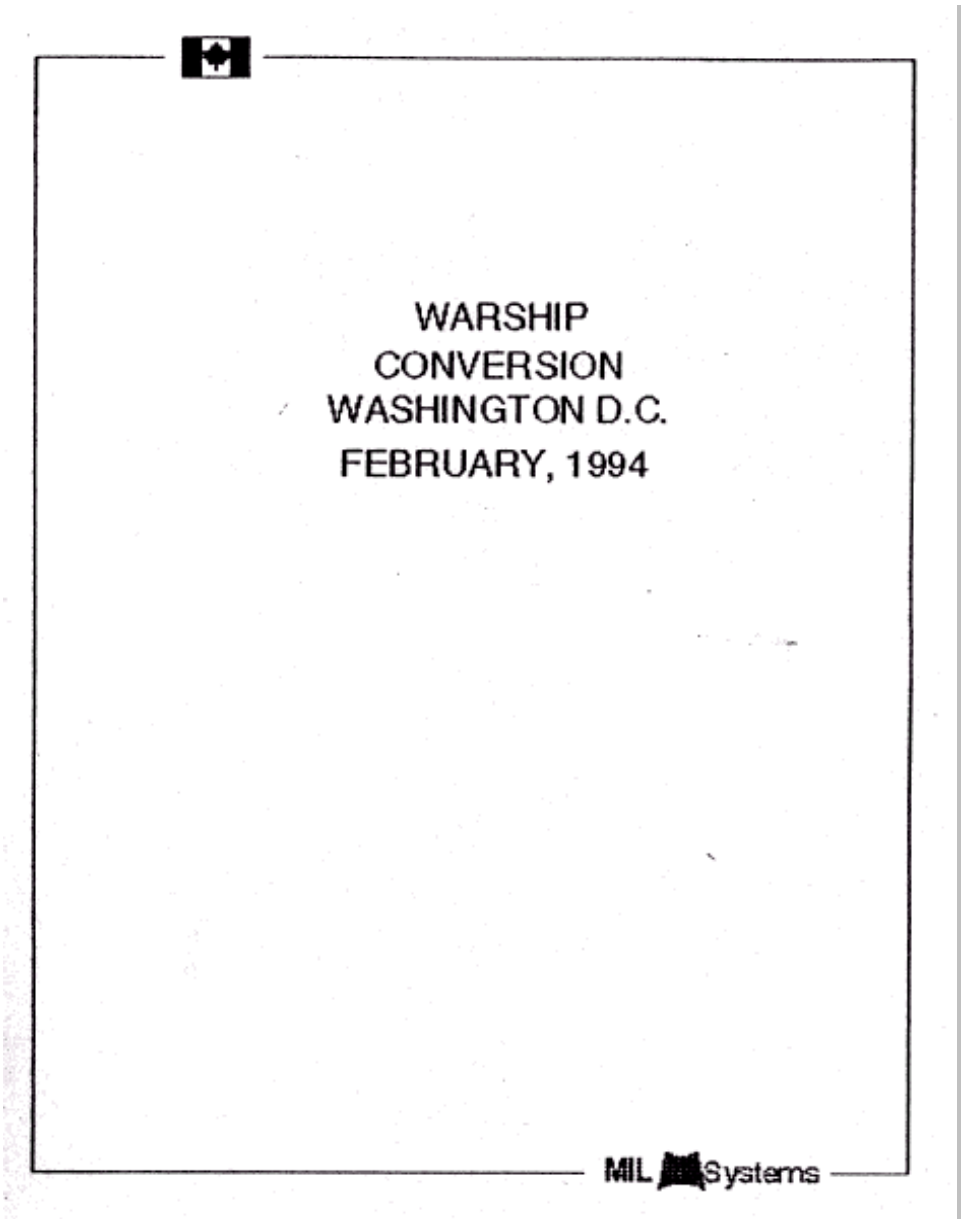
5 Existing Ship's Modernization (7)

The following Paper by VAdm (Ret'd) Jock Allan was given in Washington, DC to an assembly of US Navy and Foreign Naval Attaches posted to Washington **(7).** It was part of a 2-part presentation; the first being the RCN by Jock Allan followed by Canadian Industry (Jim Williams, President & CEO, MIL Systems Engineering Inc.) who dealt with the specifics of the TRUMP program, which is contained in Chapter 4.5 of this publication.



Canadian Embassy, Washington DC. 10/11 February 1994

Workshop on Warship Modernization

Keynote Address
Vice-Admiral John (Jock) Allan CMM CD (Ret'd)

Ladies and Gentlemen:

As an introduction to the Workshop on Warship Modernization I have prepared a short review of the history of warship construction and modernization in Canada. As well as my personal recollections and those of ship mates and colleagues, much of this background review is taken from extracts of the work of Captain Jim Knox in "RCN Retrospect 1910 to 1968" published by the University of British Columbia press, and the work of Commodore Bill Broughton in the preparation of the "SNAME Centennial History 1991".

Warships built in Canada during World War II included seventy frigates (eight for the RN), 123 corvettes (seventeen for the RN and eight for the USN), sixty-two Algerines (fifty for the RN), fifty steam Bangors (twelve for the RN), ten diesel Bangors, sixteen Western Isles trawlers for the RN, twelve motor torpedo boats, MTB's, eighty-eight Fairmile B minelayers, ML's, (eight for the USN), thirty 126-foot minesweepers (twenty-one for the RN) and forty-two 105-foot minesweepers (twenty-one for the RN) and twenty-six Transport Ferries for the RN. In addition, nineteen escort aircraft carriers were modified and completed in Canada for the Royal Navy.

These building programs were clearly one of the most spectacular engineering accomplishments of World War II. However, the development of support facilities on both coasts and the repair, modification, and improvement of ships and equipment under chaotic conditions represented an achievement of equal importance.

By the middle of 1943 the navy recognized that the crucial engineering problem was not the production of new escorts but the repair, refitting, and especially the modernization of the existing fleet of escorts.

During the period of immediate postwar consolidation, a great deal of thought was given to the lessons of the war and the requirements of the Canadian fleet. Anti-submarine warfare, but under radically altered conditions, was the most likely form of naval war for Canada in the future. This was suggested by several factors: the advent of nuclear weapons; the potential advantage to the submarine of the snorkel and high-powered propulsion plants (such as the hydrogen peroxide system developed by the Germans in Type XXI and XXIII submarines); and the Cold War confrontation between the USSR and the Western Allies. However, one lesson was clear: Canada need not and should not be dependent on others for future warships and their equipment. Canadian industry had come of age and had demonstrated its ability to produce virtually the full range of materiel needed for warships at least up to the size and complexity of destroyers.

Overhead view graph 1. HMCS NIPIGON DDH 266 2800 tons

The St. Laurent-class program for the construction of seven anti-submarine escort vessels was announced in November 1948. This program and the ones that grew out of it - involving the marriage of ship and helicopter - established the sea-going identity of the postwar RCN. What were required were small ships capable of twenty-five knots and having larger armament and more sophisticated action-information systems than the existing frigates. The proposed vessels were to be suited to rapid production in Canada and were to use equipment and material from North American, and preferably Canadian, suppliers. A new ship design of domestic origin was called for.

The naval central drawing office (NCDO), originally called, the Naval Ship Design Agency and, subsequently, the Marine Design Drawing Office, remains in existence, at least in vestigial form. The NCDO proved an essential element in the execution of the St. Laurent and subsequent destroyer, frigate and modernization programs, and ensured similarity between ships of a class. The function and capability of the original NCDO remains active today as a significant part of Mil Systems Engineering.

The Naval Staff had placed major emphasis on seakeeping, maintaining seventeen knots in a seaway, noise reduction, nuclear biological and chemical defence and damage control (NBCD) features, a high standard of accommodation, air conditioning, weight saving, and mass producibility in Canada. A flush-deck arrangement with a high swept-up turtle deck forecastle gave the cleanest possible lines for strength and ease of ship-handling and allowed the anchors to be stowed behind faired doors while the windlasses were located under the forecastle deck. Particular care was given to the provision of passageways and good access routes in order to facilitate rapid closing-down. The St. Laurent-class were the first NATO ships to provide such close-down arrangements together with NBCD filters. The resulting air-tight and pressurized "citadel", encompassing virtually all of the operations, living, and working spaces within the ship, allowed the ship to continue fighting during a nuclear attack.

Coincidental with the development of the staff requirements for the Canadian anti-submarine escort was the Admiralty's search for a power plant for a comparable class. Since Canada lacked a marine-propulsion plant design capability, the choice lay between United States Navy and Royal Navy machinery. The RN design, "Y 100," was selected with the proviso that the machinery, apart from the ship's set, should be produced in Canada.

The electric power generation and distribution systems in the St. Laurent class were designed to the United States Navy Bureau of Ships standards and manufactured and tested to American military specifications. As a result, these systems proved one of the most satisfactory features of the ships.

Two twin 3-inch/50 caliber gun mountings were fitted in the St. Laurent-class ships. These were manufactured in the Sorel, Quebec, Industries gun factory which was set up specifically for the escort vessel program but which provided guns as well to satisfy other RCN programs and USN requirements arising from the Korean War. This factory was unique in that the complete gun and mountings were manufactured from raw materials in one plant. The US Navy "Gunar" fire control system was selected for the class.

The synchro tape gyro repeater and plotting table developed in conjunction with the St. Laurent program were Canadian accomplishments of particular note. This became the first piece of transistorized equipment in the RCN and was probably the first such equipment available to any navy at that time (1955). The initial production run was for about 130 tables and ultimately some 500 tables were produced, including orders for the USN.

About modernizations of the time. There was a steady succession of fleet-destroyer conversions: HMCS Micmac completed in November 1949; HMCS Sioux completed in January 1950 with, among many other changes, bunks in lieu of hammocks - the first RCN warship to incorporate this modern touch. HMCS Nootka completed in November 1950, HMCS Iroquois was the first Tribal to receive a full "DE" conversion in which twin 4-inch guns were fitted in A and B positions, a twin 3-inch/50 caliber in X, and two Squids in Y positions with an aluminum lattice mast carrying new USN radar. She was followed over the next three years by all of her six sisters undergoing identical conversation. In February 1953 Algonquin was converted to an anti submarine frigate. HMCS Crescent completed a similar conversation in December 1955. All the

converted destroyers from Iroquois onward were fitted with the Mark 63 gunnery fire control system, which had to be especially adapted to the 4-inch mounting. This adaptation was the first independent Canadian initiative on a weapons-system basis. In 1953 HMCS Prestonian was the first of twenty-one frigates to complete her conversation in a program that was to continue until 1958.

All the warship conversion and building programmes complemented the St. Laurent-class program, since various features of the latter were developed and proven in the former. The NCDO was responsible for the Prestonian conversion and Bangor refits, Canadian Vickers being the Prestonian Lead Yard as it was for the St. Laurent class.

A second group of seven DE's was decided on in 1952. These, were to become the Restigouche class, differ from the St. Laurents principally in the substitution of a British-built 3-inch/70 caliber gun and a Mark 69 director.

The Repeat Restigouche was a six-ship program approved in 1957. Later, the lead ship was named Mackenzie. The last two ships were completed to a revised design as Annapolis-class helicopter-carrying destroyer escorts or DDHs.

Some consideration appears to have been given as early as 1943 to completing the frigates then under construction as anti-submarine helicopter carriers. A dozen years were to elapse, however, before this suggestion was taken up seriously. A key requirement was a means of instantly securing the helicopter on deck and of providing a controlled traverse between the landing position and the hangar. A development contract was let to Fairey Aviation of Dartmouth, Nova Scotia, in 1959. This resulted in the Helicopter Hauldown and Rapid Securing Device (HHRSD), known popularly as the "Beartrap".

The sea trials of helicopters operating from escorts and the identification of engineering solutions to the handling, securing, and stowage problems (coupled with recognition of the powerful advantages of ASW helicopters) prompted two warship conversion programmes. The last two Mackenzie-class ships were completed as DDH's, while the whole of the St. Laurent class of seven ships, starting with HMCS Assiniboine, was converted to the DDH configuration. These conversions were referred to as the Improved St. Laurent or "ISL" class. In 1967 HMCS Saguenay embarked the first operational air detachment, and by 1969 all nine DDH's were operational in their new role. As finally arranged, the DDH had a most impressive capability which permitted the all-weather day and night operation of a large helicopter on deck with up to thirty-one degrees of roll and nine degrees of pitch, heaving at twenty fee per second in winds up to fifty knots. Others agreed. The Japanese, Indian and U.S. navies have all purchased equipment based on the RCN system and manufactured by Indal of Toronto. A twin HHRSD system has been installed in the four DDH 280 Tribal-class ships.

The VDS fitted in the Improved St. Laurent class (ISL) and Annapolis-class DDH's was the culmination of another long development program. After World War II scientists from the NRE, concerned about the limitations imposed on sonar by ship noise and variations in water temperature (or thermal gradients), began to think about separating the transducer, which broadcast and received the sound signals from the ship. The plan was to tow the sonar over the stern of the ship. The prototype, designated AN/SQA-501 handling gear using the AN/SQS-504 sonar, was fitted and tried in HMCS St. Laurent in 1963 prior to her conversion. Production equipment was fitted in the remainder of the class during their conversions as well as the Annapolis class during their construction. In addition, VDS equipment was sold to the Dutch and British navies, and these sales helped offset the cost of development.

In 1961 work was begun on a more advanced and capable sonar system, using integrated solid-state hull mounted and variable

depth transducers. The system, including AN/SQS-505 sonar and the AN/SQA-502 handling gear, was designated "Diana One"; the VDS portion was designed for deep towing with shock absorbing (boom bobbing) incorporated in the handling gear. The production version of the system was installed in the remaining three IRE conversions, retro-fitted in Terra Nova, and installed in the four DDH 280 Tribal-class destroyers. The SQS-505 sonar was the first major piece of equipment in the RCN to have completely solid state electronics. Systems engineering and specifications for the whole Diana One system were developed by the navy.

The Canadian Navy had established confidence in its conversion process. In this manner the Navy was able to sustain the capability of the fleet while awaiting the delivery of the new ships.

Overhead view graph 2. HMCS ALGONQUIN DDH 283 4100 tons

The DDH 280 design had many innovative and successful features that made it a truly remarkable success story. These included the first destroyer in the free world to have all gas turbine propulsion, to operate two ASW helicopters, to have bridge control of the propulsion plant, to have centrally controlled, federated command and control system, an integrated interior communication system and to have extensive noise-reduction measures. In addition, further improvements were made to the high Canadian warships standards for NBCD and for habitability.

The all gas turbine propulsion systems was unique in destroyers for its day. It was a combined gas or gas (COGOG) arrangement with two Pratt & Whitney FT4 main engines, each rated at 25,000 horsepower, and two Pratt & Whitney FT12 cruise engines of 3700 horsepower each. Top speeds were 30 and 18 knots, respectively.

The machinery control system had to meet requirements for bridge control of propulsion, unmanned main and auxiliary machinery spaces, and minimized complement.

Special firefighting arrangements were required. A centrally controlled light water system served the engine room, auxiliary machinery room, helicopter hangar, JP5 pump room and forward gas turbine generator room. A separate light water system served the flight deck.

The air conditioning system represented further advances on the all air conditioned citadels of the earlier classes.

The core of the Tribal Class Combat System was the development of a centralized command and control system, the CCS 280. It operated on a federated concept by which each sub-system could be operated on its own or from the CCS 280.

The DDH 280 design was fitted with both hull-mounted and VDS sonars of the latest AN/SQS 505 design, as well as the AN/SQS 501 sonar for classifying "bottomed" targets. An entirely new ASW Data System performed integrated signal processing from the three sensors and provided target information to both the CCS 280 and the ASW mortar as well as for torpedo settings.

Similarly the electronic warfare (EW) systems were designed to operate on an integrated basis from a sub-system console with the operator as the integrating element.

The surface and air weapon system was also an integrated subsystem comprising radars, Sea Sparrow point defence missile launcher and 5"/54 Oto Melara gun.

The four 280s were built in Quebec. Two at Marine Industries and two at Davieship now part of the MIL Group.

In 1974, new policies were developed for Research and Development (R&D) and for major weapon systems acquisition. In effect, R&D with the potential to meet stated Canadian operational and technical requirements would be supported on a competitive basis as funds permitted. However, the major weapons platform contracts normally would not specify what system developments were to be fitted. The prime contractor would make the choice as part of his total systems responsibility. Hence, a supported R&D project would have to be competitively successful to be chosen by a prime contractor and thereby go into production. There were many such R&D projects, all of which were significant Canadian naval advancements of international quality. This continued record of success has meant that the smallest service of the Canadian Forces has continued to have the largest share of the R&D budget.

As an example, the advent of high volume, hot exhaust gases from gas turbine powered frigates and the introduction of heat-seeking missiles accentuated the need to develop funnel designs that would lower exhaust gas temperatures and obscure them from infra-red sensors. A concept that has achieved excellent results was pioneered by the Defence Research Establishment Suffield (DRES) in the province of Alberta. The so-called DRES-Ball combined the effects of film-cooling, cooling air entrainment and optical blockage to reduce IR emissions from the exhaust stack metal surfaces and from the exhaust plume.

The design, construction and testing for shipboard use was conducted by W.R. Davis Engineering Limited of Ottawa, Ontario. The testing proved that the design was very effective and the design of full-scale infra red (IR) suppression devices was applied to the new Canadian Patrol Frigates and the Tribal Class Modernization. The former was a full DRES Ball installation and the latter an eductor-diffuser.

Much more needs to be said about these achievments and Dr. John Legate, director of the defence research establishment in

Ottawa (DREO), is with us today to speak on the R&D activity in DND and its importance to the navy.

In the early 1980s, an entirely new concept for helicopter landing was postulated in which photogrammetry would be used to locate the helicopter and manoeuvre a new, more compact trap to meet the helicopter's probe. The RAST MK III project (a Recovery, Assist, Secure and Traverse system) originated in September 1984 with an unsolicited proposal from Indal Technologies Inc. of Mississauga, Ontario.

The most significant feature, other than the compact trap itself, was the helo position sensing equipment. This equipment used two cameras to sense the helicopter's position based on the reception of a laser light source from four beacons on each side of the helicopter. The image of the helicopter was then analyzed by the computer to determine the helicopter's relative position to the ship and the trap. This information, relayed to the pilot via a Pilot Visual Cues display (incorporated with the horizon bar assembly), indicated if he was to far forward, or left/right of the designated landing area. The ship motion prediction system conveyed a lighted indication to the pilot of a predicted five second quiescent period thus identifying an optimum recovery window. This new approach allowed the elimination of the hauldown gear and the yaw restraint system of tailguide bars and winches. As a result, there was no below deck equipment requiring valuable space and a weight saving of five metric tonnes resulted. The helicopter associated equipment was also reduced. In addition, RAST MK III offered several operational advantages. The required helicopter over-deck hovering time was reduced substantially for improved flight safety and less time required for the ship to be confined to its flying course. There was no longer a requirement for flight deck personnel during recovery and traversing, or for voice communication between the pilot and the Landing Signal Officer. Finally, the life cycle cost was estimated to be reduced by sixty percent.

Overhead view graph 3 HMCS HALIFAX FFH 330 4700 tons

The City Class (Canadian Patrol Frigate)

This project had its beginnings in 1973 just as the last of the four TRIBAL Class destroyers, HMCS ALGONQUIN, was being completed and delivered. Once again the Canadian navy was taking a longterm, broad look at its future fleet requirements. A major element of the fleet replacement program that was approved-in-principle by the Defence Management Committee was new ships to replace the River Classes.

The operational studies identified two major missions: anti-submarine warfare (ASW), and fleet air defence. Engineering concept designs confirmed that it would be more cost effective to build separate classes rather than one larger class. A key factor in this determination was the proposed new ASW operational concept using passive towed array sonars deployed for maximum effectiveness well away from the task force or convoy. In program terms, this conclusion translated into the Canadian Patrol Frigate (CPF), initially six ships, designed primarily for ASW, and the TRIBAL Class Update and Modernization Program, or TRUMP project, giving these four ships an area air defence capability.

The concept of passive operations drove the CPF design. An excellent hull for good seakeeping, low flow noise from the bow, and minimized vibration transmission from internal noise sources were called for, as well as the latest in noise-reduced propellers. The helicopter would provide localization and engagement of submarines at a distance. Because the CPF would normally operate well away from other ships in the group, extensive self-sufficiency in defence became virtually as important as the primary mission capability. Accordingly, systems to counter air, surface and submarine attack were also specified. In each case, defence in depth by both passive decoys and active weapons was called for.

Five industrial organizations submitted, without remuneration, their proposed approaches to meet the CPF project requirements. After evaluation and submission of the results to the government, two Canadian industrial groups were contracted to prepare and submit preliminary designs with supporting calculations and documentation for the detailed design, construction and delivery of the six, fully-supported ships. After another evaluation an implementation contract was awarded to Saint John Shipbuilding in July 1983.

The ship as completed at 4750 tons deep displacement incorporated many recent Canadian developments. The maximum speed on two LM2500 General Electric gas turbines exceeded 27 knots. The range was over 4500 nautical miles at 15 knots on the Pielstick PA6 diesel engine. A unique propulsion component was the combined port and starboard cross-connected and reversing gearbox built by Royal Schelde in Holland. Sufficient space, accommodation and support facilities were provided for a crew of 225 officers and other ranks with adaptability to accommodate a 10, 25 or 50 percent mixed gender crew. Storage held fresh provisions, frozen provisions and general stores for 30, 45 and 60 days at sea, respectively.

The fully integrated, SHINPADS - controlled combat system provided the latest in ASW capability and self-defence in depth. The main sub-contractor for the Combat System was PARAMAX Limited of Montreal. The primary weapons system was the SEA KING helicopter with its sonobuoys, dipping sonar and MK 46 torpedoes. The ship was equipped with the CANTASS towed array, the 505 hull-mounted sonar and its own MK 46 torpedo launchers. Air defence was provided by search and tracking radars, vertical launch sea sparrow missiles and the USN's PHALANX close-in weapon system. Surface defence was provided by radars, the USN's HARPOON missile and a 57 mm Bofors, rapid-fire gun. Passive defence included the CANEWS ESM equipment for electro-magnetic emission detection, the DRES Ball uptake infrared (IR) suppression system, radar and IR chaff launchers, RAMSES jammers and

reduction of the ship's radar cross-section by careful selection of the ship's above-water geometry.

Overhead view graph 4 HMCS ALGONQUIN FFH 2800 tons the TRUMP lead ship

The TRUMP Project has been extremely cost-effective due in large part to the team efforts of contractors and the Government in meeting the complex technical challenges inherent in a modernization project of this scope. Project Management includes the Government, contractors and suppliers who pooled their experience, innovative ideas and efforts to transform these aging ships into state-of-the-art vessels.

TRUMP design requirements were extensive in order to meet the Tribal Class' added roles of Task Group Command and Supportive Air Defence. Each ship's structure underwent substantial changes to integrate the new and modernized marine and combat systems. The success of sea trials to date has proven that the TRUMP design solutions were indeed the right ones.

Overhead view graph 5 TRUMP REFITS and SHIPALTS

Strengthening the ship's hull and incorporating a Water Displaced Fuel System allowed an overall increase in capability while greatly improving the Class' stability. Ship signatures were also reduced through the incorporation of infra-red suppression and noise reduction systems.

An up-to-date Fire Detection, Suppression, Alarm and Control System was combined with the new Smoke Containment and Evacuation System to significantly enhance Damage Control capabilities and personnel survivability. Close attention to quality control and human engineering requirements produced functional and ergonomical fighting, working and living areas.

The TRUMP Project started off with fully operating ships (Tribal Class DDH-280 Destroyers). The modernization sequence saw the strip-out of old equipment and structures, the installation of new structures and systems, and the conduct of a thorough program of tests and trials.

Overhead view graph 6 TRUMP STAND ALONE PROJECTS

As with many of the other TRUMP systems, one of the key concepts in propulsion design was integrating the new with the proven. The Canadian Shipboard Integrated Machinery Control System (SHINMACS) now monitors and operates all propulsion and auxiliary systems. In the Combined Gas Or Gas (COGOG) propulsion system, the installation of new gas turbine cruise engines, in concert with main gearing modifications and new controllable pitch propellers, resulted in improved ship reliability, significant fuel savings and increased range.

The modernized Tribal Class ships were given improved electrical systems to meet the new ship requirements. A new 1000 kW diesel generator, automatic load-shedding features and Uninterrupted power supplies for the Machinery Control System were integrated into an existing 3-bus electrical distribution system. Three existing 750 kW gas turbine generators provide redundancy and emergency power requirements.

