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ENGINEERING HISTORY PAPER #73

"Several Canadian Engineering Companies"

By Andrew H. Wilson

(produced as Cedargrove Series #48/2018 – Feb 2018)

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EIC HISTORY AND ARCHIVES

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Abstract

The research for this paper was done to provide background information for a sesquicentennial project on *150 Years of Canadian Engineering,* and is one of several intended for this purpose.

The histories that are included fall into a single category: the companies no longer exist. But, while they did, they made significant contributions to Canadian engineering. And they failed to survive for different reasons. They therefore serve as illustrations rather than models or in some definitive way.

About the Series

Principally, the Cedargrove Series is intended to preserve some of the research, writings and oral presentations that the author has completed over the past half-century or so but has not yet published. It is, therefore, the modern-day variant of the privately-published books and pamphlets written by his forebears, such as his paternal grandfather and grandmother and his grandfather's brother John.

About the Author

He is a graduate in mechanical engineering and the liberal arts and has held technical, administrative, research and management positions in industry in the United Kingdom and the public service of Canada, from which he retired over 30 years ago.

He became actively interested in the history of engineering on his appointment in 1975 to chair the first history committee of the Canadian Society for Mechanical Engineering and served both CSME and the Engineering Institute of Canada in this capacity for varying periods until 2003. He has researched, written and edited historical material for both organizations and for the Canadian Society of Senior Engineers. He is also a past president of CSME and EIC.

Introduction

During 2016 and 2017, I undertook a sesquicentennial research project that examined aspects of the history of engineering in Canada from Confederation in 1867 (and earlier) up until the present time. The material collected and analysed has been voluminous and has led to the preparation of a number of background papers, including this present one.

Brief histories of nine companies that employed engineers in the research, design, construction and manufacture of their products have been included, some briefer than others. Since these companies operated in all three time periods used for the sesquicentennial research, they have been considered in the order in which they were first formed. None is currently in business. With such a miniscule sample, no general conclusions can be drawn.

The Companies...

The Canadian Locomotive Company...

was one of only a few Canadian companies, independent of the railways, that have built locomotives in Canada, the others being the Montreal Locomotive Works, the General Motors Diesel Division at London, Ontario, Bombardier Transportation in Montréal, and Railpower Technologies in Vancouver. Initially, Canada imported its locomotives from Britain and the United States. James Good built the first Canadian one, a 4-4-0, in Toronto, in 1853.

The Canadian Locomotive Company began - and lived - its life on the waterfront at Kingston, Ontario. Founded in 1848 as the Ontario Foundry, its first products were steam engines and boilers. By the time it had built its first steam locomotive in 1854 - one of four being sold to the Grand Trunk Railway - it was the Kingston Locomotive Works. However, after building 30-odd 4-4-0 locomotives, the company went bankrupt in 1860. Its successor company, founded in 1865, was the Canadian Engine & Machinery Company. Around ten years later, having built well over 100 locomotives, it too went bankrupt and had to be re-organized, as the Canadian Locomotive & Engine Company Limited (CL&EC). Meanwhile, during the 1850s, 1860s and 1870s, the provincial railway networks had grown rapidly. But there was still a tendency among some railways to buy locomotives from the U.S. and the U.K.. And it was not until 1870 that the Dominion Parliament legislated the use of standard gauge tracks.

Another re-organization took place in 1881, led by William Harty. New shops were built, and the company's headquarters was moved from Montréal to Kingston. Encouragingly, the tariff on imported locomotives also rose significantly under the Macdonald National Policy. The new owners were Canadian Pacific investors who later sold their shares to the experienced Dübs Company of Glasgow, Scotland, who had already built some locomotives for the CPR there. The Dübs people gained full control in 1888.

Between 1878 and 1887, the CL&EC built some 140 locomotives, many for the CPR, but also for the Grand Trunk and the Intercolonial. There was also some diversification into non-railway products. Under

Dübs control, until 1900, CL&EC built around 160 locomotives, again mostly 4-4-0's, but with over 30 2-6-0's and penny numbers of several other types.

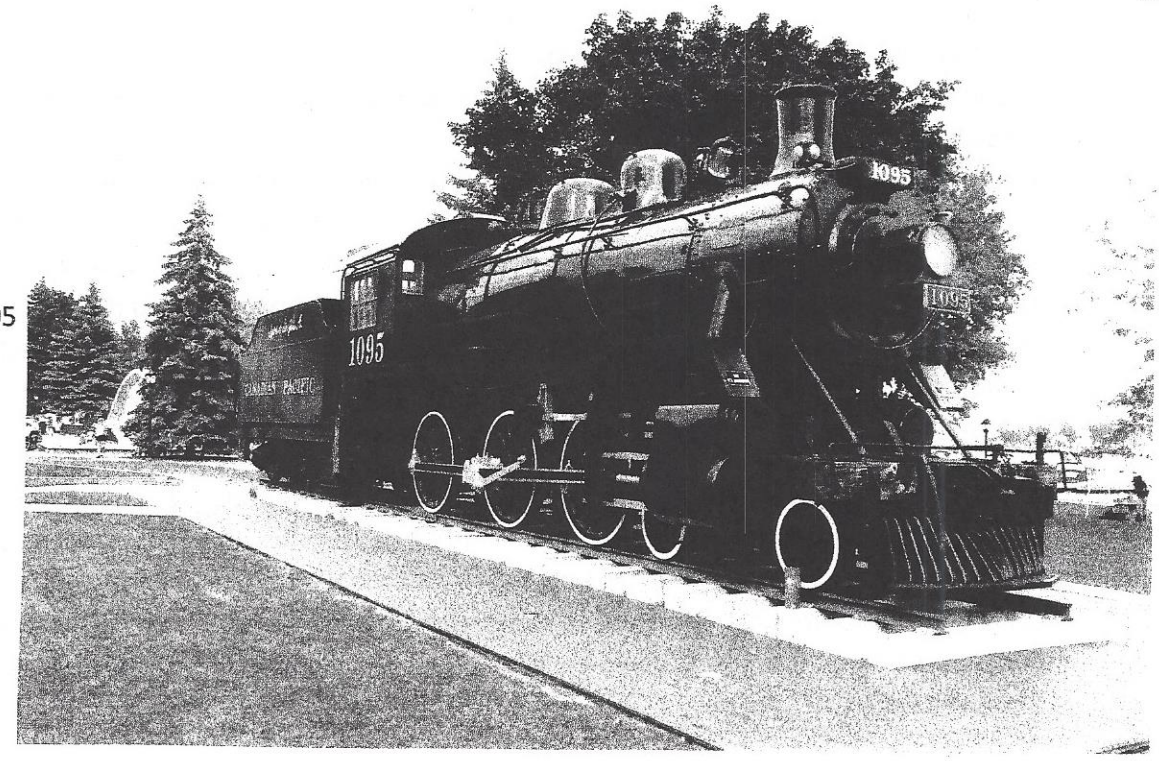
Competition, in the form of Montréal Locomotive Works, began production in 1883. Also, by 1900, both the CPR and the GTR had decided to build their own locomotives and CL&EC was forced to close down its Kingston operations. However, it was bought by yet another set of investors early in 1901 and incorporated as the Canadian Locomotive Company Ltd. (CLC). Production began again and this phase lasted until 1911, when a reorganization took place. During this 10-year period, almost 500 locomotives were built, 90 of them in 1908 alone, for a wide variety of owners. Quite a few were for the Intercolonial, but there were also some for the CPR and the GTR. They covered a wide variety of types, from 4-4-0, 2-8-0 and 4-6-0 to 2-6-0 and 0-6-0.

Locomotive production continued uninterrupted under the CLC from 1911 until 1948. During World War I, the company made armaments and munitions as well as locomotives. The 1920s were productive, the Depression years - especially from 1931 to 1936 - were not. And from 1937 to 1947 production was modest. World War II again brought armament and munitions production, but also the decline of steam locomotive production. Between 1911 and 1948, CLC built some 1400 locomotives for a wide variety of owners in Canada and abroad, including the CPR and Canadian National, the dominant types being 0-6-0 and 2-8-0.

CLC #1131

Canadian Pacific 1095

Built 1913



In 1948, CLC became the representatives of the U.S. Baldwin Locomotive Works and built diesel-driven Baldwin and Whitcomb locomotives for a variety of owners, including batches for the CNR and CPR. 235 locomotives were built under these contracts.

From 1950 to 1957, CLC built 300 diesels - mostly for the CNR - under licence to Fairbanks Morse, its Canadian subsidiary having acquired Baldwin's shares in CLC. However, the diesel market in Canada was soon dominated by Montreal Locomotive Works and General Motors Diesel, with the result that Fairbanks Morse had dropped out of it by 1957. Before then, CLC explored the export market for industrial locomotives of Davenport-Bessler design, of which it built fewer than 100 under licence, for a variety of owners, from 1956 until 1968.

In July 1965, CLC became Faibanks-Morse (Canada) Ltd.. Total locomotive production between 1966 and 1968 was 20, to be replaced temporarily by other machinery, such as marine engines. Declining business and a union strike closed the plant for good in June 1969.

Between 1854 and 1968, the Canadian Locomotive Works had built around 3000 locomotives.

CLC's waterfront site was cleared of plant and other buildings to make way for new ones. The soil was eventually decontaminated. By 2017, only three apartment buildings, a hotel and a park had moved on to it.

John Inglis & Company Limited...

began in 1858 when John Inglis, his sons and two partners started a small machine shop at Guelph, Ontario, to manufacture machinery for grist and flour mills. By 1864, the year the company became Inglis and Hunter, it was also making steam engines.

In 1881 the company moved to Toronto, to premises near Strachan Avenue, and became John Inglis and Sons. Inglis Senior died in 1898 and his son William took over the company. By 1903, it was making waterworks pumping engines as well as marine steam engines, but had discontinued the mill machinery lines. In 1913, the company was reincorporated under its long-term name, John Inglis & Company Limited. During World War I, it manufactured shells and shell forgings and steam engines for ships. In the 1920s, it added boilers, elevating equipment, conveying machinery, hydraulic turbines as well as reciprocal engines, and centrifugal pumps.

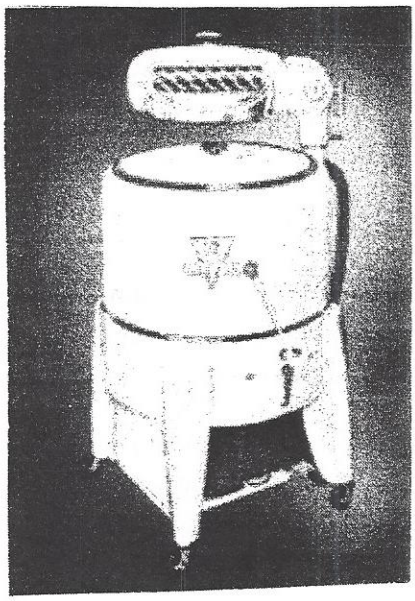
In 1937, two years after William died, and during the Depression years, the collapsed company was purchased by Major J.E. Hahn, the owner of another Toronto plant. Under his management, it started in 1940 to manufacture Bren guns on a large scale for the Canadian and British Armies. World War II production also included other guns, and equipment for destroyers. Employment soared beyond 17,000 and new facilities were built at Strachan Avenue.

