



A Wire to the New World

The Transatlantic Telegraph Cable



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West Carleton Amateur Radio Club
July 2018

First, A Little History ...

On April 14th, 1865,
President Abraham
Lincoln was assassinated



*The news reached
London 12 days later*

On September 19th,
1881 President James
Garfield died of injuries
inflicted by an assassin



*The news reached
London 12 minutes later*

This is the story of what made that possible ...

The Electric Telegraph ...



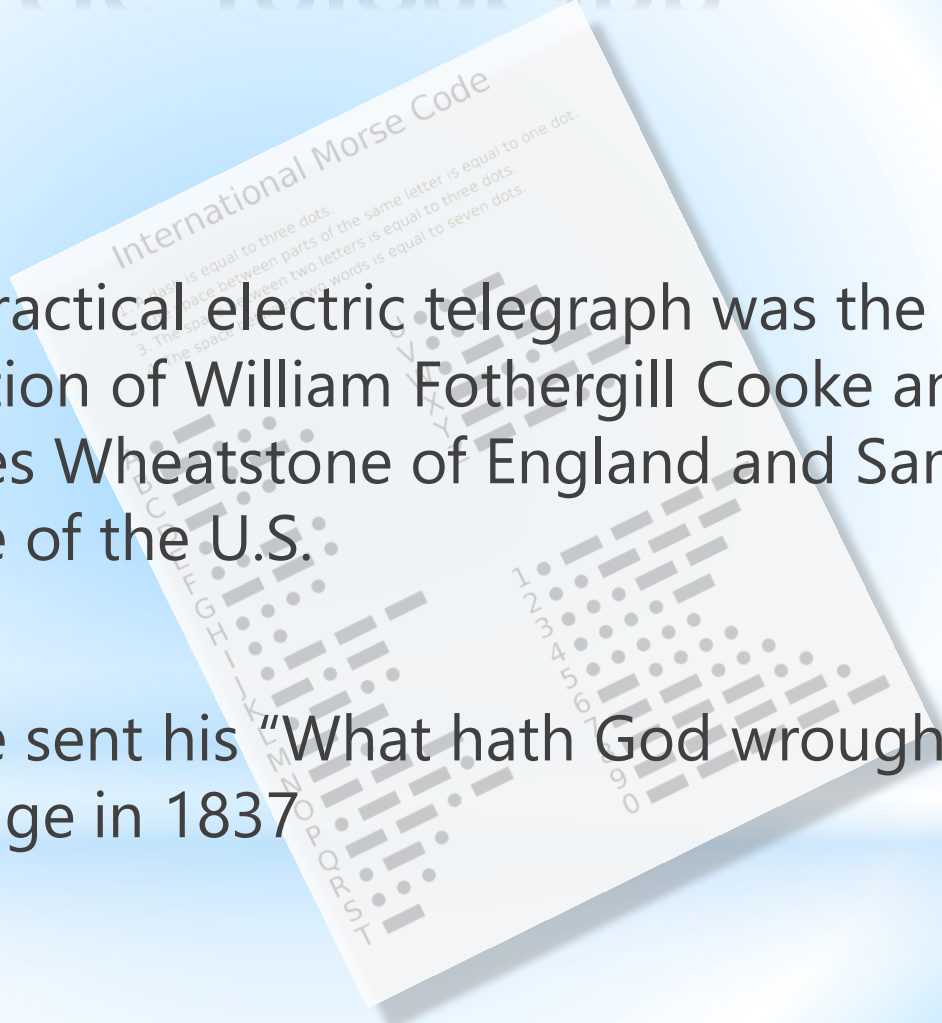
Cooke



Wheatstone

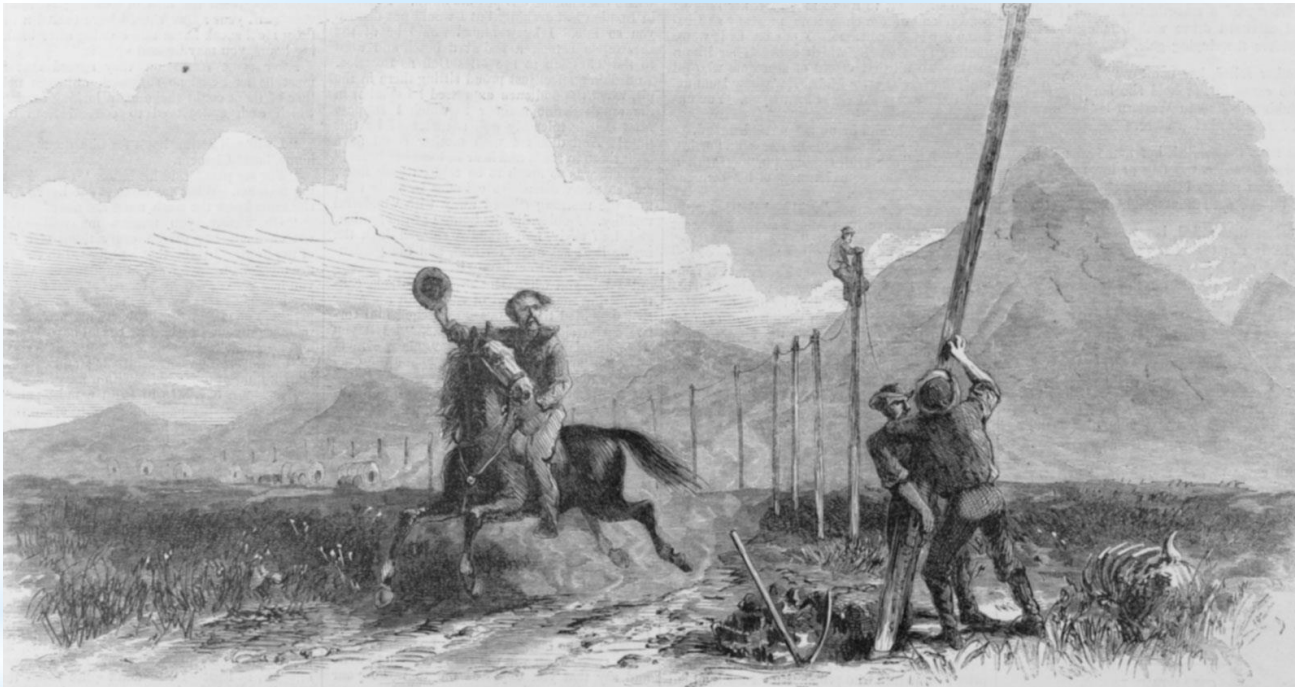
The practical electric telegraph was the invention of William Fothergill Cooke and Charles Wheatstone of England and Samuel Morse of the U.S.

Morse sent his "What hath God wrought?" message in 1837



The Growth of Telegraph Networks ...

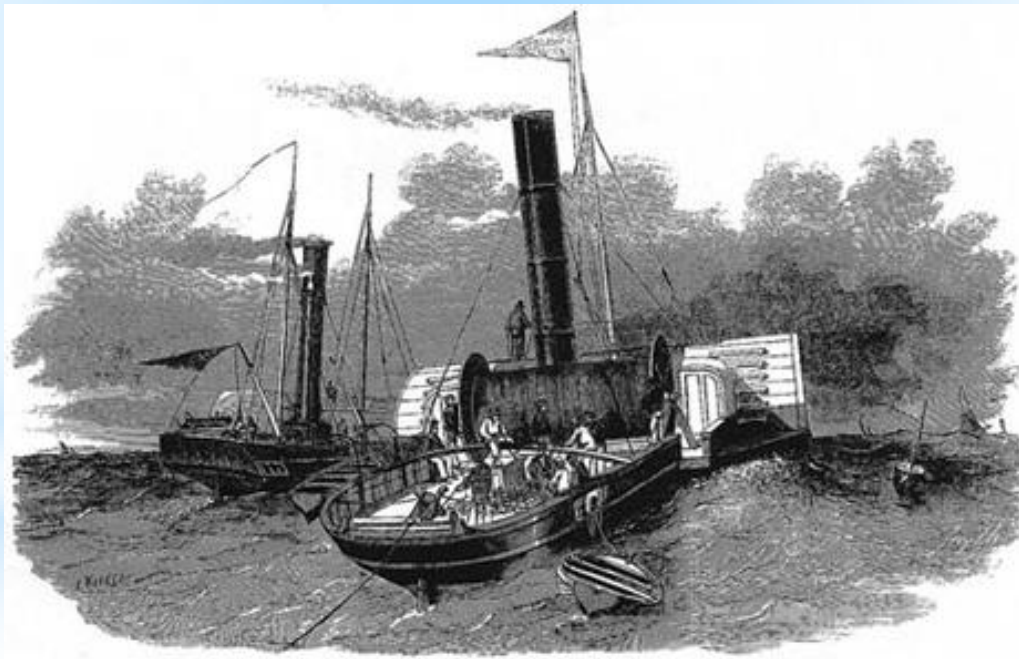
By 1850 telegraph networks existed throughout Europe and the settled parts of North America.



In 1861 in North America, the Pony Express shut down after only nineteen months of operation once a telegraph line was established to Sacramento CA.

Telegraph Cables Underwater ...

In 1850 the first attempt to lay a telegraph cable from Dover to Calais was undertaken by the steamer *Goliath*. By 1855 England was connected to the European Continent and to Ireland.



A Man and an Idea ...



Cyrus Field 1819 – 1892

In January 1854 Cyrus Field was asked to help re-finance a bankrupt venture to extend the North American telegraph network to St. John's, Nfld.

Field, a successful and wealthy New York City businessman, had no expertise in telegraphy and – initially – not very much interest.

Frederick Gisborne ...

