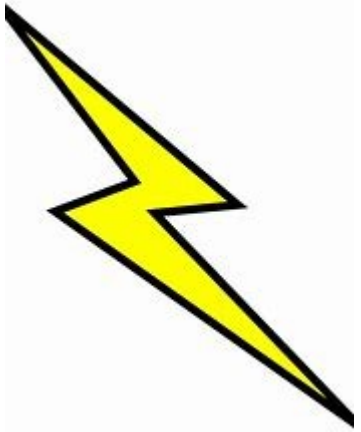
A SMORGASBORD **OF RADIO**

THE PEOPLE, PLACES AND INCIDENTS

DOMENIC MALLOZZI, N1DM

NOVEMBER 2023



Unless otherwise stated the photos in this presentation are from Wikipedia

THE SCIENTISTS AND ENGINEERS WHO DEVELOPED RADIO

- **James Clerk Maxwell (Great Britain)**
- **Dr. Heinrich Hertz (Germany)**
- **Guglielmo Marconi (Italy / Great Britain)**
- **Dr. Karl Braun (Germany)**
- **Chandra Bose (India)**
- **Alexander Popov (Russia)**
- **Nikola Tesla (Serbo-Croatian/US)**
- **John Stone Stone**
- **Greenleaf Whittier Pickard**
- **Dr. Lee DeForest**
- **Reginald Fessenden (Canada / US)**
- **Fr. Roberto Landell de Moura (Brazil)**
- **Edwin H. Armstrong**

THE SCIENTISTS AND ENGINEERS

JAMES CLERK MAXWELL (1857-1894) UK

- Brilliant Scottish mathematical physicist
- Postulated that radio waves existed mathematically in 1864. He developed a set of equations still used today and referred to as ‘Maxwell’s Equations’.
- This was done completely with mathematical models with no experimental evidence to validate this theory.

THE SCIENTISTS AND ENGINEERS

HEINRICH HERTZ (1857-1894) Germany

- An academic with a PhD
- Credited as the first to demonstrate the existences of radio waves 1886 using electric sparks
- His work was so fundamental to the development of wireless that in 1960 the unit of frequency was named the Hertz by international agreement at the IEC / General Conference on Weights and Measures (CIPM).

THE SCIENTISTS AND ENGINEERS

GUGLIELMO MARCONI (1874-1937) Italy / Great Britain

- Not a trained engineer or scientist. Educated by tutors.

- He constructed his first radio system in 1894. First patent was UK patent No. 12,039 on June 2, 1896.

- He shared the 1909 Nobel Prize in Physics with Dr. Karl Ferdinand Braun "in recognition of their contributions to the development of wireless telegraphy."

THE SCIENTISTS AND ENGINEERS

GUGLIELMO MARCONI (1874-1937) Italy / Great Britain

- After the British inquest into the sinking of the Titanic, Britain's postmaster-general stated: "Those who have been saved, have been saved through one man, Mr. Marconi ... and his marvelous invention.“

- For his funeral a one minute moment of silence was observed on radio stations of Italy, the British Empire, US, China, Japan, etc. in recognition of his contributions to radio.

THE SCIENTISTS AND ENGINEERS

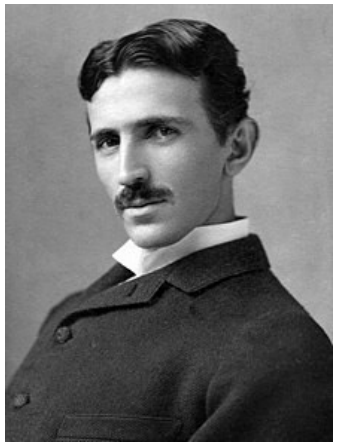
DR. KARL BRAUN (1850-1918) Germany

- Started wireless experiments in 1898. Concentrated on improvements to transmitters to extend their range.

- He shared the 1909 Nobel Prize in Physics with Marconi "in recognition of their contributions to the development of wireless telegraphy."

- Developed the cathode ray tube which is the basis of all electronic televisions prior to flat screen TVs.

THE SCIENTISTS AND ENGINEERS



<u>NIKOLA TESLA</u> (1856-1943) Serbo-Croatian/US

- Brilliant scientist who developed the multi-phase AC power transmission system we still use today. Held over 250 patents in a variety of disciplines.

- Filed multiple wireless communication patents starting in 1897

- When he was young he worked for the Edison Companies in Paris and New York

THE SCIENTISTS AND ENGINEERS

NIKOLA TESLA (1856-1943) Serbo-Croatian/US

- In May 1898 demonstrated a radio controlled boat at Madison Square Garden referring to it as ‘telautomatics’.

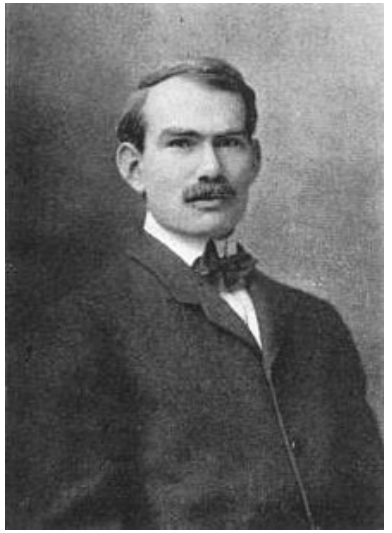
- His work on magnetic transformers was considered so seminal that in 1960 the unit of magnetic flux density was named the Tesla by the IEC / General Conference on Weights and Measures (CIPM).

THE SCIENTISTS AND ENGINEERS

<u>LEE DeFOREST</u> (1873-1961) US

- PhD in Physics from Yale
- Invented the Audion (3 element tube) in 1906 which made home radios possible along with improvements to the long distance telephone
- Very interested in transmitting the human voice by radio and demonstrated systems as early as 1907

THE SCIENTISTS AND ENGINEERS



LEE DeFOREST (1873-1961) US

- His many radio companies failed mostly due to numerous unscrupulous partners.
- Also known for giving movies their voice “the talkies”
- Credited with over 180 patents

THE SCIENTISTS AND ENGINEERS

REGINAND FESSENDEN (1866-1932) CANADA/US

- Worked for Edison for a time and was the first professor of Electrical Engineering at Perdue and University of Pittsburg

- Very interested in transmitting the human voice by radio

- First recognized voice transmissions by radio in 1900-1906. His best known experiments were from Brant Rock section of Marshfield.

THE SCIENTISTS AND ENGINEERS

REGINAND FESSENDEN (1866-1932) CANADA/US

Some of his 500 patents over the years (from http://newsm.org/people/fessenden/)

U.S. Patent 452,494, “Lead-in Wire for **Incandescent Electric Lamps**” 18 February, 1891
U.S. Patent 644,972, “Induction Coil for **X-ray Apparatus**” March, 1900
U.S. Patent 706,735, “**Wireless** Telegraphy” 12 August, 1902
U.S. Patent 706,747, “Apparatus for Signaling by Electromagnetic Waves” (voice modulation of 50 kHz alternator continuous wave transmitter) August, 1902
U.S. Patent 938,836, “Method for **Cleaning Guns**” 2 November 1909
U.S. Patent 1,015,881, “Means for the **Transmission of Energy** by Electromagnetic Waves” 30 January, 1912
U.S. Patent 1,121,722, “**Agricultural** Engineering” 22 December, 1914
U.S. Patent 1,132,465, “Apparatus for Converting **Heat Into Work**” 16 March, 1915
U.S. Patent 1,212,202, “**Submarine, Subterranean, and Aerial Telephony**” 16 January, 1917
U.S. Patent 1,213,176, “Apparatus for **Phonograph** Kinetoscopes” 23 January, 1917
U.S. Patent 1,240,328, “Method and Apparatus for **Finding Ore** Bodies” 18 September, 1917
U.S. Patent 1,247,520, “Method for **Storing Power**” 20 November 1917
U.S. Patent 1,348,828, “Method and Apparatus for **Sound Insulation**” 3 August, 1920
U.S. Patent 1,348,855, “Method and Apparatus for **Detecting Submarines**” 10 August, 1920
U.S. Patent 1,384,014, “Method and Apparatus for Signaling and Otherwise **Utilizing Radiant Impulses**” 5 July, 1921
U.S. Patent 1,384,556, “Apparatus for **Submarine Signaling**” 3 August, 1920
U.S. Patent 1,616,416, “Method and Apparatus for Coordinating Radio and Phonograph Reproductions” 1 February, 1927
U.S. Patent 1,882,183, “Means for **Parking Cars**” 11 October, 1932
U.S. Patent 1,899,026, “Means for Modulating **Electrical Energy by Light Impulses**” 28 February, 1933
U.S. Patent 2,059,221, “**Television System**” 3 November, 1936
U.S. Patent 2,059,222, “Television Apparatus” 3 November, 1936

THE SCIENTISTS AND ENGINEERS

REGINAND FESSENDEN (1866-1932) CANADA / US

- Left radio in 1912 and became consultant on underwater sound systems.
- Best known for developing the fathometer for ships in 1917.
- From 1922 to 1928 successful sued RCA for infringing on his radio patents and received $500,000 ($8.999 million in 2023 dollars).