After the war, with a much diminished work force, Inglis turned its attention to making consumer products such as house trailers, fishing tackle, oil burner pumps, domestic heaters and stoves, and home

laundry products under licence from the company in the U.S., now called Whirlpool, but with the Inglis name. This was followed some years later by fully-automatic Whirlpool washers, electric and gas dryers and dishwashers. Inglis also acquired a controlling interest in English Electric Canada at St. Catharines and began to make EE naval steam turbines under licence. It also opened a new plant in Scarborough.

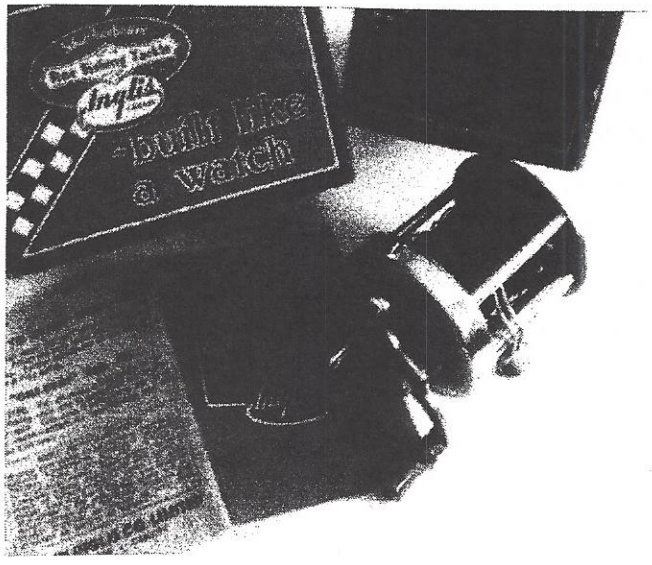
By 1966, Inglis was the leading Canadian manufacturer of laundry machinery. In 1967 it opened a plant in Stoney Creek to make refrigerators and, by 1970, dehumidifiers. By 1972 it was selling some domestic equipment under the Whirlpool name. It then expanded its warehouse and sales facilities to Laval, Québec. In 1973 the company became known as Inglis Limited. By 1981 it had moved its headquarters and some other facilities to Mississauga and had begun selling off its downtown Toronto property. The following year it acquired assets from the Canadian Admiral Corporation and began manufacturing and selling under the Admiral brand. But by 1987, Whirlpool had acquired the rights to ownership of the company. In 2001 the company became Whirlpool Canada, although the Inglis brand of appliances were still made, and new lines of domestic products were introduced.

Welding a Bren gun magazine



Early Inglis washer

Inglis fishing reel



Back in 1975 Inglis erected a billboard alongside the Gardiner Expressway in downtown Toronto, and it entertained drivers with humorous messages. It remained in place after Whirlpool took over ownership of Inglis, but was eventually removed when it became obscured by condo developments.

The Victoria Machinery Depot...

was established in 1863 by Joseph Spratt as the Albion Iron Works. It was a beneficiary of the policy of Colonial Governor Douglas of British Columbia to curb the influence of the United States in the late 1850s on the emerging west coast colony and, in particular, with regard to the Cariboo Gold Rush and the development of the Fraser River. Albion's first yard was established on the south bank of the Inner Harbour at Victoria, at Point Ellice, and began by making boilers, engines and piping for the early B.C. steamers. The first hulls were made of wood. By the turn of the century, it was building a variety of ship types including a sternwheeler, SS *Mount Royal,* designed by Alexander Watson for the Hudson's Bay Company's west coast activities fleet on the Skeena and Stikine Rivers.

However, by 1888, Joseph's son Charles Pratt was managing Albion, and it had merged with the Victoria Machinery Depot, taking the VMD name. During World War I, it operated a shipyard on the Songhees Indian Reservation under the name of the Harbour Marine Company, and continued to build cargo ships and barges there for several years after the War ended.

SS *Mount Royal*

Charles' health began to decline in the 1920s and his wife, Marguerite took charge of the company at Ogden Point and led it through the lean Depression years and the very active ones of World War II, during which VMD built cargo ships, tankers and naval vessels for the RCN. She died in 1946 and her controlling interest passed to business associates, including Harold Husband, who assumed charge of the company's operations.

Over the next quarter century, VMD built a wide variety of ships, including many of the original B.C. ferries, a large number of barges, cargo ships, tankers, passenger and naval vessels and including a large semi-submersible offshore oil drilling rig for Shell Canada. At its peak, employment was around 1,000. Shipbuilding at Ogden Point stopped in 1967, as orders for new vessels dried up, and the yard was closed. The company retreated to its original engineering factory at Point Ellice where, among other products, it supplied equipment to the Alberta oil and gas industry.

Husband sold the company in 1981, and the new owner sold it in 1984. It was in receivership by 1985, but some employees took it over in 1986. By 1994 it had closed for good.

The Cockshutt Plow Company...

of Brantford, Ontario. The first successful Cockshutt in Brantford, Ontario, was Ignatius, beginning in 1832 with his general store and ending with his death in 1901. His considerable business abilities also assisted his sons in their engineering endeavours, as well as members of the Waterous family, who engineered mill, steam, agricultural and other products at Brantford.

His eldest son was James Cockshutt, who had apprenticed at Waterous, and who had set himself up in business in 1877 to manufacture 'walking' plows and other tillage equipment. By 1882 he had designed and successfully manufactured 'sulky' or 'riding' plows - so named because the plowmen rode on them - designed for the new farms that were opening up in the Canadian West and to benefit from Sir John A. Macdonald's National Policy.

It is important to realize that, for many years, as farming was developing in the eastern and western parts of the country, settlers/farmers bought their machinery on time, with harvest-dependent 'farmers' paper,' with the result that its manufacturers had to hoard cash carefully to tide them over until the debts were paid. One result in the Cockshutt case was that the family depended on dividends and not salaries for income.

James Cockshutt died in 1885 at the very early age of 32. For the next three years his brother William reluctantly led the company before leaving to manage another Cockshutt enterprise and to run for Parliament. Their brother Frank then became president and served until 1911. His main competition came from the Massey and Harris Companies, which merged in 1891. In 1892 Cockshutt opened its first western sales branch, in Winnipeg. In 1896, having outgrown its initial plant in Brantford, Cockshutt Plow built a new one, taking advantage of the new electrical technology in its production. This plant, too, was later expanded several times.

Steam tractors were now being used for ploughing and other jobs on farms on the Prairies in place of horses and could pull larger plows. Cockshutt responded by designing and making disc plows in gangs for various numbers of furrows. But they did not make tractors. Waterous did, for example. By 1911, internal combustion-driven tractors had begun to replace the steam ones.

By 1911, Harry Cockshutt had replaced his brother as president and served until 1934, when he became chairman. Along the way he also served as president of the Canadian Manufacturers' Association, on several boards of directors, and was Lieutenant-Governor of Ontario from 1922 to 1927.

By 1911, also, the company under Harry was restructured. It acquired a share of Frost & Wood of Smith Falls and the right to sell its agricultural products - mainly, reapers and binders - in Western Canada. The Adams Wagon Company and the Brantford Carriage Company were also acquired. Both were active in the west, and Brantford in the east. They were merged as subsidiaries under the Brantford name. Harry also brought about the refinancing of the now larger Cockshutt Plow Ccompany.

During World War I, Cockshutt Plow experienced steel shortages for the first two years, but stayed with its regular products. Farm machinery was exported to Britain. The Frost and Adams units, however, were extensively involved making munitions.

Between the wars, the fortunes of the Cockshutt companies were reflected in the fluctuations of the economy in general, and especially its western component. Its major product problem was the lack of a domestically-made gas-driven tractor. In 1929 it made an arrangement to use American Allis-Chalmers (A-C) tractors. Also, in 1929 the Great Depression began, mixed in with drought in the case of the Prairies.

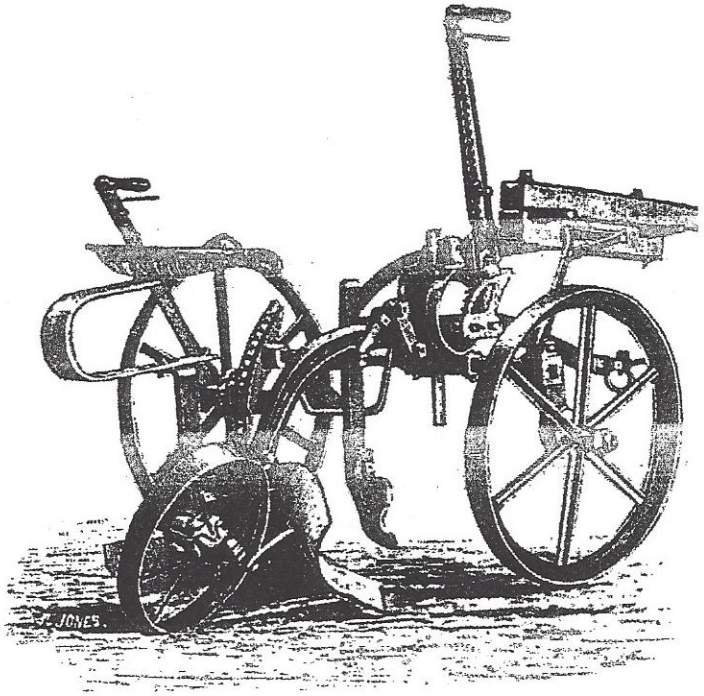
The company was still surviving when Gordon Cockshutt, son of Frank, became president in 1934, serving until 1958 and from 1944 until 1960 as chairman. His first major problem was the poor performance of the A-C tractor. In 1935, at a time when the outlook was becoming brighter and its dealer network was being revived, Cockshutt signed an agreement with the Oliver Farm Equipment Company to use the Hart-Parr Oliver tractors in Canada. It was non-exclusive, but worked well and lasted until 1946.