Overhead view graph 7 TRUMP MODERNIZATION

The Combat Systems underwent the greatest change in the ships' modernization. The tribal Class' Above Water Warfare suite now includes: a Long-Range L-band Radar; a Medium-Range F-band Radar: Fire-Control Radars; a Weapon Direction System; and the MK 41 Vertical Launch System with SMII block 3 Missiles. TRUMP's Point Air Defence Systems include a Close-in Weapon

System, the 76 mm Super Rapid Gun, the Canadian Electronic Warfare System (CANEWS) and a new Chaff and Infra-red Decoy System.

The existing significant Underwater Warfare suite, including the original complement of two Sea King Helicopters as well as hull-mounted and variable depth sonars, has been retained. Modern Torpedo Handling and Countermeasures Systems have been added.

The international suite of weapons systems is linked by comprehensive software in a new Communication, Command and Control (C3) System. The Canadian Shipboard Integrated Processing and Display System (SHINPADS) and Shipboard Integrated Communication System (SHINCOM), the Inertial Navigation System and the new Operations Room are integral components of this C3 System.

In February 1993, HMCS Algonquin conducted the successful first firing of the SMII block 3 Missile System. These firings provided a convincing demonstration of the effectiveness of the individual components and their integration through the Command and Control system.

Comment

Some may ask why modernization rather than new construction? The simple answer is that the 280's had growth potential, a life remaining in excess of fifteen years and they needed to be modernized to regain effectiveness against the threat and role they would be required to play. It was timely to exploit the growth potential in the 280 hull. Equipment upgrades would include those applicable from CPF as well as the other changes planned solely for the 280s. Thereby providing a significant cost economy over new construction. The most important factor was to be able to utilize the hull and a significant portion of the propulsion, power, habitability and fighting equipment while upgrading the ship to the level of the

new technology to provide effective general purpose capability. No ship design for a hull life of twenty or more years can hope to stay operationally relevant in this period of exponentially advancing new technology unless upgrades and modernization are undertaken. That being the case new construction designs should be prepared with suitable growth allowances anticipated. Upgrades must be looked at as the norm to introduce and activate, timely and cost effectively, the emerging technology. It is also considered that the development of technology among allied nations can be considered to meet modernization opportunities of like minded states.

Canada has international relationships in R&D. The US/CAN defence production sharing agreement and its companion defence development sharing arrangement are examples. These kinds of relationship with Canadian industry in the warship modernization role should not be overlooked.

In summary, today our fleet is small but effective. It is made up of DDE/FFE, SSK, AOR and numerous specialized and support vessels. Our history in ship replacement with new construction has not been predictable. We therefore have upgraded and modernized our ships in the past utilizing the basic hull to the maximum extent possible. This can be seen, as you will recall from the review, in the modernization of many of our WWII ships in the 1950's to upgrade these ships until the new construction River Class became available. Subsequently we continued the process with various modernization's of the St. Laurent River Class destroyers themselves, in which we were able to bring into service cost effective contributions to our operational capability in the Improved St. Laurent, the Improved Restigouche and through DELEX, the destroyer escort life extension program for all of the river class ships. The latest, most demanding and most cost effective update and modernization has been that of the four Tribal Class 280s; the TRUMP ships. In the future the paucity of funding and the rapid advance in technology will move us towards an even more logical and better planned future for updates and modernization of our current fleet. The modernization and

upgrade of the CPFs, just now joining the fleet, will be the next major upgrade activity.

The reasons for the success of the Tribal class Update and Modernization Program, TRUMP, is because we have confidence in our design, engineering, industry and our program management learned from the earlier programs such as those already discussed.

The criteria to undertake Upgrades and Modernization effectively are:

a) To plan for a modernization early so that any R&D effort can have a planning focus for fulfillment not only in new construction but also in upgrade and modernization.

b) To plan, as a requirement in new construction, realistic allowances for hull life, power and propulsion to accommodate future modernization.

c) To plan new construction and modernization activities so as to stabilize Capital and O&M cash flow.

d) To involve industry in the process, to ensure dialogue and understanding and to maintain skills which would otherwise have to be regenerated.

e) To monitor, with the upgrade as well as the new construction in mind, the developing threat scenarios and the technological responses.

f) To maintain and enhance the effectiveness of the program management and acquisition capability.

Conclusions

The cost of an upgrade and modernization project, no matter how extensive, is not as costly as that for new construction because much of the ship and ship systems are not replaced and the support for these is already in the system. We have become experts in the extension of the lives of our ships because it is necessary that we do this to keep our combat capability as current as possible while remaining within the constraints of our defence budget.

Since 1955 when the first St. Laurent was commissioned to 1997 when the last CPF is scheduled to be delivered, a period of forty two years, Canada will have introduced 36 new construction destroyer/frigate warships of three basic hull designs, the St. Laurent hull of the early 50's, the 280 hull of the late 60's and the CPF hull of the mid 80's. To date, out of these basic hull designs have come five major modernization's and many less complex changes at normal refit or special intervals. Consider the cost benefit of the increased operational capability to the fleet resulting from these modernization's. The cost benefit is equivalent to the difference between the modernization cost of five new classes versus the new construction costs if those five modernizations were to have come from new construction designs. The savings are conservatively in the order of 50 percent. In addition, each of these conversions and changes has increased the cost effectiveness of the fleet in many ways not the least of these is the opportunity to introduce to the fleet the results of our R&D efforts sooner than otherwise would have been the case.

In 1997 the Canadian Navy is projected to have 16 frigates. Twelve will be the new CPFs and four the modernized TRUMP 280s. The frigates are optimized for ASW with point air defence. The modernized 280s are general purpose area air defence. The remaining life of the 280s is probably 15 years. The remaining life of the CPF's is probably 30 years with a mid life modernization. This would seem to indicate that the next new construction, replacing the Trump 280s, will occur in 15 years and that will also be the timing for the CPF upgrade and modernization. The fifteen years projected is a long time between major programs for the infrastructure we have assembled in Canada to wait. We need to turn these industrial energies to work so that they are not lost between programs. Perhaps the advances in technology or the needs of others or both can be accommodated to ensure that the expertise now in place is retained. One thing is certain, if only because of the technological

advances sure to occur in the future, upgrades and modernizations will be required more frequently than they have in the past.

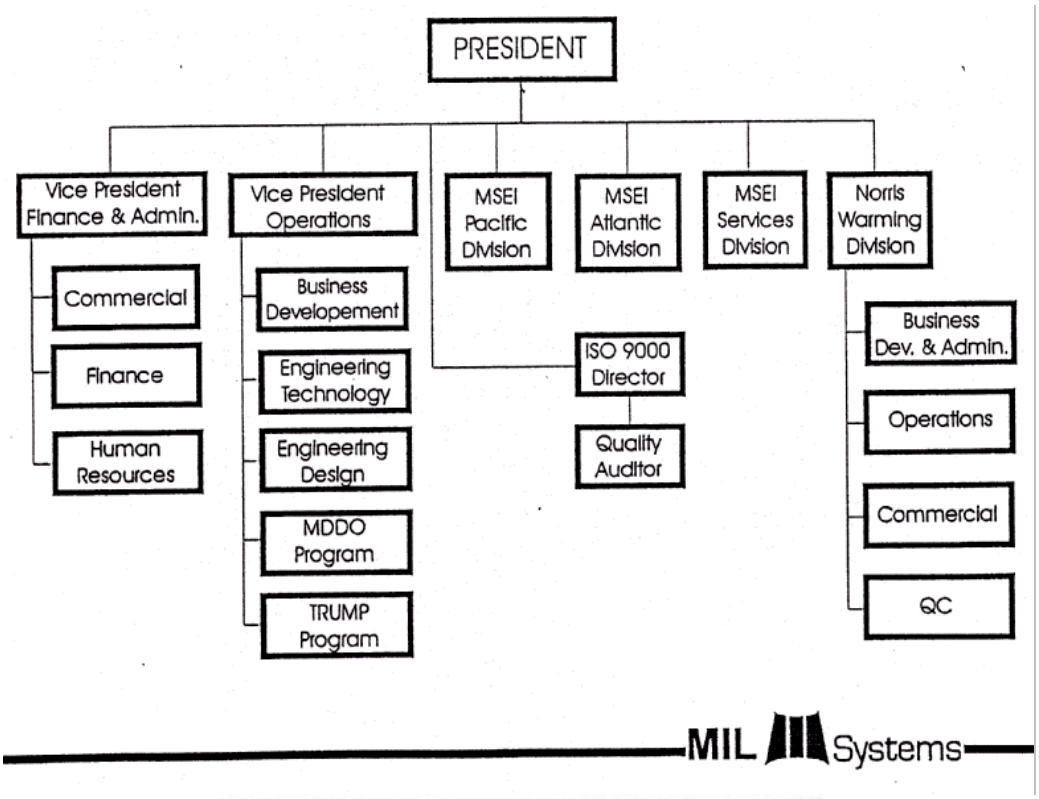
Thank You.

6

Engineering Maintenance of existing ships

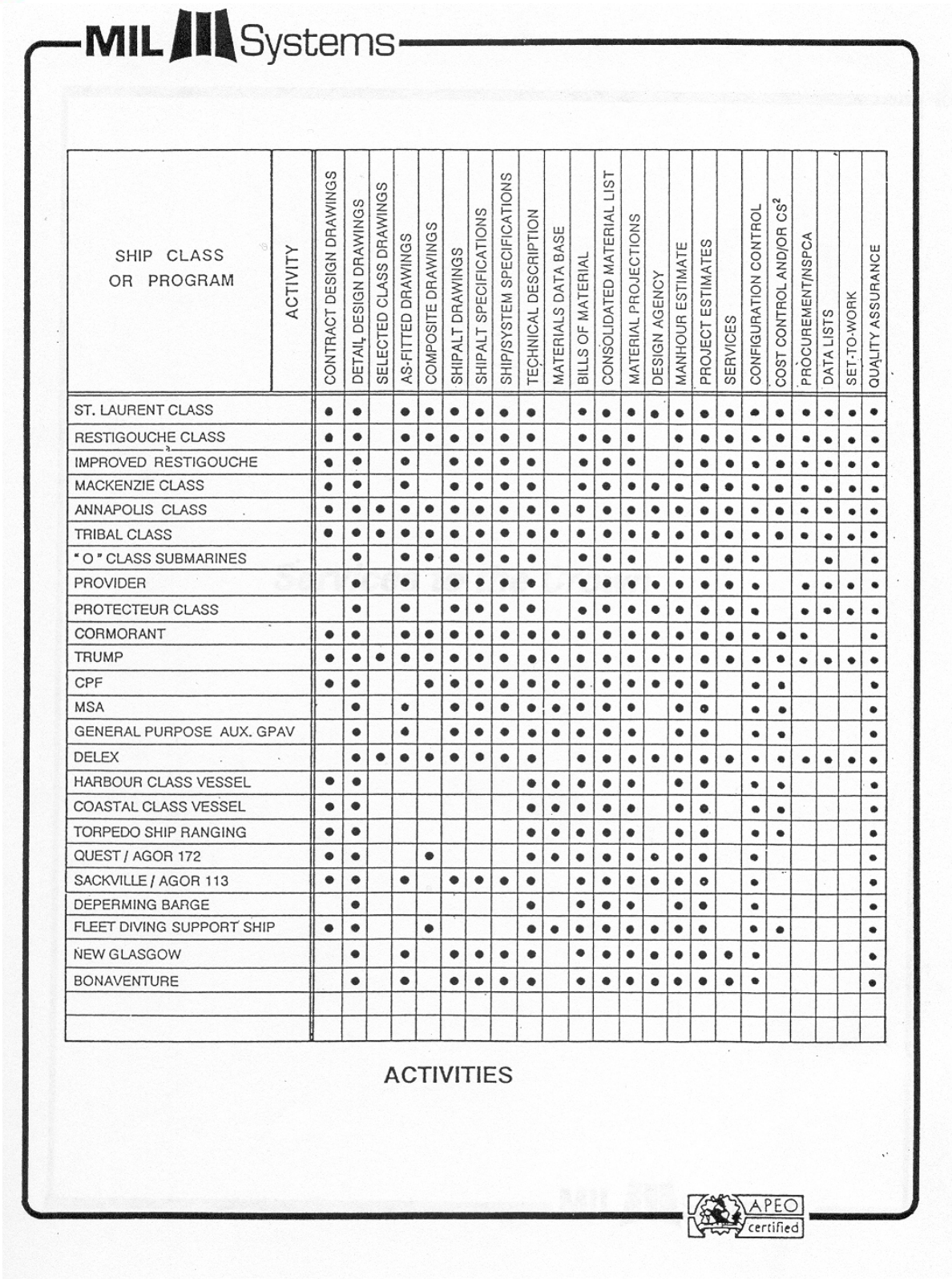
Apart from the aspect of a completely new ship design like the Halifax Class frigate, the *bread and butter* business of the Design Houses' services provided by Industry to the Navy has been in the area of modification designs to existing ships. These range from complete ship modernization such as the addition of helicopters and later TRUMP, to minor changes such as Project Number 0045 shown in the table given at page 19 of Chapter 3.1 herein "SAMPLE LISTINGS FROM LAST 3 MDDO CONTRACTS", which dealt with the removal of the AN/SRA-502 Units and their replacement with the OE-5012/SRC Automatic 7000 Channel Coupler Units.

In the 14 years between 1979 and 1993, some 1289 such Taskings were carried out under the NCDO/MDDO contract, i.e. almost 100/year. Many of those taskings were in themselves multi tasks of more than a dozen. The variety and scope were as complex as they could be in the Naval environment, and a highly specialized work force grew and was sustained in order to meet this requirement. Divisions were set up by MIL Systems Engineering outside both Dockyards to augment the work conducted at the main office in Ottawa, and the following charts show the organization put in place in order to service the Navy's requirements.



MSEI PRESIDENT Jim Williams chats with Real Admiral Robert George at the opening of new company offices on Esquimalt Road.

John Thompson Photo



Some 23 general Activity headings are shown in the preceding chart to illustrate the scope of the Engineering services (other than new ship design) required by the Navy of its Industry partner over the period 1947 to 2001. Chapter 3.1 provides more details of these Engineering services

7 Management of Contracts

Contents

Introduction

The objective of this Chapter is to present comments from the Industry side with respect to the management by the Crown of various major ship procurement/conversion programs. The Crown, quite properly, wanted to control the contract performance but used a technique that was problematic to Industry. The crown awarded Prime Contracts that included Designated Sub-contractor(s) that in some cases (a) were fierce competitors of each other and in other cases (b) the Prime Contractor did not understand the detailed Technical program requirements of the integration of the work of the Prime Contractor and the Designated Sub-contractor(s). *If the Crown had been the Prime Contractor (as it reverted to in the TRUMP case) these direct conflicts between Industry companies would have been averted.*

In the pursuit of such data a document came to light produced by Larry Sellick, whose career had been in both Government and Industry. He provided permission for his paper titled "**CANADIAN PROCUREMENT HISTORY**", which was raised in February 1993 to Phil Munro, to be included verbatim in this record. It was noted by others that Larry's references to organizations, etc., using acronyms, were not always known to readers, so I have clarified those acronyms with Larry and added them to his paper.

My own experience with Naval procurement was gained whilst at MEL Defence Systems for the **Electronic Warfare** suite for the DELEX, CPF and TRUMP programs, and with MIL Systems Engineering with the **MDDO**, **CPF design** (Halifax class frigates) and the **TRUMP design** (Tribal Class Refit, Update & Modernization Program). Overall, in my experience, the quality of the Prime Contract documents was very detailed and professional. There were the usual

contentious Clauses that had to be dealt with up front if major problems were to be avoided downstream, and that was up to the Contractor to define for his particular business environment. I found the Prime Contract details were a great asset in the raising of the subsequent Sub-contracting required. However, when the Crown chose by decree to involve competitive companies in elements of the Prime Contract, there were invariably unforeseen problems between the companies so involved. Two examples are contained herein (the CPF Design program and the TRUMP design program).

The **Electronic Warfare** systems' procurement contracts were equipment procurement contracts, and were for equipment that was to be fitted to "existing ships" per se.

The **MDDO** work was entirely ship design and conversion work. For example, Alex Patterson gave the listing of Manpower Categories imbedded in the MDDO contract, in his paper contained elsewhere in this study, as well as examples of the type of work contracted for therein.

The **CPF design** contract was badly conceived in that it ***directed*** the Prime Contractor, Saint John Shipbuilding, to award major first tier subcontracts to two of its competitors, viz. MIL Systems Engineering for the design (as opposed to the design submitted by Saint John Shipbuilding), and MIL Davie for build of three of the first six ships. When the second set of six ships was awarded, Saint John was allowed to keep all six ships to its own shipyard. Saint John therefore had a major conflict of interest in both the design stage and the build stage. The Navy wanted the Concept Design that MIL Systems had offered in the Bid Phase of the contract in preference to that offered by Saint John itself. It was therefore sensible to require MIL Systems to carry that Concept Design into the Detail Design, which is the basis for the shipyard work. Some elements of the Detail Design were retained by Saint John, however, and included some major design considerations necessary to provide the frigate with a reasonable self-protection envelope, to whit, a stealth signature, an area of design engineering they were not versed in. Furthermore, they had never designed a warship and could hardly entrust the ship's self protection (stealth) design to foreigners.

Moreover, the Radar Cross Section signature reduction design needs to be implemented as an integral part of the basic design and it is inefficient to try to implement it after that design is frozen (as it was by definition in the contract terms from Saint John to MIL Systems). In the event Saint John contracted out for an 80^{th} scale model to be made of the ship and subjected it to an 80^{th} scale imaging radar scan in a facility in the UK. The shortcomings of the resultant Radar Cross Section of the ship were then, in part, compensated for by modifications to the frigate during construction and then integrated into the drawing package by Saint John.

The noise spectrum generated by the main machinery package was sub-contracted by Saint John to YARD Ltd. in Glasgow (YARD Ltd. was at that time a major partner with MIL Systems in their joint venture YARD Inc. located in MIL Systems' facilities in Ottawa). The resulting design by YARD Ltd could have been integrated into the ship detail design better by MIL Systems, and without duplication of that capability in Saint John's.

The final outcome of this method of directing a Prime Contractor to sub-contract to a major competitor ended up with the largest dollar lawsuit in Canadian history at that time by Saint John against the MIL Group, the owner of both MIL Davie and MIL Systems. Although Saint John eventually settled the lawsuit, suffice it to note that MIL Davie was later sold off by the MIL Group, as was MIL Systems. The demise of MIL Systems was unfortunate in that the Navy lost a major warship design capability that the Navy itself had encouraged to be set up and then nurtured for 54 years.

In the case of the **TRUMP design** contract, the Prime Contract was awarded to Litton Canada who was the Supplier selected to provide the major weapon system upgrade, the Vertical Launch System (VLS). Again, the Navy preferred the bids submitted by MIL Systems Engineering for the conversion design, and MIL Davie for the shipyard implementation of that design. Litton Canada therefore was required to define and integrate the work of these two major subcontracts, and in the process left out some major linkages required between the two sub-contracts that resulted in confusion and the eventual reclaiming of the Prime Contract status by the Crown, viz. the Department of Supply & Services (DSS).

7.1 Canadian Procurement History – A perspective by Larry Sellick (9)

Larry Sellick's Paper to Phil Munro follows verbatim, and further deals with the CPF and TRUMP contracting. He uses the following abbreviations, which are included herein as an Addendum to his Paper, and are listed in the sequence in which they occur in that Paper.

DDP	= Department of Defence Production
DSS	= Department of Supply & Services
TB	= Treasury Board
DOI	= Department of Industry
DND	= Department of National Defence
RAF	= Royal Air Force
TCA	= Trans Canada Airlines
TSU	= Technical Service Unit
TSD	= Technical Service Detachment
HQ	= Headquarters
RCAF	= Royal Canadian Air Force
AMC	= Air Materiel Command
G/C	= Group Captain
RCN	= Royal Canadian Navy
CSB	= Contract Settlement Board
CCC	= Canadian Commercial Corporation
USN	= United States Navy
NASA	= National Aeronautical & Space Administration
VSEL	= Versatile Systems Enineering Ltd.
MIL	= Marine Industries Ltd., Sorel
MIL Group	= le Groupe MIL, Montreal
M&M	= a facility of le Groupe MIL in Dartmouth, NS
MCP	= Major Crown Project
ASQC	= American Society of Quality Control
QC	= Quality Control
QA	= Quality Assurance
PPB	= Program Planning & Budgeting
TCP	= Time & Cost Performance
DG	= Director General
ADM	= Assistant Deputy Minister
PCO	= Privy Council Office
RNAF	= Royal Netherlands Air Force
CNR	= Canadian National Railways

CPO	= Canadian Post Office
DPW	= Dept. of Public Works
DM	= Deputy Minister
CBC	= Canadian Broadcasting Corporation
PNO	= Principal Naval Officer
PM	= Program Manager, also Prime Minister
RAN	= Royal Australian Navy
CCS	= Command & Control System
GSM	= Government Supplied Material
CAB	= Contract Advisory Board
HMCS	= Her Majesty's Canadian Ship
ASW	= Anti-Submarine Warfare
A/C	= Aircraft
MOT	= Ministry of Transport
CSL	= Canadian Shipbuilder Ltd.
CR/PG/SX	= Government employee levels
SJSL	= Saint John Shipbuilding Ltd.
CSSRA	= Canadian Shipbuilder & Ship Repair Association
FOB	= Free On Board (a contracting term)
NFLD	= Newfoundland
ADM MAT	= ADM Materiel, DND
CVL	= Canadian Vickers Ltd.
PRG	= Program Review Group
DGMEM	= Director General, Marine Engineering & Maintenance
NCDO	= Naval Central Drawing Office
TCP	= Time, Cost & Performance
AG	= Auditor General
SRU	= Ship Repair Unit
CPW	=
NFR 90	= NATO Frigate 90
CNFG	= Canadian NFR 90 Group

CANADIAN PROCUREMENT HISTORY

To Phil Munro 3 February 1993

Dear Phil

In response to your request in Oct 1992 for procurement and project information, the following recollections may be useful to define the other side of the coin namely DDP/DSS and T. B. positions. These departments had different demands on its staff re the financial administration act and the politics of the times. This paper has been written in Florida without my Ottawa files and I hope my memory has served me well.

PURPOSE OF THIS BACKGROUND SUMMARY

I am including a summary of my private (with industry) and public (Gov't. DND/DOI/DDP and DSS) experience so that anyone wishing to use any of my experiences for what ever purpose, will have an indication of where, how and when, the data was obtained.

MY TECHNICAL AND ACQUISITION BACKGROUND

Before specializing in procurement and project management I had a technical background starting with the RAF #45, Group Ferry Command in 1943 which later became the RAF Transport Command. In the fall of 1945 I joined Canadair Ltd. with 25 other ex RAFTC people, including Al Lilly V.P. Test and Sales . Our 25 RAFTC staff moved into Canadair as 10,000 war time Canadair employees were being released. I then joined TCA at their acceptance into service of the North Star A/C from Canadair Ltd. I was then recruited from TCA by. Aviation Electric Ltd (AEL) to start their instrument shop. This lead to a Tech. Rep. Position with AEL covering Bendix products. While acting as an AEL technical service representative contracted to the RCAF in 1951 I was asked by W/C Rudy Waite the C.O. of #11 Technical Services Unit to join the government as a Detachment Commander. Then I moved on to #11TSU HQ as the senior engineering officer (civilian) in charge of 25 Detachments (TSDs), located from Ottawa to the east coast.

At this time DDP was just getting organized and the RCAF TSDs and TSUs did most of the negotiation work and all of the technical administration until DDP hired technical staff that had the required aeronautical backgrounds.

In 1958 I moved to AMC HQ Ottawa reporting to the RCAF Chief of quality control G/C Bob Macmillian. My job was to look after all matters of QC/QA and reliability for all RCAF equipment and missiles (other than the airframe) as well as all RCN aircraft. After these technical positions with DND, I joined the Dept. of Industry's Aircraft Branch when this dept. was first formed. From there I was seconded to DDP (DOI and DDP had the same Minister).The secondment was to the DDP Aircraft Branch. This involved the negotiation of yearly contracts with most of the instrument and accessory companies in Canada and around the world, that supplied material or services to the RCAF/RCN (Air).
While with the DDP Aircraft Branch I was moved at the height of the Bonaventure crisis to the Shipbuilding Branch in charge of Naval and Civil fleet refits. It was

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this position that I joined the DDH 280 project. After the DDH 280 project I replaced Des Wallace as Division Chief Shipbuilding and shortly afterward, I became Director of Shipbuilding Machinery, and Vehicle Branch of DSS. By then Des Wallace had left the government service because of the Bonaventure crisis. I then moved back to the Aerospace Branch as the Director of Aircraft and Armament. This involved the CF18, LRPA and SARP projects. My last gov't. position was as Chairman of the Government Contract Settlement Board (CSB). At CSB I handled 130 legal cases a year covering anything from cheese to CF18 jet engines, including many ship related disputes. In 1985 after 35 years service I resigned and elected to take the so called golden handshake. In order to prevent any perceived conflict of interest. I elected to return to the shipbuilding industry after being out of shipbuilding contractual accountability for over five years.

