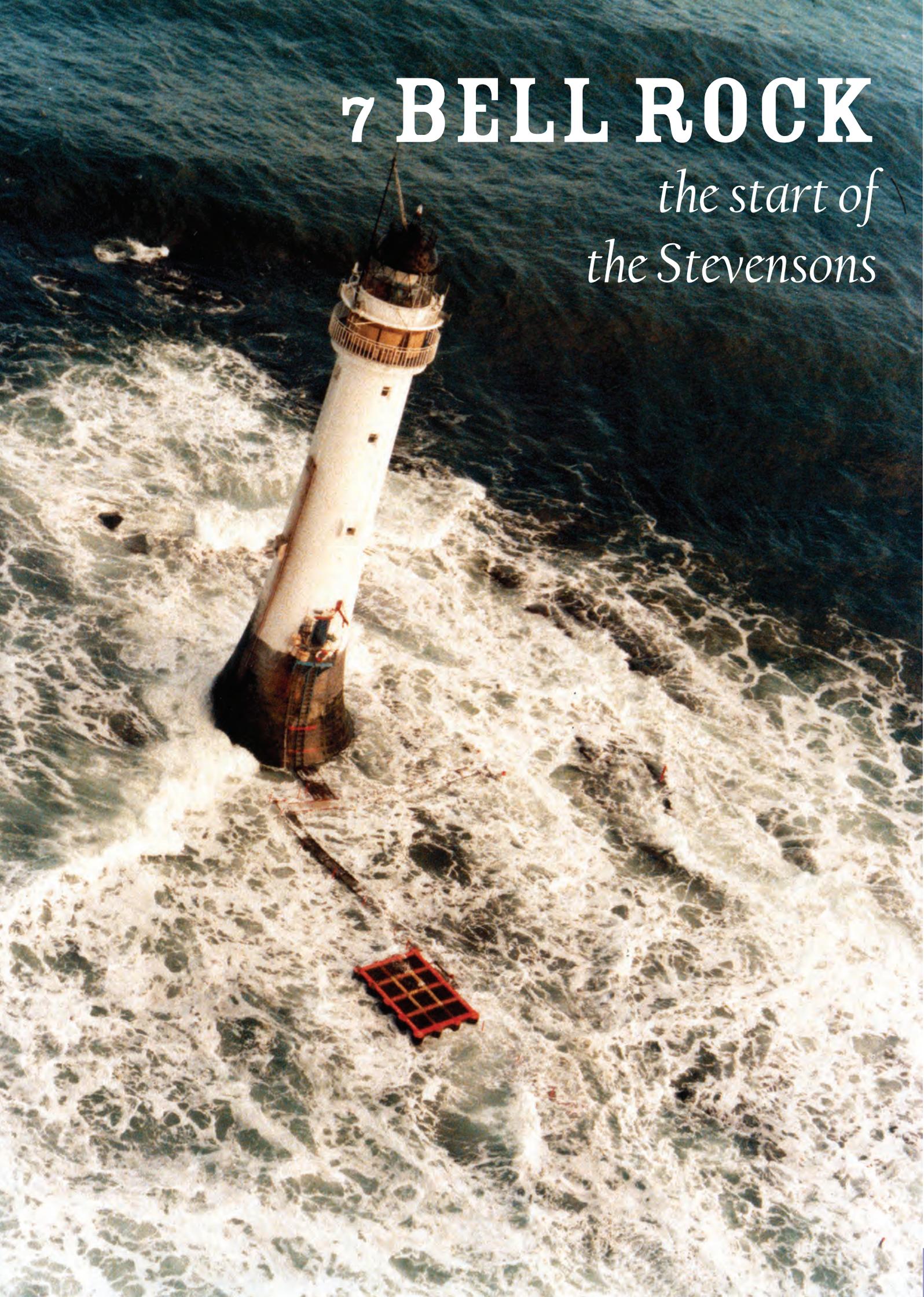


# 7 BELL ROCK

*the start of  
the Stevensons*



IF WE ARE to look for a reef which has a comparable history of disaster to, say, the infamous Eddystone, then it is surely to be found off the east coast of Scotland, where the Bell or Inchcape Rock rears its extensive bulk. The history behind this wicked reef is as famous as the lighthouse which now stands upon it, a history which stretches back to the 14th century when John Gedy, The Abbot of Aberbrothock (the ancient name for Arbroath) allegedly fixed upon it a bell tolled by wave action as a gesture to prevent further destruction and loss of life. The bell was removed by a Dutch sea-pirate who later perished on that very reef after losing his way in a storm. Since then the reef has been known the world over as Bell Rock.

