Wireless -- its Evolution from Mysterious Wonder to Weapon of War, 1902 to 1905

ABSTRACT

This is a Story in Four Parts, Culminating in the First Use of Wireless Telegraphy in Warfare, but Starting, Naturally Enough, with Marconi in Cornwall.

Lee de Forest bearded the young wireless lion – Guglielmo Marconi – in his den, Britain, in 1903. Others also concerned themselves with Marconi's ambitions, as early as 1902, as the first part of this note will discuss. But both the British government and the cable monopoly rejected the De Forest System. Yet a courageous foreign correspondent saw a future for the De Forest System in war reporting, as Japan challenged Russia in the Far East.

This is the story first of commercial intrigue, in the first part of this note: spying on Marconi. Many saw that knowledge about this mysterious wireless telegraphy could be important in business and in war. But they had to find out how it worked, and what it could do. The second part of this note discusses Lee de Forest's failed reach for the brass rings of a British government contract, and a deal for his wireless system with the cable companies in 1904. But that commercial defeat enabled the public relations victory of the success of exactly the same De Forest Wireless System on the other side of the world, in the 1904 Russo -Japanese War. That same equipment, particularly de Forest's electrolytic detector, and de Forest's crack operators, got the news of the war out to Europe and America. The third part of this note discusses that remarkable turn of events.

Japan integrated wireless telegraphy with a web of cables and other means of communication and command, a then -unique network. With its integrated war making approach, Japan sank most of Russia's two battle fleets in the Russo -Japanese War of 1904 and 1905, as discussed in the fourth part of this note.

Japan's defeat of the Russian Navy killed Russia's far-eastern ambitions, especially for a Far Eastern (relatively) warm water port, open all year round – Port Arthur, on the south coast of Manchuria.

Lee de Forest wrote a detailed autobiography that covers some of this ground.[1] The now long-forgotten electrolytic detector he employed materially advanced the nascent wireless art *circa* 1903, because it enabled long-distance high-speed traffic for the first time.

Much of what is known about the earliest wireless spying at Porthcurno results from research and writing[2] by John E. Packer, a Fellow of the Royal Geographical Society. He is a Curator of the Cable & Wireless Museum at Porthcurno. The techniques of interception of wireless messages first emerged with spying there on Marconi, whose system de Forest also challenged.

The research and writing of the Irish historian Peter Slattery on the career of journalist and spy Lionel James provide much of what is known of the events in the Far East. Lee de Forest never got west of Palo Alto or Los Angeles, nor until 1904, west of New York. But James, at his own suggestion and de Forest's urgings, took over the wireless telegraphy equipment that de Forest had used in his experimental stations in Ireland and Wales in 1903. A great deal of what is in this note about London *Times* war correspondent James's dangerous work derives from Slattery's book: Reporting The Russo-Japanese War, 1904-5 – Lionel James's first wireless transmissions to the *Times*.[3]

The Japanese Navy's Commander Kurakichi Tonami sailed with James aboard the reporter's steamship at an even sharper risk of his life. Tonami already had international diplomatic experience. Much of what is known about him (in English) comes by way of Japanese naval historian Admiral Kazuo Itoh.[4] Admiral Itoh also explains how Japan (unburdened by any old ways of doings things) early on integrated its command, control, communications and intelligence. It created a novel and successful network to manage warfare. Commander Tonami had mastered the new technology of communications on behalf of the Japanese Navy. In the unforgiving world of war, Tonami stands out as an officer's officer, a spy's spy, and a very brave man. His work, before and after sailing with James, helped Japan win its war against Russia.

WIRELESS SPYING AT PORTHCURNO, CORNWALL, UK – A FIRST

Marconi's new technology fascinated the world, and especially the cable operators. It excited much curiosity in them, and in armies and navies, and in businesses. Wireless telegraphy, telegraphy without cables, long or short, directly threatened the cable industry. But this technology also promised much: the opportunity to extend as well as overlay and parallel cable communications. Wireless promised redundancy, and hence reliability, in long distance communications. An enormous amount of cable traffic, requiring the utmost reliability, passed, for example, between London and New York. But an undersea cable break could end communications in an instant. (The first cable had indeed broken after only a month underwater, and an undersea earthquake in 1929 did break ten of the 21 Atlantic cables. Also, cables could be cut, and would soon be, in times of war). Wireless also promised extension of communication from cableheads around

the world to interiors of Empire, to armies in the field and nearby navy vessels and to vast, unserved coastal populations in cities, towns, businesses and plantations.

Western Cornwall hosted the competing U.K. interests of cables and wireless. Marconi set up at Poldhu for its proximity to the Atlantic and the North American continent. The cable companies had long centered on Porthcurno (Port Cornwall), just a few miles south of Poldhu. At Porthcurno, the cables of the British Empire, as well as its former colonies, in particular the United States, made landfall. From Porthcurno, one could see Marconi's big Poldhu antenna of 1901 – and thereby hangs a tale of wireless spying by the cable companies, a prologue to the first use of radio, wireless telegraphy, for intelligence and command in a great war.

Marconi had first revolutionized and then monopolized the English maritime industry's communications. But a well-capitalized and politically well -connected cable industry could take up supplemental maritime wireless operations. Such an initiative could turn the tables on the Marconi company.

Yet in 1902 almost no one knew anything about radio or wireless beyond press accounts. Within three years, partly as a result of determined efforts to master the technology including interception of messages, wireless helped win the first war of the 20th Century.

John E. Packer tells the story of the Porthcurno cable companies' interest in, and spying on, Marconi. Marconi's company had its big station at nearby Poldhu. It sited its working maritime station nearby at "The Lizard," a peninsula jutting south. The cable companies' surveillance endeavors revealed the primary flaw of wireless telegraphy: anybody could listen. Encryption or cipher, if used despite its own challenges, could mask the text of a message, but not the fact of a message. Transmission characteristics also gave away sources and relationships among them. Commercial claims of privacy and reliability could be tested, and were often found wanting if not false. It was very important to many interests to understand wireless telegraphy in practice, not just in patent theory.

At the time, the cable companies' wireless expert was Nevil Maskelyne, who had been an early experimenter.[5] Maskelyne devoted himself to debunking Marconi's claims, particularly with respect to the security of wireless messaging.

Mr. Packer writes, in his Porthcurno Museum publication The Spies at Wireless Point,[6] excerpted here by his kind permission:

"*The Eastern Telegraph Company and Marconi's early wireless experiments*. On the cliffs near Porthcurno in West Cornwall stands a curious structure of iron hoops that looks like some mediaeval instrument of torture. It is all that remains of a little known episode in the history of wireless. There is scant published information about the venture, partly for reasons that will become clear. Little crumbs of information are scattered through the literature; in isolation they tell little but put together like pieces of a jigsaw they reveal early wireless spying, industrial espionage.

"*Cornwall's early cables*. The first international submarine cable laid into Cornwall was landed at Porthcurno near Lands End in 1870. It formed part of a chain of cable systems that spanned the globe, linking Europe with the Far East providing Australia's first direct telegraph link with the U. K. The Eastern Telegraph Company

(ETC) grew in capacity and extent until by 1900 cables fanned out from Porthcurno beach to North and South America, South Africa, India, Australia & New Zealand, and eventually Hong Kong and China. Porthcurno had become the main communications gateway to the British Empire.

"*The Bass Point Wireless Station*. In late 1900 with several modest over-the-horizon successes under his belt, Marconi and company were already dreaming of crossing the Atlantic by wireless. They had planned a high power installation at Poldhu on the Lizard peninsula. To carry out tests with Poldhu and experiment with 'syntony' or selective tuning (so two or more stations could signal simultaneously without mutual interference) and also to provide a commercial ship-shore service to provide Marconi with revenue, another site was chosen at Bass Point, near the Lloyd's Signal Station, and a wooden hut was erected.

"*Trans-Atlantic Success*. The story of the success of the December 1901 test has been told many times... It is, however, an irony that the only means by which Marconi could communicate with his staff at Poldhu to coordinate the test was by telegrams sent over an Anglo-American Company submarine cable that the success of the test now threatened. That cable operator, Anglo-American, took him seriously enough to issue a writ forbidding him to continue experimenting because they held a monopoly on telegraphic communications from what was then the Colony of Newfoundland.

"*The growing threat*. Until now the Eastern Telegraph Company had taken only a benign and casual interest in the new technology. Suddenly the complacency of the cable operators was shaken. Marconi could apparently repeat their function without the necessity of making, laying and maintaining expensive cables. What was not clear was just how well this signaling without wires actually worked. Submarine cables seemed to be reliable, operated for twenty-four hours a day, did not suffer from interference or fading, and most importantly were secure from interception. How did wireless compare? There was an urgent need for the cable companies to keep abreast of this developing rival and evaluate its potential commercial threat. No one was better placed to do this than the Eastern Telegraph staff at Porthcurno, only a relatively few miles from both Bass Point and Poldhu.

"*Spying in the service of submarine telegraphy*. On a clear day the staff at Porthcurno could actually see Marconi's masts at Poldhu across Mounts Bay. The Eastern Telegraph Company (ETC) accordingly hired the services of an early wireless enthusiast, Nevil Maskelyne.

"The growing interest of the ETC directors in wireless can be traced in the beautifully handwritten minute books of their Board meetings. The earliest reference to wireless is a minute dated December 18th, 1901. The Company's Chief Electrician simply noted Marconi's 'experiment across the Atlantic' just six days previously. The ETC didn't waste time, however, for just weeks later in January, 1902 they were already in discussion with Sir William Preece of the General Post Office, and with Dr. Oliver Lodge and Alexander Muirhead. At the same time the ETC Directors agreed to purchase just five shares in the Marconi Wireless Telegraph Company, presumably to allow them to attend shareholders meetings to keep abreast of

developments.

"*Wireless at Porthcurno*. Directors minutes for June 4th 1902 tersely report 'progress in experiments.' In June 1902, a member of staff was to journey to the Lizard, presumably on horseback, 'to see what sort of mast Marconi had erected for his wireless experiments'.

"The enigmatic lease of seaside land and the absence of any mention of a location in Maskelyne's earlier installation proposal suggest the Company was trying to hide its intention to spy from this cliff-top above Porthcurno cove on its potential communications rival on the Lizard.

"A 170 foot three section pitch pine mast was ordered from N. Holman and Sons, Ltd. of Penzance. Its lowest section was 70 feet long and about 18 inches in diameter, an unwieldy load. A wrought iron 'tabernacle' was constructed to house the foot of this monster, and iron ring-bolts to secure the stays were cemented into the cliff top just west of Porthcurno. This site has been ever afterwards known as Wireless Point.

"A 1911 photograph shows this mast with what appears to be a simple wire aerial system, perhaps copied from Marconi's first Poldhu aerial. Below the mast is a small wooden equipment hut. The caption simply says 'experimental wireless installation.' Yet the accompanying text, which describes the cable station in detail, gives no other details whatsoever of the mast or its purpose.

"In 1902, Maskelyne, without mentioning that he worked for a cable company, wrote: 'I was commissioned to establish a wireless station at Porthcurno for the purpose of signaling to vessels now being fitted for wireless'. He continued 'last August [1902] I went to Porthcurno and commenced operations. Pending the erection of the mast I set up a wooden scaffold pole carrying a diminutive collecting circuit [*i.e.*, an antenna] in order to make preliminary tests and adjustments. At once I began to receive signals and messages in Morse code.' This was already a somewhat damning statement as one purpose of Marconi's tests at the time with the Italian cruiser *Carlo Alberto* was to refine Marconi's selective tuning or 'syntony' which allowed several stations to operate simultaneously without mutual interference, but significantly it was also claimed to provide privacy. Clearly it did not.

"Maskelyne continued 'when eventually the mast was erected and a full sized collecting circuit installed the problem presented was not how to intercept Poldhu messages but how to deal with their enormous excess of energy. That of course involved no difficulty, and by relaying my receiving instruments through landlines to the station in the valley below I had all the Poldhu signals brought home to me at any hour of the night or day.' To prove his point *The Electrician* then published a facsimile copy of the Morse inker tapes recorded at Porthcumo. So much for privacy!

"Maskelyne then went on to address the matter of reliability and seems to have relished the fact that his industrial espionage showed Poldhu taking over twenty-four hours to get one simple message through to the *Carlo Alberto* somewhere in the Mediterranean. Marconi's associate Luigi Solari reported a speed of 15 words per minute. But the messages had been heard at Porthcurno at only five.