As I had also been a director of CCC for a long period and involved with negotiating many gov't. to gov't. Contracts including CCC's biggest successes (the RAST or Bear Trap with the USN, the AVGPs with US Marines and booster recovery vehicles with NASA), I wanted to try for a private sector position in international marketing. I therefor, joined the Versatile Marine Design Group (VSEL) that was based in Ottawa and intent on selling internationally. I then became V P Gov't. Relations for Versatile of Vancouver. When Versatile was taken over by MIL of Quebec I became a Corporate VP of MIL HQ working on business development for hydro and nuclear power, shipbuilding, ship design, vehicle refurbishment, etc. This involved five MIL and M&M plants located in Ottawa, Quebec and Nova Scotia.

I resigned from MIL in 1991 and I have now set up my own small consulting company called L A S Consulting. The L A S covers land air sea and dispute avoidance consulting, as well as my initials.

MY INVOLVEMENT WITH POLICIES LEADING TO MAJOR CROWN PROJECTS, AND THEIR OVERALL MGT. AND OBJECTIVES

I had been involved with every aerospace MCP from the F86 A/C in 1950 to the CF104 and including the Avro Arrow, Bomarc, and the CF18 while with DND or DSS . I had also attended the first reliability course put on by the USA AGREE committee and various ASQC QC and QA courses. I and the head of DND Inspection Services were the only senior government ASQC members at that time who were lecturing on QC/QA needs, to all sectors of Canadian industry.

THE START OF MCP MGT. AND PPB

While with DDP Aerospace Branch I was asked to take the Peat Marwick contracting and (PPB) program planning and budgeting courses. The government directed Peat Marwick (p.M.) To set up a task force to investigate why major crown projects(MCPS) were over running time/ cost & performance (T C P) during the 1950s/1960s by 30 to 100 %. The Peat Marwick Consultants were also requested to determine why many DND projects were either still born or cancelled. The terms of reference were that this task force (with the full co operation of DDP/DND) would define the necessary organization, the necessary PPB data and the controls needed to prevent future project over runs and cancellations. In addition, DDP, DND plus T B were asked to supply their most experienced and project knowledgeable officers who would then be working full time reporting to Peat Marwick. To keep it independent, the work was to be carried out at a Sparks St. location over Sherry's Restaurant and it became known by those of us involved, as "The Sherry's Funny Farm". This study of why DND MCPs were over running, resulted in DSS sending senior people and DND refusing both staff and data. This in my opinion was where future DND problems occurred. Jack Glassford (then the senior DDP DG and subsequently promoted to ADM) therefor became the senior interface with Peat Marwick and other senior gov,t. officials. I was assigned as the DDP aerospace representative and joined one of the two man teams to cover program planning and budgeting (PPB) and time cost and performance (T.C.P.) controls.The other team member with me was Buzz Nixon. Buzz had just left the navy over various policy disputes and unknown to me was on his way to set up P.C.O. for the prime minister. Later, he became the DND Deputy Minister.

When Nixon and I started our PPB and TCP studies, it was critical that we obtain access to past and future DND project experience, which DND refused to give to anyone. I phoned a G/C friend that I had worked with at #11TSU HQ who was now the tri service PPB expert at DND HQ. I told him my problem and while stating he did not agree he confirmed the DND refusal to cooperate with those outside DND. He then suggested that I visit him at his office for coffee. I took Buzz Nixon with me and when we arrive at the DND HQ, his Sec. told us that the G/C had regretfully been called to a meeting but that coffee awaited us in his office. In addition to the coffee, all the PPB data we needed was arranged on tables around his office. In this way we got the data we needed and the G/C had not given it to us directly. This non cooperation decision by DND HQ has subsequently hurt DND from the mid 1960 to the 1980s.

Later I was part of a study-team making recommendations for more Canadian content from MCPs. There was a small DDP/DSS study team set up under Gerry Burger and Glen Woodside that started to define the first offset proposals. This offset definition started with the Ram Truck (not built) and the DDH/ NF5 offset of Canadian supplied Canadair A/C to the RNAF in exchange for DDH280 ASW Electronics from Holland. Once again DND did not participate in this critical exercise. This covers some of my technical, policy and project experience, plus an historical overview of acquisition policy that existed when I was asked to move from the Aerospace Branch to the Shipbuilding Branch.

After the DDH280 I was involved as the DSS Senior Review Board member for the dept. of Transport "R" class ice breakers, the army's Leopard tanks, and all the armies soft and hard shelled vehicles. I was involved during the set up of VIA Rail

when I worked with Transport Canada and T.B. when VIA was established. Afterward, I helped with equipment selection, some of the design trade offs and I controlled the contracting, the quality assurance and project management for VIA's President, Frank Roberts who was the ex VP CNR. I also, was the accountable member responsible for supplying all the mail handling and computer equipment for the automation of the post offices as CPO was moving towards privatizion. This required accountability with DPW and CPO for C.T.P. at four plants in Montreal and Toronto. There was a three department MAPP Management Team consisting of Jim Corkery head of the post office, Jim Wilson senior ADM of Public Works and I represented DSS. The MAPP was a $420 million dollar project.When mapp was investigated by TB, only Corkery and I responded.

WHY THE ABOVE NOTED EXPERIENCE WILL HAVE A BEARING ON THE HISTORY OF PAST EVENTS AND THE WAY I AM REPORTING THEM

Some of the more important things that occurred while I was involved in the above noted jobs, will follow. I will try as I have done in the previous paragraphs to give some of the reasons for the actions taken and also I will try to recreate the more important feelings that existed at the time. Some of these feelings that caused the responses at the time were factual and some imaginary. No doubt some of this report on acquisition and project management history will differ from some of the navy views. These differences will be analyzed as the events unfold. Some of the reasons why there may be major differences of opinion of who was at fault or who made the changes if they were successful, will be the following:- The large number of RCN people involved from DND, the short time they were working on the project because of posting, the fact that true DND accountability was at the vary top civilian (DM) of DND who never visited the ship and only obtained an overview from DND officers who wanted and needed their ship, regardless of the consequences. Whereas, in DSS it was those directly working on the projects and those who signed the contracts and negotiated the extras who were fired or at best demoted. (this was why on MAPP it was the Post Master General and I who answered TB questions and not the CPO or DPW engineers. This accountability difference was in part due to the accountability defined by the Financial Administration Act and the fact that even ministers could not sign official contracts, only dummy contracts at signing ceremonies. As an example I had to sign the aerospace and marine contracts before the minister signed the dummy page in front of the press and TV. In the case of an Aerospace contract for helicopters, the 11 pm CBC news showed me on the screen as the minister of Supply and Services signing the original contract and not the real DSS minister signing the dummy page. This difference in accountability, between the top civil authority of DND and his serving RCN officers who were never removed and the DSS contract signing officer is clearly evident with the dismissal of Mr. Armstrong the DND Deputy Minister and the heavy penalties given DSS officers like Des Wallace a division chief and the removal of Larry St Laurent to another department and another project officer who committed suicide, during the Bonnie crisis. I believe that there was only one reprimand to the PNO TSD commander at Davie during this infamous refit of our last aircraft carrier. There will be more on the Bonnie refit later, as this so called over run crisis coloured the acquisition and the RCN accountability within government and how the RCN was viewed during the 1960s to the mid 1980s.

The navy people involved in projects at all levels, unlike any other military or civil

MCP contracting, had a major mind set difference because they were generally building or refitting their next home when they went back to sea. This tended to make their priority to get the best possible ship from what ever money or extras they could accomplish. This was one of the root causes of the Bonnie crisis and the non acceptance by the RCN of the repeat Nipigon ministerial direction. This at times over came the contract wording, the acceptance criteria and at times the well being of the contractor or the gov't. authority that authorized the contract. This preoccupation with the best home for the officer and his shipmates and attempts to improve the defensive capability of their home, occasionally caused cover-ups, design rectification without a design change. This type of action lead to disputes and legal problems, that the gov't. generally lost. For these and other Bonaventure reasons, when the DDH and the LRPA MCPS started, the PM became the technical leader and DSS had the deputy role. This was occurring at the same time that DSS took on the QA/QC role for the civil fleet. This action of the DSS Deputy lasted from 1969 until the CPF & CF18 programs once again gave DND total control over all DND MCP projects, with DND having both the PM and DPM positions. This change back to DND total project control occurred from the findings of the Pennyfather report. This report (with heavy DND input) blamed the DDH280 project increase from $220m (with a defined risk of $225m at contract) to $242m when the 4 ships were accepted over two years late and sent to Halifax as a contractual and jurisdiction problem. This over run was reported by the navy as contractual instead of a different ship still being designed by their HQ, as the lead ship to the fourth ship were being built. More on this later.To my knowledge, unlike MAPP, no DSS officers were interviewed by the Pennyfather or the Queens university studies. The only ones gouted were minor supporters of the engineering functions in HQ or the DDH 280 Project Office and John Killick.

THE START AND FINISH OF THE DDH CLASS

The ministerial decision to stop building first of class vessels that the navy HQ staff disregarded, caused many problems for the contracting process. This was particularly bad as the Gov't. at all levels was moving to push the RCN acquisition requirements into the same contractual process as was being used by DSS for the RCAF and Army. Also, then as now, the acquisition process that T. B. adopted was modeled on USA contracting practices . The differences between the USA and Canadian projects were never considered when firm price for systems and shipyard target contracting was directed for the lead and three follow ships. As examples, when Janes members of Jane's Fighting Ships of the UK visited the DDH project office they could not believe the amount of new equipment and suppliers being used, the short time that was permitted for a lead ship, the small quanity of ships being built at two yards etc. When the USN,UK,and RAN navies visited the DDH 280 Project Office they could not believe that we would build a new class of military vessel with over six major first of class systems i.e. the missile system, the jet propulsion system a first for military ships, a newly designed gun, a Canadian designed CCS system by Litton who had never designed one before etc. These other countries were quick to point out that all navies try to build only one new major system into a vessel class at a time. We could not have this luxury as there was twenty years between Canadian vessel classes. This need to take design risks with the non proven suppliers and and a small quantity of non pre- designed ships, was where the problem started. It was improper specifications, with late GSM data, late

drawings and tech. manuals, that caused the contractual over runs, from day one. Also, concurrent class building in lots of 15 to 20 vessels, (like the USN and the RN], is needed before using the USA contractual processes. Building one lead and three follow vessels at two shipyards every 20 years needs a lead yard contract that permits risk budgeting and flexible time schedules, while the gov't. is getting its authorities, data or finding solutions. The contract used was wrong and until it was changed in 1970, the two contractors had to suffer and they did. NOTE: The case study by Jack Arseneault for Queens University, covers the project very well but it needed a DSS overview of the contracting process.

The differences I have outlined as the cause and affect of what happened on Gov't. MCP's, comes from being in the thick of the military MCP action for many military services (i.e. the Canadian army, navy and air force, plus the USN, US Marines and NASA). Also, for most of the other large civil government MCP's that existed in the 1950s to the mid 1980s. Also, I have many years with industry acting as the contractor in the late 1940s and again from 1986 until 1991.

I would at 65 years old be glad to meet with any of those who remember certain events in a different way than I have recorded them, as ones memory does not improve with age and it is difficult to remember specfics, without your files. Also, spelling and remembering names was never my strong point. Also, it is often a number of small innovative results or misconceptions that influence the bigger policy picture, so I will try to include both the big and small events that effected acquisition policies and practices. I will also outline how contractual refit action helped pave the way for later contractual controls and more contractor accountability on the CPF project.

WHY I MOVED FROM AEROSPACE TO SHIPBUILDING AND THEN BACK TO AEROSPACE AND THEN BACK TO SHIPBUILDING WITH STOPS IN BETWEEN

My initial posting from Aircraft Acquisition Branch of DDP to the Shipbuilding Branch was the work of the Shipbuilding Branch Director Al Allan, who wanted new blood injected into the way shipbuilding contracting was being carried out. This was the time when ship contracting was mostly cost plus, but called other things and directed.

THE CONDITIONS THAT APPLIED IN DDP SHIPBUILDING IN 1966/67

A. Pomeroy of DDP was trying with his ship CAB process to have every thing on a ship called by the same name, so that at some time in the future both cost and reliability control would be possible (he must have seen the coming of the computers]. Up to then a board consisting of ADM's or DG's with Ministerial direction determined what ship refit would be directed to what shipyard. When I arrived in shipbuilding all our DDP/DSS field staff were time and material recorders who were generally at the clerk 1 or 2 level. They counted who was working but had no ability to question if the work was called up in the directed contract or an extra. It was just entered as an hour worked and an hour that was generally paid for. Back in DDP/DSS Ottawa their were some officers with a technical back ground (i.e. ex estimators from MIL and Davie) but they had no policies or objectives to guide them. Specifications were vague, rabbits were the only way the navy seemed to have to get better habitability. At that time, the contracts were mostly of a cost plus type, the financial rule at RCN HQ seemed to be to fit the directed procurement package into a sellable work scope package, that was then developed by HMCS dockyard. This work package often started out with what work was needed on a vessel but it was

often sent back to be watered down by dockyard to suit the funds that HQ had previously earmarked. This smaller pre refit package then permitted the ship to enter refit at the Government defined shipyard. Three of the main vessel cost over run problems were steel and painting, followed by bad habitability. Of course the shipyard had a way of knowing the true condition of the ship and when they had to bid competitively later on they knew what extras to expect on opening up the ship and they bid low accordingly.

The successful St Laurent class had completed construction and the navy had excess industrial capacity. It had NCDO (engineering and drawings) at Canadian Vickers that it wanted to keep under RCN control. This was unlike the other services. Also, unlike the other services the RCN had central supply of equipment and material under its control at Canadian Vickers. It wanted to get rid of accountability for material supply and that operation was closed. The RCN retained its Mtl. laboratory by making it a mixture of contracted (Peacock Brothers) and Gov't. control. The RCN industrial base built up for the 251/265 class was no longer needed for the one vessel being built at that time, the Hydrofoil class then under construction at MIL. At this time the RCN were using only the drawing office resources of NCDO as the navy built its case and preliminary design for its hoped for large ASW and Anti Air destroyers at a projected 4600 tons. The Hydrofoil vessel was using aircraft construction methods and the prime contractor was an aircraft firm (Dehaviland) using MIL as only a construction sub contractor. Therefor, there was no incentive for the shipyard related industries or designers to stay active in military marine technology awaiting the building of next DND RCN class of vessels.

MAJOR DIFFERENCES BETWEEN THE SERVICES AT THAT TIME

Also unlike other DSS customers, the navy needed more engineering jobs as an alternative to their men always spending 12 months at sea and the resulting family problems this caused. This practice of PNO's being staffed by ship staff, has remained some what intact ever since. This resulted in another difference as the RCAF trained its staff at Victoria Island for both technical administration, QC/QA needs and how to work with other departments. The RCAF CQC HQ generally left its trained TSD staff at contractors for a long period. Another difference between the services then (as now), was that the navy wanted to keep the two SRUs open and this prevented a strong contractual industrial base from developing, as it had with aerospace and armament sectors. This combination of DND PNOs moving every three years and their TSD staff having no contractual training, together with DSS marine field staff being at very low level, was a major difference with the RCAF contracting conditions, that the RCN were now in the late 1970s being told to follow. However, the biggest difference was the RCN's reaction when the new defence minister Paul Hellyer? told the navy to forget the two 4200t to 4600 ton destroyers that were in conceptual design. The minister told the navy that they were to only build a low cost repeat Nipigon class at approximately $160m for 4 ships. The RCN while agreeing with their minister, proceeded to deviate in stages from his direction. Therefor, when contracted to MIL and Davie the design of the DDH was not complete, but it had been changed to two helicopters and not one, making a 800 ton larger vessel, an untried missile system, jet propulsion and not steam, a much expanded crew, etc. In fact what MIL was being asked to help design and build was a mixture of the RCN's planned 4600 ton ASW and Anti Air destroyers.

COMPARISON BETWEEN THE NAVY AND OTHER USERS WHEN THEY USE CONTRACTORS AND DDP CONTRACTING

Unlike the navy, the RCAF had got rid of most of their repair depot functions at RCAF Station Trenton. After the Arrow and ministerial negotiations with the US Government it had been agreed that in future the RCAF would no longer design its aircraft and it would buy them in the USA. This USA build policy was to prevent risk and cost over runs. As an offset to buying A/C in the USA the DPSA was put in place. The DPSA was an agreement largely to permit USA owned companies with Canadian Gov't. design money, to sell {mostly avionics}, to the USAF. When Paul Hellyer told the RCAF that it could not buy the more expensive fighter it wanted and that they would have to make do with a CF5 aircraft built at Canadair, the RCAF reluctantly agreed. The RCAF knowing of the CF5's short comings {unlike the navy who also knew of the repeat Nipigon's short comings}, accepted the Ministers CF5 decision and took delivery of an inferior aircraft. The navy had by now put in place the vessel class called the DDH moving from $160 to $225m to $242m and finally $248m @ Halifax when the four DDH ships were deemed to meet the original contemplation that this was the ship that the RCN were told by their minister not to build. This cost of $248m was inside the project office ceiling of $252m that was established in 1970. This attempt by Paul Hellyer for the CF5 and the repeat Nipigon was an attempt to limit high risk projects that could, like the Avro Arrow, need to be cancelled later, because they were too costly.

This was happened around the same time that Paul Hellyer was running to be PM. When he lost out, he was replaced by Thumper Macdonald, when Paul resigned. This difference in accepting or rejecting ministerial direction, had grave consequences, particularly when combined with the Bonaventure crisis of a few years earlier. Ministers lost confidence in the navy's senior management to have them do what they were told. In addition, General Dextraze then head of the army and a close friend of PM Pierre Trudeau, was not getting any of his budgeted army acquisition money to replace army boots and trucks {not until the late 1970s}, as the RCN were using his funding for its ship programs. As a result the army general wrote a very strong confidential letter to dear Pierre {the Prime Minister} covering his view of navy mismanagement and their lack of respect and control. I was one of the vary few given the opportunity to see this private letter. This happened when our DSS DM de Poujillon? Who was involved in the PM's reaction committee, showed the letter to me, as he knew I would be interviewed by T.B. On some of its contents.

ACTIONS TAKEN TO TRY A MAKE REFITS MEET THE NEW T. B. OBJECTIVES

These major political events were on going before and after I was moved to the DND LE Refit Section. As a result, some DDP branches were being directed to move towards competition and firm or target incentive contracting, like the Aircraft Branch. Also, there was much concern at all senior levels of government management over the lack of control of extras (including rabbits) which had been shown during the Bonaventure program review.
In addition, this was the period of change over, when MOT acquisition and inspection staffs were removed from MOT and moved to the DSS (at the request of Treasury Board), because of extras and over runs on Coast Guard ships and a lack of competition, for their contracting etc.

SHIPYARD RATIONALIZATION

My very first job in the Shipbuilding Branch was unlike anything I was asked to do before or since. My boss at that time called me in and asked if I had ever been to Quebec City, I stated that I had not. He then asked me to drive down on a weekend morning with a DSS/DND bid set for the refit of the RCN's Aux Vessel the New Lisgar. I was to make my presence known in Quebec, particularly at the two separate shipyards (big Davie CSL and little Davie previously operated by Can. Vickers and now being managed by CSL) and tell them I was looking for a Mr. Tacki Valiotis.
I was told by my boss not to find Tacki until after noon on sat. I was given his boat pier location and a description of him. I was told that he knew the time I would be at his boat location. As I had not previously been to Quebec, I decided to take my wife and youngest boys. I was surprised to find that at little Davie, most of the staff were having a 24 hr. seven day a week "sit in" and their families were living in tents. This little Davie action was to seek a hoped for Gov't. contract, so that the yard could remain open and CSL and the Gov't. did not want this shipyard any more.
At the agreed time when I first met Tacki I had left my wife and sons in the car. Tacki was with his mother, mistress and a young lady. When Tacki found out my wife and sons were with me they were welcomed aboard his boat, as the young lady departed. Tacki was at times a vary warm individual and at others totally unpredictable and ruthless (for those who have not met him please read "running critical" which covers his dealings at General Dynamics.
He let my boy steer his vessel. Then on his ship to shore telephone he called Minister Marchand and told him that the New Lisker bid set was received after the estimating department was closed and therefor Davie could not bid and little Davie must be closed because of the Gov't.inablility to get the drawings to him on time. He then told me that his phone was being monitored by the Quebec newspapers and the labour union and he wanted his conversation with the minister to be printed in the next days newspaper. What happened after my visit to Quebec was that the New Lisgar spent the major part of the summer tied up in Quebec City in the heat with no air conditioning. Finally little Davie was closed, as had been politically planned, all the time. This was the first step to help rationalize Quebec's over capacity in shipbuilding that until then had four shipyards ie big and little Davie's, MIL, and Can. Vickers. This was the start of rationalization of the shipyard over capacity, which is now being done successfully (with the exception of the Maritimes), much more humanly.

CHANGES MADE TO THE GOV'T. FLEET REFITS

One of the first things I did to try to met the DDP mandate to reduce over runs was to improve the field staff training and to give them the tools so that they could start to negotiate extras in the field properly and in a timely manor. I developed three L E Section Gov't. Vessel Refit handbooks. The first book covered all the policy issues, parts of the Fin. Admin. Act, DSS and L.E. Section instructions, inter departmental " Memos of Understanding" that I started to develop with DND etc.
The second book outlined the overview of the companies and shipyards i.e. the rates, the facilities that were available, what had to be sub contracted etc. Book number three contained the rules of negotiation plus a breakdown by Nato part numbers or major components by name, the cost of the last refit or sub contracted job by ship name and high and low cost for similar work that had been done elsewhere. In this way the field could start to respond to the need to get value for money, instead of just counting man hours. This training process was successful, as I watched a CR become a PG7 head of the Halifax field staff, under Director John Hammon. To over come the highest over run cost of extras I had shipyards estimate (at the time they competitively bid), the painting and steel requirements by priced percentages i.e. so much for 10,25 to 100% of the ship surface. This also, applied to machinery that showed a pattern of malfunction. They would be asked to quote a price on an "as and when" needed basis.

THE START OF MULTI SHIP REFITS

The next thing was to stop the high cost of sending one ship to a different yard for each individual refit. I started multi ship refits with three destroyers at SJSL. At first this multi ship concept was not well received by the RCN. In fact when I wanted to contract for 4 minesweepers located at Halifax, the RCN refused to supply any crews. The RCN wanted to continue the practice of one ship at a time assigned to Dartmouth Slips. With this RCN refusal and after shipyard competition, I awarded the four vessel contract to the lowest bidder, North Sydney Marine Railway (NSMR). The NSMR contract stated they would be FOB for vessel pick up in Halifax and delivery would be fob to Halifax. NSMR hired off duty MOT NFLD Ferry crews to pick up the four vessels and then returned them to Halifax in very bad weather. This saved DND so much money, they became multi ship contracting converts.

DIFFICULTIES OF MAINTAINING MULTI SHIP REFITS AND THE START OF INDUSTRY & GOV'T. POLICY MEETINGS

The next problem was with the shipbuilding industry (and CSSRA) when they found that with: 1) the tighter DSS controls over extras. 2) Our use of past pricing information. 3) The history of the time between overhauls by ship class and name. 4) Better trained field staff. 5) more cooperation with PNOs. 6) The economy of scale of three or more vessels in refit at the same yard. 7) The need to bid percentage packages etc. that they were making much less profit. The shipyards via the CSSRA stated that they would no longer bid multi ship contracts and that they wanted an immediate return to allocation or at worst individual ship bidding. When all yards refused to bid I entered into negotiations and I was able to get one shipyard,

Canadian Vickers, to bid. In order to over come a sole source situation with Vickers, I talked T.B. into permitting my staff to also bid on the same work scope requirements using our previous historical data. I then negotiated with T.B. that the Vickers and DSS bids would constitute competition and that they could be opened at the same time. It was agreed before opening that if the two prices were within 10% a contract would be awarded. The Vickers price was within limits and Vickers was awarded the contract. After the award of this contract to CVL the other shipyards agreed that they would now accept multi ship contracting. However, it was also agreed with the CSSRA that shipyards, DND and DSS would meet quarterly to work together to resolve problems like too low or high profits, better scheduling of work etc.

