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## **EIC's Historical Notes and Papers Collection**

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### **ENGINEERING HISTORY PAPER #71**

#### **“Forgotten Engineers”**

**By Andrew H. Wilson**

(produced as Cedargrove Series #46/2017 – Oct 2017)

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EIC HISTORY AND ARCHIVES

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## **Abstract**

The research for this paper was done as part of my sesquicentennial project on *150 Years of Canadian Engineering*. Some of the material has also been presented orally.

Those who know about the early history of engineering in Canada recall easily names such as Tom Keefer, Fleming, Gzowski and Kennedy, but are less familiar with those such as McTaggart, Gisborne, Schreiber, Haultain...and Tom's older half-brother Sam. This paper provides brief biographies, and some pictures, of a couple of dozen or so of the less well known (forgotten) ones.

Since most of those included were 'engineering' during more than one of the time periods I have used in reporting on the 'sesqui' project, they (with one exception) have been ordered by their dates of birth in this present paper.

## **About this 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 to chair the first history committee of the Canadian Society for Mechanical Engineering in 1975 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.

## Preamble

During 2016 and 2017, I undertook a 'sesquicentennial' research project that has examined aspects of the history of engineering in Canada from before Confederation in 1867 until the present time. The information so far collected for it has provided material for a number of background papers, of which this present one is the first. Some of its material was used in an oral presentation in June 2017 to the SAGE Kiwanis Group in Ottawa, and some has been 'borrowed' from earlier papers in my CGS Series.

In what follows, brief biographies have been written for more than two dozen engineers who have contributed significantly to Canadian engineering, but whose names are not often included in historical discussions. The list includes several who were born before 1867, but most of them made their main contributions to engineering after Confederation. None is still living. None is from the post-World War II generations, simply because they are not yet old enough to be considered 'forgotten'!

As a group, they represent only a miniscule part of the contribution of engineers to Canadian development over the years. Sometimes they were the boss, sometimes second-in-command but, in contrast to their bosses, have not been so well remembered.

Speaking of remembering, the reader should bear in mind that, before the turn of the 20<sup>th</sup> century, there were few electrical, chemical or aeronautical engineers in Canada, that most engineers of whatever discipline had no university training, and that many were immigrants.

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**John MacTaggart** served as clerk of works and senior non-military engineer to Colonel John By, when By was building the Rideau Canal. No photographs of him exist - he lived before they were developed. Nor have I been able to find sketches of his likeness.

MacTaggart was born in Kirkcudbrightshire, Scotland, in 1791, one of a farmer's 11 children. He acquired enough early education to enter the University of Edinburgh at the age of 18 to study mathematics and other subjects, but stayed for just a year. He then began to wander around Britain, learning engineering in a haphazard way that apparently included working under renowned engineer John Rennie the Elder. Apparently, also, Rennie the Younger recommended him in 1826 for service with Colonel By on the Rideau Canal.



He arrived at Bytown in August of that year and was immediately engaged in route survey work along the length and breadth of the proposed canal through the wilderness. He became thoroughly familiar with the impenetrable bush through which the canal was to pass and with the severe winter temperatures and the mosquito-ridden summers to which the Rideau constructors had to adjust. He quickly realized that engineering practice in Canada could differ from British practice, and set about learning and applying it.

He also explored local mineral deposits and had designed and built, by 1828, the first, spectacular eight-span Union Bridge across the Ottawa River linking the two Canadas at Bytown. He visited other canal sites in Upper Canada, and wrote and published numerous newspaper articles.

In 1828 he fell victim to the prevalent swamp fever...and got himself fired, allegedly for being drunk on duty. He returned to Britain, but with strong letters of recommendation from the Colonel and others as "an able practical engineer and geologist." In 1829, MacTaggart published a lengthy book on his three years in Canada, and for this is principally remembered. It is one of the earliest records of engineering in Canada. He died in Scotland in January 1830, at the early age of 38.

MacTaggart is one of the very few early engineers who *wrote*, leaving behind a record of what was being accomplished in Canada.

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Macaggart's successor as clerk of works on the Rideau Canal was another Scot, **Nicol Hugh Baird**, born in Glasgow in 1796, and son of Hugh Baird, an established canal engineer and builder. At the age of 16 he went to St. Petersburg, Russia, to an uncle who operated a machine shop, where he spent several years, returning home in 1816 for further training under his father. In 1828, with a recommendation from Thomas Telford, he came to Canada. He was immediately hired to replace MacTaggart, and spent four productive years on the Rideau Canal, acquiring along the way an interest in bridge-building. He received a patent for one of his designs.

In 1832 he surveyed the mouth of the River Trent, at one end of the proposed Trent-Severn Canal connecting Lakes Huron and Ontario. Over the next few years, he undertook survey and feasibility work on other parts of this canal. In 1836 he was appointed superintending engineer for the improvement of the Trent River and was employed part-time on these works until 1843. He was also involved in the survey and construction of the Whitby and Cobourg harbour, a survey of the Cobourg-Peterborough railway, and the construction of the Presqu'île lighthouse.





For a short period in 1840, he was the engineer for the Chambly Canal. Baird prepared reports on the Welland and St. Lawrence systems, taking account of the effect on them of the increasing use of larger steamers instead of sailing ships. He also designed and patented an improved paddle wheel for them. He became concerned about the employment of American engineers on Canadian engineering projects, and especially in times of fewer opportunities. Meanwhile, he acquired personal money problems!

Unemployed for two years after 1843, Baird then regained fulltime employment with the Board of Works of the Canadas, headed by his friend H.H. Killaly, and built roads and located railways in Québec.

Like McTaggart, Baird died young - and unemployed again - in 1849, in the United States, at the age of 53.

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**Hamilton Hartley Killaly** was born in Dublin, Ireland, in December 1800. A Trinity College graduate, he also learned canal engineering from his father. He served the Irish Board of Works from 1833 until 1834 when, doubting his future prospects, he moved to the U.S. for a short time and then to Upper Canada, where he farmed until securing an engineering post, just as railways were beginning to challenge the transportation capabilities of canals. This was in



1837, when Killaly began his association with the Welland Canal.

In 1838, Killaly was appointed to the post of engineer for the Welland. In 1841 he was appointed chair of the new Board of Works of the Province of Canada in Montréal. The following year he acquired responsibility for the Lachine Canal. He was, effectively, a supporter of the St. Lawrence canal system and an opponent of further work on the Trent-Severn Waterway.

Concurrently he was an executive counsellor and an elected member of the provincial assembly of Canada. But he found politics unattractive, resigned as a member and counsellor in 1843, but remained with the Board. In 1846, after a formal inquiry, during which Killaly's policy judgements were criticized, the Board became the Department of Public Works, with a politician as chairman. Killaly's work for it then became sporadic. He resigned in 1848, returned briefly to farming, but soon took Samuel Keefer's job as Welland superintendent (while Keefer went to work for the Department). However, in 1851 he was appointed assistant commissioner for public works and served until the position was abolished in 1859. He was then employed as a part-time inspector of railways. In 1861 he was appointed by the government to a commission of inquiry to examine the possible effects on Canada of what became the U.S. Civil War. The following year he was appointed to a royal commission studying the implications of that War on Canadian defence.

Killaly was a founding member of the (Sandford Fleming) Canadian Institute in 1849. He retired in 1862 and died twelve years later.

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There are several Keefers in Canadian engineering history. Father George was involved with William H. Merritt and the Welland Canal Company. Tom is the best known. His bio has been included in another of the 'sesqui' background papers. Charles was Tom's son, and **Samuel Keefer** was Tom's older half-brother.

Samuel was born at Thorold, Upper Canada, in 1811, the fourth son of George. From 1827 until 1833, he served an engineering apprenticeship with the Welland Canal Company, of which his father was president, but with two years out of it for other studies. His colleagues included veterans of the building of the Erie Canal in the United States. He was also introduced to the contemporary politics of his profession. As his DCB entry notes:



Expertise and political influence eventually carried Samuel Keefer to the top of his chosen profession, from which he fell from grace, only to be rescued by grateful political friends.

