WIRELESS GIANT OF THE PACIFIC

A History of the Marconi and RCA Radio Stations on the Point Reyes Peninsula

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Preface

> It can safely be prophesied that before many years are past wireless communication will be possible the whole way round the earth. It is not many years since the first radio-telegram was sent across the [English] Channel; and if in the short period which has elapsed since then trans-Pacific communication is an accomplished fact, what may we expect fifty years from now?
>
> --The Wireless World, October 1916

The arrival in 1914 of Guglielmo Marconi's world-famous wireless telegraph system on the coast of Marin County, California marked the beginning of an eighty-four year period during which it was one of the world's most powerful and important communications facilities, yet the existence of the stations at Bolinas and Marshall has been a well-kept secret. The rural towns near the stations kept this secret well: while having internationally important facilities in their midst, the towns remained tiny, with no major highways, no wide-spread development, no tourist attractions; both Bolinas and Marshall look much as they did when Marconi Wireless Telegraph Company of America broke ground for the stations 85 years ago. Only those who know radio history make the pilgrimage to the sites, to pay tribute to the operators of the now-silent telegraph keys which once roared signals across the oceans.

Through these stations the major communications of the Pacific Rim passed; while competitors had to be held at bay, Marconi Wireless and its successor RCA held the title of most powerful, most up-to-date, most popular, in essence, the biggest and longest-lived wireless communications network on the ocean. News of Amelia Earhart's ill-fated journey, the bombing of Pearl Harbor and subsequent declaration of war, the war's end, the Korean and Vietnam conflicts . . . not to speak of the day-to-day telegrams and telexes concerning international business deals, major and minor news, arrivals, shipments, weddings, births and deaths, all flashed to and from ships at sea and land stations located in countries around the Rim.

Receiving a Marconigram meant a great deal to people early in this century, just as a plane passing overhead brought stares of wonder at the same time. The new world of wireless communication excited people, created a demand and thrust electrical technology into the living room. It is a technology that moves even faster today. Satellites, cellular phones, pagers, computers, radio and television, all grew out of the simple electrical experiments performed by isolated individuals in many countries, each to become a hero in his own right. Today it is typically corporate and government laboratories rather than devoted independent individuals advancing communications technology (perhaps with the exceptions of those like Wozniak, Jobs and Gates), and the advancements are coming so fast that they are often lost in a swirl of one-upping and obsolescence. This study intends to show that a hefty stem in the root system of the tree that is modern technology, and our modern culture or way of life, reaches deep into coastal Marin soil at Point Reyes National Seashore; it should bring to light the significance of the Marconi and RCA facilities in Marin County, and establish their place in the history of this region, this nation and the world at large.

List of Maps

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I. Wireless and Radio: Birth of a New Science and Industry

A. Introduction

Marconi: the name is well-known throughout the world; undoubtedly most citizens know Guglielmo Marconi as the "inventor" of radio. While the Italian inventor has been widely credited with development of wireless communication for commercial purposes, his work was based on that of dozens of scientists and inventors who preceded him, as well as many of his contemporaries. As a young man (Marconi was not a trained scientist), he voraciously absorbed knowledge and channeled it into a cohesive system that would change the world. As Emilio Segre, winner of the Nobel Prize for Physics, wrote:

> The consequences of Marconi's inventions are far-reaching; it is not an exaggeration to say that they have deeply affected modern civilization. For this, Marconi's name is known to everybody as the symbol for telecommunications in all its forms.[1]

Signor Marconi, himself awarded the Nobel Prize in 1909, has been hailed as a hero throughout the world. His wireless systems saved hundreds if not thousands of lives, brought important news to government and people, aided the military forces of countries across the globe, and brought radio messages into homes; Marconi started a revolution like the world had never seen.

B. Early work with Electricity and Electric Waves

Orrin E. Dunlap, Jr., wireless scientist, writer and historian, considered the most important wireless pioneers to be Faraday, Henry, Maxwell, Hertz, Marconi, Fessenden, Fleming, DeForest and Armstrong; all worked in the late 19th and early 20th centuries. But the train of discoveries about electricity began more than 2500 years ago when Greek astronomer/philosopher Thales of Miletus (640-548 BC) rubbed amber with a silk cloth and produced a charge; as the first to note frictional electricity and magnetism, his work brought forth the word "elektron", Greek for amber. Englishman William Gilbert (or Gilberd) (1544-1603) first used the word "electric" and discovered that the earth is a huge globular magnet in the late 1500s.[2]

In a flurry of experimentation into electrical phenomenon during the 18th century, inventors and scientists made many important discoveries. Pieter van Musschenbroek of Holland (1692-1761) discovered the first condenser which he called the Leyden Jar, while his French contemporary Charles Francois DuFay (1698-1739) performed the first electrical transmission through a wet thread and recognized negative and positive charges. The great American statesman and inventor Benjamin Franklin (1706-1790) gave a name to these charges and made great advancements in the study of static (or atmospheric) electricity, most famous of which his experiments with lightning. Alessandro Volta (1745-1827) invented the voltaic cell (battery), generating electricity by "the simple contact of two dissimilar bodies, without the aid

of friction." Volta went on to prove that current from a battery could be controlled.

A number of scientists discovered and/or worked with primitive wireless transmission in the 19th century but most of that century was spent in preliminaries. One man, who today shares Marconi's stature in the history of telegraphy, developed a method of communications using controlled electrical charges. Samuel F.B. Morse (1791-1872) began his career as a successful portrait painter. At the age of 41 he had an idea which, after 12 years of experimentation, would become cable telegraphy using his Morse Code of dots and dashes representing numbers and the letters of the alphabet. He transmitted his famous message, "What Hath God Wrought," through overhead wires from Washington, DC to Baltimore on May 24, 1844. His developments led to the formation in 1851 of the Mid-West Telegraph Company which would become Western Union in 1856. The company constructed the first continental telegraph line and soon communications via telegram became a way of life throughout the world.[3]

Europe adopted a revised version of Morse's telegraph alphabet, and this form became International Morse Code as used in wireless communications, due to its use of more dashes and lack of spaced-letters which could become unintelligible in conditions of static and interference.

Michael Faraday (1791-1867) has been called "the Columbus of the electrical age." The Englishman followed the experiments of Andre Marie Ampere (1775-1836) and discovered the capability to produce electricity from magnetism in 1831; he subsequently invented the first generator. The American Joseph Henry, called "America's Faraday," made similar experiments; he became the Smithsonian Institution's first secretary in 1846.

These people set the groundwork for wireless telegraphy. With James Clerk Maxwell's discovery in 18-- of "the ether", an "unseen medium of light and heat in space through which electromagnetic undulations can pass," the rate of learning increased. Although scientists discounted Maxwell's discovery in the 1920s, his theory of an atmospheric medium was instrumental to inventors attempting to throw electricity through the air. Mahlon Loomis (1826-1886) experimented with what he called "aerial telegraphy, sending electrostatic impulses up to 14 miles, using a sensitive galvanometer to detect the impulses. Loomis, originally a dentist, obtained the first patent for wireless telegraphy in the United States in 1872. Edouard Branly (1844-1940) of France invented the coherer which Marconi later perfected, a device which detected wireless waves and provided the first step in translating the waves for communications. Others, including Lord Kelvin (1824-1907) and William Henry Preece (1834-1913) were active in electrical and wireless experimentation.

America's famous inventor, Thomas Alva Edison (1847-1931), received widespread fame for his development of electric lights and talking machines, but he had a profound influence on development of radio. His laboratory's work with batteries, dynamos, motors and microphones aided the progress of wireless, and his 1891 patent No. 465,971 for "Telegraphy Without Wires" was sold to Marconi in 1903. Edison had faith in Marconi's work at a time when the world's skeptics (many of whom were Marconi's competitors) made themselves loud and clear.[4]

Two influential inventors of the time contributed most to Marconi's eventual success: Heinrich

Rudolph Hertz (1857-1894) and Nikola Tesla (1857-1943). Hertz was the first to create, detect and measure electromagnetic waves, thus confirming (for the time being) Maxwell's "ether" theory. Hertz noted the similarity of light and electromagnetic waves, and how they could be reflected, refracted and polarized. Science today recognizes "Hertzian waves." Tesla, who obtained a job from Edison after his penniless arrival from eastern Europe, invented the induction motor and the Tesla coil (a revolutionary transformer). He discovered the rotating magnetic field and experimented with motors for alternating current, developing the AC induction motor. Tesla devised a system of electrical conversion and distribution by means of oscillatory discharges. In 1893 he developed his own system of wireless transmission but did not pursue the practical applications of his system as Marconi would within years. Tesla wanted to prove he could send electricity for practical use without wires. Wireless historian Eric Dollard wrote of Tesla's contribution:

> The Tesla coil (transformer) was a fundamental development in wireless transmission. After visiting Tesla's laboratory and finding the Hertz apparatus unsuitable for long distance, Marconi adapted this transformer into what became known as the oscillation transformer. This was the key component of all spark wireless sets.[5]

Many other scientists and inventors worked towards the invention of wireless telegraphy, and even more perfected the systems which would lead to increased power, range and clarity. These include Adolph Slaby, called "the German Marconi," a longtime Marconi rival who made several parallel discoveries; Alexander Popoff, Slaby's counterpart in Russia; John Ambrose Fleming who invented the valve detector; Sir Oliver Heaviside, who discovered the "roof" 60 or so miles above the earth which permitted the reflection of electromagnetic waves and allowed great distances to be attained; Arthur Kennelly, Heaviside's American counterpart, who found that the layer of ionized air that Heaviside had noted allowed wireless travel despite the curvature of the earth; Sir Oliver Lodge, whose tuning patent made wireless communication possible; Charles Steinmetz, who clarified Maxwell's theory of ether, pointing out that radio and light waves are "merely properties of an alternating electromagnetic field of force which extends through space;" and Reginald Aubrey Fessenden, who, among other things, invented the rotary spark gap which was a staple in early wireless stations including Marconi's at Bolinas.[6]

C. Guglielmo Marconi (1874-1937)

By ingeniously joining a handful of recent inventions (induction coil, Hertz wave emitter, Righi gap, telegraph key, batteries and the Branly coherer), the young Italian Guglielmo Marconi successfully sent and received a series of patterned electromagnetic waves across a mile's distance. His experiments, and his ambitious development of the technology in England, the U.S. and Italy, changed the world.

Giuseppe Marconi, from an old family of land-owning farmers, married Annie Jameson, a young Irish woman from the Jameson family of distillers. The Marconis lived on the family estate, Villa Griffone

near Ponteccio, Italy. Their second son Guglielmo (Goo-lee-AY-mo) was born in Bologna on April 25, 1874. Guglielmo showed an early interest in the sciences, following the stories of Ben Franklin and Michael Faraday. A shy boy, fascinated by mechanical and electrical devices, he spent much of his time tinkering with instruments and small machines.[7]

Under the watchful eye of his mother, Marconi's education was sporadic but rich. He eventually entered a technical school in Florence at age 12, then the Instituto Nazionale in Leghorn. Privately he studied electrophysics in his home with a Professor Vincenzo. In perhaps his most important association of his youth, a retired telegraph operator named Nello Marchetti taught the boy Morse code and encouraged his experimentation. Marconi set up experiments in his house, especially fascinated by Jean Auguste Fresnel's wave theory which proposed that light diffraction was caused by atmospheric interference.

During a vacation in the Alps, the teen-aged Marconi read a report of Hertz's theories which sent him on a course of experimentation and study towards a system answering the world's need for long-distance communication without wires. He saw the benefits, both commercial and military, of countries, businesses and armies being able to exchange messages from remote places, during travel, or even out at sea. Marconi, with a supportive mother and skeptical father, set to work.

Convinced that Hertzian waves could transmit signals a substantial distance, the young inventor attempted to produce and observe these "elusive emissions" for himself. He set out to repeat some of the previous experiments of Hertz and the prominent Italian physicist, Professor Augusto Righi.[8]

Marconi, whose education had been irregular, showed great promise as a scientist. In an extraordinary turn of events, Professor Righi himself offered use of the University of Bologna's laboratory. Righi, who had made a number of discoveries in transmission of electromagnetic waves, had been impressed by the boy's knowledge and interest and spent time supporting his endeavors. Marconi took advantage of his unusual good fortune. He became an impassioned worker, believing strongly that Hertz and Righi's inventions could be used to transmit messages across great distances without the use of wire.[9]

Marconi left the laboratory at the university to set up his own in the attic of Villa Griffone, where he could concentrate and work day and night. His secretive experiments progressed to where he could transmit electric waves across a room to ring a bell. The experiments outgrew the large attic space and Marconi, with the help of his brother and a friend, set up equipment which successfully transmitted, and received, signals over a distance of almost one mile. This event, in 1895, is considered to be the birth of wireless and opened a new era in communications; at the time Guglielmo Marconi was 20 years old.

The patriotic Marconi offered his knowledge to his government and asked for cooperation, but was refused; in fact, the Italian government continued to be slow to accept Marconi's repeated offers until it was too late to be at the international forefront. Annie Marconi brought her son and his equipment to England in 1896 where she had family connections. Marconi filed his first patent in England, and met Sir William Preece, demonstrating his finds. With the support of Preece and the English Post and Telegraph Services, who provided a full time assistant, George Stevens Kemp (who would stay at Marconi's side for many years), Marconi embarked on tests that soon expanded the range of transmission to two miles and more. In

July of 1897 Marconi and his cohorts founded the Wireless Telegraph and Signal Company, with Marconi owning a controlling majority of shares. Later, at the urging of his family, the organization officially became Marconi Wireless Telegraph Company, Ltd. By this time, Guglielmo Marconi was fast becoming a famous and important man, one who exhibited savvy in not only science but publicity and fundraising.

Marconi had a great interest in communications between ships and the shore, an application that had ramifications not only commercially but militarily as well. From his laboratory at the Isle of Wight, Marconi's equipment proved effective up to 30 meters. Marconi got a contract with Lloyd's of London to create a system for communicating ships' arrivals, a service until then done by visual observation coupled with land-based telegraph. Marconi's tuning experiments led to his famous patent No. 7,777, which prevented overlapping of signals and decreased interference, paving the way for multiple signals on one circuit; this discovery alone was of utmost importance to the success of radio.

Lord Kelvin, a scientist in his own right, delivered the first commercial wireless message on Marconi's equipment on June 3, 1898. The next month Marconi made headlines with wireless reports of the Royal Yacht Club's regatta at Kingstown:

> A fast tug-boat, the Flying Huntress, was hired. Guglielmo installed a transmitter on board, and a receiver was set up in Kingstown. Connection with the offices of the Dublin newspaper was handled through the normal telephone service. To the amazement of its readers, the "Daily Express" published reports of the races even before the boats were in sight of the shore. The story caused a sensation throughout the British Isles.[10]

Marconi broadcast the first international wireless message in the early spring of 1899, across the English Channel to Marconi's French counterpart Edouard Branly. On a trip to New York, Marconi repeated the regatta triumph and won the approval and interest of the U.S. Navy, which made an agreement for experiments on warships using Marconi's technology. While in the U.S. Marconi established the Marconi Wireless Telegraph Company of America Ltd., commonly called American Marconi. On the return voyage Marconi created the first ship's newspaper, using dispatches from his English stations to update the passengers on breaking news; the shipboard newspaper became a regular feature of voyages the world over and continues today.