"Maskelyne also noted occasions when two transmitters were on the air simultaneously from

Poldhu, incorrectly inferring it was a deliberate attempt to prevent unauthorized listeners from receiving anything but a jumble. Maskelyne however, reported that he had 'by suitable choice of capacity and induction sorted out the two sets of signals.' This was obviously an experiment in 'syntony' perhaps in conjunction with the Bass Point station. Maskelyne showed that an ability to tune selectively, perhaps breaching Marconi's four-sevens patent, was not a monopoly of Marconi's equipment.

"Maskelyne left Porthcurno on Sept 12th, but by then cable station staff and especially senior technician John Jeffrey had been introduced to the mysteries of wireless. They continued to monitor Marconi's experiments and report back to the ETC Head Office.

"*Progress at Wireless Point*. In December 1903 the ETC, still unconvinced it had chosen the best wireless available, investigated the De Forest system. ETC also sent its scientist and engineer William Duddell to look at Poulsen's arc system in Copenhagen. ETC reviewed almost every wireless system except that of Marconi himself...."

Mr. Packer presents an inker transcript of an intercepted 1902 Marconi message (Figure 1). It reads:

"[...] your Majesty[']s embassy sends by Marconi[']s telegraph humblest homages Carignani to Italian cruiser Carlo Alberto Your Majesty[']s embassy sends by Marconi[']s telegraph humblest homages Carignani ZZ"

The repetition implies a concern with error correction and fill-ins of missed or garbled characters. The actual inker likely used appears as Figure 2; it is a modified British War Department inker, not a cable inker. Maskelyn's receiving station appears as Figure 3. The "iron maiden" remains of his mast support appear as Figure 4.

Alan Renton is the Archivist at the Porthcurno Cable and Wireless Museum. As a result of his attention and the work of other dedicated historians there including Mr. Packer, that museum displays a wealth of early equipment. Some pictures appear nearby. The station at Wireless Point initially used a coherer detector (Figure 5). It also seems to have at least experimented with an electrolytic detector, as did Lee de Forest. As

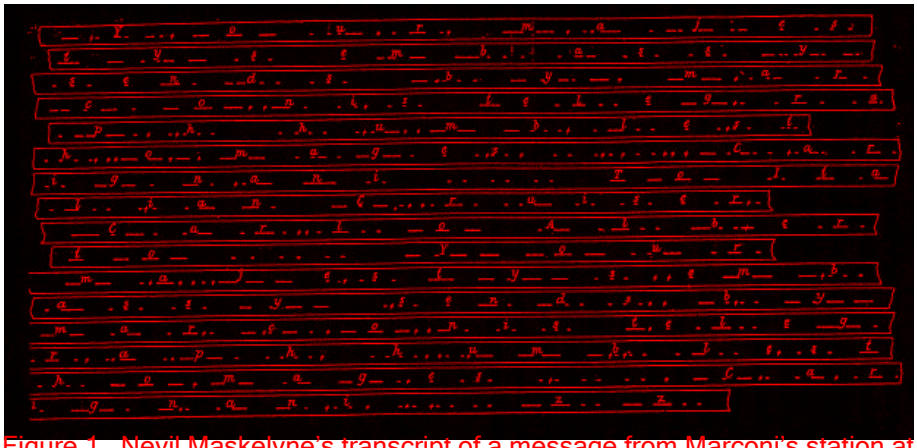


Figure 1. Nevil Maskelyne's transcript of a message from Marconi's station at Poldhu in August, 1902, as he published it in *The Electrician* (London); courtesy of John E. Packer as it appears in *The Spies at Wireless Point* [note 2]. The station used ZZ as its identifier or call sign.

Figure 2. The modified cable inker for recording signals on paper tape, likely the one used by Maskelyne to record Marconi wireless transmissions. It was found amidst the artifacts preserved by Porthcurno technician John Jeffery. It is now on display at the Porthcurno Museum. Photo by John E. Packer.

Mr. Packer writes:

"In 1999 a dusty Morse inker and glass tube coherer were unearthed in a barn at nearby Trebehor Farm. The owner, Mr. Wesley Jeffery, was having a clear out. Among cobwebs and debris were corroded brass fittings, electromagnets, motors and barely identifiable gadgets, all items from early days at Porthcurno. Mr. Jeffery's grandfather, John Jeffery, had joined the ETC in 1881 aged fourteen. He remained there until 1923, becoming expert in repairing delicate telegraph instruments. Porthcurno was used as a test bed for experimental work and trials of new devices. When one-off items were needed, John Jeffery constructed them, doing some of the work at his family farm workshop where he had a lathe. John was one of those assigned to assist with the wireless experiments. It is almost certain that the Morse inker was the one used to record Poldhu's messages, inasmuch as it is of a type that was never used on a submarine cable circuit. Mr. Wesley Jeffery kindly donated the items to Porthcurmo museum where some of them have been restored to working order and are on display in memory of his grandfa-

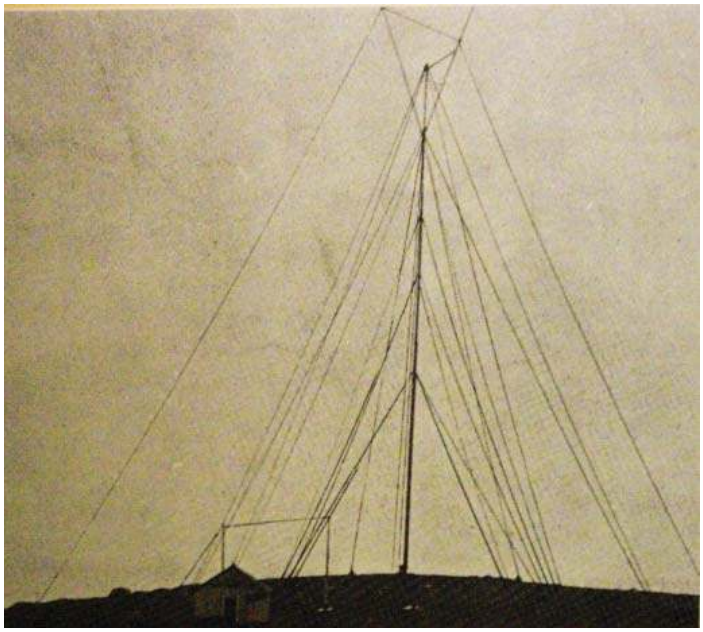


Figure 3. The receiving station Maskelyne used at Porthcurno, with his guyed mast and antenna. According to John E. Packer, this photograph is one of a series taken by Vaughan T. Paul of Penzance, for a 1911 magazine article about the Porthcurno cable station, (A Nerve Centre of Empire, in *The Syren & Shipping* for January 4th 1911). It appears amidst the interpretive material at the Porthcurno Museum.

Figure 4. The rusted remains of the "iron maiden" wrought iron cage support for Maskelyne's mast that held up his antenna for intercepting Marconi traffic. Photo by John E. Packer. The plaque at its base reads: "On the highest part of Rospletha Cliff is a concrete base with an iron cage attached for housing a mast. The mast was erected in 1902 by the Eastern Telegraph Company to monitor Marconi's experiments on the Lizard. It was supplied by N. Holmans and Son Ltd of Penzance, was in three parts total with a total height of 59 meters (170 feet), and had a large aerial attached to its top."

ther."

Poldhu Amateur Radio Club historian Keith Matthew, GØWYS, took me along for a visit to the Porthcurno Museum in June 2010. At Alan Renton's behest, I examined a then -incomplete and otherwise mysterious device. See Figures 6 and 7. The device had been found in the nearby attic of the family of the 19th century cable technician, John Jeffery. A wire (uncorroded and likely platinum) descended in a vertically held and filed -to -a -point thermometer glass tube. The base showed a circular trace of what might have been a cup, below the thermometer. Given these elements, I suggested to Mr. Renton that the device operated as an electrolytic detector. The museum reconstructed it as it appears nearby by adding a then -standard inker cup, which fit perfectly. This cup would have held the electrolytic solution. See Figure 8. A 1906 drawing of an electrolytic detector of the fine-point type (Figure 9) confirms the identification.[7]

These recently discovered artifacts show that the talented machinists of the day could put together interception equipment. It may have been simple but it worked. Moreover, an electrolytic detector, first invented in Reginald Fessenden's laboratory, permitted operators to hear the Morse code of the wireless messages and thus to copy at a much higher speed than inkers could write.

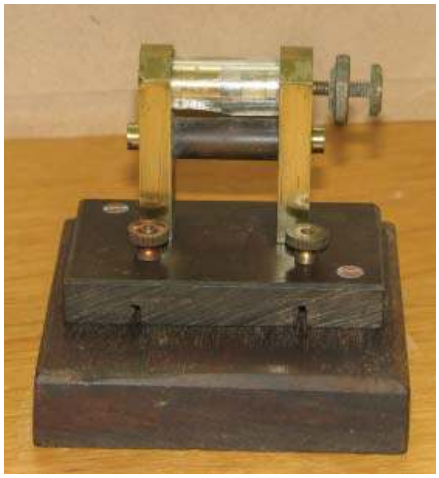


Figure 5. A coherer that was found amidst the artifacts preserved by Porthcurno technician John Jeffery. It is now on display at the Porthcurno Museum. Photo by John E. Packer. Nevil Maskelyn patented a coherer of a different (compression) design that he called a "conjuncture." According to Packer's Spies at Wireless Point [note 2] conjunctures from Maskelyne were in use there in 1903 with variable results, along with some other but unreliable Hozier-Brown receiving equipment (page 16).

DE FOREST FAILS IN IRELAND AND WALES IN 1903, AND THEN MAKES A DEAL AT SEA

Lee de Forest, like Marconi, Fessenden and others, saw trans-Atlantic wireless circuits as the Grand Prize of the day, although de Forest sought commercial success in shorter circuits. Wireless could indeed undercut the cable monopolies in price and volume of traffic. But more immediately, it also promised advances in military, naval, government and business communications. De Forest sailed for England to make his pitches. Before de Forest's approach to the cable companies (and his roughly contemporaneous approach the British government for lucrative

Figure 6. This incomplete device was found amidst the artifacts preserved by Porthcurno technician John Jeffery, and examined in 2010 at Porthcurno Archivist Alan Renton's request. Note the filed -off thermometer glass, the lever arm that can move it up and down, and the circular trace beneath it. The base measures 90 mm deep (3.5 inches). Photo by Bart Lee.

Figure 7. A closer view of the incomplete device preserved by Porthcurno technician John Jeffery, as examined in 2010. The filed-to-a-point thermometer glass has an uncorroded, perhaps platinum, wire threaded down its center. Photo by Bart Lee.

contracts), he had to demonstrate his system. He did so in Ireland (Howth) and Wales (Holyhead).

In Ireland he set up in an old fortification on the coast near Dublin at Howth. In defense of Napoleanic invasion, England had

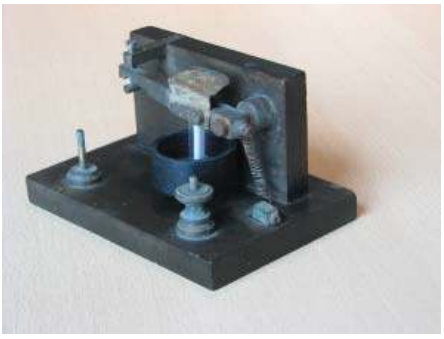


Figure 8. An electrolytic detector of the fine-point type as restored by Curator John E. Packer and staff from the incomplete device that was found amidst the artifacts preserved by Porthcurno technician John Jeffery. The inserted black cup comes from a then-standard telegraph and cable inker, according to Keith Matthew. This electrolytic detector used a screw (a modern replacement appears at the left in the photo) to adjust the depth of immersion of the probe attached to the lever, and a stop to prevent the probe from going too far down into the cup. Photo by John E. Packer.

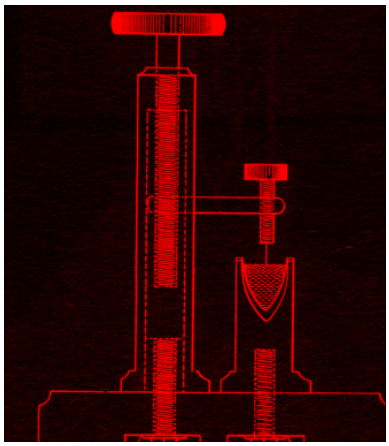


Figure 9. A diagram of a fine-point electrolytic detector circa 1904 -'05 from A.F Collins, *Manual of Wireless Telegraphy* (Wiley, 1906) as it appears in V.J. Phillips, *Early Radio Wave Detectors,* (Peregrinus and The Science Museum, 1980) his Figure 4.4 at page 71; his caption: "Fully engineered version of the fine-point electrolytic detector having screw thread adjustment of the depth of immersion of the fine point."

erected Martello Towers, round, tall cannon emplacements. De Forest installed a station in the Howth Martello Tower with an antenna pole next to it (Figure 10). (The Martello Tower is now a radio museum – Figure 11). A 1903 *Scientific American* report, picked up by the *Dublin Penny Journal* newspaper, provides much technical detail. This exact same equipment went to war in the Yellow Sea the next year.