THE SCIENTISTS AND ENGINEERS

JOHN STONE STONE (1869-1943) US

- Telephone engineer with AT&T eventually formed two wireless companies with his name in Boston and Cambridge that operated from 1900 to 1908. Companies were sold to a company owned by his friend Lee DeForest. In 1912 He helped Lee DeForest sell his Audion patent to AT&T for telephone use.

- One of the early experts on resonant circuits and tuning.

- Was for many years a consultant and patent witness. He himself held 120 patents.

- Left Boston in 1911 and was a consultant to AT&T until 1934

THE SCIENTISTS AND ENGINEERS

GREENLEAF W. PICKARD (1877-1956) US

- Attended Harvard and MIT but never graduated, worked for AT&T and RCA (who bought out his Wireless Specialty Apparatus Company). He was one of the founders of Wireless Specialty Apparatus Company.

- Started radio experiments in 1898. Smithsonian Institute funded his 1899 research at Great Blue Hills in Milton. He was still publishing significant papers on radio into 1930’s.

- After testing over 30,000 material combinations developed and patented the Silicon Crystal detector in 1906 also known as the Perikon (Perfect Pickard Contact) detector. He also patented the cat whisker detector in 1914.

- Did significant works on directional antennas to eliminate static during World War One.

THE SCIENTISTS AND ENGINEERS

EDWIN H. ARMSTRONG (1890-1954) US

- Professor of Electrical Engineering at Columbia University with 42 Radio Patents (the first in 1913)

- Inventor of modern radio receiver technology including regenerative, super-regenerative and superheterodyne receivers. Superheterodyne receivers are still the most used today.

- Invented FM radio

THE PLACES

NEW ENGLAND'S EARLY RADIO STATIONS

SIACONSET, NANTUCKET, MA

POINT JUDITH AND BLOCK ISLAND, RI

BRANT ROCK, MARSHFIELD, MA

BAR HARBOR, ME

BELFAST, ME

HOULTON, ME

CHATHAM AND MARION, MA

MARCONI’S FIRST PERMANENT US STATION AT NANTUCKET

The wireless station at Siaconset section of Nantucket Island, MA (locally known as ‘Sconset) represents the first permanent operational shore wireless station in the US. It actually went into regular operation prior to Marconi station CC in South Wellfleet (think Marconi National Seashore on Cape Cod).

The original Siasconset station (call sign SC) at Bunker Hill was installed jointly by Marconi and the New York Herald in 1901.

This was designed as a ship to shore station.

MARCONI'S FIRST PERMANENT US STATION AT NANTUCKET

Date
1903 (circa)
Notes
View of the first **Marconi** wireless telegraph station and tower in Siasconset. **Sign on the porch middle post reads : New York Herald Wireless Telegraph Station**.

Courtesy of the Nantucket Historical Association
Photo Collection
PH166 - Photographic Negative Collection

Image Number
F4210

MARCONI’S FIRST PERMANENT US STATION AT NANTUCKET

The original Siasconset station used a spark transmitter and coherer detector attached to single wire antenna supported by a 185 foot mast it was primarily intended to communicate with the *Nantucket Shoals Light Ship* and other passing vessels transiting to and from Europe. This first contact with the Lightship was accomplished on August 12, 1901.

The station operated 24 hours a day , seven days a week.

MARCONI'S FIRST PERMANENT US STATION AT NANTUCKET

THE WIRE IN WIRELESS

Messages intended for points on the mainland were telephoned from the 'Sconset station to the telegraph office in Nantucket Town and then via a combination of submarine and overland cables to Wood's Hole (via Martha's Vineyard). From Woods Hole they could go to Boston or New York. The path to Woods Hole was:

- Siasconset to Nantucket Town — Telephone
- Nantucket Town to Maddequet Harbor (Nantucket) — Land Wire
- Maddequet Harbor (Nantucket) to South Beach, Martha's Vineyard — Underwater cable
- South Beach, Martha's Vineyard to Gay Head, Martha's Vineyard — Land wire
- Gay Head, Martha's Vineyard to Pasque Island (Cape Cod) — Underwater cable
- Across Pasque Island — Land Wire
- Pasque Island to Elizabeth Island — Underwater cable
- Across Elizabeth Island — Land Wire
- Elizabeth Island to Woods Hole — Underwater cable
- Landing point to Woods Hole station — Land Wire

MARCONI'S FIRST PERMANENT US STATION AT NANTUCKET

On January 23, 1909 the station became famous when Jack Irwin on duty at Siasconset station (call sign SC) answered the call of the *RMS Republic* which was rammed at sea by the liner *SS Florida*.

Jack Binns, who would later be made famous for his heroics on the *Titanic* three years later, sent the first CQD in the US (CQD was the Marconi house distress call, prior to the introduction of SOS internationally later in 1909).

Most passengers survived due to the distress call.

1907 WIRELESS STATION
PT. JUDITH & BLOCK ISLAND , RI

In 1907 the Providence Journal newspaper in RI decided it wanted to establish two radio stations to allow a local paper to be published at Block Island, RI. This was part business and part publicity stunt.

Originally built by DeForest Co. and was eventually ‘fixed’ by Walter Massie of RI.

The two stations only lasted for 3 years.

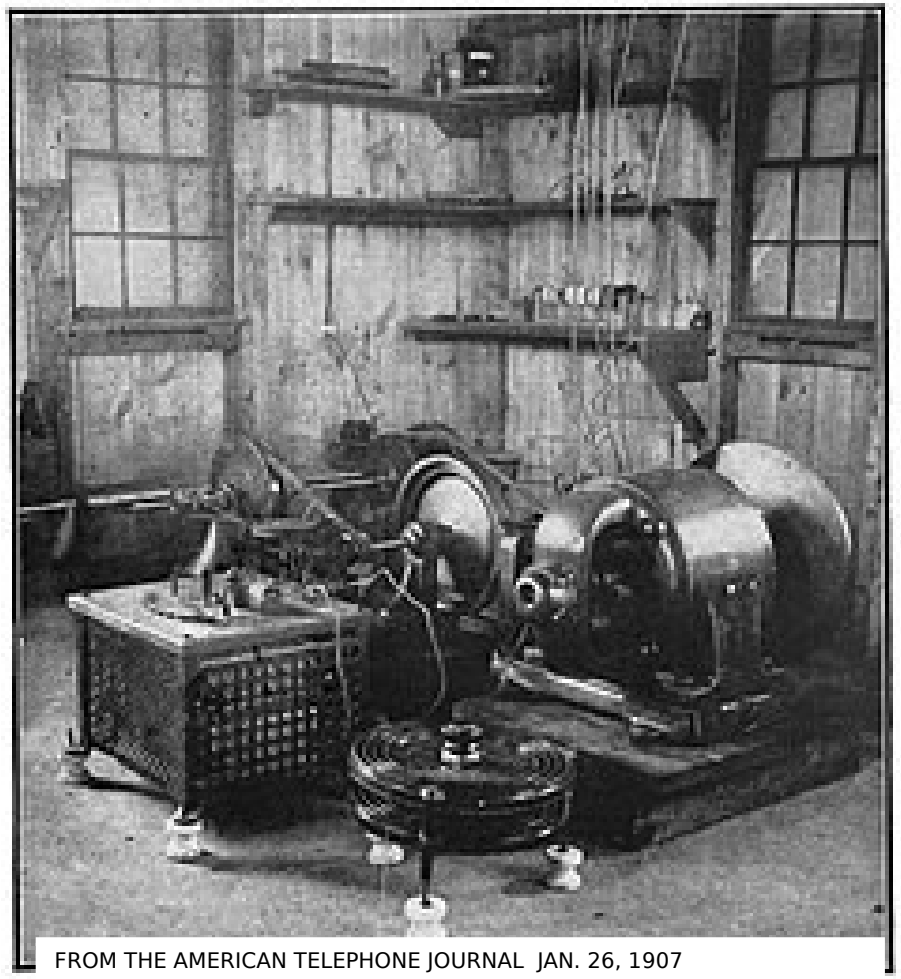
1907 WIRELESS STATION
Massie Station, RI

The photo shows the Massie spark transmitter under restoration. All of the original equipment is in the station except the change-over switch, which was assembled by Alan Douglas from original parts. The pump handle key, Massie Resonaphone tuner and operator call box are on the original table.

