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"The 'Lighthouse' Stevensons ... and Robert Louis

by Andrew H. Wilson (previously produced as Cedargrove Series #37/2015 – June 2015)

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Abstract

Many have read books written by Robert Louis Stevenson. Not so many know that he was a member of a renowned family of Scottish engineers, several generations of whom built lighthouses around the Scottish coast.

This paper traces very briefly the travels of RLS around the world, but has much more to say about the lighthouse builders, who flourished mainly in the 19th century. It is not original research, as much has already been published on both subjects. Its purpose is to remind readers of two things: that both RLS and his Stevenson family were successful in their different fields; and that the family's contributions to the building of Scotland's lighthouses, among other engineering works, should be recognized as significant.

It also includes appendices showing the Stevenson family tree and listing some of the early Canadian lighthouses.

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 almost 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 a past president of both CSME and EIC.

Introduction

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Much of the material in this paper was included in the talk that the author presented in January 2015, titled *Engineering Around the World*, to Ottawa's Friday Luncheon Discussion Club and on *The Lighthouse Stevensons* in June at a meeting of the Ottawa Section of the Canadian Society of Senior Engineers.

Since Robert Louis Stevenson, his relatives, and their lighthouses would have to share the available space with two other engineering subjects in the paper to the Friday Club, it seemed reasonable to consider that the longer version presented to CSSE should become a 'stand-alone' paper. However, since there is a good deal of biographical material already published on him, I felt that it should cover only the 'bare bones' of RLS, and concentrate on demonstrating, once again, the significance of the Stevenson contributions to Scottish engineering and, especially, to lighthouses and their construction.

Interestingly, during the first half or so of the 19th century there was another distinguished multigenerational British engineering family that included George and Robert Stephenson, of whom L.T.C. Rolt and others have written biographies. The two families can be clearly distinguished as the 've's' and the 'ph's'!

My use of *The Lighthouse Stevensons* in the title of this paper is not original. It has become the informal name for the family. Also, it was used by the author of my principal source, Bella Bathurst, as the title for her book.

A Stevenson family tree has been added as Appendix 1. Photographs of its members and their 'products' also appear throughout the text. I also felt that a summary of early lighthouse building in Canada should be added, although not as part of the main text. It appears as Appendix 2.

The paper that resulted from the remaining material of the January 2015 talk has been included in the Cedargrove Series as #34/2015. The vacant spot in it left by the Stevensons has been filled with material on early engineering along Scotland's River Clyde.

The First Words to RLS...

Bella Bathurst, in her 1999 book The Lighthouse Stevensons writes at the beginning of it:

"Whenever I smell salt water, I know that I am not far from one of the works of my ancestors," wrote Robert Louis Stevenson in 1880. "The Bell Rock stands as a monument for my grandfather, the Skerryvore for my Uncle Alan, and when the lights come out at sundown along the shores of Scotland, I am proud to think they burn more brightly for the genius of my father." Louis might have been the most famous of the Stevensons, but he was not the most productive. Between 1790 and 1940, the members of the Stevenson family planned, designed, and constructed...ninety-seven manned lighthouses that still speckle the Scottish coast, working in conditions and places that would be daunting even for modern engineers...(They) were also responsible for a slew of inventions in both construction and optics and for an extraordinary series of developments in architecture, design and mechanics. As well as lighthouses, they built harbours, roads, railways, docks and canals all over Scotland and beyond.



The Problems...

In the late 18th and early 19th centuries, the Scottish coast - which runs for around 4,500 nautical miles, including the western sea lochs - was notorious for the number of shipwrecks that occurred. Conflicting tides and currents added to the dangers of riptides, sandbanks, both visible and submerged rocks, shoals and storms. The Pentland Firth became known as 'Hell's Mouth' and there was a notoriously dangerous whirlpool on the West Coast called Corrievrechan, between the islands of Jura and Scarba. Year after year the shipwrecks destroyed large numbers of vessels and killed many people. In 1799, for example, some 70 vessels were lost in the Firths of Tay and Forth alone.

But there was a group of people strenuously opposed to the building, and the builders, of anything like lighthouses that would reduce the numbers of shipwrecks: the so-called 'wreckers,' who would wait on shore during storms for shipwrecks to occur and then plunder the stricken vessels, their cargoes and passengers. Speaking of wreckers, many of you will have read Compton Mackenzie's book or seen the film of *Whisky Galore* - also called *Tight Little Island* - which tells the story of a group of modern ones. And there were also, in times of war 200 years ago, the press gangs that forced young men into naval service against their will to fill gaps in the manning of Royal Navy ships. Although people like lighthouse builders were exempt from being taken by these gangs, they were nevertheless being 'pressed' into naval service.

The first of the Scottish lighthouses was built (by James Maxwell and John and Alexander Cunningham) on the Isle of May at the entrance to the Firth of Forth in 1636. It made use of a coal-fired brazier on top, which was of no use in stormy, windy or rainy weather. For a very long time, it was Scotland's only permanent lighthouse.