"*Wireless Telegraphy*. The De Forest System. The Tests Across the Irish Channel. During the early part of last December [1903], Dr. Lee de Forest, inventor of the De Forest system of wireless telegraphy, conducted, under the auspices of the British Post Office, a series of experiments with the system between Holyhead and Howth. These experiments were very successful. We are now enabled ... to give our readers a complete description of the apparatus used at the tests, together with interesting photographs of the stations [The *Penny Journal* substituted a drawing of the Howth station.] The distance in a direct line between the two stations is 64 miles. At Howth the apparatus was installed in the old Martello tower, at present used as a cable station, the government mast, 120 feet high, being utilized for the erection of aerials.... the successful results of the experiments deserve all the more credit, for communication between the two stations was maintained with practically free Hertzian waves – that is, the waves were not attended with the usual earth currents [for want of good grounds]. The accompanying diagrams illustrate the connections of the transmitting and receiving apparatus used at each station.... The helix, F was made of 1/4 inch copper tube, coiled in a spiral 18

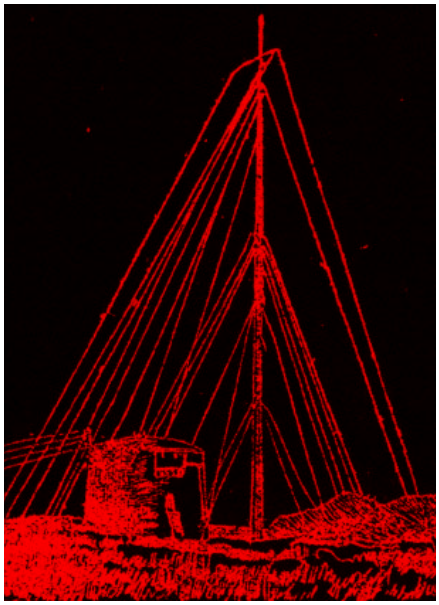


Figure 10. This is a drawing of the Dublin area Howth Martello Tower in use by Lee de Forest in 1903, with a tall mast holding up his antenna system. This drawing appeared in the 1904 *Dublin Penny Journal* [note 8], after a photograph in *Scientific American* illustrating a report on de Forest's 1903 operations at Howth and Holyhead across the Irish Channel in Wales.

Figure 11. The Howth Martello Tower used by de Forest in 1903, as it appears today. It houses an Irish radio museum whose Curators are Pat Herbert and Tony Breathnach, EI5EM. The photo comes from the Museum's guidebook. *Ulysses* by James Joyce opens in a Martello Tower near Dublin, and his *Finnigan's Wake* much concerns itself with "Howth Castle and Environs."

inches in diameter. This formed a cage about the spark gap. The self-induction of this helix, which could be varied by means of a moveable contact, was utilized to obtain an approximate syntony [tuning] of the system. Owing to the high frequency of the oscillations, a very slight movement of the contact sufficed to produce a marked effect upon the waves emitted.... The responder [in the diagram "O" -- an electrolytic detector] ... works on the same principal as the original responder invented by Dr. de Forest. This, our readers will remember, was an electrolytic device, which was self-restoring on reception of the Hertzian waves. The local receiving circuit included a potentiometer R, and the signals were produced in the telephone P. In tuning up the receiving system, the inductances K, L and the capacity N were adjusted to syntony with the transmitted waves." [8]

The drawn illustrations show the tower and antenna, and diagram de Forest's multiple wire antenna and the transmitter and receiver (Figure 12). Small gaps sparked over to connect all of the wires for transmission, but insulated all but one wire for reception. On transmit, this antenna's resonance would likely have been broad rather than a narrow peak, like a horizontal "cage" antenna. It may thus have been forgiving of variations in the frequency of excitation.

Two further salient points emerge from the *Scientific American* report. First, the de Forest system handled traffic at 30 words per minute, the highest speed of any wireless system. Thirty and more words per minute exceeded by two and three times the working speed of Marconi's and similar coherer -based systems. "Those who witnessed the experiments

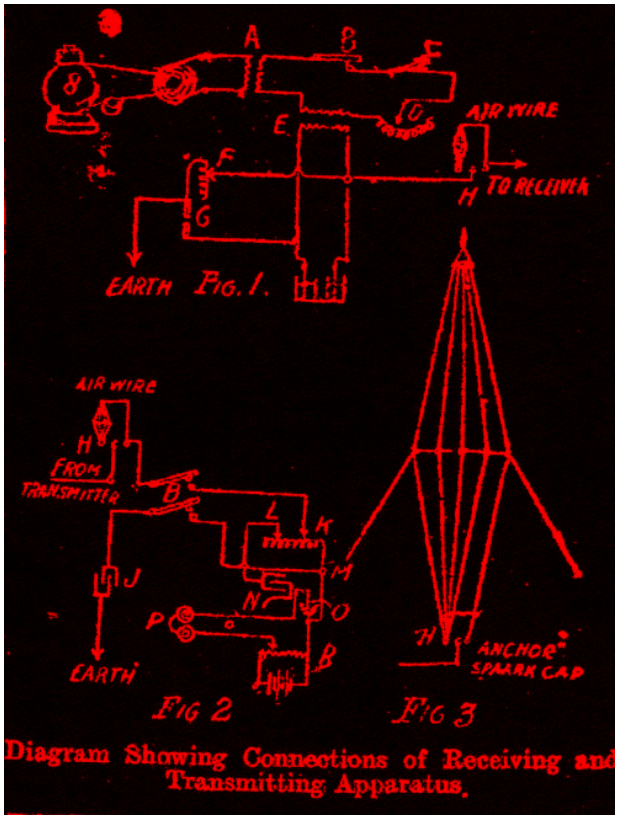


Figure 12. The circuit of de Forest's 1903 Howth and Holyhead transmitter and receiver, and his antenna, as published in *Scientific American* in 1904 and the *Dublin Penny Journal*. The "self-restoring" electrolytic detector appears at "O" but according to the article, it is not de Forest's earlier type (presumably the spade detector) but a later type, likely a compression type. The self-restoring detector permitted reception of high speed Morse code traffic by ear.

were surprised at the high speed at which messages were sent, with the normal rate being about thirty words a minute." Secondly, the de Forest system did not suffer any interference from a nearby Marconi station; it was "... not in the least affected by the Marconi station which was operating three miles away." This suggests sharper tuning than might have been expected from the other circuits of the day, including Marconi's. Given the description of the transmitter, it is also likely that de Forest operated on a much higher frequency, as Marconi had gone to lower frequencies and longer wavelengths for long distance work.

But it is the ear, not the eye, which explains the technical success of Lee de Forest's means of wireless telegraphy. Lee de Forest pursued the aural pathways of communications, ultimately to radio broadcasting and movie sound.[9] Initial implementations of wireless telegraphy modeled themselves on cables and landline telegraphy. They displayed messages to the eye by way of "inkers" that put dots and dashes of Morse code on paper strips. (Even Ambrose Fleming patented his revolutionary vacuum diode "valve" as a means to deflect an observed galvanometer). The wired and wireless communications services were happy to have such written records of traffic, a convenient practice of the time. The message either got through or it didn't, much like today's digital signals. The coherer detectors required a minimum signal level, although signal level generally was not an issue with the mature cables systems and telegraph lines. De Forest, on the other hand, listened for signals, with the very sensitive human ear. (So did Marconi in Newfoundland in 1901, and so did Marconi company operators when using

magnetic detectors after 1902, and Fleming valves after 1904).

De Forest's detector (he called it a "responder') was an electrolytic type that he modeled on one seen in Reginald Fessenden's laboratory. It demodulated radio frequency signals into audio frequencies heard on headphones. De Forest then hired fast landline telegraphers who copied by ear.

Moreover, de Forest, at the yacht races of 1903, soon discovered that his operators could pick out his higher audio frequency signals, created by alternating current generators rather than inductance coils with low audio frequency interrupters, amidst the mix of generally lower audio frequency spark signals that filled the ether during that race.[10] This provided another dimension of intelligibility. But generally there was only long wave Marconi to contend with. Coherer -based systems such as Marconi's could not copy de Forest's much faster traffic and certainly not distant or weaker signals, even if tuned to the frequency of transmission.

De Forest thought the test of the winter of 1903, between Ireland and Wales, had gone very well. He didn't understand why the British government never followed through on the successful tests. In 1931 articles and in his autobiography, de Forest tells of the tests and the results:

"That Summer of 1903 was indeed momentous in wireless history. As a result of our fine work for Sir Thomas [Lipton] on the [yacht] *Erin* [during the 1903 yacht races], the British Post Office that fall invited a demonstration of the 'amazing' Yankee wireless system in competition with their own, across the Irish Channel, where Sir Oliver Lodge had shortly before essayed a trial of the Lodge-Muirhead system, from Holyhead, Wales, to Howth, near Dublin. [Harry] Mac Horton and I therefore assembled two sets and, trusting to find necessary engine equipment and another good operator in London, sailed on the old *S.S. Majestic*, on my first trip abroad.

"I'll never forget ... the nights with Horton and [Frederick] Cornish (our British operator), fighting off chilblains with the aid of 3-Star Hennessy before the roaring fire of the old Howth Bar....

"At last the day of the test when the dignified silk-hatted official delegates from the G.P.O. [General Post Office] in London arrived at each station to watch us do our Yankee damnedest. They wrote out code messages which Horton and Cornish (who was exceptionally fast for an English-trained operator), ripped across "With looseness" at 35 words per minute in continental Morse. The Lodge -Muirhead system had exhibited a maximum of 18 words per minute (when it functioned). Then the officials themselves gingerly donned the cans, the first time they had ever received code through telephone receivers, and conversed slowly back and forth with no difficulty except that due to their inexperience in sound receiving by spark note. With sheer amazement they witnessed the ease and speed with which my two boys, eighty miles apart, slammed up and down the antenna transfer switch and got back their replies from their chattering American keys, far faster than the officials could write off their messages. It was, in short, a day of complete triumph for American wireless almost at the very birthplace of wireless telegraphy -- an eye and ear opener indeed for Englishmen.

"The tardy report of their tests and findings finally filtered through

the cumbersome files of the British General Post Office -- and there the matter rested and died. For Great Britain decided that any wireless system as simple and rapid as ours could not possibly be safe and reliable; the more dignified European methods of Marconi, Lodge and Slaby -Arco must be, by the very nature of their strictly scientific origins, 'quite the best, don't you know.'

"However, it was not long thereafter before alternating current generator transmitters, self-restoring detectors and headphone receivers began to appear in certain British (and German) wireless stations. Our bleak November labors had at least driven a nail into the coherer's coffin."[11]

The electrolytic detector performed free of the electro -mechanical limitations in speed and sensitivity of the tapped filings coherer. By taking traffic by ear, de Forest circumvented the speed limitations of the inkers in use with coherers. The British inspectors seemed impressed, but ...

Irish radio historian Tony Breathnach, EI5EM, a principal of the Howth museum, suggests British skullduggery:

"It has been argued, with some justification, that de Forest's system was far more efficient than Marconi's. It facilitated faster sending speeds and incorporated many innovated features. However, as often happens, the best system did not carry the day. Members of the British establishment and those with influence already had shares in the Marconi Company. It was not in their interests to see de Forest awarded the Post Office contract. A British government inquiry into allegations of corruption was published in 1912. Alas, all of this was too late for de Forest." [12]

The official Marconi history limits its discussion of the 1912 scandal to events of the day. Allegations in connection with the then proposed Imperial Chain of Marconi wireless stations[13] certainly were the central focus of the 1912 investigation (and not what might well have been a 1905 prequel to that scandal).

REJECTION AND RENAISSANCE:

A. Lee de Forest, Sailing Away From "Perfidious Albion," Sees another Door of Opportunity Open

De Forest offered his system, using electrolytic detectors, to the cable companies. There is no evidence of any interaction between him and Maskelyne, or of a visit by de Forest to Cornwall. At Holyhead, he would have been close enough to Poldhu to take a look, but whether or not he did is not now known. (In a recent well -researched detective novel full of wireless intrigue circa 1903, Death on the Lizard, de Forest, known to have been a golfer, may well be skulking around the area).[14]

But Maskelyne and the cable companies had made their point by the fact of interception. Communication through the ether, Maskelyne proved, could hold few secrets. Even if ciphered, it gave itself away. It was inherently insecure, compared to hard -to -tap cables.

