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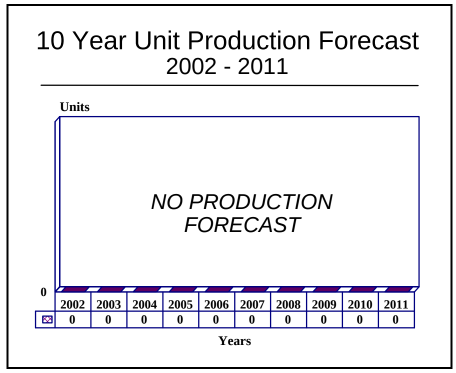
Halifax Class – Archived 04/2003

Outlook

- Program activity ending
- Financial crisis precluding proposed AAW conversion
- ESSM installation going ahead
- Export contracts now most unlikely



Orientation

Description. Guided missile multipurpose frigate optimized for anti-submarine warfare operations.

Sponsor

Canadian Department of National Defence
Minister of Supply and Services
Place du Portage
Hull PQ
Ontario K1A 055
Canada

Contractors

St. John Shipbuilding Ltd
300 Union Street, PO Box 5111
St. John, New Brunswick E2L 4L4
Canada
Tel: +1 506 632 3232
Fax: +1 502 632 5912/5915
Telex: 014 47422
(Prime; shipbuilder)

Marine Industries Ltd
Sorel
Canada
(Shipbuilder)

Atlas Alloys
Spruce Lake Industrial Park
St. John, New Brunswick
Canada
Tel: +1 506 635 8374
Fax: +1 506 635 8142
(Alloys, stainless steel supplier)

Hazeltine Corp
Greenlawn, New York (NY) 11740-1600
USA
Tel: +1 516 216 7000
Fax: +1 516 262 8002
(IFF interrogator system)

Lockheed Martin Canada
6111 Avenue Royalmount
Montreal
Quebec H4P 1K6
Canada
Tel: +1 514 340 8310
Fax: +1 514 340 8318
Web site: www.lmco.com/canada
E-mail: communications@lmcda.lmco.com
(Primary combat management system)

Magnetek
901 East Ball Road
Anaheim, California (CA) 92805
USA
Tel: +1 714 956 9299
Fax: +1 714 956 5397
(Onboard power distribution system)

MIL Group Davie SY
Lauzon
Quebec
Canada

MIL Tracy
Quebec
Canada
(Stern section)

SEMT Pielstick
2, quai de Seine
BP 75
F-93202 Saint-Denis Cedex 1
France
Tel: +331 4809 7600
Fax: +331 4809 7878
Telex: semt 233 147 f
(Diesel engines)

Licensee. No production licenses have been granted.

Status. In service, with upgrades and modernization continuing.

Total Produced. Twelve ships have been built and commissioned into service.

Pennant List

Name	Builder	Launched	In Service	Fleet
FFH-330 *Halifax*	St. John Shipbuilding Ltd	4/1988	6/1991	Atlantic
FFH-331 *Vancouver*	St. John Shipbuilding Ltd	7/1989	9/1992	Pacific
FFH-332 *Ville de Quebec*	Marine Industries Ltd	5/1991	9/1993	Atlantic
FFH-333 *Toronto*	St. John Shipbuilding Ltd	12/1990	12/1992	Atlantic
FFH-334 *Regina*	Marine Industries Ltd	10/1991	2/1994	Pacific
FFH-335 *Calgary*	Marine Industries Ltd	8/1992	9/1994	Pacific
FFH-336 *Montreal*	St. John Shipbuilding Ltd	2/1992	9/1993	Atlantic
FFH-337 *Fredericton*	St. John Shipbuilding Ltd	3/1993	9/1994	Atlantic
FFH-338 *Winnipeg*	St. John Shipbuilding Ltd	12/1993	1/1995	Pacific
FFH-338 *Charlottetown*	St. John Shipbuilding Ltd	71994	9/1995	Atlantic
FFH-340 *St. John's*	St. John Shipbuilding Ltd	2/1995	3/1996	Atlantic
FFH-341 *Ottawa*	St. John Shipbuilding Ltd	11/1995	9/1996	Pacific

Mission. The Halifax class is designed primarily as an anti-submarine warfare combatant, with a secondary role as a general-purpose warship. The frigates also escort convoys in support of Canada's NATO mission and guard Canadian home waters.

Price Range. The total program cost was quoted as C$9.4 billion for all 12 ships in 1997, suggesting a unit price of about US$610 million.

