Fessenden Article for Kintyre Magazine

Part 1

My first introduction to Fessenden was sometime in the 1950's whilst collecting gulls eggs near the Inneans. I remember asking, "What were the gigantic concrete structures near the Gauldrans?" The answer was either "they were something to do with the war" or "something to do with the nearby airfield." This answer seemed to satisfy me at that time….

Next meeting was in the late 1980's - whilst sitting in a dentist's surgery in Wick I picked up the Scots Magazine and there in front of me was an article adorned with a photo of the site in 1906, including one of the mast. Having a career in Electronics in Civil Aviation, this article always remained at the back of my mind.

Many years later whilst on the Internet, I searched for the name Fessenden and was presented with, all I can say, was a bewildering amount of information about a man I felt I should have known more. This Internet find led me to the website of Dave Riley in Marshfield/Brant Rock - the location of the site in USA mirrored by Fessendens Machrihanish station. I sent a few comments to Dave and by return found that he had been in correspondence with local man Duncan McMillan. This was about the site and in particular how to raise the profile of Fessenden, especially as it was approaching the 100th anniversary of the site and his achievements. Since then we've been involved in much work with the Laggan and Campbeltown Community Councils, TV and Radio interviews both here and across in Massuchusetts, plus had much Newspaper coverage again here and in Massachusetts. This work still goes on however will be ending at Christmas 2006 - hopefully.

Part 2

Reginald Aubrey Fessenden was born in Lakeside Drive Knowlton, Broome County Quebec, in 1866. His descendents were from Kent and his father, an Episcopalian Minister, headed a well-respected family. Reginald's father expected his son to follow in his footsteps. Reginald however, from an early age, didn't agree and as his Grandfather said "this lad is of finer clay."

In fact Reginald is quoted as saying "my parents despaired of me." Reginald would close his eyes and dream of being able to send voices around the world without wires, to which his mother said "there's no future in that." Reginald's idea of the voices were spawned from attending lectures by Alexander Graham Bell and conversations with his Uncle Cortez - a Physics teacher, also well respected.

From an early age Reginald appeared to show a most logic and intuitive mind. At 15, he entered Trinity College School where he excelled in Maths and was always the head of his class. At 17, he left to become the Head of Whitney Institute in Bermuda where he met his beloved Helen, later to become his devoted wife. Helen said of his upbringing

"he came from a loving house plus all his relatives had strong traits in medicine, law and held a strong belief in the Diety."

Reginald left Bermuda and worked for Thomas Edison soon being promoted to his Chief Chemist. Whilst with Edison, he devised the still used method of heat sealing the base of the glass envelope whilst still maintaining the wires in a vacuum through the base. He also pioneered the use of cheaper filament metals making the bulbs much more affordable to the public. His main interest however was always investigating the science of electromagnetism and reading the papers produced by the prominent scientists in this field.

Throughout his career, Fessenden seemed to have difficulty in working with people, possibly verging on the eccentric. He certainly struck a fine figure, being over 6ft, sporting a head of ginger hair and a full beard. He is also reported to have had the habit of walking about with a large flowing cloak, formidable to say the least, and not to be argued with.

In 1890 Fessenden moved again and worked with the U.S. Weather Bureau, where he devised a simpler method of morse code and established a network of radio stations along the Eastern seaboard using the “cutting edge” spark transmitters, now making their appearance. He was by this time, devising again new and I suppose “earth shattering” breakthroughs in this new science.

In the years 1850 to 1900 many people were investigating “wireless waves” or Hertzian waves and names such as Braun, Brady, Pokov and Marconi all closely watched each others' progress in this new science. Earlier, the very possibility of wireless waves had been founded by Clerk-Maxwell researching into the maths of electromagnetism. Those researches were so perfect and their maths so precise, that it took mathematicians 40 years to appreciate their significance. Even years before Maxwell, Lord Kelvin found that whilst discharging a Leyden jar, unmistakable “external” electromagnetic waves were produced. Those famous names and many others were contempories of Fessenden and their work closely followed.

In 1900 there is documentary evidence that Fessenden had already devised a crude method of sending speech on a rough spark transmission, whilst he worked with the weather bureau. The contact was with Cobh Island MD on December 3rd 1900. He had already invented insulating tape by this time incidently.