What is known is that on July 12, 1903, according to rough-copy minutes of the Eastern Telegraph Company, the company Electrical Department submitted a report to the Board of Directors in London about the De Forest Wireless Telegraph System. At the same time the Managing Director informed the Board that: "Fessenden, America, who claims superiority over all other wireless systems, is submitting

details of his system to Coy. [*sic*: Company].” [15] Fessenden’s system used the original electrolytic detector that he (or according to de Forest, his assistant Dr. Frederick Vreeland) had invented, which permitted high speed messaging.

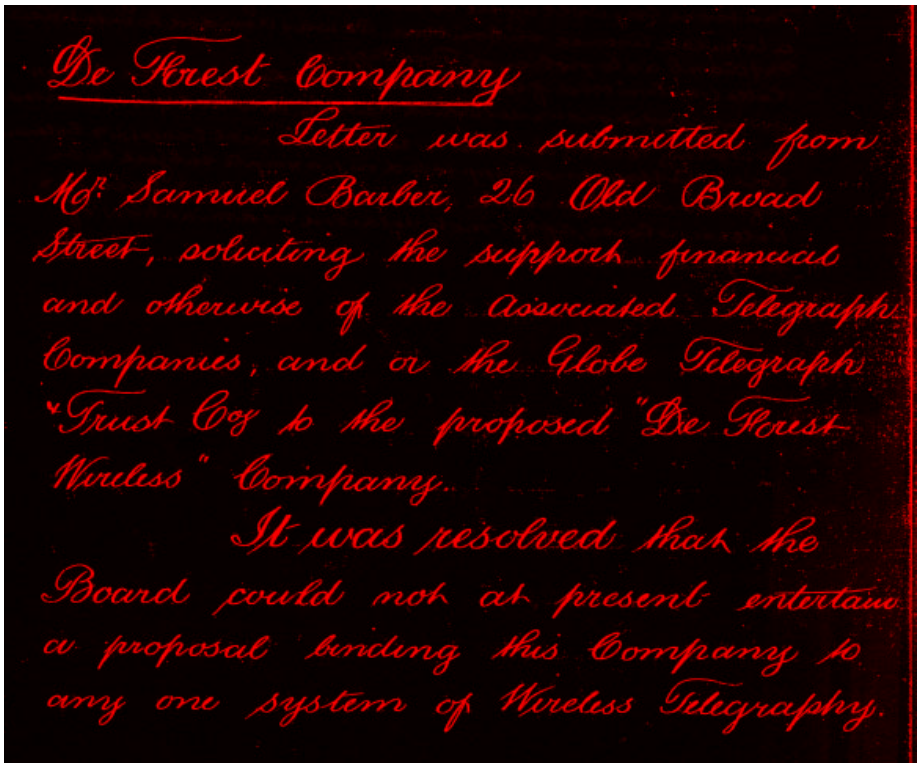
In 1904, a London agent for de Forest approached the cable company in connection with a proposed U.K. De Forest enterprise. The fair -copy minutes (Figure 13) read:

“Wireless Telegraphy ... De Forest Company ... Letter submitted from Mr. Samuel Barber, 26 Old Broad Street, soliciting the support financial and otherwise of the Associated Telegraph Companies, and or the Globe Telegraph Trust Coy [*sic*: Company] to the proposed De Forest Wireless Company. It was resolved that the Board could not at present entertain a proposal binding this Company to any one system of Wireless Telegraphy.” [16]

The same minutes reflect the companies’ continuing concern with maritime wireless and the companies’ interception of Marconi traffic:

“Wireless Telegraphy ... Letter was submitted from Superintendent, Porthcurno dated 13th October, reporting that the Hamburg American Liner ‘*Moltke*’ called up the Lizard Wireless Station on the 13th inst. and sent seven wireless messages.”

The German liner was likely equipped with German Slaby -Arco equipment. Marconi stations until 1903 generally refused traffic from ships not equipped with Marconi gear (which lead to the 1903 Wireless Conference after a diplomatic


De Forest Company

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It was resolved that the Board could not at present entertain a proposal binding this Company to any one system of Wireless Telegraphy.

Figure 13. Minutes of the Board of Directors of the Eastern Telegraph Company, July 22, 1904, extracted and graciously provided by John E. Packer [note 16], rejecting a de Forest overture.

incident). [17] Hence this traffic was worth noting.

The cable companies did explore a partnership with Marconi to handle by cable wireless traffic from a proposed circuit between two settlements in the then -Portuguese colony of Angola, according to rough -copy minutes of 1904. So, cooperation between the old and new technologies was in the offing early on.[18] It was, however, Lee de Forest who had first linked a wireless circuit to a cable circuit in August 1903, in providing wireless capability to the U.S. Army in Alaska.[19]

But at the end of 1903, Lee de Forest had completed his demonstrations in Great Britain, of which nothing came. De Forest's equipment was unsuccessful as a business proposition in Britain, although its technical level was advanced, particularly in using the self-restoring (no tapper) electrolytic detector "responder." His high performance wireless system also went ignored by the British government. De Forest nonetheless took such pride in his electrolytic detector device that he made his New York cable address "Responder."

We now know, however, (and thanks to Peter Slattery) that exactly the same state-of-the-art equipment later provided a key espionage circuit for the most sophisticated command, control, communications and intelligence operation that warfare had seen up to then. The Japanese Navy took advantage of Lee de Forest's advanced system for naval espionage.

De Forest sailed for home, embarking on December 23. If "Fortune favors the prepared hand," it smiled on de Forest on that voyage. By coincidence, Lionel James, a correspondent for the London *Times* also took passage. The *Times* was sending James to China to report on the looming conflict between Japan and Russia. De Forest retails his version of their travel together:

"But definite good did result from that first American invasion of the European ether.

"[Mac] Horton and I returned on the same old ship, '*Majestic*' with Capt. Lionel James, famed War Correspondent of the *London Times*, en route via New York, for the Orient, where Russo -Japanese war clouds were then threatening. We learned of his presence as we sailed from Liverpool. Also that Prof. [Reginald] Fessenden, my greatest wireless rival was likewise returning to America [on the *Majestic*]. Whereupon Horton and I promptly made James' acquaintanceship and between us never left him alone for one waking hour, all the way across! By the time our iceclad vessel sighted Sandy Hook, New Year's Day, 1904, we had thoroughly sold Capt. James the idea that his way to be up-to-date and scoop the entire press world was to take with him to Japan two complete DeForest wireless sets, like those we had so satisfactorily demonstrated across the Irish Sea." [20]

Lionel James, on the other hand, said that he took the initiative, according to Peter Slattery. James had seen wireless used in the September 1903 New York yacht races. Contemplating the hardships and difficulties in communicating dispatches which correspondents faced, he wrote:

" ...there had always remained in the back of my mind an idea that much of the labor, much of the risk and loss, and not least, perhaps, much of the personal discomfort might be avoided by use of the scientific progress made in the experiments with Hertzian waves."[21]

Slattery writes, quoting James:

"It is clear that the initiative for the two to meet came from James [(with de Forest) 'rising to my bait with alacrity']. It was he who sought out de Forest.... De Forest is correct in recalling that it was he who convinced James of the scheme's practicality.... De Forest convinced him that his [James's] idea was sound:

'Dr. de Forest promised me that if I succeeded in erecting a mast 180 feet in height on the China coast and used it in conjunction with a moveable station which showed an exposure of at least 120 feet of wire, that he would supply me with a set of apparatus and expert operators who would transmit messages with accuracy for 160 miles' " [22]

James persuaded the London *Times* to make a deal with de Forest, by which James inherited all of the British experiment's two stations worth of equipment and got two seasoned operators as well as engineering. James settled on the idea of using a ship (as it happened, the *S.S. Haimun*) as a reporting platform, because it could get close to the action. Also, its correspondent aboard, unlike an embedded reporter with a national fleet, could report right away rather than having to wait until his ship reached a port. De Forest got the two tons of his wireless system "machinery" from Britain to New York in short order, refurbished it, and sent it on to Seattle for the voyage to China.

As Lee de Forest relates:

"Then was another wireless impossibility accomplished. There was no proper equipment available except those two sets in Holyhead and Howth. We cabled our British representative, fortunately very much of an American, to instantly locate Cornish, our 'limey' operator, and get him to pack up and express to Liverpool both wireless sets, then rusting in their shacks on those far-separated bleak cliffs.

"I believe no Englishman ever before hustled as Cornish hustled. He had thoroughly learned how from Horton, and a trip to America and Asia was to be his reward if he could catch that boat. He properly packed and brought two tons of machinery on board as personal luggage. That just saved the bacon for us. The entire equipment was unloaded, overhauled, repaired, repacked, and jammed into a chartered express car direct for Seattle within thirty-six hours after the ship docked at New York. But the excitement and triumph was too much for Cornish. Prohibition might have saved him for the Japanese expedition; but this was fifteen years before Volstead!

"Hence a frantic call for volunteers. ['Pop'] Athearn was already slated to go west with Cornish. [Harry] Brown, of the recent yacht race episode, answered the call. So these two fine American wireless operators accompanied the express car to Seattle, caught the *Empress of China* by the skin of their teeth, and thus saved the day for ourselves and Lionel James. And again wireless history was made, thereby making the entire world wake up and recognize the utility of this startling new American enterprise.

"Never before had wireless been used for press reporting. Here was an ideal opportunity -- war maneuvers around the China Sea, where existed no means of communication whatsoever, save by boat and courier; James had chartered a swift tug for his press scout work, destined to make history in war news. He and his boat were ready when my two men arrived in Shanghai. The equipment was transferred to the *Haimun*,

and she speeded off for Weihaiwei. Working like demons, Athearn and Brown installed our set indoors on the ship. The sturdy English Fairbanks Morse engine from far-off Holyhead was ready for shore duty.

"Then Lionel James promptly began to electrify the press of the world. His American wireless enabled the *London Times* and its New York and Philadelphia correspondent papers, to scoop the other newspapers -- not merely by hours, but frequently by days." [23]

The *S.S. Empress of China* had left Vancouver for Shanghai with all aboard, including De Forest Company operators Pop Athearn and Harry Brown, on January 25, 1904.[24] James sailed for Yokohama on the *S.S. Siberia*, with permission of the *Times* to charter a vessel to report the conflict.

B. Spying as well as Reporting at Sea

James's enterprise in Japan reached beyond merely seeking permission to report on events by sea. He volunteered, in his words two decades later " ... to become a licensed spy for the Japanese Navy." James made a deal with the Japanese Navy that his proposed vessel would carry a Japanese officer expert in wireless telegraphy as "... an intelligence officer for Admiral Togo's fleet" as James described him.[25] That officer would be Commander Kurakichi Tonami, who had been the Navy's wireless expert since 1899.

James's deal with the Japanese Navy is less surprising than it might seem, because Britain had entered into a treaty of cooperation with Japan in 1902, aimed at Russia.[26] For example, the British Army in Malaya and China, within a couple of years, shared with the Japanese intercepted Russian wireless and cable traffic.[27] *Realpolitik* being what it is, Britain disclosed to Japan, after the Treaty of 1902, its own state-of-the-art wireless systems (Marconi's and Royal Navy Captain Henry Jackson's). These otherwise secret technology implementations enabled Japan to leap ahead of Russia in communications capability and readiness. The United States also determined to "tilt" (in Henry Kissinger's word) in favor of the Japanese and against Russia, threatening Germany and France to keep them neutral.[28]

Shortly after that treaty of 1902, the very same Commander Kurakichi Tonami, along with a Navy colleague, Prof. Shunkichi Kimura, got to investigate Europe's state-of-the-art wireless. A published report in 1903 summarized:

"Wireless Telegraphy In The Japanese Navy. Colonel Tonami and Engineer Kimura, both of the Japanese navy, who have been studying in Europe the practicability of wireless telegraphy, have returned to Japan. They have brought with them a complete set of apparatus for conducting experiments. It is expected that there will soon be an adoption of wireless telegraphy in the progressive Japanese navy." [29]

The British permitted Japanese officers visiting the British Fleet at Malta in May 1902, to observe the state-secret "new wireless telegraph." These full disclosures have been attributed to the then newly-concluded treaty. The British even lent them a coherer for experiments on their way to England. These officers made a full report to the Japanese navy of their investigations and results in the fall of 1902,[30] perhaps precipitating Tonami's mission.

Back in Japan, Tonami worked with his engineer and others to create the Japanese Navy's wireless sets Types 34 and 36. Britain at the

time wished to constrain Russian ambitions, for example by bottling up the Black Sea Fleet in the Black Sea. By catapulting themselves into the 20th Century world of war with modern technology (largely modeled on the British systems), the Japanese repaid British post -treaty solicitude. Disclosure of Britain's wireless telegraphy technology to Japan had world -historic consequences.