Most of those that were eventually built in later years were placed on headlands, on shore. Those few that were built out to sea were placed on rocks that were not big enough to be islands. In engineering terms, this was an especially formidable and dangerous task. They were subject, as no other buildings were, to enormous pressures from wind, weather, wave and tide. Also, when construction began seriously in the late 18th century, the available techniques, tools and materials of construction were primitive. Lifting was limited to pulleys, wheels, jib cranes and shear-legs - and human muscle. Early concreting was not always effective and some very large stones had to be quarried, shaped and transported to the sites. Explosives for blasting were new and dangerous. The unloading of stones and other materials from supply ships onto the rocks could be very dangerous.

Things were not a lot better for the on-shore lighthouses. The horses used for haulage, for example, did not find steep slopes to their liking. And a completed lighthouse, whether on shore or on a rock, was usually a strange and solitary workplace for those who kept the lights in operation.

England in the late 18th and the 19th centuries had its own separate organization for the construction, management and operation of lighthouses, called Trinity House, established by Henry VIII in 1514 to control pilotage. In 1566, during the reign of Elizabeth I, responsibility for 'seaworks' was added.

Perhaps the most famous of the early English lighthouses were the Eddystones, built on a rock at sea, 14 miles to the south of Plymouth in Devon. The first Eddystone, was a wooden structure. Built by Henry Winstanley in 1698, it was destroyed by a storm in 1703. The second, designed by John Rudyard, was also a wooden structure surrounded by a core of brick and concrete. It was completed in 1709, and lasted until it burned down in 1755. The third Eddystone, and the best known, was John Smeaton's. It lasted for over a century, from 1759 until 1877, when the

weakened structure was partially dismantled and re-erected on Plymouth Hoe. Smeaton's novel design was shaped like an English oak tree. He built the structure of granite blocks that were dovetailed together and were secured by oak dowels. He also experimented with Roman possolana-type hydraulic cement, which would set under water. The fourth tower was designed by William Douglass using techniques developed by both Smeaton and Robert Stevenson. It was first lit in 1882, was automated a hundred years later, and is still in use.

Scotland's separate organization was the Northern Lighthouse Board (NLB), founded in 1786, after a series of severe storms showed yet again that lighthouses were needed round the Scottish coast. Its members were called Commissioners, and most were appointed *ex-officio*. Its income came from sources such as a levy on shipowners. Originally mandated to build four lighthouses, the Board was later given leave to build as many as it deemed necessary.

Incidentally, the NLB purchased the Isle of May light in 1814 from the Duke of Portland after almost 200 years of service. It was replaced it in 1816 by one designed and built by Robert Stevenson.

Map of Scotland and some of the early Scottish lighthouses



Thomas Smith...

The *Stevenson* 'lighthouse' story begins with a Scottish businessman called Thomas Smith, an ingenious mechanic and self-taught engineer, who was born in 1752 at Broughty Ferry, near Dundee. His father drowned when he was young and his mother encouraged him to make his career away from the sea. He apprenticed as a metalworker in Dundee, but moved to Edinburgh to establish his own business, successfully, as an ironsmith and lamp-maker. Among other things, he provided street lights and domestic hardware to the residents of Edinburgh's New Town (to the north of the old one, which was centred on what was called 'the Royal Mile'). Smith's expertise with lights and reflectors came to the attention of the NLB and he was appointed its first chief engineer in 1786. He then applied his expertise to the construction of the first four NLB lighthouses: Kinnaird Head; Mull of Kintyre; Eilean Glas (on Harris), and North Ronaldsay. As Bathurst notes in her book:

But for all the predictable and unpredictable human difficulties, Smith's early efforts with the Scottish lighthouses provided a useful guide for all his professional successors. He was, after all, not a trained engineer in the modern sense but an imaginative man who did his best with the materials available. The Commissioners had only a vague idea of what the work would entail, and expected Smith to complete most of the supervision on his own and unpaid. For almost 10 years Thomas took no salary at all from the NLB (who were, in any case, broke) and relied entirely on his income from the Edinburgh work...

Thomas worked for the Commissioners because he believed implicitly in the need for guidance at sea, not because he thought it might profit him.

Smith had been twice widowed before he married Jean Stevenson (née Lillie), the widow of Alan Stevenson and mother of Robert, grandfather of Robert Louis. Alan had been a maltster in Glasgow when he married Jean in 1771. A year later, their only son Robert was born. Involved in trade with the West Indies, as many contemporary Glasgow merchants were, Alan and his brother Hugh went out to the Caribbean in 1774 to pursue this involvement. It ended quickly and badly when both brothers died of fever that same year. Short of money and dependent on her family for subsistence, Jean moved in 1778 with her, then, six-year-old son Robert to Edinburgh in search of better things. But it was not until 1787 that she and Thomas Smith were married.

Thomas Smith may be considered the first of the *Lighthouse* Stevensons and the only non-Stevenson. He was the step-father of Robert, three of whose sons, two grandsons and a greatgrandson followed him into the lighthouse and other businesses. A third grandson was Robert Louis, who was only briefly associated with the family businesses.

Robert, and the Bell Rock...

By 1790 Thomas Smith had taken on Robert Stevenson as an apprentice. He was 16. In addition to his work for his step-father, Robert was sent to Glasgow University for engineering studies in math, physics, drawing and mechanics.