By mid-1900 Marconi and his associates were ready to attempt his life-long dream: wireless communication across the oceans. By this time coastal communication with ships had been accepted and put into practice, with seven land stations on the English coast and numerous ships equipped with Marconi apparatus. Marconi chose a site at Poldhu, Cornwall to build a station 100 times more powerful than the ship-to-shore stations. He selected a complementary site at South Wellfleet, Massachusetts to serve as the American station. Both sites saw the erection of towering masts, and both saw storms destroy them in separate incidents. Engineers returned to the drawing board and came up with solid designs that would better withstand the harsh elements of the station sites.

Meanwhile, Marconi made a secret trip with his equipment to Newfoundland where he found a

preferred site at St. Johns. He experimented with an antenna held aloft by a balloon, which was lost, then a kite which reached a height of 400 feet. This device received, on December 12, 1901, the faint "dot - dot - dot" (the letter S) transmitted 2,000 miles from Poldhu: the first transatlantic wireless signal. It was a stunning triumph, as Marconi proved that wireless signals can travel great distances despite the curvature of the earth. Marconi announced after the event that "wireless telegraphy is possible everywhere."[11]

The Marconi Company of Canada announced that a permanent station would be constructed at Glace Bay on Cape Breton in Nova Scotia, while the Cape Cod station at South Wellfleet would serve as the American counterpart. Technicians erected a series of four antennas, each 210 feet high and in the shape of an inverted pyramid, on the bluffs of Table Head. Meanwhile, Marconi's success brought much criticism and disbelief, largely from cable companies but also from fellow scientists such as Sir Oliver Lodge. Marconi struggled to prove himself and, with improvements in power and clarity, shortly had silenced most of his critics.

Marconi's work was boosted by J.A. Fleming's development in 1902 of the magnetic detector which would serve as the most efficient radiotelegraph receiver until improvements of the 'teens. That year, Marconi received signals from Poldhu in Russia, a distance of 1600 miles overland; the Marconi Company operated 30 stations in England and five in the United States, as well as 41 Marconi-equipped stations owned by Lloyd's of London connected with lighthouses.

At the end of 1902 Marconi, with valuable assistance from George Kemp and P. W. Paget, transmitted the first substantial messages from Glace Bay to Poldhu, and on the 20th of December, the first formal transatlantic messages were exchanged between Marconi in Canada and the kings of England and Italy. A month later station CC (for Cape Cod) opened at South Wellfleet, sending a message from President Roosevelt to King Edward VII; while intending to send the message from Wellfleet to Glace Bay, then to England, the message was unexpectedly received at Polhu directly from Wellfleet, resulting in the first direct U.S.-to-England transmission. Before returning to England, Marconi visited Thomas Edison, paying homage to one of his technological benefactors.

Marconi worked to increase the power of his antennas and continued to experiment and to invent devices, including the rotating disc oscillator; his associate and scientific consultant, John Ambrose Fleming, invented the thermionic valve which was used for decades for the transmission, detection, reception and amplification of radioelectric signals, and which made voice transmission possible. Eric Dollard wrote:

> Fleming invented the thermionic detector, based upon an Edison discovery. The detector was to revolutionize wireless as the telescope did astronomy. The addition of a control element, called a grid, by Lee DeForest, created the valve, or Audion tube. Not only did the Audion allow for the magnification of faint signals, but it laid the foundation for the transmission of voice and music. Modern electronics was thus born.[12]

With these developments Marconi's system became, as his biographer Giancarlo Masini wrote, "no longer an experimental undertaking but a well-organized commercial activity, by now established as the

quickest and safest means of communication over long distances and the only link between land and ships at sea."

By 1910 hundreds of ships at sea were linked to land stations, many operated by new competitors to Marconi Wireless Telegraph Company Ltd. The importance of these links would be solidified by incidents surrounding the collision of the luxury liner S.S. Republic and the Italian steamer Florida off Nantucket in 1909. Wireless technology made possible the rescue of over 2,000 people during the disaster. That year Guglielmo Marconi received the Nobel Prize for Physics. Kings, governments, businesses, scientific institutions and academies pursued the shy Italian, seeking his association and bestowing upon him endless awards; he was considered to be the most important inventor of his time.

An even larger event shook the world and firmed up the importance of wireless, as described by Orrin Dunlap:

> The Titanic disaster--April 15, 1912--put wireless in the news as had no other event; from midocean it taught the world the importance of Marconi's immortal work. He met the rescue ship Carpathia in New York with the cries of survivors ringing in his ears, "Ti dobbiano la vita! (We owe our life to you)".[13]

Through Marconi's wireless system the word of the disaster reached nearby ships and the public, bringing news of survivors and aiding in the complicated rescue. But a severe lesson was learned as well: the radio operator of the closest ship at the time of the wreck, the Californian, had shut off his receiver and gone to sleep after a 16-hour shift, missing the early calls for help and losing the opportunity to save countless lives. Following this, ships with a certain number of passengers would be required to have a radio operator on watch at all times. But, as Dunlap wrote,

> Since that day, because of wireless, many a person has been saved from a watery grave; many a ship afire at sea or battered by wind and wave, wrecked or torpedoed, has called for help through the voice Marconi put on board.[14]

By 1914 Marconi's place in world history had been established. With successful international business, fame and honors including the Nobel Prize, Marconi and his companies stood at the top in invention and industry. That year the American court (Marconi vs. Tesla) upheld the disputed validity of Marconi's patents, ending a long battle with competing wireless businesses and inventors over the use of important advances in the field. And, that year, Marconi's American wing opened the first high-powered transpacific wireless station at Point Reyes, California.

II. Development of International Wireless Communications

A. Marconi in America

At the time Guglielmo Marconi established the Marconi Wireless Telegraph Company of America in 1899, a wireless signal could reach about 30 miles, and during the lifetime of the company, exactly 20 years, the world of wireless expanded to circle the globe with stations like the ones to be built at Bolinas and Marshall. And while many other wireless businesses began operation shortly after Marconi, only his company outlasted them all until American Marconi was disbanded by indirect order of the U. S. Government.

Marconi had already established the Wireless Telegraph and Signaling Company, Ltd. in England two years earlier, and when he came to New York to report, via wireless, on the America Cup yacht races, he was confident that he would soon be communicating between Europe and America. In order to use Marconi patents in the United States, he incorporated the Marconi Wireless Telegraph Company of America in New Jersey on November 22, 1899, with an authorized stock of 2,000,000 shares of five dollars par value. Marconi himself held 600,000 shares while the English parent company held most of the remainder. Marconi created a Canadian counterpart also. The collected companies' patent pool would include the works of Sir Oliver Lodge, Professor Michael Pupin, Thomas A. Edison and Dr. James A. Fleming, creating a corner on the market with their rights to the most important inventions. Marconi returned to America in 1901 to continue his transatlantic experiments, resulting in the first successful transmissions in December.[15]

American Marconi grew from a small but ambitious concern holding about ten percent of America's wireless business to a virtual monopoly. The business lost money for more than ten years until the upswing of the 'teens. Former New Jersey Governor John W. Griggs served as president from 1905 until 1919. John Bottomly served as General Manager until 1913 when he was replaced by Edward J. Nally. Frederick Sammis held the position of Chief Engineer from 1908 to 1912, when the United Wireless Company was purchased and its excellent engineering group joined Marconi and many advances were made. Most of the early business consisted of manufacturing equipment and supplying ships at sea, as well as training operators and technicians. Marconi's goal, however, was to encircle the globe with high-powered land stations. After the triumphs on the Atlantic, Marconi moved on to the Mediterranean, Russia and other parts of the world, including the Pacific Ocean. Other wireless companies sprouted like weeds, hoping to cash in on the new technological trend.[16]

Marconi Wireless Telegraph Company of America opened an office in San Francisco in 1912, but the advent of commercial wireless long anticipated that event. As the Pacific coast center of maritime activity, San Francisco attracted a large volume of wireless business as soon as the equipment became available. The United States Lighthouse Service installed its first wireless set on the San Francisco Lightship around 1899, and soon many Pacific Coast steamers had wireless capability. The U.S. Navy built twelve coastal stations and the Army had at least nine in Alaska. Between 1900 and 1910 four wireless companies installed dozens of ship-to-shore stations along the coast from Seattle to San Diego. These included:

American DeForest Company, whose station PH at the Palace Hotel in San Francisco was destroyed in the 1906 earthquake and fire; a rebuilt PH would become a large part of the Marconi/RCA story.

Pacific Wireless Company, established in 1900 on Catalina Island near Los Angeles. Pacific Wireless eventually operated five stations including SF at San Francisco.

Massie Wireless Telegraph Company, whose shore station at the Cliff House in San Francisco became a tourist attraction with its two 200-foot white masts.

United Wireless Telegraph Company, which bought out American DeForest and Massie after the earthquake and rebuilt station PH on Russian Hill. The new Green Street facility had a 250-foot mast and an umbrella aerial. United controlled about 30 coastal stations from Los Angeles to Alaska and hundreds of installations on ships at sea.

The late Commander Richard Johnstone, an early KPH operator and eventually an RCA district manager, wrote of the "old PH" in his memoirs: "It was a boyhood thrill to climb Telegraph [sic] Hill . . . and then listen to the magic of the "PH" spark transmitter as the wind whistled through the guy wires."[17]

The Marconi Wireless Telegraph Company of America had yet to operate a station in San Francisco, but had a network of wireless stations connecting the islands of Hawaii, including HU at Kahuku which would become the high-power transmitting station connected with Marin and San Francisco.

As the first decade of the century passed, distances became greater between shore stations and ships. PH exchanged messages with Matson ships over 1,000 miles at sea, and soon the SS Alameda and SS Mariposa were heard at 2,000 miles. The expanding shipping business on the Pacific saw the need for the service and rapidly equipped ships with the best wireless sets. However, as Johnstone wrote:

> The early installations of wireless aboard ship was beset with unexpected difficulties. Being something new and unusual, both ashore and afloat, people had a vague understanding. It was accepted more or less as a "fad" or an experiment.[18]

All oil tankers had wireless rigs and operators, with Associated, Standard and Union Oil Companies playing, according to Johnstone, "an important part in the development of Pacific Coast wireless communication."

The Pacific Ocean remained without a solid point-to-point (land station to land station) service. Undersea cables of the Commercial Cable Company connected many points on the Pacific, but service was expensive; the transatlantic cable, laid in 1879, had been a focus of Marconi's competitive spirit around the turn of the century, and wireless attracted proponents across the world. In a 1908 experiment, United's PH communicated with Marconi's HU at Kahuku, a distance of more than 2,000 miles. This event foretold a future bond between the two companies as two years later Marconi would take over United and many of the competing executives and staff would become co-workers. The two operators for the 1908 feat would become coworkers four years later: Arthur Isbell of Marconi's operation in Hawaii, and Lawrence Malarin of United Wireless in San Francisco, followed a similar paths and both ended up associated at Marconi and then RCA.

San Francisco's Federal Telegraph Company first transmitted commercial messages to Hawaii, inaugurating service on July 28, 1912. Meanwhile, an international agreement went into effect on July 1, 1911, requiring the presence of a radio operator on many ships, instigating inspections and licensing, assigning specific wavelengths to stations to avoid interference, and replacing the two-letter calls to three: on the west coast of the U.S., the shore station call letters would begin with K, while on the east coast a W; hence, PH became KPH and CC at Chatham, Massachusetts became WCC; it was the other way around for ships, with W for ships on the Pacific and K for the Atlantic.

Amateur operators, who numbered in the thousands at the time, were assigned an area letter, a number designating location and two letters, for example, W6FS for an amateur operator in the California or Hawaii area. The "Hams" received the 200 meter band which was considered unimportant but the hams would prove themselves as great contributors in both science and heroic deeds.[19]

B. Marconi in San Francisco, 1912-1919

Marconi Wireless Telegraph Company of America took over the United Wireless Telegraph Company in 1912, in a deal which included the old Massie Wireless stations as well. The business resided at 320 Market Street in San Francisco. Marconi built a new shop at 50 Main Street and installed Arthur Isbell, formerly with Marconi in Hawaii, as superintendent. It was around this time the word "radio" was coined and the term wireless began a slow descent into obsolescence.

Marconi's acquisition of United Wireless coincided with the expansion of its Pacific wireless business, which until this time had played a minor part in the international company's dealings. That year Marconi technicians decided on a site for the new station to connect the United States with Hawaii and the Orient. The company would build the world's most powerful land station network, while continuing to operate and improve the ship-to-shore station KPH.

In 1913 the company reported that the number of messages handled increased from 228,000 in 1912 to 379,000 in 1913. High-power stations for both the Atlantic and Pacific were under construction: at Belmar, New Jersey, and Carnarvon, Wales (constructed by the British Marconi Company), and in California and Hawaii, all of which would be operational in 1914. The Japanese government commenced construction of a station to connect with the Marconi system on the Pacific. In 1915 Marconi would construct high power stations at Marion, Massachusetts and Chatham on Cape Cod to communicate with Stavanger, Norway. The number of wireless units aboard ships increased dramatically since the Titanic-inspired passage of the United States Ship Act of 1912 which required ships carrying 50 or more people to have a wireless system and qualified operator at all times.[20]

C. Ship-to-Shore Station KPH

The American DeForest Wireless Company started station PH shortly after the turn of the century with equipment located in the Palace Hotel (hence "PH") on Market Street in San Francisco. Business grew until the earthquake and fire of 1906 which destroyed the Palace Hotel. United Wireless bought KPH and moved to Russian Hill, then to Hillcrest at Daly City, on the coast south of San Francisco. In 1911 the station acquired the call KPH and by that time was considered by some to be the most important station on the Pacific Coast. The ship-to-shore operation apparently attracted many of the contracts with large shipping companies, but for many years experienced interference problems with coastal stations which had more powerful signals. Johnstone wrote of "large, high-aerial stations up and down the coast [that] would illegally drown out some ships completely, even less than 200 miles away." Their competitor, KFS, had a Poulsen arc transmitter which could "blank out" KPH reception. Even after its incorporation into Marconi's system, KPH remained underpowered while the company pursued its high power point-to-point capabilities.

KPH operators worked seven days a week in the tiny Hillcrest facility, receiving two weeks vacation per year and $90 per month in salary. Job applicants had to prove a mastery of Morse code, both American and International (wireless), and be able to accurately type incoming messages. Besides handling routine messages such as ship position reports, the station provided a news service, transmitting a daily report to ships at sea at 12:30 every morning. Notification of arrivals of picture brides from the Orient came through KPH. Johnstone, who worked at KPH from 1915-1917, recalled details of the pioneer station:

> The "wireless shack" was at the top of a rocky cliff, exactly between the two antenna poles which were each 250 feet high. The aerial, or antenna, was 500 feet long. Two 4x4 twenty-five foot beams served as spreaders. As the house was directly in the center a perfect "T" formed the lead-in cable. Our ground was a problem. The ground was all rock, and a mesh of galvanized wires were laid over several acres of the hilltop. These wires were welded together to form our counterpoise ground. Grazing cows destroyed much of the wire netting by getting their feet caught, and the net developed into a giant tangle.
>
> The transmitter at KPH was a five kilowatt open core transformer with a rotary spark gap, driven by an induction motor. The spark was about the size of a large olive, and could be heard over a mile from the station. Two banks of oil plate condensers replaced the old type Leyden jars. The tone of the spark was known the world over. It was a beautiful 240 cycle note. About 25 to 30 amperes went into the antenna. Actual records of over 6000 miles were accomplished . . . in January or February 1916.
>
> There were no elaborate furnishings at KPH. Two chairs, a coal-oil heater, a fire extinguisher, and an emergency coal-oil lamp. That was it. We had a snubnosed 38 caliber revolver -- for the little fellows with the black and white fur. Being that the Marconi Wireless Telegraph Company failed to approve such extravagance the operators at their own expense purchased a small hot plate and a coffee pot. Coffee breaks, that is, approved coffee breaks were unheard of, in the days of the old KPH wireless station at Hillcrest.[21]

Wireless operators have long told of the distinguishing characteristics that, with practice, could be discerned among their brethren on the telegraph keys. Johnstone provided a explanation of the individual traits of the wireless operator:

> Both landline telegraph operators and radio operators have what we term a "fist." It may be defined as a particular style of sending which identifies an operator, exactly as a voice identifies a person. There is a definite "swing" or rhythm which one becomes used to. Also some send slow, some irregular, and some very fast. In my years spent with operators, including actual operating, and testing them for efficiency, I found that the best operators among them favored good music . . . .