Technical Data

	Metric	US
Dimensions		
Length (overall):	135.5 m	444.6 ft
Length (waterline):	124.0 m	406.5 ft
Beam:	16.4 m	53.8 ft
Draft (mean):	4.94 m	16.2 ft
Draft (max):	6.15 m	20.2 ft
Molded Depth:	11.0 m	36.0 ft
Displacement		
Operational Light:	4,300 tonnes	
Full Load:	4,750 tonnes	

	Metric	US
Fuel Weight:	550 tonnes	
Performance		
Speed – Maximum:	54 km/h	29 kt
Sustained:	28 km/h	15 kt
Operating Range:	7,250 km at 33 km/h	3,930 nm at 18 kt (turbine)
	11,100 km at 28 km/h	6,000 nm at 15 kt (diesel)
	17,500 km at 24 km/h	9,500 nm at 13 kt
Crew:	195 (capacity for 230)	

	Type	Quantity
Weaponry		
Guns:	Bofors SAK 57 mm L70 Mk 2	1
	Browning 12.7 mm M-2HB	6
CIWS:	Phalanx Mk 15 Mod 1 Block 1	1
Missiles – SSM:	RGM-84C/D-1A Harpoon	8
Missiles – Launchers:	Mk 48 Mod 0 VLS	2x12
Missiles – SAM:	Sea Sparrow RIM-7M	16-24
Torpedo Tubes:	Mk 32 Mod 9 324 mm	2x2
Torpedoes:	Mk 46 Mod 1/5	24
Helicopter:	CH-124A or 124B Sea King	1
Onboard Craft:	RIB: Zodiac (speed 30 kt)	1+1
Electronics		
Radars		
Air/Surface Search:	SPS-49(V)5	1
Target Acquisition:	Sea Giraffe HC 150	1
Fire Control (tracker):	Signaal STIR 1.8	2
Navigation:	Kelvin Hughes Type 1007	1
Sonars		
Hull Mounted:	SQS-505(V)6; SQS-510	1
Towed Array:	SQR-501 (SQR-19 (V)) CANTASS	1
Sonobuoy Processor:	UYS-503 (V)1	1
EW		
ESM:	SLQ-501 CANEWS	1
ECM:	Ramses SLQ-503 jammer	1
COMINT:	SRD-502 (Telegon 4)	1
Decoy Launchers:	Shield II triple	4
Torpedo Decoys:	SLQ-25 NIXIE towed acoustic	1
IFF Interrogator:	TPX-54 Mk XII	1
Intercept:	SLQ-504	1
Communications		
UHF Transceivers:	RT 1244(V)	9
VHF Transceivers:	RT 246	2
HF Transceivers:	MRT 66	2
Satellite Communications:	WSC 3(V)	2
Fleet Broadcast:	SRR 1	1
Shipboard Position Data Beacon:	URN-25 TACAN	1
Underwater Telephone:	WQC-501(V)	1
Combat Management System:	SHINPADS (UYK-507 computers)	
Machinery		
Propulsion Configuration:	CODOG	
Prime Movers:	GE LM2500-30 gas turbines	2x23,747 shp
Secondary (diesel):	SEMT Pielstick 20PA6-V280 MPC	1x8,800 shp

	Type	Quantity
Power Generator:	MWM TBO-602 V-16K diesel	4x850 kW
Propellers:	Escher Wyss CRPP	2

Halifax Class Frigate

Source: Canadian Navy

Design Features. The hull and superstructure of the Halifax class form an integrated structure to provide an efficient, adaptable and durable systems platform. The entire ship is assembled from modules, using a combination of longitudinal and transverse framing, light scantlings and grill construction. This provides a strong but relatively lightweight hull. Living accommodation on the ships is of a very high standard, while the galley and recreational areas are very well equipped.

The hull form is designed for good seakeeping, even under the most rigorous conditions. The high freeboard, flush deck and broad beam are carried well forward; all minimize deck wetness. The deep draught and fine bow lines reduce the tendency of the sonar dome to lift clear of the water, cut slamming, and minimize pitching and rolling on the main deck. These features, as demonstrated in service, coupled with extensive subdivision and a generous reserve of buoyancy, contribute to survivability with large angles of stability and a high degree of damage tolerance. The emphasis has been on maximizing overall ship performance through a well-balanced design.