Smith and Stevenson, between them, built nine lighthouses between 1786 and 1806. However, by 1800 Smith had tired of the strenuous annual tours of the existing Scottish lights he had to make and the detail involved in constructing new ones, and retired as chief engineer of the NLB to concentrate on his other businesses. He was succeeded as chief by Stevenson, who held this position for the next 43 years. Robert was also involved with Smith's other businesses and contributed to their growth in size and scope. He was, for example, appointed engineer to the Convention of Scottish Boroughs, which brought much new work to the company.

In 1803 Thomas Smith built a large family home, called Baxter's Place, on the Calton Hill, to the east of Princes Street, which doubled as his corporate headquarters. It also served Robert Stevenson, as head of the family and the businesses, after Thomas's death in 1814.

Beginning with the Bell Rock, Robert Stevenson is usually credited with the design and construction of lighthouses at 15 locations, including two on the Isle of Man for which the NLB and not Trinity House was responsible. His most spectacular achievement, however, was undoubtedly the one built between 1807 and 1811 on the Bell Rock, a North Sea sandstone reef some 11 miles east off the Scottish coast and east of the mouth of the River Tay. This Rock had got its name from the vain attempts made long before by monks from Arbroath on the mainland to attach a warning bell to its surface. It was also called the Inchcape Reef.



John Smeaton



The Bell Rock was tidally submerged twice daily, making the prospect of constructing a lighthouse on it even more difficult. Winter storms were also deterrents. The debate and negotiations on this construction went on for years but was strongly influenced, in late 1804, when the naval warship, the 64-gun *H.M.S. York*, was wrecked there during a storm with the loss of all 500 men on board. Finally, in 1806, a bill was passed through Parliament authorizing the construction of the lighthouse. John Rennie (the Elder) was appointed chief engineer and presented his own design and plans for the lighthouse. Robert Stevenson was appointed resident engineer...and his plans were somewhat different. After more time and discussion, the NLB Commissioners approved Stevenson's plans and Rennie's part in the project was reduced, although he still exerted influence on the work, reported regularly to the Board, answered Stevenson's many letters, and visited the site several times during construction - in spite of chronic seasickness.

A work yard was established at Arbroath, on the nearby mainland coast, unhindered by tides or winter, and it was there that the Aberdeen granite stones for the lighthouse tower were cut and shaped by hand, using the Smeaton/Eddystone dovetailing model. A supply vessel was assigned to take men and materials off-shore to the site. Supplies were also sent to the Bell Rock in ships from the Firth of Forth and the port of Leith.

Since work on the lighthouse could only be done in the summertime and at low tide, the workmen remained on board the supply vessel for the rest of the day. Their first jobs were to excavate the foundation pit for the tower and to build the beacon/barracks that would be erected temporarily on the rock to provide a light for passing ships, to create a working platform for mixing mortar and for blacksmiths to sharpen picks and boring irons, and to provide alternative living space to the supply vessel for the workmen. Apart from dealing with the slippery rock surface and the troublesome sea, the workmen had to use these picks and irons to dig the foundation pit for the tower since the use of explosives was unreliable and could not be used on the restricted space of the rock. Also, while the digging of the foundation pit was in progress, the sea water in it had to be pumped out, a task that employed quite a few workmen.

The first full day of work on the site in 1807 was August 16, and the last for the season was in early October. When Robert visited the site in March 1808, he found that none of the previous season's work had been damaged or dislodged by the winter storms. The new season's work began again at the end of May. Priority was given to the beacon/barracks and the facilities they provided. Once the foundation pit had been excavated, the first courses of the tower's stones could be laid, although landing them on the Rock from the vessels they came in, and transporting them to the tower, was also a dangerous business. To make this easier, a cast iron runway was laid between the landing sites and the tower.

Work stopped in late September, and resumed again in May 1809. The beacon/barracks was finished shortly thereafter and the men moved into it from the supply vessel. With its six ironbound legs, it would have looked to a 21st century person like a child's moon rocket! As the tower grew, a connecting way linked the working platform of the beacon/barracks with the tower. The first 25 courses were of solid dovetailed granite. Trenails (trennels), joggles and





wedges, as well as grouting mortar, were used to strengthen the connections between the courses that provided the base on which the light room and the keepers' quarters would rest. Foreman Francis Watt also contributed to the design of the gear used to lift the stones up the tower.

The work year for 1810 began in April. There had been a little winter damage to the beacon/barracks, but the tower stump was undamaged. By early July, the tower was almost finished and the final stone was laid on July 30. However, a huge four-day storm blew up and pounded the rock and the tower, after which the light room at the top was hastily completed, the lantern and reflectors installed, and the beacon/barracks dismantled.

On February 1, 1811, the Bell Rock lighthouse was lit for the first time. The optical system has been changed from time to time. The light was automated in the 1990s. Two hundred years after it was built, it still performs its intended function and has survived many a fierce storm and accidents without harm.

With the Bell Rock finished and his engineering reputation effectively made, Robert Stevenson helped to engineer a dozen or so more lighthouses, but he also turned his attention to his other businesses, to designing and building improvements to the city of Edinburgh, including - notably - the approach to the city from the east, to commissions from the Scottish Boroughs, to the construction of harbours, canals and bridges, to the early railways and roads in Scotland, and to the development of lenses and reflectors, as well as rotation and shuttering systems for the lights. He was elected a Fellow of the Royal Society of Edinburgh and the Geographical Society of London, and a Member of the Institution of Civil Engineers, which was founded in 1818 and which owed its founding in part to John Smeaton, the builder of the third Eddystone light. By 1835, Robert had become a technical expert and consultant rather than a builder of lighthouses; his sons were doing this. However, he remained chief engineer of the NLB until 1843. But his retirement was not a 'conventional' one. He remained active in lighthouse work, in the work of the family business, as a consultant, and in other non-engineering matters. He died in July 1850 at the age of 78.