THE SO CALLED BONNIE OVER RUN MESS, THAT WAS NOT

Part of the reason that these radical contractual changes were possible, was due to the so called Bonaventure mess. The Bonnie over run crisis was compared by Ministers to a sole source and high cost Bren Gun award that had caused an early election in the late 1930s. As a result of the serious political consequences of this masive over run, the Ministers appointed a rectification board of three knowledgeable officers to advise them how this condition would not happen again. The board consisted of Herk Points { who was then in a DND position that was later called Chief of Supply} a General [who's name I forget but who represented say ADM MAT.] And myself for DSS. We were able to make recommendations on delegation, work scope restructuring and the development of the 448 forms and their method of control, both in the field and at HQ. After these recommendations were accepted by ministers, I drafted the DDP Minister James Richardson's speech to the house. These changes, plus the removal of the DM at DND, satisfied the opposition PC's that an over run of this magnitude would not reoccur. It was only much later that I found out from a senior Naval Officer I/C at Halifax at the time of the Bonnie, that the dockyard work package had been estimated much higher, in the $10m+ range. I also found out that Ottawa HQ had feared that if they agreed to a refit of Bonnie for that amount of money, that the RCN's only aircraft carrier, would have been scraped by the Gov't. Therefor, the RCN HQ had directed their dockyard to reduced their estimate to under $4m and to develop a reduced work package that would fit that amount of funding. Of course when the ship was opened up at Davie, the needed work quickly surpassed the original dockyard estimate of under $4 million. However, the end cost was only a small amount beyond the dockyard's original $10m estimate. Shortly there after, the Bonnie was scraped. It may not have been scraped if the original estimate had been supported by DND HQ and the alternatives of future bigger DDH ships, been explained . However it was scraped because of the supposed over run from under the $4m Davie contract price, to above the $12m+ range. Many senior gov't. officials who were all unaware of the first dockyard estimate of $10m, believed that the shipyard had pocketed large amounts of extra unnecessary profits from unnecessary extra work.

THE POLITICS OF SHIP CONTRACTING

One other significant case was the DND/DSS storming of HMCS Margaree during a union strike at CVL, that could have locked the vessel in the ice at Montreal until spring. I sent a pro and con action plan message to my DSS DM for his review before the fact and a letter to be forwarded to Cabinet to tell Ministers that unless

we heard otherwise, the navy would take over the ship in Montreal at 3am Sunday morning. Then the plan was to remove the vessel by tug from Montreal to Halifax, for refitting.

This was strike breaking and inaddition the movement of this vessel without compensation to a different sole source location, was contrary to all bidding and acquisition policies.Hence the need for prior Ministerial approval was a serious consideration. I found out after the fact, that my DM never sent my memo to our Minister and that in fact he had destroyed my memo so that their would be no link to him if this take over of the vessel had political consequences. Luck had it that no one objected when the need for the raid on east end Montreal was explained to the unions and the industry. However, as far as Ministers were concerned I had been a strike breaker and I had authorized the removal of CVL employees property from the Queens ship and then towed it to a non competitive shipyard, for cause, but without proper Gov't. authority.

. FROM THE GOV'T. FLEET REFITS AND THE BONNIE CRISIS TO THE DDH CRISIS

It was while I was handling the refits of the gov't fleet that Al Allan moved over to become DG Project Mgt. Branch. Al's replacement as Director Shipbuilding Branch, was John Strang (who was the ex Acquisition Dir. General at MOT). It was John Strang that told me that the DG Project Management Branch wanted me to join the DDH Project as Deputy PM DDH 280. He went on to tell me that the Gov't. wanted the removal of both the PM (a Capt. and the DPM a PG7) and that two names had been proposed and approved by the DDH 280 Project Review Board, namely L/CMR John Allan (to be promoted to Capt.) by DND and myself as DPM. We would both report to the DG Project Management Branch, to P R G and to our two Departments. In other words we had many bosses. After making the offer, John Strang suggested that I refuse Al Allan's offer, because John Strang stated that the DDH280 Project was an overrun disaster. He pointed out that Government at the ADM and above level were projecting that this much bigger ship could escalate from $220 million to close to $500+ million. John Strang then went on to say that I would suffer the same fate as had happened to him while working with an operating dept.(MOT), that were designing as it was building new ship classes under target or firm price contracts. He also, talked about a lack of authority for changes and for the necessary feed back to Gov't. He said that this had caused his demotion and removal from MOT and transfer to DSS. He stated that this action had been taken so that he would be under the close control of both DSS and TB. I thanked him for his advice but decided to take on the challenge. I joined the DDH 280 Project office in the fall of 1969. This caused me to report for a month to Derry Dawson who was the DDH280 PM from the start of the DDH 280 Project. After a month John Allan was promoted to Capt. to replace Capt. Dawson, as had been previously planned by PRG.

My first briefing on the DDH 280 class was at Capt Dawson's house on a Sunday when he was preparing his project brief to the PRG. I had no indication from this briefing what bad shape the project was in and as a result I felt that John Strang had been over reacting. My first day on the job, the next monday morning quickly changed my one day period of relief, as on my desk were requests for transfers from all the senior DSS staff. The staff at that time consisted of Harry Bolster Ship Contracting, John Hammond Material Manager, Dave Curling Planning and Scheduling and Bill Walker Finance. These requests had been on the previous DPM's

desk (Jack Longhurst) unanswered for months. My interviews with these offices indicated that all was not well and they gave some of the reason why. In fact the end result seemed to be exactly as John Strang had predicted. The first months were devoted by John Allan and I trying to get this tiger by the tail and to find out where changes had to be made. As we were starting to get a handle on what was needed, the DM's of DSS and DND, the PRG members and the PM and DPM were told to report to Ministers on the hill. These Ministers consisted of Macdonald of DND, Richardson of DDP, Bud Druy of Finance and two other more junior Ministers. They made it clear they were upset that since 1967 they had not received factual project reporting and that they felt that cost was away out of control. They stated they were going to cancel the ships in the same manor the PC's had done previously to the Arrow. Like the Avro Arrow, the DDH cancellation would be reported as caused by service and shipyard mismanagement and on new options. Everyone was silent and in shock. I (the junior member present), reacted first by stating they could not cancel this project now that half the committed money had been spent, as it would only return 3 cents on the pound as razor blades. At that point every one else had recovered and then John Allan reviewed what we had done in the short time we had been on the project. Gerry Meuser an ex General and senior member on the PRG outlined how much better this project was being run now. Stu Paddon DGMEM, outlined how design needs, and design change risks were being controlled via the DDH 280 Project Office and PRG etc. The ministers only concession after this defence of the project was to give the PM and I a week to completely re-estimate the end cost ,the delivery dates, and the performance measures at acceptance. The Ministers then outlined that only if they could be convinced that the project was under control, would they remove their cancellation order. Before leaving the Ministers on the hill, the PM and I as DPM, had both taken on a personal commitment to bring the Ministers back a target ceiling arrangement for the total DDH 280 project. I had also undertaken to renegotiate a revised firm price contract with the lead yard MIL and the follow yard Davie. This was required as there was concern expressed by the Ministers that the firms may be incapable of continuing and could sue for Gov't mismanagement of the original bid documentation and late drawings, unless a new contract, a new price and conditions could be agreed. Before this meeting with the Ministers, I had already had previous meetings with MIL who had shown me their books on how they had bid the DDH280 as a smaller vessel and the current consequences to their company bottom line due to their lack of cost recovery. The PM and I had talked to Cmdr Alex Arnott who was our senior PNO. He used the number of scuppers and drains that had been in the bid documents given to shipyards as an example of the problems faced by shipyards. He pointed out that the number specified were for a 3600 ton ship and the number required now by NCDO and the RCN were the number needed for a 4600 ton ship. His evidence of the current over run and the reasons for the delays being experienced by the shipyards, had convinced us what was wrong and what needed to be done to regain control . His evidence confirmed for us that the ship that was bid and contracted was smaller than the ship being built. This started to convince us that the contract had to be completely renegotiated. The DSS staff under Harry Bolster and I using the bid documentation and what was now required, started to rework the negotiation numbers with the help of Alex Arnott. Then Alex Arrnott (PNO) and I started the renegotiation with the lead yard MIL. These negotiations took place in a Montreal hotel close to the MIL head office. These negotiations lasted many days. The MIL negotiation team consisted of Bill White and Louis Rachette. The Gov't. team as indicated above consisted of Alex Arnott the DND

PNO and myself. After MIL had agreed the Davie negotiations started. At the end of these negotiations a project all up target ceiling price of $242m and $252m respectively was agreed and then presented to the Ministers. Also, presented were major changes to both the design change control, the ship design, and the management of the drawings that were required. Some of these changes were the following, the ship was getting heavier and and it was was top heavy, this meant that trade offs had to be made like removing one
the anchors, but leaving the bear trap. The control of the NCDO design by the lead yard MIL was not workable, as the RCN HQ were designing the ship and then giving advise to NCDO of what to draw and what they would accept from the lead yard. This DND design advise was very late and incomplete (from 2 to 3 years in some cases). Therefor, we the project office took over the NCDO contract management and caused the design authority to be accountable to the DDH Project Office for timely design inputs. Also, the release of design authority cost projections for changes to GSM and timeliness of data from some directorates or officers was very late and often in error. To correct this, I had my planning officer develop a software package to statistically measure each imputing officer data to our DDH budget as to its T C & P reliability. This software was adjusted monthly, so that a probability % change was applied to each inputting officers T C P budget projections. This helped stop wishful forecasts and caused them to give factual early projections of trouble. This permitted us to take meaningful corrective action or to work around the problems. In order to share management responsibility better, I had DSS give John Allan defined contract signing authority (this was a first delegation of contracting signing authority to a DND officer) and as another first and as an offset, DND permitted me to rate the DND officers assigned to the DDH project and then Capt. John Allan rated me. Gradually the control over cost growth started to happen. About this point Tacki at Davie the follow yard had called in the Auditor General (AG) for a weeks stay in Quebec City. Tacki invited the AG and his staff so that he could try and prove why Davie and not MIL should be the lead yard. He was most upset that DPM DDH280 would negotiate an extra at MIL and then come to Davie with a ceiling price position. He also tried to convince the AG that the project office was not doing a good job. This resulted in the AG assigning a full time senior auditor to the project office. This AG officer told me many years later (after I had left Gov't. service), that instead of finding mismanagement, the AG was impressed with what was occurring. In addition, every week I would write a significant action report to senior Gov't. officials in all departments directed at the ADM level.In these significant action reports I would spell out the good and the bad news for that week. The bad news I would carry forward until the adverse issue was fixed. The suppliers and shipyards were also included on circulation, if there was a problem affecting them. This resulted in only one small CPW claim that was settled. If a proper review of the these significant action files had been carried out, this CPW claim could have been rejected.

As a first, the 4 ship sea trials consisted of DND and DSS officers being at sea who had the necessary authority to agree as to what needed to be fixed, the price and then to accept the work. If it was an out of the orginal specification extra, money was set aside for its rectification in Halifax. This unfinished work money was earmarked for the DDH280 Halifax office budget. PNO Halifax then transferred this money to the RCN Halifax SRU, who then did the work. In addition, for the 4 ships, J. Allan PM would represent the DDH office at the first week of sea trials and I would replace him for the second.

GOOD OFFSET MANAGEMENT MAKES FOR GOOD MCP PAY OFFS

When it became time to trade equipment for weight, the navy and DSS list of what should be removed differed. During this critical weight reduction meeting I found that the Bear Trap {helicopter haul down} was the first item for disposal on the RCN list and it was the first item to be saved on my list, fortunately, I was supported by L/CMDR Gwynn Hoppy {?}. The final decision was to keep the helicopter haul down and to trade off the sewage disposal system, instead. This decision has since resulted in more money coming to Canada via foreign sales of second generation helicopter haul downs, than the total cost of the whole DDH project. In fact helicopter haul down sales maybe three times the total cost of the DDH project. After the DDH project, the RCN HQ wanted to give the US navy the patent rights free of charge so that the USN could build their helicopter haul downs at an American firm. The only RCN condition was to be that the CPF ship systems would be built in canada. I, on behalf of CCC and the Can. Patent Board { headed by my ex C/O at A.M.C. A.V.M. Clair Annis}, prevented this Gov't. patent from being transferred to the usn, when the request was made by the RCN.

During the build up of President Regan's 600 ship navy, this one act by CCC and the Patent Office resulted in Indal Technologies of Toronto Canada and the Canadian tax Dept. getting the benefit of millions of dollars of sales, instead of a US contractor.

THE DIFFERENCES BETWEEN DND'S TREATMENT OF ITS STAFF AND DSS's REACTION AT THE END OF A DIFFICULT PROJECT

Whem DDH 283 was delivered, my first job was to try and find jobs for my officer staff of about 10 people and myself. The support staff were easy to place at time in late 1972, as there was a shortage of good support staff. I quickly found out that unlike DND who now had their bigger ships, DSS had little to show for this completed project, other than the original bad press off the projected $500m over run in 1970 and now it had new Pennyfather controls. In addition, DSS had little use at that time for its marine trained project staff, as the next big ship project would be many years away. The RCN on the other hand promoted all of the DND senior staff and gave the Project Manager a medal, as well as promoting him to V/ADM. To my knowledge there were only a few low dollar claims and the project with many extras under taken at Halifax dockyard, was still within the agreed ceiling amount of $252m. After the DDH ships were accepted from the contractors at MIL and Davie they sailed to Halifax under V/ADM John Allan's command. I returned to the Shipbuilding Branch in late 1972 to replace Des Wallace who had been the Shipbuilding Division Chief and who had suffered non promotion and eventual replacement, as a result of his involvement in the Bonaventure crisis and then he left Government service. After the project had finished I received no promotion or medal to come home too. Shortly thereafter, around late 1974, the Director Bob Hunt of the DSS Armament and Machinery Branch resigned, when his Directorate was folded into the Shipbuilding Branch. At that point I was promoted to an SX2 level and I became the DSS Director of a much expanded Shipbuilding, Armament, Vehical and Machinery Directorate.

SELECTION OF THE CPF CONTRACTING PROCESS

A team was set up of V/ADM John Allan, Cmdr Alex Arnott {who was to be the

PM CPF class) and myself for DSS to define the CPF options. This team visited Holland and were going to visit the UK and Germany. On this first visit to Holland, the Dutch proposed a joint venture between three to four countries who all needed a new class of ship. Without knowing it, they had come up with the start of the NFR 90 concept thinking long before the NFR 90 need and plan was developed by NATO. The Dutch navy wanted to share equipment via offsets. Then each country would build its own hulls, make any modifications in habitability etc. After the Dutch visit I voted for this joint venture as being the most cost effective and the least risky. DND voted for their own design and felt that they would get a better ship, sooner. I was not invited to visit any other countries to discuss other options. Of course with a two on one position, DND won the toss and CPF became a Canadian first of class design using NCDO like the DDH280. However, this time SJSL had much better control over the design process then had been possible under the original MIL contract. As indicated the conceptual design was carried out by CVL's NCDO, but durring the bidding process CVL lost out to SJSL for both the construction and project management. On hind sight, both the Dutch and Germans got new classes of frigates at sea before the first of class CPF. Also, equipment suppliers lost the opportunity to bid on say 50+ vessel sets. Had this 1970 proposal happened via the Dutch suggested method, it is possible that the 1987 NFR 90 start and then the decision to restrict it to only European suppliers in 1990, may have permitted Canada to be an exception and remain in the competition.

I then moved back to the Aerospace Branch as Director and thereafter, became the Chairman of the government Contract Settlement Board.

AVOIDING CONFLICT OF INTEREST CHARGES

I left the Canadian government service in Oct,1985, after 35 years of service. Earlier, when Bill Johnson the senior DSS officer had been removed at the request of the RCN and SJSL, I had been asked by our DM to replace him as the senior DSS contractual officer on the CPF project. I refused as I felt that one ship class as the contractual authority, is enough for anyone.

Just before I was leaving Gov't service there had been the Alex Arnott conflict of interest crisis when he moved from the PM CPF project office directly to Canadian Vickers incharge of NCDO. This was not the first or last case of a DND officer having a conflict of interest. Then the rules were tightened to a one year cooling off period. To prevent any accusation of conflict of interest, I joined Versatile's (VSEL) Engineering Division in Ottawa. This was five years after my last involvement with shipbuilding contractors. I was hired as the Dir. of Business Development for Versatile Systems Engineering working mainly with External Affairs on international export projects. After a short period I became VP gov't. Relations for Versatile HQ in B.C. This title changed to V.P. Business Development when MIL of Quebec acquired Versatile of B.C. My last negotiations for MIL was the close down of Canadian Vickers and then to move the Vicker's repair contract and work on the M II3 army vehicles to M&M in Nova Scotia. This was a vary sad day, as I had been born at Pie 1X close to Vickers in Montreal and I had been a Vickers cub, boy scout, and on their various teams, while my dad worked for J&J in the east of Montreal. I had watched aircraft assembly at Vickers before they managed Canadair durring WW 11. Then when I joined 11 TSU, the Vickers TSD in the 1950'S was one of my responsibilities. While with the RCAF TSU, I had been present when the torpedo tube contract for the USN's atomic submarines was negotiated and my inspectors had

been involved in most of the Vickers production until the mid 1960s. Then with Versatile and MIL I had negotiated the sales and offsets of Vickers products world wide and so the closing of Vickers, was like a death in the family.

I also, was the last Canadian industry (CNFG) Program Manager for the close out of the Canadian NFR 90 consortium consisting of six companies including SNC, CDC, SJSL, Acres, MIL and design agents. This was the result of the UK decision {at first} and then followed by France and then Germany withdrawing their support from NFR 90 project, if it continued to include North American involvement. This left only only the Dutch, the American and Canadian industry left in NFR90 so Canada had to withdraw as well. At this point the US decided to proceed on their own, after DND withdrew. I was asked by Canadian industry, using their data, to develop an extensive claim on our Gov't. This claim resulted because our industry had been at risk on this NFR 90 project for a long period {3 years} with no contractual coverage, but under direction from DND. Unfortunately, because of a misunderstanding by the previous (CFNG) PM, he had signed off a prior rights letter inorder to get a contract, CNFG only received a small period claim and a large loss, when the project was cancelled. This letter and restricted contract was signed by the PM against the direction of the CNFG industrial management board. As a result NFR 90 companies received only 50% of their out of pocket dollars.

7.2

An example of the legal pitfalls of a Designated Supplier by the Buyer to the Prime Contractor – a Case Study by Jim Williams (10)

As an example of the problems inherent in the Buyer directing the Prime Contractor to subcontract elements of the work to a specified Supplier, the following synopsis is presented wherein the Prime Contractor used legal manoeuvering in an attempt to embarrass the Supplier. The Supplier is put in a position where it has to assume loses on his work until the Courts decide the issue, and since cash flow is a major aspect of "staying in business", this process can put the Supplier out of business unless, in this particular case, the Supplier's shareholders had deep enough pockets to weather the situation. The synopsis is, of course, the view of the Supplier.

1. *Introduction*

1.1

In 1984 MSEI undertook a contract for the functional design and some 70% of the detail engineering for the Canadian Patrol Frigate Program (CPF).

1.2

The contract was cost plus fee with a Ceiling Price, with provision to increase the Ceiling whenever extra work was authorized by the customer, Saint John Shipbuilding Ltd. (SJSL).

1.3

The deliverables under the contract included drawings whose schedule was dependant upon data to be supplied by SJSL, known as Vendor Furnished Information (VFI).

1.4

In November, 1987 SJSL increased the Ceiling Price by $2.5 million (1981), i.e. $3.2 million (1987) to cover payment for 318 claims for extra work previously submitted by MSEI. At the same time, SJSL agreed to further increase the Ceiling by another $3.2 million (1987) to cover the provisional cost of further claims.

1.5

SJSL terminated the contract on May 6th, 1988 at which time a further 670 claims had been submitted, but not settled, SJSL refusing to pay MSEI although the second $3.2 million revision to the contract had been made and approved by DSS.

2. *Contract Termination By SJSL*

2.1
From time-to-time over the life of the contract SJSL had issued "notices of material breach" to MSEI as a management method to accelerate the schedule of deliverables which were being adversely affected by SJSL's delinquency in delivering VFI and for changing already issued VFI data. In each case MSEI had responded to the "notice of material breach" and SJSL let the matter pass.

2.2

On 14 April, 1988 SJSL issued another "notice of material breach" alleging late delivery, to which MSEI responded in detail. In this instance, however, on the earliest date allowed by the contract, (i.e. 20 days after notice of breach) SJSL issued a Notice of Termination (May 6), having disregarded MSEI's response to the notice of breach. At this time MSEI had completed some 99% of the design work in spite of continuing delayed/changing VFI, and was scheduled to deliver the last design drawing in six weeks time, viz. June 20, 1988.

2.3
Termination was served "for Cause" in accordance with Article J.11 of the contract, thus requiring MSEI to deliver all contract data in its current form to SJSL, and for MSEI to be liable for the costs of SJSL to complete the (terminated) work.

3. ***Counter Action By MSEI***

3.1

At the time of termination MSEI had not been paid since 05 January, 1988 and had accumulated some $6,300,000 of costs and had earned $4,700,000 of profit. Similarly, due to termination MSEI was denied the opportunity to earn/claim a further $1,450,000 of profit.

3.2

The nature of the termination defamed MSEI's professional reputation, and caused further costs to be expended to terminate the contract (pack and send the data to SJSL).

3.3

MSEI consequently retained an eminent litigation lawyer and raised a Statement of Claim for:

a) unpaid claims and profit amounting to $13.0 million
b) wrongful termination, i.e. from Cause to Convenience
c) damages for defamation of $5.0 million
d) punitive damages of $1.0 million
e) costs of termination $1.0 million

- for a total of $20.0 million (1988)

3.4

To substantiate this claim, MSEI set up a catalogue of data showing the late delivery of all VFI by SJSL to MSEI, and of relevant data such as the contract, letters, instructions, etc. There was overwhelming evidence to show that MSEI did deliver drawings as early as possible, notwithstanding late/incomplete VFI data, and that these drawings were updated as VFI became available incurring additional costs to MSEI which should have been re-imbursed by SJSL. Our litigation lawyer considered this evidence "overwhelming".

4. *Consensus*

4.1

It was considered by MSEI and by our parent, MIL Group legal staff, that SJSL terminated the MSEI contract to establish;

a) *a scapegoat to cover its own ship delivery schedule delay (in excess of 6 months)*

b) *as a bargaining chip with respect to correcting their similar (VFI and VFE) deficient deliveries to MIL Davie, the follow-on shipyard for Frigates # 3, 5 and 6.*

5. *Law Suit Activity*

5.1

MSEI filed its Statement of Claim in the Supreme Court of Ontario on 2 September, 1988 which required that SJSL file a Statement of Defence within 20 days thereof.

5.2

SJSL consistently challenged the detail of MSEI's suit and used all the avenues available under the law to delay the court action. They were effective in achieving a year's delay before they exhausted all legal delay remedies, and were finally ordered by the court to file their defence by 16 June, 1989. They filed a Pro Forma Statement of Defence on that date with notice that they would file a Fresh Statement by 31 June, 1989.

5.3

SJSL filed a Fresh Statement of Defence and Counterclaim on 4 August. The Counterclaim asks for $109,000,000 consisting of:

a) ***increased engineering costs by SJSL of $12,000,000***
b) ***increased management costs by SJSL of $1,000,000***
c) ***increased production costs by SJSL of $65,000,000***
d) ***increased material costs by SJSL of $2,000,000***
e) ***third party costs to SJSL of $4,000,000 and increasing***
f) ***costs to complete the MSEI contract work by SJSL of $25,000,000***

5.4

SJSL also cited The MIL Group and MIL Interco as being parties necessary to the suit.

5.5

MSEI prepared a "sentence by sentence" response to the SJSL counterclaim and concluded that the SJSL data was full of errors and incorrect statements. Our confidence in winning the court action was still very high and was confirmed by our legal counsel. However, the mass of data contained in 26 paragraphs (16 pages) would certainly cloud the issue of MSEI's claim of Wrongful Termination of the CPF Contract by SJSL, and would cause the case to be in front of the court for a long time. Consequently, we asked for and were granted the services of a Case Management Judge (to accelerate the process).

5.6

In an attempt to accelerate a settlement, MIL Group/MSEI agreed to a meeting with SJSL at the Hilton Hotel, Dorval Airport, on St. Jean le Baptiste day in 1988. R. Tessier and J. Williams met with A. Nightingale and J. Shepherd, and agreed verbally on terms and amount for an out-of-court settlement. In the event, A. Nightingale was not able to deliver his side of the agreement.

5.7

Once through the process of "pleadings" and in the phase of "discovery" there was potential for a more formal out-of-court settlement. SJSL requested a meeting with MSEI at SJSL offices in New Brunswick, to explore the details of a settlement on 28 June, 1989. In the event, SJSL expanded the requirement at that meeting to include a settlement of their perceived problems with MIL Davie, to which MSEI could not respond other than to terminate the meeting.

5.8

The case Management Judge ruled that "documentary discovery" be completed by 1 September, 1990 and for "oral discovery" to start immediately thereafter. This schedule was delayed due to the filing by SJSL of a $1,750,000,000 Statement of Claim against The MIL Group (including MSEI) in an attempt to tie the two cases together and in so doing slow down the MSEI suit. This was unsuccessful.