Sam's first job was political - secretary to a Lower Canada government commission on the improvement of navigation on the St. Lawrence near Montréal. He then returned to Upper Canada and, in 1834, was appointed an assistant engineer on the Cornwall Canal, where he remained until 1838. In 1839 he was appointed secretary of the Board of Works of Lower Canada. In 1841, at the age of 30, he became the chief engineer of the new Province of Canada Board, which became a Department in 1846 and, a year later, had acquired a broad mandate, including the completion of the St. Lawrence canal system. During these years, he oversaw different kinds of engineering work. In 1843, for example, he designed a suspension bridge over the Chaudière Falls at Ottawa and, from 1846 to 1848, enlarged the Welland Canal.



Keefer left the Department in 1853 to become a divisional engineer with the Grand Trunk Railway, and later its superintendent of engineering. Among his challenges was the location of the Victoria Bridge at Montréal, in which his brother Tom was also involved. He returned to the Department in 1859, to railway responsibilities, with particular reference to public safety. That year, also, Keefer became the deputy commissioner of public works. One of Keefer's early responsibilities was the design and construction of the new Parliament Buildings in Ottawa which, unfortunately for him, turned nasty politically. As a result, he retired to private practice in 1864.

One of Keefer's projects during this hiatus was the design and building of the second (Falls View) suspension bridge at Niagara Falls, which opened early in 1869 and was, at that time, the longest of its kind in the world. Unfortunately, as a result of circumstances beyond human control, it was destroyed in a storm in 1889.



In 1870, Keefer was appointed secretary to the Canal Commission by the Conservatives in Ottawa. His main achievement in this work, during the Liberals' term that followed, was the construction of the Dufferin Bridge across the Rideau Canal at Ottawa. In 1880 he was appointed to a Royal Commission into the Liberals' conduct of CPR affairs. After this, he became semi-retired, operating from Brockville.

Sam Keefer was another founding member of the Canadian Society of Civil Engineers, and followed his brother Tom as president. He was also a member of the British and American Civil Societies. He died in 1890.

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The names Daniel and Hart Massey are more clearly remembered than Alanson and John Harris. Yet they were competitively in the same business in Canada in the mid-19<sup>th</sup> century, although they had joined forces before the end of it.

**Alanson Harris** was born near Ingersoll, Ontario, in 1816. Self-taught, he began his entrepreneurial life as the owner of a sawmill but, in 1857, bought a foundry at Beamsville, where he manufactured agricultural implements. At first acquiring the Canadian rights to American patents, but doing his own design and development work as well, Harris built a thriving business in a growing industry. In 1863, his equally-entrepreneurial and mechanically-inclined son John joined him in business. In 1872 Alanson moved his operations to Brantford, then the third largest manufacturing centre in Canada, to better serve the emerging agricultural machinery market in the western provinces. His focus was on the development and production of harvesting machinery... mowers, reapers and self-binders.

By this time, too, Harris was in competition with Massey. Both of their companies had benefitted from the John A. Macdonald's National Policy, but had developed a rivalry just the same. In 1890, for the binder export market, Harris designed a new machine that allowed grain of any length to be cut and tied, giving him an edge in European markets where unbroken straw was re-used rather than burned. This worried Hart Massey, who initiated merger talks. And so, in 1891, the Massey-Harris Company was born.

Alanson Harris died in 1894. I have been unable to find a photograph or sketch of him.

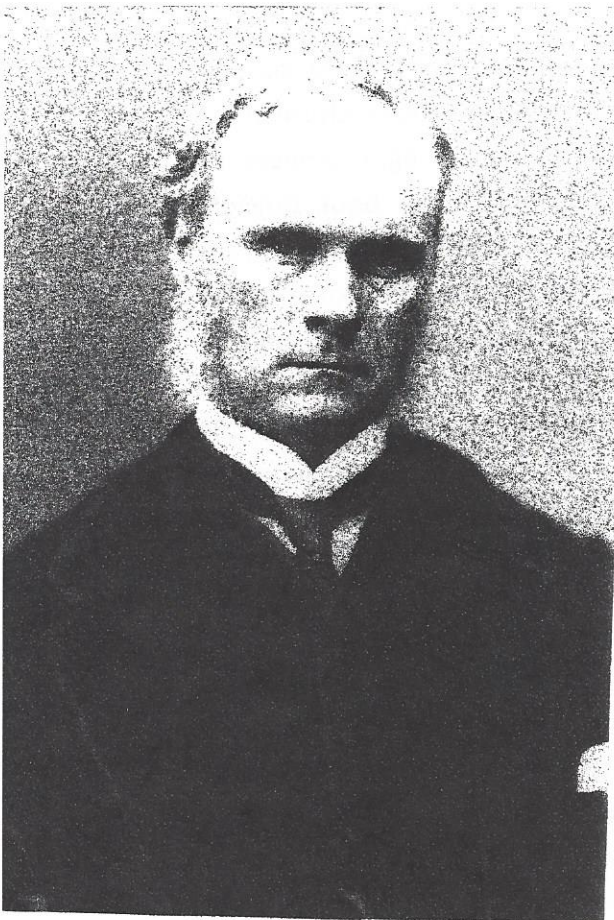
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The brothers **Walter** and **Frank Shanly** were born in Ireland in 1817 and 1820. In 1836, James Shanly - a lawyer - and his large family emigrated to the London area of Ontario, where they

became friends with Hamilton Killaly, who took Walter with him to the Board of Works in 1840 to begin his engineering training. A year later, he had joined the staff building the Beauharnois Canal. In 1846, Walter was assigned to the Welland, to work under Samuel Keefer.

That same year Frank got a temporary engineering position with the Great Western Railway. In 1847 he joined Walter on the Welland. A year later this work ended for both of them, when the Department of Public Works ran out of money. Frank then went south, to a job with the Northern Railroad in New York State, and shortly after that Walter joined him, in a senior position. It was during this time that the brothers established their engineering specialties, Walter for design and construction and Frank for management. In 1850, Frank moved on to canal work in Pennsylvania, where he stayed for a year. Meanwhile Walter, in 1851, returned to Canada as chief engineer for the Bytown and Prescott Railway.

From 1852 until 1856, the brothers served the Western Division of the GTR, Walter as chief engineer and Frank as a resident and, during this time, both worked closely with contractor, Casimir Gzowski. After this, Frank worked for Gzowski while Walter established himself as a canal and railway consultant. Frank also married. Walter did not.



Walter and Frank

Shanly





When his GTR work finished, Frank joined the Welland Railway for the next three years. , then became a contractor on the Toronto-Collingwood line. By 1862 the market for railway construction had been reduced by the American Civil War and Frank became a consultant.

Back in 1858, Walter had become general manager for the GTR, a position he resigned in 1862 as the railway went through difficult times. In 1863 he was elected president of the Edwardsburg Starch Company and held the position for 20 years, and he participated in the Mechanics' Bank in Montréal.

By 1863, also, Walter had turned to politics and was elected to the Province of Canada Assembly, followed by election to the House of Commons in 1867. Both he and Frank ran as Conservatives in the 1872 election, but both were defeated. As noted in my IEEE Canadian Review (Summer 2000 issue) of Richard White's biography of the brothers:

Walter's presence as a parliamentarian was appreciated and his committee assignments reflected his professional, consulting and business expertise. He spoke in the Assembly and the House principally when matters involving this expertise arose. He took little part in most debates on national issues.

The engineering project for which the brothers are perhaps best remembered was the six-year (1868-1874) building of the five-mile-long Hoosac Tunnel at North Adams Massachusetts - a reversal of the contemporary practice of employing American consulting engineers on Canadian projects! (The Hoosac story has been told by Frank Walker in his book *Daylight Through the Mountain*, published by the Engineering Institute in 1957.) However, Frank dissolved the partnership in 1871. Walter carried on alone, while Frank did railway construction work with a variety of partners - and acquired a lot of debt. Walter helped save him from this, but Frank's contracting days were over and he returned to consulting. In October 1875 he was appointed engineer to the city of Toronto. This 'political' job and the consulting he did 'on the side' were terminated in 1880 when he became chief engineer of the Intercolonial Railway and began commuting regularly by rail between Toronto, where he lived, and Ottawa, where the ICR work was. He died suddenly in September 1882 on one of these trips.