But a piece of his Bell Rock past kept dogging him: the question of who really deserved the credit for the design and construction of the lighthouse: Rennie or Stevenson? They had had their technical arguments during the design and building processes, but Stevenson appeared to win these, in part because he was in Edinburgh during these times, while Rennie was elsewhere in the country and in England looking after other projects. As resident engineer during construction, Stevenson sent letters to Rennie asking his advice on many matters, and receiving replies. Rennie visited the site twice during construction but, being a poor sailor, stayed away as much as he could.

When it was finished, and at the insistence of the NLB, Stevenson wrote an account of the construction of the lighthouse, but it was not published until 1824. In it, he downplayed Rennie's role and his position as chief engineer and ignored Watt's contributions to mechanical devices. He was criticized for this. However, when Stevenson died, the NLB paid tribute, carefully, to his design and construction work in connection with Bell Rock. In any event, Rennie was convinced

he had not receive sufficient credit for his contribution to the Bell Rock light, and fought back. He died in 1821, but his son - John Rennie the Younger (later Sir John) - carried on the argument...for years.

Alan, and Skerryvore...

Robert Stevenson married his step-sister, Jean, daughter of Thomas Smith and his first wife, Elizabeth Cooper. Robert and Jean had nine children but only five survived. The eldest, Jane, married Dr. Adam Warden and in later life became Robert's companion and secretary. Rob, the third of the survivors, also became a doctor - with his father's blessing! But Robert Senior was determined that his other three sons, Alan, David and Tom, would all be engineers and would follow in his footsteps. He required them, at the age of sixteen, to state in writing that they would submit to apprenticeships and be trained as engineers. Only David did so willingly.

Alan was born in 1807. Growing up, he was both a sickly (like his brother Tom and nephew Robert Louis) and a solitary child whose prime interests were in the arts rather than the sciences. He even wrote fiction and poetry, to his father's dismay. Eventually, he agreed to learn the business more or less as his father had done, through a mixture of practical experience in the field during the summers and theoretical and design work during the winters. As Bella Bathurst writes in her book:

Alan also spent a great deal of time outside Edinburgh, inspecting the lights and learning the various disciplines of civil and marine engineering...During 1824 he was despatched to bridgework at Annan, harbour works at Crail, and to the lighthouse under construction out on the Rinns of Islay. For a while he studied under Thomas Telford, examining riverworks down of the Wirral (in Cheshire). Alan's introduction to Telford had, as usual, been organized by Robert, who felt it would benefit his son's future career to have studied under such an illustrious (engineer).

Alan's 'big break' came in 1834, when he was appointed clerk of works for the Skerryvore lighthouse, on Scotland's west coast. It became his equivalent of his father's Bell Rock. Skerryvore's rock occupied only about 300 feet of a seven-mile-long, mostly submerged reef, much of which remained underwater even at low tide. Until the lighthouse was built, it was a ship-wrecker of the highest order. It was 12 miles from the treeless island of Tiree, where the wreckers lived, who did not want a lighthouse on the reef!

Again, it was to be a lighthouse on a rock, but this time farther out to sea and in the much more turbulent, super-windy Atlantic, and much further from the Edinburgh NLB headquarters. Again, it took the Commissioners a very long time to decide, finally, to put a lighthouse there. It was another massive undertaking. Its construction logistics were more complex and the preliminary

work for it took several years. For Alan, this occupied 1836 and 1837. There were still no forklift trucks, electric power, telegraphs or telephones, although explosives were becoming safer and into greater use.

Alan was promoted to be resident engineer at Skerryvore in 1838. He had already helped design and build seven lighthouses under the close supervision of his father. For this lighthouse's design, he had to ensure that the tower had a low centre of gravity, gave a storm's waves less leverage, and yet was still tall enough for the light to be seen well out to sea. In contrast with 68 feet for Smeaton's Eddystone and 100 feet for the Bell Rock, Sherryvore would rise 138 feet above its rock. Its stonework would weigh almost twice as much as the Bell Rock and four times that of Eddystone.

In contrast with weather conditions on the North Sea, Atlantic storms would begin suddenly, and cause weather delays and other problems for the workers. They could even be storm-bound at the workyard at the village of Hynish, on the island of Tiree! Again, skilled tradesmen had to be brought to Skerryvore from places such as Edinburgh, since only unskilled men were available locally.

A special dock was built at Hynish for the trans-shipment of people and materials. Since the Tiree gneiss was of limited use in building the tower, the main supply of granite - harder than the Aberdeen variety used for the Bell Rock - had to be quarried and brought from the island of Mull, 26 miles away. A special tender was built to do this job, in addition to the lighthouse supply ship.

As with the Bell Rock, there would be a temporary beacon/barracks to house working space and workers during construction. However, before it was ready, the workers would need to be transferred to, and from, Hynish on a daily basis. The journeys at the end of the workday were often stormy and unpleasant due to seasickness. Also, a mooring place for rowboats linked to the bigger supply boats had to be built on the rock.