In 1939, World War II brought changes to Cockshutt. Steel again became scarce and production levels dropped. Brantford went into the airplane business, employing women as well as men. They covered the wings and fuselages with canvas for the likes of *Ansons* and *Mosquitos* and machined and built undercarriages for these planes and for *Lancasters*. They also made engine manifolds. Frost & Wood made armaments, but they also made swathers for the western wheatfields. Brantford Carriage made army vehicle and ambulance bodies. And during the war, in secret, Cockshutt began the development and design needed to manufacture their own brand of tractor, although it had an American engine and other bought-in components. In 1946 the first tractor series went into production. It had a new feature, a Brantford-designed live power take-off (LPTO). This allowed engine power to continue to be delivered

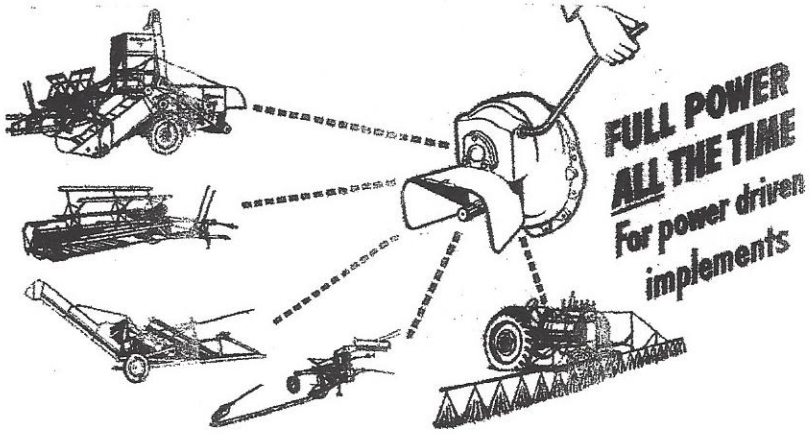
to whatever implements a tractor was pulling after the clutch had been disengaged. This put Cockshutt ahead of its competition. However, this Brantford innovation soon became a required feature of agricultural tractors. But Brantford engineers had also designed a supplementary gear assembly - the creeper gear - which doubled the number of forward speeds available.

Immediately postwar, Cockshutt also expanded its sales and dealer organizations across Canada and into the United States through the National Farm Machinery Co-operative. The Frost & Wood name was replaced by Cockshutt. However, the sellers' market had begun to taper off by 1953.

By 1958, business at Cockshutt had changed. The Frost & Wood production had been moved to Brantford. Some of the U.S. outlets were no longer operating. Two problems were uppermost: one, the relatively small size of family-owned Cockshutt in comparison with its U.S. competitors; two, the lack of another generation of interested Cockshutt men to carry on the business.



Riding plow



Live power take-off

Suffice it to say that, in 1957 and 1958 the company was the target of a hostile U.S. takeover, which succeeded. And although the production of farm equipment continued, the family connection was broken in February 1960. In December 1961, Cockshutt was sold to the White Motor Company of Cleveland, Ohio. The Brantford Coach & Body Company was unaffected by the sale to White. It operated until 1965.

The Dominion Bridge Company...

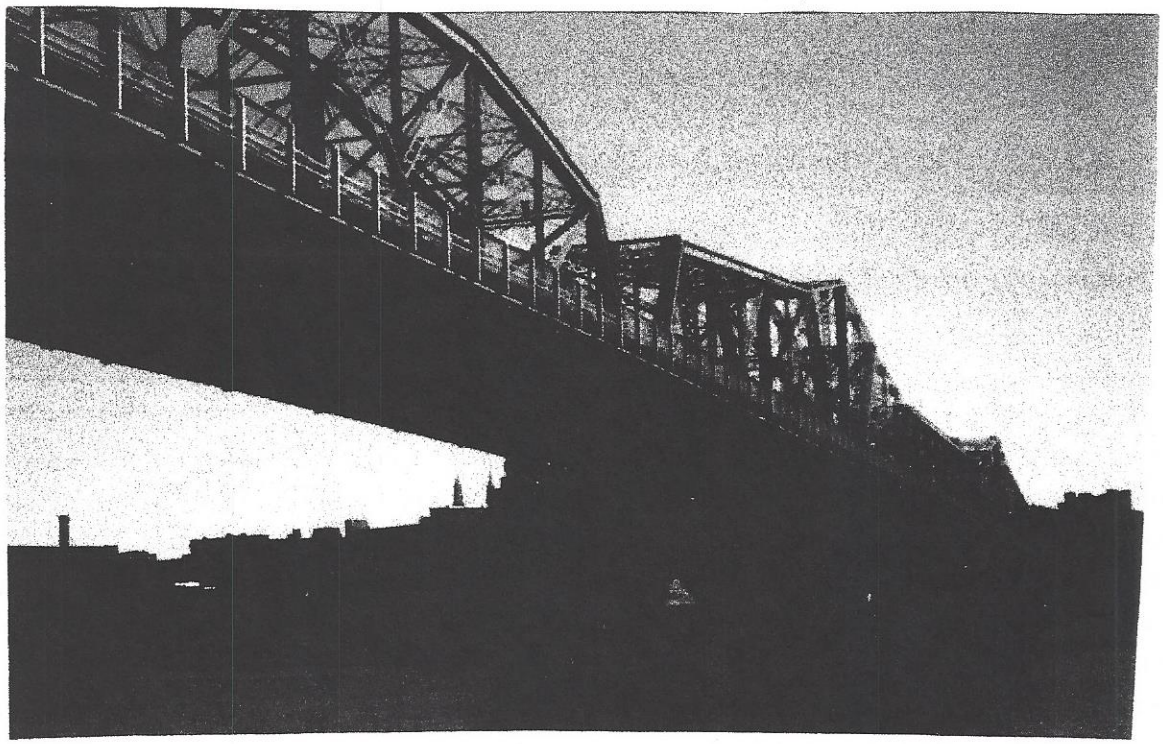
received a federal charter "to manufacture and erect wooden, iron and steel bridges, and to make and sell iron and steel throughout the country" in September 1882. This was a direct result of the Macdonald National Policy, with special reference to the building of the CPR line to the west coast. Dominion Bridge (DBC) built its first manufacturing facility at Lachine, Québec, to be near the headquarters of its best potential customers, the Grant Trunk and Canadian Pacific Railways. Initially, the Board (including those resident in Glasgow, Scotland), as well as the senior executives, were involved in the decisions made on bids, project details, costs, profits etc.. The first chief executive was a multi-talented, well-travelled American, Job Abbott, who had presided over the earlier Toronto Bridge Company.

Throughout the early years of the DBC, iron and steel products were imported from Britain and the United States, and mainly from the former during the years of the National Policy. Canadian steel-making only became significant after the turn of the century.

Among the DBC's early bridges were the Reversing Falls Railway Bridge at Saint John, New Brunswick (1883), and the Côteau Bridge, at Lachine, Québec (1886). Abbott's presidency ended in 1890, when he returned to the U.S. and became a consultant. James Ross was president for the next 23 years.

The challenge of the transcontinental railways for the bridge builders, and especially through the mountains, was to design and build iron and steel bridges where once wooden ones would have sufficed. In 1893, for example, DBC built a steel bridge at Stoney Creek, between Revelstoke and Golden in B.C. to replace the original wooden structure. In addition to the increasing lengths of bridges, they had to accommodate heavier locomotives and longer trains. Having no computers to test their designs, engineers had to rely on their own experience and the experience of others. In the 1890s, also, DBC provided the steelwork for a number of large buildings, including the Chateau Frontenac Hotel at Québec, the Royal Victoria Hospital in Montréal, the original Massey Hall and the 'old' Toronto City Hall, and Union Station in Ottawa. DBC also built the Alexandria Bridge across the Ottawa River, provided the steelwork for the Peterborough and Kirkfield Lift Locks, built the structures for the Windsor Station in Montréal and the Legislative Building in Regina.

In DBC's early days the leading engineers included Abbott and Ross, George H. Duggan, Eli Adler, W.S. Thompson, and especially Phelps Johnson. In 1913 Johnson followed Ross as president. Ross had also served as president of St. Lawrence Bridge, a partnership between DBC and Canadian Bridge formed to rebuild the Québec Bridge after its 1907 collapse.



Alexandra Bridge, Ottawa-Hull

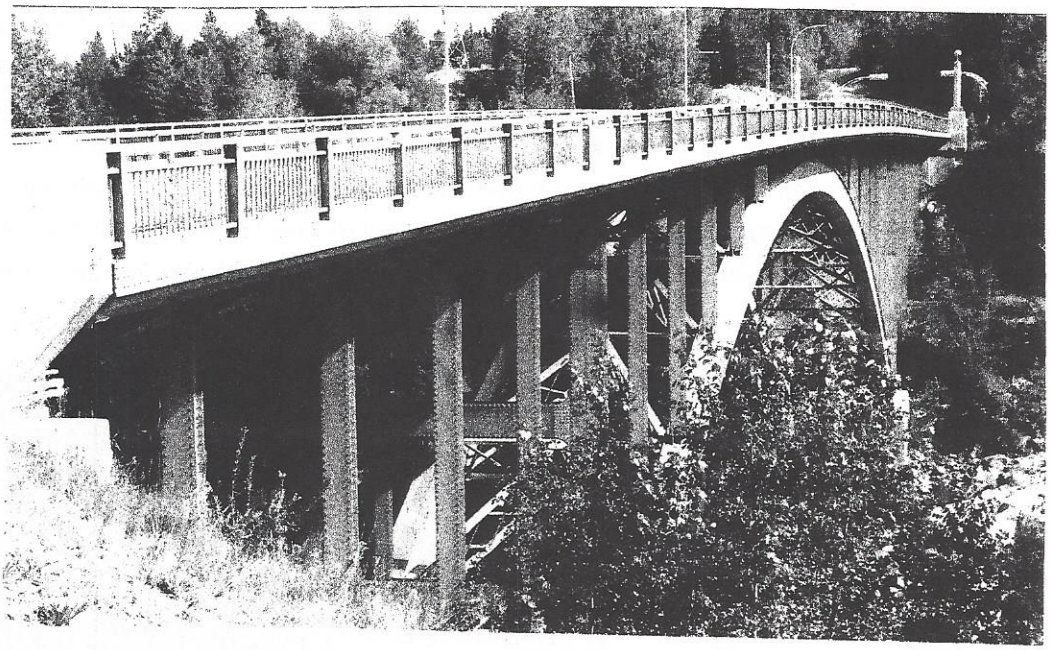
Phelps Johnson was president until 1919, including World War I when the company turned its attention to the production of shells, ships, cranes and miscellaneous armaments. The bridges built ranged from the Lytton Arch Bridge in B.C., the Kildonan Swing Bridge in Winnipeg, the Dorchester Bascule Bridge at Québec, the Highway Arch Bridge at Saint John and, in 1917, it finished the Québec Bridge. It also participated in the reconstruction of the Centre Block of Parliament in Ottawa after the 1916 fire.