Hull form, shaft lines and appendages are carefully shaped to provide a friction-free flow to the propellers. The bow and propellers are strengthened to allow the ship to operate in brash ice. Hull and superstructure are of all-steel construction, fabricated primarily of low-alloy, high-tensile steel, but with selective use of high-yield steels for additional strength in high-stress areas and for ballistic protection. The superstructure is integrated with the hull through the transverse and longitudinal bulkheads and the side shell. All structural steel plate is notch-tough to provide an extra margin against cracking. The superstructure is designed to withstand air blast and underwater shock, as well as the shock effects and blast of the ship's own weapons. Particular attention has been paid to avoiding structural resonance.

Internally, the ship is subdivided by a combination of structural bulkheads, non-structural bulkheads, lightweight steel bulkheads and steel honeycomb core joiner bulkheads and linings. All bulkheads, including the joiner partitions, are fire-rated and capable of supporting equipment under shock. The lattice masts are constructed of square, hollow steel sections, with minimal use of gusset plates to reduce radar reflections. Mast supports are aligned with bulkheads to ensure structural continuity. The entire hull is designed for a service life of 30 years, and a generous margin is provided for future growth.

The propulsion system is a combined diesel or gas turbine (CODOG) arrangement. Except for a brief period during a changeover from one mode to another, the two types of engine will not be run simultaneously. The drive modes used are either with both cross-connect clutches engaged (normal mode), or with at least one cross-connect clutch disengaged (abnormal mode).

The SEMT-Pielstick 20 PA6 V290 MPC is water-cooled, with twin turbochargers and air-cooling of the whole engine within the acoustic enclosure. At 1,050 rpm the diesel delivers 6.47 MW, equivalent to a maximum speed of 15 knots. It can also deliver 10 percent more output for two hours in every 12. The 20 PA6 MPC unit was selected because of its harmonic characteristics and the well-proven success of the PA6 series. The diesel installation is double mounted. The upper stage connects the engine to the machinery raft, with dampers specially tuned to attenuate low-frequency resonances without degrading the important high-frequency isolation. The second stage secures the raft to the ship's structure. Like the gas turbines, the diesel engine is surrounded by an acoustical thermal enclosure.

In order to minimize detection, the design of the Halifax class incorporates the latest stealth technology. To reduce radar cross section, several features were stressed:

- flared hull sides,
- an angled transom,
- angled vertical superstructure surfaces,
- the minimum number of superstructure decks, and
- the minimum number of topside reflecting corners.

The magnetic signature is minimized by a comprehensive degaussing system. This is continuously course-corrected and is usable in all sea states. It can be fine-tuned to cope with special circumstances.

The infrared (IR) signature has been minimized over the 3-5 and 8-13 micron bands through the adoption of several design features. Insulation has been installed throughout the ship, but in particular near exhaust pipes and ducts, to control heat emissions, and special cold-air ventilation has been added in the funnel. The IR signature values of exhaust ducts and heat-plumes are controlled by exhaust cooling devices, including the Canadian-designed Defence Research Establishment Suffield (DRES) Ball in the gas turbine uptakes, and cheese grater eductor devices in other uptakes. These decrease the surface temperature of exposed exhaust ducting and lower the actual plume temperature through air-mixing.

Underwater radiated noise has been reduced under a strict noise-control program. Noise and vibration criteria were set for equipment in the initial design process, and were then followed through to implementation:

- Propellers were designed to maximize the speed at which cavitation occurs.
- The gas turbines, the main diesel engine and gearboxes are raft-mounted; the diesel engine is mounted on a separate double raft and the gas turbine on a single raft.
- The transmission of vibrations to the hull was minimized by using noise-attenuating resilient mountings and flexible connections.
- Double raft mountings were provided where needed.
- Underwater hull openings were kept to a minimum.
- Hull openings were designed to reduce turbulence and resonance, also improving the performance of sonars.

Originally, BTR A bracket bearings (similar to those on the UK Royal Navy's Type 23 frigates) were installed, but these did not meet the Canadian Navy's requirements for low noise. They were replaced with Thorndon bearings similar to those used in US Navy nuclear submarines. Two Prairie air masker belts were fitted, as were propeller masking systems. These systems were found to be ineffective and represented a major maintenance burden. They were therefore abandoned in February 2000.