During the 16th century this legend was perpetuated by a Scots historian who wrote, "On this great hidden rock...there was a bell fixed upon a tree or timber which rang continually, being moved by the sea, giving notice to the saylers of the danger. This bell or clocke was put there and maintained by the Abbot of Arbroath and being taken down by a sea pirate, a yeare thereafter, he perished upon the same rocke with ships and goodes, in the righteous judgment of God."

In 1815 the poet Robert Southey ensured the immortality of these events when he wrote the ballad of 'Sir Ralph the Rover' in which he describes:

*The pious Abbot of Aberbrothock  
Had placed that bell on the Inchcape Rock;  
On the waves of the storm it floated and swung,  
And louder and louder its warning rung.*

*When the rock was hid by tempest swell.  
The mariners heard the warning bell;  
And then they knew the perilous rock,  
And blessed the Abbot of Aberbrothock.*

Sir Ralph the Rover was Southey's name for the pirate who upset the kindly Abbot's intentions by severing the bell from its float,

*Down sank the bell with a gurgling sound,  
The bubbles rose and burst around;  
Quoth he, 'Who next comes to the rock  
Won't bless the Abbot of Aberbrothock'.*

On return from one of his plundering raid, heavy seas and thick mists upset his navigation:

*'Canst hear,' said one, 'the breakers roar?  
For yonder, methinks, should be the shore.  
Now where we are I cannot tell –  
I wish we heard the Inchcape Bell!  
They hear no sound – the swell is strong;  
Though the wind hath fallen they drift along,  
Till the vessel strikes with a shivering shock –  
'O Heaven! it is the Inchcape Rock!'*

*Opposite: The Bell Rock lighthouse with the walkway just visible between the lighthouse and the helicopter landing platform before it is finally engulfed by a rapidly rising tide. (P. D. Green)*



*Sir Ralph the Rover tore his hair,  
And cursed himself in his despair.  
The waves rush in on every side;  
The ship sinks fast beneath the tide!*

*Down, down they sink in watery graves,  
The masts are his beneath the waves!  
Sir Ralph, while waters rush around,  
Hears still an awful, dismal sound –*

*For even in his dying fear  
That dreadful sound assails his ear,  
As if below, with the Inchcape Bell,  
The devil rang his funeral knell.*

It is doubtful whether any bell existed or such events actually took place, although the regularity with which vessels continued to strike the Bell Rock and perish was a figment of no one's imagination. During a particularly severe three-day gale in December 1799, over 70 ships foundered on Scottish coasts, many of them had been driven northwards from England. At least two of these met their end on the Bell Rock including, it is said, HMS *York*, a warship of 74 guns which was lost with all hands.

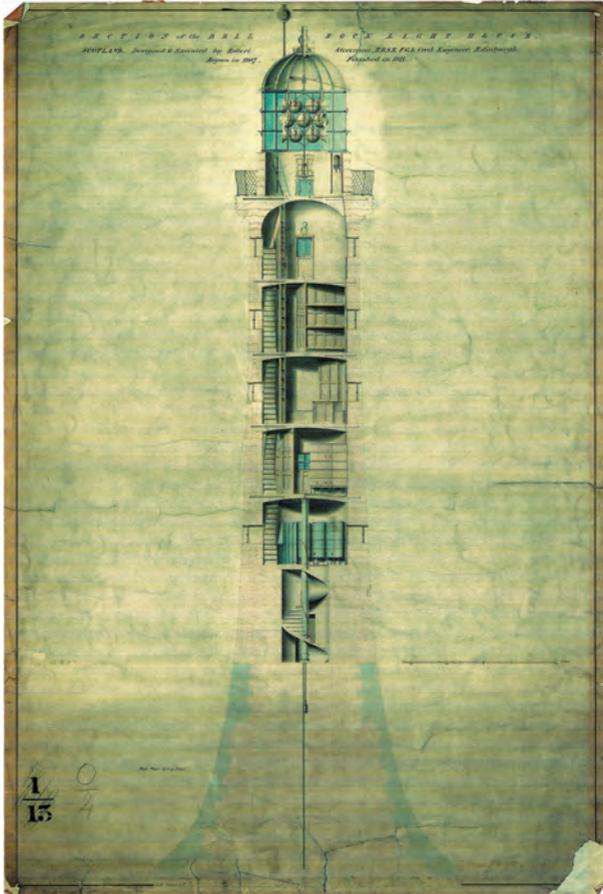
The Commissioners of Northern Lighthouses had been entrusted with the erection and maintenance of beacons in Scottish waters since 1786. They were not blind to their responsibilities over Bell Rock but could find no bank willing to advance the many thousands of pounds which would be necessary for the placing of a beacon on such a hazardous site. Its design, too, was proving elusive. Many and varied were the structures proposed by private individuals – stone towers on hollow metal legs filled with sea water, stone towers on stone legs, a solid stone base built on a wooden raft, floated into position and sunk. There were more,