In a spark transmitter, very simply, the radiation is produced by the discharge of high energy across a small “spark gap”that is controlled not so basically by a morse key - press the key make the spark!!…. Unfortunately the process of keeping the spark going for any length of time presents problems and although all right for morse, would never be any use for speech transmission.

Fessenden realised this and was determined to devise a new system able to carry speech. Years before when out with his Uncle Cortez, he had reasoned that the radio wave must

propagate like ripples from a stone thrown into a pond and not as Marconi had envisaged like a "whiplash effect." In other words, the wave must be continuous and thus "spark" would never be any use in sending speech.

In 1900, Fessenden again moved on and this time established his own firm called the National Electric Signalling Company (N.E.S.C.O.) He was backed by two American millionaires - Given and Walker. However he found that Government red tape was rearing its head and he was refused a license to erect radio masts in his own country of birth Canada. In fact Marconi was given the license. Fessenden tried to establish a company in Canada at that time but his millionaire friends refused to back this venture and it came to little.

All through this time Fessenden was amassing patents under his belt, some of those being used by his rivals, however through business ineptude, little money was coming to him. Apparently Fessenden was more interested in the experimentation side than in the finance. At this time, basic spark transmitters existed and Fessenden indeed used those again, developing more advanced methods of both transmitting and receiving signals. His method of heterodyning signals is still in use today. Telegraphic undersea cables existed across the Atlantic at this time, however were not reliable and were also costly to utilise. To cross the Atlantic by "wireless" would bring in well needed funding and so the target was in the sight… but also for his rivals.
Fessenden was indeed in this race but still dreamed of the voice and speech over the radio that was the way to the future as he saw it

In 1901, Marconi backed by the UK Government and who now had his masts in Newfoundland at Signal Hill, was reputed to have sent a signal the letter(s) from Poldhu in Cornwall. This was however a "claim" and many say the "jury remains out" as to whether he indeed managed this. In any case it was only one way if anything. This was of course using "spark" technology. Marconi never went down the speech path even in later years.

The Fessenden's few years of moving into the business environment took them to Newark N.J. Pittsfield MA and Pittsburgh PA. During those moves he must have met many kings of industry and finance. Fessenden took the chair at Allegheny College and this led him to meet the greatest academic minds of the time. Names like J.P. Morgan and George Westinghouse, Baldwin and many others. Whilst he was there, he published a major study of the "Deluged Civilisation" of the Caucausus Isthmus through the Massachusetts Bible Society. This was a massive work however it was helped by a system he invented - microfilm..

Fessenden throughout his life did not suffer the legal system well and as a result must have left some of his life and health behind him in sometimes futile courtroom bickering and dramas.

Part 3

In 1905, a piece of land was leased from Capt Mac Neal of Losset Estate near Uisead Point for a period of 6 years, Lord Strathcona being involved in the transactions. Why there??
In those days, it was not clear whether radio waves would clear hills etc and this was the best "track" available from the UK to Brant Rock, Fessendens main station. Plus they also thought that a mythical wall of water 120ft high existed between them due to the curvature of the earth. The Kennelley Heavyside layer not been credited as yet. Incidentally Fessendens son was called Kennelley after the latter.

The station in Machrihanish was begun after Glasgow Fair in 1905. The N.E.S.C.O. company used the Brown Hoisting Machinery Company of Cleveland to erect the mast. The firm Locke Insulator Company of Victor N.Y. supplied the antenna insulators and Neil McArthur was used to cut the roads and other work at the site as a sub-contractor.

The Station Manager at Machrihanish was a Mr Glaubitz. The mast was completed after some delay on 28th December 1905. It consisted of 8ft long metal tubes of 3 feet in diameter, bolted together and eventually taking the mast to 450ft. Each 100ft section was guyed off to massive tethering points. The mast sat on a ball and socket device, which in turn was insulated from earth. Each guy was also insulated. Three buildings were erected to house the machinery the operators using the smaller building. The entire area near the station had a counterpoise "earth" of hundreds of wires buried below the surface in a grid formation and joined together eventually returning to the mast base but insulated from the tower proper. It should also be noted that as there was no electricity on the site the power had to be supplied by a coal fired steam engine The rotary spark-gap machinery was driven by belts from this engine. Electricity did however exist at Losset at this time… but that's another story. There were some problems in getting the station working and a Mr Armor left N.Y. on the saturday before Christmas, arriving at Machrihanish on January 2nd at 5pm after a very rough passage - the last few miles in a horse and cart!! The station was however soon ready for receiving. A Mr Shields from the U.K. Patent office was also on site to view the experiment.