Operational Characteristics. The ship's two drive modes (normal and abnormal) permit a wide range of machinery combinations. The normal drive mode allows both gas turbines to drive both propellers, one gas turbine to drive both propellers, or the diesel engine to drive both propellers. The abnormal drive mode allows each gas turbine to drive its own shaft, one gas turbine driving its own shaft and the other trailing or locked, or the diesel driving one shaft and the other trailing or locked. The gearbox system consists of port and starboard main gearboxes made by Schelde of the Netherlands, and a cross-connect gearbox. The port gearbox has a traditional two-stage, locked-train configuration, whereas the starboard gearbox employs two idlers in the first reduction stage. These impart motion in opposite rotation to the starboard shaft line. This setup compensates for the two gas turbines having the same direction of rotation while the propellers rotate inboard.

The gearboxes are designed for low noise levels and high reliability. The noise limits of primary concern are structure-borne noise and consequent underwater noise. The low noise levels are achieved through a combination of precise machining and strict attention to design. All pinions and wheels feature double helical teeth with an involute profile to ensure smooth engagement and disengagement of the gear teeth. The gearbox and main machinery raft are mounted on noise-damping rubber mounts in series, with shock-absorbing spring stacks.

An electrohydraulic starting system brings each turbine from the cold iron condition to idle within 60 seconds. The two hydraulic units can be cross-connected to start either turbine. Each gas turbine is mounted in an acoustic/thermal enclosure. Airborne noise is thereby attenuated to sufficiently low levels to ensure that ear protectors need not be worn, even when the turbines are running at full power. The enclosures also act as engine ventilation air ducts, provide a fire-containment boundary, and prevent heat from being transferred to the engine compartment. Each turbine and enclosure is mounted on a subframe secured to the main machinery raft.

The Escher Wyss Sulzer controllable reversible-pitch propeller (CRPP) system comprises two five-bladed propellers, two shaft lines and hydraulic control systems. As with all other propulsion train components, the propellers and shafts are capable of operating continuously at 120 percent of rated torque and can withstand 150 percent of rated torque for transient operation. A separate hydraulic control oil system is provided for each propeller, with two pumps to each, one electrically driven and the other belt-driven.

The integrated machinery control system (IMCS) allows one-man junior ratings, with operation from the bridge control console or one-man monitoring and control from the machinery control console. In combination with the remote surveillance provided by the closed-circuit television (CCTV) monitoring system and the damage control system, the IMCS allows the engine rooms and auxiliary systems to be unmanned. Although watchkeepers must be available for troubleshooting and roving patrols, the system can also be used for routine maintenance tasks.

Changeovers from the normal drive mode are usually effected from the bridge control console, but changeovers involving the abnormal drive mode must be made from the machinery control console or at local operating panels. Ship speed is changed by the IMCS in response to operator demand. Demands for speed in knots are entered by the operator for each shaft. The IMCS automatically calculates the required engine power and propeller pitch.

Exterior communications and radars can be shut down to prevent detection by other ships and aircraft or the radar seekers of anti-ship missiles. The emissions control panel is located in the operations room, and when necessary the operator can shut down external communications and radars selectively by frequency.

Close-range anti-submarine warfare (ASW) protection is provided by two 324 mm Mk 32 torpedo tubes, firing from a fixed position in the forward end of the hangar. They carry 24 Mk 46 torpedoes. The location of the tubes allows for centralized torpedo handling in the hangar. The principal sonar system is a low-frequency hull-mounted SQS-505 active sonar with passive capability. There also is a passive towed array sonar, the SQR 501 CANTASS (Canadian Tactical Towed Array Sonar) system, which uses the wet end of the Gould SQR-19 TACTAS.

The ships have two banks of eight Sea Sparrow point defense missile cells each. Provision was made for the class to carry 12 reload missiles in addition to the 16 missiles in the cells, but these have since been deleted. The Vertical Launch System is located on either side of the superstructure. Anti-ship firepower is provided by Harpoon missiles. Normally four are carried, but up to eight can be carried if required. These are supported by a Bofors 57 mm L70 Mk 2 gun which also has a substantial anti-air role.

The primary long-range radar is the SPS-49, a two-dimensional air search radar. The Swedish Sea Giraffe 150 HC radar, designed to track small objects including sea-skimming missiles, is the primary medium-range air/surface search radar. Propulsion is via a combined diesel or gas turbine (CODOG) system.

The class is outfitted with one CH-124A Sea King helicopter for long-range ASW. The Sea King carries a dipping sonar and sonobuoys. Its armament consists of four Mk 46 lightweight torpedoes or, alternatively, four Mk 11 depth charges.

Variants/Upgrades

Canadian Patrol Frigate (CPF). Alternative name for the Halifax class.