1824 -1892



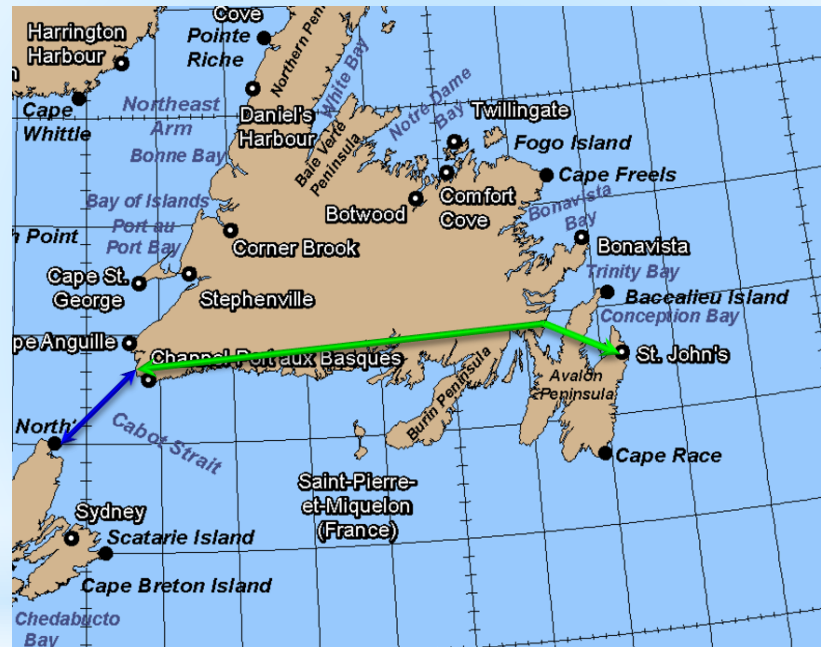
Cyrus Field's meeting was with Frederick Gisborne who had taken leave from his post as General Manager of Nova Scotia's telegraph network to promote a business venture which, it was hoped, would reduce the time it took messages to cross the Atlantic between Europe and the Americas.



Tombstone: Beechwood Cemetery

Gisborne's Project ...

As originally proposed, an undersea cable from Cape Breton to Newfoundland and an overland telegraph line to St. John's.



Ships from Europe could then exchange messages in St. John's and shave two to four days off the communication time to New York— then 12 to 14 days or more.

Thinking big ...

But, Cyrus Field took another look at the map ...



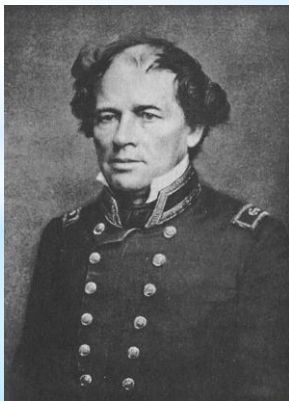
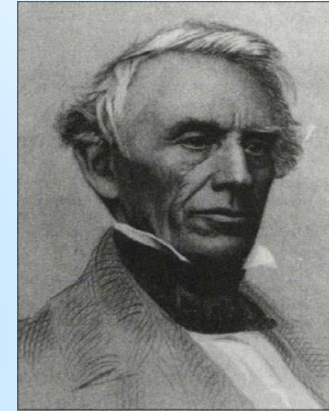
Newfoundland to Valentia Island, Ireland - about 2200 miles - the closest distance between Europe and North America.

Why not extend the cable across the North Atlantic?

But, could it be done ?

Field then consulted two experts ...

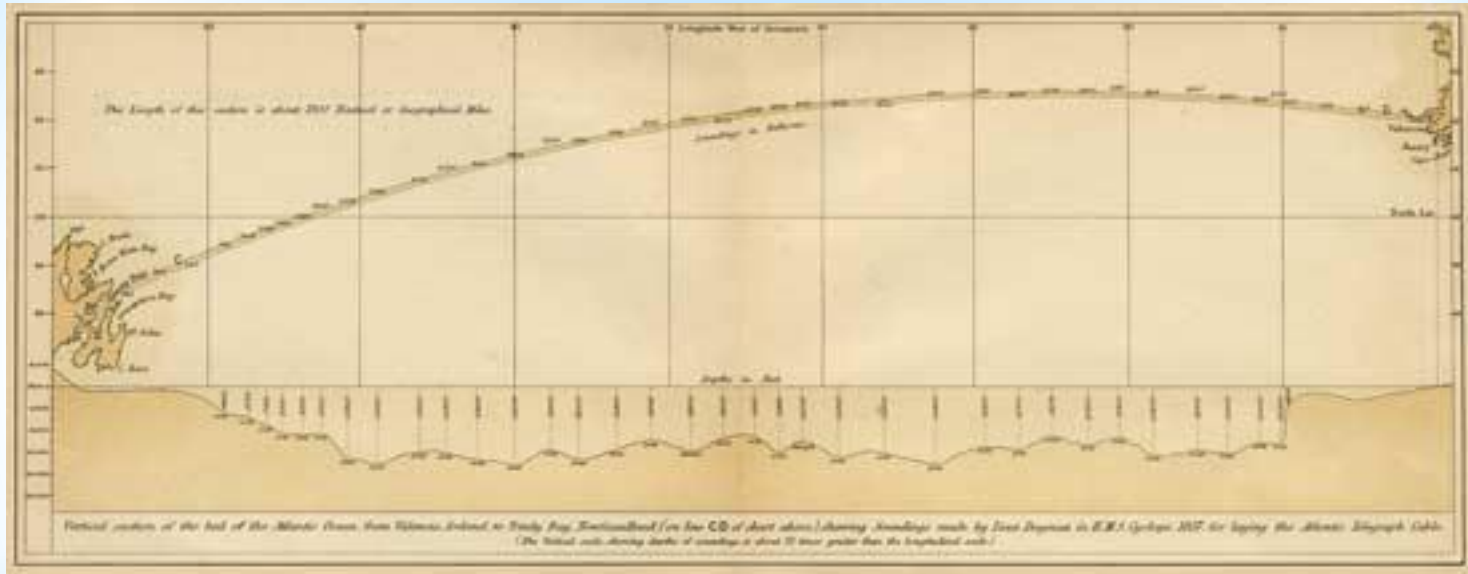
Samuel F.B. Morse was considered a “father of telegraphy” and originator of the code that bears his name.



Lt. Matthew Maury USN had just completed a survey of the North Atlantic Ocean.

“Funny you should ask”

“The Telegraph Plateau”



“... from Newfoundland to Ireland ...is a plateau which seems to have been placed there especially for ... holding the wires of a submarine telegraph ...”

Lieutenant Matthew Fontaine Maury USN

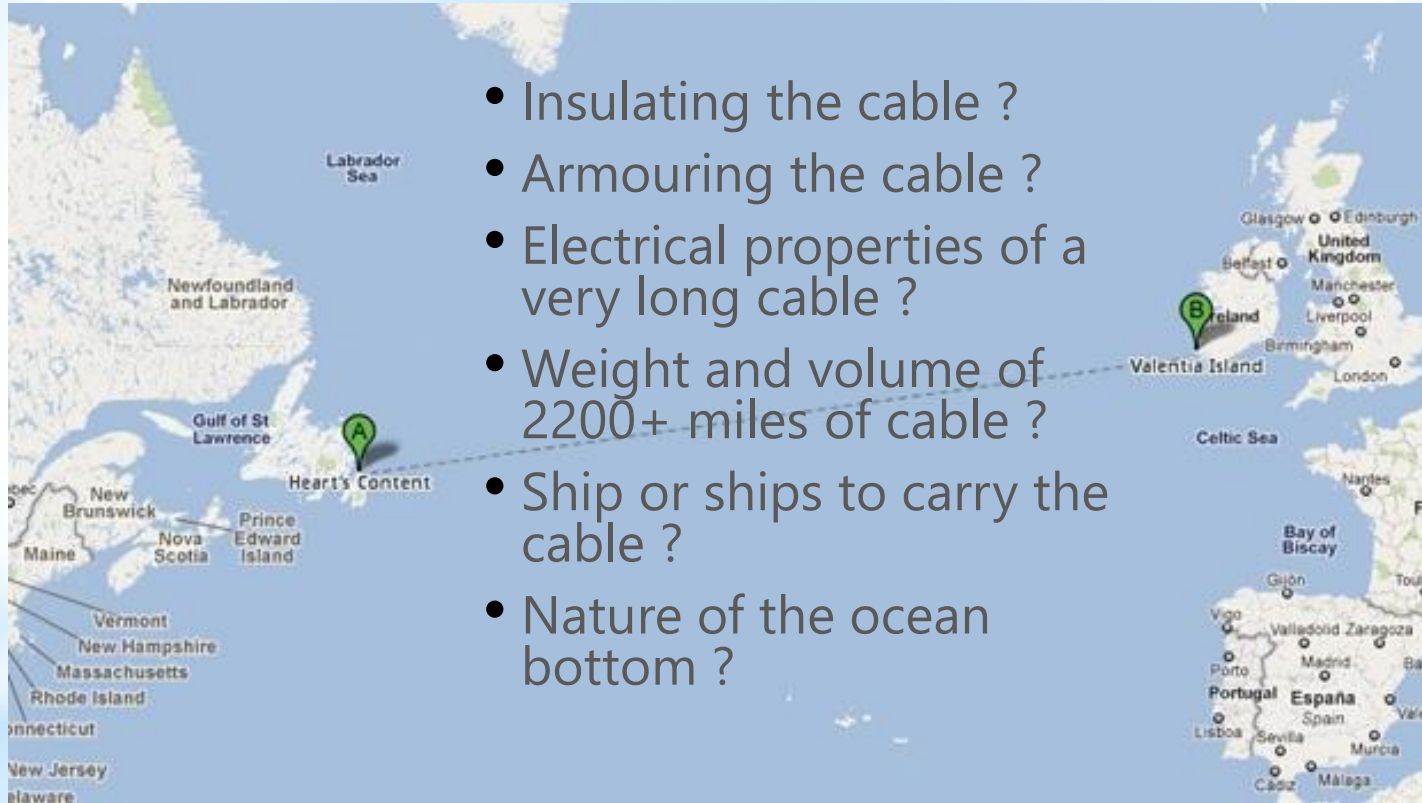
Maury Monument - Richmond VA



Pathfinder of the Seas

A Wire to the New World ?