A wireless operator writing 50 years later expanded on the theme:

> Code, or CW as we call it, is so universal a language that mixed breeds can work together without the struggle that always occurs in voice language. It has a personal quality to it also, just like voice. You can recognize people by what we call their fist. It can be slurred or chopped, sluggishly labored, musically lively, technically perfect, or sent with many other telltale inflections. This does not include the fellow on a ship just leaving port, who is also slightly loaded, and whose rendition of dots and dashes take on an abstract style.[22]

The KPH station underwent improvements in 1916, including new antennas and installation of a quenched-gap transmitter, but the results were disappointing to the old-timers, who missed the raucous old rotary spark system.

sidebar:

The life of a ship's radio operator could be a grand one if he was lucky to be placed on a luxury liner, but often, especially in the early days, it was a dismal existence. Many ships were old, in bad condition and had poor rations and sanitation. Nevertheless, the magical world of wireless at sea transfixed boys and young men seeking adventure and news of the world. Many a teenaged wireless fancier dreamed of life aboard a ship, communicating with strange people of distant lands, visiting exotic ports, and rubbing shoulders with veteran "old salts." They often became a nuisance at port, visiting ships, sometimes sneaking aboard trying to get a glimpse of the Marconi sparks set which would be head and shoulders above the crude sets they would have at home.

Richard Johnstone recalled that many ship captains were slow to accept wireless technology as it potentially undermined their absolute power aboard ship. Wireless operators, while trained in the radio side of things, did not know ship etiquette and often ran afoul of officers; they also were independent, being trained and hired by the wireless companies rather than the shipping operators, so resentment arose when, for example, the wireless man (commonly a very young man) could stroll off the ship as soon as it made port while the seamen had chores to do and tightly scheduled shore leave. Poor quarters, the second sitting at meals, a salary of $40 per month, and rough weather taxed the inexperienced operator and sent the veterans to the comforts of a shore station. In time, the wireless operators, typically nicknamed "Sparks" for the nature of their transmitters, became acknowledged as important and, sometimes life-saving, parts of the maritime fraternity.

Some operators stayed on ships for their career, as many had better situations and found the life aboard ship to their liking, but most of those ended up with careers on shore.[23]

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An early attempt to establish the most powerful Pacific transmitter occurred in 1905-06 on Mt. Tamalpais, Marin County's highest peak and a short distance from San Francisco. The Pacific Wireless Company, based in Seattle and operating short-range stations along the Pacific coast, built a station in late 1905 on the middle peak of the mountain at an elevation of 2500 feet. Heralded as "The Most Powerful Wireless Station Ever Built" by Popular Mechanics at the time, the station featured two 300-foot wooden towers with 3,000 pounds of copper wire stretched between them. The largest induction coil in the world, weighing four tons, was expected to produce 500,000 volts. Unfortunately, a storm on December 10, 1906, toppled the towers and the station was not rebuilt despite assurances to the contrary from the company.[24]

find picture--end sidebar--

MAKE THIS INTO A MAP:

Marconi Wireless had nine coast stations between 1911 and 1917:[25]
California: Avalon KPI; Los Angeles KPJ; San Luis Obispo KDN; San Francisco KPH; Eureka KPM;
Oregon: Marshfield KPX; Astoria KPC;
Washington: Friday Harbor KPD; Seattle KPA

III. Wireless Across the Pacific

A. Marconi Chooses Marin County for Network Link

Marconi Wireless Telegraph Company of America engineers, and according to rumors, Marconi himself, traveled the Pacific coast with their instruments searching for the "cleanest" receiving site. Interference can originate from both natural conditions and competing commercial frequencies so the engineers carried equipment to measure static and interference and to evaluate ground conditions. In 1912 the engineers decided upon the Point Reyes area, ideal as not only the best and cleanest site, and as a bonus in close proximity to its western headquarters in San Francisco. A newspaper reported the first inkling of the development in October of 1912:

> THE BOLINAS WIRELESS [station's] . . . usefulness will be exclusively for trans-Pacific dispatches. We have creditable authority for the announcement that the poles for this important station to be erected about a mile above Duxbery [sic] Reef, are now awaiting use at the Union Iron Works at San Francisco and operations will commence as soon as the deeds to the Inkerman [sic] ranch are placed on record.
>
> It is not yet decided how the electricity necessary for operation, will be served, but we are assured there will be a surplus, for both power and light, and the people of the whole Bolinas locality will have an opportunity to dispense with candles and gasoline before many weeks go by.
>
> Another wireless station will be erected in the vicinity of Tomales Bay for the use of the coast towns north of San Francisco.[26]

The transmitting station would be located on relatively flat cow pasture at the ocean's edge northwest of Bolinas, while the receiving and operating station would be constructed south of the town of Marshall, on the Northwestern Pacific Railroad line, on rolling, grassy hills overlooking Tomales bay. Both were spectacular sites. The distance between the two stations was necessary as the tremendous power of the transmitting facility would blur the reception at its counterpart without a sizeable separation.[27]

The stations would send and receive to matching stations to be constructed in Hawaii, the transmitters at Marconi's Kahuku site on the northeast shore of Oahu, the receiving station at Koko Head, a picturesque site east of Honolulu. These stations would act as relays to Asia, and so were duplexed, allowing them to send and receive from both the Orient and the United States. The design of the buildings and antennas was practically identical to those constructed in Marin County, although the transmitting power house at Kahuku needed to be larger in order to accommodate a steam plant for generating the tremendous amount of electricity needed; the plant would burn fuel derived from sugar cane waste.[28]

Bolinas was (and remains) a small coastal village located about two miles west of the main highway, today's State Highway 1. Founded in the Gold Rush on the Mexican land grant Rancho las Baulines, the town attracted lumbermen, fishermen and boatbuilders, and dairy farmers. Tourists found an attractive destination although the summer weather consisted mainly of cold, foggy days. At the time the Marconi

Company came to the area, Bolinas had no electricity, all dirt roads, and a small wharf that accommodated the local schooners, the Owl and the Jennie Griffin, that plied the waters between the village and San Francisco. Marconi engineers selected a site two miles northwest of the town, a flat and grassy mesa overlooking Duxbury Reef and the Pacific Ocean.[29]

The picturesque hamlet of Marshall, founded by a family of Irish ranchers and potato farmers of that name, sat astride Tomales Bay, a 13-mile long finger of water formed by the ancient San Andreas Fault. A narrow gauge railroad wound its way along the inlets and bluffs of the eastern shore of the bay, with stops at oyster and fish outfits, post offices and the one town, Marshall. South of Marshall lay the obscure settlement of Reynolds, a former Indian rancheria whose residents were descended from the local Coast Miwok tribe. A sandspit south of Reynolds housed numerous Miwok dwellings, all rustic wood frame shacks and houses.[30]

One of the sandspits, known as Fishermen's, became a popular stop on the railroad where fresh fish could be purchased from the locals. Here Marconi built his receiving station.

B. Construction at Bolinas

Marconi Wireless Telegraph Company of America purchased three parcels of Bolinas ranch land totalling 643 acres from the Albert Ingermann family on May 18, 1913. The land included parcels for the transmitting station and support buildings, the vast antenna, and a parcel reaching west over hills to Pine Gulch Creek for a reliable water supply. Easements for transmission lines, which would bring commercial power from Mill Valley and separate telegraph lines owned by Marconi Wireless and connected to Marshall and San Francisco, stretched over the hills to the community of Woodville. Ingermann's dairy ranch with house and barns occupied part of the site adjacent to Mesa Road.[31]

Albert Ingermann emigrated from Prussia in 1854 and became a pilot on a schooner on the Bolinas to San Francisco run. He purchased the ranch in 1866 after marrying neighbor Anna Strain. Mrs. Ingermann died in childbirth but her husband remained, operating a dairy ranch.[32]

The J.G. White Engineering Company drew up plans for the buildings and acted as construction contractor, beginning work by the middle of 1913. The plant would consist of four major concrete buildings: the power house, hotel and two cottages, and additional wood frame outbuildings including a garage, cottages and shacks holding technical apparatus. The largest of the structures, the power house, was two stories high with massive reinforced concrete walls and steel framing, large multi-light wood-frames windows and a bi-level roof with tiled hipped-roof clerestory units. The concrete foundation required additional piers and foundations for huge motor generators, disc dischargers and other machinery. A cooling tower with a massive concrete foundation stood west of the powerhouse, overlooking the ocean bluff.[33]

The hotel, referred to as a "commodious clubhouse" by the San Francisco Chronicle at the time it opened, would serve visiting technicians and dignitaries as well as some of the operating staff as needed.

Built with two stories with a tile roof, 18 sleeping rooms and a kitchen and common area, the hotel featured landscaped grounds and a tennis court located nearby. Two matching concrete cottages, also with tile roofs, would house the Engineer-in-Charge and the Assistant Engineer; one cottage was located adjacent to the hotel and the other closer to the power house. A wood-frame cottage near the ocean bluff would house the Chief Rigger (the first of whom was George Hansen).[34]

C. Construction at Marshall

For the Marshall receiving station, Marconi Wireless Telegraph Company of America purchased 1,125 7/10 acres of the former Kowalsky Ranch in a puzzling two transactions: first, on August 31, 1912, from longtime Marshall-area dairyman Silvio J. Maggetti and his wife, Clorinda; then, on February 26, 1913, from the W. F. Breeze family, the second transaction apparently necessary after settling a title problem. The parcel reached from Tomales Bay shoreline to the ridge top. Samuel J. Clark sold a right-of-way for a line tower in June, 1914.[35]

Construction began mid-year and by December of 1913 the structures were nearing completion and some antenna masts had been constructed. The structures included the operating building on the north side of the property, a large, 35-room hotel for staff and visitors, two cottages matching those at Bolinas (and the Hawaiian stations as well), a power house and various wood-frame outbuildings. Reportedly, the company spent $226,000 to build the Marshall station alone. As at Bolinas, the major structures were built of reinforced concrete and steel with tile roofs. No doubt over 100 workers labored on the Marin project; in Hawaii, 141 persons worked at Kahuku, and 108 at Koko Head. James Marshall told a Marin County reporter how Marconi "paid a premium for land and for men. They paid $5 a day for riggers, really something for those times."[36]

Civil engineer John C. Oglesby recalled the extensive receiving antenna system installed at Marshall:

> They (Marconi Wireless Telegraph Company) wanted to get a beam to China. So they had to run an aerial line 12 miles long on the great circle that took in China at this station. We ran the thing back into Chileno Valley. It had to be anchored in water so we dug a well and put the termination of the line into water. Then they wanted a beam for Tokyo. We ran a line from Marconi to Tocaloma on the great circle. We had Paper Mill Creek to terminate the line. But this never did go into service. A discovery was made that two ordinary power poles set approximately 40 feet apart with wires draped between them crossing the great circle at Marconi did the same service as the long aerials.[37]

For this antenna system Marconi Company had to obtain rights-of-way from dozens of land owners in the area.

D. Challenges of Construction

Materials and equipment for both the Bolinas and Marshall sites arrived by wagon from both the Northwestern Pacific Railroad line at Point Reyes Station and from the wharf at Bolinas, home port for the small steamers Owl and Jennie Griffin. The Owl, operated by Louis Petar and Arthur Bourne of Bolinas, hauled much of the equipment; according to Oakland historian Ted Wurm: "It is said some of the wireless masts were so long they projected well beyond the vessel's hull fore and aft on the journey." Sherman Smith of Bolinas had the teaming contract from the Bolinas wharf. According to the former county surveyor, road bridges had to be strengthened to handle the Marconi loads.[38] A contemporary magazine reported:

> The site at Bolinas is not advantageously located for bringing in heavy loads of material . . . the coast is so dangerous to shipping that owners of vessels are reluctant to have their craft navigated in and out of the bay. As a matter of fact, only one small schooner enters the bay, and she makes the trip only when there is enough material to warrant it. The construction work has strained to the utmost the schooner capacity of 100 tons and overloaded the wharf. A larger derrick has been installed to unload the heavier pieces and the area of the wharf has been extended to give greater space for materials.[39]

The station at Bolinas would require tremendous amounts of electricity in order to throw electromagnetic waves across the ocean from its two 300 KW transmitters, operating on 6,700 meters or 44.77 KHz. Pacific Gas and Electric Company constructed a 20-mile long, 11,000 volt line from the Northwestern Pacific Railroad's powerhouse at Alto, built near Mill Valley in 1903 to serve electrified interurban rail service in Marin County. The line passed over the rough, wooded terrain of Mt. Tamalpais to the Bolinas area. Some of the canyons required long spans to cross, the longest of 1,440 feet at the Bourne Ranch on Bolinas Lagoon. With commercial power terminating at Woodville north of Bolinas, the Marconi Company ran the final mile to the transmitting station underground on rights-of-way that had been purchased previously. Nearby towns of Willow Camp (Stinson Beach) and Bolinas tapped the new line, bringing many 20th century improvements to the households there.[40]

Haraden Pratt, fresh out of the University of California at Berkeley, obtained an appointment as assistant engineer at the Bolinas station, while a classmate took a similar job at Kahuku in Hawaii. Pratt arrived as the building contractors were finishing, in order to set up and test the transmitting equipment. Pratt's boss, Adolph Rau, soon took a three-week leave for a honeymoon. "When he returned to Bolinas," Pratt wrote, "we were already testing with Honolulu." Pratt found the assignment a challenge, with missing or incorrect blueprints and an unreliable delivery system for the equipment. Horse-drawn wagons carrying equipment got bogged down in muddy roads and the ocean steamer service operated on the whims of the tides and weather. "To make matters worse, my only technical assistant electrocuted himself," he recalled. There were other problems as well, as Pratt related:

> At this high-power Marconi station, some 2,000 amperes of current flowed in the local oscillatory circuit through bus-bars which were twenty-four inches wide. When the power was first turned on for the initial test, the building filled with smoke from burning paint on the beautiful steel and iron bus-bar supports, which became excessively hot. Entire new supports of bronze had to be made in San Francisco to replace the iron and steel.[41]

Despite ongoing technical problems, the transmitting station began operation on September 24, 1914, amongst great fanfare.

E. Opening Day: First Service to Hawaii

The great Marconi station, with its counterpart at Kahuku being two of the three largest in the world (the other, of equal power being Marconi's new station at Belmar, New Jersey), opened on September 24, 1914, with a ceremonial message between dignitaries of San Francisco and Hawaii. One writer characterized the event as "a victory over place and time the like of which only the living generation has experienced, and it is doubtful whether our sons or yet our grandsons will witness another triumph on so gigantic a scale."[42]

Guests rode the Northwestern Pacific ferry to Sausalito, the train to San Anselmo, then boarded auto stages to Bolinas. Included among the dignitaries were Mayor James Rolph of San Francisco, Captain Robert Dollar of the famous Dollar Lines, M.H. de Young, owner of the San Francisco Chronicle, C. F. Michaels, head of the San Francisco Chamber of Commerce, and others including a contingent representing Marin County. While a similar party with 200 guests was going on at Kahuku, visitors to Bolinas ate a sumptuous lunch, heard speeches and toured the facility courtesy of A. H. Ginman, superintendent of Marconi's Pacific Coast Division. Ginman's fellow company representatives included district superintendent G. Jessop, C. H. Taylor, assistant chief engineer for the Marconi International Communication Company in London, and A. H. Rau, chief engineer of the Bolinas station.