*Right:* This is what the Bell Rock reef looks like as a rising tide with a strong wind stirs the whole reef into a maelstrom of white water. There were no second chances for vessels driven onto this particular graveyard.  
(Jim Bain)







Right: A plan of the lighthouse that has been delicately hand painted and shaded to show what it would have looked like immediately after completion. Details such as the clock in the service room below the lantern or what looks like a marble bust above a window in the room below make this drawing a real work of art. (Northern Lighthouse Board)

lighthouse engineer throughout the world. It is simply that at high water the Bell Rock is submerged by 12 to 16 ft of water, making it completely invisible. At low water a scant 4 ft appears, and between tides this whole weed-covered submarine plateau becomes a confused scene of white water and swirling currents.

If any structure was to be built here the workings would be completely immersed twice a day until they could rise above the high water mark. The time actually possible on the rock for construction would be scarce indeed before the rising waters drove the workmen from their site. Smeaton's Eddystone, set upon a site above high water at all times, was considered an unsurpassable achievement, yet here was Robert Stevenson attempting to emulate him on a rock immersed twice daily by the notorious North

Sea. Stevenson knew that this work would test all his powers as an engineer.

It would also be a costly venture. Smeaton's stone tower had cost somewhere in the region of £20,000. Stevenson estimated that about £43,000 would be necessary to finance the erection of a similar structure on the Bell Rock. The Northern Lighthouse Board did not have such money in their possession but an Act of July 1806 provided for a levy to be extracted from vessels passing the rock, and an advance of £25,000 was paid for the venture to be started.

In 1807 work on construction began. John Rennie, probably the leading civil engineer of the day, was appointed as consulting engineer by the Lighthouse Board, to advise and assist Stevenson in his task, although, as we shall see later, the actual design and day to day routine of construction was very much the work of Stevenson, despite a claim by Rennie's son to the contrary.

During the early months of 1807 the tedious but necessary business of employing masons, blacksmiths and foremen began. A base was established at Arbroath where the stones would be cut and dressed before despatch to the rock. Two sailing vessels were acquired by Stevenson. The *Pharos* was a 70 ft Prussian fishing vessel which was to serve as a temporary light and barrack for 30 of the artificers, while the *Smeaton* was a specially built tender of 40 tons to be used for the ferrying of rough stone from the quarries into the yards at Arbroath, and the finished product to the reef. She could also accommodate 24 men. The *Pharos* was towed into position in July and anchored a mile off the rock, from where a light was exhibited on 15th September onwards. On 17th August the *Smeaton* was sailed to her moorings a quarter of a



Left: Robert Stevenson (1772–1850) the engineer of the Bell Rock lighthouse. (Northern Lighthouse Board)



mile from the rock, while Stevenson and six masons landed to select a site for the lighthouse and wooden barrack they planned to erect as a refuge for the men while on the reef.

It was seven years since Stevenson had first set foot on the reef at the request of the Commissioners. On that day in 1800 he, and the boatmen who had brought him there, were vividly reminded of the reef's morbid record. Scattered over the surface and lodged in its crevices was the debris from the wrecks of centuries past, each a catalogue of human misery and despair. Stevenson described the activities of his companions on that first visit:

*...meantime, the boatmen were busily employed in searching all the holes and crevices in quest of articles of shipwreck, and by the time the tide overflowed the rock, they had collected upwards of 2 cwt of old metal, consisting of such things as are used on shipboard...such as a hinge and lock of a door, a ship's marking iron, a piece of ship's caboose... a soldier's bayonet, a cannon ball, several pieces of money, a shoe buckle, &c,...a piece of kedge anchor, cabin stove, crowbars, &c.*

*Above: An early engraving showing the scene on the Bell Rock in about July 1810. The masonry is almost complete, and the wooden barrack in which the men lived is clearly seen. So too is the walkway between it and the tower, and also the cast-iron tramway laid over the reef for the transport of blocks from boats to the tower. (Dundee Courier)*

Once the site for the wooden refuge had been selected work could be commenced on the 12 holes, 2 ins in diameter and 20 ins deep, which would hold it securely to the reef. The sandstone was resistant to the blows of their tools which blunted quickly. The comparative spaciousness of the rock allowed a portable forge to be set up which returned the men's tools to their former keenness, although not without some considerable skill on behalf of the blacksmith who had to maintain the forge while being continually harassed by breaking waves and tides which rose with alarming speed.