The helix and straight spark gap are on top of the condenser cabinet. On the left wall above the helix are a hot wire ammeter and anchor gap.

Bert Pine donated 100 sheets of 18″ square 1/8″ glass and Michael Thompson has made 70 of the 100 glass plate condensers that fit in the cabinet below the spark-gap and helix. Rolf Richter cast new zinc spark gap electrodes, machined new electrode holders, and even had the machined parts nickel plated. The original high-voltage cables had bright green woven cloth insulation. Dave and Judi Kernan made a covering for the new high-voltage cables that closely matches the appearance of the originals. We used a Marconi 2 KW spark coil because we don't have a Massie coil or information on the design of a Massie coil. We made a key relay using a Massie wooden parts box to make the pump-handle key safer to use during demonstrations. The transmitter now makes big sizzling sparks! We will not connect an antenna to the transmitter so we can keep the FCC happy. This is one of the oldest working wireless transmitter in the world. We currently have about 0.05 mF of capacitance so the transmitter operates at about 350 KHz. It will operate at about 300 KHz when the remainder of the condenser plates are installed.

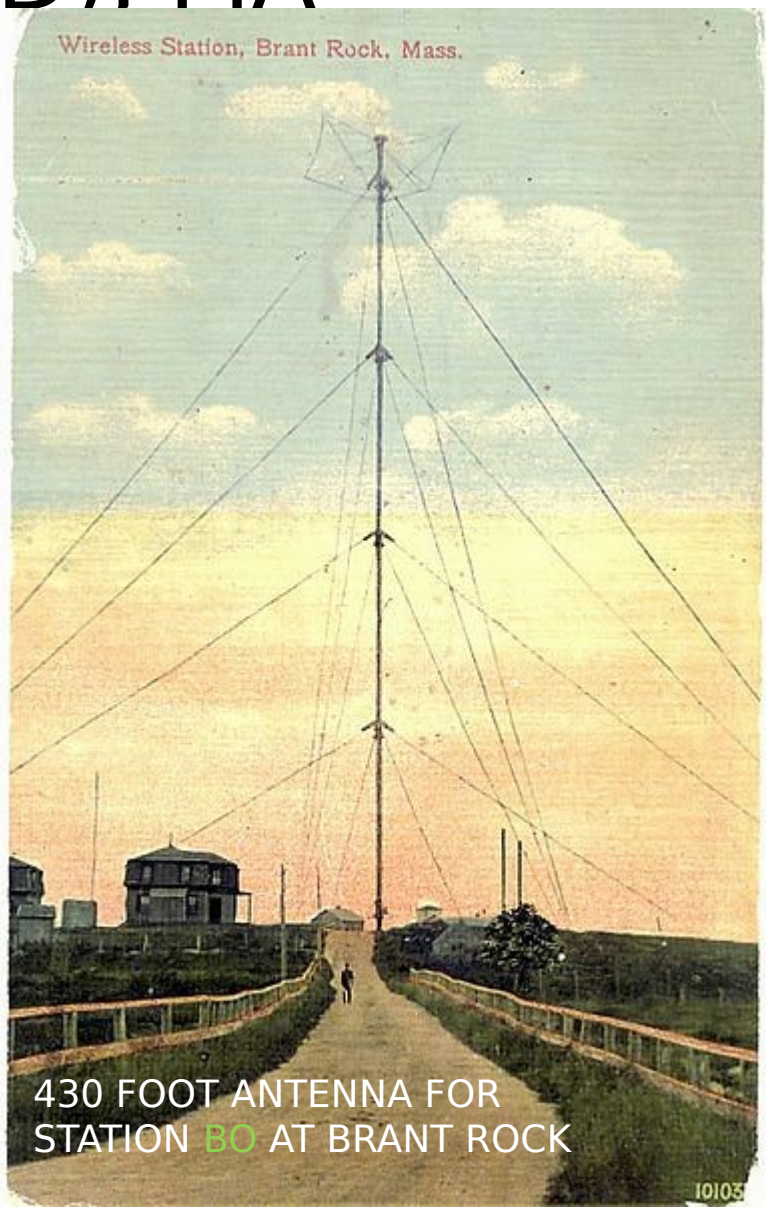
BRANT ROCK (MARSHFIELD), MA



FROM THE AMERICAN TELEPHONE JOURNAL JAN. 26, 1907

GE 50 KHz ALTERNATOR USED BY FESSENDEN FOR VOICE & MUSIC TESTS IN DEC. 1906

REGINALD FESSENDEN



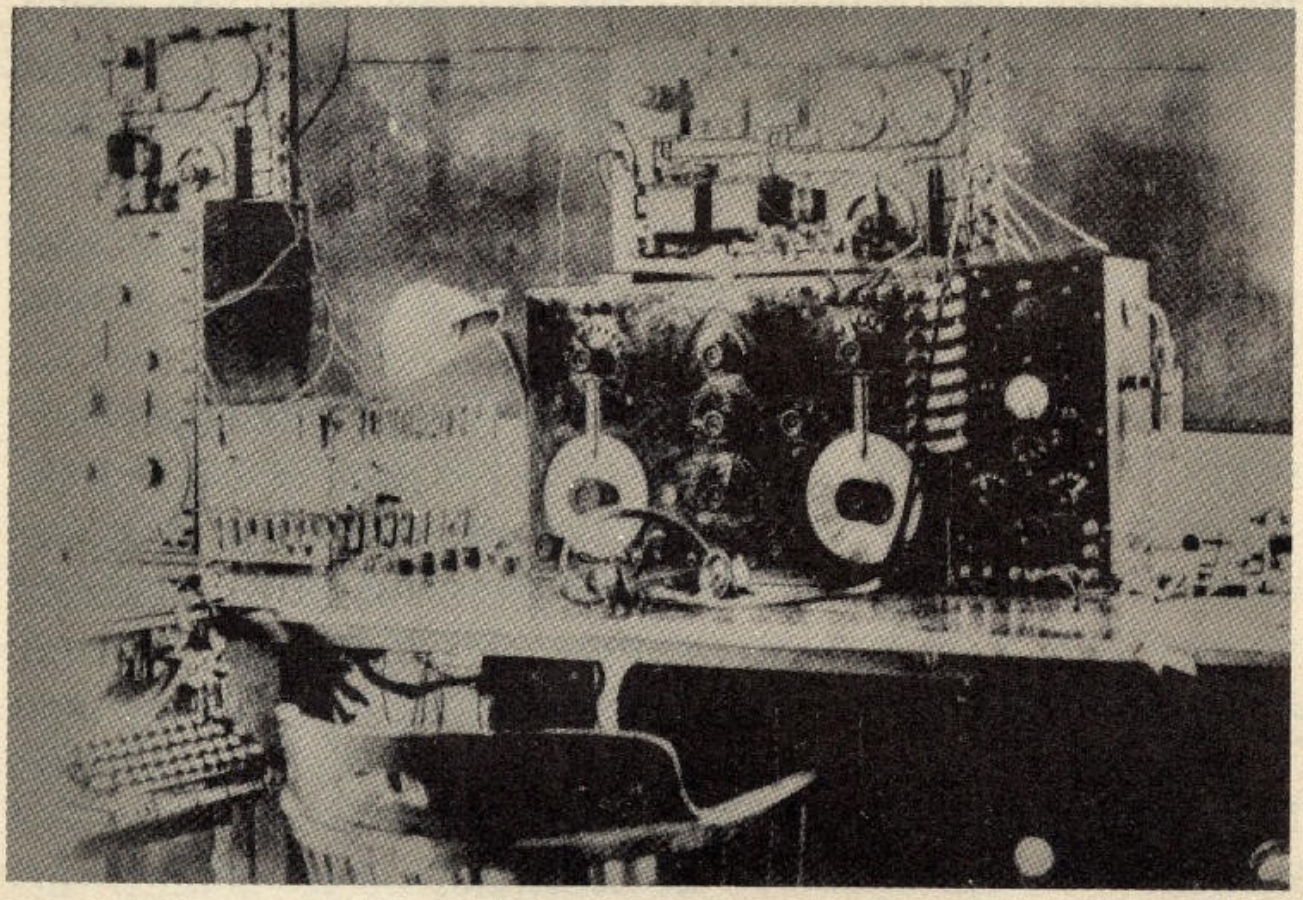
430 FOOT ANTENNA FOR STATION BO AT BRANT ROCK

1918 STATE OF THE ART ‘LF’ RECEIVER AT U.S. NAVY STATION NDB, BAR HARBOR, ME

Located at U.S. Navy radio station NBD - Otter Cliffs in Acadia National Park near Bar Harbor, ME.