In the Far East, James set up his shoreside station, primarily for reception (see Figure 14) in China, on the west coast of the East China Sea in the Yellow Sea at Weihaiwei, a British -leased enclave 115 miles from Port Arthur, the Russian -leased enclave. See map, Figure 15. Weihaiwei enjoyed Eastern Telegraph Company cable connections West to London. Pop Athearn (all of 21 years old) handled the shoreside operations. Harry Brown (all of 30 years old) operated from the chartered vessel the *S.S. Haimun*.[31]

James had chartered the *Haimun*, 1,300 tons, and fairly new, through British connections. She had served both the British in the 1900 Boxer Rebellion and the United States in the Philippines. But first Brown and Athearn had to get the wireless equipment working at Shanghai, and then get it transported.

The war, however, would not wait: the Japanese attacked the Russian -held Manchurian enclave of Port Arthur on February 8, 1904. Diplomacy had failed, and the first war of great powers in the 20th century started with a surprise attack. James (still in Japan) and a colleague reported by dispatch to the *Times* on February 11, 1904: " ... three Russian vessels – two battleships and one cruiser – apparently total wrecks. The Russian Fleet appears completely demoralized...." [32]

In transit at Kobe, the de Forest wireless operators participated in the populace's celebration of the victory at Port Arthur and discovered sake. "We were astounded by the spirit of patriotism which we saw manifested by the people." [33]

On February 12, James made a proposal to the Japanese Navy, as Peter Slattery writes: " ...offering to put the *Haimun,* its wireless and its operator at the service of the Japanese forces in return for opportunities to gain war news." In an interview with an Admiral, he offered to take aboard a Japanese officer as his translator. This offi-

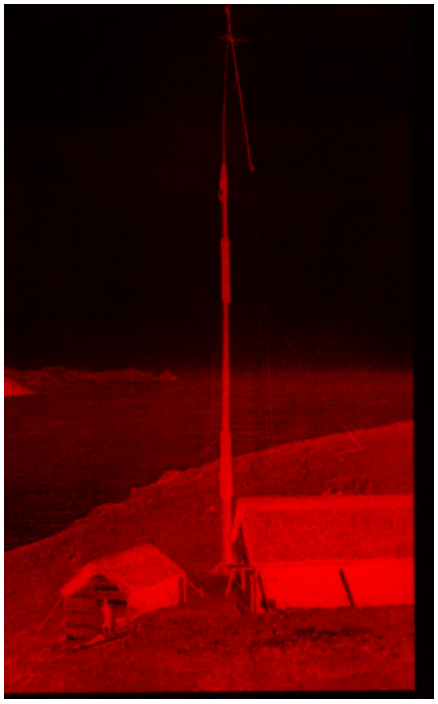

Figure 14. The wireless station at Weihaiwei built by de Forest employees Harry Brown and Pop Athearn, with a 170 foot tall mast (here storm damaged). David Fraser, a correspondent colleague of Lionel James, took the photo in 1904 and published it in his book *A Modern Campaign* (1905). It appears in Peter Slattery's Reporting the Russo–Japanese War as Plate 5, after page 76 [note 3].

Figure 15. A map circa 1904 of China, Japan and the Yellow Sea, which also shows some cable connections. Weihaiwei is on the peninsula jutting into the Yellow Sea from China on the left. Port Arthur is on the peninsula jutting down from Manchuria near the top of the Yellow Sea 115 miles North. The source is Cassell's *History of the Russo-Japanese War,* 1905; the map is now accessible as commons. wikimedia.org/ wiki/File:Jap-Rus_Image7.jpg .

cer was to be one of the Japanese Fleet's intelligence officers. Thus James intentionally made himself and his vessel operatives for Japanese naval intelligence.[34]

The Navy agreed and gave him sailing orders empowering the onboard officer to manage the wireless communications and control the travel of the vessel. The Navy also assigned to the *Haimun* a unique wireless numerical identifier, as a callsign. By this means it could call to Japanese stations and specifically be called by them, without identifying itself.[35] (The transmission from the *Haimun* differed in speed, and for anyone listening, tonality, but the callsign may have provided some more security at least in reception). Slattery notes: "The officer was a wireless specialist who would have his own codebooks and wireless communication with Japanese stations, and act as a link to the Japanese Fleet." [36]

The *Haimun* with the two de Forest wireless stations and the two de Forest wireless operators got to Weihaiwei on February 18. Athearn and Brown overcame many challenges in getting operational. "...It was necessary to erect a pole 170 feet in height for the receiver. "[37]

Commander Kurakichi Tonami came aboard, in civilian clothes and not in uniform, on March 7, as the *Haimun* (at Japanese Navy direction) called on Nagasaki ostensibly to take on coal.[38] On March 14, James met de Forest's men at Weihaiwei, (see Figure 16) and sailed that night, very pleased to have effected his new and unique idea of reporting war by wireless. After a test at 20 or more miles out

from Weihaiwei, James started his war reporting by marine wireless telegraphy.[39] See Figure 17 for the *Haimun* rigged with the de Forest antenna.

At one point, Brown's transmissions could be copied from 240 miles at sea. As soon as Athearn at Weihaiwei got good copy, he passed it on to the Eastern Extension Telegraph and Cable Company (one of the Porthcurno companies), by messenger, for transmission to London. "In less than half an hour after a message started, and it started as soon as anything developed, it was on its way by cable." [40]

James's first radioed dispatch appeared in the London *Times* on March 16: "By de Forest's wireless telegraphy." [41] The *New York Times*, a partner in the enterprise, also carried this and all subsequent marine dispatches, all (but one) noting: "By de Forest's wireless telegraphy." James, with a much-involved Tonami aboard, moved the *Haimun* into the action.

When James saw Russian battleships ten miles out of Port Arthur in the third week of March, he radioed his observations direct to the Japanese Fleet, pleasing Tonami.[42] After a lull, Tonami suggested sailing out of Weihaiwei to contact the Japanese Navy for leads as to the most productive areas.[43] James and Tonami developed a cordial working relationship, once Tonami appreciated the care with which James treated Japanese naval interests in his reporting at sea.[44]

In James as a spy, the Japanese got a great deal – commitment, years of experience as a war correspondent, good cover, and de Forest's unique and advanced communications system. In James as a paying customer, Lee de Forest also got a bargain: world-wide publicity. He reports a 1904 letter from his brother in New York, about the *New York Times* advertising of the dispatches:

" 'They [the *New York Times*] have placarded all the elevated stations in New York with the

Figure 16. Harry Brown, Pop Athern, Lionel James and Commander Tonami (on the right) standing in front of the wireless station at Weihaiwei in 1904. David Fraser, a correspondent colleague of Lionel James, took the photo in 1904 and published it in his book *A Modern Campaign* (1905). A larger version appears in Peter Slattery's Reporting the Russo-Japanese War [note 3] as Plate 7, after page 76.

Figure 17. The *S.S. Haimun* sails the Yellow Sea at war in 1904. Note the antennas on the aft mast. One F.L. Blanchard made this drawing after a sketch by Lionel James and it was published in *The Graphic* (London) on May 14, 1904, according to Peter Slattery in Reporting the Russo -Japanese War [note 3], where a larger version appears as Plate 10, after page 76. Slattery notes that at one point, Jack London also took passage on the *Haimun* as a war correspondent; he was accredited to the *San Francisco Examiner*.

"*Times* – de Forest" posters and great is the wrath of our rivals, Marconi, Fessenden, Graf-Arco.' " [45]

James appears to have sent about nine such marine dispatches from the *Haimun*.

The de Forest wireless operator aboard the *Haimun*, Harry Brown, thought Tonami, whom he took to be the "censor," nonetheless " ... a great little fellow." He continued:

"He knew everything about naval affairs. Maybe he was an officer in the Japanese Navy. You never can tell just what a Jap really is, as they are not inclined to be talkative about their official positions. At any rate, from the messages he passed, he was the best censor Capt. James could have had." [46]

A recent American analysis suggests:

"During the Russo -Japanese War ... the *Times* personnel began to base stories on analysis of intercepted transmissions – not the content, because the messages were ciphered, but on the basis of rudimentary 'traffic analysis' techniques." [47]

James well understood what became known as traffic analysis. In a barely fictionalized series of accounts of the war,[48] he tells of an instance. A Russian Admiral gets a strip of inker tape from the wireless room.

"It was a jumble of dots and dashes. The message was Japanese. It did not matter if it was in cipher. The Admiral could read the history the tape related as clearly as if it had been in his own language. It meant that the Japanese patrol-boats had made his movement out. That they had raced to the guardship with the news, and that the guardship was now transmitting it, as fast as the wires could make it, to the Japanese fleet..."

James tells a second wireless story from a Japanese perspective:

"Two men sat crouching over a charcoal fire in the worst apology for a hut that imagination could conceive.... Outside a very tumult raged... [but] the light was good and bright – well it might be for it was electric.... A bell rang – electric too – and presently a wheel began to click, slowly but deliberately.... Both men listened, nodding out the dots and dashes as they read them. Then one of them jumped to his feet. 'That is it – that is our own – not the honourable Russian.' ...

the symbols were ticked off on it at the rate of ten to fifteen words a minute. All the men could tell was that it was their own cipher... it was to be transmitted farther.... The great spark crashed out, filling the room with a white blue glare.... Over sixty miles across that stormy sea it had come. It was now going seventy miles through space to the receiving station. In two hours, the Admiralty in Tokio would know how two destroyers had ... at Port Arthur ... disabled another Russian battleship."

On a least two occasions, Brown copied Russian traffic, passing it on to the Japanese. One intercept permitted the Japanese to destroy a Russian wireless station just north of Weihaiwei. The other led to decipherment by the Japanese and significant news for James as well, about the later death in mid -April of Russian Vice-Admiral Stepan O. Makarov, the Commander of the Russian Fleet. See Figure 18. It is likely that James was writing about Admiral Makarov, a wireless expert, in his account of an Admiral drawing inferences from the facts of Japanese naval wireless traffic. The story also fits the facts of the naval engagement in which Makarov lost his life and his battleship.

James kept up his roving maritime reconnaissance from the beginning. [49] But the Russians, and likely Admiral Makarov, who was the Russian Navy's foremost exponent of wireless communications, smelled a rat.

The Russians boarded the *Haimun* on April 6. James knew he could face internment but Tonami knew he faced death if discovered. On diplomatic duty in Paris, he and the Captain of the Russian intercepting ship, the cruiser *Bayan,* had known each other. Tonami knew that the Captain would recognize him as a Japanese staff officer. He prepared himself to take his own life rather than be captured as a spy.[50]

Figure 18. Admiral Stepan O. Makarov, Russia's leading exponent of naval use of wireless, and commander of the Russian naval forces until his death on April 13, 1904, when his flagship, the *Petropavlosk*, hit a Japanese mine. This portrait comes from Radovsky, *Alexander Popov -- Inventor of Radio* [note 58], plate after page 92.

James claimed that he had a better idea and disguised him as a Malay sailor and made him the temporary helmsman. The boarding officer inspected the wireless cabin and read the official traffic. James had sent a last message saying that the Russians were boarding. He gave a copy to the officer, who then knew the world was waiting for further word. Then, pure, seasoned genius, James lied to the officer, claiming to have seen four Japanese cruisers nearby that could cut off the *Bayan* and its Admiral (Makarov) from their port and maybe sink them as well. The *Bayan* fled. James and Tonami got away with it.[51]

The de Forest operator, Brown, shared his perspective:

"On April 6 we had our most trying experience.... There were two Russian officers in charge of the party that boarded, and they inspected everything, from our papers to the wireless instruments. The Russians had not yet reached the side of the *Haimun* when Capt. Tonami disappeared from view. He didn't put in an appearance at all, and we explained his absence to the Russians by saying he was a coolie whom we employed as a servant, and that he was mortally afraid of Russians. The Russian officers laughed, and said we needn't send for him. After the Russians had left, and they left in a big hurry, too, I went to search for the Jap. I found him in his cabin. He had disrobed, and was standing, knife in hand, ready to commit hara-kiri if any attempt has been made by the boarding party to make him prisoner. When we told him they were gone he laughed and said 'All right,' but he would have killed himself as sure as I live if one of the Russians had made any move toward him. He didn't propose to be captured for a minute." [52]

Brown continued, speculating on the hasty exit of the boarding party:

"The way I figure it out is that the Russians had heard the Japs working their wireless, and then had heard our message, and concluded that they didn't have time to pull us into Port Arthur."