At the appointed time of two o'clock, a guest pressed a silver key at the luncheon table at Kahuku and the first message was sent to "the great concrete station" at Bolinas (via the Marshall receiving station) from Governor Pinkham of Hawaii to President Wilson:

> With time and distance annihilated and space subdued through wireless triumphs and impulse, the Territory of Hawaii conveys its greetings, profound respect and sympathy to Woodrow Wilson, President of the United States, as he so earnestly seeks the blessing of peace and good will for all men and all nations.

This message was then sent via Western Union land lines to Washington, D.C. The Bolinas operator relayed the response from the president:

May God bless the nations together in thought and purpose and lasting peace.

The mayor of Honolulu then sent "personal aloha and good wishes" to Mayor Rolph, who responded:

> Your cordial message has been received by me in the operating room of the Marconi Wireless Company at Bolinas, and with me a large delegation of San Franciscans. We are the guests today of the Marconi Company, witnessing the inauguration of their new wireless service with our neighbors in Hawaii. We send you hearty greetings and join with you in wishing success to this new enterprise, which benefits us all. Aloha from San Francisco to Honolulu, to which I add personal regards to you.[43]

Guglielmo Marconi sent a message, evidently from London:

> Please accept for yourself and convey to [Marconi engineer] Taylor and all those associated with him my warmest thanks for their effective work in forging the first link in the Pacific chain.[44]

Other messages followed, including ceremonial words from the U. S. Secretaries of War, the Navy, and Commerce Department; the chief of staff of the Army in Washington and the commandant of Mare Island; and various Chambers of Commerce and commissions. At the end of the ceremony, commercial service commenced.[45]

The San Francisco Chronicle reported on its front page that "with an interchange of messages . . . spanning 2100 miles of open ocean, the two great Marconi stations on the Pacific were opened . . . . [The messages] spread over the sunlit sea from the gigantic masts of the Bolinas station. Almost simultaneously it was read by the operator at Kahuku, in Hawaii, for the time of wireless transmission between these two points is but a fraction of one second." The reporter noted that "the first impression of [the station's] power comes from the nine steel masts, each 300 feet high . . . from which the messages are flashed across the seas and literally 'over the heads' of intervening shipping, whose radio apparatus is not keyed to receive the long waves of this long distance service." The reporter continued by describing technical aspects of the station:

> The very size of the buildings and the stability of their construction also speak power. But when one hears the deafening sound of the sparks--deafening even when it comes through two heavily padded doors, and from a chamber that is inspected in operation only through a tube with the aid of mirrors--then there is no mistaking the expression of power.
>
> These sparks, which singly would be so many crashes of sound, coming at a frequency of 420 a second, blend in a note--high A in the musical scale, but reminding one more of the high-pitched shriek of a gigantic circular saw than of things melodious.
>
> The sparking is continuous. The function of the operator at the keyboard is to regulate its transmission to the antennae on the high masts by opening and closing the switch, all of which is done with the same kind of instrument used by the other telegraph operators and at a speed of from eighty to 100 words a minute.

> The system used at Bolinas is duplex. That is, messages are received and sent at the same time. This is accomplished through a second station twelve miles to the north of Bolinas, on Tomales bay, where the incoming messages are not blurred by the noise of the big sending plant, which in turn is operated directly from the distant station through an overland wire, whose operator opens and closes the switch in the big power station with the ticking of his key. By this arrangement, if a word is not understood in a message being received, the operator may instantly "break," as in wire communication, and ask for a repetition.
>
> Owing to the great power of the plant, it is expected to maintain a constant day as well as night service with a staff of twelve men, working in three shifts, and including three engineers, three operators, three dynamo attendants, a machinist and three riggers."[46]

A report in The Wireless World further described the technical operation of the spark system in place at Bolinas:

> The current . . . is first transformed to 440 volts, all the mechanical parts of the plant being operated at that voltage, including the motor that drives the alternator, changing the current to 210 cycles and 2,000 volts. It is then stepped up in transformers to 13,000 volts, at which voltage it charges the condensers and is sparked across the discharger, which is mechanically connected with the alternator by a shafting and run at 1,800 revolutions a minute, the number of studs in the discharger giving a spark frequency of 420. From the condenser banks to the discharger the current, instead of being carried on copper wires, is transmitted over continuous copper sheets more than a foot in width.

The writer continued with a description of the Kahuku transmitting station, site of an older Marconi operation and almost identical "brother" to the Bolinas plant:

> The great plant at Kahuku, which is literally the largest wireless station in the world, is a system to wonder at; the huge concrete power house with its bewildering mass of machinery, its huge coils, its mysterious glass tanks, its spark room where red danger signs flame on the walls and where an incautious intruder would emerge with deafened ears, all create an atmosphere which is best described as indescribable.[47]

The series of antennas at the stations warranted lengthy descriptions in technical journals. The Bolinas and Kahuku antennas elicited a great deal of attention for their sheer size and power. One account explained some of the tricks to keeping a series of 300-foot masts standing:

> The masts of these stations are of the Marconi type of pressed steel sections bolted together and erected from the base of concrete. The novel feature of construction is the arrangement of guy wires and their connection. To support one of these larger masts requires 12,500 feet of 1-inch diameter steel cable of exceptional tensile strength. The difficulty of the guying problem arises from the necessity of breaking up the lengths of wire at frequent intervals with porcelain insulators. This must be done to prevent absorption of the energy of the wireless waves by the guys, which would occur if any length was long enough to have a period of

> vibration approximating the wave-length of the transmitting station, or even a division of the wave-length. All energy thus absorbed is lost to any practical work.[48]

Wireless businessman Ralph M. Heintz wrote of the "enormous antennas" at Bolinas, where the high towers "made triangular baskets, [like a] spider web between those towers that came down to a lead-in." Because of the harsh and salty marine environment, the guy wires at Kahuku and likely Bolinas were protected by layers of paint, Russian spun yarn and a coating of tar.[49]

Assistant engineer Haraden Pratt recalled one incident at the station opening not reported in the papers:

> At the inauguration of service, Mr. Ginman escorted a busload of prominent San Franciscans, including Mayor James Rolph, to Bolinas. While they were looking at the oil-filled entrance insulator for the antenna feeder, it exploded. Fortunately the oil spray did not reach the place where the visitors were standing. It took some time for a crew to chop a hole in the concrete wall to clear the antenna feeder.[50]

The opening of the station was no doubt a blow to the cable companies, whose monopoly and high rates would come to an end. Also aiding the wireless business would be the imminent opening of the Panama Canal and the increased maritime activity in the Pacific Ocean that would result.

The public could choose from a number of service options, including a Weekend Lettergram, Cable Letter, Deferred Service and a Press Service. At the opening of regular service at the station, rates were set as follows: 25 cents a word for regular messages; one dollar for the first ten words of a lettergram, and one and a half dollars for the first twenty-four words of weekend lettergrams. Rates were set for British communication, and all international messages were designated "Via Marconi". Messages to Hawaii could then be sent by Marconi wireless to the islands of Maui and Kauai, or would be mailed at no charge to the other islands.[51]

A contemporary technical journal described electrical facets of the operation at Bolinas:

> Energy is supplied by an 11,000-volt 3-phase transmission line connecting with the Pacific Gas and Electric Company's sub-station at Alto [near Mill Valley], Marin County. This is stepped down to the proper voltage through four transformers. Two of these transformers are normally held in reserve. They supply power for the frequency changers, auxiliaries, exciter sets, air compressor motors, blower motors, fan motors, and the motors driving AC generator sets furnishing power for the operation of signaling circuits, all of induction motor drive.
>
> The current supplied by the frequency changers is again stepped up through five transformers of special design, one being held in reserve.
>
> All of the above units are in pairs, allowing one complete frequency changer and set of auxiliaries to remain in reserve. All units are each interchangeable. The switching arrangements allow any transformer to be cut out on both high and low sides, the step-down transformers being connected to the 11,000-volt feeder line through remote control oil-switches placed in vaults underneath the switchboard gallery.

The high voltage circuit charges a large condenser which, in turn, discharges twice per cycle through 24-inch wide copper strip buses across the spark gap, located in a sound-proof vault.

The compressors supply air for cooling and regulating the discharge, ventilation being supplied with fans. The condenser discharges in series with an inductance, constituting the primary of an oscillation transformer, the secondary of which is connected directly to the aerial-earth system through two regulating coils.

Eight 300-foot tubular steel masts support a 32-wire rectangular antenna about 2000 feet long and 600 feet wide. Directly below this is an elaborate ground system of 32 wires besides an earth plate buried in the ocean below the low-water level.

Signalling is done manually or automatically, at either Marshall or Bolinas, and the arrangement makes it possible to operate the transmitter at very high speed. A small benchboard contains the instruments and switches controlling the automatic circuits. Lightning protection is afforded by four disconnecting and grounding switches located in the incoming aerial line.

Lighting and small power for the entire plant is stepped down to 110 volts through two 25 KVA 3-phase transformers. A machine shop is located in the main generator room. Two rooms on the second floor provide space for an office and an operating room. Here the operator has in front of him the necessary switches for the changing over from transmitting to receiving, lamps being provided to indicate to him the position of the controlling apparatus.

The power-house thus resolves itself into two sections: the first being virtually a sub-station containing switching apparatus, step-down transformers and generating equipment proper, the second comprising the radio equipment proper. All the buildings are of structural steel and reinforced concrete construction.[52]

Marconi organized the staff at the stations efficiently and the company provided recreational opportunities to counteract the rigors of the isolated location. As described at the time of the opening of the station:

Each station has three department heads. The operating manager has direct supervision over the handling of traffic, and is held personally responsible for the efficiency of the operating staff.

The engineer-in-charge is held responsible for all electrical and engineering equipment, and must see that the apparatus is at all times in condition for efficient operation.

The hotel manager in charge of the living quarters is an experienced hotel man. He is held responsible for the proper management of the staff's living quarters. These consist of reinforced concrete buildings at each station. The ones at the receiving stations contain thirty-five rooms, part of them with connecting baths.

Each hotel has a reading and writing room, billiard and card rooms, and a large reception room. The hotels at the transmitting stations have equal accommodations, except that there are but eighteen sleeping rooms.

In addition to these hotels, there are four cottages at each set of stations. These cottages are finished throughout in oak, are modern in every detail, and are completely furnished by the company.[53]

F. Operations, 1914-1920

The Bolinas station took on the call letters KET, its Hawaiian counterpart KIE. In the years after the Marin stations opened, many advancements occurred in both wireless technology and in the distances reached by the transmissions around the world. A radiogram received in San Francisco (presumably at the Marshall Marconi station) from Papeete, Tahiti made headlines in 1916 which noted the astounding distance of 4,000-miles covered. That year the Marconi station received signals from Europe. Marconi manager Lawrence Malarin stated, "Our station at Point Reyes has picked up many messages from Hanover, Germany in the past few months. It is considered unusual, as our station is not tuned to work with the German stations. We have made no attempt to cut in other than to identify the messages as coming from the Hanover station. The distance between San Francisco and Hanover is approximately 7,000 miles."[54]

The biggest news of 1916 came with the opening of the Marconi service to Japan, creating the longest commercial link in the world. Marconi established service between Bolinas and Funabashi, a government owned station ten miles from Tokyo, via the Hawaii Marconi stations, on July 27. Japanese messages during the testing were picked up at the Marshall station, an amazing feat for the time. Commercial service opened on the morning of November 15, 1916. As with the ceremonious dedication of the station in 1914, wireless greetings were exchanged between President Woodrow Wilson and, this time, Yoshihito, Emperor of Japan. The President's message read:

> The Government and the people of the United States of America send greetings to your imperial majesty and to the people of Japan, and rejoice in this triumph of science which enables the voice of America from the Far West to cross the silent spaces of the world and speak to Japan in the Far East, hailing the dawn of a new day. May this wonderful event confirm the unbroken friendship of our two nations and give assurance of a never ending interchange of messages of good will. May the day soon come when the voice of peace carried by these silent messengers shall go into all the world and its words to the end of the world.

Emperor Yoshihito responded:

> It affords me much pleasure that the first use of the installation of wireless telegraphy between Japan and Hawaii has been to transmit your cordial message. In return, I send this expression of my thanks for the good will exhibited toward me and my people and of the hearty desire entertained throughout Japan for the continued prosperity and welfare of the United States.[55]

Using the relay at Hawaii, the message traveled about 5,400 miles. Other messages from public and commercial interests followed, including from a Marconi executive who spoke of the link "which welds two nations together by an invisible bond." A message from Guglielmo Marconi himself noted that "the cheaper and easier communication made between two peoples the better do they learn, know and under-

stand each other, and the greater is the development of their mutual interests. May this new service contribute substantially in this direction." Rates to Japan were set at eighty cents per word, as compared to $1.21 charged by the cable companies.[56]

Less than a month later, general manager Ginman resigned, as did George Jessop of the marine division. New managers from other parts of the Marconi organization replaced them. Ginman had joined American Marconi in its second year, 1900, participating the growth of the business and technology from communications of fifty miles to the recent Tokyo triumph.[57]

Long the bible of wireless students and technicians, Elmer E. Bucher's Practical Wireless Telegraphy featured a technical description of the Marconi stations as they were in 1917:

> Because the transmitter at Kahuku is duplexed for simultaneous transmission to Japan and the U.S.A., the two circuits, No. 4 and No. 5, have been grouped together. Beginning with the Bolinas Station, the transmitter is of 300 K.W. capacity, current for its operation being supplied by duplicate 500 H.P. steam turbine driven generators delivering current at 180 cycles per second. In the usual manner, this current is stepped up by closed core transformers to approximately 50,000 volts and employed to charge a bank of high voltage oil plate condensers. Although normally operated at from 75 to 150 K.W. the full 300 K.W. can be employed whenever necessary.
>
> The aerial for receiving [sic: transmitting] from Bolinas, Cal., is nearly a mile in length erected on two rows of tubular steel masts in the usual manner. The receiving aerial at Marshalls, California, has 7 masts, each of which are 330 feet in height.
>
> The receiving station at Koko Head, Hawaiian Islands, has two distinct receiving aerials, together with balancing out aerials, one being employed for reception from Bolinas, Calif., and the other from Funabashi, Japan.

The report lists the notable Marconi high-power transmitting stations in the world which include: Carnarvon, Wales, 100-300 KW; Clifden, Ireland, 75-150 KW; Glace Bay, Nova Scotia, 75-150 KW; Stavanger, Norway, 150 KW; Marion, Massachusetts, 150 KW; New Brunswick, New Jersey, 150-300 KW; Bolinas, California (300 KW, wave length 6,000 to 12,000 meters); and Kahuku, Hawaii, 300 KW.[58]

G. World War I and the Wireless Stations

The war in Europe had loomed on the eastern horizon for two years, and when the United States entered World War I on April 6, 1917, the Navy closed all private wireless stations and took over operations of some strategic ones, including Marconi's KPH and KET. Lieutenant C. H. Maddox, district naval communications superintendent, issued the order on April 9, 1917. It read, in part:

> Pursuant to the President's War Proclamation, all radio stations of all classes are hereby ordered closed and dismantled immediately, except such stations as are specifically permitted to

remain in operation under competent military authority.