5.9

In 1991, documentation discovery was conducted by both MSEI and SJSL. Oral discovery was completed by MSEI, but was never started by SJSL. SJSL had been so tardy in its discovery process that MSEI approached the Case Management Judge to rule on a required completion date; he first set 31 January, 1992 as that date. In September 1992, the Case Management Judge again directed that all discovery be complete by the fall of 1993, and that irregardless he would then set a pre-trial date.

5.10

In parallel, MIL Group and MIL Davie were negotiating with SJSL to settle their $1,750,000,000 suit. In the process, MSEI's suit was integrated into the MIL Group settlement package, and a global "out of court" settlement was reached and finally ratified with the Canadian Government (CPF PMO et al) in March 1993. MSEI as a consequence did not recover its costs, either contractual or its accrued legal fees, but on the up side the contingent liability was removed.

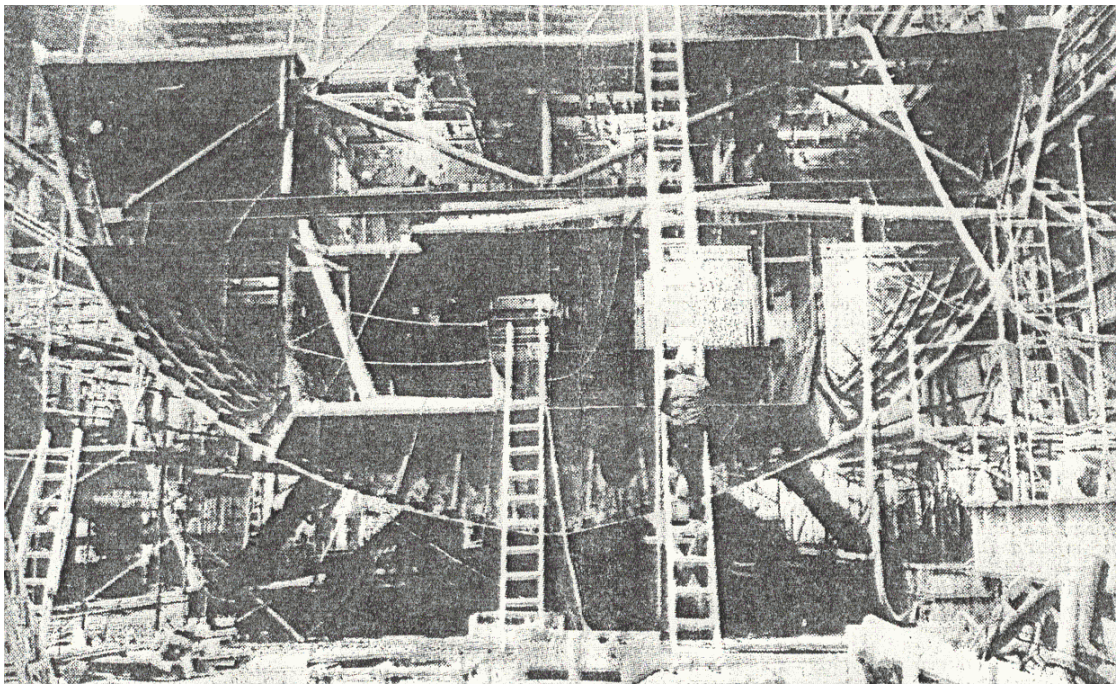
7.3

A "third party" view of the foregoing Case Study – "A Marriage of Convenience" by Kate Dunn, Montreal Gazette, 12 November 1988

A marriage of convenience

Rival frigate-builders work together for now but jockey for future business

(An article published in the Montreal Gazette newspaper on 12 November 1988 in the Business Section)



One of the pre-constructed modules for CPF No. 2
@ Saint John Shipbuilding Ltd., New Brunswick

By KATE DUNN
of The Gazette

SAINT JOHN, N.B. — Shipyard president Arthur Nightingale had a toothache *and* a reporter to deal with one miserable foggy Tuesday when he got back to his office at Saint John Shipbuilding Ltd., located in the city at the heart of the K.C. Irving empire.

The Irvings and their employees are not used to submitting to public scrutiny, though much has been written from the outside about K.C., who was recently named third richest man in the world by *Forbes* magazine.

Ever since Irving's Saint John shipyard won two government contracts totalling $6.2 billion to build 12 frigates for the Canadian navy, they've learned to accommodate public interest in their operations. They even hired their first-ever public relations expert.

Finishing inside

Like Quebec's own MIL Group Inc., which is building three of the frigates for Irving, Saint John Shipbuilding wants everything shipshape with its public image. Neither wants stories of Pentagon-style procurement scandals.

Right now, Saint John Shipbuilding has the first frigate, HMCS Halifax, floating at the dock with shipworkers finishing it off inside, readying it for sea trials in the spring.

The patrol frigates will specialize in detecting and locating submarines, which will be dealt with by missile-carrying helicopters stationed on the ship. The weapons system, being designed and built by Paramax Electronics Inc. of Montreal as part of a total $2-billion contract, is to be ready for installation at Christmas.

Canadian Patrol Frigate No. 2 is partially constructed. Things are just getting under way with CPF4 in Saint John.

CPF3 is being built by MIL's Davie and Tracy shipyards in Quebec and is "20-per-cent complete," said MIL Davie president Donald Challinor.

MIL is also building CPFs 5 and 6. Superstition prohibits names from being used on ships under construction, until the champagne is smashed on the bow at launching. Montreal and Quebec City are two of the 12 Canadian cities for which frigates will be named.

Looking beyond frigates

Nightingale said the Halifax will be delivered to the Department of National Defence on deadline in late October 1989. "She will be commissioned on time," he said, working his jaw a little to try to lessen the pain from his toothache.

Problems are arising, however, as MIL and Saint John Shipbuilding look beyond the frigate program to multibillion-dollar projects they hope will sustain their yards into the next century.

The two firms are not working together on the frigates by choice. Normally business rivals, they formed an uncomfortable alliance to complete the first six ships in the 12-frigate program. The working marriage was forced on them by a federal government concerned with spreading around the benefits of big projects.

Both want to finish on time and within budget on the first ships they're building so they'll get a good crack at the controversial $7 billion-plus contract to build Canada's new submarines — if that contract sees the light of day after the election.

MIL and Irving have to co-operate on the frigate project at the same time as they are jockeying to win the submarine contract and any other government naval projects going. But they don't want to have to share the business again. Each has scale models of their shipyards for visitors to study, and those models include little black submarines each company hopes to be building in the next decade.

MIL Group Inc., formerly known as Marine Industries Ltd., and Saint John Shipbuilding "are fierce competitors," Challinor said.

MIL owns the Davie shipyard across the river from Quebec City as well as one in Tracy, near Sorel. The Quebec government's industrial holding company, SGF Group, owns 65 per cent of MIL Group.

A $20-million lawsuit has been launched by MIL against Saint John Shipbuilding for cutting off another subcontract, given to MIL Systems Engineering Inc., to do part of the engineering design of the ship.

"They weren't performing," said Nightingale. MIL officials say they had completed "99 per cent of the contract."

The gloves are coming off in other ways.

Saint John Shipbuilding agreed to pay MIL Davie $208 million in 1981 dollars to build three of the first six ships, and provide MIL with design drawings and materials. Challinor said there have been "delays" in delivery of both to MIL, but "given continued support by Saint John Shipbuilding, we are going to be able to deliver on schedule."

However, he added, "I don't think the perception is they're falling all over themselves to make us look good."

The cancellation of the MIL engineering design contract has not upset the construction of HMCS Halifax, said Commodore Michael Saker, project manager of the government group in charge of the frigate program.

"We're satisfied" with progress to date, he said, adding the government had no hand in the decision to end the MIL design contract.

The entire Saint John shipyard has been dedicated to building the frigates. "We don't even do our own Irving ship repair here any more, Nightingale said. MIL, on the other hand, is building three frigates along with a Cape Breton-to-Newfoundland ferry and overhauling the navy's Algonquin and Iroquois, which take one million man-hours each — about half the effort needed to build a frigate.

Although Nightingale bridles over questions about whether the Halifax and its weapons systems will be 100 per cent operational by next fall, he agreed "there were problems with the project and the public has a right to know, to the maximum extent possible, and the media is responsi-

ble to do that."

But he said media reports of problems such as a rusting hull were exaggerated and uninformed. Last June questions in Parliament about Paramax's ability to meet its deadlines were dismissed by the government as being based on old concerns already investigated.

Nightingale said the Departments of Defence and Supply and Services "have more access to detail on this contract than any other commercial client" of the Irving family of businesses.

Both Nightingale and Challinor said the modular method of building the ships saves time and money, and they're getting better at it as they build each frigate. Each wants to convince Ottawa that its particular expertise in building frigates will save Canadian taxpayers money on future projects.

Fitted in place

The design is broken into blocks, or modules, which are constructed separately. Each is outfitted with lighting, pipes, machinery and so on to the greatest extent possible. Even the light bulbs are in place in the modules before the huge chunks are transported on carts capable of carrying 190 tonnes to a monster-sized crane which lifts them down on to the keel in drydock.

It's a way of cutting costs preferred to the old method of building the ship from the keel up, one deck at a time.

Those modules are to be transported by barge up the St. Lawrence River to the Davie shipyards in Lauzon, a small city across the river from Quebec City.

The original project called for Tracy to build half of each of the three ships assigned to Davie for construction; the halves were to be floated up the St. Lawrence to Lauzon, an idea that MIL's Challinor junked in favor of modular construction when he came on the scene.

Both MIL and Saint John Shipbuilding say the government of Canada should benefit from the expertise each has gained in managing the huge building project. Managing is where the money is.

Money in designing

Just why the MIL design engineering contract was cancelled when it was almost completed may be connected to Nightingale's future plans for Saint John Shipbuilding. He wants to market worldwide the company's brain power in managing and materials procurement in big government naval contracts, rather than fighting to actually build the ships. The awarding of building contracts is always politically controversial.

The arithmetic is clear. Just $208 million is being paid MIL for building three ships, out of the $3.5 billion Saint John is getting for the first six ships. That indicates that most of the money paid for the ships goes on designing them, getting the right materials and managing the complexities of modular design.

With Saint John handling most of those chores, they may have the upper hand in bidding on future maritime construction projects for the government — if practicality is the only concern.

"The Crown has poured considerable amounts of money into this company for the frigate program and it is my firm conviction that

Frigate builders jockey for contracts

(Continued from Page F-1)

what we have learned in it should be used by the Crown in any other such project," Saint John Shipbuilding's Nightingale said.

"We're not getting that much out of this frigate contract," Challinor said. MIL and Saint John Shipbuilding went "head to head" in fighting to win the whole contract to build the second batch of six frigates, Challinor said. Saint John won, and nothing had to be subcontracted to MIL. However, Paramax got another $800 million for weapons systems.

"It's very difficult to be working with our competitor," Challinor said. "We went after that second batch of frigates as prime contractor. That was something that hurt our relationship and I don't think we've recovered. I've noticed a hardening of the relationship."

Matters weren't helped when Saint John Shipbuilding found out MIL is now part of a powerful consortium made up of Litton Industries, Halifax-Dartmouth Shipyards, Lavalin Engineering and SNC Group, intent on winning the submarine contract.

While Quebec politicians will push all the pressure points to win that contract for the province's shipyard, Saint John's Nightingale is confident it will come down to a question of price and the expertise of bidders.

"I'm aware of the political arguments (of giving such a big contract to Quebec) but I look at it from a logical point of view. The minister of defence has stated publicly the submarine contract will be a competition. As long as there is a competition for the subs, I'm confident Saint John Shipbuilding can win."

Note, by Jim Williams:

It should be pointed out that the premonition stated by Kate Dunn in her paragraph titled "Money in designing" proved accurate, for by 2002 the Saint John Shipbuilding company had acquired, one way or another, both the then existing warship design houses and shipyards. Fleetway in Ottawa, owned by Saint John Shipbuilding, is the centre for their warship design activities now that MIL Systems Engineering Inc. has gone out of business through lack of work (and its core of the original NCDO personnel has dispersed), and HalShips where the MCDV ships were designed and built was acquired by Saint John Shipbuilding even before all 12 of the MCDV's were completed. The Davie shipyard has changed hands a number of times since the MIL Group sold it after the CPF and TRUMP contracts were completed. The MIL Group shipyards at Sorel and Montreal were both shut down by the MIL Group during the CPF era. So essentially, Arthur Nightingale's objectives for Saint John Shipbuilding were realised even though he had by that time moved on.

7.4 An example of the Program pitfalls of Designated Suppliers by the Buyer to the Prime Contractor – a case study by Jim Williams (11)

The following data details a problem that arose during the TRUMP Contract in which Litton Canada was Prime and MIL Systems Engineering and MIL Davie were designated sub-contractors for the design and the implementation, respectively, of the work necessary to accomplish the upgrading of the DDH 280 class to its new role of Task Group Command and Supportive Air Defence. Litton Canada was the Supplier of the major new weapon system, the VLS, and its parent company in the USA was a renowned warship designer and builder. However, the interface required between the Designer and the Shipyard was not well enough established in the sub-contracts let to those two companies by Litton and furthermore the two companies were restricted by their individual sub-contracts from communicating with each other on these matters. As a consequence, interface problems arose which became immersed in the contract terms rather than the solution required to best implement the work. Eventually, the Crown retrieved the Prime Contract Status from Litton Canada and managed the contract to its conclusion – which did yield the new ship capabilities that the Navy sought. The following is a detailed account of the ensuing problem, as raised by MIL Systems Engineering at the time.

INDEX

Section No. 1 - Introduction

Sub-section A - Presentation

This presentation addresses the TRUMP risk management responsibilities as interpreted by MSEI in the following areas identified by MIL Corporation (MIL Interco):

- Composite Drawings
- Vanguard Team
- Lift-offs
- Accuracy

To fully understand the background of the subject one has to read and be aware of the:

- MSEI Contract Requirements
- Design Process and Constraints
- Baseline Documentation
- Sequence of Events

All of the above background data will be addressed as appropriate in the following sections.

Reference should be made to Attachment "A", "Scientific Research and Development Proposal dated 29 August, 1988" which was successfully submitted to the Crown identifying the design process and the inherent risk at each stage of a ship project.

NB - Attachment "A" is included in Chapter 4 of this publication

Section No. 2 - Composite Drawings

Sub-section A - MSEI Contract Requirements

Nowhere in the MSEI Subcontract does it make reference to a requirement to produce composites, except that a date is given in Schedule C1 for the delivery of composites.

It is understood that MIL Davie were entitled, in accordance with their Sub-contract, to receive composites on an as-required basis.

This requirement was not passed on to MSEI.

MSEI believe that Litton were sending to MIL Davie, for planning purposes, those composites being produced by MSEI as sketches.

It would appear that the contracts were incompatible in this area.

It should also be noted that MSEI was not responsible for the areas of the TRUMP Program covered by the refit specification.

Section No. 2 - Composite Drawings

Sub-section B - Design Process and Constraints

In order to avoid interference problems between systems, some form of checking must be conducted in the design process. MSEI has traditionally accomplished this through the production of composite drawings.

The composite drawings logically precede production drawings, especially those associated with the deckhead as they are the means for allocating real estate space for main runs of piping, cableways, ducting, hangers and deckhead mounted equipments.

Once allocated, the composite serves as a control document for any changes that impact on the deckhead services.

The main constraints of detail to be included on composites depend on the end use of the drawings, i.e. a Planning Document or a Production Document.

On the TRUMP program it was considered a Planning Document.

Another constraint was that only areas of the ship that fell under that classified as Modernization and stand alone Shipalts were considered as candidate areas for composites in support of the design activity.

It was also decided that all piping below 1½" DIA would be "lined off" and "run at ship".

The composite drawings nominally fall into the category of "Functional Design" (see attachment "A" Section No. 4, Sub-section "F")

The risk factor at the start of the composite process will be five (5) on a scale of one (1)-least-to ten (10)-most.

It is expected at the completion of the first iteration the factor will be reduced to two (2).

Changes to Contractor Furnished Information (CFI) could require major re-work and a further loop around the design spiral.

Communication with Litton, MSEI and MIL Davie is most important at this stage. (see Page 4-F-1 of Attachment "A").

Section No. 2 - Composite Drawings

Sub-section C - Baseline Documentation

The Baseline documentation required to develop the composites must come from Litton in the form of CFI.

The CFI identified would be in three main areas:-

(a) The original ship drawings
(b) The contract design package
(d) New Equipment Data

(a) The original ship drawing package consisted of:-
- working (production) drawings
- selected class drawings
- as made drawings

The original build program in the early 1970's was subjected to a strict Quality Assurance program where changes at the ship would be transmitted to the engineering office through a system similar to the current DRN method and incorporated into the working drawings.

The selected class and as-made drawings were generally diagrammatic and did not include the detail necessary to prepare composites.

Subsequent changes to the ship after commissioning were the responsibility of the Crown to keep the drawings "up to date".

Consequently it was not unreasonable to expect the original ship drawings to reflect the ship as she was configured when passed to HIL Davie for the TRUMP project.

(b) The Contract Design Package consisted of all the drawings prepared and accepted by the Crown and Litton during the contract design negotiations and would be used as a base to develop systems and compartment layouts.

(c) New Equipment Data was necessary to confirm systems and space requirements.

MSEI were the custodians of the original working drawings and were contracted through a separated contract (MDDO) to update the drawings on an "as and when" required basis by the Crown.

To ensure that the two (2) contracts did not get confused MSEI requested from Litton copies or the original tracings.

This was an attempt to keep both contracts at arms length and to identify C.F.I. responsibility which, on the TRUMP project, was Litton's.

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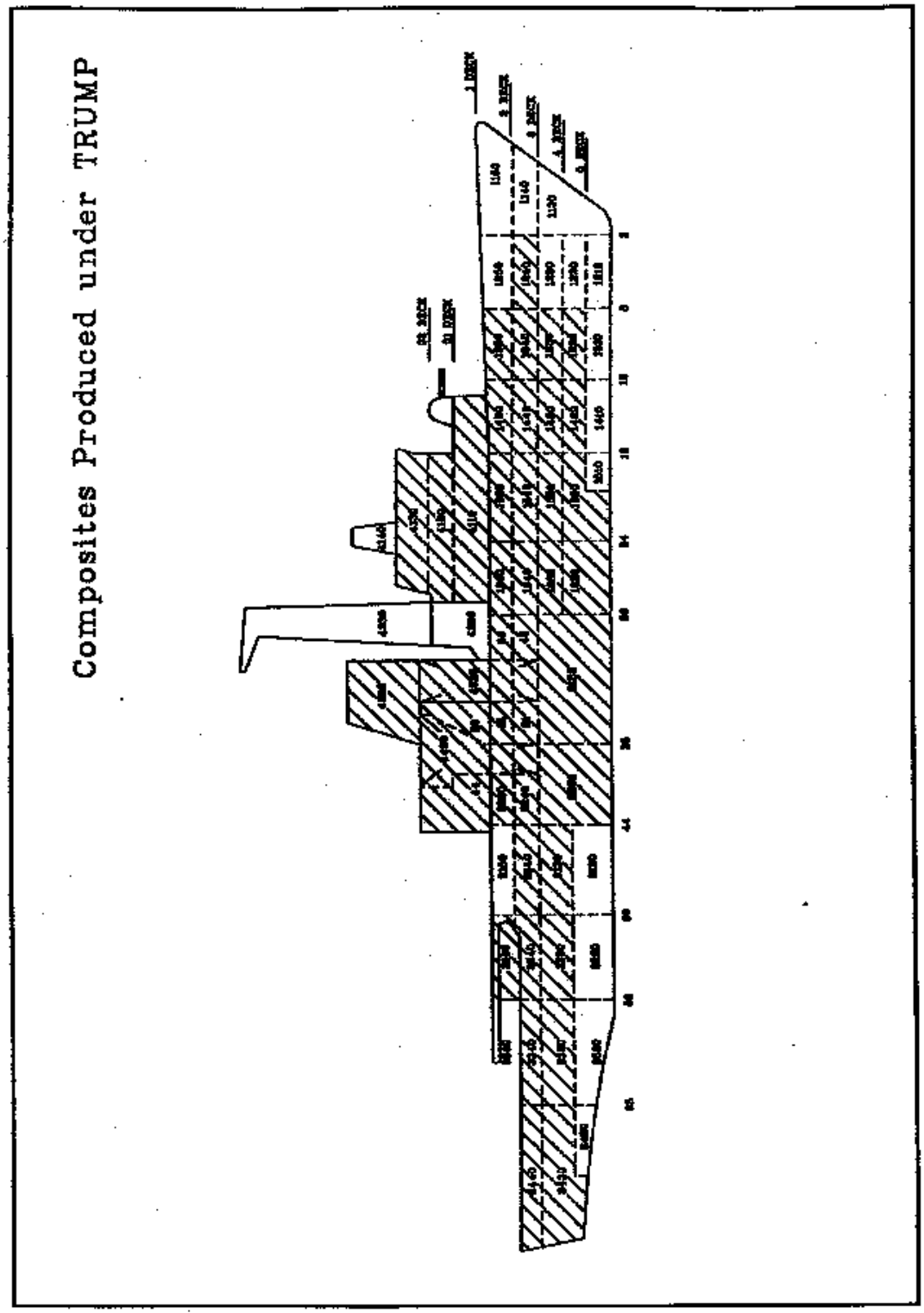
Composites Produced under TRUMP

Did Litton request from MIL Davie the composites they required and were copies of the composites sent to MIL Davie?

Were they delivered at a time suitable to meet MIL Davie's schedule?

What use did MIL Davie make of the composites if they were delivered?

MSEI cannot answer any of the above questions for at no time did:

- Litton identify to MSEI the composites that MIL Davie required or MIL Davie acknowledge to MSEI receipt of the composites.
- Litton question the content of the composites.
- MIL Davie or Litton request changes to the planning information that the composites provided.

Finally, as stated in Attachment "A", page 4-F-1

Para 2:

"At this stage of the design cycle new methods and concepts of ship construction are probably the most underestimated stage of the whole design schedule."

Para 4:

> *"Three (3) way review meetings take place between Crown (Litton), Designer (MSEI) and Shipyard (MIL Davie) to discuss and agree on proposed design changes to facilitate the requirements of the Shipyard."*

Communication between all three (3) parties was lacking and the responsibility for action lies with Litton to insist the necessary steps be taken to alleviate the design process through three (3) way meetings.

This did not occur.

Section No. 3 - Vanguard Team

Sub-section B - Design Process and Constraints

During the construction stage of the project the normal day-to-day problems that may arise are resolved through direct communication between the Designer (MSEI) and the Shipyard (MIL Davie).

To avoid delays in the resolution of the problems it is important that the Shipyard (MIL Davie) review workpackages and installation procedures at source and at a suitable time ahead of the shipyard production schedule.

This function and the people involved are identified as a Vanguard Team.

The main constraint of making all of this happen was a lack of acknowledgement of a need for this team at the start of the project and the failure to include the requirement in all Subcontracts.

A second constraint that was introduced is identified in Article 8.1 of the MSEI Subcontract which stated:

> *"Communications: The Subcontractor shall not establish official lines of communication with other organizations for the passing of TRUMP Data or the giving or receiving of direction except as specifically directed by the Contractor. Where*

official points of contact are required by the Subcontractor, the onus shall be on the Subcontractor to identify these, in writing, to the Contractor. Certain cognizant organizations will be assigned technical or management responsibility for applicable TRUMP disciplines. Interfaces with these organizations and their authority/responsibility will be clearly defined to the Subcontractor by the Contractor."

The Vanguard Team concept nominally falls into the category of "Production Design and Trials" (see Attachment "A" Section No. 4 – Sub-section "G")

The risk factor at the start of the Vanguard Team process will be two (2) on a scale of one (1) to Ten (10).

It is expected at the completion of the Trials the factor will be reduced to zero (0).

Section No. 3 - Vanguard Team

Sub-section C - Baseline Documentation

The baseline documentation required to assist the Vanguard Team would be installation drawings prepared by MSEI and procedures supplied by Litton, MSKI and other Sub-contractors.

All drawings and procedures prepared by MSEI were validated for producibility by MIL Davie Liaison Representative located at MSEI and as noted in Section No. 3, sub-section "A" of this presentation.

Section No. 3 - Vanguard Team

Sub-section D - Sequence of Events

What was to become the Vanguard Team had its roots in two separate activities.

It was recognized by MSEI that there was a need to have a Liaison Representative within MIL Davie to answer MIL Davie's queries regarding the drawings that were being produced.

The activity, although considered outside of MSEI's scope-of-work, was initially funded by Litton and served as a conduit for passing questions from MIL Davie back to MSEI and for obtaining information when specifically requested to make checks on the ship by MSEI.

In December, 1988 it was requested by MIL Davie and Litton that a fast-track method of conveying changes to MIL Davie be implemented.

Contractually, MSEI is only obliged to issue drawings and no reference in MSEI's Subcontract is made of any fast-tract process.