Walter retained his Commons seat during the Hoosac years, but was defeated again in 1874 as the project ended. He returned to full-time consulting and ran again, successfully, for the House in an 1885 by-election. He retained his seat in 1887 and was the Member who introduced the Bill that same year that established the Canadian Society of Civil Engineers - but, surprisingly, took no part in its debate. He was elected a founding vice-president of the Society, but was never its president.



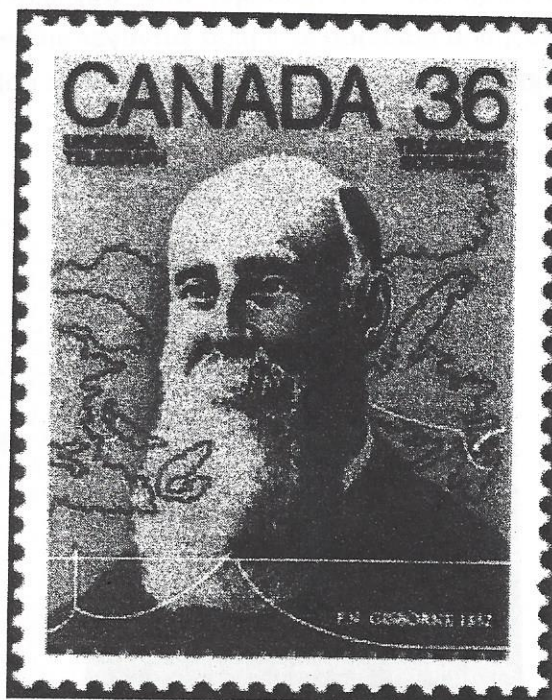
Walter's career began to wind down from this point. By 1887 he had also passed his 70<sup>th</sup> birthday. He retired from politics in at the time of the 1891 election, turned his hand to writing historical and biographical material, and took an interest in the CSCE's debates on professional status for engineers, led for many years by Alan MacDougall. He died at his home in Montréal in December 1899.

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**Frederic Newton Gisborne** was born in 1824 into a distinguished English family. His middle name came from Sir Isaac, an earlier relative on his mother's side. His early, private education included mathematics and some electrical and civil engineering. Between 1842 and 1845 he travelled round the world. Meanwhile, his family's fortunes were disappearing and action was required. His was to emigrate to the Canadas.

For the next two years he farmed in Québec but, finding it unattractive, and having noted the success telegraphy was then having in other countries, he studied it in Montréal. He then joined the Montréal Telegraph Company as an operator and station manager. At the same time, he furthered his business contacts, with the result that in 1847 he was appointed general manager of the British North American Electric Telegraph Association, where he developed telegraphic links between Quebec, New Brunswick and Nova Scotia. From 1849 to 1851 he was superintendent of the government lines at Halifax, during which time he experimented with gutta-percha as the insulating material for underwater telegraph cables.

In 1851 he contracted privately to build a landline in Eastern Newfoundland but was also granted a telegraph construction charter by the island's government, which was completed in 1856. By 1852, Gisborne had laid the first underwater telegraph cable in North America, between PEI and New Brunswick. He had also begun to think about the feasibility of a transatlantic telegraph cable, and had taken counsel of New York financiers, such as Cyrus Field. However, due to business difficulties,



Stamp issued by Canada in 1987 to commemorate Gisborne's laying the first ocean cable on this side of the Atlantic, connecting Prince Edward Island with New Brunswick in November 1852.



Gisborne abandoned telegraphy after 1857 and devoted himself to mining in England and to representing Nova Scotia in the mining field and Newfoundland at international exhibitions. He also collected medals for his inventions, including several in the telegraph field.

Back in Nova Scotia in 1869, Gisborne became interested in the Cape Breton coalfields, contracted to build railways and piers at Sydney and Louisbourg. In 1879, he accepted appointment as superintendent of the Dominion Government Signal Service. One of his first tasks was to reorganize the telegraph system in British Columbia. In 1883 he turned his attention to Saskatchewan. In 1885 he constructed lines in that province during the Northwest Rebellion, and later rebuilt the Edmonton-Calgary line in Alberta. He was still in harness when he died in Ottawa in 1892.

Gisborne was a founding member of the Royal Society of Canada in 1882 and of the Canadian Society of Civil Engineers in 1887.

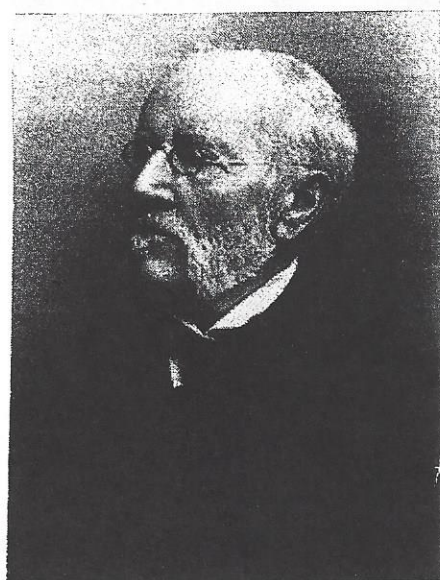
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Another pair of brothers come next, the Baillargés...**Georges-Frédéric-Théophile**, the public works engineer, and **Charles-Philippe-Ferdinand**, the engineer-architect.

Georges was born in 1824, had a good education and studied law before taking a drafting position in 1844 with the Board of Works of the Province of Canada. He served as assistant to surveyor/engineer F.P. Rubidge, who was associated with early work on the Trent-Severn Waterway, and qualified as a land surveyor and engineer, a field he served for 46 years. And he soon began writing up the history of Canadian public works. By 1891 he had compiled and

G-F-T

Baillargé



C-P-F

Baillargé



published the first consolidated (and very valuable) listings of Canadian public works engineers, their assistants and superintendents since 1779 (but mostly since 1867). Over the years, he was involved in numerous projects that also involved his brother Charles. Georges died in 1909.

Charles was born in 1826. He worked as a surveyor and an engineer, but mostly as an architect. For example, with Thomas Fuller, he was largely responsible for the Parliament Buildings and their Library and what was the Langevin Building in Ottawa. He was also deeply involved in religious architecture. He died in 1906.

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A son of the manse, **Collingwood Schreiber** was also born in England in 1831 and received his training there, as an engineer and surveyor. He came to Canada in 1852 and joined the engineering staff of the Hamilton & Toronto Railway. In 1856 he joined Sandford Fleming in private practice, but four years later returned to railway work as a superintending engineer. In 1864 he began his association with the Intercolonial Railway, in Nova Scotia, becoming a sectional engineer four years later, when Fleming was chief engineer. By 1871 he was the district engineer at Amherst, as well as doing contract work for the PEI Railway.



In June 1880, Schreiber replaced Fleming as chief engineer of the CPR, shortly before taking charge of all government railways in operation on behalf of the newly-formed Dominion Department of Railways and Canals in Ottawa. His main concerns were railway operations, the costs of construction and the conditions of government financing. He made many inspection tours of the CPR's westward line during its construction. His administrative style was skilled but authoritarian.



Late in 1892, Schreiber was appointed deputy minister and chief engineer of the Department, with responsibility for the expanding railways as well as the canals, by the incumbent Conservative government. He retained the position when the Liberals under Laurier won the 1896 election. He retired at the age of 73 in 1905, but continued working for the government as a consulting engineer on the Grand Trunk Pacific line to the west, and remained as a consultant after the completion of that line in 1914. He had helped to accelerate the completion of *both* the CPR and GTR westwards. Having demonstrated physical stamina during his lifetime, he never really retired.

Schreiber was a founding member of the Canadian Society of Civil Engineers in 1887. The railway town of Schreiber, Ontario, was named after him. He was knighted (KCMG) in 1916 for his services, and died in 1918.