Duggan's years as president of DBC, from 1919 to 1936, included the postwar recession and recovery in the 1920s...and the worst years of the Depression. The pre-Depression years saw the building - for example - of extensions to the Chateau Frontenac Hotel at Québec, City Hall and the Mount Royal Hotel in Montréal, the Chateau Lake Louise and Banff Springs Hotels in Alberta, Toronto's Royal York Hotel, the CNR Station and the Nova Scotian Hotel in Halifax, the Palliser in Calgary, the Hotel Vancouver and that city's Marine Building, and the Empress Hotel in Victoria. The company's work on Maple Leaf Gardens in Toronto, the Sun Life Building in Montréal, the Bessborough Hotel in Saskatoon, the Dorchester Boulevard Viaduct and the Mercier Bridge at Montréal, the Île d'Orléans Bridge downstream from Québec and the Lion's Gate Bridge at Vancouver helped the company recover from the Depression, by which time William F. Angus had replaced Duggan as president, who moved up to Board Chairman.

World War II saw DBC turn its attention once again, but to a larger extent this time, to the production of armaments, ships and ship repair, engines, boilers and condensers, anti-aircraft guns and drydocks. It also took a part in the construction of the Shipshaw hydro-electric plant in the Saguenay region of Québec in support of the production of aluminum at Arvida.

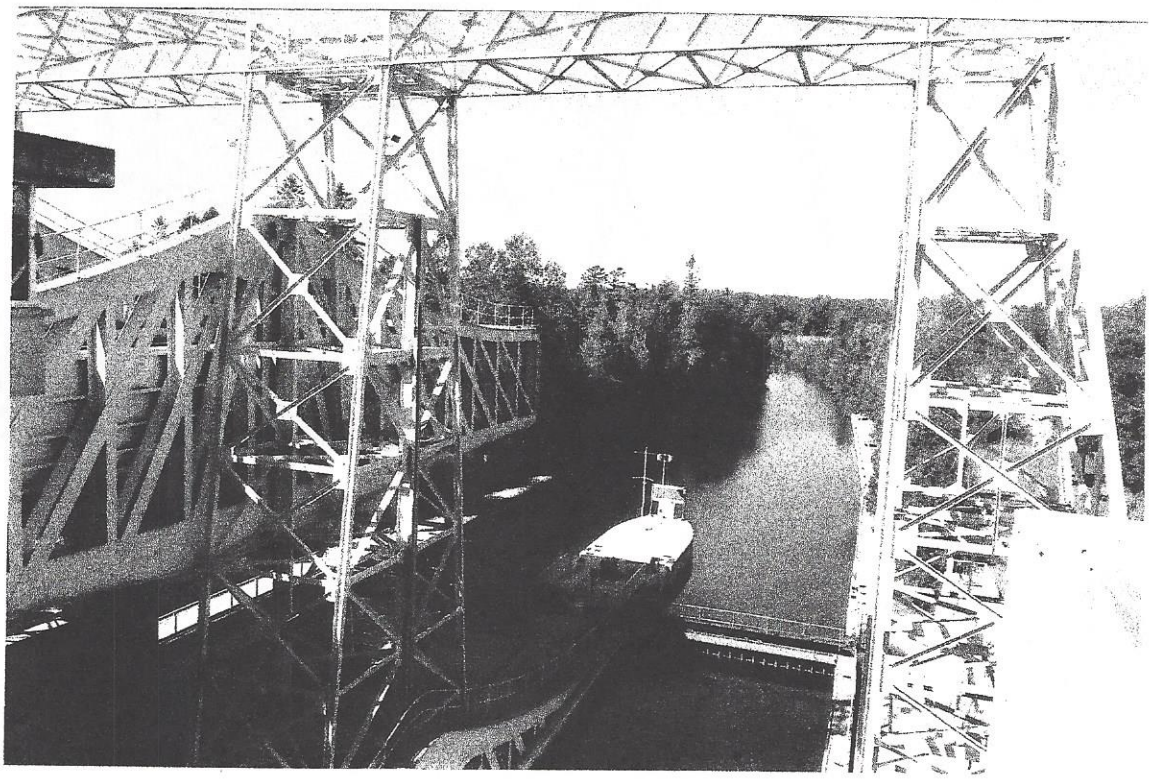
In 1951 Angus was replaced by Whitham Taylor-Bailey as president. That year, DBC completed the

construction on the Saguenay, close by Shipshaw, of the world's longest aluminum bridge, notable also for the riveting technique for it developed by the company. DBC's major projects included the Angus L. Macdonald Bridge at Halifax, the Queen Elizabeth Hotel in Montréal, the B.C. Electric Building in Vancouver and the Burlington Skyway at Hamilton. During the mid-to-late 1950s, DBC also participated in the construction of the St. Lawrence Seaway, providing components such as bridges and lock gates, and the twin lift bridges for the Jacques Cartier Bridge.



Aluminum Bridge

Shipshaw



Kirkfield

Liftlock

Hubert G. Welsford became president in 1958 and served for five years, during which it built the Lion's Gate Hospital and the first Port Mann Bridge in Vancouver, and the Bras d'Or Lake Bridge on Cape Breton Island. Mackenzie McMurray replaced Welsford in 1963 and served until 1974. It was during this period that DBC's projects began to include more industrial plant and equipment as well as bridge and building structures. Among the bridges were the twinning of the Mercier at Montréal, the Macdonald-Cartier at Ottawa, the Laviolette at Trois-Rivières, and the buildings included Sir George Williams (now Concordia) University in Montréal, the Toronto-Dominion Centre and Commerce Court in Toronto, and the West Coast Transmission Building in Vancouver. Among its other projects were the NRC's radio telescope in Algonquin Park, the Kitimavik Pavilion at EXPO 67, the world's first zirconium reactor calandria for Taiwan, the basic oxygen furnace plant for Algoma Steel at Sault Ste. Marie, 90 miles of transmission towers for Calgary Power, Sportsplex facilities at Lethbridge for the 1975 Canada Winter games, a municipal incinerator for Montréal, and the iron ore concentrator plant for Cartier Mining at Mount Wright, Quebéc.

Laviolette Bridge,

Trois-Rivières

By 1972, DBC and the subsidiaries it had by then acquired employed 7,500 people in 19 facilities in Canada and four in the United States. Yet there was uncertainty about the direction in which the company should go. The U.S. appeared to provide more opportunities than did Canada in terms of

market size and stability, productivity and labour costs, and its revenues from outside Canada were increasing faster. In 1974, Kenneth S. Barclay replaced McMurray as president and CEO, and promised that the situation for DBC would improve. By 1977 he was *chairman* and CEO and had begun the move into the U.S.. While the head office remained in Montréal, the main administration moved to Hanover, New Hampshire, within easier reach of New York and Boston.

Backtracking for a moment, in 1969 DBC had sold its subsidiary, the Dominion Engineering Works, to Canadian General Electric and had the resources with which to acquire additional companies, which it proceeded to do, beginning in 1971, including several large American manufacturing companies with greater product diversity. By 1981, to reflect its growing presence and activity in the United States and around the World, the company became the U.S.-based AMCA International.

Begun by an American, the company ended by becoming American!

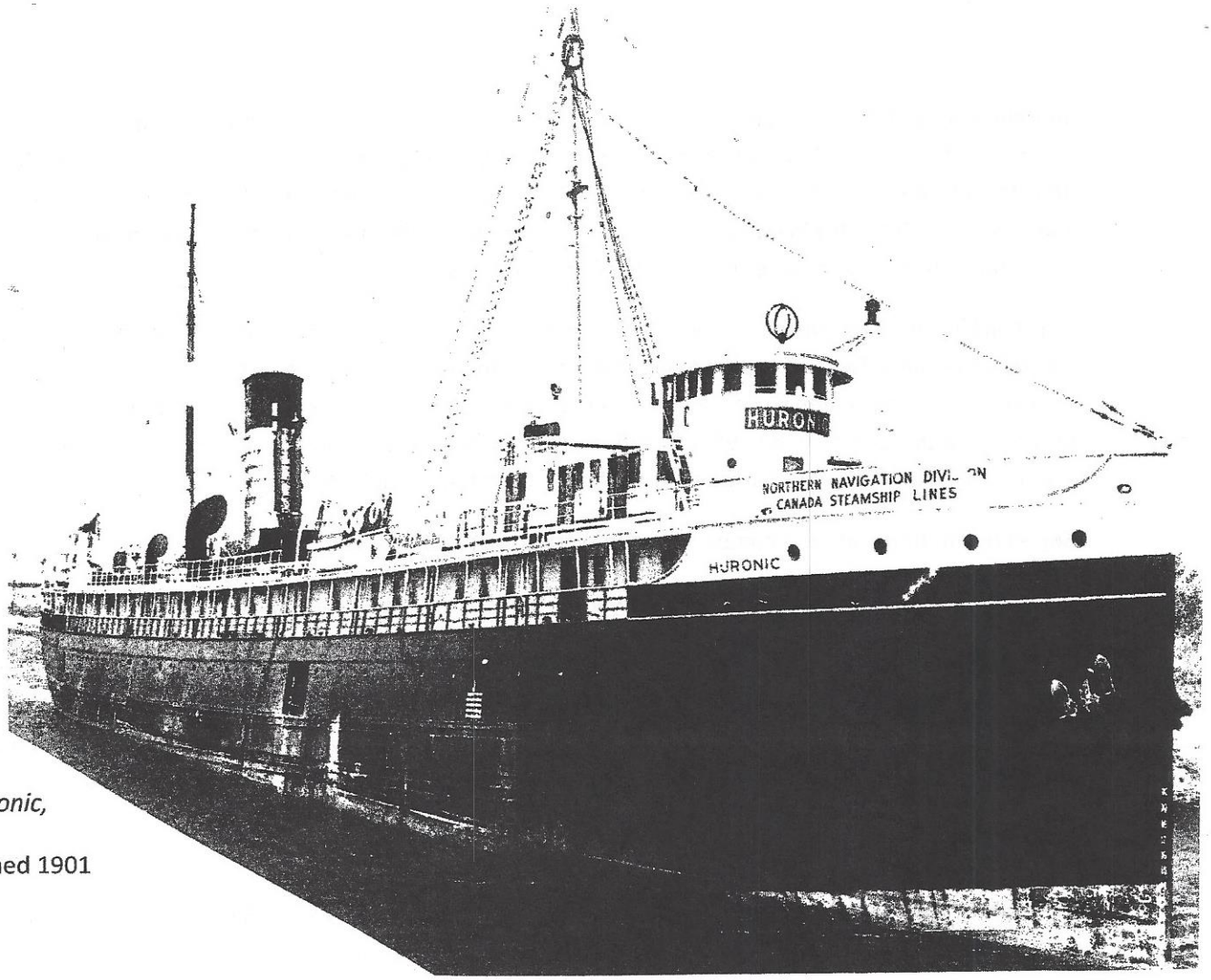
The Collingwood Drydock, Shipbuilding & Foundry Company...

of Collingwood, Ontario, was also founded in 1882, by J.D. Silcox and S.D. Andrews and their partners. Part of the attraction of Collingwood for such a facility was its access to Georgian Bay, Lake Huron and the West - as well as competition for the shipbuilding facilities at Owen Sound. A drydock was built and opened in 1883 as the Queen's Drydock. Ship repair and building began slowly and included sail- as well as steam-driven craft. However, the facility did not prosper and was turned over to the Town Council in 1889, who leased it out for the next dozen years.