The proposed approach was to make use of Drawing Revision Notices (DRN) a commonly utilized method by which specific changes are promulgated which are then appended to the drawings. The drawings are then updated periodically when the number of DRNs become excessive.

The fast-tracking system required personnel in both MIL Davie and MSEI with the process consisting of solutions being adopted at MIL Davie which would then result in a DRN by MSEI personnel in Ottawa which could then be formally sent through Litton and back to MIL Davie.

It was agreed between Litton, MSEI and MIL Davie that it was inappropriate to spend time assessing the responsibility for individual changes as this would only delay the process and defeat the fast-track purpose of the system.

Litton proposed that Litton, MIL Davie and MSEI agree to a three (3) way fund sharing budget with a suggested $250,000 contribution from each company.

It was intended to monitor the new system to ensure maximum benefit to all participants with no contractual implications/responsibilities by all parties resulting from proposed and approved decisions made to keep the program moving with needed momentum.

Litton and MSEI agreed to the proposal with Litton funding three (3) MSEI Shipyard Representatives and MSEI accumulating all other costs under Project No. 1509.

The proposal was for MSEI and MIL Davie to split the costs of Project 1509 equally.

It became apparent that MIL Davie were not prepared to contribute to the exercise and as a result all costs up

to that point incurred in Project 1509 were transferred into MSEI's TRUMP Contract.

Litton recognized the need for continuing a fast-track process and agreed to pay MSEI the cost of raising DRNs in addition to the other direct costs involved in pricing any out-of-scope change received from them, however, they would no longer fund the MSEI personnel at MIL Davie.

MIL Davie did eventually agree to fund the cost of maintaining one MSEI person at MIL Davie to act as liaison.

In July, 1989, a funded request was made to MSEI from Litton to provide six (6) people at short notice to MIL Davie for a period of two (2) weeks to perform unspecified support activities.

It was requested that these people should all be experienced people who could problem-solve and give advice. Consequently, a very strong team of individuals was sent to the shipyard, including several managers.

On arrival, as they were instructed to do by Litton, the team reported to Litton's Representative (Steadman) who sent them to work directly for MIL Davie.

It soon became apparent that the team was being employed on duties quite different from those requiring the calibre of individuals requested.

The team was directed to lining-off activities and conducting assessments of cable lengths for local run cabling.

At the end of the two week period, MSEI recommended that this team be withdrawn, but that should MIL Davie require these lining-off activities to be conducted, then MSEI could send a more suitable mix of individuals to MIL Davie under a different contract.

This offer was accepted by MIL Davie and this was the start of Project 1493, today known as the Vanguard Team. This was intended to be a four (4)-week activity after which the need would be reviewed.

Due to the team's diversion by MIL Davie onto other activities, the duration was extended indefinitely and grew to seventeen (17) MSEI employees conducting MIL Davie specified duties solving local problems being discovered at the ship.

It became apparent to MIL Davie the value of this activity and in _____ they requested that a much larger team be sent to MIL Davie to provide whatever services were required of them by the MIL Davie production personnel.

In addition, a team was to be established at MSEI to provide backup support to the MIL Davie team.

It was envisaged that solutions to problems would be found by the MIL Davie team who would then pass this

information back in the form of a sketch to MSEI-Ottawa where a Production Engineering Notice (PEN) would be produced, ultimately leading to a drawing revision.

The scope-of-work being conducted would be as directed by MIL Davie in the shipyard.

In December, 1989 Litton wished to formalize the PEN by the allocation of DRN numbers and a procedure was established to ensure the configuration control of MIL Davie generated queries.

PENs were later to be renamed FECNs because of MIL Davie concern of the use of the phrase, Production Engineering.

In October, 1990 MIL Davie requested additional personnel from MSEI for QA, Test and Trials activities.

Section No. 3 - Vanguard Team

Sub-section E - Conclusion

It is not so much a question as to whether MSEI has a contractual responsibility to have a Technical Liaison Representative on-site at MIL Davie, but more a professional responsibility to ensure the best design process is followed.

When addressing a "First of Class" ship, i.e. Algonquin, there is an inherent risk attached to Production Design and Trials (see Attachment "A") the category under which an on-site Technical Liaison Team is associated. While MSEI was cognizant of the risk, it took both Litton and MIL Davie some time to appreciate the risk and the impact to schedule.

It is obvious that the intent and functions of what was defined as the Vanguard Team responsibilities were not carried out and indeed, the Vanguard Team became a global definition of all support at MIL Davie acting in most cases as in a "Fire Fighting" role.

The communications restrictions imposed by MSEI subcontract (Article 8.1) became a burden and no one appeared to take the initiative. Contractually both MSEI and MIL Davie were not the Prime Contractors, therefore it became Litton's responsibility to lead and mediate if necessary, although it was in the professional interests of both MSEI and MIL Davie to insist on this happening.

The acknowledgement of the desire to have a three (3) way funded project to address the problems was initiated by MSEI and Litton and it was MIL Davie's negative approach to the proposal which was without prejudice, which caused a disruption at a time when a polarization of ideas and positions was detrimental to the project.

When MIL Davie appreciated the value of the Team and expanded the number of people involved the PEN-FCEN-DRN format began to put some control on the changes which reflected MSEI errors, MIL Davie errors and Litton changes and clearly paved the way for defining responsibility.

All changes received from Litton that could be directly attributable to Litton were recorded by MSEI and when noted to be "out of scope" the claim procedure was followed. Copies of all extras and supporting documentation is available at MSEI and the information has been made available to MIL Davie.

Could the Vanguard Team concept have been applied to the benefit of the project?

Could the communication lines between Litton, MSEI and MIL Davie have been more user friendly?

Could the control of the MSEI team at the shipyard have been better focused?

The answer to the above questions has to be yes in all cases if:

- MIL Davie had acknowledged the three (3) way attempt to fund their part of the original fast-track system

- Litton had played a Prime role in leading the construction phase communications links instead of passively sitting back hoping it would happen.

- MSEI and MIL Davie had insisted that Litton be the leader and not the co-ordinator.

- MSEI and MIL Davie had reacted as one under the umbrella of MIL Interco.

- MIL Interco had been more assertive with MIL Davie and MSEI and mediated the differences between the two companies which detracted from the technical claims against Litton and the delay and disruption costs that emanated from a slip to schedule.

Finally, as stated in Attachment "A", page 4-G-1:

Para 2

"During the construction stage of the project, the normal day-to-day problems are resolved through direct communication between the Designer and Shipyard tradesmen."

Para 4

> *"The remaining design risk can only be removed at the successful completion of the system and ship trials."*

A leadership role is the responsibility of the Prime (Litton).

This did not occur.

The professionalism of all participants was necessary for a successful project.

This did not occur.

Section No. 4 - Lift-Offs

Sub-section A - MSEI Contract Requirements

The MSEI Subcontract makes two (2) references to an activity that could be interpreted as a "Lift-off". Sub-article 3.7.3.2 which stated:-

> *"Working Drawings - The Subcontractor shall prepare all drawings for the first ship to undergo conversion. These shall enable the Shipyard to perform all the work necessary to convert this ship to the TRUMP Ship System configuration as detailed in the relevant specifications. A physical check of the first ship shall be performed by the Subcontractor to confirm the validity of these drawings."*

and Sub-article 3.7.3.3 which stated:

> *"Particularized Drawings - The Subcontractor shall prepare particularized working drawings for the second, third and fourth ships by amending as necessary the working drawings for the first TRUMP ship. The Subcontractor shall confirm the validity of these drawings by a ship check."*

MSEI's interpretation of the above Articles is not a reference to a Lift-off, but more a validation of the working drawings against the original ship.

Section No. 4 - Lift-Offs

Sub-section B - Design Process and Constraints

MSEI based its approach to the TRUMP program on that successfully implemented on the DELEX program.

The DELEX program was also a major modernization program and can, in this respect, be considered comparable to the TRUMP program

The only major difference between the two (2) projects is that the Crown was Prime for DELEX and Industry (Litton) is Prime for TRUMP.

The main problem with this line of responsibility was a disclaimer by the Crown on the TRUMP program that they *"did not take responsibility for contents of the original drawings"*.

This was unacceptable to MSEI.

MSEI is the only organization in Canada which has been involved in a similar exercise of modernizing a warship. With this precedent established it is of relevance as Sub-article B.6.02 of the Subcontract specifies:-

> *"The Subcontractor* _____ *will fully and properly perform and complete all of the Naval Architecture and Engineering Design Work* _____ *in a timely and professional manner, in accordance*

with prudent naval architecture/shipbuilding standards so as to meet, or achieve, all of the terms and conditions of this Subcontract."

As it was not unreasonable to expect the original drawings (CFI) to reflect the actual configuration of the ship and it also was not unreasonable to develop the working drawings based on this supplied CFI.

The completed working drawings could then be validated for the first ship.

The contractual schedule imposed by Litton and MIL Davie made it impossible to follow this design process and meet Schedule C1 dates for issue of the drawings.

Litton understood this schedule constraint and arranged for MSEI to visit the Lead Ship "Algonquin" and "eyeball" the different compartments and systems affected by the modernization program.

This process was carried out by using the original drawings and confirming that the systems and equipment were generally where they were supposed to be, i.e. between frames, longitudinals, stiffeners, etc, and normal shipyard tolerances would apply.

Another constraint was the availability of the, yet to be developed, modernization drawings. Therefore certain assumptions with their inherent risks had to be made regarding extent of strip-out and arrangement of new systems and equipment.

The same process is used for the Second, Third and Fourth Ships, however the modernization drawings prepared for the First Ship with all of the approved changes incorporated was a better base for "eyeballing" and particularization of the Second, Third and Fourth Ships.

The above design process falls into two (2) categories "Functional Design" and "Production Design and Trials" (see Attachment "A", Section 4, Sub-sections "F" and "G").

The risk factor at the start of the Lift-off and validation process will be five (5) on a scale of one (1) to ten (10).

It is expected at the completion of the validation process the factor will be reduced to zero (0).

Section No. 4 - Lift-offs

Sub-section C - Baseline Documentation

The baseline documentation required to assist in the Lift-offs and the validation of drawings must come from:-

- Litton in the form of the original ship drawings (CFI).

- MSEI in the form of the modernization drawing including all changes.

Section No. 4 - Lift-offs

Sub-section D - Sequence of Events

In _____ MSEI carried out the "eyeballing" lift-off of the "Algonquin" and where differences occurred the differences were noted and included in the preparation of the modernization drawings.

At this point in time only the original working drawings were available and all information confirmed was used as the interface point between the "old" and the "new" ship.

In _____ MSEI carried out the "eyeballing" lift-off of the "Iroquois" and where differences occurred the differences were noted and included in the particularization of the modernization drawings.

At this point in time, where possible, the modernization drawings for the "Algonquin" were used together with the original working drawings.

All differences were noted on the "Algonquin" class drawing or a separate drawing was prepared for the "Iroquois".

In _____ MSEI carried out the "eyeballing lift-off of the "Athabaskan" and in _____ MSEI carried out the "eyeballing lift-off of the "Huron". Like the process followed for the "Iroquois", changes

were noted in the particularization of the modernization drawings.

At this point in time most of the modernization drawings for the "Algonquin" were used, together with the original working drawings.

Also, like the process followed for the "Iroquois", change for the "Algonquin" and "Huron" were noted on the "Algonquin" class drawing or a separate drawing was prepared for "Athabaskan" or "Huron".

Since the lift-off of the "Athabaskan", the ship has been the subject of massive changes to prepare the ship for the Gulf.

The changes will, in part, negate most of the previous lift-off data and will require a re-visit of the ship.

There is also an area of opinion that another lift-off of both ships to firm up previous lift-off information would be of benefit to MIL Davie and by projection, Litton.

It is felt that the new lift-off would reduce the risk factor and the possibility of fouling points.

Section No. 4 - Lift-offs

Sub-section E - Conclusion

It is not so much a question as to whether MSEI has a contractual responsibility to do lift-offs or validate drawings at any specified time, but more a professional responsibility to ensure the best design process is followed to meet a precise schedule.

The qualification that the Crown placed on the content of the original drawings created doubts in the mind of the Litton that could not be accepted by MSEI.

MSEI's contracted price allowed for the "eyeballing" of the systems and equipment with the precedent setting determination to the contents of the working drawings.

The professional responsibility of MIL Davie to acknowledge tolerances in large Naval refits was expected, but the methods employed by MIL Davie (a form of IHI method) did not allow the flexibility that would be required on a modernization and refit project.

It is worth noting that there were relatively few problems found in the new construction areas where the IHI method is best suited.

Could the lift-off/validation task have been better understood?

Could the schedule of taskings been adjusted to control the strip-outs?

Could the construction methods and tolerances have been more practically applied?

Could the approach to the whole project have been better addressed?

The answer to the above questions has to be yes in all cases if:

- Litton, MSEI and MIL Davie had met and understood the professional and contractual implications of accurate CFI (original drawings from Crown).
- Litton had prepared and managed to an integrated schedule which would have determined the precise time to start strip-outs and in what sequence.
- MIL Davie had appreciated the implications that their construction methods (IHI) had created when they had not been contracted for by MSEI.
- MSEI and MIL Davie understood the relevance of tolerances and the need to resolve the local foulings which will occur.
- Litton convened and led a task force of all participating subcontractors to discuss and understand each subcontractor's unique problems and

the precedents that had already been established in the industry.

Finally, as stated in Attachment "A":-

Page 4-B-1, Para 3

"Warships, unlike aircraft, are built without preliminary prototype work ..."

Page 4-F-1, Para 4

"The Japanese Shipbuilding Industry are the leaders in this method, but have only perfected the procedures for commercial vessels which are less sophisticated and do not have the space or operational restrictions of a warship."

Page 4-G-1, Para 6

"Thousands of engineers, technicians, draftsmen and trades have had their input into the design and build of the first ship-"

"THE PROTOTYPE"

Section No. 5 - Accuracy

Sub-section A - Introduction

A consideration that links the arguments for the lift-off, the composites and the subsequent need for the Vanguard Team is the accuracy to which the drawings must be produced.

The accuracy of the drawings should be dictated by the use to which they are to be put within the shipyard.

Prior to the TRUMP program MSEI had been involved in two (2) major programs which illustrate the different and changing requirements of shipyards in constructing warships.

Section No. 5 - Accuracy

Sub-section B - Historical Background

Most recently MSEI produced drawings for the Canadian Patrol Frigate (CPF), a new construction program in which extensive use was being made of modular construction techniques presenting 1980's new building technology.

The techniques make extensive use of construction-by-stage, implying that component pieces be accurately produced so that when they are assembled in later construction stages everything will fit together correctly.

The approach does not require the use of craftsmen within the shipyard, but rather requires that the workforce assemble the ship according to the drawings. This puts great pressure on the drawings to be accurate.

In this new construction it is recognized that some work will have to be done at ship and an example of this was the decision by SJSL not to produce pipe spooling pieces for piping below 1½ inches.

MSEI also produced the construction drawings for the DDH 280 class ships when they were built, both in MIL Tracy and MIL Davie facilities in the 1960's/70's.

The drawings were produced to a standard not markedly different from those for the later CPF, however, in the

construction phase more reliance was placed on craftsmen at the ship to solve minor interference problems and this appreciation by quality assurance within the shipyards allowed the craftsmen the flexibility to build the ship in a functionally acceptable manner, but without necessarily having to rigorously adhere to the construction drawings.

At the commencement of the TRUMP program informal discussions were held between MSEI and MIL Davie with regard to the methods to be used at MIL Davie and the types of drawings that they would be requiring. MIL Davie said that 'DDH-280-style' drawings would be adequate.

The estimate for Litton was prepared by MSEI for producing drawings on this basis. Consequently, a Lift-off was conducted on the ship in _____ consistent with past refit practices in Canadian warships. The Lift-off essentially involved 'eye-balling' the ship against the existing drawings to ensure that systems were appropriately located.

No attempt was made by MSEI to physically measure off every pipe or system in the compartments. This would have been prohibitively expensive and outside the cost basis for the original estimate, and would also have been unnecessary given the assumed use to which the drawings would be put.

During _____ MIL Davie introduced the concept of construction blocks in lieu of a system-oriented approach.

Over the next _____ MSEI issued to MIL Davie, via Litton, all of the working drawings required for ship # 1, "Algonquin". Through the use of composites MSEI eliminated the vast majority of new-system-to-new-system physical clashes, however, the old systems were assumed to be accurate as per the working drawings unless this was obviously not the case as determined during the ship Lift-off.

The accuracy of these drawings was such that in areas of the ship that might be considered "new construction", for example the forward deck house, the funnel and the casings, the accuracy of the drawings was high as appropriate to a "new build" ship. However, in the remainder of the ship the accuracy would ultimately be a function of how accurately the original ships were built to their original construction drawings.

Experience on the ship has essentially borne this out with relatively few problems being found in the new construction areas. In the areas of the ship with significant existing systems retained problems have occurred, as witnessed by an element of the activities of the Vanguard Team. These problems are becoming apparent essentially because MIL Davie is using a construction method inappropriate to the level of accuracy of the drawings produced by MSEI.

Section No. 5 - Accuracy

Sub-section C - Options

a) Mil Davie could adopt a construction method consistent with the accuracy of the drawings in areas which retain a majority of existing systems.

This would entail doing the work based on late 60's/early 70's methodologies which would require an increased reliance on the skills of craftsmen and an appreciation with respect to quality assurance to remove the need for every departure from the drawings to have to be the subject of a Non-conformance Report.

b) To improve the accuracy of the drawings for Ships # 1 & 2 can only be accomplished by the activities of the Vanguard Team producing feedback to MSEI so that the drawings can be modified to reflect an as-built condition for the ship, thus ensuring that MIL Davie efforts are accurately backed-up by the correct documentation that can pass quality assurance's scrutiny.

For Ships # 3 & 4 a further Lift-off of the original ships could be conducted to improve the inherent accuracy of the drawings. It should be noted, however, lifting the ship off to a level at which no problems will occur is

considered to be an impossibility within the budget and schedule constraints. Further Lift-off leads inevitably to diminishing returns.

c) If the total removal occurred of existing systems then essentially MIL Davie would be left with a new construction problem in which it becomes cost effective for both MSEI to produce accurate drawings and for MIL Davie to conduct construction activities.

Such a result would have been realized had MSEI's proposal for a new superstructure been adopted, but it is possible that an option entailing total strip-out of existing systems in the superstructures with corresponding additional drawing effort, might accomplish the same results.

Section No. 5 - Accuracy

Sub-section D - Conclusion

The problems with accuracy clearly stem from a failure to formally coordinate MIL Davie drawing requirements with the types of drawings being produced by MSEI at the beginning of the contract.

The responsibility to coordinate the two sets of activities is obviously that of Litton and furthermore, both MIL Davie and MSEI were precluded from communicating with each other on these matters.

As design proceeded, however, this process was rendered unworkable if schedules were to be maintained due to the extraordinary volume of change received from Litton in the form of newly issued and constantly changing CFI.

As a fast-track substitute for updating the composites to reflect the CFI changes special teams were formed representing disciplines necessary to conduct a composite-like review of the affected areas.

This action, together with twice-a-week design review meetings, went a long way to keeping on top of the design and where technically possible, to retain schedule.

On a number of occasions work-around schedules had to be submitted to Litton for their approval.

7.5 An example of DND's bidding practises to Industry – a case study by Jim Williams

MCDV Concept (by Jim Williams)

The following is included as an introduction to this Chapter, and is an example of a rather severe practise by the Crown purchasing Department DSS/PWGSC in its approach to some of its Defence Contracts. It was an attempt by DSS/PWGSC to get the "biggest bang for its buck" and was justified to Industry as being "the price of doing business", presumably meaning that the loss would be borne by that bidder's Marketing Budget! This, notwithstanding that DSS's regulations cited a **normal** profit limit in such contracts of 6.5% that could however, under various circumstances, be escalated upwards. As will be seen from the following, the arithmetic did not add up. No corporate entity could afford such financial constraints and many companies went out of business as a result. In the case of the MCDV project, the losing Bidder for the Construction Contract did go out of business and only the winner (Fenco-McLaren) knows whether it actually made a profit on the overall program.

As has been recorded in Chapter 3.2, in 1987 MIL Systems Engineering submitted to the Navy a self-funded Design Study for an MCDV. This was followed up in 1989 with a Discussion Paper for an updated version of the original Design Study 1989. In 1991 DND, via its Contracting arm DSS - Department of Supply & Services (later named PWGSC – Public Works & Government Services Canada), requested Bid Submissions from Industry, and let it be known that there was $10 million in the budget for this phase of the eventual complete project, of which $1 million was reserved for in-DND costs with the remaining $9 million to be shared between two successful bidders from Industry. MIL Systems Engineering submitted two Bids, one fully compliant and priced at just under $10 million, and one with a modified data package requirement, priced at $6.5 million in order to get a priced Bid as close as possible to the need of the Navy's budget. In the event, that latter Bid of $6.5 million was rejected, notwithstanding that MIL Systems Engineering had previously invested more than $0.5 million in its pre Bid Request period of 1987 to 1989. DDP awarded two Industry Bidders $4.5 million each; it is well known that eventually both Bidders spent close to $10 million each. This required that the winner of the production contract would have to dilute any profit earned in that contract by $5 million or so before it could honestly claim to have earned a profit. The construction contract was fixed price at $62.5 million so that a minimum profit of 8% was required to break even. This method of imposing contracting competition by the Government on Industry left a lot to be desired since the subsequent contract auditing by DSS's Audit Service Bureau was usually very thorough. Of course, all losing Bidders suffered the loss value between its actual costs and the amount covered in the contract (in the case of the MCDV, some $5.5 million).

8 APPROACH TAKEN TO THE RESEARCH

It is appropriate to identify the approach taken to this reseach.

Initially, the available published literature was researched and made possible the identification of the various aspects of warship design and build over the period of interest, viz. 1930 to 2002. This showed that in the first decade there was a plethora of small craft that were perhaps, at least initially, not worth pursuing, and that the real period of primary interest was 1940 onward, with indigenous designs of major warships starting in the post World War II period – the St. LAURENT Class of destroyers (1949) and the setting up of what became known as the NCDO.

Charts were produced that showed all subsequent *warships by ship class* and their *design Company & build Shipyard*, only the **design** aspect of which contains the data germane to this study.

These data are shown in the following 10 charts:

Charts A1 – E1 (*Major Warship Program in Canada 1935 to 2001)*

Charts A2 – E2 *(Design Company & Shipyards of the Major Warship Build Program in Canada 1935 to 2001)*

The source references for these charts are:

(1) The Ships of Canada's Naval Forces 1910-1981 by Macpherson & Burgess
(2) Jane's Fighting Ships 1991-1992
(3) Jane's Fighting Ships 2001 internet service

I have not tried to show the specific dates by the usual D/M/Y definition but have approximated them within the correct year.

With respect to DELEX, I have not been able to determine whether any shipyard other than Burrard (261, 262 263, 264) was involved in this update program and I have assumed that Naval Dockyards did the work (which are not themselves Industry companies).

The picture presented by the charts is clear. In the 1950's and early 1960's ship build was eked out to shipyards primarily on an individual ship basis, so that just about every ship produced was in fact a "Lead Ship" and no "learning curve" advantage was ever gained hence the efficiency of the industry was low. In the late 1960's this trend

disappeared to a degree, and the two AORs and the four Tribals were packaged in batches of two ships per shipyard [SJSL, MIL Sorel & Davie].

No new ship designs were then seen for 20 years, at which time the initial 6 CPF ships were split evenly between two shipyards [SJSL and MIL.Davie], and the following 6 ships put into just one [SJSL]. The resulting efficiency at SJSL was quite marked for the second 6 ships. This trend continued in 1994 with all 12 MCDVs going to just one shipyard [HalShips], which SJSL promptly bought to consolidate its objective of being the major Canadian warship shipyard. No other shipyard had SJSL's financial staying power.

The West Coast shipbuilding industry has its own "navy", BC Ferry Corporation, so managed to stay busy until recent years, and also enjoys a reasonable trade in cruise ship maintenance, but no new warship has been built out there since the mid 1960's.

The Canadian Coast Guard also has quite a large fleet of much smaller vessels except for the occasional large icebreaker, but it is not the subject of this study.

Another aspect of the Naval Shipbuild industry [other than ***ship design, build and modify***] is the ***system design and equipment supply***, plus the ***Program Management***. The latter has not been an industry success story – TRUMP was initially industry managed then reverted to the Crown half way through the program, and the CPF "industry-managed" program involved some spectacular law suits between the Prime and the First Tier Sub-contractors.