All aerials, antennae or wires for radio or wireless communication, whether for transmitting or receiving, or both, must be taken down and all apparatus disconnected.

The antennae on all merchant vessels must be lowered to decks when such vessels are within the three-mile limit of the United States.[59]

The Navy took over 53 of the American Marconi stations including the high-power stations at Point Reyes (renamed NWO by the Navy) and Hawaii, and closed at total of 28. The KPH facility at Hillcrest was taken, but the staff enlisted as Navy personnel. The KPH receivers moved first to San Francisco then to Yerba Buena Island, and an enlarged staff of twelve handled the traffic, of which there was little due to the communications blackout. Marconi was effectively out of the communication business but their 20,000 square-foot manufacturing plant at Aldene, New Jersey received millions of dollars of equipment orders from the American government. Marconi technology aided the war effort in immeasurable ways, providing facilities, new equipment and trained personnel. Included in the Navy takeover were all of the communications patents, a treasure trove reflecting decades of invention and development of wireless technology.

The U. S. Navy takeover had a broad effect which would change the face of the national, and eventually, international wireless business. According to RCA historian Kenneth Bilby, "through its wartime powers, the navy had coalesced a bickering and fragmented wireless industry into an instrument of national utility."[60]

At war's end in 1918 the Navy purchased 45 of the coastal stations they had taken over from Marconi for $789,500; David Sarnoff, the commercial manager of the company, made the announcement. However, the stations at Bolinas, Marion (Massachusetts) and New Brunswick would be returned to the company. President Wilson approved return of the stations to their owners on July 11, 1919, effective March 1, 1920. So many advancements had been made during the war effort that most of the lower-power coastal stations would be out-of-date and scrapped, and the next five years would prove to be an era of great advancement in the field of wireless, and great changes at American Marconi.[61]

The Marconi timed spark 300 KW transmitters became obsolete, with the lower-powered arcs replacing them. The revolutionary 200 KW Alexanderson alternator developed by General Electric had come into use during the war and Marconi himself was very interested in its use. Marconi's desire to obtain rights to the alternator caused concern among the Navy and fueled a patriotic sentiment with the intent of keeping foreign powers from controlling the wireless media in the United States. A movement arose in the government and industry to relieve Marconi of his hold on American wireless, resulting in the formation of Radio Corporation of America which would receive exclusive use of the revolutionary alternator and thus stifle Marconi's international growth. Surprisingly, American Marconi executives supported the idea.[62]

Marconi Wireless Telegraph Company of America president John W. Griggs wrote to stockholders explaining why a sale to Radio Corporation should be supported:

The principal aim and purpose of the Marconi Wireless Telegraph Company of

America during all the period of its existence, has been the establishment and maintenance of transoceanic communication. Although the company has done no inconsiderable business in minor branches of the Wireless art, such as the equipping of vessels, the operation of ship to shore traffic, the collection of royalties, and the manufacture of wireless apparatus, yet these by the management have always been considered as incidental to the greater and more profitable business of long distance communication.

We have found that there exists on the part of the officials of our government a very strong and irrevocable objection to your company because of the stock interest held by the British Company. Consequently your company has found itself greatly embarrassed in carrying out plans for an extensive oceanic traffic, and unless the British Marconi interest in your company is eliminated, your President and Board of Directors believe it will not be possible to proceed with success on the resumption of its preparations for a world wide service when its stations shall be returned to it, as they will be in the near future.

In a word, we are satisfied and convinced that in order to retain for your company the proper support and good will of our own government it is necessary that all participation in its stock, as well as in its operations on the part of any foreign wireless company must be eliminated.

Having these considerations in mind, your officers have lately undertaken to remove the objections of the government and to do away with the threatened embarrassment of which we have spoken.

Certain long distance and other radio devices and systems have been developed by General Electric Company. Some of these devices and systems promise to be of great value in transoceanic radio communication.

A corporation has been formed called the Radio Corporation of America which has entered into an agreement with General Electric concerning present and future patent rights, the manufacture of patented apparatus and devices exclusively by General Electric for R.C.A. and the exclusive right of R.C.A. to sell patented radio apparatus of General Electric.

General Electric has appropriated two and a half million dollars, a portion of which is to be used by G.E. under an agreement satisfactory to your Directors in the purchasing of the shares of stock in your company now owned and held by Marconi Wireless Telegraph Company of Great Britain.

Each stockholder of Marconi Wireless Telegraph Company of America will have the privilege of exchanging his stock in the company for an equal amount, par for par, of the preferred stock of R.C.A. and in addition shares of common stock of the new company equal in number, to the shares held by the present company.[63]

MWTCA shareholders met on November 20, 1919 and agreed to the proposal. The operating organization, patents, factory at Aldene, approximately 350 ship installations and its three high power land stations -- Bolinas/Marshall, Kahuku/Koko Head and New Brunswick -- were transferred to RCA. Marconi sold the properties at Bolinas and Marshall to RCA on March 27, 1920, and on April 6 the shareholders met again, this time to dissolve the company.[64]

IV. Radio Corporation of America

A. Birth of a Monopoly

With the blessing of the U. S. government, specifically Navy Secretary Franklin D. Roosevelt whose influence with President Wilson was key to the deal, and with the transfer of the wireless patents the Navy had held during the war, Radio Corporation of America was created on October 17, 1919. General Electric Company paid Marconi Wireless Telegraph Company of America 3.5 million dollars for a controlling share of its stock. Officers of the new company were: Owen Young of General Electric, Chairman; Edward J. Nally, former General Manager of Marconi, President; and young David Sarnoff of Marconi, Commercial Manager. The new company inherited the remaining commercial wireless facilities from the Navy.

While the merger of General Electric with Marconi Wireless gave birth to Radio Corporation of America, a consortium of additional large companies was necessary to build the patent pool to make the business competitive. RCA approached its competitors, American Telephone & Telegraph Company (AT&T) and Westinghouse Electric Company, both of which had been deeply involved in wireless advances during the 'teens, especially with their lucrative government contracts during the war. AT&T was the giant of the telephone business and held DeForest's patent of the Audion tube; Westinghouse was a smaller but important manufacturing competitor to GE, holding the patents to Armstrong's devices and in the process of acquiring wireless stations across the country. These companies wholeheartedly supported the Americanization of wireless communications; another business, the United Fruit Company, joined the deal, as they had a fleet of banana boats that relied on wireless. AT&T exchanged its patents for 10.3 percent of RCA preferred stock; Westinghouse obtained 20.6 percent, and United Fruit Company took 4.1 percent for rights to its patents on crystal detectors and a loop antenna. General Electric held 30.1 percent, the largest block of RCA stock, and various investors and brokerage firms held the remaining 34.9 percent. Together, the participating companies owned almost 2,000 patents, most of important of which was the vacuum tube. The deal smacked of monopoly, but the sentiment at the time supported any move towards American domination of international communication.[65]

While RCA set to work upgrading its wireless stations and expanding the wireless network, much of the focus shifted to providing radio to a mass audience. RCA began to manufacture personal radio sets and to broadcast entertainment such as sports events and music. The east coast broadcast in 1921 of the Dempsey-Carpentier fight opened and era of public demand of home entertainment. However, the expansion of the wireless system was not lost in the shuffle, and RCA organized its transoceanic stations for full efficiency.

Arthur Isbell, the Hawaii-based operator for Marconi in the 1908 test, became the Pacific Coast general manager and Lawrence Malarin, Isbell's United Wireless counterpart in that test, was appointed marine superintendent. At this time, vacuum tube transmitters were being installed on ships around the world, but tube technology for land transmitting remained experimental. After restarting KPH, RCA's

marine competition in the early 1920s included the Federal Telegraph Company, Globe Wireless Company, Kilbourne-Clark Company from Seattle, Haller-Cunningham Company, Gray and Danielson Company, Ship Owners' Radio Service and Independent Wireless Company. Competition was brisk and sometimes fierce, and hundreds of experienced radio operators were available after their wartime training and service. Ships sailing under the United States Shipping Board were assigned commercial stations so as to spread around the business.[66]

Radio Corporation of America grew rapidly during the 1920s. In San Francisco, the high-power circuits and marine service at Marshall and Bolinas were controlled from the San Francisco office, which also had a growing sales department which distributed home entertainment apparatus, tubes and radio receivers. In the mid-1920s RCA moved to new, larger quarters, with the sales department occupying an entire floor. The marine shop was moved to Brannan Street. Numerous newcomers entered the business, sometimes leaving the "sparks" oldtimers bitter at the new breed of entertainment salesmen and ambitious corporate types. Around the country, competing businesses felt bitter about the monopoly. Ralph Heintz, contracted by the Dollar Steamship Lines to install radio apparatus aboard ships, reminisced about pursuing his work "in spite of the Radio Corporation's patents. They had everybody by the throat in those days .... Instead of being a patriotic thing, it was just the opposite. Radio Corporation took command of the whole thing and denied the use of their patents to everybody unless they were in this group .... It was such a foul monopoly that congress proceeded to break up the Radio Corporation . . . they were stifling all competition."[67]

Using the resources afforded them by the multi-corporate roots of RCA, engineers rapidly developed and installed the latest technology in the shore stations. A series of Alexanderson alternators, developed by General Electric's Dr. Ernest F. W. Alexanderson (1878-1975) during the war, was installed at Bolinas in 1921 and the east coast high-power transmitting stations. With most of the important patents in its hands, RCA and its cohorts produced tube sets, antennas, tuners and all of the equipment it could need to dominate the international communications field. Between 1921 and 1922 the number of messages carried by RCA increased from 18 million to 23 million, while the gross income of the company increased by almost 50%; RCA's Radiomarine division increased from $553,000 to $630,000 in the same time. Because of RCA's powerful place in the Pacific Rim, U. S. Navy Secretary Josephus Daniels claimed in 1922 that "nobody now fears that a Japanese fleet could deal an unexpected blow on our Pacific possessions . . . radio makes surprises impossible."[68]

During this time RCA adopted the slogans "World Wide Wireless" and "Via RCA". Advertisements encouraged consumers to "mark your Radiograms 'Via RCA' and insure Accuracy -- Speed -- Economy." Ship-to-shore rates ranged from nine cents per word from San Francisco to fifty-five cents per word from the Yukon. Marine rates included a six cent coast tax. Transoceanic rates were 25 cents per word to Hawaii (40 cents to other islands) and 72 cents to Japan. Services known as Night Letter and Week-end Letter continued as in the Marconi days.[69]

RCA continued to soar in the inflation-free economy during the 1920s. The public bought cars

and radios with their high wages, and RCA stock was among the most popular and safe to own. The demand for home entertainment brought the birth within RCA of the National Broadcasting Company (NBC) and the purchase of Victor Talking Machine Company, as RCA became involved with radio networks, motion picture sound, car radios. The 1920s brought prosperity and an ambitious direction to the Marin wireless stations.

B. The 1920s at RCA's Marin Stations

The reopening and relocation of KPH restarted a significant chapter in marine radio history. RCA inherited the station from the Navy in 1920 and chose to restart the service in the Marshall receiving plant. Frank Shaw, a Marconi oldtimer who had worked at Hillcrest and possibly the original PH, accepted the task of reopening KPH at its new location at Marshall in April or May of 1920. Shaw immediately hired Raymond Walling as his assistant. Walling wrote, 56 years later:

> Within a matter of several days KPH was open for business. The transmitter was a shipboard model P-8 quenched gap rig operating at about 1 1/2 KW. It was installed in a small "Chick Sales" type of a building at the base of one of the transpacific 365' towers. The antenna was a 4-wire flat-top on spreaders and suspended from the top (or near top) of the tower at a sharp angle to a ground anchor. The receiving installation was something that almost defies description . . . .[70]

Shaw and Walling each took 12-hour shifts, spending much of their time trying to get business away from the Navy stations, which at that time still offered commercial service. The poor equipment made this a difficult task, and only after RCA upgraded KPH with a 7 1/2 KW transmitter at Bolinas. The KPH operating crew increased to three, eventually growing as business picked up.

Walling also described part of the KET system at Marshall:

> The station building consisted of three operating rooms, the office of the engineer-in-charge and a furnace room in the basement. The Transpacific receiving antenna consisted of two narrow spaces wires supported by 7 or 8 365' guyed towers running into the back country for possibly 5 or 6 miles.

W.R. Gompf acted as engineer-in-charge upon the reopening of point-to-point KET, to be succeeded by Frank M. (Red) Roy and then Irl C. Reid. Frank Shaw left KPH in 1921, to be replaced by John (Jocko) Parachini, who would stay with the station until World War II. RCA often assigned student operators from the RCA Institute in San Francisco to sit in with the operators and copy code for practice.[71]

A dramatic event in the Pacific put KPH in the news on October 12, 1922. A rapidly moving fire overtook the passenger liner City of Honolulu, with 261 people aboard, while she was steaming more than

600 miles off shore. San Francisco marine stations of RCA and Federal Telegraph Company picked up the SOS distress calls and, after determining the position of the ship and her potential rescuers, relayed word to the nearby ships, including the steamer West Farallon, Army transport Thomas and Matson steamer Enterprise. Operators at KPH stayed in constant contact with the crew of the Honolulu until they abandoned ship less than five hours later. The rescued passengers watched from the Thomas as their ship disappeared in flames; they would be delivered to San Francisco in three days.

The San Francisco Chronicle littered the front page coverage with items headlined, "Wireless Wins Victory Over Sea" and "Radio Corporation Scores Triumph." In a dramatic rendition of events, a reporter wrote:

> A wireless net, cast over the Pacific Ocean Thursday, swept nearly 300 souls to safety and scored another victory of the air over the sea . . . . Ashore and afloat the sparks that talk leaped into the ether to sound the call of helpless passenger steamer, but to one man belongs the credit of saving the castaways from the City of Honolulu many hours in open boats, and possibly the lives of some. His name is H. E. Coyle and he is the wireless operator in charge of the Federal Telegraph Company's Beach Station in San Francisco.

RCA's Arthur Isbell claimed that KPH operators caught the SOS hours before any ship in the Pacific, and noted that RCA was the only station powerful enough to communicate with all the vessels concerned in the rescue; the news accounts reflected the heavy competition in the marine radio business at the time. Needless to say, the wireless science had proved its worth many times over with this and other incidents at sea.[72]

Newspapers routinely reported ship arrivals and departures, and for many years the San Francisco Chronicle and its competitors published columns of "Wireless Reports" which detailed the position of ships all over the Pacific, organized by the source marine radio station. For example, Radio Corporation's report for November 11, 1923 listed 37 ships like this:

> Stmr CITY OF VICTORIA--Kobe for Coos Bay; 860 miles from Coos Bay.
> Stmr GOLDEN GATE--Vancouver for Nagoya; 2640 miles from San Francisco

The Chronicle shipping page usually filled at least a full page of the newspaper, providing not only shipping news but weather and events tied to the shipping industry.[73]

RCA appointed John S. Philbrick as the Engineer-in-Charge at Bolinas after he had served the in the same position at Kahuku for Marconi and the Navy (during his Navy assignment Philbrick was the Officer in Charge, U.S.N. Radio Station, Kahuku). Philbrick, a tall, well-dressed engineer who typically wore riding breeches, ruled the Bolinas plant efficiently, as evidenced in papers surviving and preserved at the Bolinas Museum.[74]

The following information is extracted from a set of papers given to the Bolinas Museum by James

(Jimmy) Bourne, a long-time rigger at the station, and his estate. They consist of photographs and what appears to be an entire personnel file from 1923, which sheds insight on life at the station at that time.