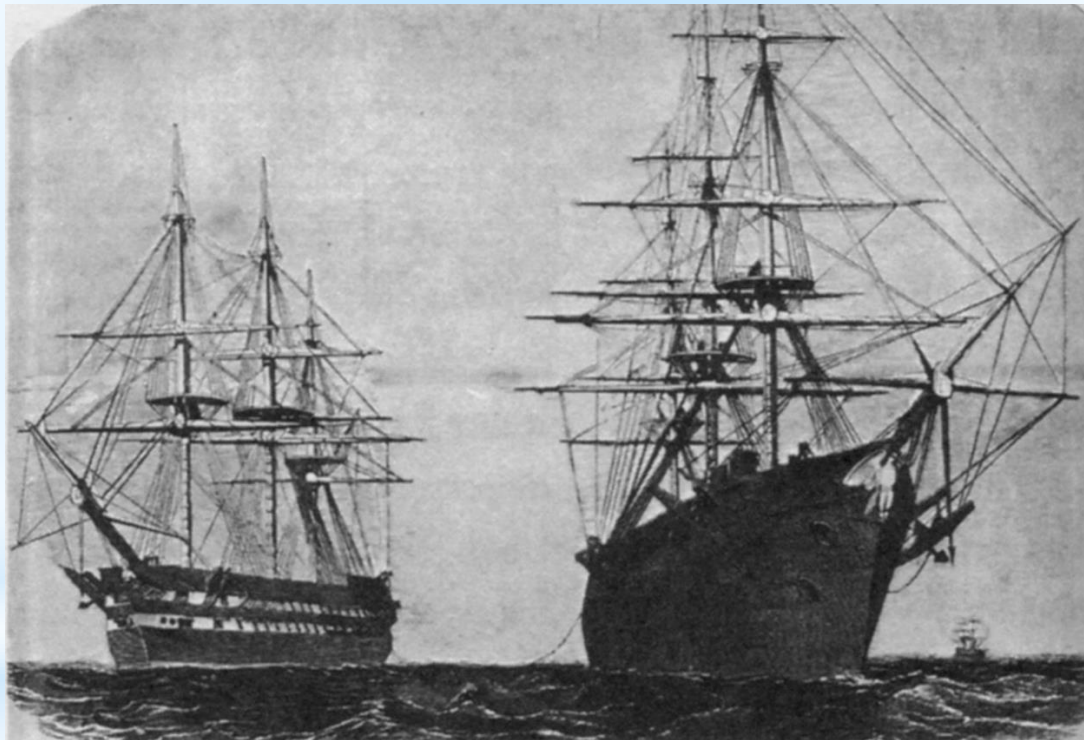
Questions needing answers...



The longest undersea cable at the time was 110 miles at depths to 1800 feet

The First Try ...

The USS *Niagara* and the HMS *Agamemnon* ...



... laid the 1857 and 1858 cables

The 1857/58 Cable Laying ...



The crew of HMS *Agamemnon* (1858)

1857: The First Attempt: Failure

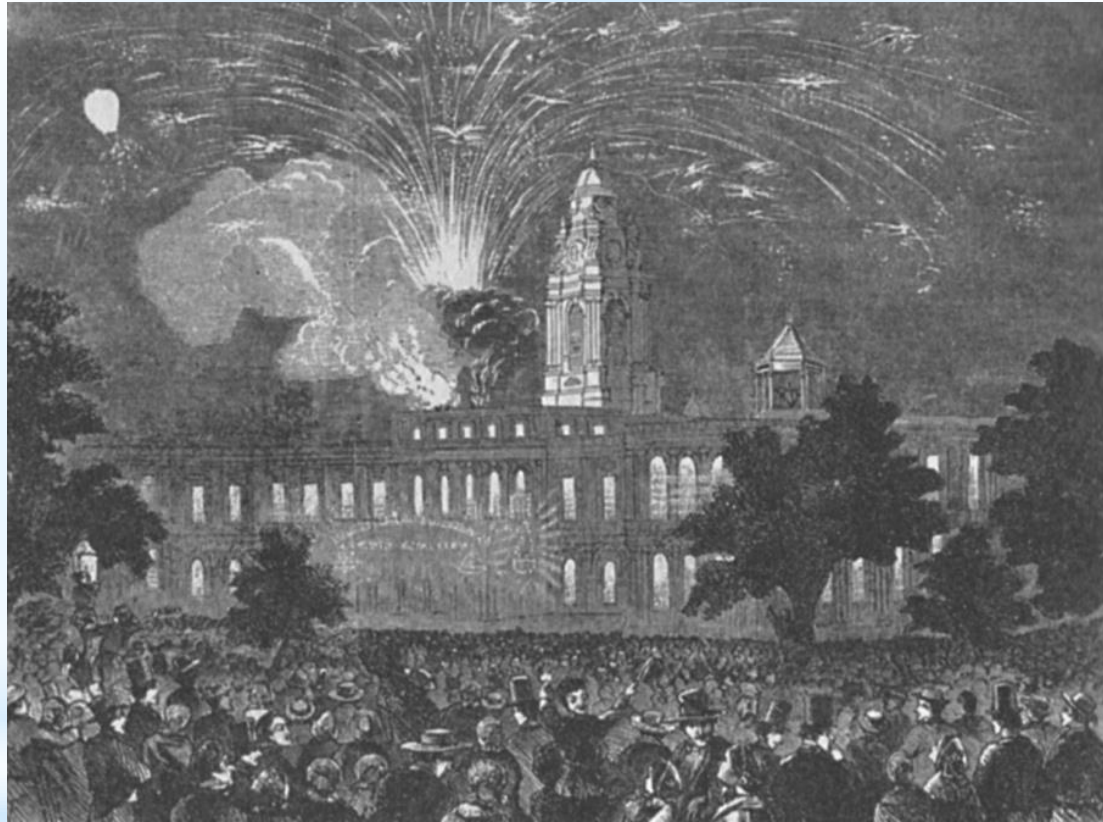
- Both ships sailed from Valentia
- Once all its cable was played out, the *Agamemnon* spliced the end of its cable to the *Niagara*
- The *Niagara* then continued to sail west
- But 200 miles from the Newfoundland coast, the *Niagara's* cable snapped and was lost

Then, in 1858, another Attempt ...



The *USS Niagara* landed its cable at Bay of Bulls Arm on the west side of Trinity Bay on August 5th, 1858.

Jubilation !!



Ecstatic reaction to the news that Europe and the Americas were joined by a telegraph cable

Queen Victoria Sends a Message ...



The Queen and U.S. President James Buchanan exchanged congratulatory messages.

To the President of the United States ...

The Queen desires to congratulate the President upon the successful completion of this great international work, in which the Queen has taken the deepest interest.

The Queen is convinced that the President will join with her in fervently hoping that the electric cable which now connects Great Britain with the United States will prove an additional link between the nations, whose friendship is founded upon their common interest and reciprocal esteem.

The Queen has much pleasure in thus communicating with the President, and renewing to him her wishes for the prosperity of the United States.

Queen Victoria Sends a Text

Bryan Rawlings, VE3ON

On August 16, 1858 Queen Victoria sat down and composed a text message to US President James Buchanan. Her message of 98 words was transmitted more or less instantly via the new network of telegraph cables to Valentia Island off the west coast of Ireland. There a telegrapher carefully began retransmitting the words, one by one, through the 19th century's creaky wonder – a cable 2000 miles long lying on the ocean floor.



People opposite the Cable Station in Heart's Content, Newfoundland. From left: Bill Inger, VE3RT, Glenn MacBorneil, VE3ON and Bryan Rawlings VE3ON.

unintelligible by any yet-to-be-invented primitive galvanometer in a small village in eastern Newfoundland. Victoria's message did indeed get to President Buchanan but not much else. The physical nature of the electrical factors affecting cables of this length doomed the 1858 cable after only three weeks of frustrating operation. In a testimony to the perseverance and the optimism of the age, however, soon the energy summoned and funds to try again were summoned and a much-improved cable was laid from Valentia Island in 1865. It snipped and project ordered up another batch of cable and a second cable was laid in 1866 to Heart's Content on Trinity Bay. It worked perfectly. So satisfaction was that the 1865 cable, spliced new cable to it and brought the second cable into Heart's Content. Europe and the Americas have never been out of touch since.

The world's press hailed the transatlantic cable's completion with a sense of marvel only equalled in the twentieth century by the Apollo moon landings. Suddenly, what happened in London was instantly known in New York and, via the connected cable networks, from San Francisco to Alexandria, Heart's Content and Newfoundland became for the several decades that followed the centre of the telecommunication's world.

These who conceived the 1858 cable were aware that undersea cables had previously been brought into operation, connecting England to Ireland and to Europe and North Africa. However, the sending telegraph signals through 2000 miles of wire and laying the Norm Atlantic were challenges that had to be met and overcome and this was finally achieved in the 1858 cable.

The physical problems included controlling the speed at which the cable was played out from the cable ship as well as managing the weight of the suspended section of the cable until it settled on the ocean floor. This could, of course, be considerable in deep depths and became the cause of the cable snapping with disastrous consequences.