During this preliminary work a much-documented incident occurred on 2nd September. There were 32 men working on the rock, landed from three boats. Work proceeded until the winds freshened and the sea took on a mood of turmoil. Two men left the reef in one of the boats in an attempt to secure the moorings of the *Smeaton*, a fruitless mission as it turned out for the mounting seas had broken her ropes and she was drifting seaward at a rate of knots, dragging





the small boat with her. Stevenson happened to look up and noted the situation. It was quickly apparent that this predicament was somewhat perilous. Stevenson wrote later that he found himself:

*...placed between hope and despair, but certainly the latter was by much the predominant feeling in my mind – situated upon a sunken rock in the middle of the ocean, which, in the progress of the flood tide, was to be laid under water to a depth of at least 12 feet in a stormy sea. There were this morning 32 persons in all upon the rock, with only two boats, whose complements, even in good weather, did not exceed 24 sitters.*

The *Smeaton* was by now 3 miles distant when the rapidly rising tide called a halt to the work. The men, still oblivious of the circumstances, made their way to where the boats were moored to find that only two remained. Two boats which normally only carried eight men in such rough conditions. The men stood in silence. Stevenson was lost for words. Their plight was all too obvious and needed no verbal explanations. Stevenson had decided that the only solution to what appeared to be an insoluble problem would be for some men to take to the boats while the remainder hung from the gunwhales.

By the grace of God, before he actually presented his plans, a boat was spotted approaching the reef. It was the pilot boat from Arbroath delivering the mail. Only a stroke of good fortune brought the boat close, for seeing the *Smeaton* disappearing into the distance the captain assumed that all hands would be on board and was about to return to port. It was only at the last minute the stranded men were seen. Sixteen souls were plucked from the reef by the pilot while the remainder scrambled into the boats. Three miserable, storm-tossed hours passed before they made contact with the *Smeaton* close to midnight, to bring to an end the day many thought would be their last. So shaken were the men that only eight would return to the reef the following day. The safe return of this gallant party restored confidence in the others who returned to normal working.

By sheer coincidence, a similar incident is reported just three days later on 5th September, when the *Pharos* had her moorings cut by a piece of floating wreckage. Luckily there were no men on the reef when this occurred and the *Pharos* was returned to a mooring slightly more distant from the rock.

Throughout the remaining days of September large numbers of men, sometimes as many as 52, toiled on the reef to erect the wooden struts for the refuge beacon and secure them into the

*Opposite:* A striking image taken by a former keeper at Bell Rock from the helipad as the white water roars in on a rising tide.  
(Jim Bain)



*Left:* Before automation and helicopters, the reliefs at Bell Rock were done from open boats which tied up at one of the cast-iron walkways that radiate from the lighthouse. Everything then had to be hauled up through the entrance door.  
(Northern Lighthouse Board)



*Left:* Thirty years on, a picture from almost exactly the same spot. This time the relief is done by helicopter, but everything landed still had to be hauled through the entrance door.  
(Author)



rock by means of metal clamps. Twelve wooden beams were fixed together to give a pyramidal structure whose base diameter spanned 36 ft, which gave a height of 55 ft above the reef. Cross members and raking struts gave extra stability and the whole was further strengthened by chaining it into the rock. The first 12 ft of the legs were coated with pitch to resist saturation by sea water, and lashed to the very top were numerous cases containing 5 lb of biscuits and 48 bottles of drinking water for use by any unfortunate mariners wrecked in the vicinity. With the framework of the barrack in place, and five days spent in excavating the base of the tower, work finished for the season during October.

In the winter months, the now familiar routine of preparing and shaping the huge granite and sandstone blocks using a template was followed. Stone was ferried into the workyard from two sites; sandstone from Mylnefield near Dundee, and granite from Rubeslaw at Aberdeen. At Arbroath gangs of men laboured meticulously to dovetail the blocks and cut holes through them for trenails.

A new tender, *Sir Joseph Banks*, was constructed, and that in turn carried three new rowing boats for the speedier conveyance of the prepared blocks, as well as incorporating living quarters for 15 men. It was during this winter that plans were also in hand for a novel idea designed to overcome the problem of moving the blocks, which could weigh as much as 3 tons, from the point of off-loading from the boats to the site of the tower. In certain circumstances this could be almost 300 ft across a rock surface split by cracks and gullies. A cast iron railway was planned, surrounding the base of the tower and radiating from it to the various landing sites. Iron trolleys carrying the blocks used this ingenious device which stood on iron legs, 5 to 6 ft proud of the reef and that enabled it to be laid almost level.