The British steamer *S.S. Hipsang,* a little later, was not so lucky. A Russian destroyer sank her on July 16, 1904. James believed the Russian Captain mistook her for his wireless boat. In his "fictionalized" account, he has the Russian captain explain about "newspaper boats":

" ... the most noxious of these boats was one equipped with wireless telegraphy... then we made out, or ... thought we made out, her wireless apparatus hanging from the mainmast.... We obeyed orders. It was not until we picked up the captain ... that we realized we had been in error. The vessel proved to be the *Hipsang*.... Such mistakes and accidents must occur in war." [53]

The Russian sinking of the *Hipsang,* despite official courts of inquiry, and formal protests, was never otherwise explained.

On April 13, James, Tonami and the *Haimun* steamed with the Japanese Fleet, and close into battle. Tonami disclosed to James that the Fleet had laid mines outside Port Arthur. During the engagement, James saw, at a long distance, a big Russian ship go down.[54] Admiral Makarov's battleship, the *Petropavlosk,* hit at least one mine and sank quickly, taking Admiral Makarov, and Russian hopes in the Far East, down to a cold wet grave.

Brown reported:

"We were still in plain sight of Port Arthur when the *Petropavlosk* came out of the harbor and ran into the mine which put an end to her career.... We saw the *Petropavlosk* leave the harbor, and then start back when she saw that the vessels standing in close were merely decoys. Suddenly a great shaft of water shot up from her side, and she began to wobble like a drunken man. She plunged this way and that. Suddenly she gave a plunge and disappeared." [55]

Peter Slattery reports that after leaving port, the Russian ships intercepted wireless signals of the Japanese Fleet. He suggests that this intercept prompted Admiral Makarov's fateful return to port, through the minefield he did not know about, although James did.[56] It is likely this intercept that James

"fictionalized" provides an early example of traffic analysis.

The Japanese strategy of laying mines and then luring Admiral Makarov's Flagship through the minefield worked. Makarov's death had special significance with respect to Russian battle communications. Admiral Itoh[57] writes:

"Makarov took up his new position in Lushun [Port Arthur] as the Commander of Pacific Fleet on March 8, immediately after the start of the war. Right after assuming his position, he delivered detailed instructions on the operation of telegrams [wireless equipment] to each ship, making it compulsory to activate telegrams twenty-four hours per day and to undertake a roll call every day. Also, he provided each ship with the Japanese Morse code. The ships of Russia's Lushun Fleet were equipped with wireless telegraphs made by Telefunken Co. The crew members of the Lushun Fleet included some experienced active duty officers. One month after his assuming the position of Commander on April 13, Makarov died when the battle ship the *Petropavlovsk* with Makarov on board, was sunk by an underwater mine offshore of Lushun. If Makarov was alive, he might have skillfully operated wireless telegraphs and been a formidable opponent for the Japanese. "

The Soviet era appreciated Makarov as well,[58] as a promoter of Alexander Popov's wireless telegraphy technology (see Figures 19 and 20):

"Makarov was one of the very few naval officers who realized the importance of the work of Popov and supported it."

James wrote as part of his "fiction" account[59] (in the voice of a Russian officer):

"That was a fateful period, because we lost our fleet then. That is,

Figure 19. Alexander Popov as commemorated on a 2009 Russian memorial postage stamp along with one of his early wireless receivers, and his notes, as interpretive material.

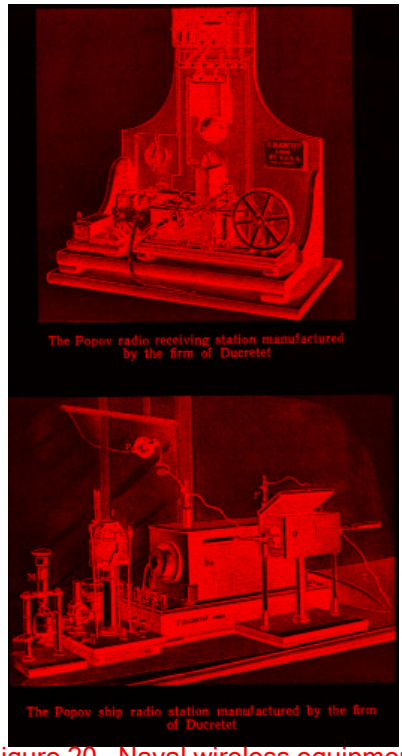

Figure 20. Naval wireless equipment designed by Alexander Popov and made by the Ducretet company in Paris. These captioned drawings after photographs come from Radovsky [note 58], plate after page 116. According to Radovsky, the Russians could have had the advantage of Popov's discoveries and engineering, such as this set, along with the coordination of communications that Admiral Makarov tried to institute. Russia, however, failed to exploit Popov's lead.

we lost Makaro[v] in the *Petropavlosk*; and when Makaro[v] went, we felt that we couldn't hope to do much until we were reinforced from Europe."

At the beginning of the April 13, 1904 battle, Russian shore batteries started firing at the Japanese Fleet. James got a dispatch out within a minute.[60] Brown recalled: "Capt. James was writing the story of the bombardment as it progressed, and I was sending right away."[61] James regarded his reporting of this critical day of the war as " ... the most successful day of my whole journalistic career."[62]

Lee de Forest[63] happily claimed credit (although decades after the events, de Forest reversed the actual roles of his two operators shoreside and at sea):

"It is safe to say that never in the annals of telegraphy had any service performed a more faithful work at a critical time than did the De Forest system on board the *Times* boat *Haimun* on that morning far out in the Yellow Sea.

"Cruising all about the Yellow Sea, from Chemulpo [Korea] Harbor, 240 miles away, and even when at Nagasaki to coal, Pop [*sic*: Brown] kept always in touch with Brown [*sic*: Pop Athearn] at Weihaiwei. One notable war message of 800 words flashed over this distance at twenty-five words a minute, without a single error. And that, remember, was in early 1904, when wireless over such distances and for swift press purposes was an absolutely untried experiment. Nothing whatever today -- true. But those two lads made wireless history. Made such significant history that after the first six weeks of war, during which period Lionel James and his wireless continued consistently to scoop the press of the world, the Japanese military authorities suddenly revoked his permit, and summarily dismantled his tug, forcing him thereafter to resume the tedious, time honored methods of his competitors.

" 'It ceased because the system proved to be of far greater excellence than was believed by the Japanese to be possible; far superior to their own military and naval wireless system of communication.'

"These were the exact words of Capt. James at a banquet given in November, 1904, in London, in honor of him and the Americans who had amazed the newspaper world by the astonishing efficiency of our wireless in war journalism.

"It had proven indeed a lucky chance that Horton and I had caught the ship at Liverpool, which carried Lionel James to our shores. But it was a sore disappointment to both Horton and Cornish that neither could accompany to the Orient the wireless gear which they had so brilliantly broken in across the Channel of St. George."

On April 16, the Russians declared to London and Washington that they regarded even neutral vessels with wireless capabilities for foreign correspondents as spies. That meant the *Haimun*. The *New York Times* said that that promised hanging, and protested. The British and American governments protested. The De Forest Company protested. Lee de Forest delighted in the extensive new publicity given to his system at work at sea.[64]

Ashore, Athearn radioed the warning to the *Haimun* of the Russians announcement that if such a wireless equipped vessel were taken, its crew would be treated as spies.[65]

For James, it all became moot because the Japanese thereafter kept him out of the combat zones in the north of the Yellow Sea

near Port Arthur. Brown reported that the *Haimun's* wireless traffic had interfered with Japanese commanding Admiral's wireless transmissions of general orders.[66] It may well be that the Japanese Navy did not want either of its seagoing spies captured, interrogated and hanged. James reported his restriction in a dispatch on the 15th of May: "By de Forest's wireless telegraphy." James accepted the Japanese limitations, in part: "Out of deference to ... our peculiar national relationship." [67] ("Peculiar" means "unique" in this context, likely a reference to the Treaty of 1902). But James was out of the action if not totally out of business and not happy about it. Nonetheless, Britain appreciated his accomplishment. Peter Slattery quotes[68] William Preece of the British General Post Office (Marconi's mentor):

"The *Times* transmitted much news to Printinghouse Square by Eastern Telegraph Cable: 2,000 uncensored words were one day sent across 180 miles of sea at a mean speed of 30 words a minute, and thence 14,010 miles to London, where they were printed in the *Times* the next morning with marvelous accuracy."

Wireless as an adjunct to the cable system had proved its worth.

In the Far East, intrigue continued: A Russian agent offered James 20,000 British Pounds to get an encrypted message to Port Arthur using the Weihaiwei wireless. James refused, which is hardly surprising inasmuch as he was a Japanese agent, journalistic ethics aside. Later James had to hold the Russian agent off with a Colt pistol. Shortly thereafter, Pop Athearn reported copying a figure-cipher Morse wireless message to Port Arthur; he could tell it had been sent on Marconi equipment.[69] (The Russian Army used Marconi equipment, and maintained a station at Vladivostok).[70]

James sent his last dispatch via Weihaiwei "By de Forest's wireless telegraphy" and from the *Haimun* on June 6, 1904.[71] James went on to cover the land war in Manchuria with great distinction after great hardship.[72] Ten years later as an officer in the British Army, Peter Slattery reports, he fought bravely in World War One, twice honored as "mentioned in despatches" and awarded a combat Distinguished Service Order (DSO).

COMMANDER KURAKICHI TONAMI'S WIRELESS WINS THE WAR, 1905

After June 1904, the new wireless technology played a dispositive role in the ultimate Japanese victory – thanks to Commander Tonami's earlier work. The Russians had the advantage of Alexander Popov's discoveries a decade prior, but made nothing of them. Popov, for example, first used a tapper to reset a coherer. Then he invented a coherer that did not require tapping. Popov made wireless telegraphy available to Russia, but the Russian military establishment mostly ignored his work. A Soviet era history[73] termed that dereliction criminal complacency:

"Although the Ministry of the Navy acknowledged the importance of wireless telegraphy in naval affairs, in deed it did not show any initiative at all. In reality, the Navy remained without radio equipment, and the production of such was at the lowest possible level. The Russo-Japanese War, which broke out in 1904, showed how criminal was the complacency of bureaucratic heads in the Army and Navy... they did not take a single practical step to organize properly the production of radio

equipment and to supply the units of the Army and warships with it.... Makarov spoke of the absurd state of affairs in the country, for although radio was invented in Russia, the country had to order radio equipment from abroad."

Admiral Makarov saw the naval potential of wireless telegraphy as early as 1897, but a Japanese mine took him to the bottom of the sea. Despite Makarov, the Russian Navy had not exploited Popov's lead, and ended up buying German Slaby -Arco -Braun wireless equipment for its fleets. It was not seaworthy, and the German company engineers did not long stay with their equipment. Like the Marconi gear the Russian Army bought, it detected signals with a tapped coherer, and was slow and insensitive compared to the de Forest system (although some magnetic detectors may have been in use in the Russian Army).

Yet aside from Tonami's use of James's de Forest system, the heart of which was the electrolytic detector, the Japanese Navy also used coherer equipment. It was, however, better, Japanese -made gear and Japan used it in its integrated communications and command system.[74]

But the only reason they had it at all was Tonami's (and other progressive officers') investigations of British Navy wireless equipment (with the consent of the British) and perhaps other European systems. The British saw every mutual advantage, after the Treaty of 1902 with Japan, to full disclosure of modern methods of communication. Tonami and his engineer Professor Shunkichi Kimura brought the designs back to Japan. (Kimura much later founded the Japan Radio Company -- see Figure 21). They built Type 34, then Type 36 wireless equipment for the Japanese Navy. The nomenclature refers to the year of the Meiji era; 36 is 1903. Type 36 bears a strong resemblance to Marconi/Jackson British Navy sets, tapped coherer and all. See Figures 22 and 23.

Thus, and unexpectedly, the Russians faced an enemy with superior although not cutting edge communications technology. The Russians were at a disadvantage in capability with unsuitable German equipment, and the Japanese had an enormous advantage in readiness. The Russians hardly understood how to use their equipment. The Japanese wove theirs into a powerful, integrated communications web, on land and at sea.

The Japanese naval historian Admiral Kazuo Itoh argues[75] that Japan created what we now call "net-centric" warfare in 1901 through 1905. Wireless and cables linked shoreside installations. Wireless linked an extensive observation network on islands and

Figure 21. Professor Shunkichi Kimura, later in life. He worked with Commander Tonami to investigate wireless systems in Europe and the United States, and in Japan to implement their principles as the Japanese Type 32 and Type 36 wireless systems. Image from Sato and Sato, [note 79] at pages 460.

Figure 22. A Type 36 coherer receiver in service. Note tapper beneath the coherer. Image from Sato and Sato [note 79] at page 460.