Then again, the electrical theory affecting a circuit of this length was poorly understood. To detect the feeble current through a loop of this length, the early operators decided to increase the voltage at the transmitting end – a practice that ultimately destroyed – a practice that affected on the received signal of the accumulated capacitance of 2000 miles of wires lying side by side and the accumulated inductance of the same conductors. What was criss CW at one end was smoothed at the far end requiring the sender to slow the code and was impractical levels. It's a tribute to the early promoters of the cable that they thought out the best improvements for the 1858 cable – which diameter was about 5/8-inches in these – and weighed about 2000 lbs per mile. The newer cable used for the 1865 and 1866 cables weighed about twice as much, had several layers of insulation using improved gutta serena and was armoured with a new compound of iron. The cable-laying ship used was the Great Eastern, the spectacular steam and sail ship designed by England's great 19th century engineer Isambard Kingdom Brunel.

Detection of the signals at the cable stations, in an age before headphones, buzzers and improved form of mirror galvanometer and improved form of mirror galvanometer in which the meter needle is replaced by a carefully-balanced snail, on which is mounted a small mirror, is greatly improved. A beam of light is directed onto a nearby mirror and then reflected into a nearby mirror, greatly amplified the small changes in current and permitted a skilled telegrapher to detect the dots and dashes sent from the far end.

These epochal events all occurred before Edison invented the incandescent light bulb, before he invented the telephone, before anything we associate today with modern electronics, yet they opened the door on the modern connected world we experience and live in today. So, by watching the dotting light sea in motion by the telegrapher on the other side of the vast ocean, the telegraphers were helping to close out a world separated by time and distance and usher in our modern world of instant communications.

Queen Victoria's great, great granddaughter now gives a New Year's address before television cameras and her image and words are flashed around the world by satellites and fibre-optic cables and switched by many on their tablets and smartphones. Such is the future of the dawnings as the electric telegraph came to Heart's Content.

This year marks the 150th anniversary of these great events. We, and all our fellow citizens of the world with their internet smart phones, trace our age back to those who dared to project the cable back to Heart's Content, England and the United States. We could all be proud to have a part in it. Happy New Year!

TCA

The Canadian Amateur

Canada's Amateur Radio Magazine

La Revue des Radioamateurs Canadiens

NOVEMBER / DECEMBER 2016 – NOVEMBRE / DÉCEMBRE 2016

Bill Burgess, VE3CRJ

Eddie Kucbel, VE3KRP

Season's Greetings – Joyeuses Fêtes

Welcome to the
VHF/UHF Special Issue

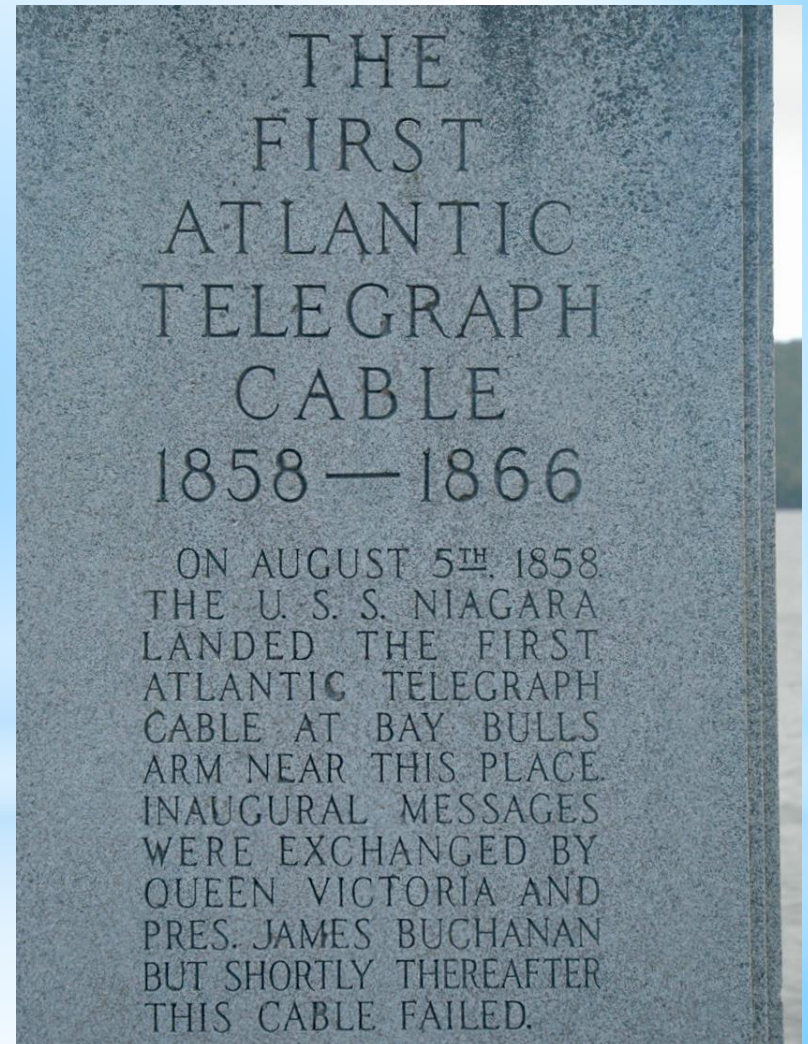
Publications Mail Agreement # 4008688 Registration # 0966

But, amid the celebrating, a dark secret ...

The cable's performance
was poor

The Queen's message of 98
words had taken sixteen
hours to transmit

After three weeks the
cable failed completely



What Went Wrong?

UK Government Inquiry into 1858 Cable failure found ...

- ✓ Excessive voltage applied to cable
 - Dr. Edward Whitehouse (Wildman Whitehouse) blamed
- ✓ Poor quality control during cable manufacture
- ✓ Cable deterioration during outdoor storage
 - Gutta-Percha insulation left to dry out at dockside



Dr. Edward Whitehouse

In the Age of Optimism: Dealing with Failure...

Cyrus Field was determined to try again ...

- But his reputation had been hurt in the U.S.
- Little support in the U.S. then experiencing Civil War
- In the U.S. Western Union were promoting an alternative route through Alaska, under the Bering Strait and across Siberia
- Eventually, however, he found support and backers in Britain
- Field made over thirty visits to the U.K. during the American Civil War

The Next Attempt ...

- Field managed to enlist a new group of (mostly British) investors
- He engaged the services of William Thomson (Lord Kelvin) to advise on the new effort
- The new attempt would incorporate all that was then known about electrical physics and about the fabrication and protection of underwater cables

Along Came an Opportunity not to be Missed ...

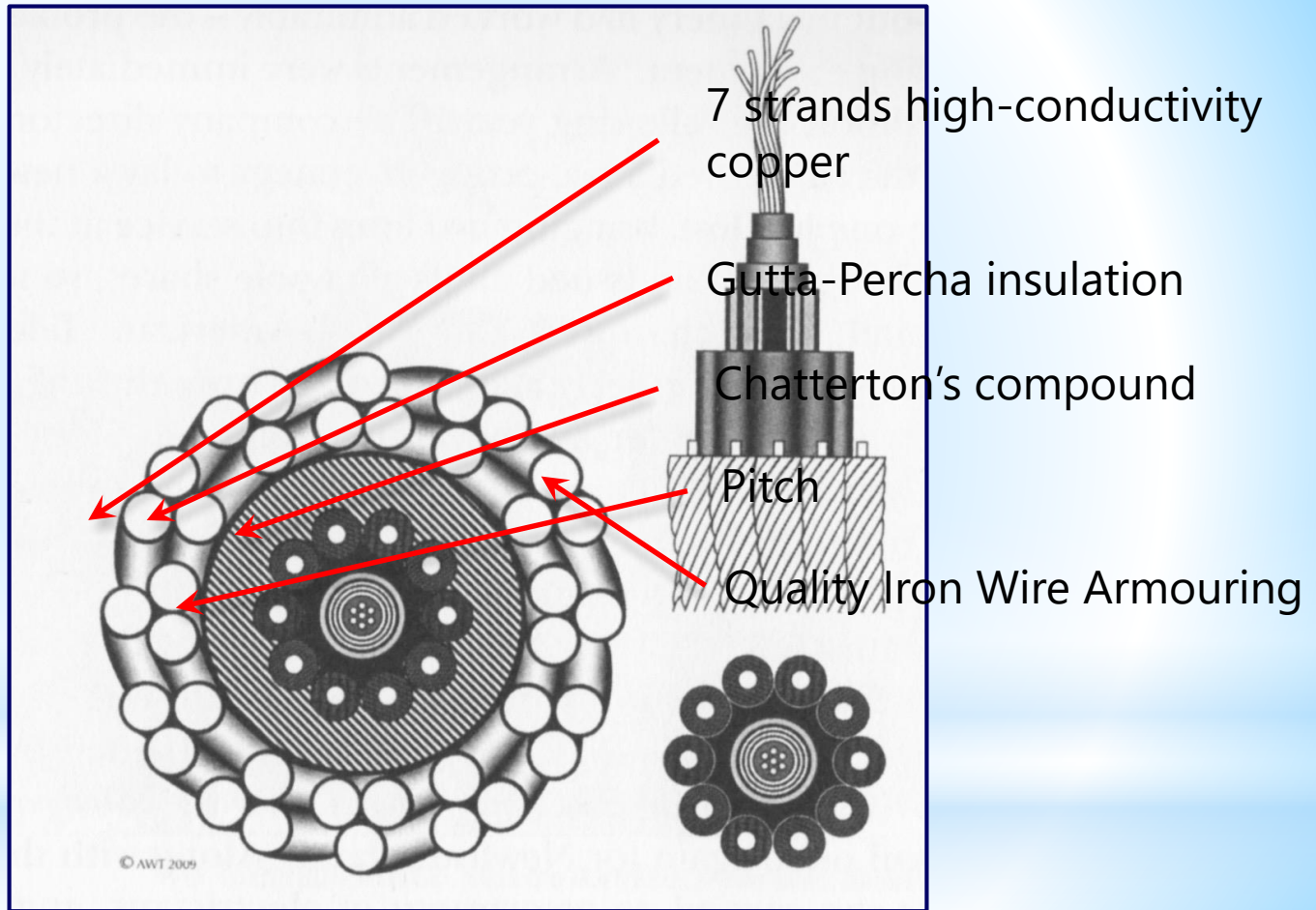
The largest ship in the world to lay the cable...