Second Flight. The original plan was for the second group of six ships to have a 10-meter hull extension. In initial drafts, this was to have provided additional Sea Sparrow missile launch tubes, but these were deleted to save money. The extra hull space was then set aside for additional crew accommodation, a requirement made necessary by a decision to include female sailors in the complement. Finally, the hull extension was deleted completely and the second group of ships duplicated the first. All Halifax class ships have female sailors as part of the crew, and three are designated as French language ships in which all shipboard operations will use Quebecois French as the primary language. Neither of these changes will make any substantial difference to the ships.

Third Flight. The original Canadian Patrol Frigate included a possible third flight of six ships. This proposal was revived with the suggestion that six AAW derivatives of the Halifax class be built after the 12 ASW variants were completed. The AAW version (see Province class below) would feature a Mk 41 VLS for Standard SM-2 Block 4 missiles, with the new Canadian/Dutch/German APAR (active phased array radar) and a command system derived from a fusion of SEWACO and SHINPADS technology. The hull would remain basically unchanged. As ships equipped with area-defense surface-to-air missiles, the AAW Halifax class would be considered destroyers rather than frigates.

Export Family. In early 1994, St. John Shipbuilding announced a new family of surface combatants based on the Halifax class design. These would include the following ship types:

City Class. Export version of the Halifax class, although virtually identical to it. Refers to the fact that the ships are named after Canadian cities.

Province Class. A 144.7 meter, 5,575 tonne stretched version of the Halifax class, featuring a Mk 41 Vertical Launch System with a capacity for 64 Standard SM-2 missiles or a quad-packed Evolved Sea Sparrow, a 76 mm Otobreda gun and two Mk 15 Phalanx mounts. This design, equipped with the Signaal APAR fire control radar and a 57 mm in place of the 76 mm, could be the basis for the new Canadian AAW destroyer once that procurement is confirmed.

Scimitar Class. Version of Halifax class proposed to Saudi Arabia, differing from the Halifax class only in having a 76 mm Otobreda gun in place of the Bofors 57 mm and having two Phalanx Mk 15 mounts. Competed against the French La Fayette design.

Missile Patrol Vessel. This is a 64.6 meter, 450 tonne fast attack craft armed with a Bofors 57 mm L70, a Bofors 30 mm gun, eight Harpoon anti-ship missiles, and a Crotale Navale NG mount with eight reloads. The vessel is capable of speeds in excess of 40 knots and has a tactical range of 2,000 nautical miles at 16 knots.

Multipurpose Corvette. A 76.8 meter corvette design displacing 960 tonnes and capable of 28 knots. The design is equipped with a 76 mm L62 Otobreda gun, a twin fast-forty, Crotale Navale NG point defense missiles, and a single Phalanx Mk 15. No provision is made for a helicopter.

Multipurpose Fast Frigate. Downsized version of Scimitar class (see below), 105.8 meters in length, displacement 2,800 tonnes. Maximum speed is 33 knots and range is 7,000 nautical miles. This somewhat superior performance with a smaller hull probably represents the usual export market trade-off against less visible aspects of naval performance.

Offshore Patrol Vessel. A lightly armed 76.8 meter OPV, displacing 850 tonnes and capable of speeds of around 30 knots.

Upgrade/Modernization. Modernization of the ships is ongoing, and they are expected to have an effective service life of about 23 years. All ships of the class had their hull-mounted sonars upgraded to SQS-510 standard by the end of 1998, retaining the same array as on the 505(V)6.

Furthermore, the Link 16 CEC (cooperative engagement capability) upgrade is planned for all ships, as is the modernization of their EW suite. The CANTASS passive-only towed array sonar may be replaced by the TIAPS (Towed Integrated Active-Passive Sonar) after 2002.

A contract for 13 SINS (Ship's Inertial Navigation Systems) was granted to Sperry Marine in the summer of 1998. The deal involves the installation of dual Mk 49 Ring Laser Gyro Systems for all 12 vessels plus one land-based trainer. The contract also included a provision for installation support and training.

The Mk 49 is a state-of-the-art inertial navigation system that generates exact position, velocity, attitude and attitude change rates in both digital and analog format.