The station was built by Allesandro Fabbri (amateur call 1AJ) and offered to the U.S. Navy for the war effort with the condition that Fabbri became the facility commander.

Station equipment and some antennas were provided by Wireless Specialty Apparatus Co.



One of the trans-Atlantic long wave receiving positions, Otter Cliffs.
Photo courtesy Jesup Memorial Library.

BELFAST, MAINE

- RCA receiving site from 1921 to 1927 (with some ship to shore transmitters)
- Had massive European Beverage antennas one of which had three elements 9 miles long each they were spaced in parallel 6 miles apart.
- One antenna fed multiple receivers
- Was involved in the first Transatlantic broadcast hook up in March 1925. The Belfast station received a program from London via a Chelmsford, UK transmitter on 124 kHz. They retransmitted the program to NY via a relay transmitter on 70 M. Eventually was feed to broadcast station WJZ in NYC.

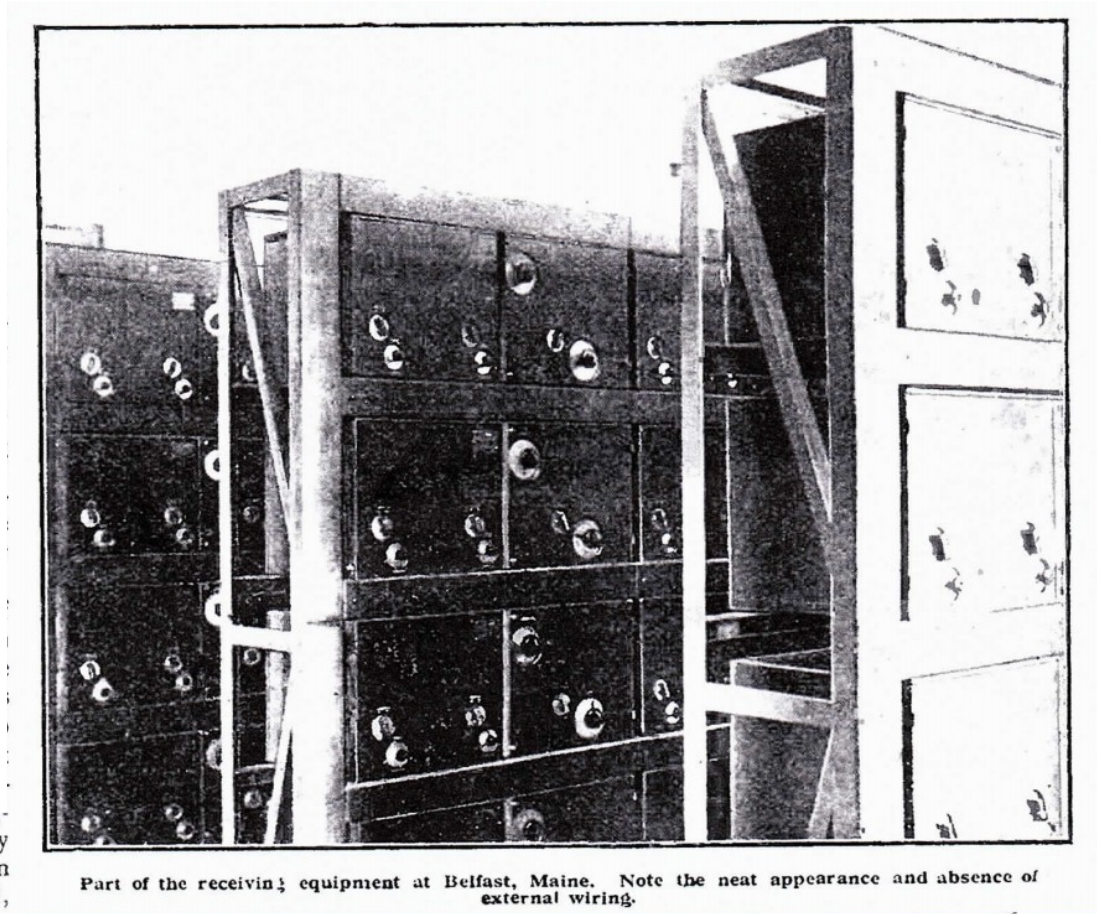
BELFAST, MAINE

ORIGINAL RCA BELFAST STATION

BELFAST, MAINE

This is a bank of low frequency receivers at the Belfast station.

The station could receive 16 channels simultaneously.



Part of the receiving equipment at Belfast, Maine. Note the neat appearance and absence of external wiring.

nals can be received very much better at Belfast than at Riverhead, Long Island,

From: Wireless World Magazine Jan. 18, 1928 page 68

HOULTON, MAINE

- During World War One there was a U.S. Army radio intelligence station at Houlton that only lasted for the part of the war.

- In 1927 AT&T with help from RCA established a receiving station at Houlton for Transatlantic phone calls. The transmitter was on Long Island at the massive RCA Rocky Point transmitting site. This predates the availability of phone calls via underwater cable by 30 years.

HOULTON, MAINE

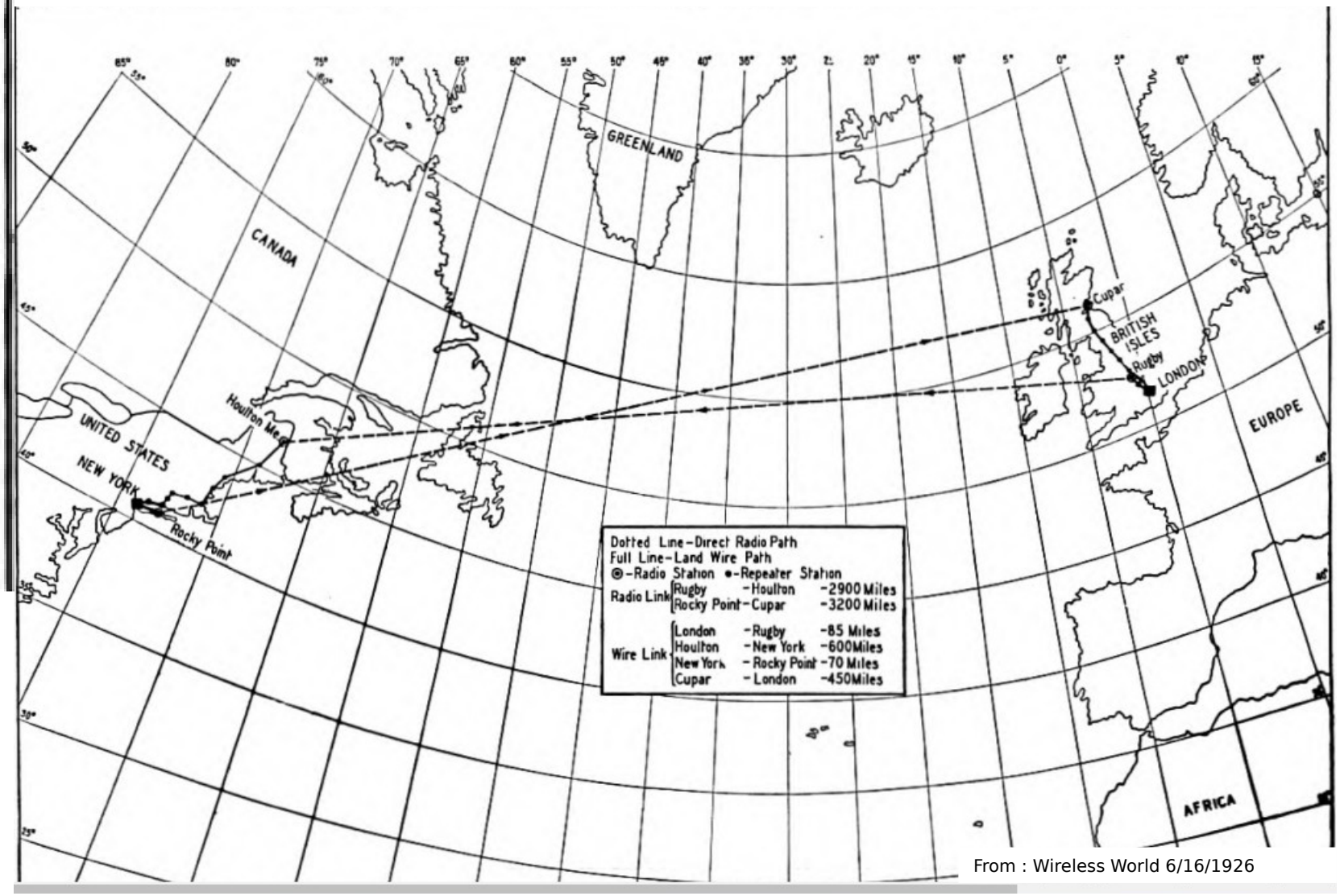
- The transatlantic telephone receiver used Single Side Band on approx. 60 khz.
- It was initially a single channel operation.
- The antenna was a 4 antenna array with each antenna 14784 feet long (approx. one wavelength) in 2 offset pairs, each pair was spaced 1149 feet apart and the total width was 11039 feet. Because of the staggering of pairs in the direction of the azimuth, the total antenna length was 18297 feet. This resulted in an incredible *7.2 square mile antenna*. The antenna was so unusual it was issued its own U.S. Patent.