Alan decided that dovetailing the tower stones, except for the upper courses, was unnecessarily expensive in view of the structure's weight, its low centre of gravity, and the fact that the bottom of the tower was never under water at high tide. Accurate shaping and dressing of them would be enough. Also, explosive powders could be used to dig the foundation pit although, in view of the small area of rock on which the light was being built, these operations would still be very dangerous.

Work began on the Skeryvore rock in May 1838. The priorities were to build a temporary work hut and raise the wood/iron beacon/barracks, beginning with the slotting of its legs. Unfortunately, not many weeks after Alan and his crew had left the rock in September, their summer's work was destroyed in a storm. So the beacon/barracks was redesigned, strengthened and more effectively anchored. The construction of the new model occupied a good deal of time on the rock during 1839 and 1840. The foundation pit for the light was also dug. At Hynish, priority was given to the preparation of the stones, the largest of which weighed over two tons. All told, and over a period of 18 months, around 5,000 tons of stones were shaped and shipped to Skerryvore. On July 7, 1840, the Duke of Argyll laid the foundation stone for the tower.

The beacon/barracks was ready when work began again in April 1841, with the tower the priority. This work continued through the seasons for that year and the next. The tower was finished in 1842. The remaining tasks were the installing of the lantern, lenses and other equipment for the light and finishing the living accommodations for the keepers.

In 1843, Alan Stevenson - who had earned two degrees from the University of Edinburgh succeeded his father, Robert, as chief engineer of the NLB and his direct role in Skerryvore ended. His 26-year-old brother Tom, later the father of RLS, took over and completed the job in 1844. However, since the Board omitted to cancel Alan's appointment as clerk of works, he effectively did both jobs, to the detriment of his uncertain health.



Skerryvore Lighthouse and Alan Stevenson



Skefryvore

David Stevenson, the third surviving son, was born in 1815 and, as mentioned, undertook his engineering training willingly, as his father wished.

While Alan was at Skerryvore, David began to take special interest in the work of the family business - for example, for the Convention of Scottish Boroughs - that included harbour and canal construction, river dredging, highways, bridges and municipal engineering. He became a very effective manager. On a more theoretical level, he studied the effects of tidal forces on coastal works.

During 1836 and 1837 he made an extensive tour of civil engineering works in England and visited the United States. Of this latter tour, Bella Bathurst writes:

...the first thing David noted on arrival in New York was not the glittering images of a foreign city but a careful record of American dockand harbour-construction techniques. His tour included Philadelphia, Washington, Mississippi, Ohio, and the Great lakes....He liked American engineering but found Americans themselves bizarre...The trip took eight months in total...

But, like his father and his brothers, David had his own 'Bell Rock' experience: the lighthouse that was built at Muckle Flugga, the rocky northern tip of Unst, the most northerly of the Shetland Islands, in an inhospitable and storm-plagued sea, and almost the last piece of rock between Scotland and the Arctic Circle. It was not an 'out to sea' site like the Bell Rock or Skerryvore. Nor was it a headland site like so many of the others the Stevensons had built. It was not even a flat shelf, but a steep triangle rising out of the sea. Access to the site was very much up-hill and very difficult to manage. Ships bringing supplies by sea had difficulties landing their cargoes.

Beginning in 1851, there was a great deal of opposition to the Muckle Flugga proposal. A negative survey by David made no difference. It was needed, said the Navy people in London. The Crimean War (1853-1856) was being fought against Russia, so access to the Baltic and to Northern Russian waters was essential. To complicate matters, being wartime, the Navy's press gangs were once more a threat to those who might seek to work on the project. But the Admiralty was both intransigent and insistent. The NLB Commissioners reluctantly agreed to build a light. Alan Brebner, one of the non-Stevenson apprentices trained by Robert and one of the most talented, was assigned as resident engineer, with David as overall supervisor. Tom Stevenson also assisted his brother. One difficult problem was solved, however, when it was decided that any stones used would be quarried on Muckle Flugga but, since the rock there was flawed, the tower would be built of bricks, which were also easier to transport than the granite blocks from elsewhere.

Work began in July 1854, while the War was going on. A 50-foot temporary tower was erected,

but was ruined during the winter storms that followed. Work began on a redesigned permanent structure the following year. It was 64 feet high, with walls three-and-a-half feet thick, and its foundations were seated ten feet into the rock. Skilled labour was again unavailable at or near the site and had to be brought in. All through construction, these workers had to dodge strong winds and high waves. It was completed in January 1858...too late for the War!



Muckle Flugga Lighthouse

and David Stevenson





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Tom, and Dhu Heartach...

As noted already, David Stevenson's entry into the engineering profession was smooth. His brother Tom's was not. As the youngest of the surviving boys and, following the infant deaths of four siblings, he was perhaps less subject to his father's pressures and expectations. But he was still prone as a student to inadequacies at school and, as a young man, to self-doubt. He secretly wrote fiction, and was demonstrably unexcited about engineering. Various alternative occupational attempts, with paternal support, came to nothing. By the spring of 1836, at the age of 18, Tom had begun his apprenticeship and was attending classes at Edinburgh University.