In June 1998, Boeing won an order of undisclosed value for 13 Advanced Harpoon Weapon Control Systems (AHWCS) to upgrade the anti-surface warfare (ASuW) capabilities of the Halifaxes. These systems include automatic flight missile routing to avoid shorelines and multitarget, multimissile engagements. The installation of these systems is part of the long-term plan to incrementally upgrade the capabilities of all these ships, spreading the total cost of the series over a number of years. Presumably, the frequent problems encountered in firing of the missiles from both frigates and destroyers from the early to mid-1990s were a factor in deciding to boost the shipboard capabilities.

AHWCS is the first weapon control system to use common hardware and software for three separate platform types (ships, submarines, ground launchers). Much of the architecture is based on commercial off-the-shelf (COTS) technologies which are used to enhance the system's performance and reliability while lowering the price-performance ratio in both initial acquisition and life-cycle support stages.

These ships will continue to be modernized and upgraded over the next several years, with the first ships being ready for mid-life refurbishment around 2005.

Program Review

Background. During the 1970s and 1980s it became apparent that many of Canada's naval ships were nearing the end of their useful lives. The 20 ships of the St. Laurent and follow-on classes were all 15-20 years old and needed replacement due to their frequent arduous patrols in the North Atlantic. It was decided to replace them with a multipurpose frigate designed and built in Canada.

The acquisition of these frigates became known as the Canadian Patrol Frigate Project, and it called for the delivery of 12 new ships named after Canadian cities – hence the name City class in reference to these ships. It is still the largest military procurement program ever undertaken by Canada. The Canadian Department of National Defence (DND) announced the program in December 1977, but did not issue the Request for Proposals until August 1978. The Department specified that 65 percent of the equipment must be of Canadian manufacture. It added that the ships must have a peacetime role in addition to their designed wartime functions. The design studies were all from private industry. To prevent cost overruns, the DND said that the ships would be designed to a set cost.

The majority of proposals were received by July 1979, but by mid-1980 only St. John Shipbuilding and SCAN Marine Inc were left in the bidding process. The Canadian government told these two firms to submit their detailed proposals by the end of 1982. In October 1982, the two firms submitted their designs. They were similar in many respects, including having a steel superstructure to reduce fire damage. The major differences were that the SCAN Marine design had a 76 mm Otobreda gun and gas turbine propulsion only, while the St. John design had both gas turbine and diesel propulsion and a 57 mm Bofors gun.

In June 1983, the Canadian government awarded a contract for six frigates to St. John Shipbuilding. The Canadian government pressed St. John to bring in a second yard to help Canada's ailing shipbuilding industry. In late 1983, St. John announced that Marine Industries of Sorel, Quebec, would build three ships. These ships would be fitted out by Versatile Vickers Ltd of Montreal, Quebec. Primary combat systems support would come from Paramax Electronics Inc, a subsidiary of Unisys Corp. In fact, it was set up to comply with Canadian regulations concerning domestic manufacture of parts. Unisys gave Paramax major technology transfers and also rights to carry out all ship-level systems integration.

Originally, the keel of the HMCS *Halifax* was scheduled to be laid in July 1985. In May 1985, however, the Canadian government announced that this would be delayed until January 1986. Some of the shipyard labor unions had held a work slowdown to renegotiate their contracts. The Canadian Navy also had troubles, since it had not taken part in any warship construction since 1971, and its design bureau was inexperienced. As a result, Bath Iron Works, which managed the FFG-7 Oliver Hazard Perry destroyer program for the US Navy, sent 25 consultants to St. John in early 1986 to help with the Halifax program. HMCS *Halifax* was laid in January 1986, HMCS *Vancouver* two months later.

Shortly after the second keel was laid, it was discovered that large quantities of the steel plates that had been delivered to St. John Shipyard were corroded or brittle. Construction and steel deliveries came to a halt for five months while the Canadian Navy and the steel makers inquired into the problem. The payments and delivery schedule were renegotiated. Fabrication of modules for HMCS *Halifax* resumed in September 1986. Due to the large amount of steel that was replaced, HMCS *Halifax* received what amounted to a second keel laying in January 1987. By the end of 1987, construction was progressing on five of the six Halifax class frigates.

In November 1987, the DND confirmed reports that the second group of frigates would be larger and of a slightly modified design from the Halifax class. This group was provisionally designated the Montreal class. The Department awarded a C$6.3 billion contract for the six ships in December to St. John Shipbuilding. Awarding the entire package to one shipyard was estimated to save the government about C$150 million. The award to just one shipyard drew protests from Quebec's parliamentary representatives and the losing shipyards. At this time, the Canadian Navy planned to begin procuring long-lead items for the second group of six frigates.