TRANSATLANTIC PHONE CALLS

Dotted Line - Direct Radio Path
Full Line - Land Wire Path
◉ - Radio Station • - Repeater Station

Radio Link	Rugby	- Houlton	- 2900 Miles
	Rocky Point	- Cupar	- 3200 Miles
Wire Link	London	- Rugby	- 85 Miles
	Houlton	- New York	- 600 Miles
	New York	- Rocky Point	- 70 Miles
	Cupar	- London	- 450 Miles

To get the audio from ME to NY used a 600 mile telephone line that had 9 repeaters along its length.



From : Wireless World 6/16/1926

TRANSATLANTIC PHONE CALLS

This is the receiver site in a 1920 farm house in Houlton, Maine. This house still exists today as a private residence.

The 3 right hand racks are the SSB receiver for the UK transmitter and the remaining racks on the left are the equipment to send it by telephone line to New York

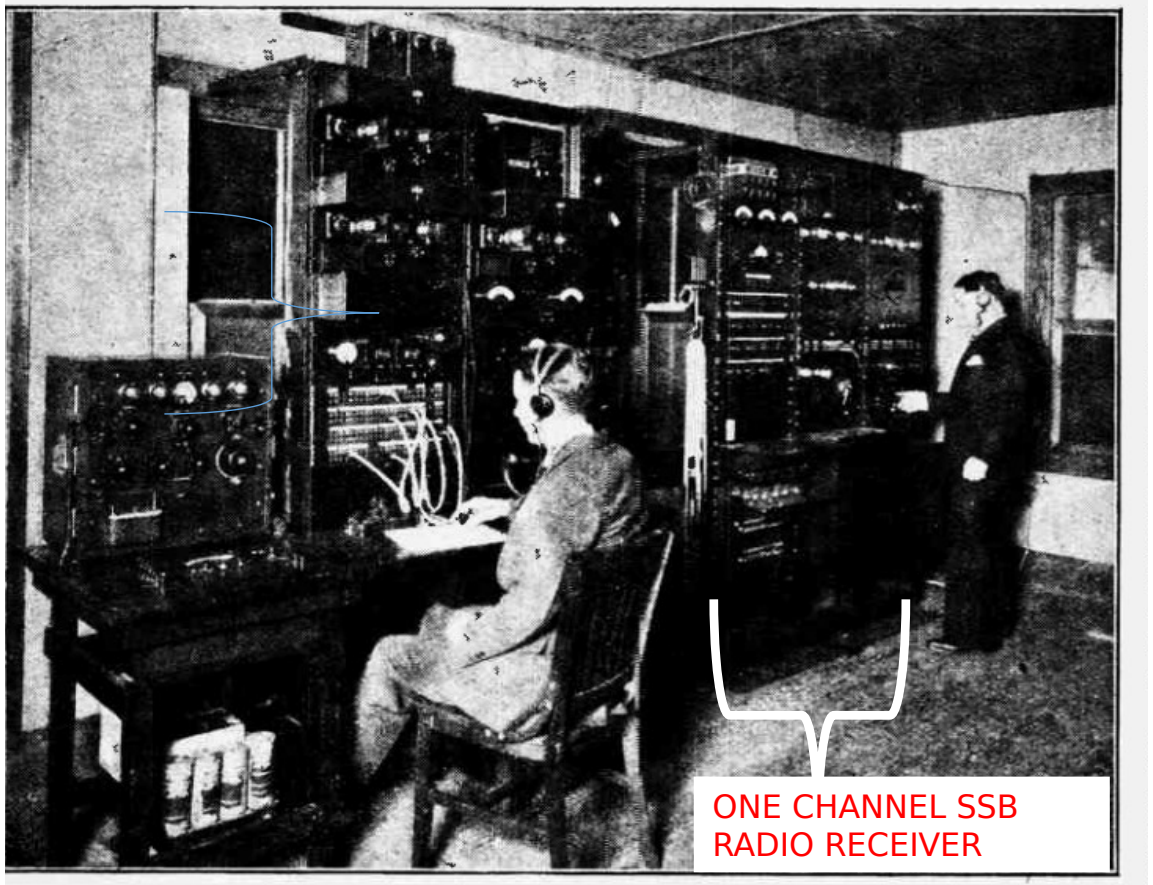
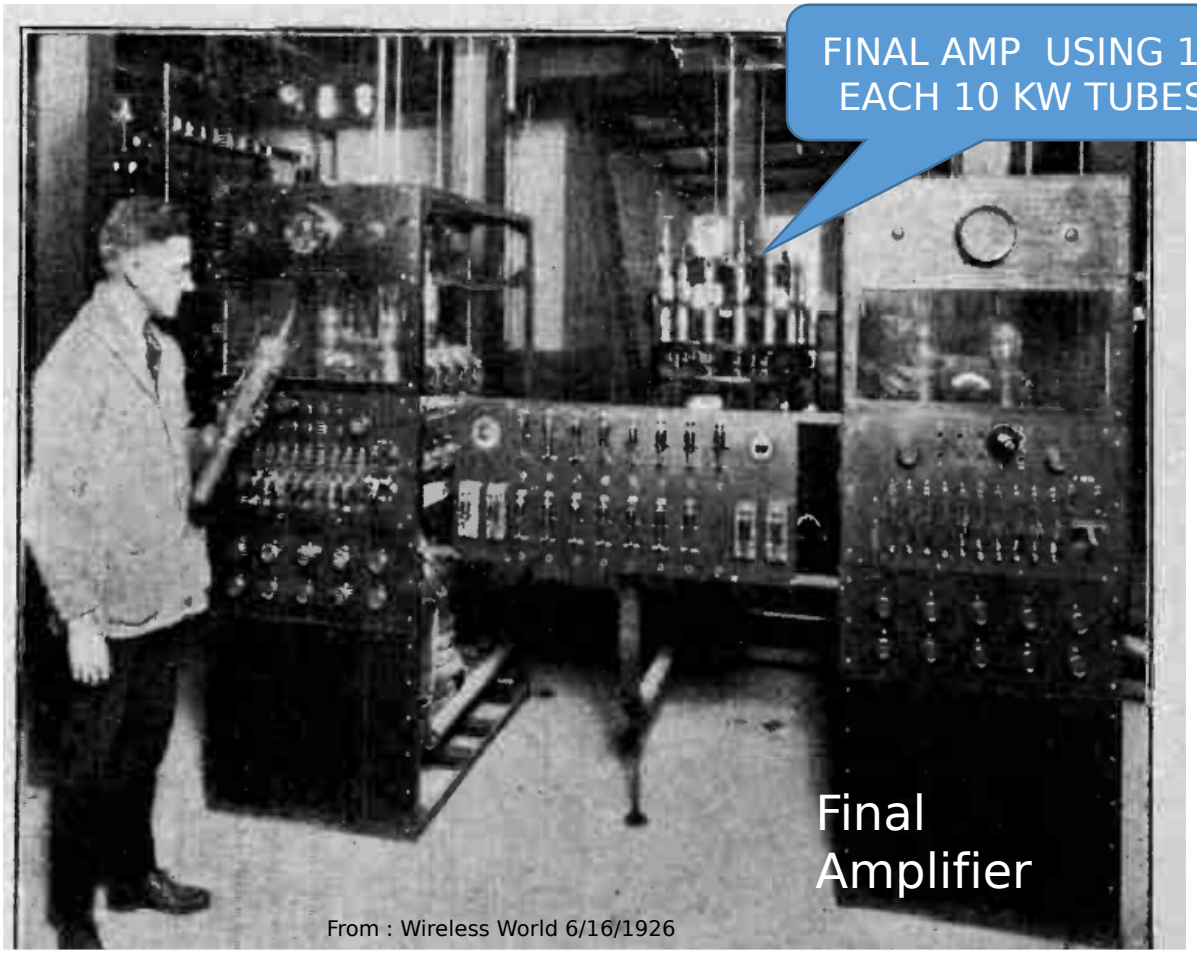


