Who Really Made It Across First?

An analysis of the first trans-Atlantic amateur radio contacts

1. Introduction

While there is not much doubt that radio signals cross the Atlantic Ocean on the shortwave radio bands, there is much history to be studied as to what the conditions were under which the first successful amateur contact occurred. In this short paper, let us examine the history of hams working each other across the pond.

2. Beginnings

Initially, radio operators thought that radio waves travelled entirely through surface diffraction. A basic understanding of refraction (in optics) will give some understanding of Snell's Law -- waves will bend towards a higher index of refraction. The Earth, being solid, had a very high index of refraction, but, other propagation modes (such as electromagnetic surface waves) were not well-understood. As such, quite a few scientists attempted to explain radio wave propagation using these theories. Early on, Dr. Hector Macdonald attempted to solve the mystery. He determined that the longer the wavelength (and the lower the frequency), electromagnetic waves would bend along a spherical surface. However, he did not explain the attenuation or any other notable effects. Building on Macdonald's work, Henri Pincare determined that it was possible for electromagnetic waves to fully traverse the Earth, and would experience attenuation. Unfortunatley for Pincare's model formula, a constant of attenuation was required -- this constant would have to be determined experimentally. Realizing that this was going to be rather difficult to determine, the model was taken as scientific observation, not engineering practice.

Continuing on the mystery, Dr. John Nicholson essentially confirmed the earlier theories of frequencies. However, Nicholson noticed something odd -- diffraction alone would not have given enough effect to allow radio waves to go great distances (citing Marconi's efforts in experimentally evaluating radio propagation). He successfully came up with a "perfect" formula for radio wave diffraction, but, also determined that something else had to exist to allow those waves to go further than what could be mathematically solved. At this point, the only way to determine what was allowing waves to go vast distanes was to solve it experimentally. At this time, the US Navy had tremendously powerful longwave spark-gap transmitters (running

in the hundreds of kilowatts) all over the world -- these would surely be a good test; not to mention the amount of radio-equipped ships at sea. Louis W. Austin enlisted the Naval station in Brant Rock, MA, to transmit on 80 and 300 KHz. The USS *Salem* and USS *Birmingham* would be the receivers. This would occur in December 1909 through January 1910. Once the experiments had concluded, Austin had managed to derive an actual mathematical formula relating frequency, station distance, transmit and receive antenna height, transmit antenna current, and would yield the receive antenna current. The formula was:

$$I_r = 4.25 * \frac{h_1 h_2 I_t}{\lambda d} * e^{-\frac{0.0015d}{\sqrt{\lambda}}}$$

Despite this looking promising, it did not necessarily discriminate between the effects at play -- it did also not make any assurances where the formula no longer applied (it was said to only be good at longwave frequencies). Only two frequencies were used in the determination of the ranges, so, fitting a curve was rather difficult. Nonetheless, this was a step in the right direction. Even then, this formula was only reinforcing the idea that longwave was the only “good” frequency range, and that everything above 300 KHz would be useless.

3. 1BCG and 2ZE

2ZE, Paul Godley, was a receiver designer in the late 1910s and early 1920s, known for his terrific receiver design (known for their high gain, sensitivity, and selectivity). Paragon Paul, as he came to be known as, made a trip across the Atlantic for an event that would occur in mid-December, of 1921. A variety of stations were participating in what was a semi-large operation to probe the propagation of “useless” higher frequencies; amateurs were relegated to “200 meters and down” by then (set in April 1920), and, the valuable longwave freqencies were reserved for commercial stations. Even by the infamous “200 meters and down” order, longwave DXing was very much so a thing people did -- amateurs were advised to have a different antenna for that, though (their primary antenna was advised to not have a natural resonant frequency any higher than 160 meters). This proved to be “devestating” -- an evaluation of the propagation characteristics of stations operating higher than 1.5 MHz was necessary. Furthermore, non-amateur interests (namely the US Navy) were highly interested in understanding radio propagation at all then-achievable frequencies.