At the same time, the introduction of the new SHINPADS command and control system placed another time delay on the project. SHINPADS was originally meant to be installed first on the reconstructed Iroquis class destroyers, which were being converted from ASW to the area defense AAW roles. However, long delays in the Iroquois Upgrade Program (a.k.a. TRUMP) meant that these ships were not going to be commissioned until the first Halifax class ships were finished. Consequently, the SHINPADS program shifted priorities, and the Halifax class became the trial ships for this new C^2 program.

While no change was officially announced in the construction schedule, HMCS *Halifax* was not launched until mid-1989. In mid-1990 it was announced that the delivery date for HMCS *Halifax* had slipped another six months, presumably due to the complexity of the SHINPADS and its fitting on board. It was reported at that time that the only ships to be affected by the delay were the first two ships. HMCS *Halifax* was delivered to the Department of National Defence in October 1990.

The ship was then delivered to the Canadian Navy on June 28, 1991, and sea trials proceeded on schedule. As expected, minor deficiencies were detected, mainly related to the software in the command system. Additionally, some noise problems affected the ASW capabilities. While on 70 percent of the readings the ship exceeded its specifications, on 20 percent it was on target and on 10 percent, below specifications. The noise problems were traced to sound shorts between the rafted diesel and the hull and to unexpected propeller cavitation. The former was quickly corrected by properly instructing dockyard staff on the importance of maintaining sound isolation, the latter by fine-tuning the propeller design. Dampening the tonal vibrations transmitted by the ship's engines through the hull was found to be an effective method. Some press reports grossly exaggerated these shortfalls, neglecting the fact that ships run trials to detect troubles of this type. By the end of 1992, some of the problems had been corrected and solutions to the others had been determined.

Tests were initially done on the older destroyer, HMCS *Annapolis*, in 1991 using anechoic tiles. Consequently, HMCS *Montreal* was fitted with about 12,500 anechoic honeycomb tiles made of a special synthetic rubber on the outside of the hull. The application and testing of the tiles cost an estimated $2.1 million. At the same time the tiles were being applied on the HMCS *Montreal*, the ship's propellers were being modified to reduce the broadband radiated noise caused by cavitation. According to Commander John Westlake of the Directorate of Maritime Policy and Project Development, however, this modification "wasn't a redesign, just some smoothing of the propeller base."

In October 1992, Saudi Arabia expressed interest in acquiring three Halifax class frigates as a substitute for the French La Fayette class ships, then the subject of negotiations between the French and Saudi governments. This interest was prompted by the Iranian Navy's acquisition of the first of its Project 877EKM (Kilo) class submarines from Russia. The introduction of potentially hostile submarines meant that the primarily ASuW La Fayette class ships were not as capable for the developing environment as had been expected. The Canadian government initially approved the sale, and negotiations continued until mid-1994. A version of the Halifax class, designated the Scimitar class, was modified to meet the Saudi requirements. The Saudi Navy did select the Halifax class and requested government approval for the purchase, but the decision was overruled at the highest levels, and French La Fayette class frigates were eventually ordered instead.

In 1993, Belgium became another prospective purchaser of the Halifax class. Unofficial reports suggested that the Belgian Navy was interested in acquiring two ships of this type, funding the purchase by selling the existing corvettes of the Weilingen class.

The Halifax design was offered to Norway as the Canadian entry in the competition for a group of three or more frigates to replace its aging Oslo class. The final decision was for a design closely resembling the Spanish F-100 class, with a downgraded SPY-1 radar/fire control system on board.

The Canadian defense forces' decision to rearrange the naval resources in a tiered system with differing levels of readiness in late 1999 puts one Halifax in each Task Group in a vanguard unit role and another in a STANAVFORLANT (Standard Naval Force Atlantic) role. The staggered readiness system is expected to provide savings in operational costs while maintaining a fleet of realistic defense capability. Because of the lack of funds for any major future procurement of platforms, it is essential that the service life of the existing ships be utilized to the maximum.

In April 2000, the Halifax class became the center of an investigation into a series of failures of the RIM-7P Sea Sparrow missile. Two Halifax class frigates, HMCS *Calgary* and HMCS *Charlottetown*, experienced launch failures with successive Sea Sparrow launches. Following investigations into the accidents, approval was given to upgrade the Halifax class with the Evolved Sea Sparrow Missile. The missiles are scheduled for delivery in 2003, with shipfits beginning in 2004. The installation program is due to be completed in 2010. This program leaves unanswered the questions concerning the replacement of the Tribal class AAW destroyers that are due to leave service by that year.