Using predetermined times and wavelengths signals were received in the beginning of January 1906 (Jan.2nd) loud and clear. Machrihanish was soon ready to transmit and to the delight of Fessenden at Brant Rock, signals were soon and **repeatedly** sent **both ways** Machrihanish to Brant Rock and vice versa. Cables were continually sent for weeks for onward passage from Campbeltown Telegraph office onto the existing cable network. There is some conjecture as to who actually heard the first messages. Credit was given to Mr Armor but the Head Operator, a Mr Beakes was also present and listening. It should be noted that this was the **First** repeated crossing of the Atlantic by radio.

Signals however dropped out during springtime due to the longer daylight hours with their higher absorption. Autumn 1906 and the stations would be preparing to commence the telegraphic service once again. As mentioned earlier Fessenden was always dreaming

of the speech over the radio systems and had been experimenting in this area. He had developed what is called a High Frequency Alternator - a large rotary machine capable of producing high voltage outputs, the frequency of which rises into the radio spectrum and this will, with additional components, produce a radio wave the frequency which is dependent on the speed the machine is run., thus avoiding the "spark gap"system. After much work on this system and constructing machines with unheard of wooden armatures, he now, to cut the story short, had his Continuous Wave method of producing the "wireless" signal as opposed to the on-off method of the spark. Progress indeed again and another first for Fessenden. This system was indeed used until superseded by the thermionic valve invented by Sir Ambrose Fleming in London in 1904 and complemented by Lee De Forrest in U.S.A. in 1907 could be utilised commercially.

In November 1906 Brant Rock and Machrihanish were operational but both undergoing some engineering modifications.Brant Rock was modifying a new system between itself and another station in Plymouth Mass. about 12 miles away. Machrihanish on the other hand was listening and obtaining various data as to the absorpsion levels to be expected when communication re-commenced per the schedules. They were also listening in case any cables were by chance sent to them to avoid the high cable charges by land.
Brant Rock was often on the air with the Plymouth station with a new wireless telephone system between them.
Fessenden and his engineers incidently had often noticed a strange and remarkable phenomenon that showed that speech could be transmitted by speaking in close proximity to his rotary spark gap but never investigated it at the time.
You can imagine Fessendens surprise to receive later in Nov. a registered letter marked and this proved to be correct."personal "from one of the Machrihanish operators in which he detailed the time and date of reception of the voice , loud and clear of Mr Stein one of his engineers, instructing the Plymouth station on how to run up their generators. The report was not sent by cable so as not to run any risk of premature disclosure.
This was the **first** time human voice had ever been heard across the Atlantic by radio.
The records were checked and there was no doubt it had been heard at Machrihanish
It must be said however that the quality left much to be desired for broadcasting music.
The operator at Machrihanish was again Mr Armor..Also in this document (Scientific American 1918 Sept. 8th) Fessenden makes reference to the "false claim that signals were sent from Poldhu in Cornwall to New Foundland in 1901" by Marconi .Mr Armor when he heard the speech at Machrihanish wrongly thought that it was the above phenomena of speaking near the spark gap causing the modulation, however it was Fessenden using his new very recently perfected H.F. Alternators, his microphone being in series with the antenna proper. Later checks were conducted to verify that the spark gap phenomena did exist as explained.

However on December 6th, due to a gale, one of the mast guys broke, and unfortunately, due to the increased pressure on the remaining guys, they each broke in turn, the mast buckling. Two sections landed near to the operators hut and the remaining structure landed in the direction of where the lifeboat shed is now situated. Photos exist of the mast on the ground but unfortunately are of poor quality. This was a disaster, when Fessenden was so successful in the project and although they claimed the mast would be re-erected

it never came to place due to financial constraints upon N.E.S.C.O in U.S.A.

Fessenden wasn't finished yet however and his finest triumph was yet to come - unfortunately without Machrihanish's help this time.

He had, as mentioned earlier perfected his High Frequency Alternators. Approaching Christmas 1906, he cabled his listening operators on various ships etc, to listen at 9pm on Christmas Eve, to receive an important message. Whereupon at the prescribed time they were stunned to hear instead of the usual " morse spark" transmissions, Fessenden playing "Holy Night" on his violin, reading passages from the Bible and ending by wishing them all a Merry Christmas. This was the **first** ever published radio broadcast and another triumph for Fessenden. This was also the first time that voices had been heard over the air with Fessendens new system of what is called Amplitude Modulation - A system still used today worldwide.