Figure 23. A display of the Type 36 wireless telegraphy system circa 1905, on display aboard the memorial battleship *Mikasa* in Japan. The coherer receiver is on the far left. In the center is a 30 cm (12 inch) inductance coil and spark gap in front of it. The antenna transmit -receive switch is at the top center above it. The motor and belted wheel device on the right may be a motor generator to power the spark coil primary. The device in front of it may be a keying relay. Image from Rear Admiral Kazuo Itoh, *The Battle of Tashima Was Real Network Centric Warfare*, [note 4].

coasts. The Navy equipped its warships with state of the art devices and trained operators and officers to use them. Admiral Itoh lays this out, proving examples:

"One dispatch boat was assigned to each Japanese fleet. There were three dispatch boats in total. When dispatch boats are located between ships engaging in communications, the distance of communications becomes longer. Dispatch boats may be allocated between the fleet and coastal stations and may link up telegraphic messages. The distance range of communications for the Type 36 Wireless Telegraph was approximately 80 miles between large warships, even though the distance differed depending on the condition of the air and the locations of antennas. The Japanese Navy used the dispatch boats for information exchange with the shore by deploying them inside and outside ports and offshore near watchtowers."

Another example has to do with readiness:

"Also, in accordance with progress on the wireless telegrams onboard ships, the 'Handling Regulations for Wireless Telegraphs' and the 'Regulations on the Wireless Telegraphs of the Combined Fleet' were enacted to direct the operational methods of the wireless telegraphs. Other than those, the 'Secret Telegraph Code' and the 'Naval Signal Book' were developed. The 'Telegraph Addresses' that used to be prepared for each fleet, were prepared as calmly as those for the Combined Fleet for the fleet battles. The 'Type 36 Wireless Telegraph Handling Manual' and 'The Russian Signals Book' that recorded Morse Codes used by Russians, were also prepared and distributed to each ship."

After the losses of 1904 to their Pacific Fleet, the Russians sent their Baltic Fleet, enlarged, to the Far East. The smaller vessels transited the Suez Canal. The British monitored the Russian wireless communications:

"An intelligence report on signals intercepted by HMS *Diana* at Suez shows that the rate of sending was extremely slow by British standards, while the Royal Navy interpreters were particularly critical

of the poor standard of grammar and spelling among the Russian operators." [76]

Commander Tonami then spied on the Russians at Suez with British assistance.[77] He watched the Russian vessels go by, observed the antennas, and may well have also monitored the same wireless transmissions, and reported back to Japan. Admiral Itoh[78] writes:

"Tonami reported to the Vice Minister of the Navy as to whether the ships had wireless telegraphs or not, what kinds of telegraphs they were equipped with, and where the telegrams [wireless rooms] were installed, based on the installation positions, the heights, and shapes of communication antennas on the ships."

The Russian fleet got to Asia, some through Suez and the rest around the Cape of Good Hope, a *tour de force*. The Japanese knew the Baltic Fleet was coming. But the Japanese did not know, in the vastness of the Pacific, which of the several possible routes, East or West of Japan, which the Russians would take to get to Vladivostok. They knew only that the fleet had left Cam Rahn Bay in French Indo-China.

On May 27, 1905, the cruiser *Shinanomaru* spotted the Russian Fleet near the mouth of the Tsushima Straits between Korea and Japan. The *Shinanomaru's* wireless message to the Japanese Fleet ensured an ambush in the ensuing Battle of Tsushima Straits, a classic "Crossing the T" naval engagement. See Figure 24. The *Shinanomaru's* message was sent and received on the Type 36 sets which Tonami and Kimura (and the British Foreign Office) had made possible. It was pure, vital intelligence: "Enemy fleet observed at position 203, enemy moves to east channel." [79]

The Russian Fleet had been ordered to turn off its unreliable wireless sets on May 16, leaving Indo -China, lest transmissions be detected by the Japanese. There is no indication that any Russian vessel heard the *Shinanomaru's* message to her fleet, although the Russians did intercept enough wireless traffic to know that they had been seen, but not soon enough for it to be of any use.

Figure 24. The Battle of Tsushima Straits. The Russian Fleet is in blue. The Japanese Fleet, in red, "Crosses the T" in front of the Russian Fleet, permitting the Japanese to fire broadside while the Russians could only use their fore turrets. From wikimedia.org/ wikipedia/ commons/ thumb/e/ea/ Bataille_de_Tsushima... The Japanese in this battle lost 172 men; the Russians more than 4,000 men and most of their warships.

The *Shinanumaru's* transmitter used a 30 cm spark coil made by the company Annaka Seisakusho (now Anritsu) for the Ministry of the Navy.[80] Its receiver was of the coherer Type 36, as was the receiver in Japan's flag battleship, the *Mikasa* (which now, as a historical vessel, displays a reproduction).[81] According to a summary[82] in Wikipedia:

"At 4:55 AM, Captain [Hakaru] Narukawa of the *Shinano Maru* sent a wireless message to Admiral Tōgō [Heihachiro] in Masampo [in Korea] that 'Enemy is in square 203' By 5 AM, intercepted wireless signals informed the Russians that they had been discovered and that Japanese scouting cruisers were shadowing them. Admiral Tōgō received his message at 5:05 AM, and immediately began to prepare his battle fleet for a sortie.... the entire Japanese fleet put to sea, with Admiral Tōgō from his flagship *Mikasa* leading over forty vessels to meet the Russians. Meanwhile, the shadowing Japanese scouting vessels sent wireless reports every few minutes as to the formation and course of the Russian fleet. There was still mist which reduced visibility and the weather was poor. Wireless gave the Japanese an advantage; in his report on the battle, Admiral Tōgō noted the following:

'Though a heavy fog covered the sea, making it impossible to observe anything at a distance of over five miles, [through wireless messaging {wiki insert}] all the conditions of the enemy were as clear to us, who were 30 or 40 miles distant, as though they had been under our very eyes.' "

The Imperial Japanese Navy won a stunning and overwhelming victory over the Imperial Russian Navy. The Battle of Tsushima ranks with the most important battles in naval warfare, and among the most complete victories at sea.

It has been said that this was the first use of radio, wireless telegraphy, in combat.[83] Lionel James's earlier adventures, however, and what is known of Japanese naval communications in 1904, suggest that earlier date as the advent of combat wireless in the Russo-Japanese War. Moreover, both belligerents used tactical wireless in the 1904 land battles around Port Arthur, including jamming.

The potentials and hazards of communications through the ether could not be ignored. Its time had come. Commander Tonami's vision of the future of this then-primitive technology promoted Japan's victory. Within three years, Tonami captained a Japanese cruiser, the *Yakumo*.

Thus, as Japanese experts have concluded: "In the Russo-Japanese war electronics clinched the victory for Japan ..."[84] Many historians have suggested that the loss of the war caused the Russian Navy mutinies of 1905 and contributed to the Revolution of 1917, and thus cost Tzar Nicholas II his Romanov reign and then his life. See Figure 25. Japan's victory established it as a world power for the next several decades.

CONCLUSIONS

In the crucibles of war as well as the competitions of commerce, wireless telegraphy played early and important roles. Men like Lee de Forest, using innovations like Fessenden's (and Vreeland's) electrolytic detector, and Lionel James, in his innovative real-time reporting with wireless from the midst of sea battles, and Kurakichi Tonami, master spy, each envisioned its possibilities and advanced the art. Although wireless was in an early state of development in 1904-'05, employment of the art fostered and

Figure 25. A recent painting of Tzar Nicholas II and behind him the scene of the second day (February 9, 1904) of the opening engagement of the naval war. The cruiser *Varyag* chose to make a fight of it against a superior Japanese flotilla intending to capture Chemulpo (Inchon) Korea. It was lost. See en.wikipedia.org/wiki/ Russian_cruiser_Varyag_(1899). The painting by Gherman Komlev appears on a 1998 (revenue -raising) postage stamp of the Marshall Islands, which at its bottom right, in blue, shows the Yellow Sea and the Korean peninsula, West of which this and subsequent 1904 battles took place. I am grateful to Judy Mears for supplying this image.

frustrated even Imperial Russian ambitions. In three short years, wireless telegraphy went from a little understood wonder and a curiosity to a weapon of war, remaking Empires. As the art advanced (see, *e.g.*, Figure 26), it has played roles in every war, and in every economy, that perhaps not even visionaries like Lee de Forest, Lionel James and Kurakichi Tonami could foresee – although maybe Nicola Tesla did.

Notes and sources follow. I hope I have acknowledged in the text and the following notes the many people who have helped me in putting this article together. I am grateful to each of them and all the more so to anyone I have inadvertently omitted.

Figure 26. Cable and wireless telegraphy working together in the British Empire world-wide after the finances -driven merger of the cable interests and the Marconi interests into Cable and Wireless, Ltd. in 1929. (See Baker [note 13] at Chapter 27, page 226). As the cable interests had feared, wireless communications (by 1929 short wave radio, the Marconi "beam system") had cut their revenues badly, inasmuch as "half their traffic had gone over to the beam" according to Baker (page 229). Baker concludes that the merger "... gave Great Britain and the Empire the finest system of world communications ever to exist under the control of a single body...." (at page 232). Baker reports that when an undersea earthquake broke ten of 21 Atlantic cables in 1929, the traffic seamlessly shifted over to radio (page 233). On the map, cables loop around and wireless circuits appear as dotted straight lines. The map (showing the whole world with interesting images in the margins) dates from 1947. It comes from the archives of the Porthcurno Telegraph Museum whichreproduces it as a poster. This image is from a photograph by Bob Berry of part of the map, gracing a postcard from the Museum. The world now has a much more extensive cable network, but mostly fiber optics.

ENDNOTES

1 Lee de Forest, *Father of Radio*, Wilcox & Follett Co., (1950) (self -published); Chapter 15, Wireless Goes to War, page 135. De Forest is often charged with self-aggrandizement, with his autobiography cited as "Exhibit A." From the perspective of a century, perhaps not even he gave Lee de Forest enough credit for all he accomplished. His memory is tarnished by business failures, and hostility from engineers as a result of the courts siding with him over E. Howard Armstrong regarding radio frequency oscillations from vacuum tubes. Armstrong knew what he was doing, but de Forest just did it – but time after time. Still, Armstrong's claims to *unique* invention with respect to both regeneration and the superheterodyne principle are dubious. So too are de Forest's with respect to the triode, given Fleming's prior art, and to his "Responder" given his acknowledgement that he got the idea from Dr. Vreeland in Fessenden's lab. But that was (and is) the nature of invention. While Athena may have leapt fully formed from the head of Zeus, the birth of an invention is a messier process, and most inventions have many fathers (as we know at least from the patent paternity disputes in the courts). I find de Forest's autoredemptive autobiography to be trustworthy, although he omits a great deal: a wife here, a fact there. The sections here quoted are particularly reliable having been written and published in the 1930s when many of the principals could have spoken up if need be. People who worked with Lee de Forest loved him as "Doc" and respected him for his pioneering and accomplishments; Armstrong partisans, not so much, and many of them were the most capable engineers of the day.

2 John E. Packer, FRGS, The Spies at Wireless Point, (2005), pages 6ff, published by The Cable and Wireless Porthcurno and Collections Trust, Porthcurno, Penzance, Cornwall, UK, used by the kind written permission of Mr. Packer. Excerpts are edited for American usage and continuity. I am grateful to Keith Matthew, GØWYS, a principal of the Poldhu Amateur Radio Club, for the connection to Mr. Packer, and to Archivist Alan Renton, and for many years of hospitality in Cornwall in our mutual investigations into early wireless.

3 Peter Slattery, Reporting The Russo -Japanese War, 1904-5 – Lionel James's first wireless transmissions to the *Times*, Global Oriental, (2004). Cited below as "Slattery." See also: Peadar [Peter] Slattery, EI2JA, From the Irish Sea – to the Yellow Sea, *PW* [Practical Wireless – U.K.], February 2001, p. 24. Mr. Slattery's texts and communications have been extraordinarily helpful. His work is thorough and compelling, well written and interesting beyond the merely technical as an incisive history of nations and of the advance of journalism into the 20th Century and its implementation of newly available means and methods to inform the world.

4 Rear Admiral Kazuo Itoh, The Battle of Tashima Was Real Network Centric Warfare, translated by [Commander (US) Naval Forces Japan] CNFJ Political and Civil Affairs Specialist Takuya Ueji (no date, *circa* 2008) at page 9, accessible at U.S. -Japan Naval Friendship Association, http://janafa.com/ronbun/janafa36-ronbun-2.pdf. This is a detailed history of communications electronics in the Japanese armed forces through 1905. Cited below as Admiral Itoh.