The Bolinas crew in July of 1923 consisted of:

J. S. Philbrick, engineer-in-charge
R. E. Franklin, assistant engineer-in-charge (replaced soon after by C. L. Flory)
E. R. Riddle, senior shift engineer
T. S. Baker, shift engineer
E. P. Hill, shift engineer
R. C. Woods, alternator attendant (or dynamo tender)
E. E. Longmyre, alternator attendant
C. H. Trimingham, alternator attendant
W. E. Price, alternator attendant
A. Kraft, machinist
H. Nidros, chief rigger
J. G. Meyers, assistant rigger
J. S. Newman, temporary rigger
C. A. Carpenter, laborer
J. T. Slattery, laborer
L. G. Baker, cook
E. L. Smith, waiter

Personnel files indicate that the entire staff lived on the premises. Dynamo tenders, responsible for the full-time operation of the Alexanderson alternators, received $75 per month until the end of 1923 when the amount was increased to $85; shift engineers received $110 per month. The company provided lodging and board for about $30 per month. The laborers, or ground men, were paid $4 per day. The station had a number of personnel troubles that year, with an inordinate number of resignations. Some complained of the pay and high expenses, others spoke of better opportunities elsewhere, and some experienced health problems, possibly from the difficult conditions in the power house. One sticking point was the requirement that employees take two-year shifts at Kahuku. The assignment to Hawaii brought a temporary 10% raise in pay due to the higher cost of living and, perhaps, the isolation and strangeness of the plant, located on the northeastern shore of Oahu.

Some seemed to feel that the Hawaii assignment was a trip to nowhere. One employee, a shift engineer, refused to go to Kahuku unless given a sizeable raise. General Manager Arthur Isbell wrote in a memo to Philbrick, "It is not the policy of this office to tolerate Bolsheviks. When we find men who are developing these tendencies, we weed them out . . . ." A Bolinas man who had worked for over three years as a laborer, dynamo tender and switchboard operator, delayed his voyage to Hawaii in apparent resistance to the change. He and another employee was fired, and another was requested to leave, during this insurrection, leaving the station in need of replacements. As a result, and upon hearing that other local men had refused jobs at the station, Isbell wrote to Philbrick, suspicious that "there is someone at Bolinas who is

responsible for such a spirit of unreliableness. I suggest that you conduct a quiet inquiry." He then ordered Philbrick to "weed out whoever is responsible for the bad esprit de corps at Bolinas." He later scribbled angrily to Philbrick, "Pls do not hire local men. One experience with Mamas babies . . . --is enuff."

A big event at the station was the visit on November 26, 1923, of RCA's Chief Engineer Dr. E. F. W. Alexanderson, inventor of the huge alternators that revolutionized high-power transmitting in the 'teens. The engineer-in-charge sent out orders that "each watch turns the station over in perfect order."

In February, 1923, Radio Corporation of America offered "the privilege of subscribing for shares of Radio Corporation 7% Cumulative Preferred Stock (par value $5.00)" at a cost to the employee of $2.80 per share. Employees had no obligation to buy, and were limited to a minimum purchase of twenty shares and a maximum dependent on the salary of the purchaser. This would have been a profitable venture later in the decade as RCA grew, but at the time no one could anticipate the stock market crash of 1929.

The Marshall receiving station's employees included manager I. C. Reid, C. Bailey, V. P. Vettel, E. J. Stenman, F. Frease, A. A. Hilldring, J. F. Parachini, D. P. Goodger, V. M. Goldsmith and Joe Rocca. Soon to join the crew at Marshall would be Frank Geisel and Joe Sciallo, both of whom left their imprints on the operations in years to come.[75]

A somewhat whimsical tour of ship-to-shore station KPH while located at Marshall appeared in Radio magazine in January of 1923. The author, David P. Gibbons, appealed to amateur radio operators, trying to dispel some of the mystery of the powerful station:[76]

> If your aerial is located anywhere between Alaska and Mexico on the sunny side of the Rockies, and if your receiver consists of something just a trifle better than a drug store $1.98 tantalizer, some such thought must have passed through your cranium, when at one time or another, you listened to the deep, steady note of the "big noise of the Pacific."

Gibbons wrote of obtaining an official pass to the station from Arthur Isbell, taking the "dinky railroad that finally lets you off at a station appropriately named Marconi." After wondering aloud why any radio operator would last an assignment so far out into the boonies, Gibbons found one reason for employee satisfaction: "I had arrived in time to meet some of the staff before dinner was announced, and that dinner gave the key to the problem. The motherly lady in charge of the culinary department in the spacious hotel where the staff is housed is just as efficient in her line as the other members in theirs, and that's saying a mouthful. In other words, she wields a wicked skillet."

The amenities at the station impressed Gibbons, as he noted the spacious, heated living quarters, billiard room, library, reception rooms, tennis court and the large veranda where off-duty employees enjoyed "magnificent views" of Tomales Bay and Point Reyes.

With two entities, the high-power land station and the low-power ship-to-shore facility, the station had two sets of antennas. The KPH antenna was "the tall mast on the top of the hill," about 600 feet above the water, while the high-power receiving, Gibbons described

> two large rectangular loops, supported on telegraph poles . . . . They are 300 feet long and about 30 feet high, set at right angles to each other, and in addition to these a very novel and efficient form of loop is employed by using the guy wires of the main mast in the single shape of two triangular loops, which are also at with angles to each other.
>
> Balancing and partial tuning is accomplished by goniometers in series with these loops located inside the building in the high power receiving room. Impulses picked up by these loops from New York, Honolulu and Japan are amplified by two stages of radio frequency, then detected and passed though two stages of audio frequency, and then transmitted to the San Francisco office through what is known as the "tone channel," but which is really nothing more than an extension of the telephone receiver cords. Here they are again stepped up by two stages of audio frequency, whenever necessary, with the result that the strength, clarity and freedom from static of these signals in San Francisco is amazing, and they are copied directly on the mill [large-type typewriter] by skilled high-speed operators. At the same time a perfectly legible copy of every dot and dash is made on an automatic [paper] tape recorder in this office. About thirty-five words per is the average speed on this circuit when using hand sending, but using the automatic transmitters and receivers, speeds up to two hundred words a minute are quite frequent.
>
> The receiving operator in the city has direct control of the powerful alternator at Bolinas by means of an ordinary, innocent-looking little key on his desk, just as the marine operator at Marshalls (KPH) has control of his spark transmitter also located at Bolinas twenty-eight miles away.
>
> The interior view of the Bolinas station gives a good idea of the elaborate and finely constructed equipment that is used in modern high-power radio transmission. The reliable daylight range of this set is remarkable. During a recent breakdown of the land wires the Associated Press wanted direct service to New York, and they got it. In twelve hours over 6,000 words were handled between San Francisco and Radio Central, Long Island, New York, while at the same time the regular traffic with Honolulu was maintained without the slightest interruption.

Gibbons detailed three examples of "speedy service" from RCA, including a commercial message from a San Francisco office building to Honolulu and back in thirteen minutes; a request from Associated Press for the passenger list of a ship in trouble, which had to be flashed from San Francisco, to Hawaii, to the steamship offices, then back, in 32 minutes; and a tale of receiving messages from a ship 5476 miles at sea and amplifying them onto the streets of San Francisco with perfect clarity. The writer closed the article with a homage to the skills and energy of the KPH operator, of whom "it is hardly necessary to say that the gentleman who waggles the bug at this station has to be a darn good one. It's emphatically no place for a bird who doesn't possess a steady fist and an equally steady head, and to remark that his time while on watch is fully occupied is putting it very mildly. The one-armed paper hanger with the hives was a restful individual in comparison."

While RCA spent a great deal of energy developing and promoting its home entertainment enterprises, it did not ignore its original mission, the international communications system. The company made many advancements during the 1920s, including the use of vacuum tube transmitters and improved an-

tenna design. They worked hard against their competition and continued to make records in speed and efficiency in the handling of international messages. During the 1920s the average time elapsed for a message between San Francisco offices at 28 Geary Street and Tokyo, via Bolinas, was eight minutes. In the latter part of the 1920s, RCA made a number of moves towards expansion of its empire.[77]

C. Improvements of the 1930s

In order to focus its various energies from communication to industrial and consumer goods and entertainment, Radio Corporation of America formed a subsidiary communications wing, RCA Communications, Incorporated (RCAC), in 1929; the following year RCA deeded its properties in Marin to RCAC. Later the marine services were split off into a company called RCA Radiomarine; the two would merge again in the 1950s. In 1930, David Sarnoff became Chairman of RCA, forging the power base that would eventually put him singularly in charge of one of the biggest industrial and communications businesses in the world.

In 1929 the company embarked on a major expansion of the west coast operations, in response to an increase in demand for communications with the Orient and South Seas. The primary goal would be increasing the transpacific circuits to include China, Manchuria, Siberia, Java, French Indochina, Manila, New Zealand and Australia. The new technology increased the distance possible: for instance the Java circuit would reach an unprecedented 8,646 miles.

RCA announced plans to enlarge the transmitting station at Bolinas to accommodate twenty short wave circuits, which would require construction of a new transmitting building and expansion of the antenna field. A huge antenna planned for adjacent property was rethought, probably because of recent transmitting innovations.[78] The Marshall station would undergo a transition which would portend the eventual closing of that plant. An entirely new point-to-point receiving station would be constructed overlooking the Pacific Ocean to the west, on the McClure family's dairy ranch.

The San Rafael Independent reported that the Point Reyes coastline would become "the nerve center of a vast radio communicating system that will link the United States with all of the important trans-Pacific countries from Australia north to Siberia." The difference between these events and those of 1914 and 1916 would be the existence of an expanded network to many nations rather than the one direct link to Hawaii and Japan, a net as opposed to a single fishing line. And, perhaps more important to RCA executives and the U.S. government, the new circuits would eliminate communication using foreign radio stations as intermediaries, providing, in the words of RCA's Pacific division manager G. Harold Porter, "American business with an all-American channel of communication with prospective trade . . . ."[79]

D. Land Procurement

The expansions would require new and larger parcels of land at both Point Reyes and Bolinas. The addition of circuits to the Orient required more land for antennas at Bolinas. On October 8, 1928, RCA purchased the 120-acre ranch of Mary Strain, located directly to the south of the RCA holdings. A small dairy ranch existed on this property and continued to operate under lease to the Luis family. At Point Reyes the procurement of land would be more complex.[80]

The James McClure ranch (historically named G Ranch in the Shafter-Howard dairy empire), a 1,472-acre, mostly flat parcel located on the Pacific shore south of Abbotts Lagoon, would be the perfect receiving site. Negotiations with the McClure family proved fruitless; the family and the RCA could not agree on a price (reportedly RCA offered $100,000 and the McClures wanted $130,000). Perhaps the McClures were reluctant to sell a good dairy ranch that they had purchased only ten years earlier after decades of tenantry on the Charles Webb Howard estate. In May of 1929, Radio Corporation of America filed suit in the Federal District Court in San Francisco seeking condemnation of the property, stating that the company needed the land to provide a public service. Named as defendants were James McClure, his sons James II and John, the Bank of San Rafael and several John Does. Two months later a jury agreed with RCA and set a price of $127,500, awarding James McClure $120,000 for the property and John McClure $7,500 as tenant of the property.[81]

Following the court judgement, RCA paid the McClures on October 15, 1929 and took possession of the ranch after giving the family ninety days to vacate. The McClures moved to a rented ranch near Olema until purchasing the prominent Pierce Ranch on Tomales Point to the north; RCA then leased the McClures' dairy facility to the Grandi Company, a general merchandise firm in Point Reyes Station. Al Bianchi and Richard Velloza operated the dairy ranch for about ten years, followed by Frank Labrucherie. For a number of decades the ranch was referred to as the RCA Ranch. The Joseph Lunny family operated the dairy under lease from RCA from September, 1947 until RCA sold the land in 1977; the Lunnys run beef cattle on the ranch today, under a special use permit from the National Park Service.[82]

E. New Construction at Point Reyes and Bolinas

RCAC prepared drawings for the numerous buildings necessary for the new receiving station in late 1929, making revisions in February of 1930. Engineer-in-charge Irl C. Reid of the Marshall station, already an RCA veteran who had worked in New Jersey and at Koko Head, took great interest and became a major player in the activities. After all, Reid had made many of the observations in choosing the site. RCA purchased right-of-way from Inverness to the station from the O.L. Shafter Estate in March of 1930 for a land line to connect the new station with Bolinas and San Francisco. The Marin County Journal reported that "Many workmen are rushing the work of felling trees from Point Reyes Station to Point

Reyes proper . . . in preparation for the monster receiving radio station of the Radio Corporation of America, which is soon to be erected there. It is reported to be much a heavier station than the present one at Marshall." The report spoke of the new station's potential effect on local commerce:

> This super radio station easily makes Marin County at least the field headquarters for the forces of the Radio Corporation and means that another investment of several hundred thousand dollars is entering the county. Not only will Marin County benefit from the construction money expended, but it adds another picturesque feature on the Western coast which will prove a lure for tourists, many thousands of whom travel long distances to view the wonders of Marvelous Marin, growing more wonderful each year.[83]

At Point Reyes, the new receiving station was designed with an Art Deco facade of fluted columns decorated with brick details at their tops; across the front was the words RCA COMMUNICATIONS, INC. in large letters. The receiving building was a T-shaped structure measuring 68 by 66 feet, two stories high. Its heavy concrete construction required a special foundation system due to the high water table and sandy soil. Two white spherical light fixtures stood on pillars at either side of the entrance stairs, adding an air of elegance. RCA also constructed, in the same style, a garage with two bays and a riggers shop, and a four-room utility building housing the water system, generator room, and storage. An antenna field stretched from all sides of the building. The long driveway from Sir Francis Drake Highway terminated at a landscaped circle in front of the building; decorative entrance posts matching the Art Deco motif welcomed the visitor. Longtime maintenance man Joe Sciallo planted the driveway with Monterey cypress trees, creating what is now a landmark on the landscape of Point Reyes.[84]

The new transmitting building at Bolinas would be a two-story, reinforced concrete structure measuring 95 feet by 60 feet, with a flat roof, larger than its counterpart at Point Reyes. Of construction similar to the original sturdy Marconi buildings, it featured the Art Deco motif as at Point Reyes; elegant lanterns graced either side of the entrance doors. Next to the building stood a 14- by 26-foot power house for the heavy transformers, and a 20- by 52-foot garage with five bays and a service area with gas pump; as at Point Reyes, the auxiliary buildings showed the Art Deco motif throughout. Pipes connected the water-cooled transmitters to a zinc and concrete spray-cooling system outside the south side of the transmitting building. Roads connected the new complex with the old Marconi powerhouse, with a curbed circular turnaround in front of the main building, and plants and lawns constituted the landscaping of the grounds.

Probably at this time the company assigned numbers to the buildings: the 1914 Marconi power house became Building 1, the new transmitting plant Building 2; the transformer house Building 9; etc.