During his career, Tom took a special and continuing interest in the theoretical aspects of engineering as applied to the marine aspects of engineering, observing and recording the actions of various types of waves as they broke on rocks, shores or on built structures. For example, at Hynish, while finishing the Skerryvore lighthouse, he developed and used a dynamometer to measure the forces exerted by moving sea water beneath the surface.

Tom Stevenson's 'Bell Rock' was the lighthouse at Dhu Heartach (now spelled Dubh Artach), a rock that rose 40 feet above high water and was 240 feet in length in the infamous 10-mile long, scattered, Torran Reef situated on the edge of the Atlantic, 33 miles to the southeast of Skerryvore and 12 miles to the southwest of Mull. This reef sat in the middle of a shipping channel and had been the graveyard for at least 30 ships between 1800 and 1854. Dhu Heartach had no natural landing place or shelter from which to land materials and moor supply boats. It was later used by RLS, who visited it in 1869, for the scene of a shipwreck in his book *Kidnapped*. As Bella Bathurst points out:

Tom could have lit the reef from end to end and still not been confident it was marked well enough. He therefore needed to pick his site with care, to ensure that the light would be seen from all approaches...As Tom pointed out, the whole place was snared with natural traps as impassable as anything Alan or David had ever contended with...

Tom's design for Dhu Heartach's tower was a smaller version of Alan's for Skerryvore. It was built of dovetailed Mull granite. The shore station was established at Earraid, a tiny island 15 miles away, connected to the Ross of Mull by a sandy tide-washed spit. Tom also used a Bell Rock/Skerryvore beacon/barracks tower during construction. Again, skilled labour had to be brought to the site. The work was placed in the charge of Alan Brebner as resident engineer. Tom remained mostly in Edinburgh, busy with other projects as well as supervising Dhu Heartach.

The building of the tower began in April 1867, but little was done during that year due to the weather. The weather again interfered with the 1868 building season and work did not start again until late June. It was during August of that year that Brebner and 13 workmen were trapped inside the beacon/barracks for a week during a storm. Work remained intermittent during the next two working seasons. The light was finally lit in 1872.

1872 was also the year that a violent storm destroyed the breakwater of the harbour at Wick, in Sutherlandshire, one of many that had been designed and built by the Stevensons. This disturbed Tom, particularly, since he had studied the behaviour of the sea during his engineering career. The breakwater was redesigned and rebuilt but, in 1877, another violent storm washed it away. Wick harbour was Tom's most visible failure.

By this time, there had also been changes in the senior management of the Stevensons' lighthouse and other businesses. Alan had replaced his father as chief engineer to the NLB in 1843. Unlike Robert, he shunned publicity and preferred to deal with one matter at a time rather than many at once. While he also found writing easier and loved to travel, he suffered his double workload with difficulty and lacked relish for the annual lighthouse tours that the chief had to make. His health suffered and in the succeeding years he was frequently ill, progressively more so as time went on. With hindsight, because the disease was not identified until later, Bella Bathurst speculates that he was suffering from multiple sclerosis. Alan resigned as chief engineer in 1853 and was replaced by his brother David, who also became head of the other family enterprises, and supported in these activities by his brother Tom.

Alan Stevenson lived in retirement until 1865. In their tribute to him, the Commissioners noted their regret at the passing of such an educated, talented and kindly man. They alluded to his contributions to the building of Skerryvore and to his significant contributions to his pioneering work on optical technology for lighthouses.





Tom

Stevenson



Dhu Heartach

under

construction









Dhu Heartach, 2014



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Lights and lenses...

The early Stevenson lighthouses were fitted with Argand-type lanterns with reflectors and oil lamps that produced steady beams of light. Robert carried out experiments with silvered reflector lanterns. Also, to differentiate between beams from nearby lights, he devised systems for rotating the reflectors and the use of coloured glass, so that different beams could flash at different times.



By 1820, Robert had begun a relationship with the two Fresnel brothers in Paris - later actively carried on by Alan with the surviving brother - that helped to spread the development and use of the lenses that the brothers had developed. A series of prisms was placed at the front (the dioptric lens), with reflectors behind the lamps. This arrangement provided significantly more efficient and effective beams. The Bell Rock light was eventually converted, but the Skerryvore one had Fresnel lenses from the beginning.



Unfortunately, a dispute arose in 1825 between Robert and a friend and optics expert, Dr David Brewster, with regard to whom the credit for first introducing the Fresnel invention to Scotland should go. Brewster also demanded that all Scottish lights be converted immediately, while Robert recommended testing and gradual introduction, which was what took place, beginning with the Inchkeith light. David and Tom eventually became involved, as did a Parliamentary Committee, whose intervention led to Trinity House being given a say in the activities and future projects of the Scottish Board, much to the frustration of the Stevensons. The Stevenson-Brewster dispute was not finally settled - in the former's favour - until 1860.

Robert Lewis...

Ten years before then, Robert Lewis Balfour Stevenson was born, the only child of Tom and his wife Margaret, four months after the death of his grandfather Robert. His mother was the daughter of the Rev. Lewis Balfour of Colinton, then a village outside Edinburgh, and in whose household RLS and his cousins spent many summer holidays. From his Balfour grandfather, as well as from his Stevenson uncles, it appears that young RLS - as he became so well known - inherited his weak health. From his father and his uncle Alan, he may have got his literary leanings and their initial disinterest in the profession of engineering. He did, however, acquire a strong affection for his cousins. Rob and Katharine, son and daughter of Alan and his wife Margaret, became his lifelong friends. It appears that, at the age of 18, young RLS insisted that the 'Lewis' in his name be changed to 'Louis' (but with the 's' sounded!). The 'Balfour' was also dropped.