Although there has been no official word on this program, the budget crisis afflicting the Canadian armed services is now so severe that any radical modernization or upgrade of the Halifax class appears improbable. Further activity in this program therefore seems unlikely.

Funding

This program is funded by the CDND.

Recent Contracts

Contractor	Award ($ millions)	Date/Description
Lockheed Canada	11	1991 – Spares and support for the SLQ-501 CANEWS ESM system of the first six ships of the class.
Paramax Electronics	17.6	1991 – UYK-507 computers to replace the UYK-502s and UYK-505s in the first six ships of the class.
Lockheed Canada	9.5	1991 – Spares for SLQ-503 Ramses jammers on the first six ships of the class.
DRS Technologies	1.6	June 5, 1998 – Interface products for shipboard communications, flight safety systems for helicopters on board (part of SHINCOM).
Sperry Marine	13.5	July 1998 – Ship's Inertial Navigation Systems (SINS), with deliveries from mid-1999 to late 2000.
Boeing	N/A	June 30, 1998 – Thirteen AHWCS (Advanced Harpoon Weapon Control Systems) for the RGM-84 anti-ship cruise missiles.
Hollandse Signaalapparaten (Signaal)	N/A	December 1998 – Four Active Phased Array Radar (APAR) systems, for delivery from mid-2001 to late 2003.

Timetable

Month	Year	Major Development
	1975	Need to replace steam-driven destroyers identified in DSR
	1977	Department of National Defence (DND) presents statement of requirements to Cabinet
	1978	Project definition phase for six ships approved
Aug	1978	Request for Proposals issued by government
	1978-1983	Evaluation of five competing offers, leading to three finalists
Jun	1979	Initial proposals received by government
Jun	1983	DND orders first six frigates (St. John selected as prime contractor)
	1985	Work on the first ship begins
Jun	1986	First keel laid; program delayed due to steel problems
Sep	1986	Construction resumes; modular construction technique adopted

Month	Year	Major Development
Dec	1987	DND orders second group of frigates
	1988	Personnel Training Facility at Halifax completed
Apr	1988	First-of-class launched
Jun	1991	HMCS *Halifax* delivered
Jun	1992	HMCS *Halifax* commissioned to full service
Jun	1996	Last ship of the class delivered
Sep	1996	HMCS *Ottawa* commissioned to full service
Late	1997	Soundproofing tiles tested on one ship to reduce sonar signature
Mid	1998	Contract for Ship's Inertial Navigation Systems from Sperry
Late	1998	Advanced Harpoon Weapon Control Systems upgrades, four APAR systems ordered
	1999	Upgrade of sonars from SQS-505(V)6 to 510 level completed
End	1999	Canadian Navy establishes new tiered readiness system for entire fleet
Early	2000	Failure of hull sound-muffling system acknowledged

Worldwide Distribution

Canada. 12 in service

Forecast Rationale

Although the Halifax class frigates eventually matured into very effective warships, it appears that the severe financial crisis affecting the Canadian defense forces will preclude any serious attempts to upgrade or improve these ships further. Plans to backfit at least some of the Halifax class with the Thales Radar Nederland APAR three-dimensional search radars to provide a limited air warfare capability now appear to have been abandoned, although there has been no confirmation of this and, theoretically at least, the option remains open. Installing the APAR radars will present a tough engineering challenge, since the stability margin built into the Halifax class has already been used and the ships were originally designed for a traditional radar. Major changes would be needed on the ships' superstructure and compensating ballast would have to be carried. In a period of financial stringency, the cost-effectiveness of this work has to be questioned. It would appear that a more likely solution is to accept that the upgrade of the STIR radars and provision of ESSM missiles will "fulfill" the AAW requirement, allowing the elderly Tribal class ships to be retired without real replacement.

Hopes of exporting the Halifax class have now faded. While there are some candidates for ships of this generic type, requirements for these types of ships are being addressed by the mainstream export market shipyards. Restarting the Halifax production line for anything less than a large multiship order would be prohibitively expensive, effectively ruling the class out of future competitions. For these reasons, no future construction of this class is likely, and even the extensive retrofit program is open to doubt. The Halifax class will have to be added to the long list of designs that were never quite in the right place at the right time to win major success.

Ten-Year Outlook

No new production is projected – only modernization and upgrade activity of the onboard systems will continue throughout the forecast period; the forecast chart has therefore been omitted.

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