By 1892 it was known by the shortened name of Collingwood Shipbuilding. Its core business was building vessels for service on the Great Lakes and ships for the Royal Navy. It also specialized in launching its ships sideways.

In 1894 the yard lengthened the *City of Midland.* It built the wooden-hulled *Majestic* in 1895 and the *Germanic* in 1899. All of these vessels later perished in fires. In 1900, the company name became the Collingwood Shipbuilding and Drydock Company. The next year the company was purchased and the enlargement of the facilities began. The new drydock was 500 feet long.

The core of the new company's business became vessels for the Great Lakes that could also fit into the Welland Canal and, later, the St. Lawrence Seaway. The first of its steel-hulled ships was the *Huronic* (Hull 1), launched in 1901. The company also adapted existing ships to fit the pre-Seaway Third Welland Canal and St. Lawrence locks. The *Agawa* (Hull 2) was built as a towed barge in 1902 but converted to a steamer in 1907. The third vessel, the 395-foot long *W.D. Matthews* was built for the St. Lawrence and Chicago Steam navigation Company and launched in 1903. It was later purchased by the Canada Steamship Lines (CSL) and in 1926 became the *Brentwood* and, several years later, was one of the first to transit the new Welland Ship Canal. The *Emerson* was the 108-foot Hull 5, a tug launched in 1903. It delivered barges to St. Lawrence ports and across the Lakes. The only order in 1905 was for the scow



Hull 1:

SS *Huronic,*

Launched 1901

that became Hull 7. Hull 8, in 1906 was the barge *Ungava.* Launched in 1907 as Hull 12, the oldest surviving Collingwood vessel in 1992 was the tug *Helena*.

By 1905 the shipyard had 200 employees. This figure reached its maximum during World War I, when almost 1700 were employed, although some were working on armaments.

Around 1907 also, quite a number of scows were built. The larger ships included CSL's 400-foot SS *Collingwood* (Hull 17), launched in 1907, and the *Hamonic* (Hull 22), a combination passenger and freight carrier. In 1910, the Collingwood yard built its first 500-foot bulk carrier, the SS *Emperor* (Hull 28). Hull 31, the 212-foot lighthouse tender *Estevan,* was launched in 1912 and sailed 17,000 miles to its post on the west coast by way of the Straits of Magellan. It was retired in 1969 and scrapped. The 550-foot freighter *James Carruthers* was launched in May 1913 and could handle 10,000 tons of cargo. It sank with all hands in a storm six months later. Hulls 39 and 40 were 200-foot long dredgers built in 1914 for the federal Department of Marine and Fisheries for service in the St. Lawrence. Both were out of service between 1917 and 1925 and saw limited service after that, until 1937. Hull 42, the *J.H.G. Haggarty* replaced the *James Carruthers* in June 1914.

The early ships built by the Collingwood yard were driven by reciprocating steam engines. But as the 20th century wore on, most were diesel- or steam turbine-driven.

The Collingwood yard built only a few ships during World War I. These included Hull 45, the *Royalite,* the first oil tanker to be built in Canada. Intended for the Great lakes, this vessel also served on transatlantic runs from Halifax during both World Wars. In 1917 the *Westmount* (Hull 48), another 500-foot bulk carrier was launched for CSL. Hull 51 was a small general cargo ship, *War Wizard,* built for the British Imperial Munitions Board and launched in 1918. It made a few trips before the War ended, was sold to Italian interests soon afterwards, and spent its working life sea-going under foreign flags. Collingwood also built eight large minesweeping trawlers during the War.

The immediate postwar years were busy ones for Collingwood. Between 1918 and 1921 Collingwood built nine freighters for the Great Lakes, each with *Canadian* in its name. In a few cases, building had been started by another company, which had gone bankrupt, and was finished by Collingwood. Hull 71, the *Charles Dick,* was a sand-sucking dredger built in 1922. Hull 77 was the ferry *Agoming,* built to serve Sault Ste. Marie. Hulls 80 and 86 were gatelifters, small and large, for the Welland Ship Canal, built in 1928 and 1930. Collingwood built few ships during the Depression. One was the *Wm. J. Stewart* (Hull 87), built for hydrographic research on the west coast and launched in 1932. Another was the HMCS *Fundy* (Hull 88, 1937), a small minesweeper for the west coast. The first cargo vessel in ten years was the *Imperial* (Hull 89), launched in 1938 for Imperial Oil.

During World War II, Collingwood shipyard built 23 warships for the RCN and the RN, mostly corvettes and minesweepers, mostly for Atlantic convoy service. Hull 90 for example, HMCS *Collingwood,* was the first Canadian corvette to enter service. Hull 98, HMCS *Halifax,* began life as a corvette in 1941 and ended it around 1955, having been converted into a cargo ship and sold to a foreign registry. Hull 99, which began life as HMCS *Woodstock,* ended up as a Japanese whale catcher. Most of the other vessels were broken up when their Navy service ended. Collingwood also built four ships for the U.S. Navy, and several cargo ships. The building of at least four ships was cancelled.

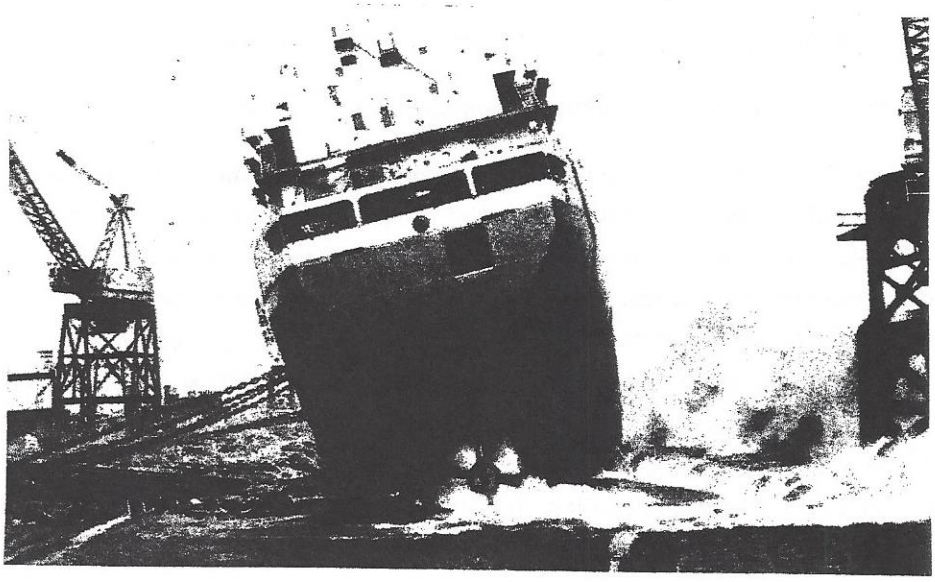
In 1945 the company was bought by Canada Steamship Lines.

The first of the post-World War II Great Lakes passenger ships, the *Norisle* (Hull 136), was launched at Collingwood in July 1946, followed by the tanker *Imperial Collingwood* (Hull 137) a year later, and two sister ships. They were followed by three hopper barges (Hulls 140, 141 and 142) and the double-ended auto/passenger ferry *James W. Curran* (Hull 143), launched in 1947 for service at Sault Ste. Marie. Hull 144, the *Hochelaga,* 639 feet in length, and the largest vessel built to date in Canada, was launched at Collingwood in August 1949. It was followed, between 1950 and 1955, by a number of similarly-sized tankers and freighters. The *John A. McPhail* (Hull 153), another Sault Ste. Marie ferry, was launched in 1955. However, this vessel lost its business there with the opening of the International Bridge in 1962 and, two years later, was itself lost in a storm on its way to service at Kingston. Hull 154, the *Montclair,* was the first Collingwood ship (general cargo) in many years to be registered in the United Kingdom, in 1956.

Hull 164, the *Murray Bay,* was the first Collingwood bulk carrier built (in 1960) to the new maximum length of 730 feet, made possible by the opening of the Seaway. From then until the shipyard closed in 1986, Collingwood built 24 more bulk carriers to this dimension, most of them self-unloading, including the *Tadoussac* (Hull 192), whose sideways launching began prematurely, resulting in two deaths, the *J.W. McGiffin* (Hull 197), which was the first to have all its cabins aft, the *John B. Aird* (Hull 224), the stern section of which was built at Collingwood and towed to the Lakehead, where the bow was attached, and the very last ship to be launched at the yard, the *Paterson* (Hull 231). Another ten vessels over 600 feet long were also built. Many were owned by Canada Steamship Lines.

Among the unusual, later, vessels were some that sailed the Maritime Provinces, the Atlantic coast and the Caribbean as well as the St Lawrence and the Lakes. Some were tankers, of different sizes, such as the 375-foot *Imperial Quebec* (Hull 161). Others included the passenger/ cargo ship *Taverner* (Hull 195, 190-feet long) which served the coastal communities of Newfoundland and Labrador, the Coast Guard survey ship *Nicolet* (Hull 183, 170 feet long), the bunker-tanker *Imperial Dartmouth* (Hull 196, 205 feet long), the twin 100-passenger Toronto ferries *Harvey H. Simpson* and *Gladys M. Simpson,* and the 365-foot *Chi-Cheemaun* auto-passenger ferry (Hull 205) that served between Tobermory and Manitoulin Island.

Collingwood Shipyard's business slowed through the 1970s. The yard closed officially on September 12, 1986. There was no single cause for this. Like many other yards around the world at the time, it was subject to a series of pressures, including shipbuilding over-capacity and the consequent lack of available business. Freighters, tankers and passenger ships were all getting bigger, and fewer were needed. Collingwood's employees dwindled from around 800 to 50 when the *Laurier* was finished and, eventually, to zero. It was simply too costly to keep it open. The city has since built a boardwalk at harbourside with individual inlaid plaques commemorating each of the 231 vessels.



Hull 222

SS *Atlantic Superior*

Launched (sideways) 1981

The Northern Electric and Manufacturing Company...

began life in 1895 in Montréal. It has since been known as Northern Telecom Limited (NTL), the Nortel Networks Corporation, or Nortel. Along the way, Bell-Northern Research (B-NR) was established in 1971 by Northern Telecom and Bell Canada but, beginning in 1996, was absorbed gradually into Nortel Networks. Nortel itself perished in the aftermath of the so-called 'dot-com' bubble at the beginning of the 21st century, compounded by the world-wide financial crisis of 2007-2009 and significant changes within the company itself.