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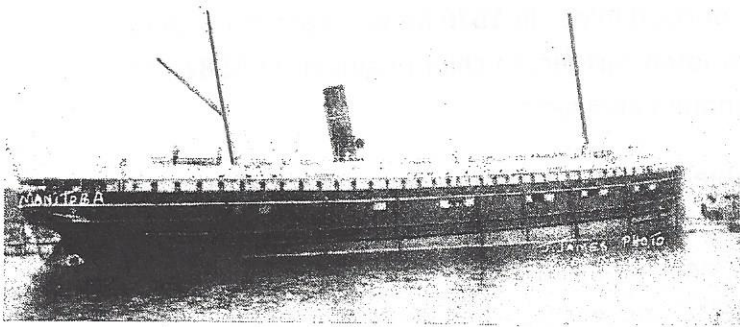
This is the third 'joint' entry, in which two engineers with professional and family connections are considered together, this time a father and his son. Unfortunately, none of the photographs found of the Polsons are suitable for reproduction in this paper.

In 1883, **William Polson** (born 1834) and his son, **Franklin Bates Polson** (born 1858), founded the William Polson Company in Toronto to build steam yachts and their boilers and engines. Three years later, they incorporated the Polson Iron Works Limited for the same purposes. In 1888, the company opened a yard - on favourable terms - at Owen Sound, which was then an important port for CP steamships and where it remained until returning to Polson Pier in Toronto in 1897, having experienced difficulties during the recessions of the 1880s. However, by 1891, Franklin was leading the company.

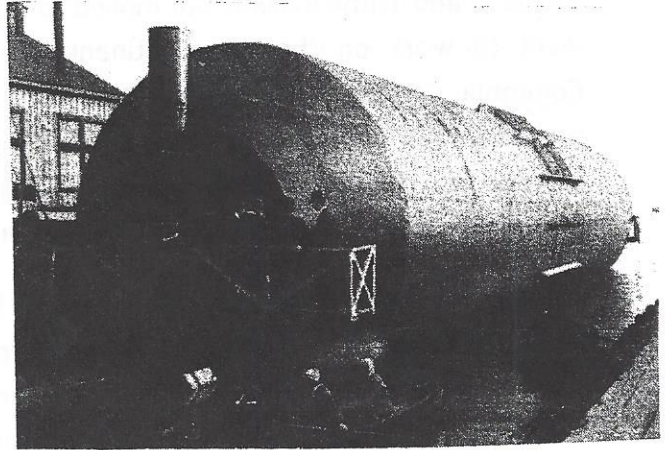
William Polson had trained as a machinist and was later a mechanical superintendent for the Grand Junction Railway in Belleville, Ontario. Son Franklin also trained as a machinist, but with the Coburg, Peterborough and Marmora Railway and two other companies. He was later the mechanical superintendent for the Victoria Railway in Lindsay, Ontario, and master mechanic for the Midland Railway at Whitby. For Polson Iron Works, he also served as naval architect and was concerned with the construction of each vessel built by the company.

In the beginning, Polson's built steam yachts for wealthy customers, along with their engines and boilers. During 'lean' years, it built more engines and boilers than ships. With time, opportunity, salesmanship and some political influence, the company also built ferries, tugs, dredges, scows and the occasional armed vessel.

Notably, in 1889 the Polson yard at Owen Sound built the SS *Manitoba*, the first steel-hulled vessel in Canada. Later, at Toronto, it produced the *Vigilant*, the first armed, Canadian-built fisheries protection vessel for the Great Lakes. In 1897 Polson's built the unusual Knapp's Roller Boat, a double-cylinder craft with roller bearings between them, 125 feet long and 25 feet in diameter, driven by two 60 hp engines housed - as was the passenger compartment - in the inside cylinder. The driven outside cylinder had paddles. It was abandoned after a short working life.



SS *Manitoba*



Knapp's Roller Boat

Among its steam yachts for wealthy customers was the steam-and-propeller-driven *Ella Mary*, built in 1910, which was later sold to several owners and renamed the *Bigwin*, which served the inn of that name of Ontario's Lake of Bays. Extensively rebuilt in recent years, and now electrically driven, this vessel still serves as a cruise ship on that Lake. The side-paddle ferry *Trillium*, another Polson 1910 product, was built originally for the owner of Toronto's professional baseball team to carry fans from the city to the island, is also still in operation as a charter ship. The company also built, in 1911, the steel hull for the stern-wheeler *Bonnington*, one of the largest of its kind in Canada, and shipped it west for assembly at Nakusp on B.C.'s Arrow Lakes.

William Polson died in 1901 and Franklin in 1907. Prior to his death, William was a member of the Toronto Board of Trade, the Canadian Manufacturers' Association, and the Canadian Society of Civil Engineers and took an active interest in technical education. Franklin's energies were directed principally to his company responsibilities. At the time of Franklin's death, the company employed 500 people. It remained in business, led by John B. Miller, until bankrupted in 1919, having over-extended itself during World War I. In all, the company built over 100 ships and as many engines.

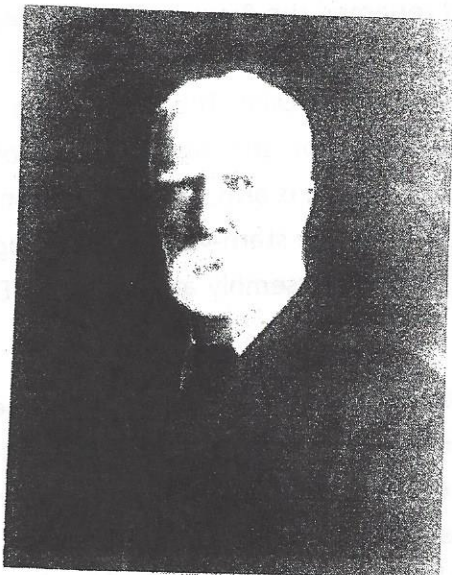
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Another joint entry. This time about two engineers who played major roles in the completion of the very difficult section of the CPR transcontinental railway as it passed through the mountains, and particularly the Fraser Canyon, of British Columbia - **Henry John Cambie**, the engineer, and **Andrew Onderdonk**, the contractor.

Cambie was born in 1836 in Ireland but educated in England. As a youth, he emigrated to the Province of Canada where he learned surveying and civil engineering. In 1852 he was employed by the Grand Trunk Railway but moved to the Canadian Pacific in 1859. After Confederation, he went to work on the transcontinental railway. When this railway expanded into British Columbia, Cambie was appointed the CPR's chief surveyor in the province and argued for the route through the Fraser Canyon, terminating at Burrard Inlet. In 1876 he was appointed chief surveyor for the CPR's Pacific Division, being promoted further, to chief engineer, in 1882. He was involved in the supervision of some of Onderdonk's contracts.

When his CPR work was completed in 1887, Cambie went to live in the new city of Vancouver, where he became a prominent citizen, providing advice on the development of the city's infrastructure and prominent buildings over the next 40 years on land, much of which was owned by the CPR. He remained employed until 1921, and was 91 when he died in 1928.



Henry J. Cambie



Andrew Onderdonk



Andrew Onderdonk was born in New York in 1848 of Dutch ancestry and trained as an engineer at Rensselaer Polytechnic Institute at Troy, New York. He began his career surveying townsites and roads in New Jersey, after which he moved west to manage contracts. One of his major projects was the construction of the San Francisco seawall.

Beginning in 1879, Onderdonk won a series of Canadian government contracts in the western section of the CPR transcontinental. He built, for example, the section between Port Moody and Savona, beginning in 1882 which, in places, involved extensive and expensive tunnels. The most controversial aspect of this contract work was the use of Chinese labourers, who were often given the most dangerous jobs. He also built the steamboat *Skuzzy*, with which he challenged the Fraser Canyon's swift and dangerous current between Hell's Gate and Boston Bar.

Onderdonk also built a number of the easier eastern sections of the CPR in British Columbia. After November 1885, when these were finished, Onderdonk bid successfully for work in Eastern Canada, including the Trent-Severn Waterway, and in the United States.

He died in the United States in 1905.

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**Herbert L. Wallis** was among the early professional mechanical engineers in Canada and one of the few prominent railway engineers to be associated with the design and construction of locomotives.