Lewis's early writing, while still a teenager, was influenced by Scottish history. His first publication, a pamphlet on *The Pentland Rising: A Page of History 1666*, was financed - surprisingly - by his father and appeared when he was only 16. His first articles were published while he was a university student.



Reluctantly, at the age of 18, RLS began an apprenticeship and was sent to the University of Edinburgh for theoretical studies related to engineering. He toured the lighthouse sites and projects with his father during the summers, but his mind was not always on them. He simply wanted to write. When he was 21, his father finally agreed to allow him to drop out of

RLS

engineering and, for security's sake, to study law. He qualified, was called to the Scottish bar in 1875, but never practiced. Instead, he began his travels around the world - usually in search of places where he would not be ill - that included both Europe and America, where his marriage to the divorced Fanny Osbourne took place. They also included his cruises in the Pacific and his sojourn and death in Samoa in 1894. His lifetime of ill-health has usually been associated with tuberculosis although, nowadays, it might have been called something else.

Early in his writing career, RLS developed a useful friendship with Leslie Stephen, editor of the *Cornhill Magazine* (and father of Virginia Wolff), and a stormy one with author W.E Henley. Later in life, he occasionally collaborated with his stepson, Lloyd Osbourne. His long-time friend Stanley Colvin became his literary editor. He wrote many essays and poems and extensively about his travels. Perhaps his most successful writing period was between 1880 and 1887, when four of his best-known novels were among the pieces written. He also wrote music.

The Later Stevenson Engineers...

David Stevenson, uncle of RLS, spent many years as chief engineer to the NLB and head of the Stevenson family businesses. In these activities, he had the help of his brother Tom, father of RLS. But it was not always an easy relationship. They were men with differing interests, enthusiasms and commitment to the businesses. Nevertheless, during their careers they collaborated in the building of nearly 30 lighthouses. By the end of this time, the Stevenson influence on the design and construction of lighthouses had become world-wide.

David became ill in 1881 and retired. The burden of managing the Stevenson civil engineering and NLB businesses then fell to Tom and to David Alan and Charles Stevenson, David's two sons, by then well established in the engineering profession. But this was not a happy relationship. Tom's lagging enthusiasm had waned further when his brother retired. David died in 1886, and Tom in 1887.

After Tom's death, the connections between the Stevensons' engineering business and the NLB were 'streamlined.' They became, effectively, consultants to the Board and more and more of the design, construction and inspection work was contracted out.

Both David Alan and Charles had studied engineering at the University of Edinburgh as part of their training. David Allan was associated with the building of three lighthouses with his Uncle Tom and partnered his brother Charles in the design and construction of 23 more. David Allan led the business and headed the Board's engineering activity, until his death in 1938. Technically speaking, the brothers consolidated the lighthouse building technology established by the earlier Stevenson generations, but added their own contributions - David to the management of the design-build process and Charles to the improvement of the optics. They also consolidated the family's position as lighthouse consultants to the rest of the world. Interestingly, the adoption by

the earlier Stevensons of the dovetailing of the stones was applied to the design of lighthouses in earthquake zones.

David Alan had a daughter, Dorothy Emily (D.E.) Stevenson, who was also a novelist. Genealogically, she was RLS's 'first cousin, once removed.' She wrote over 40 books that were described as 'light romantic novels.' (My mother and my paternal grandmother both read them!)



David Alan

Charles

D. Alan

The last of the 'Lighthouse' Stevensons was D. Alan, son of Charles, who was born in 1891. He became a partner in the family business in 1919 but never headed it. When his uncle David Alan died in 1938, the NLB Commissioners decided not to appoint yet another Stevenson as its chief engineer. Instead, D. Alan participated in the Clyde Lighthouse Trust and became an independent consultant on lighthouses. He wrote and published a book on the history on the world's lighthouses before 1820. At the time of his death in 1971, he was working to update Robert Louis Stevenson's own account of his family of engineers.

Lighthouse structures designed and built by the Stevensons have lasted for 200 years. Bella Bathurst sums them up this way:

(The family) took up the challenge of their times, blended it with the scientific breakthroughs of their day, and brought both to a point of near perfection. As Louis later noted, engineering "was not a science then. It was a living art, and it visibly grew under the eyes and between the hands of its practitioners."

The Last Words to R.L.S...

RLS wrote a number of 'pieces' about his family of engineers and about engineering, none of them published during his lifetime.

The New Lighthouse at Dhu Heartach was written in manuscript form in 1872. An edition was published in 1995.

Perhaps the best known is *Records of a Family of Engineers*, which was unfinished at the time of his death in 1894 and was first published two years later. It was principally concerned with their lighthouse-building achievements and was focussed on the life of RLS's grandfather, Robert.

Memoirs and Portraits is series of unconnected essays, one of which is devoted to his father, Thomas Stevenson, and was written in 1887. An edition was published in 1912 by Chatto & Windus.