In 1882, the Bell Telephone Company of Canada established a department to manufacture telephone sets. In 1895 this department was 'spun off' as a separate company - NEMC. Its products were expanded to include non-telephone lines. For example, in 1900 it produced the first flat-disc phonographs in Canada. In 1907 it opened a sales branch in Winnipeg. In 1913 it signed a reciprocal agreement with the AT&T manufacturing arm, Western Electric, governing patents and equipment purchases. In 1914 NEMC was amalgamated with the Imperial Wire & Cable Company to form the Northern Electric Company Limited, majority owned by Bell Canada, along with Western Electric and others. During World War I, the Canadian plant was involved in armaments production. By 1922, it was producing vacuum tubes for the growing radio market. By 1924, it had manufactured automatic telephone exchanges. During the Depression, Western helped Northern survive financially. Again, during World War II, the Canadian plant made war materials, including magnetron tubes for radar systems.

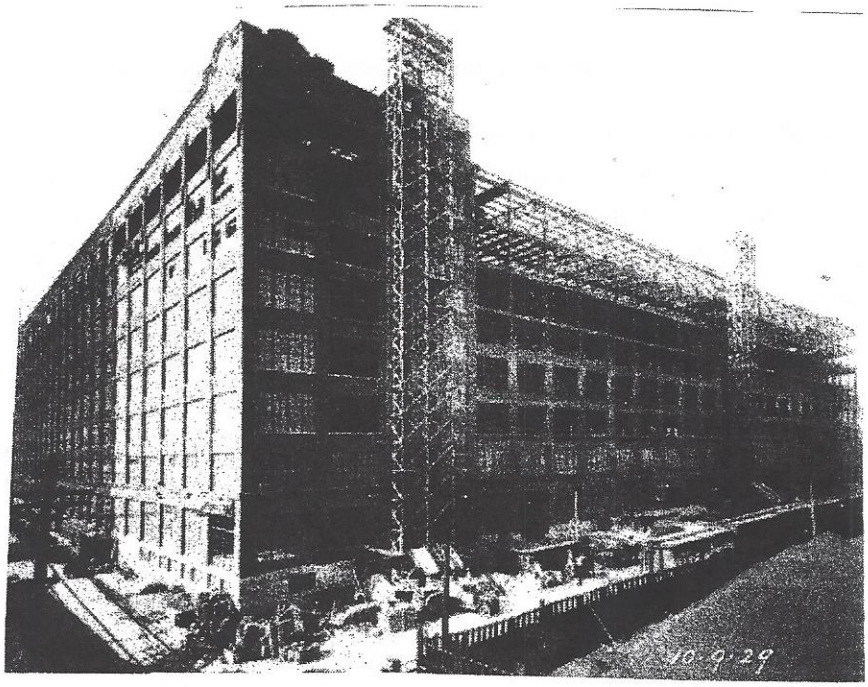
In 1947, Northern had opened a plant at Belleville to make switchboard equipment and, by 1953, the company was making TV sets, with RCA picture tubes.

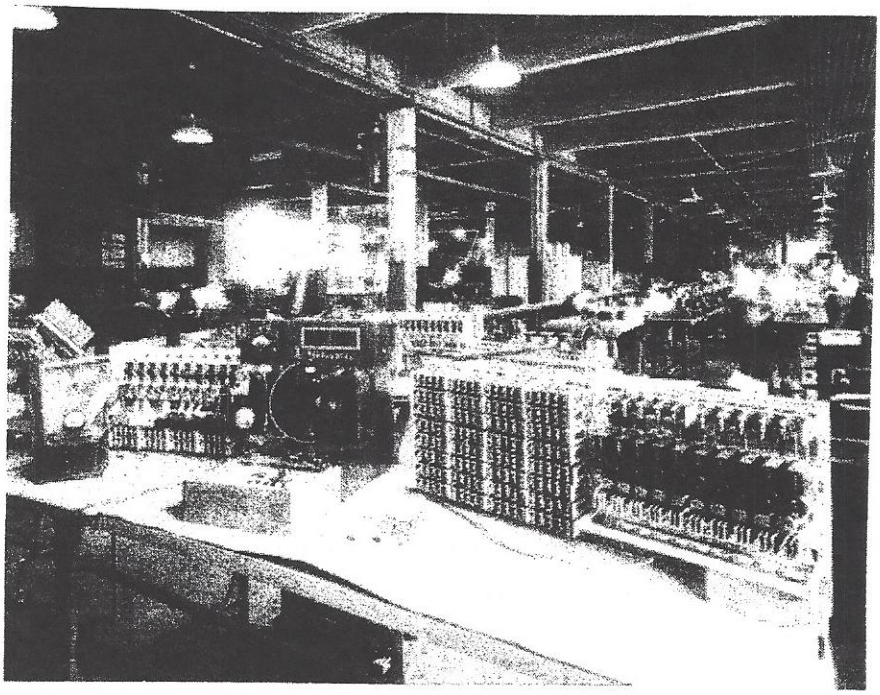
In 1956, a Consent Decree was signed by AT&T and the U.S. Justice Department which led to Northern Electric being separated completely from Western Electric. Northern was therefore faced with the prospect of 'going it alone' - and chose to do so. It disposed of its radio, TV, theatre equipment and household appliance production lines. By 1959, Northern had organized laboratories to coordinate the company's R&D activities in telecommunications. In 1960 it opened a telephone set manufacturing plant in London, Ontario; in 1963, one in Brampton to make switching systems; in 1965, an Advanced Devices Centre in Ottawa to make transistors and integrated circuits; and in 1966, at Saint John and Calgary.

In 1962, Northern Electric became a wholly-owned subsidiary of Bell Canada.

In 1969, Northern established MicroSystems International Ltd. as the manufacturing arm for semiconductors, but in 1974 'folded' it into its research arm, Bell-Northern Research (B-NR). B-NR had begun life as the N.E. Laboratories in 1966 but became B-NR in 1970, owned jointly by Northern Electric and Bell Canada. That same year, Northern Telecom Inc. was established as a wholly-owned subsidiary to make and sell telecommunications equipment in the United States. Two years later a plant was established in Malaysia and, three years later, Northern's subsidiary in Europe. In 1975, research centres were set up in Montréal and California, as were a U.K. Subsidiary and an Export Corporation. In 1976 the company became Northern Telecom Limited and, in 1978, established Northern Telecom International.

Northern Electric plant building under construction, Montréal 1929





Northern Electric products, Montréal plant

In 1980, Northern moved its headquarters from Montréal to Mississauga, Ontario, and later to Brampton. In 1983, Bell Canada Enterprises (BCE) was formed as the parent company for Bell Canada and Northern. Northern also benefitted market-wise from the complete 1984 break-away from AT&T. It even gained a foothold in Japan.

Throughout these years the company had digitized telephone communications and acquired international markets for its switching systems. The DMS-10, for example, was sold in Japan. The DMS-100 was a fully digital central office switch serving as many as 10,000 lines. An 18,000 line was installed in Brooklyn, New York. The DME-250 and 300 systems were sold in the U.K., and the Meridian SL-1 system to the Paris Stock Exchange. In 1988 the Norstar system was launched. In the 1990s, the company extensively expanded B-NR's Ottawa laboratories...and its international sales and reputation continued to grow up until the recession in 1993. By then it was beginning to feel the strains of size and rapid growth.

Northern's presidents/CEOs, from Keefler and Marquez, through Lobb and Vice, to Light, Fitzgerald and Stern, helped grow the company energetically but more or less conventionally. This changed in 1993 with Monty and Roth, and their successors, Dunn, Owens and Zafirowski. The long-time leaders of Northern's R&D and B-NR were Brewer Hunt and Donald Chisholm.

In 1995, Northern celebrated the centennial of its founding and its market growth resumed. It became Nortel Networks, or simply Nortel. The company had spent something like $1.4 billion the year before on R&D and an estimated 80 per cent of its products had come from work done by B-NR. At its height, Northern employed 95,000 world-wide, including 26,000 in Canada. For 1997, the company's revenues were $15 billion. Yet its business was changing. The Internet, wireless and broadband were on their way. Jean Monty, who became president in 1993, wanted to change its business from hardware to software. To strengthen and decentralize management, he established four 'lines of business' - each with a president. In 1996, he renamed B-NR Nortel Technology, bringing in Brian Hewat to be its chairman and chief executive, a position that had not previously existed.

John Roth was Nortel's president from 1997 to 2001. He viewed the company's business as the Internet-stimulated information transfer, and no longer voice transfer. He continued Monty's move to change the company from a hardware manufacturer to a software/digital systems designer and network builder, from internal growth to growth by acquisition...of hardware manufacturers, beginning with Bay Networks in 1998. In 2000, BCE distributed its holdings of Nortel to its stockholders.

However, by the late 1990s the Nortel's market was becoming saturated. By 2000 it had been caught up in the so-called 'dot-com' bubble. Its order book and its stock plunged. Roth retired in 2001 and was replaced first by Dunn...and a series of financial and other scandals, which Owens and Zafirowski were unable to surmount. But the company hung on until almost the end of the first decade of the new century. The world financial crisis that began in 2008 put an end to it. Nortel filed for bankruptcy in January 2009, selling off what assets it could - including 6000 patents – and leaving behind conditions that, in 2017, have not been fully cleared up.

The Foundation Company of Canada...

was established in 1910, when Franklin Remington brought his caisson-based Foundation Company from New York to Montréal to help with the foundations for the CPR's Windsor Station...and stayed.

A year later, young Canadian engineer Richard Chadwick, who had been working on bridges and docks for the City of Toronto and was looking for some fresh opportunities, joined the company in New York. During a lull in the work there, he was sent north to Montréal to be acting chief engineer of the Canadian operation. When its foundation work at the station ended, the company looked for - and found - other opportunities working on piers and bridges for the CPR. Gradually, and inspired by Chadwick's leadership, it acquired jobs in other parts of Canada. By 1919 he was manager of the Canadian operation and was broadening the company's engineering activities into building construction.

By 1922, Chadwick had established a subsidiary, the Construction Equipment Company (CEC), which supplied Foundation with equipment, but which grew into a Canada-wide equipment sales and rental company. During World War II, the Atlantic Tug and Equipment Company was established to extend CEC operations to floating construction equipment.

During its early years in Canada, Foundation hired talented men, such as V.G. Younghusband, Frank Gahagan, Fred Rutley, William Smick, Walter Griesbach and John Masterton, who spent the rest of their working lives with the company and made significant contributions to its engineering successes.

During World War I, activity in Canada declined for construction companies like Foundation, but picked up again when the War was over. In the 1920s, also, Chadwick, with the help of investment dealer V.M Drury who later joined the company as a vice-president, negotiated the establishment of the Foundation Company of Canada, with American participation, as a limited company specializing in heavy construction and industrial and building construction. But by 1929, the American company was folding. So the Canadian one bought it out and became independent. Its shares eventually became widely held. Interestingly, the Canadian company was soon undertaking work in the United States.