Pacific Gas & Electric reportedly spent $70,000 to provide an additional 60,000 volt power line to Bolinas via Olema, terminating at a new RCA substation constructed by PG&E on Mesa Road at the Bolinas property.[85]

RCA Communications put the new plants at Point Reyes and Bolinas in operation by 1931. KPH remained the lone occupant of the Marshall plant, handling its ship-to-shore work as it had since moving

there in 1920. The Bolinas station mothballed its massive Alexanderson alternators and commenced sending its signals through new, water-cooled vacuum tube transmitters located in the new building. Power switching equipment, a machine shop, storeroom and bathroom occupied the first floor of Building 2, while the transmitters and offices were housed upstairs. Line feeds exited the building through insulators imbedded in the walls to the antenna fields, consisting of separate broadside curtain antennas aimed at the various destinations around the Pacific; later, most were of the fish bone type, so named for the distinctive shape appearing as a vertically mounted, huge fish. The KPH transmitters remained in Building 1, the old Marconi power house.[86]

A gas-filled, 26-pair cable connected the three entities comprising the San Francisco RCA station: Point Reyes, Bolinas and the CRO (Central Radio Office) in San Francisco. RCA riggers maintained the line which ran along the roadside from Point Reyes to Bolinas via the Olema Valley, thence over the hills to Sausalito and under the bay to headquarters on Market Street or Geary Boulevard, depending on the year. The line required careful testing and maintenance as the gas system was susceptible to leaks and vandalism.[87]

The Great Depression slowed profits at RCA but the corporation survived and thrived, probably because of the determined leadership of David Sarnoff. His greatest challenge of the 1930s was the Justice Department's formal complaint of RCA anti-trust violations, an ironic turn of events as the American government had manipulated and sanctioned the formation of RCA as a virtual monopoly in 1919. Although AT&T had sold its RCA stock in 1923 and GE and Westinghouse had sold their shares of NBC and the newly-formed RCA Victor to RCA, the Justice Department filed its complaint on May 30, 1930, as U.S. vs. General Electric, Westinghouse, AT&T, RCA and General Motors Radio Corporation. The suit mostly pertained to the consumer products side of the business but it threatened the overall corporation. Sarnoff, sensing the trouble ahead, proposed a breakup of the consortium, and in the consent decree of November, 1932, RCA was effectively split off from its former partners. As a result, Owen Young resigned his RCA post which placed Sarnoff in full charge, while RCA ended up in good shape with two networks, broadcasting stations around the country, manufacturing facilities and the international and domestic communications facilities. Shortly after the decree, RCA moved to its new headquarters at Rockefeller Center, the famous "Radio City," and soon the company reported profits for the first time during the depression. In another of Sarnoff's triumphs of the 1930s, his company introduced RCA's television system at the World's Fair in New York in 1939. Although the introduction of mass television would be slowed by World War II, Sarnoff's passion for the medium and energetic development of color television would seal RCA's fate as the leader of consumer as well as commercial communications during the central part of the century.

The creation of the Federal Communications Commission in 1934 brought more order to the radio industry. While focusing on the consumer broadcasting business, the FCC also regulated the wireless industry, setting standards, allocating frequencies and adjucating disputes.[88]

As of May, 1936, RCA communicated with 47 foreign countries out of its Marin stations, and

from those 47 stations, messages could be relayed to just about anywhere on the earth. In the United States, RCA held an agreement with Western Union, Inc. for land line communications. Other services included interesting radio programs such as "Hawaii Calls," featuring music and talk from the Pacific islands, that were broadcast to the states via RCA's coastal station. At this time the Photogram service was developed, enabling the transmission of photographs, maps, handwritten material, signatures and fingerprints, for example.[89]

F. The 1940s

The following description of operations at RCA's Point Reyes facilities derive from a series of interviews with Gus Kovats and Jim Hepburn. Kovats worked at RCA as an engineer from 1940 to 1967, then managed the Bolinas site until 1971. Mr. Kovats continued his work at RCA, overseeing new construction and technology, until his retirement in 1981. Hepburn went to work as a shift engineer at Bolinas in May of 1941 after graduating from University of California at Berkeley with a degree in physics. He transferred to Kahuku in late 1942, then to New York headquarters in 1949 where he worked as an engineer. From 1968 to 1975 Hepburn served as district manager and later a vice president at the San Francisco office. He retired in 1981 after serving as RCA's vice president of operations and engineering in New York City.

The Point Reyes receiving station (RS) had changed little between the time of its opening and Kovats' arrival in 1940. The lower floor of the building housed generating equipment, battery banks, a lunch room, locker room, restroom, and boiler room/distillery for pure water. Upstairs, the heart of KET filled the large room and a few smaller ones: the receivers, tuning apparatus and office. Irl Reid managed KET at the time. It had been rumored that RCA Chairman David Sarnoff had visited the station to see the new operation.

A newly arrived Third Class technician, required to read 15 words per minute in code, made $35 per month; the requirements became stiffer and the pay went up to $47.50 for a First Class technician; all employees had a union contract. The equipment was considered the best in the field, manufactured by RCA at its Riverhead, New York factory specifically for point-to-point operations. Point Reyes had a tuning facility used by the station's competition as a service, making use of about 15 RCA-made Beveridge antennas.

KET's staff of technicians routed business and government traffic; many of the government and military messages were encoded. The facility only received and relayed signals to the central radio office (CRO) in San Francisco and did not record them other than to monitor signal quality.[90]

At Bolinas, one of the Alexanderson alternators remained in Building 1, although it had not been used since about 1930. The 300-foot towers built by American Marconi remained standing with many of the wires intact, but in a somewhat deteriorated condition. On the periphery of the massive old antenna

were the currently used broadside curtains and big "V" antennas, designed by Phil Carter of the RCA Laboratories. The KPH high frequency marine transmitters, were located on a balcony in Building 1; a 146 Khz long wave transmitter remained also. Building 2 housed about twelve tube transmitters ranging in power from ten to fifty KW, probably the original transmitters installed in the late 1920s. Hepburn's job included stopping and starting the transmitters and making repairs as necessary. Up to three times a day the frequencies needed to be adjusted depending on weather conditions and time of day; RCA technicians relied on weather reports generated from the New York office.[91]

Kovats and Hepburn worked at the RCA shore stations at a critical time. The growing war in Europe and Asia loomed over the west coast and the country in general, with events to come that would send RCA and RCAC through another major change.

G. World War II

On the early morning of December 7, 1941, 353 Japanese planes attacked Pearl Harbor on Oahu, killing 2,400 American soldiers and bringing the United States into World War II. Radio calls from Japanese transmitters were the first to be intercepted; then the nearby S.S. Lurline reported a submarine threat. These were received at RCA's station KPH in Marshall, while Frank Geisel stood watch. News of the bombing followed; Geisel relayed the information to ships at sea and RCA headquarters and soon the world knew of the earth-shaking event. David Sarnoff, a patriot long interested in military and domestic intelligence and other government affairs, immediately sent a telegram to President Franklin D. Roosevelt: "All our facilities are ready and at your instant service. We await your orders."

Roosevelt declared war on Japan the next day, and RCA was required to shut down KPH.[92] John Parachini relieved his entire crew except Geisel, who spent a few weeks closing the station down. RCA would not renew operations at this historic facility built by the Marconi Wireless Telegraph Company of America; it would sell the property shortly after the war's end.

--sidebar--

On December 7, 1941, night operator D. S. Scherrer, nearing the end of his shift at KPH in Marshall, received a mysterious transmission: JFOE JFOE JFOE DE JOC SOS OK OK JCS DE JOC SOS SOS SOS JFOE etc., which repeated until changing to Japanese naval code. Soon after, Frank Geisel took his watch. History unfolded before his ears and eyes, as the messages of the bombing of Pearl Harbor and concurrent events in the Pacific came sounding out of his receiver. Geisel considered that the first message was a "pre-arranged signal to Japanese ships to scatter. It was a land station sending." He then picked up some troubling messages during the following four hours, such as this one:

> RUSH 500 (MSG FM LURLINE ON HF) NMC TELLS HIM GA RUSH FROM KIEK - NAVY SANFRAN - USAT CYNTHIA OLSON SENT DISTRESS SIGNALS AT 1838 GMT REPORTS SUBMARINE IN LAT 33.42N LONG 145.29W AND REQUESTS LURLINE TO STANDBY

The SS Cynthia Olson, a small steamer sailing 750 miles southwest of Seattle, was torpedoed shortly after the warning; this was the first American ship lost by enemy action in World War II.[93]

It was Geisel, later to be manager of KPH, who would soon send out the following message to the world under orders from the U. S. Navy:

> URGENT TO ALL U.S. MERCHANT SHIPS - FOLLOWING FROM COMMANDER IN CHIEF PACIFIC AIRRAID ON PEARLHARBOR HOSTILITIES WITH JAPAN COMMENCED WITH AIR RAID ON PEARL HARBOR THIS IS NO DRILL.[94]

These event not only changed the direction of RCA's radio stations, the would change the direction of world history.

--end sidebar--

President Roosevelt took Sarnoff up on his offer. RCA went into full time production towards the war effort, and made its communications facilities and staff available to our military forces. While the military did not take over the stations as had occurred in World War I, Sarnoff made his company available for all services needed, through production of needed equipment and components (RCA was instrumental in the development of walkie-talkies, radar, sonar and navigation systems such as Loran and Shoran) and use of coastal stations and personnel. RCA provided the Army with coded Japanese messages it received at its coastal stations, which would be decoded and distributed to the high military command. Sarnoff himself advised the president on strategic communications issues and was called by General Dwight Eisenhower to create the radio infrastructure for the infamous D-Day allied assault on Normandy in 1944, and led the rebuilding of the French communications systems after the occupation. Sarnoff became a Brigadier General in the Army of the United States to facilitate his wartime service.[95]

H. Wartime KET

Operations at KET continued somewhat as usual during the early years of the World War II, but the reality of war could not be avoided. Manager Irl Reid, a reserve commander in the Navy, received orders, and at least three of the top technicians went into Navy service. The Army took over a room of the Point Reyes facility as a command post and built a barracks and cook shack for the Coast Guard beach patrol, as the Point Reyes Peninsula was considered a crucial and vulnerable setting for possible enemy attack. RCA monitored Japanese transmissions and reported daily to the FBI on half-inch tapes with inked dots and dashes. Several technicians became deputies, patrolling the area after their shifts ended.[96]

At the request of the Navy, RCAC restarted the Alexanderson alternator in Building 1 at Bolinas and upgraded the massive Marconi long wave antenna; another idle alternator at Bolinas had been shipped to a secret Navy installation at Haiku, Hawaii, via Kahuku.[97] As in the early Marconi and RCA days at the transmitting station, there was again so much high radio frequency in the antenna field that the soldiers' rifles got hot to the touch. Gus Kovats recalled that occasionally and automobile would burst into flames after unsuspecting visitors parked under the high-power antennas.

RCA transferred engineer-in-charge John Philbrick to Hawaii to build a station there; he would return to Bolinas after the war for a short time. The War Department approached RCA asking for personnel to go to the war zone to provide radio reports for the news media, so Kovats volunteered and was sent to Italy as an RCA employee, although protected by the Army with its medical care and supplies. He was given a simulated rank of Major so as to receive supplies as needed from Army supply. Close to the front lines, the RCA men took reports and forwarded them to the news organizations.

At war's end, David Sarnoff and his RCA were national heroes. Not only was Sarnoff made a Brigadier General (he insisted on being called General Sarnoff after the war, and reportedly coveted at full commission as a General but failed in his attempts to secure one) and awarded the Medal of Merit by

President Truman, but he was in flush with the U.S. government, including his friend President Eisenhower. RCA received government contracts to an extent of making it one of the top fifteen government contractors in the country during the 1950s; the company also benefitted from the extensive developments made by military technicians during the war. RCA participated in intelligence operations during the Cold War, including the interception of messages out of Russia and Eastern Europe and providing their contents to the National Security Agency and the FBI.[98]

V. Post-War Years at RCA

A. Restarting KPH; Point-to-Point Services Expand

Frank Geisel, the marine operator at Marshall who had spread the word of the Pearl Harbor attack, received instructions in September of 1945 by RCA to reactivate KPH at the Point Reyes receiving plant. The Marshall property would be sold on February 7, 1947 to J. E. Davis.[99] Geisel, who had worked during the war inspecting radio installations on warships, collected three war veterans and put KPH back on the air on January 1, 1946. RCAC provided the station with cramped quarters that had formerly served as half of the KET lunch room; there may have been some resentment from the point-to-point staff to have their space decreased, however slight it may have been. (One KPH operator implied that some of the point-to-point technicians looked with disdain and perhaps horror at the CW men, seeing them as a relatively undisciplined bunch of practical jokers with no technical "smarts".) The sending operation for KPH was remoted to Bolinas, with transmitters housed in old Building 1.[100]

Bill Meloney, who joined KPH in 1946 after a thrilling record as a radio operator during the war, wrote of the difficulty Geisel had in finding operators:

> Initially Geisel had to recruit operators with little or no coast station experience, since experienced personnel were reluctant to hire on at a starting rate of pay which was substantially below industry standard. The problem was to find people with a natural knack for operating and having the ability to work together in a sometimes tension-filled work environment who could survive on forty five dollars a week. The early years were plagued with frequent operator turnover but eventually a competent nucleus developed into a staff second to none.[101]

Geisel worked hard to restore business to KPH and accomplished his goal within years, when he had up to 20 operators under his wing. Christmas was an especially busy time at KPH, as special messages and gifts by wire flew across the water. The operators at KPH became like family, working, playing, occasionally fighting, but acting as a tight group with a singular purpose. Veterans recalled staff parties, provided with abundant abalone, clams and deer meat from Joe Sciallo, a native of west Marin and well-loved employee. The mid-1950s marked the start of what one former employee called "the glory years."

RCA built a new marine transmitting station after the war at South Chatham, Massachusetts to

replace the old Marconi-era station at Marion. The handsome Cape Cod-style brick structure housed WCC until the 1990s when the station was remoted to Point Reyes and the property sold. The point-to-point stations on the east coast were located at Riverhead (RD) and Rocky Point (RP), on Long Island in New York. These eastern stations handled communications with Europe, Africa and South America, services which required larger facilities. The Rocky Point transmitting station Building 9 was practically identical to Building 2 at Bolinas, only larger; both were built at the same time.[102]

RCA removed the 300-foot masts at Bolinas, made for use with the spark gap transmitters and Alexanderson alternators, after the war; at about the same time, long-time engineer-in-charge John Philbrick retired. The original twelve transmitters from the late 1920s continued to send messages across the Pacific.[103]

Gus Kovats generously provided a narrative description of the Point Reyes point-to-point receiving station as it appeared at the time he worked there in the early 1950s:

> The main room upstairs was where we had all our receivers in the early days. They were what we called the "Green Giants," 30" wide and 7 feet tall, divided into sections. We had the audio section down at the bottom, the detector section in the middle and the RF section above. The antennas we had in the field were on top on standoffs, coming in the ports on the walls. We had three-receiver diversity, that way when a signal would fade on that antenna, it wouldn't fade on this one because it takes time for the signal to fade over here. So the other two receivers would maintain a constant output signal to be used for the city. The antennas were "patched" to the receivers. We had a whole network of wires going from the front of the room to the back of the room and you just plugged in to the antenna that you wanted. Once you tuned a signal in, you never touched it again until it faded out and you had to retune to get another signal at a different frequency.
>
> There would be one or two technicians on the floor here. We'd go around and check for stability to be sure that the signal was always right on frequency. The city would call and say, "I'm getting noise on such and such a signal," from Papeete for instance. "I'm getting noise on there, please retune." We had sounders all over the room. So no matter what you were doing or where you were, there was always a key close by to give them a dit dit in Morse code. You went and looked at the signal to see if it was all right, then you'd call the city, S-F-D-E-R-S and then Go Ahead Papeete G-A-P-A-P.
>
> We had to go around to check each receiver to be sure that something hadn't crapped out in one of them. When you have three receiver diversity you can have good signal on two of them but the antenna in the other area may be getting some interference from something else or one of the receivers may be causing a problem to the circuit. This is why, whenever you get a request to check whatever signal they're complaining about you have to go through all three receivers to be sure that it isn't our equipment, that it is interference from another signal. This is what the technicians would do there.
>
> When I was here we had a desk with a monitor receiver on it. We'd get the big call for a frequency to be brought up, either by Australia or Japan or Manila. Then we could sit here with this receiver and tune into the frequency that the guy is supposed to show up on. As soon as he came up, we went and tuned it in. Once the circuit was in they'd be sending 300 words a minute, which was recorded on a paper tape in the city where there is an office full of

operators, a couple of hundred down there.