Fig. 7.—Interior of receiving station at Houlton, Maine, U.S.A. The wireless receiver is on the extreme right, the other panels being the terminal boards and amplifiers for the telephone lines from New York.

From : Wireless World 6/16/1926

TRANSATLANTIC PHONE CALLS



These two pictures show the 150,000 watt transmitter in Rocky Point, Long Island, New York. This was a single channel transmitter like WBZ only on a much lower frequency. This transmitter used VOX. WBZ only uses 50,000 watts.

TRANSATLANTIC PHONE CALLS

In the first year approx. 2000 calls were made. The typical call was 5 minutes and cost $2646 in 2023 dollars (yep, $529/minute).

This became a backup site once HF radio took over this service in early 1930’s. Houlton remained available as a backup until 1957 when trans-Atlantic cables became capable of carrying voice transmissions to Europe.

CHATHAM & MARION, MA

Marion was the high power transmitter site for the Marconi communications station with the receivers and low power ship to shore transmitters at Chatham, MA. Starting in 1914.

After World War One the station was taken over by RCA. The site in the late 1940's thru 1950's was controlled by the U.S. government

THIS IS THE 200 KW ALEXANDERSON ALTERNATOR TRANSMITTER

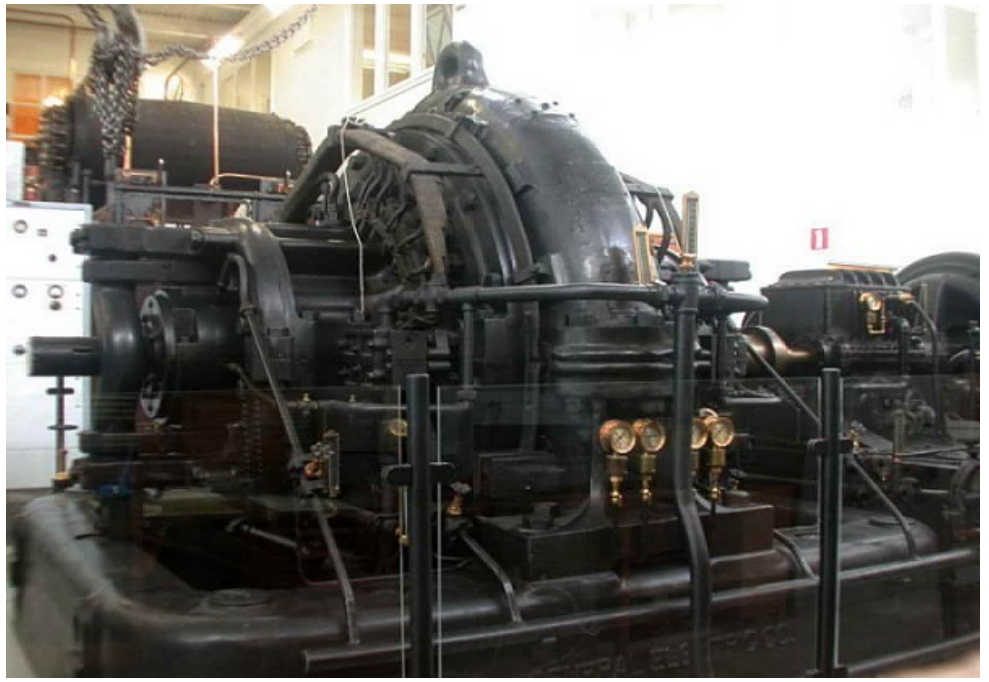
The first Alexanserson alternator was installed in 1920 followed by a second in 1922.

They were keyed from NYC by a 245 mile committed telephone line and had an ultimate capability of 225 wpm.

1953 PHOTO FROM THE SIPPICAN HISTORICAL SOCIETY

CHATHAM & MARION, MA

ALEXANDERON ALTERNATORS OPERATED BETWEEN 16 AND 32 khz. YEP khz. As a result antennas were massive being about 7000 feet long on multiple towers. In use for 27 years between 1920 till 1959.



These pictures are from the remaining operational site SAQ in Sweden.

CHATHAM & MARION, MA

Today the Chatham receive and ship to shore site is the Chatham Marconi Maritime Museum. It is located on Comers Road in the Ryder’s Cove section of Chatham.

THE REAL QRO STATION

US NAVY RADIO STATION
NAA IN CUTLER, MAINE

BECAME OPERATIONAL IN 1961

VERY LOW FREQUENCY TRANSMITTER (24 KHz)
WITH A POWER OF 2,000,000 WATTS

ANTENNA IS 75 MILES OF WIRE ON 26 TOWERS

GROUND SYSTEM IS 2000 MILES OF BURIED WIRE

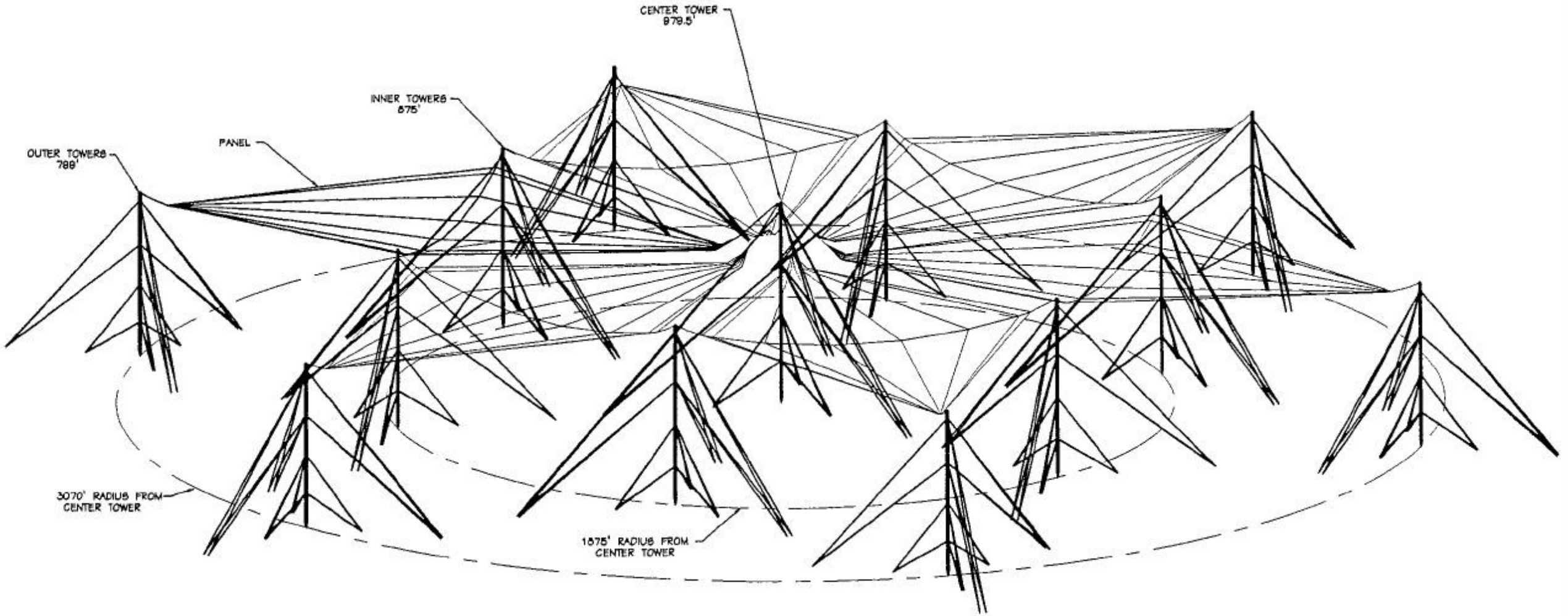
3000 ACRES INCLUDING A PENINSULA
WITH 12 MILES OF ROADS