He was born in England in 1844 and educated there. At age 17, he was articled to Matthew Kirby, the locomotive superintendent of the Midland Railway in Bradford. At the completion of his 'time' in 1866, he was made foreman of the locomotive department. Five years later he came to Canada and joined the Grand Trunk Railway as an assistant mechanical superintendent in Montréal. In 1873 he was promoted to head the mechanical department, a position he retained until his retirement in 1896. During this time, he carried out numerous experiments on the efficiency of locomotive steam engines, as a result of which the use of the compound steam variety became standard in the GTR. He also contributed significantly to the improvement of its shops and the construction of its locomotives and engines.



A mechanical among many civils, Wallis was a founding member of the Canadian Society of Civil Engineers in 1887 and served as treasurer and vice-president before becoming the first 'mechanical' president in 1896.

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The first university-level engineering instruction in Canada was given in 1854 at King's College, at what is now the University of New Brunswick. In 1853 the lieutenant-governor of the province was granted leave to establish a Commission of Inquiry into the affairs of (then) King's College. J. William Dawson, a geologist and naturalist and the superintendent of Education in Nova Scotia, and Egerton Ryerson, superintendent for Upper Canada were appointed with three political people to carry it out. As Ray Findlay has noted:

Their report, when it finally was submitted, was a model for future generations to aim at in regard to its practicality, political expedience, liberality and genuine concern for educational attainment.

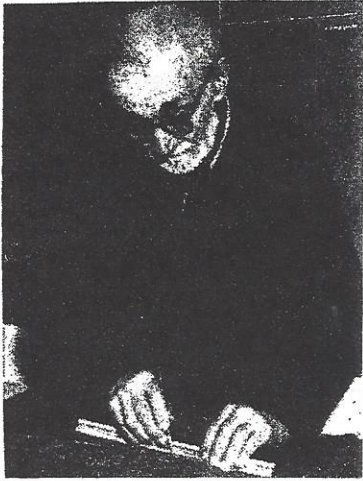
It provided for diplomas in civil engineering and land surveying and was submitted in December 1854. However, Lt.-Gov. Head was convinced it was already sufficiently encouraging that instruction could begin before it was ready. So the first regular instruction in engineering in British North America began the previous February, although potential students had been given preliminary instruction the previous fall in chemistry, physics and mathematics. The engineering curriculum was designed to mirror the current dominance of the railway branch of civil engineering, but also included mechanical and electrical engineering subjects as they were then known, with field instruction at weekends.

**Thomas McMahon Cregan** (birth and death dates unknown), an engineer with the British firm of Jackson, Peto, Brassey, was the first professor. His class had 26 students. However, ill health prevented him from repeating the course the next year, although provision was made at King's to continue engineering instruction. From 1859, when the University of New Brunswick received its Charter, to 1890, engineering courses were given regularly to small numbers of students. A year earlier, a chair of civil engineering and surveying had been established and in 1893 one was established in electrical engineering. Foster Baird was appointed the first professor of civil engineering and Earle Turner of electrical engineering. By 1899, diplomas had been superseded by degrees and an Engineering Building was opened in 1901. In 1907 the MSc degree was established. In 1908, John Stevens was appointed the first professor of mechanical engineering.

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Two Canadian engineers were born in 1855 and 1856 and both lived to be over 100.



**F.X.T. Berlinguet** was the oldest member of the EIC when he died at the age of 102 in May 1957. Educated at l'Université Laval, he graduated in 1876. He began his career with the Intercolonial Railway, but soon joined the Dominion's Department of Public Works and was employed on harbours at Québec and Trois Rivières. He later became chief engineer for his district.

Berlinguet also worked on a St. Lawrence River survey. After 46 years with Public Works, he retired to private practice at Trois Rivières. M. Berlinguet joined CSCE as an associate member on its founding in 1887, transferred to member in 1890, and was later a life member. The EIC was represented at his hundredth birthday festivities. His obituary appeared in the July 1957 issue of the *Engineering Journal*.

**L.S. Pariseau** died in June 1958, four months short of his 102<sup>nd</sup> birthday. He was a member of the first class to graduate from École Polytechnique in 1877 and immediately joined its staff. He later joined the Dominion's Department of Railways and Canals and worked on the Grenville and Lachine Canals and the survey of the Richelieu River. He was appointed superintendent of canals for the Province of Québec in 1923 and retired in 1930 after 51 years of public service.



Pariseau received honorary degrees from Université de Montréal and Université Laval. He also joined CSCE as an associate member in 1887, transferring to member in 1917. He later became a life member. Once again, the Institute was represented at his hundredth birthday celebrations. His obituary appeared in the August 1958 issue of the *Journal*.

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**Charles Alexander Magrath** has been designated by the Historic Sites and Monuments Board of Canada as 'a person of national importance.'

Born in Ontario in April 1860, he began land surveying in Western Canada in 1878. From 1885

until 1906, while working for the Galt Companies, he developed expertise in irrigation and water resources engineering, which he practised throughout the West, the Northwest Territories and particularly in Southern Alberta, where he managed the Alberta Irrigation Company.



However, for an engineer, Magrath was unusually active in politics. From 1892 to 1898 he was a member of the Northwest Territories Legislature and, from 1898 until 1901, a cabinet minister. He was elected major of Lethbridge in 1901, and served until 1906. From 1906 until 1911, he was in the House of Commons as the member from Medicine Hat. From 1911 until 1914 he was a member of the International Joint Commission and was chairman of the Canadian Section of it from 1914 until 1935. During World War I, he held several administrative positions associated with the Dominion government. After it, he served on a special committee investigating agriculture in Southern Alberta.

At the provincial level, in 1913 Magrath chaired a special commission investigating the highway system in Ontario and, in 1919, was appointed to chair the Advisory Council on Highway Construction in the province. From 1925 until 1931, he was chairman of the Hydro-Electric Power Commission of Ontario. In 1933 he served on a Royal Commission on Newfoundland's finances.

In 1941 the Engineering Institute of Canada awarded Magrath its Julian C. Smith Medal in recognition of his engineering services to Canada. He had retired in 1937, and died in October 1949.

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**Herbert E.T. Haultain** should be remembered for initiating what became, in Canadian engineering circles, the Ritual of the Calling of an Engineer, or the Iron Ring Ceremony.

Born in 1869 in England into a military family which came to Canada in 1875, he graduated in civil engineering from the University of Toronto's School of Practical Science in 1889, where he had also been the first student president of the Engineering Society. He did graduate work in mining in England and Germany, followed by 20 years of practice in mines in Canada, Germany, South Africa and the United States. In 1908 he was appointed professor of mining engineering at UofT.



After World War I, he became interested in the possibility of developing an oath to be taken by graduating engineers, similar to the one taken by new medical doctors. In 1922 he convened a meeting of seven past presidents of the Engineering Institute of Canada at which his idea was accepted. Haultain then invited Rudyard Kipling to write the text for the Ritual, which he did. The seven past presidents were the first to experience the Ritual, and became the first Council of Seven Wardens, charged with supervision of the administration of the Ritual to graduating classes since it was to be independent of both the universities and the professional organizations. The first university Iron Ring Ceremonies were held in Montréal and Toronto in 1925. The first rings were made from material supplied by a dealer known to Haultain. Nowadays, the Ritual is administered by Camps located at each of the schools of engineering across the country. It may also be administered to qualified foreign engineering graduates through these schools.

Professor Haultain taught at Toronto for 30 years but devoted time to research during his retirement. He had also invented devices for ore processing in the laboratory. Concerned about the drift of Canadian engineers to the United States in the 1920s, and in order to expedite placements in Canada, he had co-founded the Technical Service Council with Robert A. Bryce. He was inducted into the Canadian Mining Hall of Fame and had the Mining Building at UofT named after him. He died in 1961.



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**Frederick George Creed** was an inventor and entrepreneur rather than an engineer, but what he invented and promoted had relevance for engineering. And although Canadian-born, he spent most of his life abroad. No suitable photograph or sketch of him has been found.

Creed was born in 1871 in Nova Scotia and began his working life at 15, as a check-boy for Western Union at Canso, where he taught himself a great deal about telegraphy. As a young adult, he went to live in South America, in Peru and Chile, but still in the telegraph and cable business. However, using Morse keys and Wheatstone tape punches bored him. So he invented a typewriter-style machine that would let the operator punch Morse code signals on to paper tape.