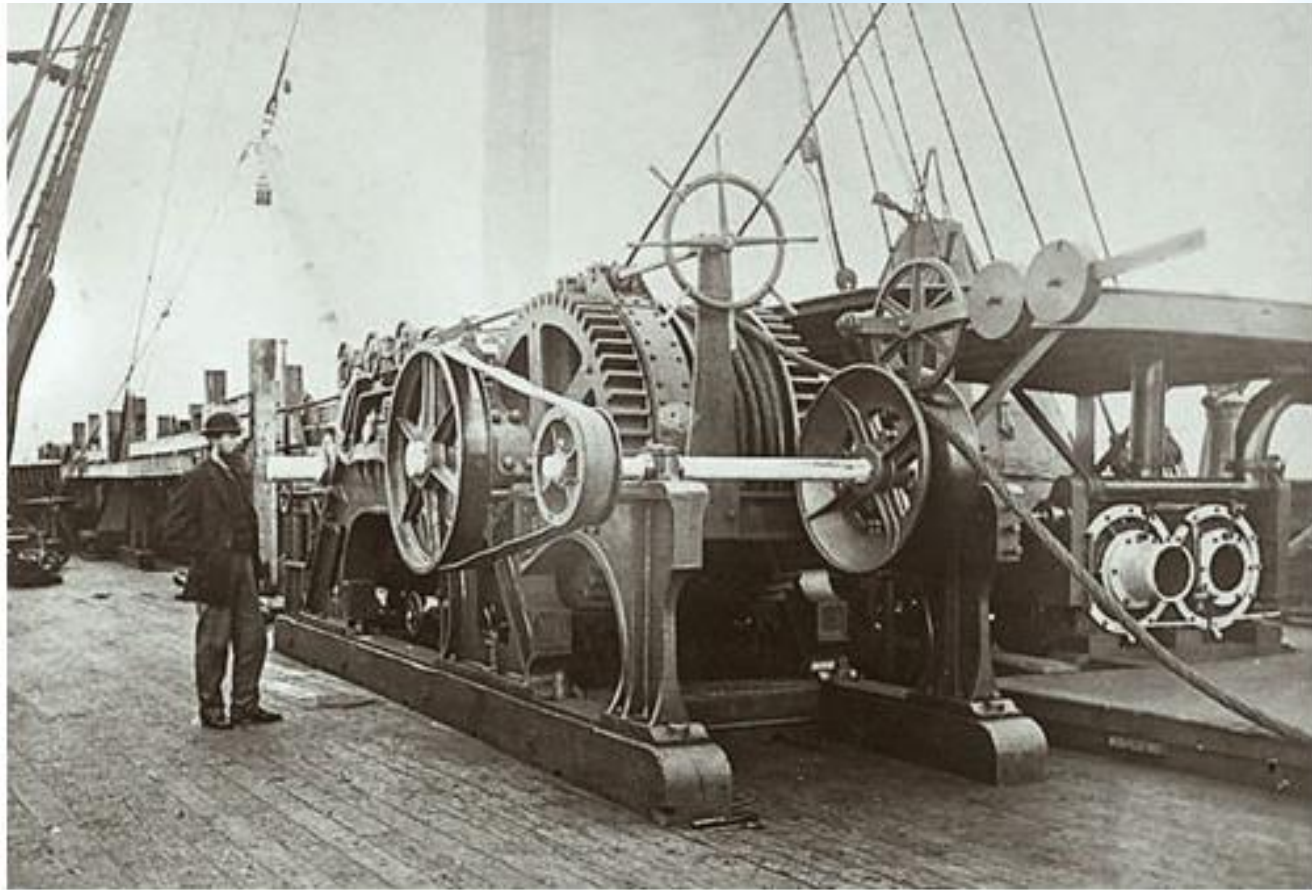
- ✓ Five times larger than anything else afloat
- ✓ 693 feet from stem to stern
- ✓ 22,500 tons displacement
- ✓ Had to be launched broadside

The Great Eastern

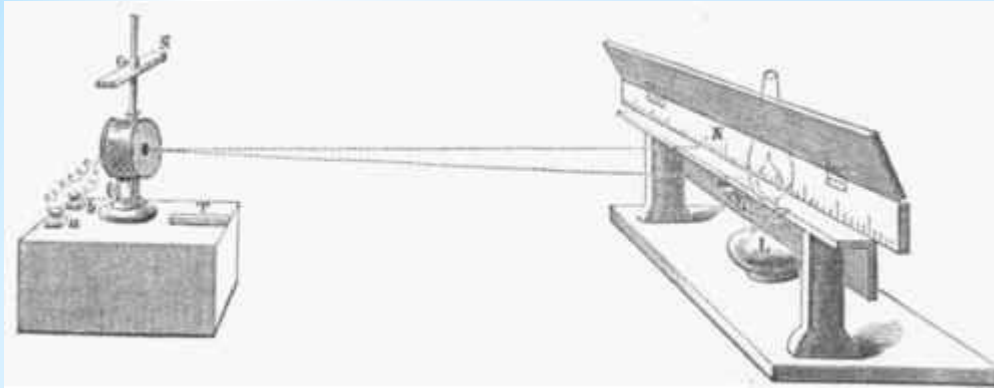
A New and Better Cable Design ...



An Improved Paying-Out Machine ...

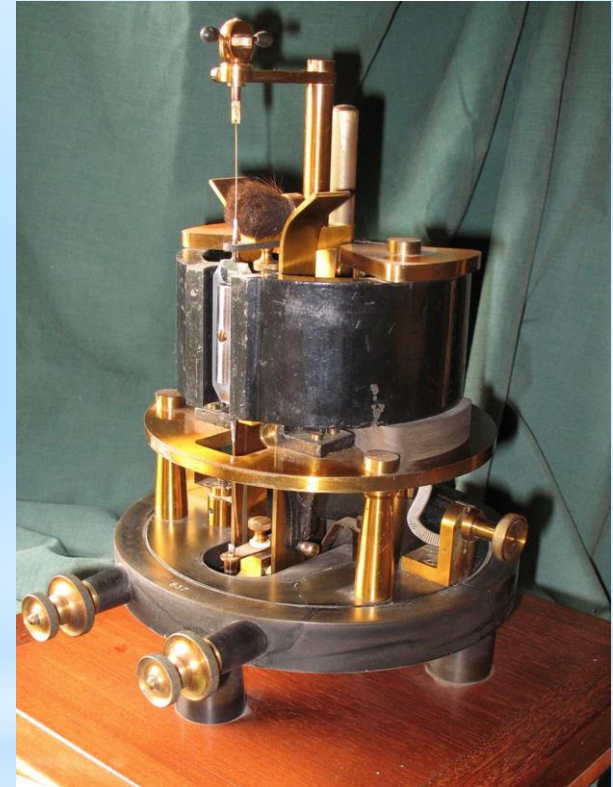


And to Detect the Weak Signal ...



Lord Kelvin's Mirror Galvanometer

The Morse Code could be read in Heart's Content with ten volts or less applied in Valentia.



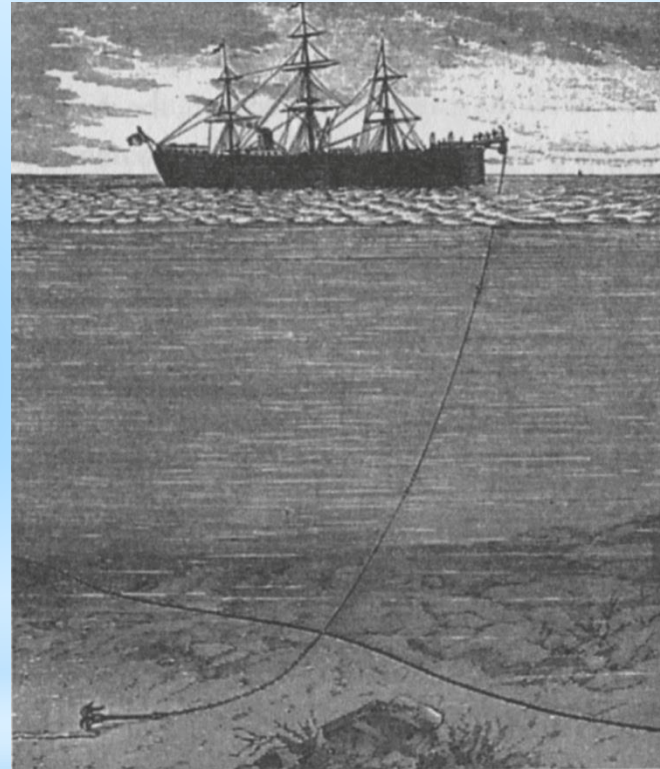
The *Great Eastern* departs Valentia ...

In constant touch with the cable station at Valentia, the *Great Eastern* steadily laid the new cable.

