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TRANSATLANTIC CABLES

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Early Signalling Systems

Before the telegraph system, messages were hand delivered by foot, by horse or coach, by rail and by ship, or by a combination of methods.Despite enticing names such as "Flyer" or "Lightning", stage coach journeys and associated mail deliveries were slow. A coach left Exeter at 5 a.m. and the fastest, the "Telegraph", reached London some 17 hours later. With the favourable trade winds, communications with America took a month.

Flags, lamps and mechanical semaphores were also used to send messages. However, they were ineffective in fog or heavy rain and were often slow and expensive - each line-of-sight receiving tower re-signalling the message to the next, with increasing risk of errors. A mechanical semaphore telegraph system was established between London, Portsmouth and Newmarket as early as 1774 and in 1826 a 70 mile chain of eleven stations connected Liverpool with Holyhead.

In 1837 cooperation between William Fothergill Cooke and Charles Wheatstone resulted in a Patent for "improvements in giving signals and sounding alarms in distant places by means of electric current transmitted through metallic circuits". The system was demonstrated to the Directors of the new London and Birmingham Railway between Euston and Camden Town on 24th July 1837.

Despite insulation problems (when the cotton covering of the cores in the metal conduit became damp) the Directors of the Great Western Railway were impressed, and in 1839 arranged the installation of Cooke and Wheatstone's five needle telegraph over a distance of 13 miles between Paddington and West Drayton. The conductors were now strung above ground, suspended from glass insulators fitted to iron posts at the track side. Line resistance was overcome by developing the work of H. C. Oersted (Influence of current on a magnetic needle 1819-1820) and positioning lightly pivoted

iron needles close to the operating coils; deflections to the left or right by two of the five needles, providing 20 points of intersection and an alphabet of 20 letters.

For one shilling the public could enter the telegraph office to view this wonder of the world and for a further shilling could send a message - and so the public telegraph system was born.

Early Submarine Cables

Insulation and cable manufacturing methods improved and by the 1840's experiments were progressing with underwater telegraph cables on both sides of the Atlantic.

The first notable achievement, laying a cable across the Channel from Dover, was carried out by Jacob and John Watkins Brett in August 1850. A paddle steamer, The Goliath, modified for the task with a large wide reel of cable installed amidships, become the Worlds first cableship. On completion of laying, a Cooke and Wheatstone needle telegraph was connected and a message transmitted to Prince Louis Napoleon Bonaparte. Shortly afterwards the cable was fouled by the anchor of a French fishing boat - its skipper "salvaging" a length of the golden seaweed.

Oceanography

In 1839 Sir James Charles Ross, whilst sailing for the Antarctic, ordered a 76 lb lead weight to be lowered over the side. It took nearly an hour to reach the bottom, some 14,550 feet below. This discovery of "depressions of the bed of the ocean beneath its surface very little short of the elevation of Mount Blanc above it" profoundly influenced oceanography and our knowledge of the World.

In 1855 the book, Physical Geography of the Sea and Its Meteorology, by former US Naval Officer M. F. Maury, suggested that ocean currents dictate climate. His contemporary, John M. Brooke, developed a deep sea sounding device which obtained samples of the seabed whilst measuring its depth. Maury arranged for ships all over the world to use Brooke's device, and organised the systematic sounding of the North Atlantic, paving the way for laying the first transatlantic cable.

HMS AGAMEMNON

The First Crossing of the Atlantic

The first attempt to lay a transatlantic telegraph cable was made in 1857 between Valentia Island, County Kerry, and Newfoundland. To reduce costs the British Government provided HMS Agamemnon, built in 1852 and of 3,200 tons displacement, whilst the Americans provided USNS Niagara**.**Built in 1855, she was the finest ship in the American Navy and at 5,200 tons, the largest steam frigate in the world. Both ships were extensively modified to accommodate the 3,000 miles of cable; 1,250 tons of cable on each ship. Together with their escorts Leopard and Susquenhana and other support vessels, they became known as The Wire Squadron.

The cable was manufactured at the Glass Elliot Cable Works, Greenwich, it comprised 7 copper strands twisted together to make a single core which was then wrapped with three layers of gutta-percha insulation, a rubber obtained from the tree of that name, native to Malaysia.

Cable laying commenced on 6th August 1857; with the intention of the Niagara laying the first half. After 4 days with 335 miles of cable laid, the brakes on the paying out mechanism were applied too quickly, causing the cable to break and be lost irretrievably in 2,000 fathoms.