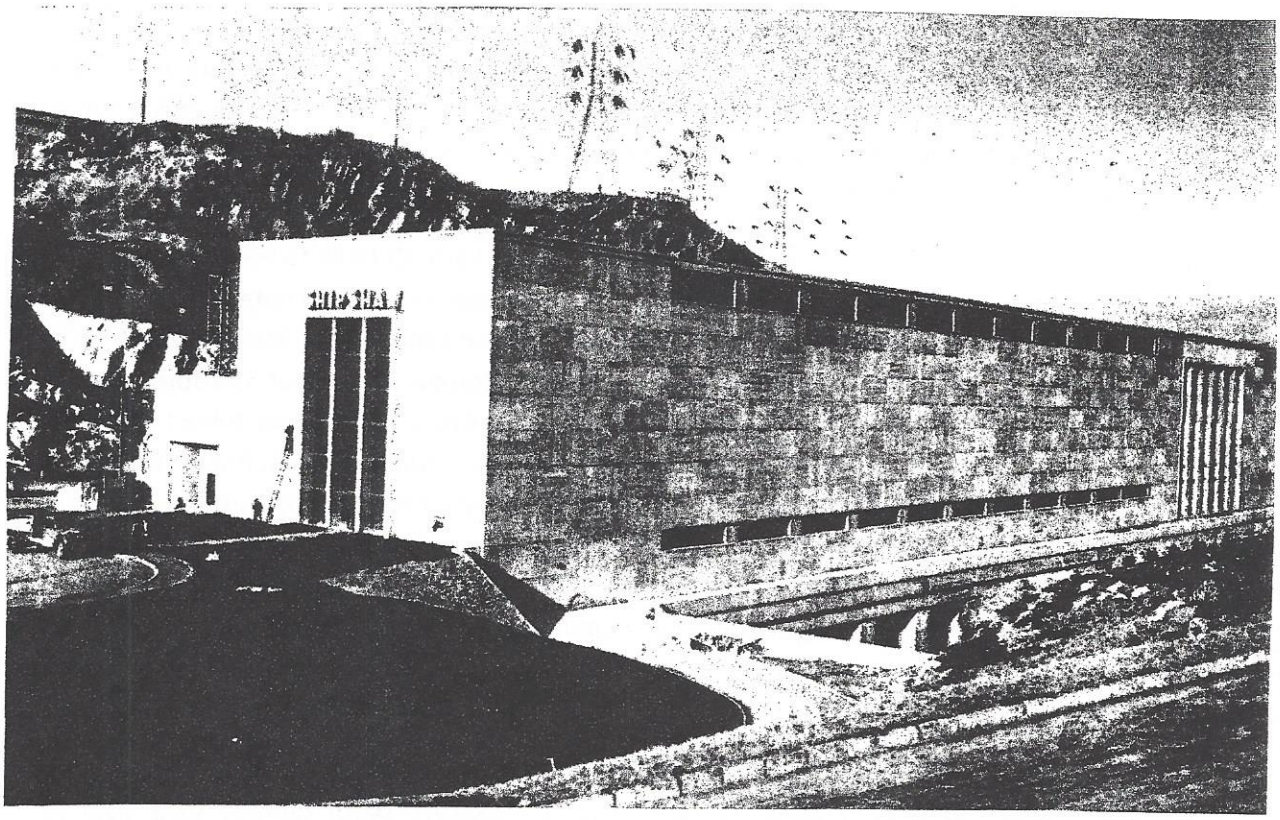
In the 1920s, the company focussed on the mining and pulp and paper industries and on hydro-electric projects. Still not very large in the years before World War II, Foundation worked, for example, on the piers for the Caughnawaga (later Mercier) Bridge at Montréal, built a paper mill for the Ontario Paper Company on the remote North Shore of the St. Lawrence at what became Baie Comeau, helped develop the Thetford Mines, built the Mercier Dam on the Gatineau River in Western Québec, as well as one of Canada's first earth-filled dams at the Ghost River project in Northern Alberta, and the Charlo Dam in New Brunswick. It also set up the company's second subsidiary, Foundation Maritime Ltd., in the maritime salvage business in Halifax. Its first tug was the *Foundation Franklin*. At one time, its salvage fleet was the largest on the Canadian eastern seaboard.

In 1935 Robert F. (Bob) Shaw joined the company as a recent McGill graduate in engineering and, over the next 30 years, made significant contributions to the company in ever more senior positions. In 1941,

Chadwick took the unusual, but significant, step of amalgamating the design and construction branches of the company. It took several years to prove this arrangement efficient.

Foundation's expertise was put to work in large measure during World War II. For example, it built the Shipshaw hydro plant on the Saguenay River to serve the huge Arvida aluminum plant, which the company also built. It undertook several shipbuilding efforts in the Maritimes, built a huge shell-filling plant at Cherrier, Québec, and paper mills in Northern Ontario, while Foundation Maritime provided rescues to over a hundred ships and salvage services along the Atlantic coast. Near the end of the War, Foundation participated in the building of the new nuclear research plant at Chalk River.

Challenges continued into the post-war years. Among them was the building of the Distant Early Warning (DEW) Line across 3,000 miles of Canada's north, for the U.S. Air Force, the construction of underground stations on the new Toronto subway line, and parts of its Gardiner expressway and extensions to the Dorval airport at Montréal. Foundation was also participating in the construction of the St. Lawrence Seaway and helped built the first Canadian nuclear power reactor at Rolphton, near Chalk River.



The powerhouse at Shipshaw

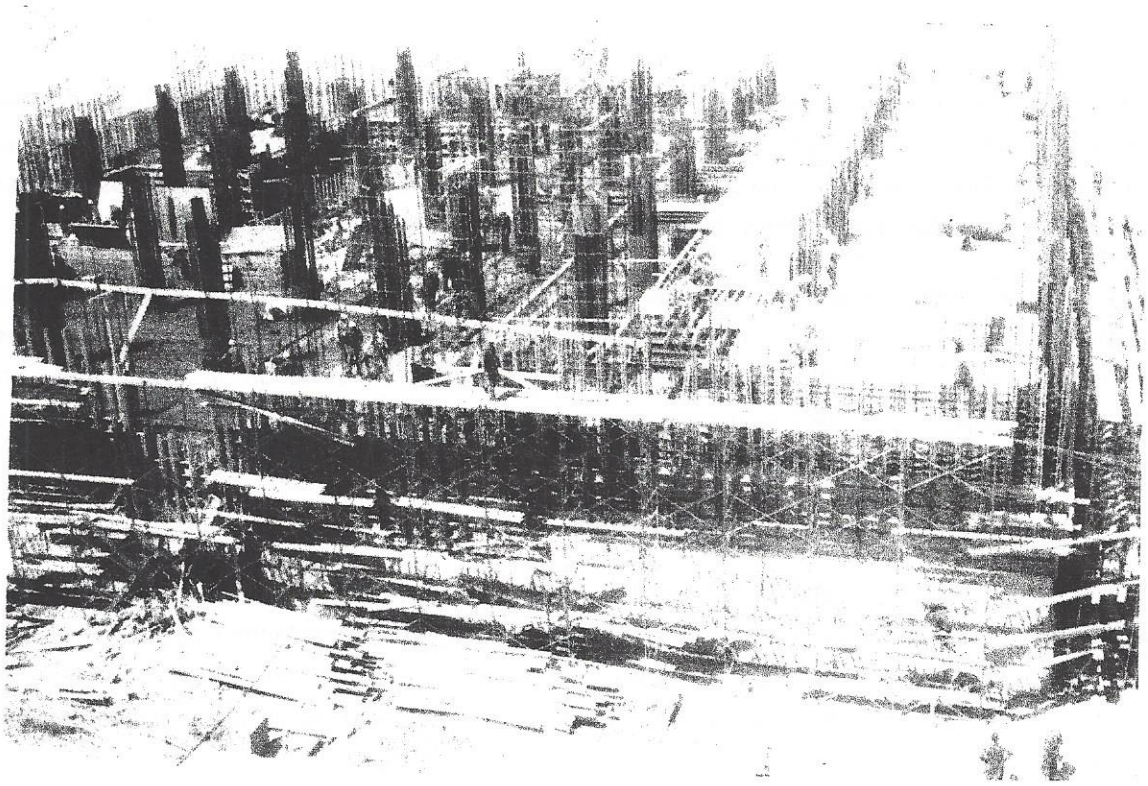
In 1953 the company formalized the earlier design-construction amalgamation by making it into a subsidiary, the Foundation of Canada Engineering Corporation Ltd., or FENCO, which provided consulting services beyond those required by the parent company. It also formed a subsidiary, Geocon, which capitalized on the company's soils expertise. In 1958, after purchasing the company, Foundation turned A.D. Ross & Company into an electrical and mechanical installation contractor.

In the 1950s, the company was also changing its top management. In 1952, long-time president Richard Chadwick became chairman and Fred Rutley succeeded him. In 1958 Rutley became chairman and Lionel McGowan president, with a shift in emphasis from heavy construction to commercial and institutional building - in keeping with a similar national shift. Also, late in 1961 the company found itself the subject of a blind take-over bid, which was successful and Slater Steel Industries (SSI) became the majority owner of the company, and began to change its management and culture in what turned out to be a period of tighter markets and diminished opportunities for profit. Rutley retired from the chair in 1962 and was succeeded by the chairman of SSI. McGowan retired as president in 1962 and was succeeded by Bob Shaw. However, Shaw was gone within a year,. The federal government had asked him to be deputy commissioner-general of EXPO 67. His replacement was Robert Armstrong, until 1966 when Calvert Baker took over.

In the 1950s, Foundation began to extend its reach overseas, taking part in such projects as the building of the Canada-India nuclear reactor at Trombay. Later, it built hotels in South America and provided partner support for the construction of a large irrigation project in Peru, the Mount Mauna Kea telescope project in Hawaii and the Bourguiba Flood Control Dam in Tunisia.

In the early 1960s, Foundation built the so-called 'Diefenbunker' at Carp, Ontario, to house the Canadian Government in the event of a nuclear attack on the Capital. The structure was also notable as one of the first to make use of computer calculations in its design and of the Critical Path Method (CPM) in its construction. Foundation also built the permanent Shakespeare Festival Theatre at Stratford. Prior to EXPO 67, it built Place Ville Marie in Montréal, including the rebuilding of the railway tunnel under the building, and contributed to the construction of Montréal's subway. Through the A.D. Ross subsidiary, it participated in the construction of the EXPO Express for the World's Fair. It helped extend Toronto's airport. Particularly through FENCO, it had started to provide specialized services to the oil and gas industry. Through subsidiary Foundation Developments Ltd., the company provided design and construction services for commercial developments. Foundation Maritime was gradually closed down and, by 1968, its salvage towing and docking operations had ceased. At the same time, CEC was wound down and, by 1975, had disappeared.