HAS ITS OWN POWER STATION CAPABLE OF 15,000,000 WATTS CAPABILITY
DOCK AND TANK FARM FOR FUEL FOR 5 GENERATORS (22,000 BARREL STORAGE)

US NAVY RADIO STATION NAA IN CUTLER, MAINE

ONE ANTENNA CONSISTING OF 26 TOWERS BETWEEN 798 FEET AND 979 FEET TALL

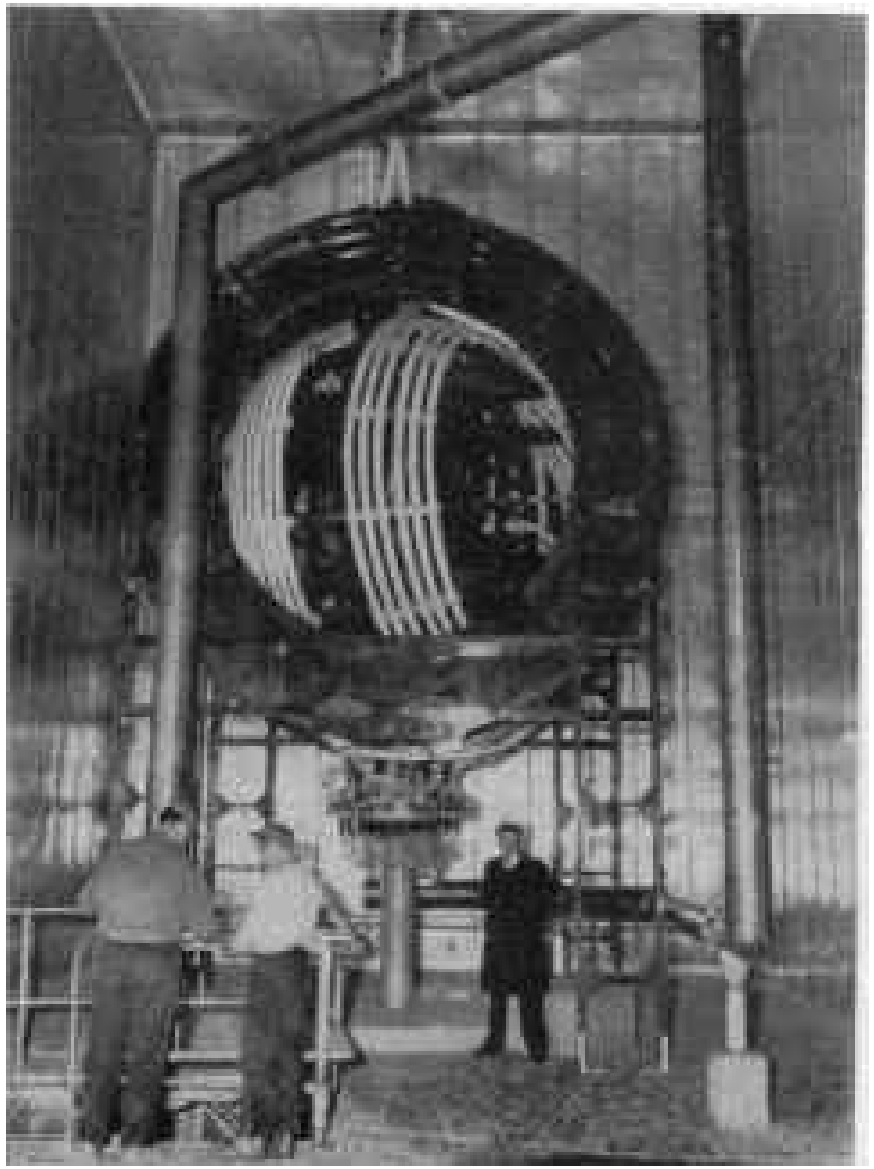
THE ACTUAL ANTENNA CONSISTS OF 396,000 FEET (75 MILES) OF 1 INCH CABLE



ONE HALF OF THE NAA ANTENNA

VLF ANTENNA ARRAY
NOT TO SCALE

FROM : WIKIPEDIA

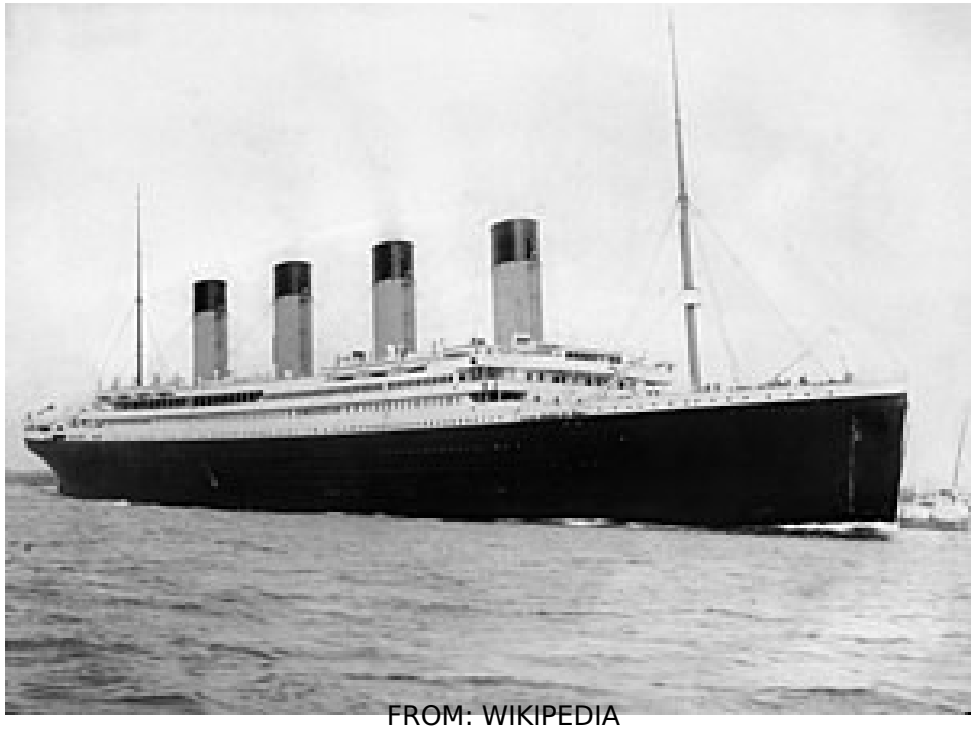


ANTENNA TUNER

FROM: [NAA Cutler Maine - Navy VLF Transmitter Site (navy-radio.com)]

ONE OF THE GREAT INCIDENTS THAT MADE RADIO A HOUSEHOLD NAME

“THE TITANIC”



FROM: WIKIPEDIA

THE TITANIC

- Sunk on maiden voyage April 14, 1912
- 1514 died
- 710 were saved after the *RMS CARPATHIA* responded to a wireless distress call
- The *SS CALIFORNIAN* was closer but did not respond to distress rockets and their only radio operator was asleep.