The paying out gear was modified, a dynamometer fitted to regulate the tension and over the next year methods modified and practiced. It was agreed that the two ships should meet in mid-Atlantic the following summer, join their cables and then steam away from each other; maintaining contact via the cable as they progressed. Work restarted on 28th June 1858, but after laying only 6 miles the cable broke. The ships returned to the starting position and layed 80 miles before the cable broke. On a third attempt 200 miles was laid before failure struck again. It was now reckoned that too much cable had been lost and the disheartened fleet returned to port. After much debate it was concluded that sufficient cable remained for one final attempt and after loading fresh supplies they set out again. On 29th July 1858, after riding out one of the worst storms ever recorded in the Atlantic, during which the Agamemnon almost foundered, the cables were spliced and the ships sailed for "home". On 5th August 1858 the Agamemnon sailed into Dingle Bay and shortly after the Niagara "reported" its arrival in the Bay of Bull's Arm, Trinity Bay, Newfoundland. At 2:45 a.m. the first transatlantic telegraph message was passed; simply reporting that the cable was "open for commerce".

Premature Rejoicing

The success of the enterprise was acclaimed as being among man's greatest-ever scientific achievements. On 16th August 1858 Queen Victoria sent the American President James Buchanan greetings - the 103 words taking over 16 hours to transmit.

In America, the newspaper tycoon Cyrus W. Field, the man behind the project, became a National hero, whilst at home the project engineer, Charles Bright, was Knighted - at the grand old age of 26. A firework display at New York City Hall got out of control and the building was almost destroyed.

After the transmission of some 400 messages, attempts to increase the signal by operating at almost 2,000 volts wrecked the cable. The American Civil War then deflected attention elsewhere**.**

Developments

Deep sea cable sections, which are at reduced risk from third party damage, were made with less protection and weighed between two to three tons per mile, compared with ten to thirty tons per mile for the more vulnerable and heavily armoured shore ends. However, the lightly protected gutta-percha insulation of the deep sea sections proved a tempting delicacy to the teredo worm which inhabits the depths and it was found necessary to incorporate a brass tape.

In 1860 repairs to a cable between Corsica and Sardinia had a profound effect on marine biology.

It had been believed that below 1,800 feet the dark seas and oceans were lifeless. Yet the cable recovered from 7,200 feet had living coral formations established on it, proving conclusively that organisms could flourish in total darkness, at near freezing temperatures and at pressures of over 3,000 lbs/sq.inch. Cable manufacturing methods and materials improved and by 1866 over 100 submarine telegraph cables were in operation worldwide.

The Second Transatlantic Cable

In 1865 at the end of the American Civil War, a report (that appears to have taken a committee the duration of the War to write!) was finally published, recommending a further attempt to "tame" the Atlantic.

It was decided that the cable should be laid in one continuous run. However, only one ship in the world was capable of carrying 2,600 miles of improved cable, now weighing 7,000 tons - the SS Great Eastern. Originally called the Leviathan, she was designed by Isambard Kingdom Brunel and built between 1854-58 at John Scott Russell's shipyard at Millwall on the Isle of Dogs. At 22,000 tons, she was five times the size of any other vessel afloat. Designed to make the trip to Australia without refuelling and carrying 4,000 passengers in luxury, the Great Eastern was designed to out-perform the fastest clipper ships on the route. But she became dogged by escalating construction costs, a much delayed launch and troubled trials; almost bankrupting her owners even before her maiden voyage. A slump in trade with Australia forced the company to trial her on the trans-Atlantic run, but she was too slow to compete with the smaller faster vessels dominating that route. In 1861, thanks to Brunel's new bulkhead construction she survived a severe storm and two years later her innovative double hull construction saved her again when a rock tore a 85 ft hole in her. By 1864 three companies had been bankrupted by her expense. Building of the Suez Canal, for which she was far too large, finally ruled out any profitable return to the Australia or Far East routes.

After lying idle, fate now smiled on the Great Eastern and gave her a purpose for which she was uniquely suited - Transatlantic cable laying. After significant modifications to accommodate cable tanks and paying out gear, cable laying from Valentia commenced on 23 July 1865. After laying 1,186 miles of cable the cable handling engine broke down, the cable snapped and was lost in 2,000 fathoms. After several unsuccessful attempts to grapple the cable, the Great Eastern turned for home.

However, enthusiasm remained high and a further 1,990 miles of cable was ordered. On the 30 June 1886 she set out again from Valentia. After 14 days and no major problems, Brunel's Great Eastern succeeded in joining Europe and America with a cable from Valentia to Hearts Content, where connection was made to existing land lines to New York. The cable carried its first message on 23 July 1866. Not content, the Great Eastern returned to the position of the lost 1865 cable, which she had marked with buoys. After thirty attempts the cable was hauled aboard and jointed to the new cable which was laid back to Newfoundland - there were now two working Transatlantic telegraph cables!