In 1968, SSI sold its stake in Foundation to a competitor, A. Janin & Company, and Foundation once again had construction-wise management. In 1971, Janin's chairman, Henri Gautrin, took over as president of Foundation and Baker moved up to chairman. Meanwhile, financial pressures mounted and the business of design and construction became more difficult still. In 1978, FENCO and Geocon were sold.



The *Diefenbunker* under construction, 1960

Nevertheless, in the 1970s and 1980s Foundation took steps to bolster its market position by undertaking both Canadian and overseas projects. It took part, for example, in two very large Canadian projects, the Asbestos Hill Development in Northern Québec, and the construction of the CN Tower in Toronto. In partnership with Canatom Ltd, the company formed Nuclear Construction Managers (NCM) and undertook the building of the Wolsung-1 reactor in Korea, which went critical in 1982. In the 1980s, it partnered with a Philadelphia-based contractor to form Energy Engineers and Constructors Inc. and undertook the rehabilitation of U.S. nuclear plants.

Foundation's success, however, had led in 1980 to a new partnership, this time with between the company and a group of Canadian investors allied with a leading Swedish contractor, Skanska, with whom Foundation had worked before internationally. In 1981 Rolf Kindbom (after 18 months as a vice-president) succeeded Henri Gautrin as Foundation's president. Paul Opler, a 12-year veteran of the company, became chairman of the Board for three years, being succeeded in 1984 by Andrew McCaughey, whose experience was in finance, but in the life insurance industry. The company created operating divisions to serve the domestic and international markets. In 1983, it established an operating subsidiary in the United States. It also acquired a controlling interest in the Jackson-Lewis Company of Toronto, whose long-time activities had centred on the construction of industrial and commercial buildings.

For the next few years, Foundation pursued opportunities large and small in Canada and abroad, alone and with partners. For the projects abroad, financing was sometimes provided by the Canadian

International Development Agency (CIDA). Projects in which the company participated included the Kiambere Hydro Project in Kenya, the Madura Oya Reservoir Project in Sri Lanka and the Sicomed Hospital in the Ivory Coast. Its Canadian projects included the development of coal deposits at Tumbler Ridge in B.C., wharf facilities at Digby, Nova Scotia, and the Prince Rupert grain terminal, again in B.C..

The end for the Foundation and Jackson-Lewis companies came in 1987 when they were acquired by the Banister Continental Corporation, with the involvement of Skanska. Banister later became the BFC Construction Corporation and was, in 1999, acquired by Ambro Construction. In 2001, Ambro became the AECON Group. As this paper is being written, the sale of AECON to Chinese Government interests is under federal negotiation/investigation.

Noorduyn Aircraft Limited...

was co-founded in early 1934 in Montréal by Dutch-born aircraft designer Robert Noorduyn, an engineer and pilot, with an artificial leg, who had worked for several prominent aircraft manufacturing companies in England and America, including the Dutch company, Fokker. His partner was Walter Clayton. By 1938, the company had become known as Noorduyn Aviation Ltd.. The only airplane it ever made was the *Norseman,* in various models.

While in the United States, in 1924 Noorduyn set up a company to manufacture Fokker aircraft and began designing new ones with his boss, Anthony Fokker. Two types were built, and found their way into Canada's far north in the 'bush pilot' era of the early 1930s. They later designed and built the Fokker Tri-Motor which also flew in the Arctic. This partnership dissolved in 1929 and Noorduyn went to work for Bellanca, where he got more design experience. In 1932 he was designing autogyros for Pitcairn. Two years later he left Pitcairn and came to Canada, where he saw an opportunity to design and build an airplane specifically for the far north. By 1935, the design of the first *Norseman* was ready - significantly, without the help of wind tunnel testing - and manufacture was begun at Cartierville, north of Montréal. It had an all-welded stubby, steel tube fuselage, with wood stringers and a fabric skin. The wing was of wood, with steel tubing for the flaps and ailerons, and it was also fabric covered. The plane also had floats. This Mark I aircraft made its first flight in November 1935 from the St. Lawrence. It was later tested on the Ottawa River for airworthiness. It was also fitted with skis and had a larger-than-usual cargo door. Early in 1936 it was purchased by Dominion Skyways of Rouyn, Québec.

This particular aircraft remained in service until 1953. It even appeared in the James Cagney film, *Captains of the Clouds,* in 1941. It was called the 'robust freighter,' the 'one ton flying truck' that was needed in the North.

The Mark II *Norseman,* of which three were built, had a more powerful engine and could use floats, skis or wheels.

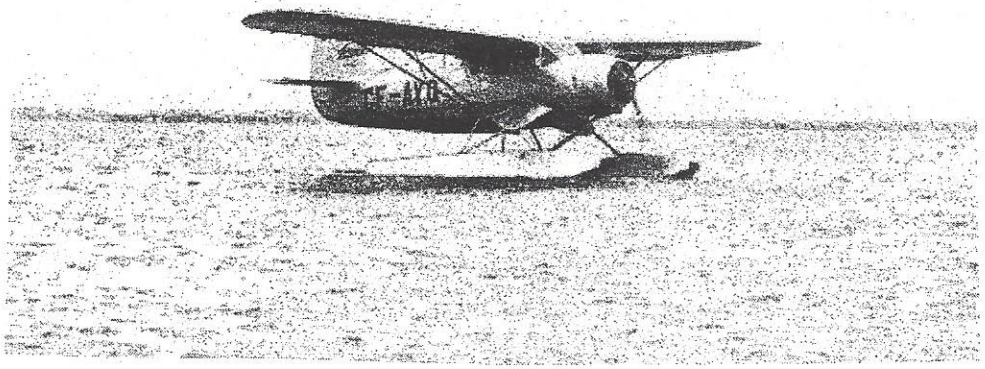
One of them, CF-AZE, has been immortalized in the famous Bob Bradford painting. Another, CF-AZA, was re-engined with a Pratt & Whitney for greater horsepower and, effectively, became the Mark III, which

Norseman I,

test flight,

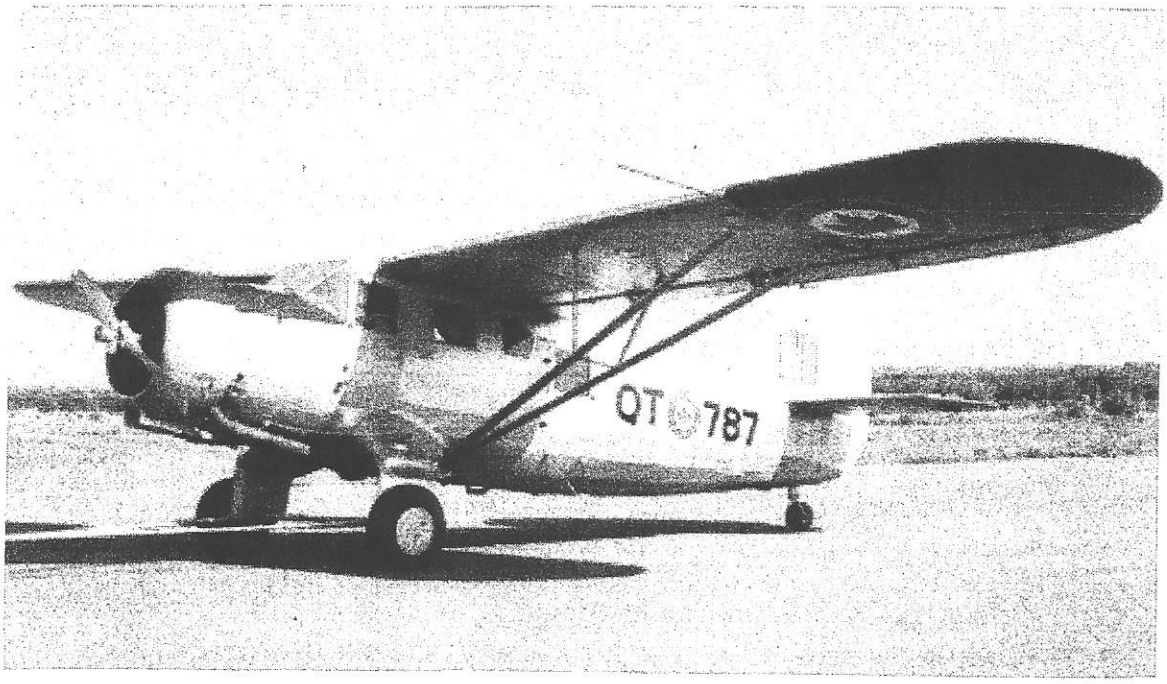
St. Lawrence

1935



Norseman VI

World War II



went into production. But it required a further P&W engine change, and became the Mark IV. By which time, World War II had begun and commercial deliveries were interrupted. The RCAF 'impressed' five *Norsemen* into service (including CF-AZA), and ordered more. In all, the RCAF ordered 74 of these aircraft. Later, the U.S. Air Force ordered 20 Mark VI *Norsemen* (Nooduyn temporarily skipped Mark V - for 'Victory'). The USAF liked it, and ordered many more. It became the first Canadian-designed aircraft to be adopted by the U.S. military. During World War II, *Norsemen* were also flown by the Australian, Brazilian and Norwegian Air Forces, and used in many more of the countries involved in the War. Its cruising speed was 150 mph, its ceiling 17,000 feet, and range over 900 miles. It was apparently in a *Norseman* that Glen Miller disappeared in December 1944.

After the War, surplus *Norseman* airplanes were to be found working around the world and, in some cases, becoming the 'founding' airplanes for new airlines. This surplus, however, was too much for the Noorduyn company to accommodate and the manufacturing rights were sold to the Canadian Car & Foundry Company, which put them into production. But after building 51 planes, CCFC, too, gave up. It did, however, design and build a prototype Mark VII, with an all-metal wing and a bigger engine, and more cargo space. However, the Korean War interrupted the CCFC's plans. Robert Noorduyn bought back the jigs from CCFC and started Noorduyn Norseman Aircraft Ltd. to make them. Unfortunately this plan stalled when Noorduyn died in 1959. However, the company built three new (post-war) Mark V airplanes and provided support for aircraft already in service, until 1982, when its assets were sold to Norco Associates, which provided service but no new aircraft. In all, a total of 904 *Norsemen* were built.

In Summary...

All nine companies no longer exist as Canadian entities. Perhaps we should be critical of them for disappearing, and of their managements for allowing this to happen. But perhaps we should also be celebrating what they did achieve while active and Canadian.

While the companies disappeared for different reasons, they had at least one contributing reason in common: the markets for their products changed, especially after World War II, and the companies could not/did not change accordingly.

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