Work started for the second season on 26th May 1808 when *Sir Joseph Banks* dropped anchor off the reef. The upper portions of the wooden framework were quickly enclosed to form a covered refuge for the men incorporating a platform, 20 ft above the waves, for the blacksmith's forge and for the mixing of cement. The beacon would now serve two invaluable functions; the blacksmith was able to work unhindered by the waves which previously had doused his forge with untimely regularity, and more importantly, the shelter it afforded made the wearying journeys to and from Arbroath unnecessary and offered the opportunity to work for every possible moment on the tower.

Throughout June large numbers of men worked feverishly between the tides to excavate the footings of the light and to erect the railway from their workings to the various landing points. Within the circular base of the tower any irregularities of level caused by fissures were filled by 18 variously shaped blocks which were loaded on to row-boats and dropped over the site at high water as the railway was not yet complete. Once in position, a circular base 42 ft across with a perfectly smooth floor was ready to receive the first complete course of 123 stones. The first was set on 10th July and the remainder occupied the rest of that month. Every block



*Left:* This is a really unusual view of Bell Rock lighthouse – the top of the lantern dome. A couple of keepers work on the emergency beacon while another captures the scene from the ladder that leads to the anemometer – the highest point it is possible to climb to on the lighthouse. (Jim Bain)



*Left:* This view of the lantern from an NLB helicopter shows exactly how the previous photograph was taken. The ladder to the weather vane and anemometer leans against their support, although a head for heights was clearly needed if any work was to be done on the instruments. Bell Rock used to be a Met Office coastal reporting station. (Author)





was cut following Smeaton's precedent on Eddystone – dovetailed to its neighbour and held in position using wedges, joggles and trenails until its security was finalised by the setting of the mortar or by the laying of another course on top of it. In this first course 508 cu ft of granite and 76 cu ft of sandstone were used, weighing together 104 tons.

A second course of 136 stones, weighing 152 tons, was laid by 27th August, which brought the solid base 2½ ft from its foundations and clear of the reef, thus removing the time-consuming and monotonous pumping of the workings before the day's labours could be commenced. By 21st September the third course was complete, but heavy weather forced Stevenson to call a halt to the proceedings. Over 400 stones had been set upon the reef to give a pillar of granite which rose almost 5 ft from it and weighed 388 tons.

During the close season two more vessels were acquired or built in an effort to ensure the continual supply of stones into the workyard and the dressed blocks from there to the reef. Every stone, upon being finished, was laid out in the yard to check its fit with that of its neighbour. If satisfactory, the grooves and holes for the wedges and trenails could be cut.

The new season started badly, towards the end of April. By 31st May, six days after the first stones of the fourth course had been landed, 3 ins of snow lay on the workings. Fortunately, it did not last, and work on the wooden beacon could go ahead apace. A ropeway was slung between barrack and tower giving access before the tide had receded fully. By 25th June, the seventh course was in place, thanks to the efforts of over 50 men who worked solidly through both tides. At one point during the summer months the blocks were actually being laid at a faster rate than they could be delivered, so much so, that by 8th July it was noted that the high

*Above: A striking study of Bell Rock lighthouse from the east. Notice how the green staining, caused by wave action, extends almost half way up the tower!*

*(Peter J. Clarke)*



tide failed to cover the stump of the tower, now 13 ft above its base. This was the signal for much rejoicing and decorating of the masonry and attendant vessels with flags. A three-gun salute was fired, to the hearty cheers of all concerned.

By lodging in the three-tiered barrack, every single opportunity could be taken to press ahead with the work. During August the tower rose with tremendous rapidity, sometimes at the rate of over 50 blocks a day, until on 25th August all 1,400 tons of the solid base were finally complete. It had taken three seasons to get just this far, 31 ft above the rock and 17 ft above high spring tides. This was, Stevenson concluded, a fitting point at which to call a temporary halt to the upward progress, although 24 men stayed behind until November to complete the railway and strengthen the legs of the beacon.

By the April of 1810 work had started once more, mainly repairing storm damage to the railway and fixing a rigid timber walkway between barrack and tower. The first batch of stones arrived on the *Smeaton* on 18th May. Throughout June and July, frenzied activity from the men was the order of the day as Stevenson realised that it was within his grasp to complete the masonry by winter. Several times gales swept over the unfinished tower and halted their progress, but by 9th July the final stones were unloaded on to the reef ready to be hauled almost 100 ft up the side of the tower. On the 30th of that month the last stone was gently lowered into position to complete the 91st course, accompanied by a statement from Stevenson: "May the great Architect of the universe, under whose blessing this perilous work has prospered, preserve it as a guide to the mariner." The masons returned to Arbroath and were replaced by carpenters engaged to complete the internal fittings. Doors, window frames and ladders were positioned, and by 25th October the Argand burners were installed in the lantern. Finally, as the culmination of three days continuous labour, two 5 cwt fog bells were hung.