THE TITANIC

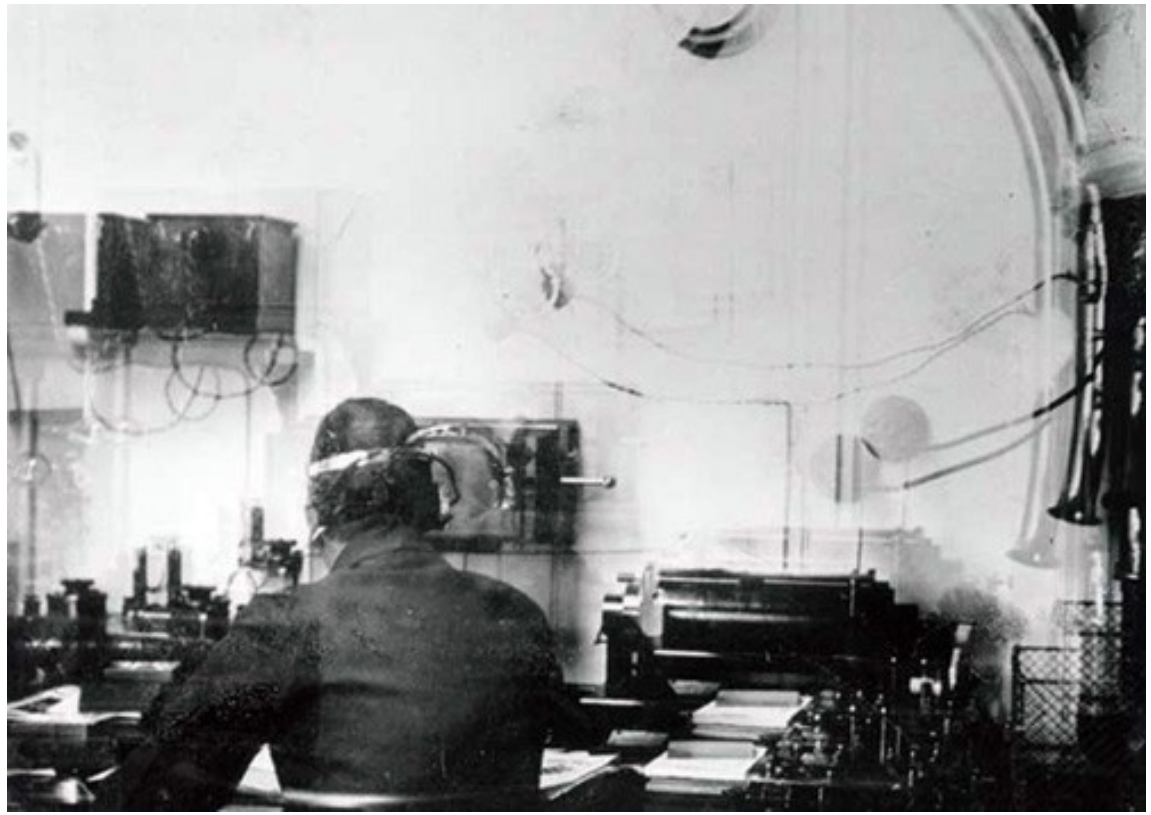
- The Marconi operators on the *Titanic*, John ‘Jack’ Phillips (died) and Harold Bride were considered heroes, as was Harold Cottam of the *Carpathia.*

THE TITANIC

- The prominent hero in this incident was Capt. Arthur Rostron of the *RMS Carpathia*. His rescue effort was consider a incredible feat of organization. He was recognized by the King of England with a knighthood and was later appointed as Royal Naval Reserve aide-de-camp to King George V. The US Congress presented him with a Congressional Gold Medal.

RMS CARPATHIA
FROM: WIKIPEDIA

THE TITANIC



From: http://www.dx-qsl.com/titanic-radio-room.html

Reproduction from James Camroon's movie TITANIC

From: http://jproc.ca/radiostor/titanic.html

THE TITANIC

EFFECTS ON RADIO OF THE TITANIC'S SINKING

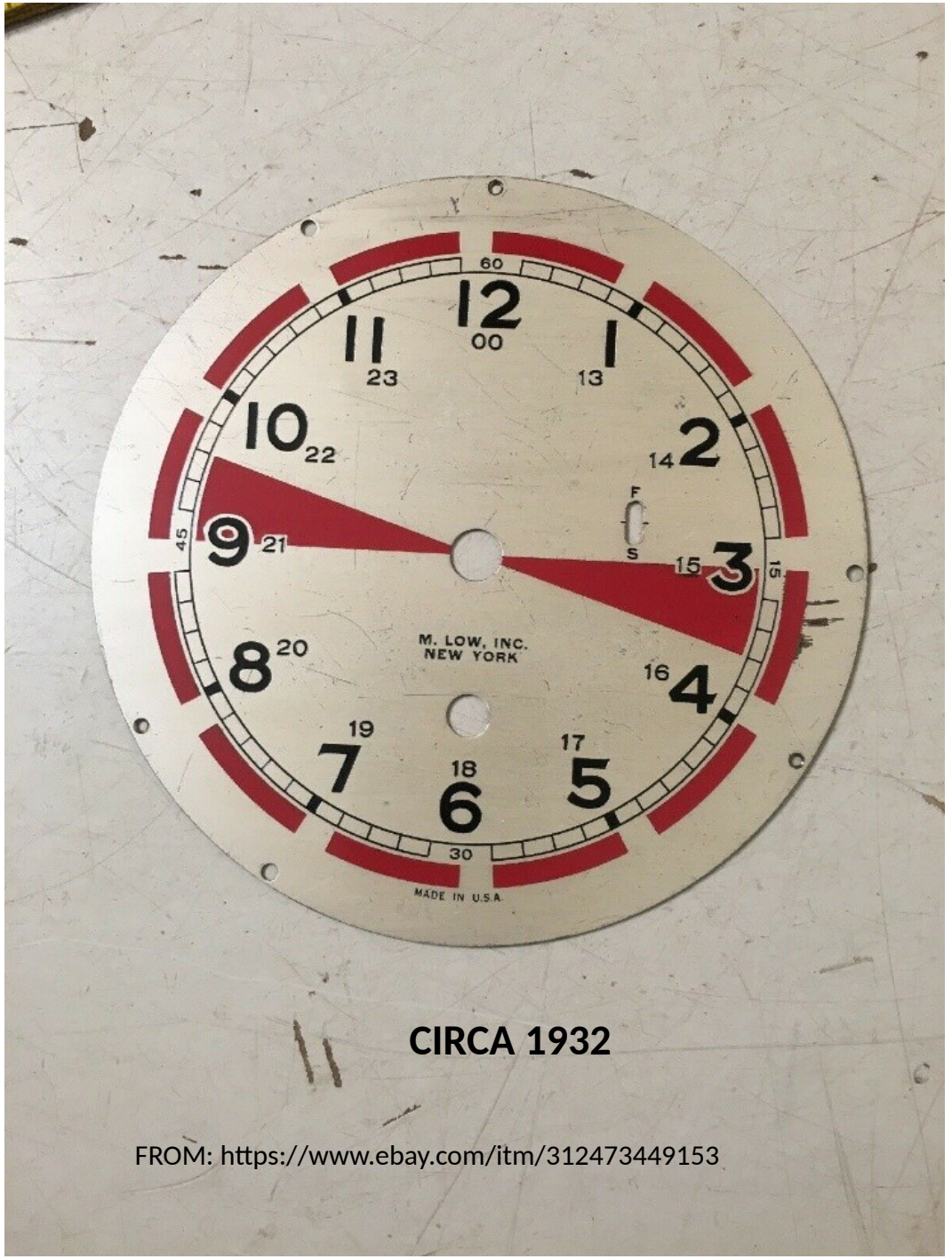
- SOS became the only distress signal
- Required all wireless equipped ships over a certain size to have some provision for continuous monitoring (2 or more operators).
- Required ships to monitor for distress calls 2 minutes of every 15 minute period. Eventually this was modified to 3 minutes every 30 minutes.
- The International Ice Patrol was formed and till today is operated by the USCG.
- Eventually lead to a system called auto-alarm in 1927 to allow all ocean going ships to monitor continuously for CW like distress calls.

THE TITANIC

THE SHIPS RADIO ROOM CLOCK AFTER THE *TITANIC*

The red 3 minute crescents were *SILENT PERIODS* for which all ships operators and shore stations were supposed to monitor the 500 kHz international calling frequency for distress calls in CW.

This requirement existed from 1912 until 1999.



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