Part 4.

Why did it fall…

The system of jointing the guys had been used before in bridges in the USA and had given no problems so why now?
The method of joining the thick cables, was to push the end of the stranded cable into what looked like a type of " filter funnel" after treating the ends with hydrochloric acid to act as a flux . The end, after coming through the small part or neck of the device is splayed out and in some cases a wedge is hammered into the cable. The ends are placed alongside the funnel sides and molten zinc is poured into the splayed ends along the inside of the funnel. The zinc solidifies and forms a plug of cable and metal thus preventing the cable from pulling back. The other cable end is treated in the same way on an identical funnel all attached together on a base plate.

On examination locally it was found that the zinc had not been heated to a high enough temperature and had not combined with the cable, plus it had a crusty appearance rather like a poor solder joint. This may have looked ok externally but when any strain was put on the joint, it simply pulled through the funnel.The jointing was reported to have been done by a sub-contractor.

Thus came the end of Fessendens involvement with Machrihanish.

Part 5

Fessenden however, carried on and devised the first ever device to enable ships to measure the depth of water below them, eg the "Echo Sounder." He however called it his "Fathometer." In 1916 he had a device forerunning the "Sonar" used by ships today. This was able to detect icebergs… and had a certain ship called the "Titanic" in 1912 had one fitted, history may have been very different.

The scope of Fessendens inventions are much too large to be scripted here, suffice to say that next time you switch on the “wireless” or TV or use your mobile phone, just think where and who to thank. Well perhaps not the mobile phone!!! TV - oh yes, he had the first TV operating in USA in 1919.

In all, Reginald Fessenden is credited with over 500 patents from insulating tape to tracer bullets…a wide range indeed.
Fessenden fell out again with his backers and left radio work However his High Frequency Alternators, because of their complexity, high cost and limited range of frequencies, would never be used for public broadcasting but they did make superb Longwave transmitters and were used for transoceanic services well through the 1940’s. In fact by 1919 his alternator-transmitter patents were considered so valuable that the question of ownership triggered the formation of the Radio Corporation of America. Because of national security reasons, the U.S. Government did not want the British owned Marconi Company to gain control of the alternator-transmitter rights.

Hopefully a small memorial will be erected on the Machrihanish site in due course. What happened there is just too important to forget. We hope you agree.

Epilogue

Reginald Fessenden sometimes broke, sometimes rich, managed to claim monies from many of those who had unlawfully used his patents. He retired to Bermuda, where he died in 1932. He was survived by his wife Helen Trott Fessenden, who died in 1941. His monies host a Scholarship Fund in Bermuda to this day.

What he said of himself "My parents despaired of me. They saw my future as a church minister, but when I closed my eyes and dreamt, I saw an invention that could send voices around the world without using wires or cables. There's no future in that, my mother told me, and she was both right and wrong." In my lifetime, I developed hundreds of inventions, including the electric gyroscope, the hetrodyne, and a depth finder. I built the first power generating station at Niagara Falls and I invented radio, sending the first voice message in the world on December 23rd 1900. But despite all my hard work, I lived most of my life in near poverty. I fought years of court battles before seeing even a penny from my greatest inventions. Worst of all, I was ridiculed by journalists, businessmen and even other scientists, for believing that voice could even be transmitted without wires. However by the time of my death, not only was I wealthy from my patents, but all of those people who had laughed at my ideas were twisting the dials on their newly bought radios to hear the latest weather and news.”

Also like Michael Dell and Bill Gates he never finished college…

Finally

The site today is still recognisable as a radio station. The mast is of course long gone, as is the counterpoise earth mat but the massive guy anchor points are still there and even

the building foundations can be recognised from 1906 photographs. The mounting bolts of the machinery are still embedded in the concrete. The mast base is also very evident with the counterpoise earth strips still in situ and with insulator shards littering the surrounding ground. The very base of the chimney can also be seen which was used by the steam engine.

Reginald Aubrey Fessenden is buried in St Marks's Church Cemetery, Bermuda. On his grave are the words "By his genius distant lands converse and men sail unafraid upon the deep." His wife Helen died in 1941.

His grave is surmounted by hieroglyphics which when translated say.

"I am yesterday and I know tomorrow"

This article was produced by the Fessenden Project Team in Campbeltown

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