However, it was not until 1st February 1811 that the lighthouse entered service owing to difficulty in obtaining large sheets of red tinted glass for the lantern. This accomplished, a notice was inserted in various newspapers and journals to the effect that:

*A lighthouse having been erected upon the Inch Cape or Bell Rock, situated at the entrance to the Firth of Forth and Tay, in north lat. 56°29', and west long. 2°22', the Commissioners of the Northern Lighthouses hereby give notice that the light will be from oil, with reflectors, placed at a height of about one hundred and eight feet above the medium level of the sea. The light will be exhibited on the night of Friday, the first day of February 1811, and each night thereafter, from the going away of daylight in the evening until the return of daylight in the morning. To distinguish this light from others on the coast, it is made to revolve horizontally, and to exhibit a bright light of the natural appearance and a red-coloured light alternately, both respectively attaining their greatest strength, or most luminous effect, in the space of every four minutes: during that period the bright light will, to a distant observer, appear like a star of the first magnitude, which, after attaining its full strength, is gradually eclipsed to total darkness, and is succeeded by the red-coloured light, which in like manner increases to full strength and again diminishes and disappears. The coloured light, however, being less powerful, may not be seen for a time after the bright light is first observed. During the continuance of foggy weather and showers of snow, a bell will be tolled by machinery, night and day, at intervals of half a minute.*

With the appearance of the notice nobody was more relieved than Stevenson himself. His devotion to his task throughout the four years had finally been rewarded. Four years which had seen some of the most foul weather the North Sea could produce, allowing only furious bursts of work before the rising tides or menacing seas drove them off the reef. In the end his determination had won through. He had produced a masterpiece – a solid pillar of stone rising 115 ft out of the sea, 42 ft across its base, tapering smoothly to only 15 ft at the top. In all, 28,530 cu ft of stone



weighing 2,076 tons had been shaped, dovetailed and cemented into a monolith of true beauty. It had cost £61,331. Six rooms were provided, the lower three for coals, water and oil, the upper trio serving as bedroom, kitchen and sitting room. Above these was the cast-iron octagonal lantern room with its burners, reflectors and highly polished glass.

On that day in February 1811 when the lantern machinery was set in motion, a reassuring multicoloured flash greeted mariners close to the Forfarshire coast. Sadly, to overshadow his triumph, Stevenson's efforts were questioned in public some years later and, while it is generally accepted today that the architect and engineer of the Bell Rock lighthouse was Robert Stevenson, this has not always been the case. It appears that during the latter half of the 19th century there was considerable dispute between the Stevenson family and the son of John Rennie, who together with Stevenson and the famous Thomas Telford, were jointly responsible for the execution of the undertaking although not, it now appears, to the same degree.

The misunderstanding first came to light in about 1848 when Sir John Rennie published a paper in which he claimed his father, who had since died in 1821, designed and built the Bell Rock lighthouse. Stevenson's sons promptly denied this claim in literature of the time, yet it again sprang to prominence when a book entitled *Lives of the Engineers* by Samuel Smiles appeared in 1874, even though when Stevenson died in 1850 the Commissioners of Northern Lighthouses honoured their great engineer by stating that to Stevenson "...is due the honour of conceiving and executing the great work of the Bell Rock lighthouse."

It was apparently from a letter of March 1814 written by John Rennie to a friend, claiming that he prepared the plans and visited the site on occasions, plus minutes of the Northern Lighthouse Board proclaiming Rennie as chief engineer, that Sir John based his claim. While it is true that Rennie prepared a plan for a lighthouse, it was in fact never adopted, the design of the tower is unquestionably Stevenson's. Also, it would appear from correspondence of Rennie's that, for various reasons, on the only three occasions he visited Arbroath to see the stones being cut, he never actually set foot in the tower while it was being constructed, despite travelling out to the reef and landing during two of the visits.

There exists much more documented evidence to suggest that Sir John's statement about his father, while not being a complete figment of his imagination, certainly seems to fall down under close investigation. Much of this lengthy documentation appears in an appendix to a book entitled *The World's Lighthouses Before 1820* by D. Alan Stevenson, himself a descendant of Robert. Even so, the evidence is presented in such a concise and unbiased manner that it leaves the reader in little doubt as to whose brain-child the Bell Rock lighthouse was. Most modern sources concur with the conclusions reached in this appendix and honour Robert Stevenson as the creator of this great work of civil engineering.