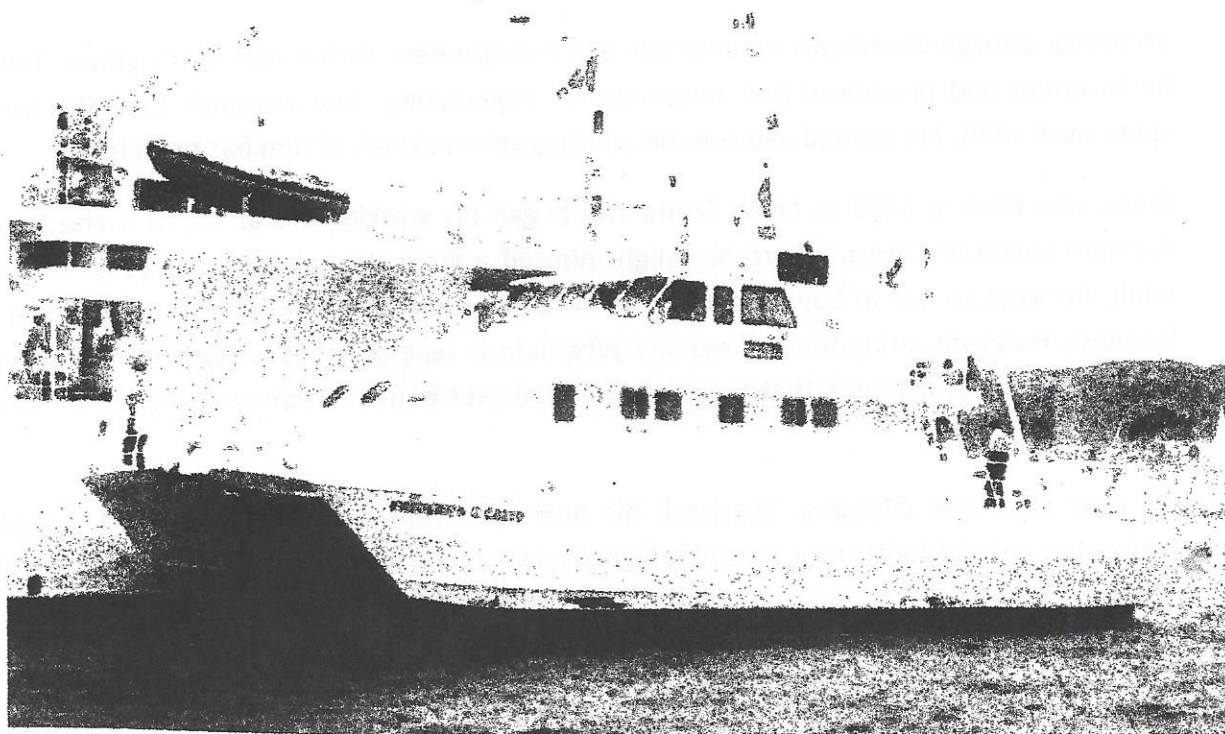
His next stop was Glasgow, Scotland, his next invention a machine that had a keyboard perforator, a re-perforator for incoming signals, a decoding printer and was based on an old

typewriter. This evolved into the Creed High Speed Automatic Printing System. Creed received an order for a dozen machines from the British General Post Office and opened a plant to make them, and others, which he continued to develop.

In 1909, at the age of 38, he moved to London, nearer the GPO, where he established a company with a Danish-born telegraph engineer. He became the sole partner after his partner's accidental death in 1916. The manufacturing business prospered, especially after the start of World War I, and Creed did more experimenting with high-speed telegraphy using radio transmission. His plant also made military equipment and instrumentation. By 1920, his teleprinters were in widespread use by newspaper publishers, both in Britain and in a number of other countries. Creed continued in this business until 1928, when his company was sold. He retired in 1930, but continued inventing, turning his attention to boats.

Sometime before 1938, Creed pioneered the design of the SWATH - small-waterplane-area, twin hull - type of vessel, which he offered to the British Admiralty. It resembled the catamaran, except that its twin hulls were completely submerged, minimizing the hulls' cross section areas near the sea's surface and giving the vessel a stability at high speeds and in high seas that single-hulled ships did not have. The vessel's deck, therefore, formed a relatively stable platform. A patent was awarded in 1946. However, Creed died (in 1957) before the first SWATH vessel was launched, by the Netherlands, in 1968.

*CCGS Frederick G. Creed*





Even although SWATH vessels are more expensive to build than single hulls or catamarans, it still surprises me that, even now, there are so few SWATH ships in operation. There is only one in Canada, the Canadian Coast Guard vessel named after Frederick Creed.

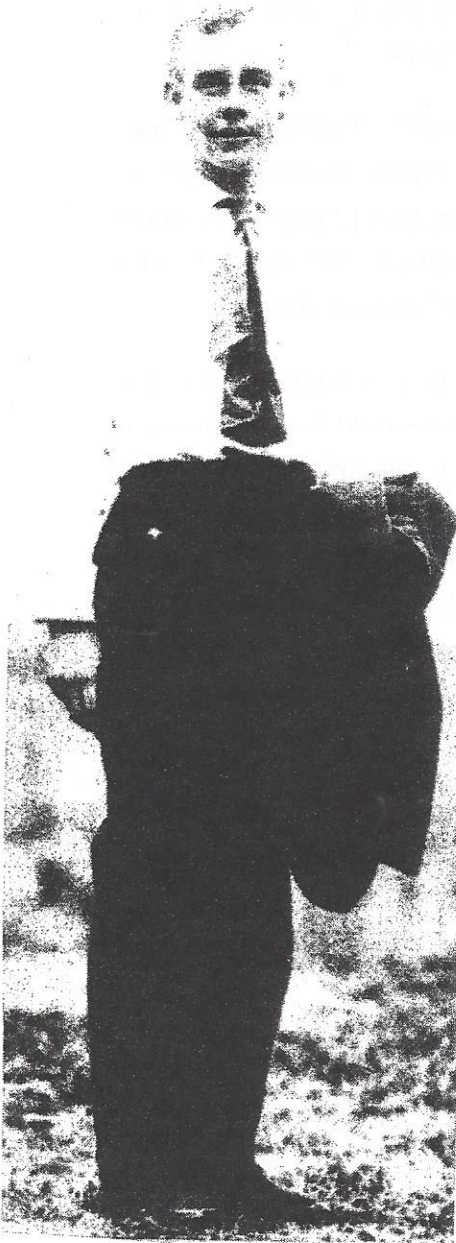
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Historically speaking, **Frederick Walker (Casey) Baldwin** was overshadowed by his boss at Baddeck, Nova Scotia: Alexander Graham Bell. To some extent, as a pilot, he was also overshadowed by his contemporary and colleague, J.A.D. (Douglas) McCurdy. But especially after Bell's death in 1922, Baldwin was his own man.

Baldwin was born in Toronto in 1882, the grandson of politician Robert Baldwin. He was educated at Ridley College and the University of Toronto, from which he graduated in 1906 with a degree in electrical and mechanical engineering. He then went to Baddeck to visit his college friend McCurdy and to meet Bell - and stayed for the rest of his life.

In 1907, Mabel Bell funded the Aerial Experimental Association for her husband, McCurdy and Baldwin and two Americans, Glenn Curtiss and Thomas Selfridge. They designed and built several experimental aircraft, including the *Silver Dart*, flying which in February 1909 McCurdy became the first to fly a heavier-than-air machine in Canada. However, Baldwin was the first Canadian to fly one - at Hammondsport, New York, the previous year.

Baldwin became manager of the Bell Laboratories at Baddeck in 1909. By 1914, McCurdy had left for Toronto, Curtiss for the United States, and Selfridge had been killed in an accident. By then, also, Bell and Baldwin had turned their attention to powered watercraft. By 1919 they had designed and built the HD-4 hydrofoil, which went on to set a world water speed record. After Bell's death, Baldwin built sail and power boats and experimented some more with hydrofoils, until 1933, when he was elected to the Nova Scotia Legislature, serving one full term.