See eRoom entry

"CANDIB Charts"

for details

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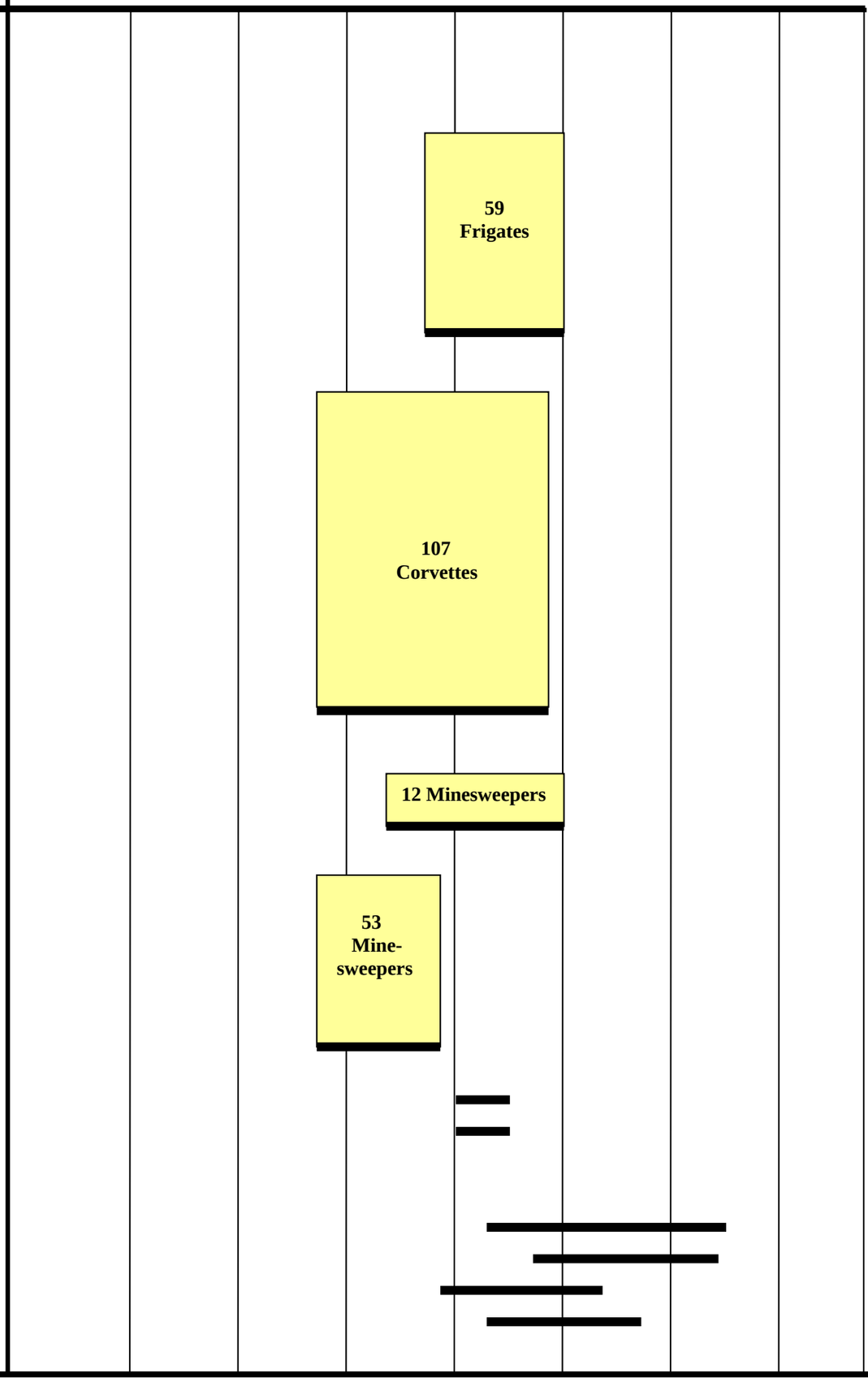
Ship Class

1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949



River Class Frigates:
"K pendants"
407, 663, 350, 244, 317, 03, 665, 518, 418, 318, 337, 419, 668, 672, 673, 444, 319, 320, 321, 448, 332, 326, 324, 325, 456, 323, 681, 327, 328, 459, 329, 331, 661, 685, 409, 664, 410, 670, 414, 666, 667, 669, 519, 671, 400, 676, 675, 662, 677, 678, 680, 454, 366, 344, 531, 682, 683, 538, 684

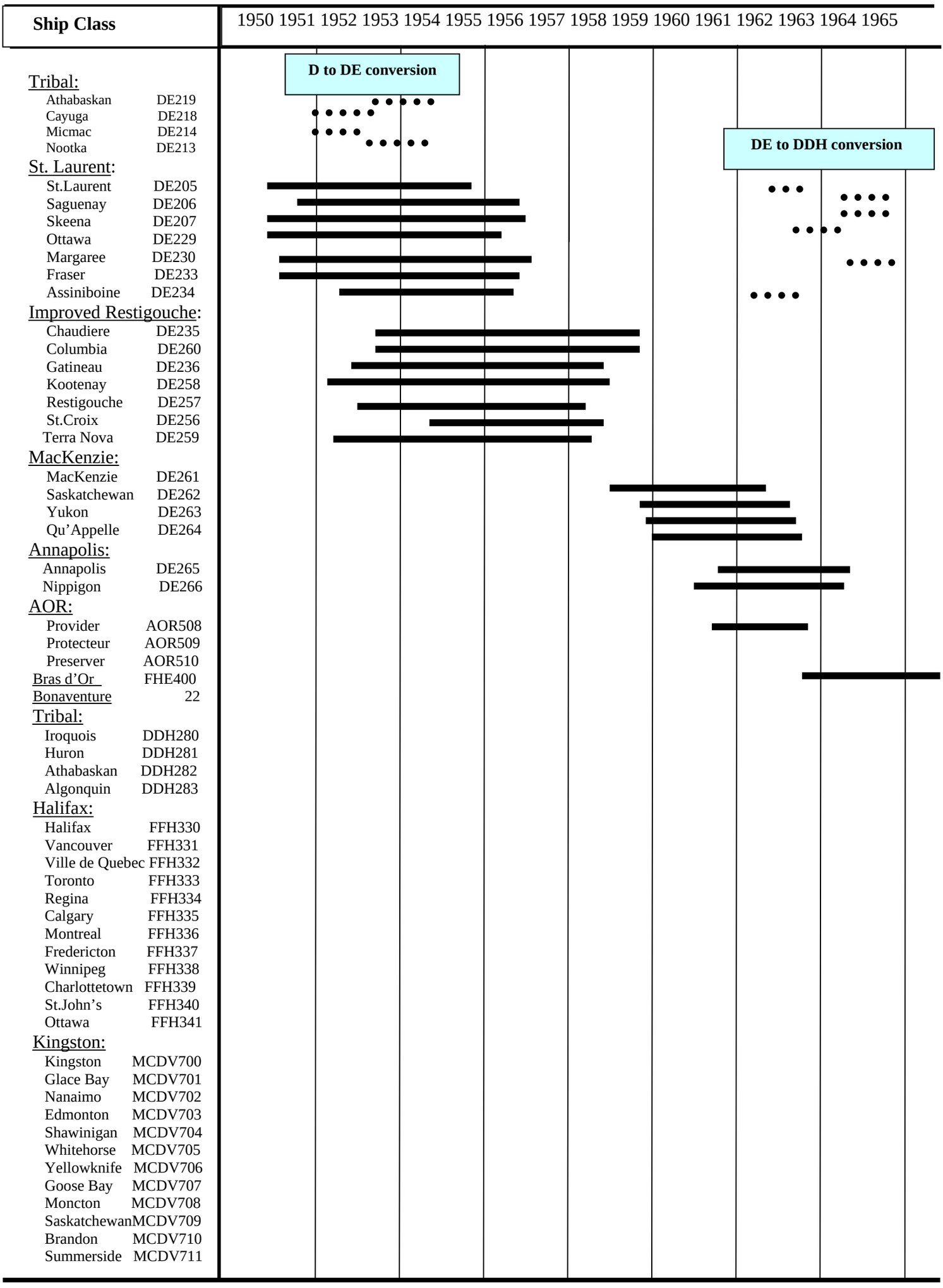
Flower Class Corvettes:
"K pendants"
129, 103, 127, 148, 145, 113, 147, 138, 165, 152, 149, 179, 154, 116, 156, 131, 124, 180, 157, 104, 167, 177, 106, 150, 194, 163, 159, 176, 171, 125, 160, 115, 143, 151, 112, 191, 139, 164, 170, 101, 118, 178, 119, 146, 161, 133, 121, 169, 181, 158, 136, 110, 152, 166, 153, 198, 162, 141, 168, 174, 173, 175, 173, 153, 218, 229, 220, 228, 223, 240, 231, 244, 245, 237, 225, 273, 233, 234, 242, 238, 15, 333, 686, 335, 687, 415, 338, 401, 520, 339, 340, 537, 343, 368, 346, 358, 540, 332, 440, 688, 341, 342, 345, 457, 455, 394, 569

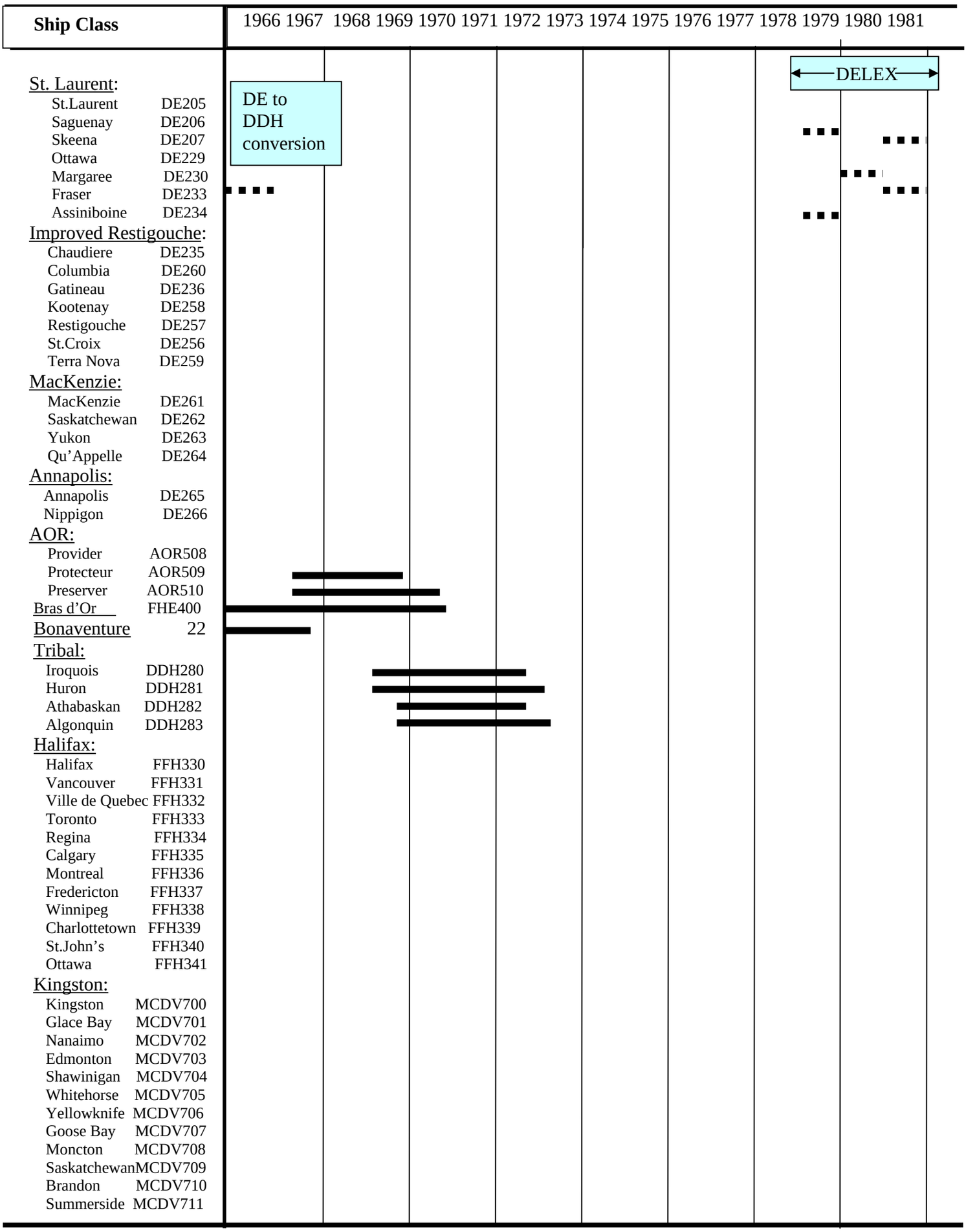
Algerine Class Minesweepers:
"J pendants"
344, 396, 326, 328, 397, 330, 331, 355, 334, 332, 336, 337

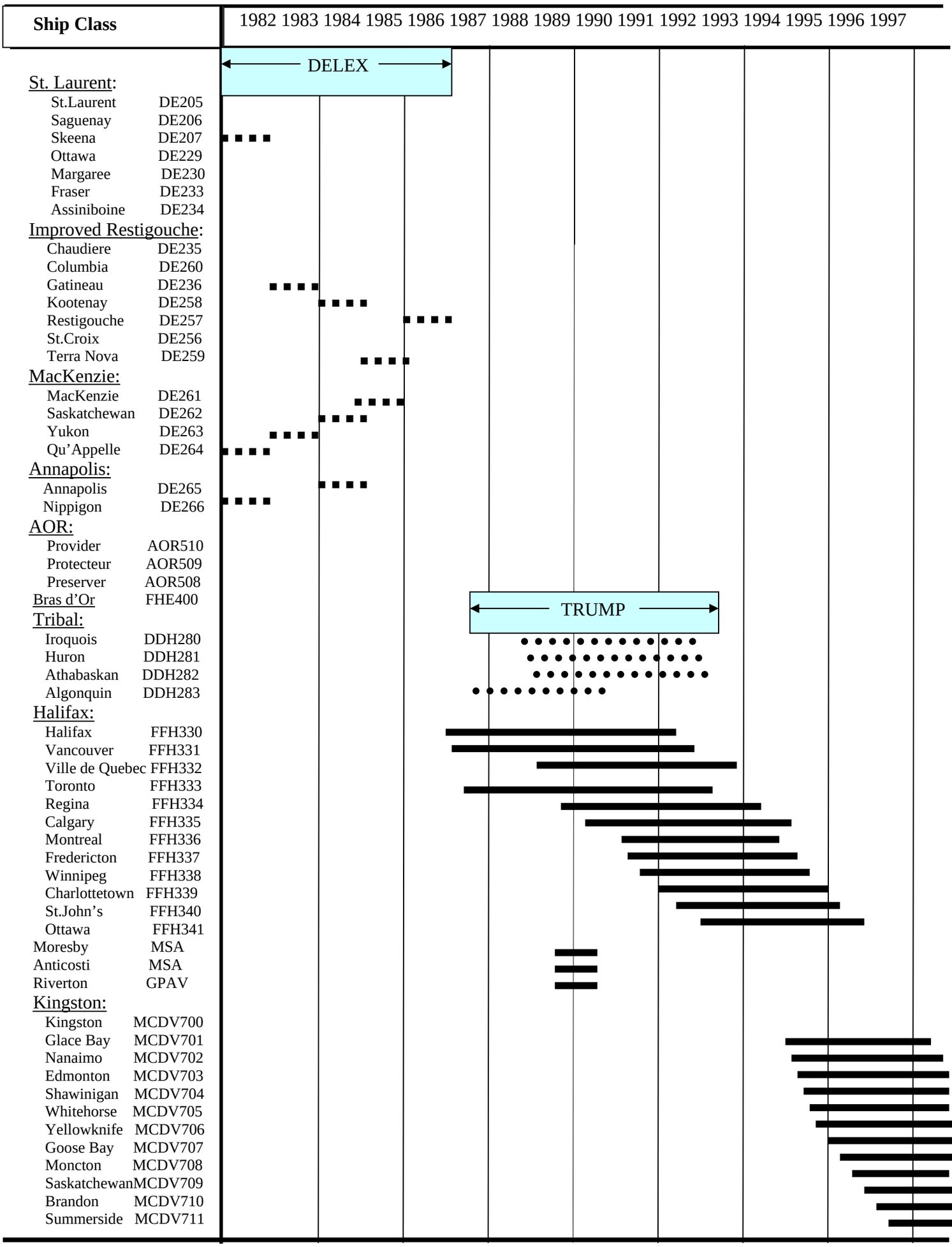
Bangor Class Minesweepers:
"J pendants"
170, 250, 168, 160, 174, 146, 144, 159, 148, 165, 169, 154, 161, 152, 166, 156, 149, 162, 08, 21, 38, 52, 69, 100, 262, 253, 259, 260, 258, 261, 256, 255, 254, 257, 270, 267, 272, 264, 266, 263, 265, 271, 269, 268, 314, 311, 281, 312, 317, 313, 280, 309, 310, 318,

Auxiliaries
Dundalk) no
Dundurn) pendant

Tribal Class Destroyers
Athabaskan R79/219
Cayuga R04/218
Micmac R10/214
Nootka R96/213


Ship Class
1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965
D to DE conversion
DE to DDH conversion
Tribal:
Athabaskan DE219
Cayuga DE218
Micmac DE214
Nootka DE213
St. Laurent:
St.Laurent DE205
Saguenay DE206
Skeena DE207
Ottawa DE229
Margaree DE230
Fraser DE233
Assiniboine DE234
Improved Restigouche:
Chaudiere DE235
Columbia DE260
Gatineau DE236
Kootenay DE258
Restigouche DE257
St.Croix DE256
Terra Nova DE259
MacKenzie:
MacKenzie DE261
Saskatchewan DE262
Yukon DE263
Qu'Appelle DE264
Annapolis:
Annapolis DE265
Nippigon DE266
AOR:
Provider AOR508
Protecteur AOR509
Preserver AOR510
Bras d'Or FHE400
Bonaventure 22
Tribal:
Iroquois DDH280
Huron DDH281
Athabaskan DDH282
Algonquin DDH283
Halifax:
Halifax FFH330
Vancouver FFH331
Ville de Quebec FFH332
Toronto FFH333
Regina FFH334
Calgary FFH335
Montreal FFH336
Fredericton FFH337
Winnipeg FFH338
Charlottetown FFH339
St.John's FFH340
Ottawa FFH341
Kingston:
Kingston MCDV700
Glace Bay MCDV701
Nanaimo MCDV702
Edmonton MCDV703
Shawinigan MCDV704
Whitehorse MCDV705
Yellowknife MCDV706
Goose Bay MCDV707
Moncton MCDV708
Saskatchewan MCDV709
Brandon MCDV710
Summerside MCDV711


Ship Class
1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981
DELEX
DE to DDH conversion
St. Laurent:
St.Laurent DE205
Saguenay DE206
Skeena DE207
Ottawa DE229
Margaree DE230
Fraser DE233
Assiniboine DE234
Improved Restigouche:
Chaudiere DE235
Columbia DE260
Gatineau DE236
Kootenay DE258
Restigouche DE257
St.Croix DE256
Terra Nova DE259
MacKenzie:
MacKenzie DE261
Saskatchewan DE262
Yukon DE263
Qu'Appelle DE264
Annapolis:
Annapolis DE265
Nippigon DE266
AOR:
Provider AOR508
Protecteur AOR509
Preserver AOR510
Bras d'Or FHE400
Bonaventure 22
Tribal:
Iroquois DDH280
Huron DDH281
Athabaskan DDH282
Algonquin DDH283
Halifax:
Halifax FFH330
Vancouver FFH331
Ville de Quebec FFH332
Toronto FFH333
Regina FFH334
Calgary FFH335
Montreal FFH336
Fredericton FFH337
Winnipeg FFH338
Charlottetown FFH339
St.John's FFH340
Ottawa FFH341
Kingston:
Kingston MCDV700
Glace Bay MCDV701
Nanaimo MCDV702
Edmonton MCDV703
Shawinigan MCDV704
Whitehorse MCDV705
Yellowknife MCDV706
Goose Bay MCDV707
Moncton MCDV708
SaskatchewanMCDV709
Brandon MCDV710
Summerside MCDV711


Ship Class
1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997
DELEX
TRUMP
St. Laurent:
St.Laurent DE205
Saguenay DE206
Skeena DE207
Ottawa DE229
Margaree DE230
Fraser DE233
Assiniboine DE234
Improved Restigouche:
Chaudiere DE235
Columbia DE260
Gatineau DE236
Kootenay DE258
Restigouche DE257
St.Croix DE256
Terra Nova DE259
MacKenzie:
MacKenzie DE261
Saskatchewan DE262
Yukon DE263
Qu'Appelle DE264
Annapolis:
Annapolis DE265
Nippigon DE266
AOR:
Provider AOR510
Protecteur AOR509
Preserver AOR508
Bras d'Or FHE400
Tribal:
Iroquois DDH280
Huron DDH281
Athabaskan DDH282
Algonquin DDH283
Halifax:
Halifax FFH330
Vancouver FFH331
Ville de Quebec FFH332
Toronto FFH333
Regina FFH334
Calgary FFH335
Montreal FFH336
Fredericton FFH337
Winnipeg FFH338
Charlottetown FFH339
St.John's FFH340
Ottawa FFH341
Moresby MSA
Anticosti MSA
Riverton GPAV
Kingston:
Kingston MCDV700
Glace Bay MCDV701
Nanaimo MCDV702
Edmonton MCDV703
Shawinigan MCDV704
Whitehorse MCDV705
Yellowknife MCDV706
Goose Bay MCDV707
Moncton MCDV708
Saskatchewan MCDV709
Brandon MCDV710
Summerside MCDV711

Ship Class	1998 1999 2000 2001
St. Laurent:	
St.Laurent DE205	
Saguenay DE206	
Skeena DE207	
Ottawa DE229	
Margaree DE230	
Fraser DE233	
Assiniboine DE234	
Improved Restigouche:	
Chaudiere DE235	
Columbia DE260	
Gatineau DE236	
Kootenay DE258	
Restigouche DE257	
St.Croix DE256	
Terra Nova DE259	
MacKenzie:	
MacKenzie DE261	
Saskatchewan DE262	
Yukon DE263	
Qu'Appelle DE264	
Annapolis:	
Annapolis DE265	
Nippigon DE266	
AOR:	
Provider AOR510	
Protecteur AOR509	
Preserver AOR508	
Bras d'Or FHE400	
Tribal:	
Iroquois DDH280	
Huron DDH281	
Athabaskan DDH282	
Algonquin DDH283	
Halifax:	
Halifax FFH330	
Vancouver FFH331	
Ville de Quebec FFH332	
Toronto FFH333	
Regina FFH334	
Calgary FFH335	
Montreal FFH336	
Fredericton FFH337	
Winnipeg FFH338	
Charlottetown FFH339	
St.John's FFH340	
Ottawa FFH341	
Kingston:	
Kingston MCDV700	
Glace Bay MCDV701	
Nanaimo MCDV702	
Edmonton MCDV703	
Shawinigan MCDV704	
Whitehorse MCDV705	
Yellowknife MCDV706	
Goose Bay MCDV707	
Moncton MCDV708	
Saskatchewan MCDV709	
Brandon MCDV710	
Summerside MCDV711	

Ship Builder

1940 1941 1942 1943 1944 1945 1946 1947 1948 1949

Burrard (BC)
129,131,173,174,175,170,168,165,169,152,166,162,

Cdn Vickers (Quebec)
665,518,668,672,673,444,319, 436,681,327, 666,669,675,
677, 678,531,116,156,157,150, 160, 191, 58,172,259,258,
256,255, 254,257

Collingwood Ship (Ont)
138,165, 180,167,163,164,119,168,237,238,686,687,339,
340, 274,275,276,277,

Davie (Quebec)
244,318,685,664,410,670,414,667,519,691,676,662,
680, 366,344,683,538,684,147,149,179,159,115, 151,146,
1 21,136,110,166,198,155,269,264,266,263,265,268,282,283,
309, 310,318

Dufferin Ship (Ont)
250,144,154,156,259,260,

Kingston Ship (Ont)
118,161,162,244,335,368,332, 342,345,284,285,

Midland Ship (Ont)
K218,220,333,338,

MIL Sorel (Quebec)
145,152,154,177,194,152,153,231,245,225,273,234,346
,341,455,394,369,279,280,281,270,271,269,400

Morton Eng. (Quebec)
663, 350,03,418,337,322,459,329,113,143,112,141,242,15,415,
401,520,537,343,358,540,440,688,457,

North Van. Ship (BC)
160,146,159,148,161,149,08,21, 38,52,69,100,

Port Arthur Ship (Ont)
127, 124,171,125,170,178,169, 233,344,396,326,328,397,
330, 331,355,334,332,336,337,314, 311,312,317,313