Above: Huge rollers break against the Inchcape Rock from the east. The iron walkways are seen to good effect in this shot. (Jim Bain)

This is not the only time that the name of Stevenson occurs in this volume. Indeed, the Bell Rock heralds the start of an era of lighthouse construction around Scottish waters that is dominated by the Stevenson family. Many of Robert's descendants maintained the standard set by their father to build towers whose beauty and grace equalled, if not exceeded, that of the Bell Rock. Trinity House boasted that the name Douglass was connected with its finest works, while north of the border the Stevenson family reigned supreme, acclaimed by all who knew their work as the finest lighthouse engineers throughout the world.

The history of the Bell Rock lighthouse is a long one. Nearly 200 years have elapsed since the first stone was set upon the reef and it is now the oldest remaining rock tower in existence around the British Isles. There is no other rock station where the original tower still functions without being superseded by a more modern structure. For nearly 200 years it has resisted tempest and storm to remain as sound as the day it was built. Its durability or strength have never been called into question.

Obviously, with such an extended history its lonely vigil has not been without incident. On 30th July 1814, only three years after its operations commenced, it was visited by Sir Walter Scott while on a tour of Scottish lighthouses. After partaking of breakfast with the keepers he wrote the now famous verse in the visitors book:

*Pharos loquitur  
For in the bosom of the deep  
O'er these wild shelves my watch I keep,  
A ruddy gem of changeful light,  
Bound on the dusky brow of Night:  
The seaman bids my lustre hail,  
And scorns to strike his timorous sail.*

It was also in 1814 that Stevenson decided the outside of his lighthouse should be painted white, a decision prompted by the discolouration of its walls.

The lantern room of the Bell Rock has also witnessed many modifications – most intentional, but with the occasional unexpected remodelling! For instance, it is well known that the brilliance of a lighthouse often acts as a curious magnet for seabirds. On the night of 9th February 1832 a herring gull dashed against the windows of the lantern room with sufficient force to shatter the glass into thousands of fragments. The keepers, hearing the splintering glass, rushed to examine the cause of the damage and found a herring gull, with an estimated wingspan of 5 ft, on the floor of the lantern room. A sizeable herring was lodged in its gullet, along with a piece of plate glass.

In 1842, the entire contents of the lantern (lamps, reflectors and machinery) were removed and shipped to Newfoundland where they continued to give excellent service in Bonavista lighthouse for another thirty years. The replacement machinery in the Bell Rock was converted to use paraffin as an illuminant instead of colza oil in about 1877.

By 1890 the lighthouse could warn of fog using a tonite (an explosive made from gun cotton and barium nitrate) explosive fog signal which replaced the two fog bells. On 5th April that year an explosive charge detonated prematurely causing considerable damage to the lantern windows and the optics themselves. It took until 13th April before repairs could be effected and the light returned to service – the first time since it was built the lighthouse had failed to give its nightly warning.

There were further modifications in 1902 when the entire lantern was removed and all



the equipment replaced by what has been described as, “one of the finest lenticular apparatuses then made.” The lenses had equiangular glass prisms with a focal distance of 1330mm emitting a red and white flash every 60 seconds. During these alteration the two obsolete 5cwt fog bells were removed, one of which was donated to Arbroath Museum where it can still be seen today in the Signal Tower Museum.

The major modifications of 1964 improved the optics and upgraded the living accommodation for the keepers, this having changed very little since the lighthouse was built. At this time Chicken Rock lighthouse off the southern tip of the Isle of Man was being automated and its original lenses of 1875

would become redundant. It was decided to install these in the Bell Rock. The paraffin vapour burners were removed and replaced with a 3,500 watt electric light bulb which produced 1,900,000 candlepower in a single white flash every



*Left: The Summer Rose from Arbroath was the Bell Rock supply boat, although on this day there is not much to supply as the lighthouse is being converted to automatic operation. The solar panels are in position on the gallery, but there is no lens in the lantern. Two temporary lanterns have been stacked on top of one another on the roof of the dome. The flags decorating the tower are to celebrate its 175th anniversary. (Jim Bain)*

three seconds that was visible for 28 miles. The electricity was produced by generators installed inside the tower. Fresh water and fuel oil capacities were increased by additional tanks, some of which are on the lantern gallery, the tonite fog warning system was replaced by three supertyfon compressed air generators, while the rooms within the tower had their functions changed around. From top to bottom they became; lightroom, control room, living room, bedroom, store room, upper engine room, lower engine room, access shaft and entrance. The old lightroom had all the optics installed on an upper level, while all the complex electrical control and monitoring gear was installed below this.