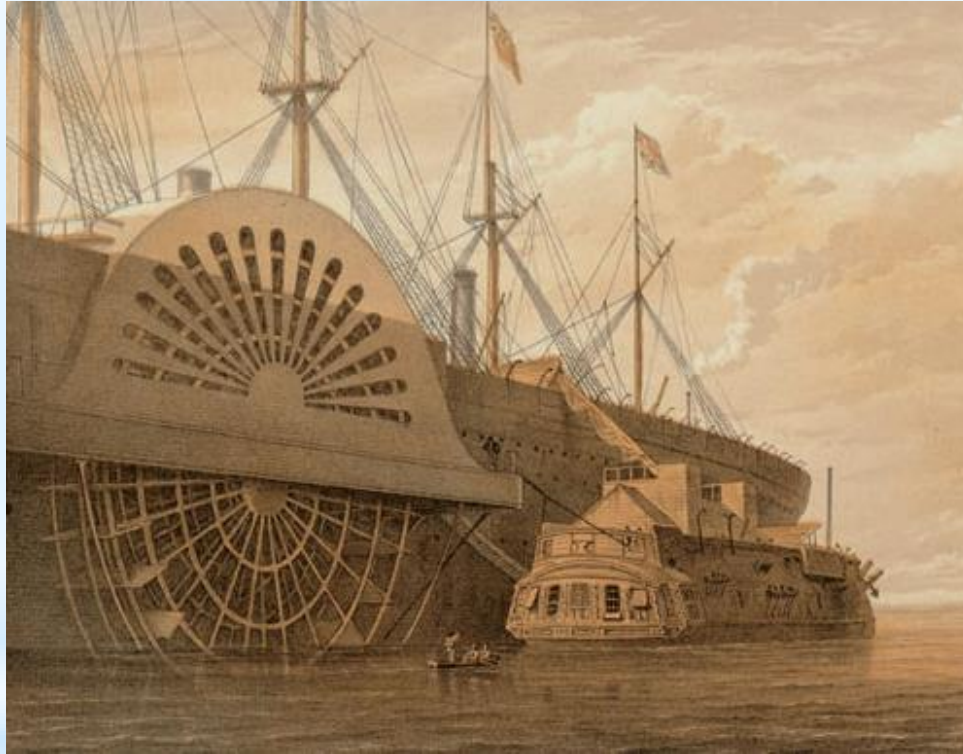


A Heartbreaking Failure ...

- Within 600 miles of Newfoundland the cable snapped and was lost
- Three days of grappling caught the cable on several occasions but the crew were unable to raise it on board
- On August 5, 1865 the *Great Eastern* abandoned the effort and set sail for Ireland.



The Following Year - Try Again ...



Loading cable onto the *Great Eastern* at Sheerness on the Thames River in the summer of 1866

Friday, July 13rd 1866 ...

- Once again the *Great Eastern* set sail from Valentia Island with a cargo of 2200+ miles of undersea cable
- The cable used in the 1866 run was improved over that used the year before
- The paying-out machinery was upgraded
- The 1866 cable was laid down 30 miles south of the 1865 cable so there would be no risk of confusion if grappling to locate a broken cable
- The *Great Eastern* averaged six knots and the voyage was uneventful

Friday, July 27th 1866 ...

The *Great Eastern* then sailed to where the 1865 cable had been lost, retrieved the cable from the ocean bottom, spliced new cable to it and on September 7th brought a second working cable into Hearts Content.

Europe and the Americas have never been out of electronic communication since.

Lasting Success !!

THE NEW YORK HERALD.
WHOLE NO. 10,570. NEW YORK, MONDAY, AUGUST 7, 1866. PRICE FOUR CENTS.

THE GREAT ATLANTIC CABLE.

Map of the Starting Points in Ireland and Newfoundland and Route of the Old and New Cables as Laid.

THE CABLE.
The Great Eastern Out at Sea and all up

THE SHORE END LAID.
The Great Eastern Out at Sea and all up

THE SHORE END.
The Great Eastern Out at Sea and all up

MAKING THE SPICE.
The Great Eastern Out at Sea and all up

THE DEEP SEA CABLE.
The Great Eastern Out at Sea and all up

Operation of the Atlantic cables began immediately at Valentia and at Heart's Content.

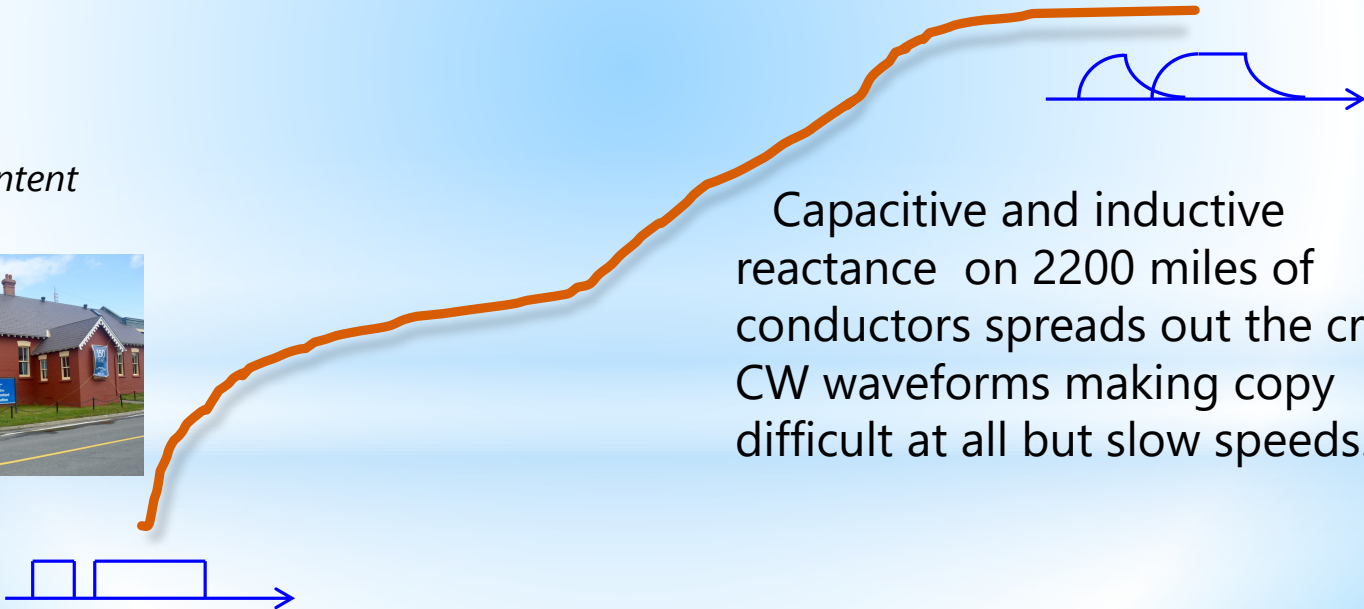
Dealing with “Retardation” ...