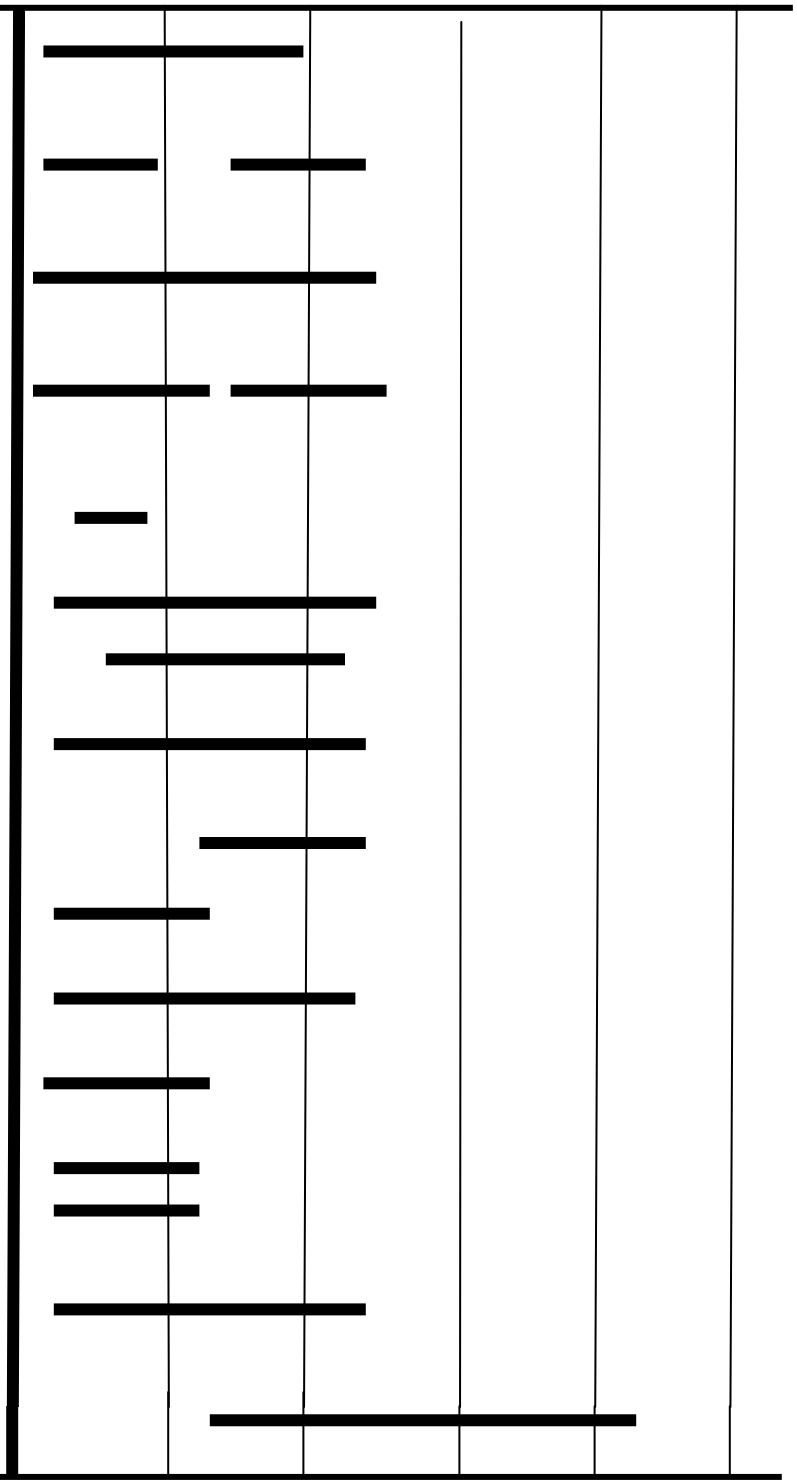
Prince Rupert DD & Ship (BC)
174,152,262,261

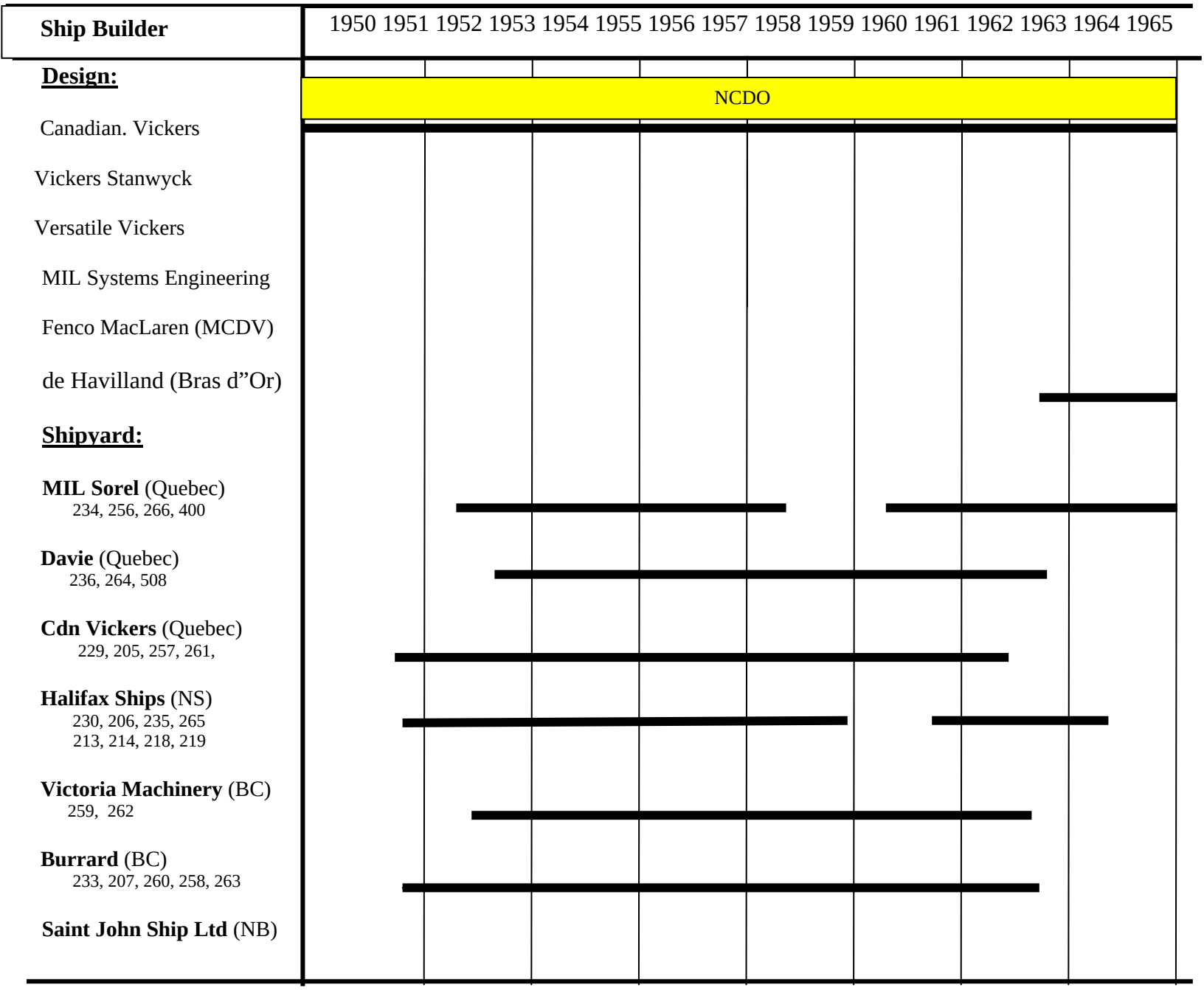
Saint John Ship Ltd (NB)
148,139,181,

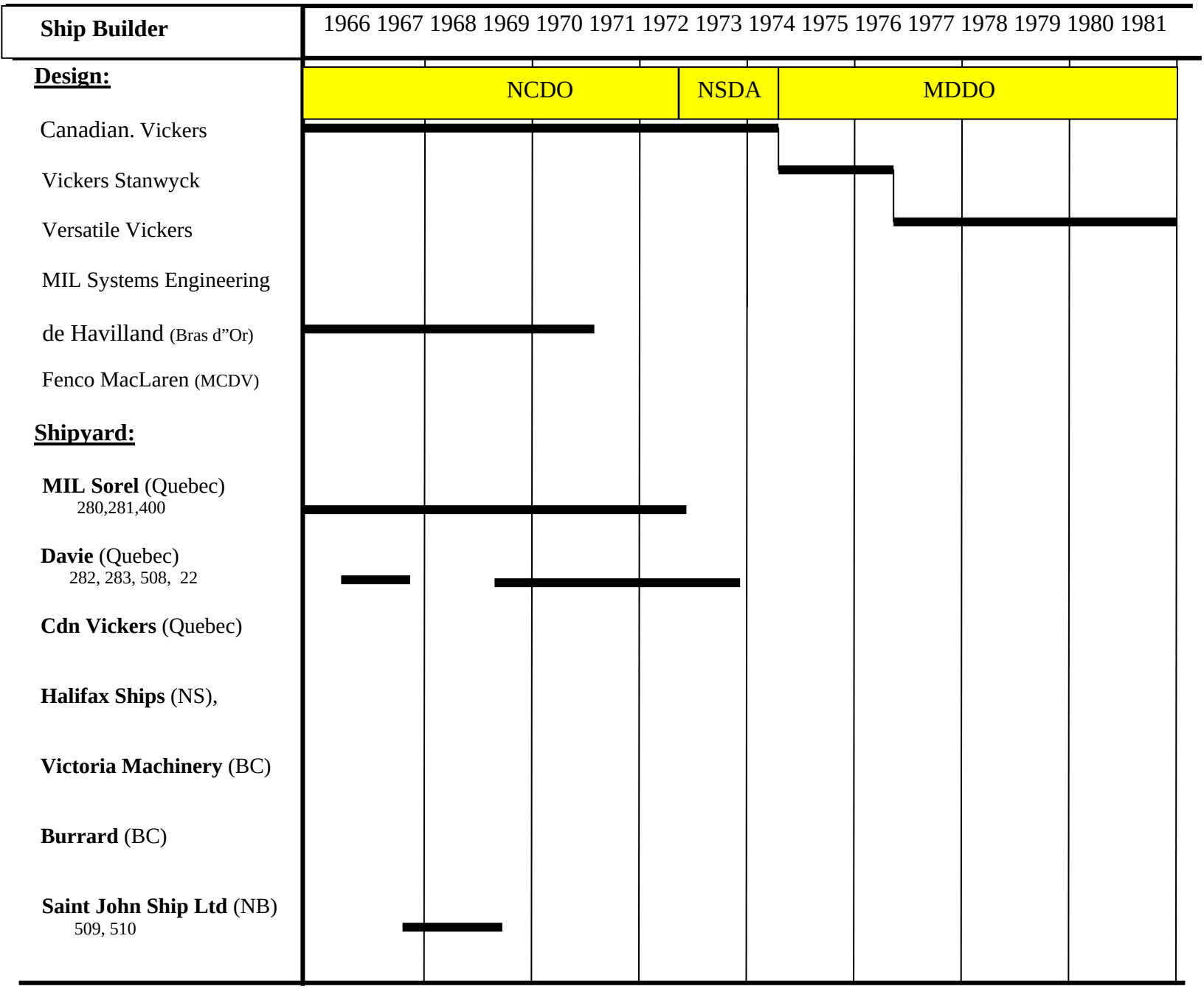
Victoria Machinery (BC)
104,176,133,228,229,

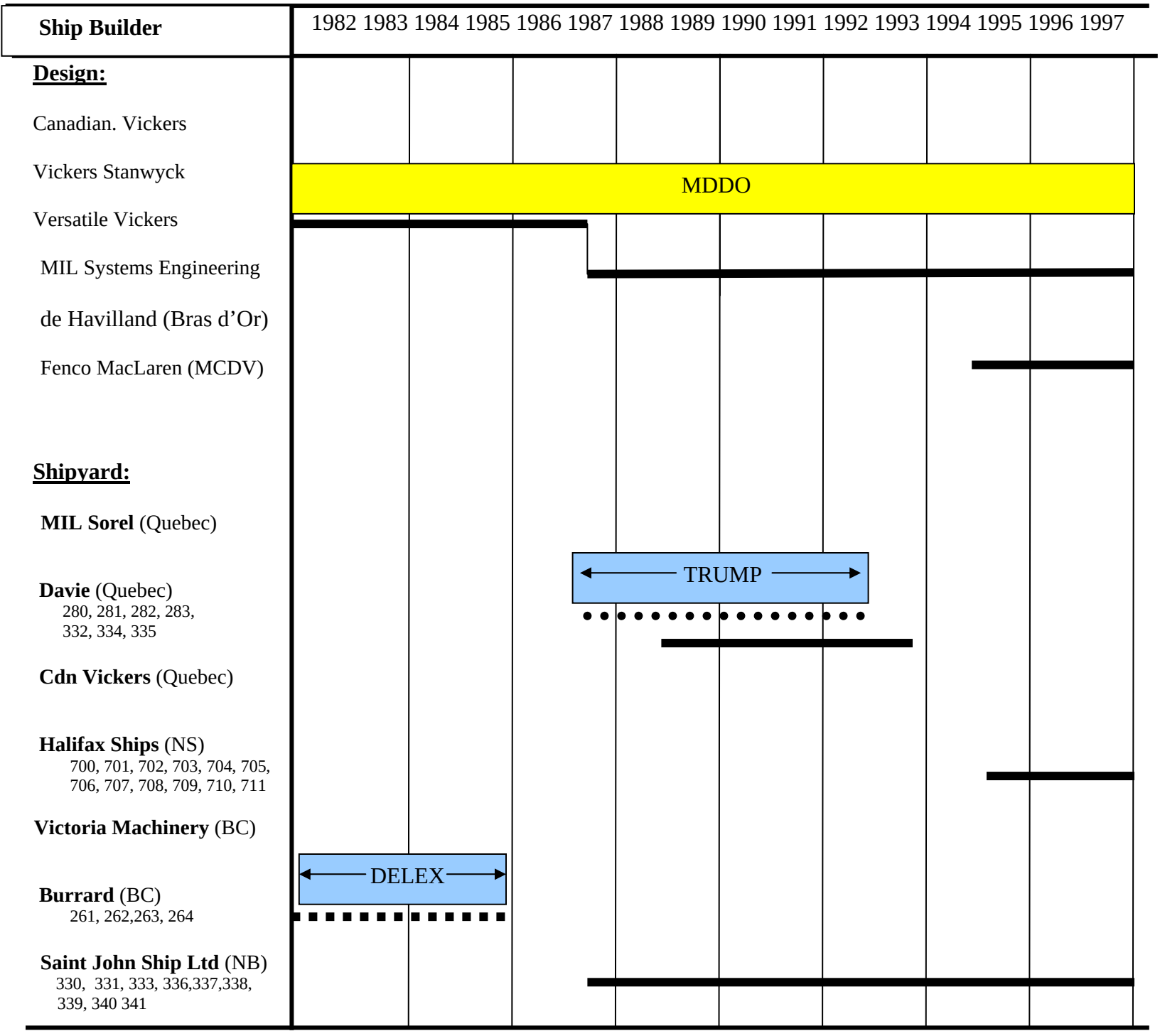
Yarrows Ltd. (BC)
407, 317,419,320,321,448,326,324
325,323,328,330,331,661,409,454,
682,103,106,101,223,240,

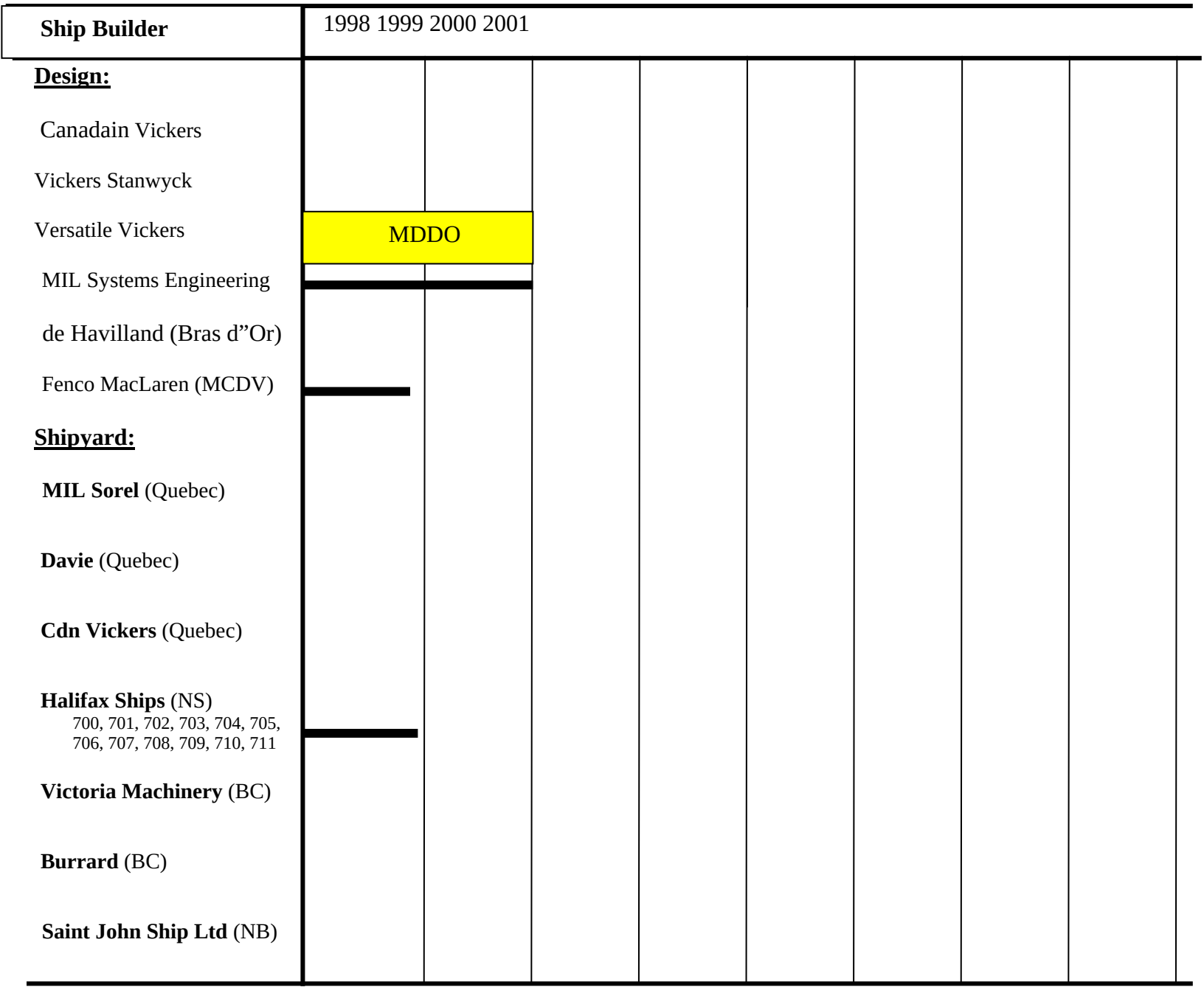
Halifax Ships (NS)
213,214,218,219




Ship Builder
1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965
Design:
NCDO
Canadian. Vickers
Vickers Stanwyck
Versatile Vickers
MIL Systems Engineering
Fenco MacLaren (MCDV)
de Havilland (Bras d"Or)
Shipyard:
MIL Sorel (Quebec)
234, 256, 266, 400
Davie (Quebec)
236, 264, 508
Cdn Vickers (Quebec)
229, 205, 257, 261,
Halifax Ships (NS)
230, 206, 235, 265
213, 214, 218, 219
Victoria Machinery (BC)
259, 262
Burrard (BC)
233, 207, 260, 258, 263
Saint John Ship Ltd (NB)


Ship Builder
1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981
Design:
NCDO
NSDA
MDDO
Canadian. Vickers
Vickers Stanwyck
Versatile Vickers
MIL Systems Engineering
de Havilland (Bras d"Or)
Fenco MacLaren (MCDV)
Shipyard:
MIL Sorel (Quebec)
280,281,400
Davie (Quebec)
282, 283, 508, 22
Cdn Vickers (Quebec)
Halifax Ships (NS),
Victoria Machinery (BC)
Burrard (BC)
Saint John Ship Ltd (NB)
509, 510


Ship Builder
1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997
Design:
Canadian. Vickers
Vickers Stanwyck
MDDO
Versatile Vickers
MIL Systems Engineering
de Havilland (Bras d'Or)
Fenco MacLaren (MCDV)
Shipyard:
MIL Sorel (Quebec)
TRUMP
Davie (Quebec)
280, 281, 282, 283,
332, 334, 335
Cdn Vickers (Quebec)
Halifax Ships (NS)
700, 701, 702, 703, 704, 705,
706, 707, 708, 709, 710, 711
Victoria Machinery (BC)
DELEX
Burrard (BC)
261, 262,263, 264
Saint John Ship Ltd (NB)
330, 331, 333, 336,337,338,
339, 340 341



Shipyards of the Major Warship Build Program in Canada *Page E2*

NB: During the 1951 – 1957 period a number of small craft were also built for the Navy, including Bird Class patrol craft (4) -780, 781, 782, 783, Bay Class minesweepers (19) – 143, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 156, 157, 159, 160,161, 162,163, 164 and Porte Class gate vessels (5) – 180, 183, 184, 185,186 [ranging from 66 to 429 tons displacement] in 6 of the above major shipyards and in 8 others from coast to coast.

JRW 15611d

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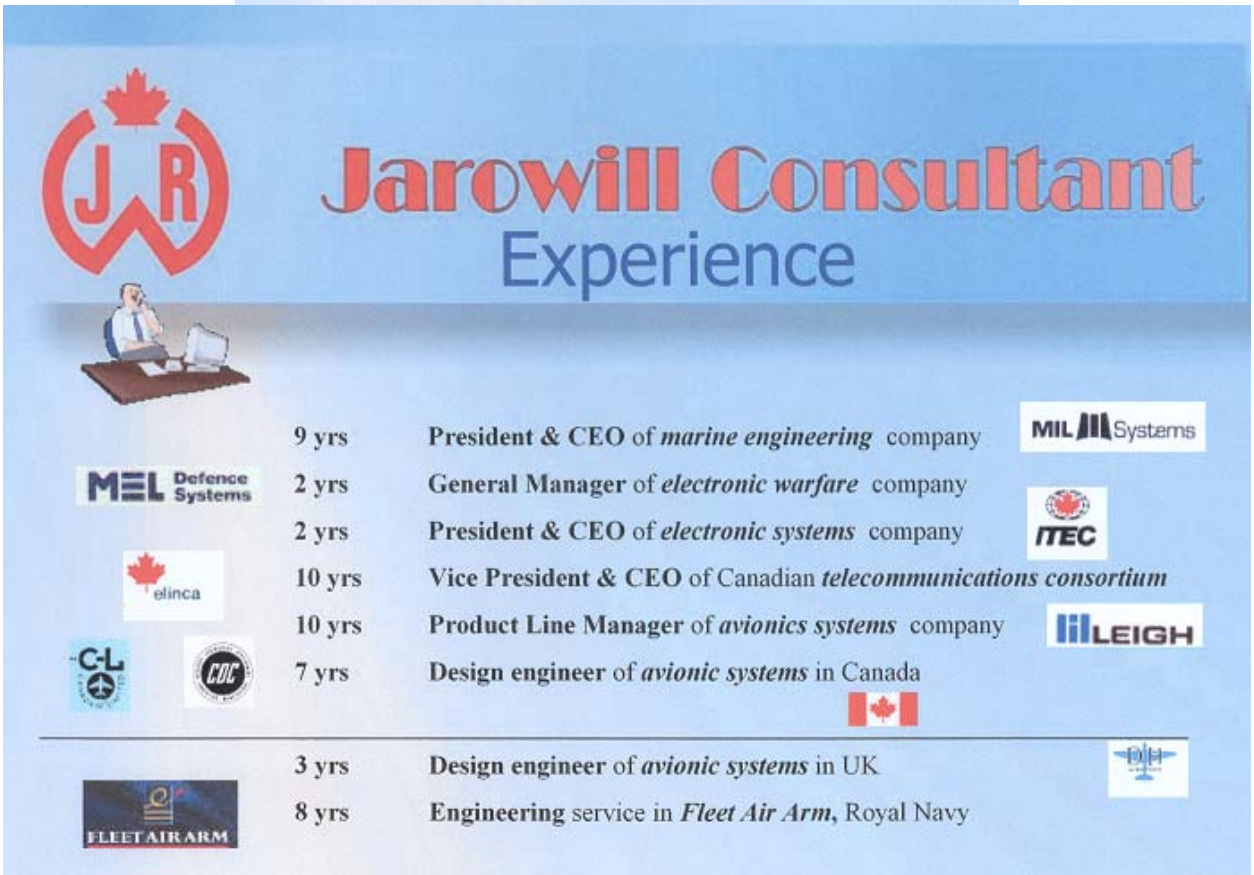

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