The Telegraph Act 1869

By 1869 the Railway Companies and a large number of rival Telegraph Companies had erected a total of 16,000 miles of telegraph lines. The Telegraph Act of 1869 set out to nationalise the numerous private telegraph companies to form a long overdue integrated national network. Many companies rushed to install lines and cables into unprofitable areas, to benefit from the benevolent compulsory purchases to follow. In October 1869 The Fusilier steamed from Zawn Reeth near Porthcurno towards the Scilly Isles laying cable, only to run out before making landfall - in the rush a serious miscalculation had occurred. Not to disappoint the dignitaries gathered at St Mary's the engineer ordered full steam ahead, breaking the cable. Towing just a few yards of cable she received a rapturous welcome!

The All-Red Line

One of the men who financed the crossing of the Atlantic was John Pender, a wealthy cotton merchant and entrepreneur. The venture's success inspired him to develop the "All-Red Line", a round-the-world cable linking the British Empire.

Multiplexing was used on busier circuits and by the 1920's speeds had increased from 12 words per minute to over 200. In 1925 "Regeneration" was introduced, in which delicate electro-mechanical devices cleaned up, amplified and re-transmitted faint incoming signals at each stage automatically; thus saving human intervention and reducing errors. Long telegraph cables later employed

repeaters every 100 miles or so, powered from each end, with a total voltage of up to 12,000 volts.

Selecting Submarine Cable Routes

Cable routes are surveyed to avoid great depths and one popular area in the North Atlantic became known as "Telegraph Plateau". Areas of volcanic activity are also best avoided, however, in 1929 an eruption and associated underwater landslide caused breakages in over 20 telegraph cables with repairs taking over two months.

Cable laying ships show at the masthead a double cone between two balls to indicate they are cable laying and require a clear passage. It is a complicated task with the rate of paying out continually adjusted to match the slope of the ocean bed. Despite showing cables on Admiralty charts, dragged anchors can damage cables and expensive, time consuming location and repairs are needed. Today a fleet of modern cable laying ships, equipped with the latest dynamic positioning, computerised profiling and bow thrusters, remain on standby at strategic locations throughout the world to locate and repair faulty or damaged submarine cables.

Valentia Island

The original 1866 telegraph station at Corabeg was replaced in 1871 by a new station near Knightstown, which remained operational until 1965. A visit to the quaint museum in Knightstown is a rewarding experience with one room full of original equipment, documents and press cuttings of those early pioneering days.

Cornwall's Association with Submarine Cables

Cornwall has also played a major role in Transatlantic communications. The first cable came ashore at Porthcurno in 1870 - almost by accident. The Falmouth, Gibraltar and Malta Telegraph Company, originally intended Falmouth as the point of departure. However, due to last minute concerns over anchors dragging in Garrick Roads they diverted the cable into the sandy cove of Porthcurno. The company, founded in 1869 by John Pender, was one of three established to lay a chain of cables linking Porthcurno and Bombay. In 1872 they merged to form The Eastern Telegraph Company and, with associated companies, developed worldwide telegraph communications, with Porthcurno at its hub. Porthcurno (code name PK) manually transmitted and received cable code, a type of Morse, which was received as a flickering spot reflected from a sensitive mirror galvanometer. After 9 years, the siphon recorder, developed by Professor William Thompson, later Lord Kelvin, simplified their task. By 1872 Porthcurno had 27 staff, including 15 probationers, who learnt to operate the system by shadowing trained staff.

In December 1901, following concern that Mr Marconi's radio might put the Eastern Telegraph Company out of business, a 170 foot wooden mast was obtained from Holman's of Camborne, and a large aerial was erected on the cliff above Porthcurno to monitor radio messages from nearby Poldhu - thus the birth of industrial espionage. However, the Government believed the best interest of the Empire would be served by a merger and in 1929 Imperial and International Communications was formed, being renamed Cable and Wireless in 1934. A Training School was established in 1915, with initial training in London and the best 12 of each class of 30 sent on to Porthcurno.

During a visit to Porthcurno during the Second World War Mr Churchill, concerned that all the Empire's telegraphy was routed through one house, ordered that tunnels be excavated into the hillside and within those tunnels the complete telegraph station was rebuilt. The station still has its own generators and blast proof doors; though the flame-barrage protecting the beach from invasion has gone!

The arrival of international submarine telephone cables in the 1950's was the beginning of the end for telegraphy and Porthcuurno, which at one time operated 14 cables, closed in 1970, remaining as a C & W Training College until 1993. Now known as the Museum of Submarine Telegraphy, the property and its wealth of original equipment is in the care of The Trevithick Trust.