5 John E. Packer also kindly supplied me with a copy of: Graeme Bartram, Wireless and the Art of Magic: A Reappraisal of Nevil Maskelyne and His Contribution to Wireless Telegraphy, *BVWS Bulletin* [British Vintage Wireless

Society – U.K.], Vol. 28, No. 4, Winter 2003, page 28, from which my initial discussion of Maskelyne derives.

6 Packer, above, pages 6ff.

7 Vivian J. Phillips, *Early Radio Wave Detectors*, Peregrinus and the Science Museum (1980), at figure 4.4 on page 71, attributed to A.F. Collins, 1906.

8 Wireless Telegraphy – The De Forest System, *Dublin Penny Journal*, (1903) page 745, as preserved and graciously provided by Tony Breathnach, EI5EM, who is, along with Pat Herbert, a Curator of the Irish radio museum now in that same Martello Tower, Ye Old Hurdy Gurdy Museum of Vintage Radio. The *Scientific American* report appears at Vol. xc (90), no. 3, January 16, 1904 at page 40. I am grateful to both Tony Breathnach and Pat Herbert for their hospitality at their museum.

9 Mike Adams, *Lee de Forest – King of Radio, Television and Film*, Springer, New York, (2012).

10 De Forest, Father of Radio, above, at p. 149.

11 Lee de Forest, Pioneer Radio Operators, a series in *CQ* ("A Magazine OF, BY and FOR Commercial Radio Operators and Technicians"), December 1931, page 9; substantially reprinted in Father of Radio, above, pages 153-54 but there abridged. The *CQ* texts are somewhat fuller and perhaps more accurate, they being only three decades after the events rather than five. For example, in *CQ*, de Forest tells of experimenting with wireless reception on the voyage East to the U.K. on the *S.S. Majestic:*

"With a single antenna wire, by [Mac] Horton surreptitiously hung in the shrouds and brought into our cabin's port -hole, we held New York until the ship was 75 miles out – and were well satisfied thereat." But in Father of Radio, de Forest claims 140 miles (p. 152). I have found this sort of minor exaggeration decades later fairly common in several writers looking long back.

12 Tony Breathnach, EI5EM, in the Guidebook to the Ye Old Hurdy Gurdy Museum of Vintage Radio (sited in the Howth, Ireland Martello Tower) (2007) at p. 20.

13 W.J. Baker, *A History of the Marconi Company*, Methuen & Co., London, (1970), at pages 143ff; Chapter 17, "The Marconi Scandal." This book is cited below as W.J. Baker. One recent IEEE history notes:

"The 'Marconi Scandal,' although not ruinous, eventually ended Marconi and Britain's chances of regaining global dominance of radio, leaving the door open for the fast-rising American telecommunications industry."
www.ieeeghn.org/wiki/index.php/Guglielmo_Marconi

This too was too late for de Forest. At this remove it is difficult to determine to what extent the events of 1904 – '05 involving de Forest played a role, even as background, in the 1912 scandal. But Tony Breathnach is certainly right that Marconi interests were close to the British Government even then.

14 Robin Paige, *Death on the Lizard – An Edwardian Mystery*, Berkeley Prime Crime (2006) at p. 92: "... at Lizard point ... A man there says he's come all the way from America to play golf, although he's spending most of his time nosing about the village...." Marconi in this fiction (p. 186) is alarmed that "The De Forest Wireless Telegraph Company has put out a five million dollar stock offering" as well he might actually have been at the time, although it was actually only $3,000,000. Paige has the cable companies at Porthcurno intercepting all of Marconi's traffic but then doing nothing with it (p. 211). They did, however, use the fact of interception to rebut claims of privacy, and the product of the interception to show unreliability in wireless communications.

15 Minutes, of the Board of Directors of the Eastern Telegraph Company,

July 22, 1904, (n.p.), extracted and graciously provided by John E. Packer, FRGS.

16 Minutes, of the Board of Directors of the Eastern Telegraph Company, July 22, 1904, page 36, extracted and graciously provided by John E. Packer, FRGS.

17 W.J. Baker, above, p. 95.

18 Minute Book of the Board of Directors of the Eastern Telegraph Company, No. 12, Wireless Telegraphy, November 28, 1906, extracted and graciously provided by John E. Packer, FGRS.

19 Father of Radio, p. 150.

20 Father of Radio, Chapter 13: Wireless goes to War, p. 155.

21 Slattery above, p. 2, quoting a James article of 1905.

22 Slattery, above, p. 12-13.

23 Father of Radio, p. 156.

24 Slattery, above, p. 16.

25 Slattery, above, p. 119.

26 Phillips Payson O'Brien, *The Anglo -Japanese Alliance, 1902 -1922*, Routledge (2004) (via Google Books); cited below as O'Brien.

27 Wikipedia, Russo-Japanese War, at n. 24 citing Chapman, John W.M., 'Russia, Germany and the Anglo-Japanese Intelligence Collaboration, 1896-1906' pages 41-55 from *Russia War, Peace and Diplomacy,* ed. Mark & Ljubica Erickson, London: Weidenfield & Nicholson, (2004), page 55.

28 Capt. L. S. Howeth, USN (ret.), *History of Communications -Electronics in the United States Navy*, Bureau of Ships and Office of Naval History, Washington [DC] (1963) at page 85, note 1.

29 *Japan and America*, Vol. III, No. 1, New York, (January, 1903) at p. 16 (via Google books).

30 Admiral Itoh, above.

31 Wireless Workers Back from the Scene of War, *New York Times*, August 31, 1904, page SM6, subtitled:
"New York Operators Tell of their Oriental Experiences. Adventures of the *Haimun*. Describe Capture by *Bayan* and the Sinking of the *Petropavlosk* after Port Arthur Bombardment."
This article, cited below as NYT 1904, is an interview with Athearn and Brown. It lays out their whole adventure. It is accessible at radio historian Thomas H. White's website, United States Early Radio History - Pioneering U.S. Radio Activities: http://earlyradiohistory.us/1904back.htm. See also Father of Radio at p. 158.

32 Slattery, above, p. 27, quoting the London *Times* story of February 13, 1904.

33 NYT 1904.

34 Slattery, above, p. 37.

35 Slattery, above, appendix, p. 123: "Regulations issued to Lionel James by the Japanese Imperial Navy." Moreover, according to Slattery, the British Navy also assigned the *Haimun* a callsign, HN, to identify itself in communications with Weihaiwei. Weihaiwei was assigned WH. Some 26 British Navy warships also got two letter callsigns, based on their names. The communications at least related to needs for coal as the ships came to port. Slattery, above, at p. 80. Thus James's *Haimun* enjoyed assigned callsigns from two navies hostile to the Russians at the same time.

36 Slattery, above, p. 37.

37 NYT 1904.

38 Slattery, above, p. 37.

39 Slattery, above, at pages 39-40. James much later said 70 miles out. Perhaps later recollections are often given to exaggeration, *e.g.*, de Forest's of his range of reception out of New York (note 11 above).

40 NYT 1904.

41 Slattery, above, p. 42.

42 Slattery, above, p. 49.

43 Slattery, above, p. 51.

44 Slattery, above, p. 53.

45 Father of Radio, p. 171.

46 NYT 1904.

47 Charles N. Dragonette, "The Birth of COMINT," *Naval Intelligence Professionals Quarterly,* Vol. 11, No. 2 (April 1995) at page 16.

48 Lionel James (writing as "O"), *The Yellow War,* McClure, Phillips & Co., New York, (no date, *circa*

1905), a fictionalized, but James says entirely accurate, series of accounts of specific actual events of the war as published in London press, at pages 123 and 145ff. Cited below as: James as "O".
49 Slattery, above, p. 55.
50 Slattery, above, p. 57.
51 Slattery, above, p. 57-58.
52 NYT 1904.
53 James as "O" at pages 219ff.
54 Slattery, above, at pages 64ff.
55 NYT 1904.
56 Peadar [Peter] Slattery, EI2JA, From the Irish Sea – to the Yellow Sea, note 3 above, at page 27. Cited below as Slattery PW.
57 Admiral Itoh, above.
58 M. Radovsky (trans. G. Yankovsky), *Alexander Popov -- Inventor of Radio*, Moscow, (1957), page 97, note. Cited below as Popov.
59 James as "O" at p. 297.
60 Slattery, above, p. 66.
61 NYT 1904.
62 Slattery, above, p. 66, quoting James.
63 Lee de Forest, Pioneer Radio Operators, in *CQ* [see note 11 above] (May, 1932), p. 11.
64 Slattery, above, p. 7
65 NYT 1904.
66 NYT 1904.
67 Slattery, above, p. 92.
68 Slattery PW p. 26; Slattery, note 3 above, at page vii, cites Preece to a book by E.C. Baker, *Sir William Preece F.R.S., Victorian Engineer Extraordinary*, Hutchinson, London (1976).
69 Slattery, above, p. 97.
70 W.J. Baker, above at pages 102-03.
71 Slattery, above, p. 99.
72 Slattery, above, p. 110.
73 Popov, at pages 103-04.
74 Admiral Itoh, above.
75 Admiral Itoh, above.
76 R.F. Pocock and G.R.M. Garratt, *The Origins of Maritime Radio,* London, Her Majesty's Stationery Office (1972) at p. 47.
77 O'Brien, above, at page 73: "Port Said: Japanese naval officer's sneaking."
78 Admiral Itoh, above, p. 36.
79 Gentei Sato and Motoyuki Sato, The Antenna Development in Japan: Past and Present (cited below as Sato and Sato) appears as Chapter 14 in Tapan K. Sarkar, *et al.*, *History of Wireless*, Wiley, Hoboken, NJ, (2006) at pages 460ff, section 14.4: "Sea Battle of the Tsushima Straits and the Japanese Radiotelegraph"; the message appears at page 461.
80 Sogo Okamura, *History of Electron Tubes*, Ohmsha Tokyo, IOS Press, Washington [DC] *et al.*, (1994); sec. 4.1: Early Wireless Communication (via Google Books).
81 Sato and Sato, above.
82 Admiral Togo's report on the Battle of Tsushima, as published by the Japanese Imperial Naval Headquarters Staff, Sept. 1905 at www.russojapanesewar.com/togo-aar3; cited in Wikipedia: en.wikipedia.org/wiki/Battle_of_Tsushima. I have inserted full names and located Masampo in Korea. The insert in brackets [] in Togo's text -- "through wireless messaging" -- is Wikipedia's.
83 Evans, David C. & Peatie, Mark R., *Kaigun: strategy, tactics and technology in the Imperial Japanese Navy, 1887-1941*, Naval Institute Press, Annapolis, MD (1997) cited in Wikipedia/ Imperial Japanese Navy, at n. 64. "*Kaigun*" was the Japanese word for its Imperial Naval Forces.
84 Sato and Sato, above, at p. 471.

ABOUT THE AUTHOR

Bartholomew (Bart) Lee, K6VK, xKV6LEE, WPE2DLT, is a long time member of AWA and a Fellow of the California Historical Radio Society (CHRS), for whom he serves as General Counsel Emeritus and Archivist. He has enjoyed radio and radio-related activities in many parts of the world, most recently in Asia and the Middle East. Radio technology and history have fascinated him since he made his first crystal set with a razor blade and pencil lead more than 50 years ago. He is especially fond of those sets of which it is said: 'Real Radios Glow in the Dark.' Bart is a published author on legal subjects and most recently on the history of radio. He has written about and lectured on early radio technology, radio intelligence activities ('episodes in the ether wars') from 1901 into the latter 20th Century, wireless telegraphy especially Marconi's early work, wireless developments on the West Coast since 1899, radio ephemera including radio stamps, and radio in emergency and disaster response. Since 1989 he has made some 20 presentations to the AWA conferences on his research interests including short wave radio and the development of television in San Francisco in the 1920s. The AWA presented its Houck Award for documentation to him in 2003 and CHRS made its 1991 'Doc' Herrold Award to him in connection with his work for the Perham Foundation Electronics Museum. In 2001, during disaster recovery operations in New York after the '9/11' terrorist enormity, he served as the Red Cross deputy communications lead from September 12 to September 21, (the 'night shift trick chief'). He has served in RACES as the Liaison Officer for the San Francisco Auxiliary Communications System, and as an ARRL ARES Emergency Coordinator. He presently serves as an ARRL Government Liaison and Volunteer Counsel. Bart has been a litigator by trade, prosecuting and defending civil cases in both state and federal court for 40 years. He also had taught Law & Economics for 20 years, including the economic history of telecommunications. He is a graduate of St. John's College (the 'Great Books School') and the University of Chicago Law School. Bart's son Christoffer Lee is also a licensed amateur radio operator and is now also a practicing lawyer. Bart invites correspondence at: KV-6LEE@gmail.com .

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