The amateurs in Britain, at this point in history, did not have very good

receivers. Motivated possibly by the small size of the British Isles and their close proximity to continental Europe (with a conductive body of water between them), the simpler receiver designs that were obsolete by 1921 were still being used. Some amateurs in the US postulated that, should a British station be built and equipped with the latest and greatest in superheterodyne technologies -- also with a good antenna -- US stations could be heard. The first attempt to evaluate this theory only reinforced this idea -- in Feburary of 1921, a variety of tests were done that determined that the British amateurs were totally deaf at receiving America-originating wavelengths shorter than 200 meters.

The goal of the December re-do experiment was to determine if amateur stations running less than a kilowatt could propagate across the Atlantic Ocean. Station 1BCG, in Greenwich, Conneticutt, was erected with a powerful transmitter and antenna for the experiment. 2ZE boarded a ship bound for Europe (the *Aquataina*) on the 7th of December, 1921, and met someone very interesting on the way -- Harold Beverage! The Beverage antenna, as it is now known, is a very long, very directional, and very sensitive antenna suitable for lower frequencies where beam-type antennas are not feasibly constructable. Upon landing on the 11th, Godley and Beverage erected a receiving station in London, but, terrible fate struck them. While trying to listen on 200 meters for American stations, he was blown away by harmonics from almost every ocmmerical longwave station in Europe! After trying for a few nights, he decided it was time to relocate. Off to Adrossan, Scotland he went, armed with his Paragon RA-10 and Armstrong superhetrodyne receiver (equipped with some RCA-loaned tubes). The extremely sensitive receiver, Beverage antenna, good will from Guglielmo Marconi himself (whom Godley had met at a dinner before his experiment would be ran, convincing his company to loan some antenna wire and other radio parts), and tent were deployed on the Scottish coast, and, Godley listened. He listened in, with the hopes that he could breathe life into the “useless bands.” Marconi himself was also allied with the experimenters; he took a keen interest in these amateurs and their tests (Marconi famously called himself an amateur, likening himself to the expirementer he once was himself). Both the Marconi Company and RCA took note and aided as they could.

And listen, he did! Like a roar, the American stations boomed in on the morning of the 11th (this would have allowed for the Atlantic Ocean to be “dark” -- allowing for 160 meter propagation). He heard quite a few stations stations, many more than expected. The first station copied was 1AAW, determined to be running a synchronous rotary spark-gap transmitter (one could tell based on the characteristics of the emitted signal). The most powerful station was 1BCG, outputting about 500

watts. Operated by Edwin Armstrong, Ernest Amy, Walker Inman, John Grinan, George Burghard, and Minton Cronkhite (owner of the 1BCG callsign), the mighty station soared through the air with great command. Powered by state-of-the-art vacuum tubes loaned by RCA (four UV-204 tubes which would have cost a small fourtine) However, that was far from the only station heard! The following other stations were also heard:

Spark

- 1ARY - Burlington, VT
- 1AAW - “illegal station, not yet located”
- 1BDT - Atlantic, MA
- 2BK - Yonkers, NY
- 2DN - Yonkers, NY
- 3BP - Newmarket, ON

Continous Wave

- 1RU - Hartford, CT
- 1RZ - Bridgefield, CT
- 1ARY - Burlington, VT
- 1BDT - Atlantic, MA
- 1BGF - Hartford, CT
- 1BKA - Glenbrook, CT
- 1XM - Cambrige, MA (MIT’s Amateur Radio club)
- 1YK - Worchester, MA
- 2EH - Riverhead, NY
- 2FD - New York, NY
- 2FP - Brooklyn, NY
- 2ARY - Brooklyn, NY
- 2AJW - Babylon, NY
- 2BML - Riverhead, NY
- 3DH - Princeton, NJ
- 3FB - Atlantic City, NJ
- 8BU - Cleveland, OH
- 8ACF - Washington, PA
- 8KV - Pittsburgh, PA

Nonetheless, this mirrors modern-day propagation on the 160 meter band. These experiments proved invaluable in getting radio where it is today, and, we would certainly be years behind without it!