Valentia



The letter “A” crosses the Atlantic

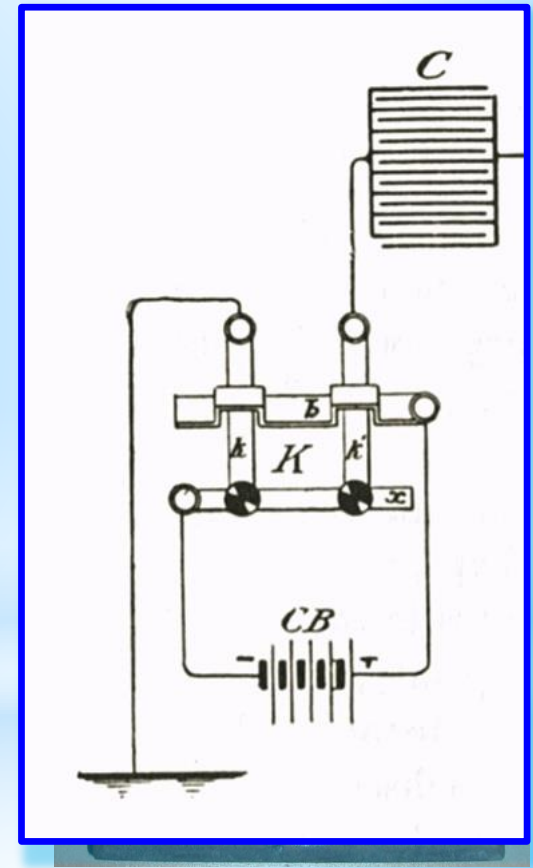
Heart's Content



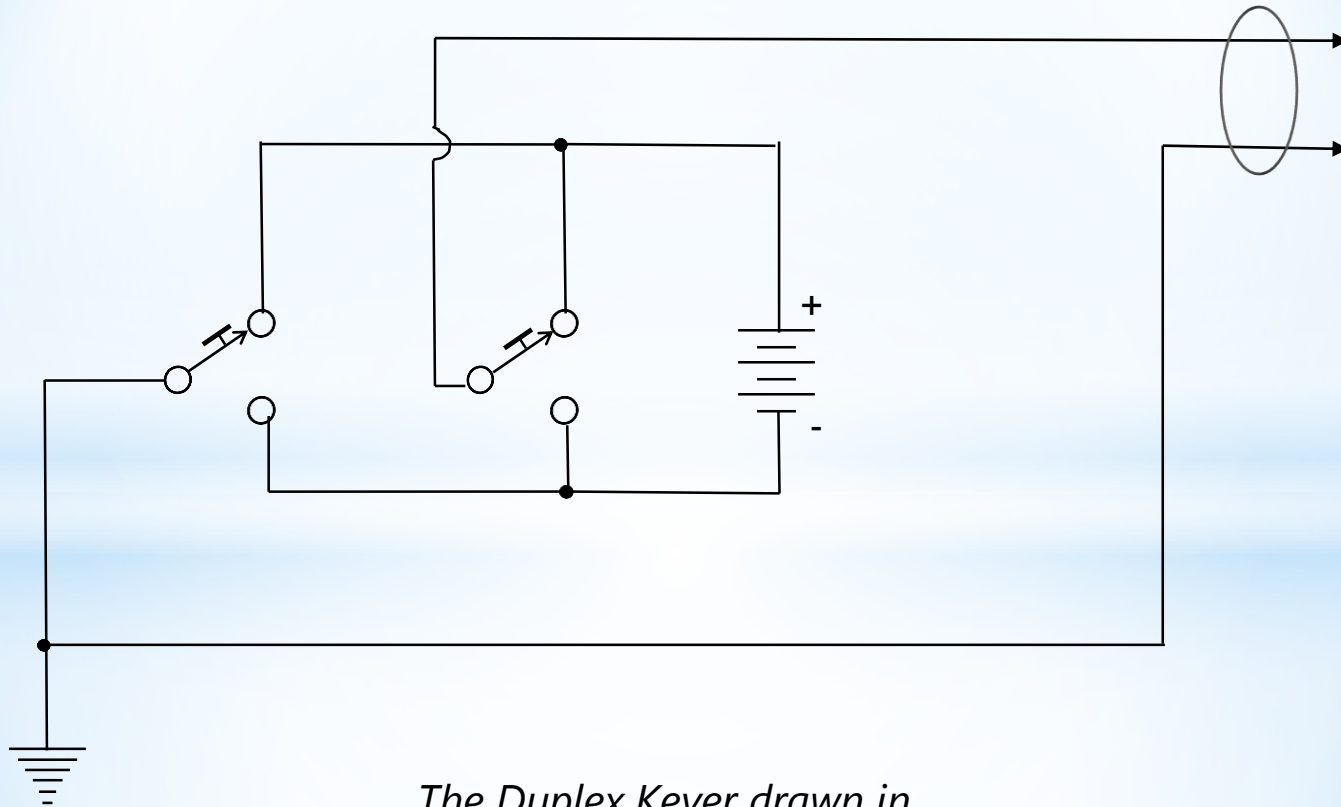
Capacitive and inductive reactance on 2200 miles of conductors spreads out the crisp CW waveforms making copy difficult at all but slow speeds.

Sending Code through the Cable ...

- Dots on left key; dashes on right key.
- The direction of the current through the cable reversed between dots and "dashes"
- At the receiving end one operator read the deflections of the light beam while another wrote down the message
- Dots moved the light of the mirror galvanometer to the left; "Dashes" moved the light to the right
- The outgoing cable was shorted when both keys were up
- Known as the "duplex" or bi-directional code sender



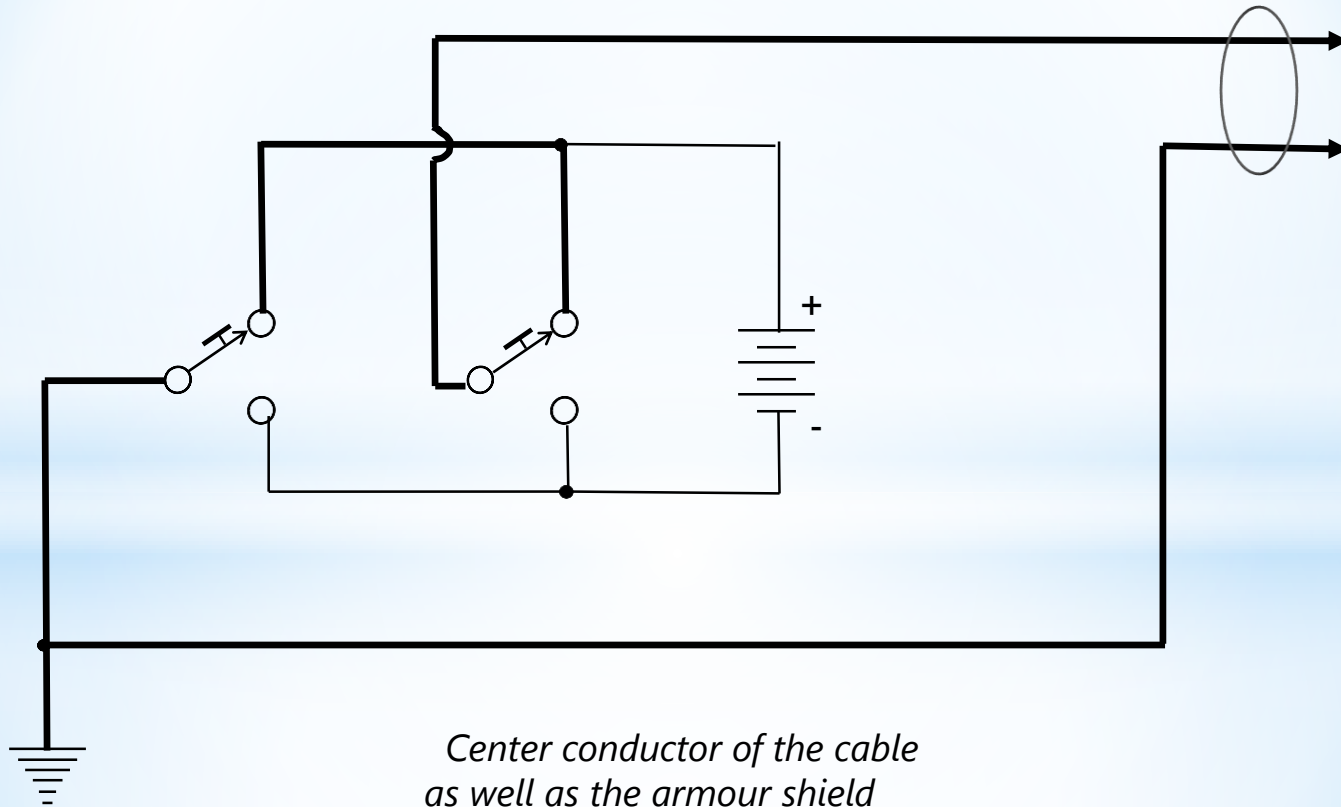
The Duplex Keyer ...



The Duplex Keyer drawn in modern symbols.

Duplex Keyer

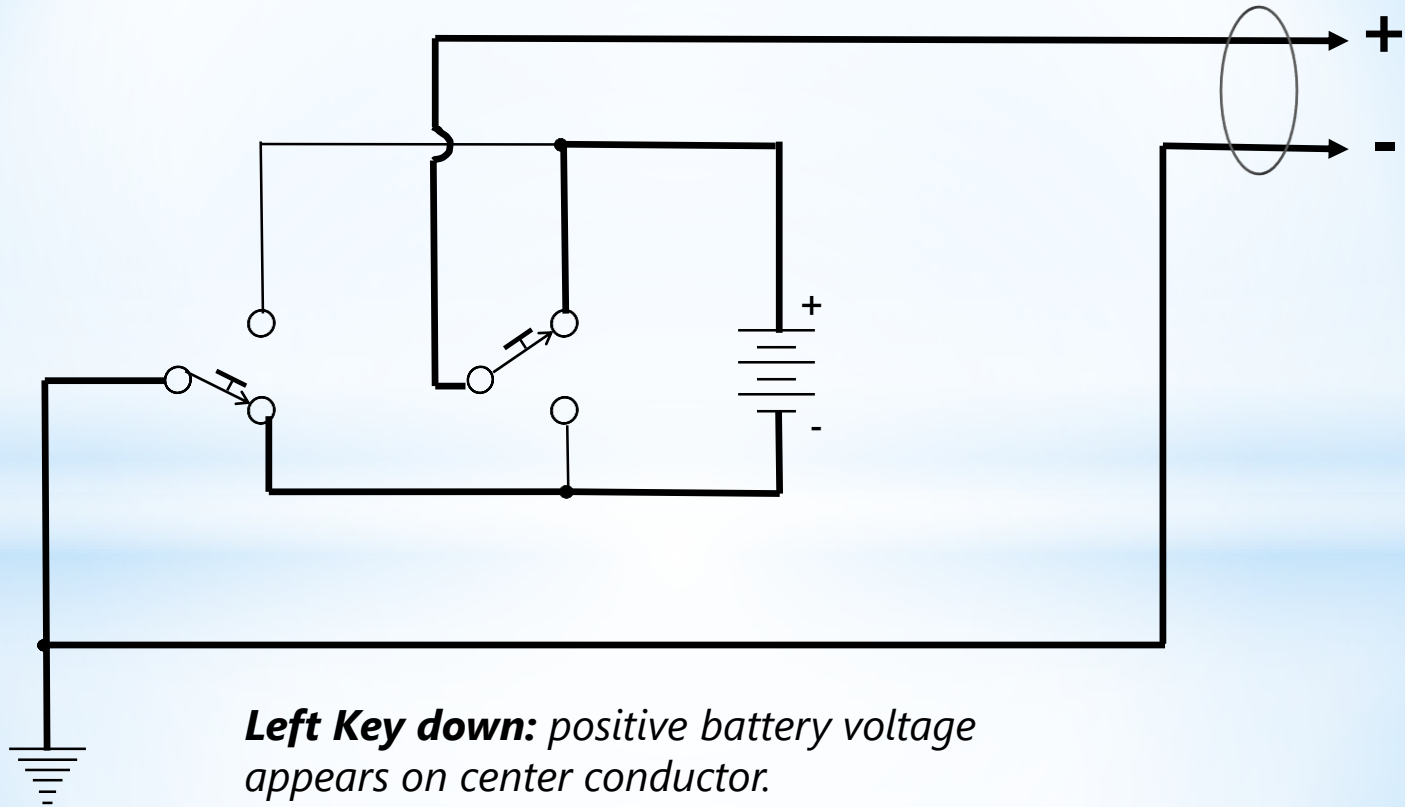
With Neither Key Depressed ...



*Center conductor of the cable
as well as the armour shield
are at ground potential.*

Duplex Keyer

Sending a "Dot" ...