A similar incident to the 1890 tonite explosion took place many years later during World War II, although its cause was rather more deliberate. On April 1940 an enemy shell was dropped onto the reef, exploding about 10 yards from the base of the tower, but near enough to destroy several lantern panes. This, together with cursory machine-gun attacks at intervals during the hostilities, resulted in 9 bullet holes through the dome, 14 lantern panes broken, 4 damaged lens prisms, 6 red shades smashed, plus damage to the balcony and balcony rail. Fortunately, there were no fatalities.

During the First World War a rather unfortunate chain of events combined to produce what were nearly fatal consequences. Normal practice during wartime was for the lighthouse to be in darkness, except when specifically requested to be otherwise. On 27th October 1915, the Captain of the *Argyll*, an armoured cruiser of 10,850 tons, sent a message to the Admiral Commanding the Coast of Scotland at Rosyth requesting the Bell Rock to be lit on the night of October 27th/28th. All messages to the lighthouse had to be delivered by boat as no radio was installed, but unfortunately the message never reached the keepers owing to heavy seas. The *Argyll* foundered on the reef but the crew of 655 were saved.

The crew of an unauthorised helicopter delivering newspapers to the keepers in December 1955 were not so lucky. The rotor arms caught the top of the tower plummeting the craft into the sea. The crew died as a result of their misjudgement while the damaged lantern made the lighthouse unserviceable for a week.

*Opposite: Spokes of light wheel around the night sky above the Bell Rock on a foggy night.  
(Jim Bain)*

The lighthouse remained unserviceable for a considerably longer period after a disastrous fire on 3rd September 1987. A spillage of diesel fuel oil, the fumes from which ignited, caused a severe fire in the kitchen and required the keepers to evacuate the tower completely. On their way down through the tower they wisely closed hatches behind them and threw out any inflammable materials left by contractors working in the tower, thus minimising the effects of the fire. The three keepers were air lifted from the entrance balcony into a Search and Rescue helicopter from RAF Leuchars without injury.

The greatest damage occurred in the kitchen where the mainly wooden fittings burned fiercely. The heat was sufficiently intense to crack the internal granite walls (some of the cracks extending through to the outside), blow out the windows and melt the aluminium ladder to the lightroom. As the fire spread upwards into the lightroom it destroyed the lantern glazing, radio equipment and batteries, as well as being hot enough to blister the paintwork on the outside of the lantern dome. A temporary light and two 'racons' mounted above the dome survived. Immediately below the kitchen, the bedroom suffered smoke damage.

If ever such a disaster could be described as 'fortunate' this might be an appropriate description of the Bell Rock fire. The lighthouse was in the course of conversion to automatic operation and was at the interim stage between the removal of the 'old' equipment and the installation of the automatic machinery. The lost equipment was therefore of little consequence, apart from the fact that the programme of automation was somewhat delayed.

A temporary kitchen was installed in the room below the bedroom while refurbishment commenced. The tower was made weatherproof and remanned on 6th November 1987. Contractors filled the internal cracks by pressure injection of concrete and reglazed the lantern, enabling the automation programme to recommence early in March 1988. An interesting angle to the conversion progress was the installation of solar panels around the lantern gallery to provide power for rotating the optics and powering the 'racon' and radio monitor. An acetylene gas burner provides the light.

The Bell Rock has never had a 'helideck' as such but today it does have a huge netting shroud that looks a bit like the Trinity House style of helideck supports, draped over the outside of its lantern. Its purpose is to prevent migrating sea birds perching on the solar panels, fouling them with droppings and reducing their efficiency. The final keepers of the Bell Rock lighthouse were withdrawn on 26th October 1988, since when it has been monitored from the NLB Headquarters in Edinburgh.

It would be fair to say that the building of the Bell Rock lighthouse was a landmark in this field of civil engineering. Its success was due, not only to the genius of its designer, but also to the enthusiasm and dedication of the men he had in his charge. By insisting on minimum periods for working on the rock, and paying particular attention to the welfare of these men, Stevenson was able to inspire and lead them to the rapid completion of their project, despite the seemingly overwhelming factors against them.

Its construction was watched with awe by sceptics on the Scottish coast, just as today's generations marvel at its slim profile breaking the horizon 11 miles off Arbroath. While they watched the slender stalk of masonry grow they were probably unaware that this was going to be the last major rock tower built with the aid of sailing vessels, for the Age of Steam was soon to revolutionise civil engineering.

Stevenson saw the Bell Rock operate for less than 40 years before he died. If he could be remembered for just one achievement then it would surely be this lighthouse. Its ageless defiance of the waves is matched only by the dedication of its builder.