On the Choice of a Profession was written in 1887, but not published until 1912. It has nothing to say about engineering as such. It is, rather, a whimsical, tongue-in-cheek essay on how a gentleman (in Victorian times, in England) might find himself 'choosing' a professional career. The publication of the manuscript in 1916, by Chatto & Windus, was arranged by RLS's stepson, Lloyd Osbourne.

In her book, Bella Bathurst notes that RLS recognized (in 1886, and far from Edinburgh) that his own fame was "swallowing up the recognition his family deserved." She quotes his reaction to his American publishers in regard to this problem:

"My father is not an "inspector" of lighthouses; he, two of my uncles, my grandfather, and my great-grandfather in succession, have been engineers to the Scotch Lighthouse service; all the sea lights in Scotland are signed with our name; and my father's service to lighthouse optics has been distinguished indeed. I might well write books till 1900 and not serve humanity so well; and it moves me to a certain impatience to see the little, frothy bubble that attends the author, his son, and compare it with the obscurity in which that better man finds his reward."

Robert Louis Stevenson's fame as a writer has fluctuated with time since his death and has been focussed principally on his fiction and poetry rather than on his biographical and non-fiction writing. He also composed music. The engineering achievements of his family of mainly modest people has, for the most part, been largely forgotten - at least outside Scotland. It should not be...

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Appendix 1

The Stevenson Family Tree



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Appendix 2

Earliest Canadian Lighthouses

The first Canadian lighthouse predates Confederation by more than 130 years. It went into service in 1734 at Louisbourg, Cape Breton Island, Nova Scotia, when the French occupied the fortress. It was modelled on the *Phare des Baleines* that had been built off La Rochelle, France, in 1682. It was destroyed by British troops during the siege of Louisbourg in 1758 and was not rebuilt until 1842. The current lighthouse dates from 1923. The second was the Sambro Island Light, in 1760, located at the entrance to Halifax harbour. It has been upgraded from time to time, but remains the oldest continuously operating lighthouse in North America. The Cape Roseway, on McNutt's Island, Shelburne, Nova Scotia light dates from 1788 but was hit by lightning and destroyed by fire in 1859. It had a 92-foot octagonal masonry tower, braced with wooden timbers and a clapboard exterior. In 1809 one was built at Bear Island on Digby Neck and replaced in 1832. The current one dates from 1944. Also in 1832, a lighthouse was built at Sydney Harbour.

The eight-sided wooden tower design now found in many Canadian lighthouses originated in the 1840s in the Atlantic provinces. The use of British cast iron structures originated in Newfoundland, but was quickly found unsuitable for the cold, damp climate.

There have been four lighthouses at Partridge Island at the entrance to Saint John, New Brunswick. The first went up in 1791, but was destroyed by fire in 1832. A second one was built in 1859 and equipped with the first steam-powered fog horn, invented by Robert Foulis. It was replaced in 1880. The third was replaced in 1959 by a fourth, with a concrete octagonal tower. Also, on Campobello Island, N.B., a lighthouse was built in 1829.

The first lighthouse on Prince Edward Island was built in 1846 at Point Prim, at the entrance to Hillsborough Bay near Charlottetown Harbour. It was one of the few in Canada to be constructed of brick, though now covered with wooden shingles. The second was at Panmure Head, on Panmure Island, at the entrance to Georgetown Harbour, in 1853.

The earliest lighthouse on Newfoundland was built at Fort Amherst, St. John's, in 1813. The Cape Spear and Cape Bonavista lights were built by England's Trinity House in 1836 and 1843. They were outfitted with the old Argand lamps from Scotland's Inchkeith (Spear) and Bell Rock (Bonavista) lighthouses.

An organization named after Trinity House was established in Lower Canada in 1805. Among its first lighthouses was the 1809 circular one on Ile-Verte, at the junction of the Saguenay and St. Lawrence Rivers. It served as a model for later ones built downstream at Pointe-des-Monts in 1830, on Anticosti Island in 1835, two others in 1843 and one in 1848.

The oldest lighthouse on Lake Ontario was built in 1804 at the mouth of the Niagara River, but

was demolished to make way for a fort during the War of 1812. The False Duck Island light was built in 1828 and demolished in 1965, Gibraltar Point on Toronto Island in 1829, and decommissioned in 1907, Point Petre was built in 1831, Nine Mile Point in 1833 and Presqu'ile in 1840. The latter two are still standing, although Presq'ile has no lantern.

Manitoba has a salt water coastline as well as many navigable lakes and rivers. The two oldest lighthouses were the one at the mouth of the Red River on Lake Winnipeg, built in 1898, and at Black Bear Island in Lake Winnipeg, also built in 1898. Beacons were installed in the 1930s with the opening of Port Churchill on Hudson's Bay.

Landlocked Saskatchewan and Alberta have lakes and rivers but no officially maintained lighthouses. There are private ones at Cochin/Jack Fish Lakes, Saskatchewan, built in 1989 and at Sylvan Lake (1988, demolished 2012) and at Pratt's Landing (2013) on the Peace River in Alberta

The first British Columbia lighthouse was built in 1860 at Fisgard, near Victoria. It had a Fresnel lens, made in England. Less than a year later, a second lighthouse was built at nearby Race Rocks.

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