Baldwin died in 1948. In 1974 he was inducted posthumously into the Canadian Aviation Hall of Fame.

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**Andrew G.L. McNaughton** and **E.L.M. (Tommy) Burns** are both very well remembered...as Generals and soldiers. They were also engineers.

McNaughton was born in 1887 in Saskatchewan, when it was still part of the Northwest Territories. From McGill, he earned a BA degree in physics in 1910 and an MSc in electrical engineering in 1912. He had joined the Canadian militia three years earlier.

In 1914 he held a commission in the 4<sup>th</sup> Battery of Artillery in the Canadian Expeditionary Force and went overseas with it. He applied science and engineering to artillery, inventing a sound-ranging direction-finder (a forerunner of radar), the rights to which he sold to the Government. It proved valuable in helping destroy the enemy's guns...at, for example, the Battle of Vimy Ridge. He ended the War as a Lieutenant-Colonel, in command of the Canadian Artillery.

In 1920, McNaughton enlisted in the regular army. In 1922, he was promoted to Deputy Chief of the General Staff, and to Chief in 1929. Much of his work during these years was mechanizing the army and modernizing the militia. During the Depression he championed the highly controversial 'relief camps' that would feed, house and employ unemployed single men. In 1935, McNaughton became a civilian himself, on his appointment as president of the National Research Council. Re-engaged in 1939, he led the First Canadian Infantry Division, which grew under him into a Corps and then an Army. He also applied his engineering knowledge to the improvement of weaponry. But under pressure from critics and in ill-health, he resigned his command late in 1943.

He returned to Ottawa and entered politics, becoming Minister of National Defence in 1944. He was, however, unable to win a seat and resigned in 1945. Postwar, he served on the U.N. Atomic Energy Commission, chairing it from 1946 to 1948. Between 1950 and 1959 he chaired the Canadian Section of the International Joint Commission, and served on many other committees and commissions. He died in 1966.

McNaughton was a member of the Engineering Institute of Canada and in 1940 received its highest honour, the Sir John Kennedy Medal, and IEEE Canada named its highest award after him.

Burns was born in Montréal in 1897. Prior to World War I, he served in a militia regiment, achieving the rank of signal sergeant. In 1915, he graduated from the Royal Military College and



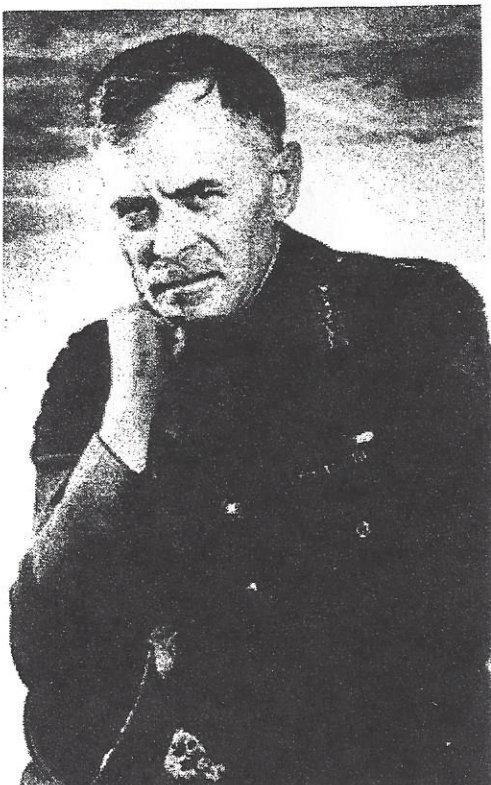
was commissioned in the Royal Canadian Engineers. In 1916 he went overseas with the 3<sup>rd</sup> Canadian Division Signal Company and was on the Western Front from then until the end of the War. On his return to Canada in 1919 he served as an engineer officer. Then, as Wikipedia notes:

He attended the School of Military Engineering, Chatham, England, for eighteen months. He was (then) an instructor at the Royal Military College, Kingston. He returned to Halifax and served on duty during the miners' strike at Glace Bay. He worked in the Survey Department in Ottawa. In 1924 he was appointed as an instructor at RMC in field engineering...

In 1939, as a lieutenant colonel, he attended the Imperial Defence College in London, England.

During World War II, Burns commanded the 4<sup>th</sup> Canadian Armoured Brigade, the 1<sup>st</sup> Infantry Division, the 5<sup>th</sup> Canadian Armoured Division and the First Canadian Corps. He, too, attracted controversy!

As a civilian, postwar, Burns served as Deputy Minister of Veterans' Affairs. As a soldier, he was involved in the Middle East peace process from 1954 until 1959 and was instrumental in the development of UN peacekeeping. He was Canada's principal disarmament negotiator from 1960 to 1968. He held a chair in Strategic Studies at Carleton University from 1969 to 1975.



McNaughton



Burns



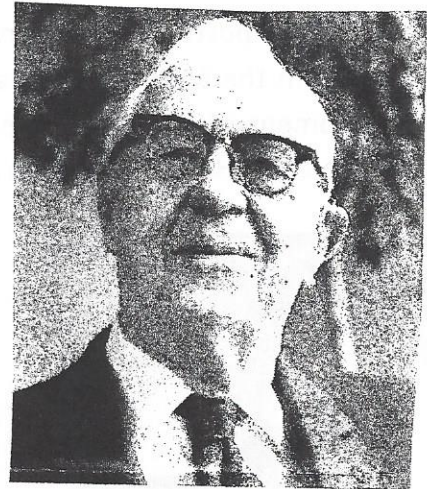
Burns was awarded the Military Cross in World War I, in 1967 became a Companion of the new Order of Canada, in 1970 was awarded an honorary doctorate, and in 1981 the Pearson Medal of Peace. His writings have been extensively published. He died in 1985.

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**John Seaman Bates**, born in Woodstock, Ontario, in 1888, did several notable things during his life, including - at 95 years of age - publishing his autobiography, something engineers seldom do at any age!

John Bates graduated first from Acadia University with B.A. and B.Sc. degrees, followed by one in chemical engineering from Columbia in New York. In 1914 he received Columbia's first-ever doctorate in this branch of engineering. He was also the first Canadian to get this degree. Bates' thesis and the resulting patent were later to lay the groundwork for the competitive (to Canada) market challenges of the Southern U.S. to Canadian producers of wood pulp and newsprint. Bates, however, chose to spend most of his life in Canada.

But first he travelled to Northern Europe to inspect its pulp mills. Back home, he became the first superintendent of the Forest Products Laboratory of Canada (1914-1918), the first technical superintendent of Price Brothers at Kenogami (1919-1921), and the first chemical engineer of the Bathurst Company (1921-1926). From 1926 until 1932, he was chief chemist of Price Brothers, and from 1933 until 1939 he was their technical adviser in London, England. He was the first Canadian manager of Price & Pierce in Montréal from 1940 to 1951, during which time he made extensive tours of the pulp and paper industries in South and Central America. For the next nine years, up until 1960, Bates was active as a private consultant, serving clients across Canada. Concurrently, and for some years afterwards, he served as the first chair of the provincial Water Authorities in all three Maritime provinces. He 'retired' in 1967 at the age of 79, but was still serving as the chair of the Building Committee for a new public library in Sackville at the age of 95.



John Bates was a founding member of the Canadian Pulp and Paper Association in 1914, and the first chair of its Technical Section. In 1921 he was among the founders of the Chemical Institute of Canada, and he chaired the Board of the Canadian Forestry Association from 1949



to 1953. Bates received two honorary degrees, was inducted into the Order of Canada in 1989, and in 2006, posthumously into the Paper Industry International Hall of Fame. The Pulp and Paper Technical Association has named its gold medal after him. He died in 1991 at the age of 103.

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The only Canadian engineer so far who has almost become the country's prime minister was **Robert H. Winters**, in 1968, when he ran against Pierre Elliot Trudeau for the job. As an engineer in the Cabinet of Louis St. Laurent, he was overshadowed by that other engineer-politician, Clarence Decatur Howe. But by the time Lester B. Pearson was prime minister in 1963, and Winters was one of his ministers, Howe had been defeated and retired from politics.

