and control and weapon system that can detect, identify, engage and destroy a threat without a human being in the loop. In the CPF Project, the combat system integration facility proved invaluable in the design, development testing, set-to-work and integration of the combat system, saving time and money that would have been expended had it been done piecemeal in the lead ship. As we approach NSPS, in which 60% of the warship cost will be in the combat systems, the establishment of a sustained payload facility will be as important as a sustained shipyard.

For half a century, the Navy's shipbuilding projects have been completed successfully, creating good jobs and delivering excellent ships. It is evident however, that the Navy's ship batch programs alone were insufficient to sustain the Canadian shipbuilding industry and its suppliers. Under NSPS it is anticipated that a continuing series of ship programs will sustain the industry and the supporting system and equipment manufacturers and integrators. This will depend on the Government's provision of funds in its budget for both naval and other government ship projects. The CNTHA believes that as implementation contracts begin under NSPS, the lessons of the past in system technology development and ship acquisition management have, and must continue, to guide the design, construction and project management of the new ships. If Canada is to continue as a serious maritime nation operating in three oceans, it will be important to retain a shipbuilding and ship repair capability as a national, sustainable resource.

NOTES

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[16] Transcript of CNTHA Oral History Review with Rear-Admiral (Ret'd) E.J. Healey, RCN former DND ADM(Mat) and CPF Project Manager
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[23] Transcript of CNTHA Oral History Review with Commander Robert Mustard, RCN (Ret'd), Project Manager MCDV Project for Fenco Engineers, 17 August, 2007, p3.
[24] Ibid. p3.