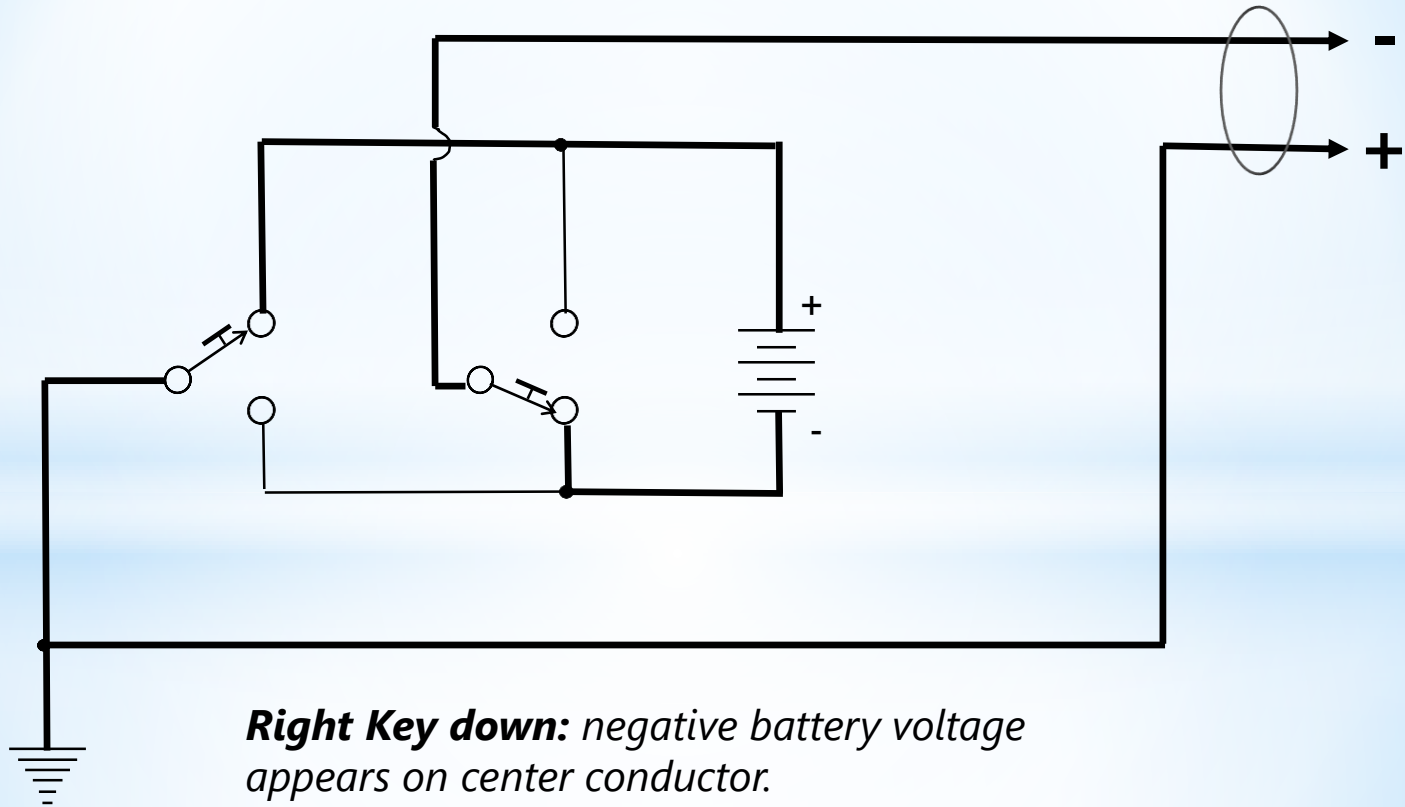


Left Key down: positive battery voltage appears on center conductor.

Left Key up: center conductor shorted to ground to discharge capacitance.

Duplex Keyer

Sending a “Dash” ...



Right Key down: negative battery voltage appears on center conductor.

Right Key up: center conductor shorted to ground to discharge capacitance.

Duplex Keyer

The Transatlantic Cable at Heart's Content ...

- In 1873 the *Great Eastern* returned with a replacement for the 1865 cable
- A new cable to Valentia was laid west-to-east by the *Great Eastern* in 1874
- In 1880 the *Great Eastern* returned with a replacement for the 1866 cable
- The current Cable Station building was opened in 1876

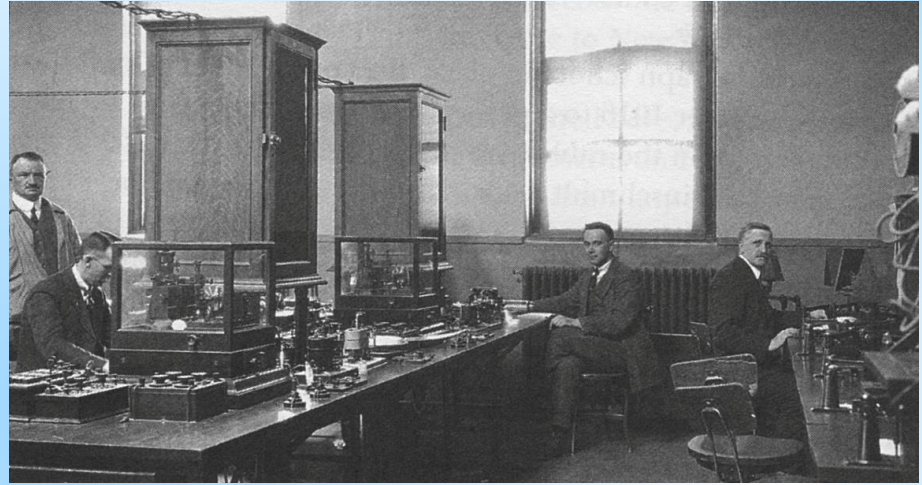
Heart's Content Cable Station ...



1876

A Century of Service ...

- For a time Heart's Content was the center of the communications world
- Rapidly, however, other cables were laid across other routes



- After his 1901 success with radio at Signal Hill, the cable company blocked Marconi's plan for a wireless telegraph station in Newfoundland
 - but the handwriting was on the wall
- The Cable Station ceased operations in 1965
- It is now a Provincial Historic Site

Heart's Content NL today ...



September 9th, 2016

Heart's Content Historic Site ...



1948



2016

1866 - 2016 ...



Cable Entrance ...



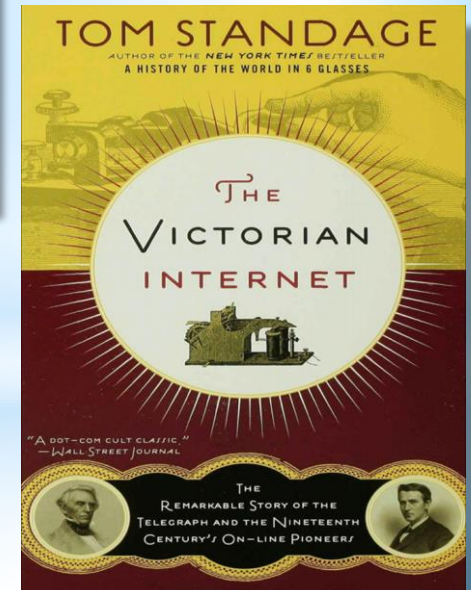
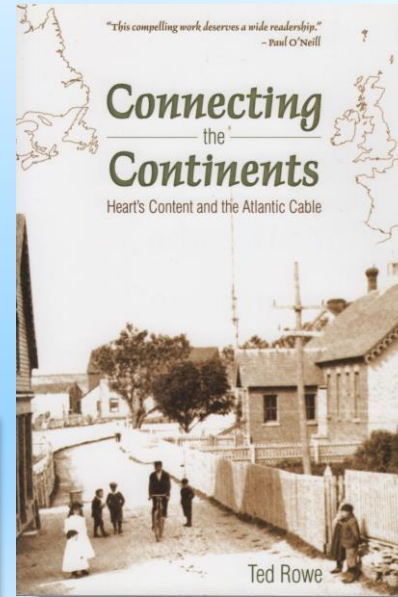
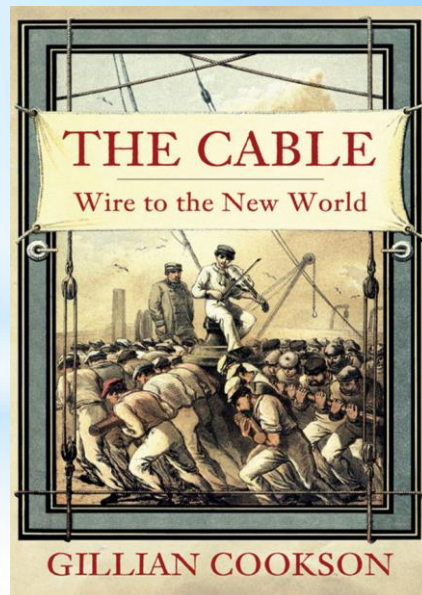
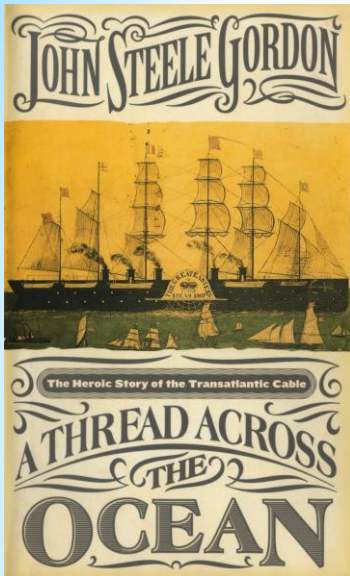
Plaque placed over Access Cable ...



Displays the first message sent through the 1866 cable in English and in Morse Code.



Curious ? Further Reading ...



and, a video documentary ...



The Great Transatlantic Cable complete documentary on  YouTube



Thank you!