Like Creed, Nova Scotia-born, in 1910, the son of a fishing captain based at Lunenburg, Bob Winters attended Mount Allison University but completed his electrical engineering degree at M.I.T.. He worked for the Northern Electric Company before joining the army in World War II, achieving the rank of Lieutenant-Colonel. First elected to the House of Commons in 1945, he succeeded another engineer, J.J. Kinley, as the Member for the riding of Queens-Lunenburg. Winters was appointed to Cabinet in 1948 by Louis St. Laurent, serving in a number of portfolios, including public works.



Defeated along with St. Laurent and Howe in 1957, Winters served as CEO of a number of public companies and was an advisor to the Government of Newfoundland on Churchill Falls, before being persuaded to run for the Toronto seat of York West in the general election of 1965. Pearson appointed him Minister of Trade and Commerce. In 1968, he was awarded the Julian C. Smith Medal by the Engineering Institute of Canada for his contributions to the development of Canada.

Bob Winters chose to leave politics at the time of the 1968 election and became president of the Brazilian Traction Company and a vice-president of the CIBC. He also served as the first chair of the Board of Governors of York University. He

died suddenly while on a trip to California in 1969.

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**Richard D. (Dick) Hiscocks** was born in Toronto in June 1914. His childhood passion was aviation and in high school he built and flew model aircraft. He graduated in engineering physics from the University of Toronto in 1938. He was then hired by the de Havilland Aircraft Company of Canada (DHC), having had prior summer employment there, and was sent to the main de Havilland design office in the U.K..

Hiscocks returned to Canada in 1940 and accepted an appointment to lead a group in the NRC's structures laboratory, where he worked on wooden replacement parts for *Anson* and *Harvard* aircraft. In 1945 he was chosen to join a small group of Canadian aeronautical engineers sent to Germany to assess that country's wartime technology advances. Meanwhile, in 1946 he had returned to DHC to work under chief designer Fred Buller on the *Beaver* project, where he was concerned particularly with wing geometry. He was appointed chief engineer at DHC in 1949 and contributed to the design of the DHC's *Otter*, *Caribou*, *Buffalo* and *Twin Otter* aircraft. The STOL capability and rugged performance of all of these aircraft became a DHC feature. Hiscocks organized the R&D needed to provide them with the full airworthiness that enhanced DHC's reputation.



In 1968, Hiscocks went back to NRC, this time as vice-president for industry. His job was to encourage and assist Canadian companies to take advantage of NRC's facilities. He was also appointed president of Canadian Patents and Development Ltd., which licenced federally-generated patents for exploitation by industry. From 1976 until his retirement in 1979 he was back at de Havilland as vice-president of engineering, with responsibilities for the *Dash 7* and *Dash 8* aeroplanes.

Hiscocks was a frequent lecturer during his active career. In retirement, and from his Vancouver base, he assisted Murphy Aircraft of Chilliwack, B.C., with the design of a 'bush' plane and was an adjunct professor at the University of British Columbia. He also acted as a consultant to several Canadian and American companies.



During his lifetime, Dick Hiscocks received a number of awards. For example, in 1947, his NRC work earned him a British MBE. He was the first to receive the CASI's McCurdy Award, and later received a Julian C. Smith Medal from the Engineering Institute for his work in the development of Canada. He also received several honorary degrees, and was inducted into the Canadian Aviation Hall of Fame posthumously in 1998. He published many papers. He died in 1996.

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**John Wesley (Jack) Beaver**, born in 1920, was one of the few First Nations members of his generation to become an engineer. A suitable photograph is not available.

A fighter pilot as well as an electrical and nuclear engineer, an electric power consultant as well as a public servant, Jack followed his World War II experience with an electrical engineering degree from Queen's and wide experience in electric power generation, joining what was then Ontario Hydro on graduation in 1949. He held a number of engineering and management positions within Hydro. In 1960, for example, he participated in the commissioning and operation of the Nuclear Power Demonstration plant at Rolphton. In 1972 he left Hydro to join the Churchill Falls project in Labrador as general manager of operations.

An award in Jack's name has recently been sponsored by Ontario Power generation to enable First Nations students to pursue full-time education in Ontario.



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**Keith E. Hunt** was born on a farm in Southwestern Ontario in 1923. At 16, he began an electrician apprenticeship with Canadian National Railways in London, Ontario. In 1942 he joined the RCAF and qualified as a navigator and officer and flew mostly transport aircraft in Europe until 1946, when he returned to Canada and re-started his apprenticeship. He also decided to benefit from the Veterans' Act and enrolled in electrical engineering at Queen's, graduating in 1951 - and finally completing his apprenticeship. He rose quickly through the engineering ranks at CNR, and was involved in the switch from steam to diesel. A vice-president from 1970, he was involved in rail operations and regional management - and oversaw the

construction of the CN Tower. He was also deeply involved in railway operation safety issues. However, the turbo-train project with which he was closely connected failed. It did, however, set a railway speed record for Canada in 1976.

Hunt died in 2008 at the age of 84.

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**John James Kinley** is likely well remembered in Nova Scotia, but not in the rest of Canada. Jim was born in September 1925 at Lunenburg. Serving in both the Canadian Merchant Marine, the Royal Canadian Navy and in the RCNR, retiring in 1958 as a Lieutenant-Commander, he was a graduate in engineering of Dalhousie, Nova Scotia Technical College and MIT. He began and ran several businesses for many years, including the Lunenburg Industrial Foundry and Engineering Ltd. and the Lunenburg Marine Railway.

The Hon. James Kinley was the 29<sup>th</sup> Lieutenant-Governor of Nova Scotia, from 1994 until 2000. He was inducted into the Order of Nova Scotia in 2002. He was also a member of the Engineering Institute of Canada, and was awarded its Sir John Kennedy Medal, was a fellow of the Canadian Academy of Engineering and a long-time P.Eng. in Nova Scotia. He served for two years as president of the Navy League of Canada.

He died in 2012 at the age of 86.

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Gerry Bull's career has been the subject of articles and books and has even been used in fictional stories by Frederick Forsyth and Louise Penny, as well as in an HBO film. His fame - and notoriety - rests on the controversial attempts he made to use long-barrelled guns to launch satellites into space.

**Gerald Vincent Bull** was born at North Bay in March of 1928, son of a lawyer. His early years were influenced by the Depression and by serious family problems, including the death of his mother. His high school hobby was building model aeroplanes of his own design. He began university studies at Queen's but spent most of this time at the University of Toronto, graduating with a doctorate at the early age of 23 from its Institute of Aerospace Studies. His thesis was on wind tunnels.

Bull then moved to the Armament R&D Establishment (CARDE) at Valcartier, Québec, to work on instrumented guns and, at Laval University, on wind tunnels. He also began work on large, high-velocity guns. This latter work impressed some high-ranking American military people and a program was set up at the U.S. Aberdeen Proving Grounds. Meanwhile, Bull fired aircraft models from his gun, including some for the Avro Arrow. He also became known for his tempestuous behaviour and for his participation in rows with his superiors, some of which had political repercussions. He resigned from CARDE in April 1961.



Meanwhile, he had acquired land on the Québec-Vermont border, at Highwater, which he turned into a gun range in association with McGill University. He was also promoting the idea of using guns to put missiles into earth orbit as a less-expensive alternative to the use of rockets. So the HARP Project was born, and the U.S Navy supplied it with a surplus 16 inch gun. But the Highwater site became too small and HARP was transferred to a larger one, run by McGill, in Barbados. Joint Canadian-U.S. funding was arranged. In 1964, a second barrel was attached to Bull's gun at Highwater, tested, and shipped to Barbados. Bull was also named director of McGill's Space Research Institute. A new company, the Space Research Corporation, was set up to commercialize Bull's ideas. A production workshop was established at Atwater, Québec. The gun was extensively tested in 1965 and 1966.

However, funding began to dry up in 1967. So, while the company enjoyed some success, Bull

became an international supplier of weaponry. As well, the U.S. attitude to HARP changed during the presidency of Jimmy Carter, and Bull found himself in an American jail, and sued in Québec for illegal arms dealing. He moved his operations to Brussels in 1980. Ten years later he was assassinated there, in mysterious circumstances.

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