These were battery operated receivers. We had commercial power for house use, but the radios were DC operated. We had motor generators downstairs that supplied low voltage for the filaments and other generators to supply the high voltage for the tubes. These are receiving tubes so the filament power for the number of receivers that we have here was 600 amps at 5 volts. The generators put out more than 5 volts but it was always adjusted for the load so that there was 5.1, 5.2, 4.9, in that range, to supply the filament power to light the tubes. The plate generators ran from 125 to 250 volts for the receivers. There also were a great bunch of capacitors. These filtered out the commutator ripple that is prevalent in all motor generator sets. So you had pure DC and that's what we needed -- no hum, no nothing.

The battery room had plate batteries, bias batteries and the filament batteries. The filament batteries supplied 8 volts of DC. They were 8 feet long, 3 feet wide and 2-1/2 feet deep. They had a short circuit capacity of 26,000 amperes that would melt just about anything. When we were charging these, we had two sets of batteries. One was always on-line and the other one was just a trickle charge. Every month we would run one down to minimum voltage and then charge the hell out of it. And there was so much gas in here that we had to have blowers sucking the hydrogen gas out, gas like in your automobile battery. Talk about an explosive condition, why we had it. So nobody smoked, and the doors and windows were always open and fans going, to suck all that hydrogen out into the open. This was a big battery room.

The plate batteries supplied the high voltage for the vacuum tubes. You had to have a negative bias for the vacuum tubes, so they had the bias batteries. The filament batteries were used to light the tubes. If the generator or the AC power failed, nobody would know the difference because the batteries would be here. We had an emergency generator outside that would supply house power for the station if needed.[104]

An extensive, illustrated article about the RCA stations in Marin County appeared in the Marin Independent-Journal in early 1950. Written by Inverness writer/photographer M. Woodbridge (Woody) Williams, the article provided a detailed yet readable description of activities and staff at the time.[105]

Williams' article noted the juxtaposition of radio technology and ranching, the vast fields of antennas and grazing cows and sheep. The public's curiosity served as the basis for the article, explaining to the uninitiated reader the mysteries of the stations. For example:

> If John Doe is observant, or more likely it will be Junior, who is already tampering with his Dad's 20 tube set, the family will notice that the antennas at each station are much the same in design, except that at Point Reyes the great nets of wire are high in the air but on a horizontal plane on the ground, while at Bolinas they are perpendicularly suspended between poles like gigantic seines.

Williams described the directional receiving antennas, called fish bone antennas, including the different orientations and power capabilities between the receiving and transmitting antennas. "Our receiver antennas operate on microvolts (microvolt equals 1/1000 of a volt), Bolinas transmitter operates on kilovolts, or thousands of volts. Ask Frank Spicer who absorbed 11,000 volts at Bolinas a short time ago [he

survived]." The cables for sending messages on to headquarters in San Francisco, on poles like telephone lines but owned and maintained by RCA, are described as containing 24 pairs of wires, each carrying ten messages spaced one behind the other. Both Bolinas and Point Reyes were connected to the city offices by these cables, as well as having a link between the stations.

The reporter's description of the point-to-point system provided a fine outline of the operations at Point Reyes:

> On back in the receiving room Elgin Baker and John Mundo were on watch, and their main job appeared to be keeping constant check on the incoming signals to see that they were not garbled. This they called monitoring, and they would plug in with earphones to the tall sets, listen, and then jot down notes. But these sets seemed quite inanimate, as they did their work in silent fashion. Only in San Francisco did their output become a noisy reality, unless one of the Point Reyes technicians plugged into the tone control board at the far end of the room, which resembles a telephone switchboard without the pretty operator. Here the incoming signals become audible and even visible if the oscilloscope is plugged into the circuit. The main function of the board, though, is to connect the receiver output with San Francisco.
>
> In order to again check the clearness of the signals the oscilloscope is utilized which actually operates on the principles of a television set. It transforms the audible signal into a visible one, and across the screen of the scope one will see the wavy pattern of the radio signal just as it is diagrammed in text books.
>
> Walt Matthews explained that the scope makes it possible to check the "distinction of keying characteristics," or to see that a dot is a distinct dot, and a dash a distinct dash. Sometimes a dash will have a tail on it, and the signals may run together, producing a confused message on the automatic printers in San Francisco. It is possible that such conditions are due to faulty transmitting, but generally they are more likely produced by atmospheric conditions that create a situation called multi-path, where a signal sent from, say, Japan will take several routes across the Pacific, and in so doing arrive once at the receiver, and a minute fraction of an instant later arrive again, the tail on the dash say representing the second arrival.

The RCA frequency measuring service, supplied by subscription to competitors for a fee, Williams described as such:

> [The reported entered] the measuring frequency laboratory where Clarence Griffith had another array of panels with countless dials, and a strange contraption suggestive of a glorified stock ticker that was called simply a "recorder." The equipment was used to check other stations' broadcasts to see if they were on or off the frequency assigned them by the Federal Communications Commission. In other words each station must only use an allocated frequency or else there would be a traffic jam in the airways. A frequency might be thought of as a one-way road through space over which only one station can travel at a time. Due to the large number of stations, one that is off its path just a small fraction may cause trouble. For this reason commercial stations purchase the frequency measuring service offered by RCA so as to "keep on the beam" and also not to get into trouble with the FCC, FM and telephone stations included. Of course RCA uses the lab to measure their own frequen-

> cies used at Bolinas, and they also examine the entire band for transmitters that are usually unintentionally off their assigned frequencies.
>
> Briefly this is accomplished by setting up a primary frequency standard at Point Reyes whose precision is four parts in 10,000,000. Incoming frequencies are compared against this standard, by an operator who calculates the exact degree that a given station is off its frequency and the automatic recorder also will give a visual record on paper tape.
>
> The standard frequency is set up in an air conditioned room by a quartz crystal housed in a bronze oven which is covered by a glass container. This crystal generates the frequency by oscillating at exactly 100,000 vibrations, or cycles per second. The radioman says the oscillator generates a frequency of 1000 kilocycles a second. The crystal oscillator is connected with a clock that does not vary more than 1/100 seconds a day. The clock is checked daily against time signals from the U. S. Observatory at Washington, D.C.

Williams skillfully reported details of the point-to-point operations at Point Reyes and notes the different style of KPH upon his entrance to its tiny operating room:

> Then from this barren room of precision and accuracy I went to a room with calendar pin-ups on the wall and jammed with telegraphic and teletype equipment. Under the charge of Frank Geisel who started his career in Marin at the old Marconi station at Marshalls on Tomales Bay, the room is the clearing house for the most powerful ship to shore station on the Pacific Coast.
>
> . . . This type of work is the last stamping ground for the manual key operator, because mechanical equipment has not been devised to handle the variety of messages to the coast guard, but the majority of their business concerns routine ship to shore messages via radio telegraph.
>
> Perhaps their most interesting service is medical instructions for emergency cases on the high seas. Symptoms are sent from the ship and forwarded to the Marine hospital in San Francisco where instructions for treatment are drawn up and wired back to the ship.
>
> The medical service has undoubtedly saved many lives . . . .

At the close of his article, Williams ponders the technical facts he has learned and points out the irony of the mysterious radio stations on the coast, providing needed perspective:

> At least it gave me the impression that RCA is Marin county's most universally known industry even though it is seldom recognized as such at home. But an isolated spot free of man made interference seems to be a prerequisite for its success. And that is why RCA is set up in west Marin among grazing sheep at Point Reyes, and Steve Balzan's dairy herd at Bolinas.

At the time the article was written in 1950, the staff at RCAC included chief engineer I. C. Reid, assistant engineers Walter I. Matthews (an RCA veteran who went to work at Kahuku in 1924 and succeeded Reid in the mid-1950s) and Bob Streich, technician Clarence Griffith, and receiving technicians Gus Kovats, Elgin Baker, John Mundo and others, for a total staffing of about ten in the upstairs point-to-point operation. Downstairs at Radiomarine, Frank Geisel's crew of radio operators included Harold Zimmer,

Arnold Hansen, Bill Meloney, John Gray, Jack Stegar, Earle Foster, James Steiger and others for a total of about 10 persons. Up to 20 riggers worked for the stations as well.[106]

Between 1957 and 1959 RCAC modernized the point-to-point receivers, replacing most of the old DC receivers which stood in rows for AC sets. The new receivers stood in six-foot racks around the walls of the room, each receiver taking two racks for components such as the RF section with its 16 channels, the tone generators and receivers themselves. A central console, from which all the receivers could be seen and monitored, acted as a master control where outgoing frequencies could be checked. The three Tokyo circuits had the most activity, with the 1600 words-per-minute speed considered remarkable by the staff at the time; before that a rate of 100 words per minute was called fast. The few remaining old DC receivers, installed when the building was new in 1931, continued in use as straight teletype circuits. Staff kept up a circuit with Communist China; technicians in Point Reyes and Shanghai tested the circuit daily but no traffic passed until U. S. China relations improved in the early 1970s.[107]

The DC/AC conversion had a curious effect on the environment at the station. A furnace in a special first floor room heated the building, a necessity because of the damp and cold climate of Point Reyes. The new AC receivers generated a great deal of heat, making the room sometimes too hot and the furnace obsolete, so it was removed. About twelve years later a furnace had to be reinstalled because the new satellite system, like the old transmitters, made no heat of its own.

Walter I. Matthews, long the assistant engineer-in-charge, replaced Irl Reid as engineer-in-charge after his retirement in the early 1960s. The station experienced little staff turnover, perhaps due to the low stress of the point-to-point work and the good job security and benefits at RCA. When Dick Flint took a job there in 1959, the next person above him in seniority had already been working there for 12 years. Staff occasionally changed their responsibilities: Lee Richardson of Inverness advanced from a rigger to point-to-point technician within a matter of years. But as the 1960s progressed, the specter of satellite technology grew darker, and the days of the historic point-to-point station were numbered.[108]

The conversion from DC to AC receivers ended the need for the series of generators, batteries and switches which took up most of the first floor of the Point Reyes plant. KPH staff, after being rebuffed by RCAC management for funds, remodeled part of the vacated portion and moved into somewhat larger quarters in the northwestern corner of the first floor. Eventually, as the generator/battery system phased out completely in the late 1960s, KPH took over the entire floor with their operating and telex rooms, shop, storage room and an enlarged lunch room for the staffs of both KPH and point-to-point. The former KPH operating room became the manager's office with space for a secretary in the former crystal room, where frequency measurements could be obtained by radio stations for $3 per measure. Most of the KPH work was done with petty cash, as RCA continued to look upon the marine business as an obsolete and burdensome entity. Around 1956, RCA dissolved Radiomarine and put the marine stations back under RCA Communications, Inc.[109]

B. Bolinas in the 1950s[110]

Gus Kovats transferred from the receiving station to Bolinas in 1954 to work with the transmitters under engineer-in-charge Jack Napier. At the time he arrived an old military surplus 10 KW water cooled transmitter, installed after the war for KPH, still occupied Building 1. It had been replaced and the cooling tower outside the building had been removed. The Alexanderson alternator had reportedly been shipped to Guam; riggers used the space for their trucks and equipment. A 200 watt transmitter was housed under the landmark 300-foot triatic tower, last remaining from the old days, in what recently has been called the coil house.

In Building 2, an array of 10, 20, and 40 KW output transmitters left over from the original installation in the early 1930s filled the top floor; Kovats recalled the difficulty getting tubes for them. The original power supply equipment consisting largely of heavy transformers was located downstairs. The PG&E lines from Alto and Woodacre remained intact, although one time a storm knocked out both sources and the station had to run off generators for about two days.

The cottages and hotel had been used in 1940s, housing technicians and later military personnel, but by the 1950s they stood vacant and open to vandals. RCA expanded their land base with the purchase of the 470-acre Garzoli (formerly Nott) ranch. The ranch, in two parcels, composed the hills and flats directly northeast and northwest of the transmitting station. Dairy ranching leases to the Luis family continued until 1948, when Steve Balzan took over the leases, expanded his acreage, and later operated a dairy at the former Garzoli ranch.[111]

Responding to a need for modernization and expansion in 1959, RCA constructed an addition to Building 2, doubling it in size. The plain, two-story cinder block-and-steel addition, designated Building 2A, had a low gable roof of corrugated transite with a long vent at the top of the gable. Technicians installed ten new RCA 20 watt single sideband transmitters, called "K" and "L" sets, and eventually donated the old transmitters in Building 2 to an interested technology organization. The "L" sets, actually older AM broadcast transmitters, were ingeniously converted by an RCA technician named Kahn to single sideband. Later, a series of 10 KW "H" sets replaced the temperamental "L" sets, although they temained in place.

For KPH, RCAC installed an impressive new transmitter christened BL-10 (the designation actually covered at least one previous transmitter), and five Federal 10 KW transmitters in Building 1. This last BL-10 remained in use by KPH until the early 1990s.

More than 20 technicians worked at Bolinas at the time, and an equal number of riggers. The money-making circuits required excellent antennas, spurring RCA to build a series of new 800-foot curtain rhombic antennas, popular for their versatility, minimum maintenance requirements, and adequate directive qualities; the older 300-foot fish bone antennas, while more efficient, took a great deal more maintenance and would eventually be scrapped. High frequency trunk lines left Building 2 on dense pole structures, to be distributed to the individual antennas.

When the point-to-point station closed starting in 1971, technicians modified the single sideband

transmitters for use by KPH.

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Cold War

During the Cold War, in conjunction with military agencies, RCA set up voice circuits on telephone lines between Guam and other military areas in the Pacific for the Strategic Air Command, an activity that was very secretive and expensive because it was labor intensive. Also, the National Security Agency and the Federal Bureau of Investigation asked RCA, as well as ITT and Western Union, to cooperate in intercepting messages from eastern Europe and Russia in 1947. David Sarnoff was a personal friend of FBI Director J. Edgar Hoover, and was intensely patriotic. Kenneth Bilby wrote:

> This intercept program, under the code name Operation Shamrock, generated a momentum of its own, with intelligence agents copying on a regular basis private messages of interest to them at the Washington and New York offices of RCA Communications . . . . Operation Shamrock was not halted until 1973, two years after [Sarnoff's] death, when word of the intercept program began to leak to the press, leading to a legislative investigation and public hearings during the Gerald Ford administration. RCA, ITT, and Western Union were harshly upbraided by a House subcommittee headed by Representative Bella Abzug for compromising the privacy of cable and wireless message traffic.[112]

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An article appeared in the Oakland Tribune in 1964 reporting that RCA had 65 point-to-point circuits at Bolinas, 44 of which served the Orient. According to the article, KPH received about 385 messages a month from Communist Chinese operators, mostly business matters; curiously, the point-to-point stations had no contact over their China circuit other than testing transmissions. Manager Frank Geisel described the worldwide operators as a fraternity, "because we do business with hundreds of ship's operators and over the years we've learned to recognize their touch on the key. It's like a voice. We don't feel we're talking station to station, but to a person. The men in this work are dedicated, they love their work and wouldn't change it." In the article Geisel recalled his communications in the 1930s with Amelia Earhart, the Byrd expedition in Antarctica, the Graf Zeppelin, and with the Nautilus which first explored under the Arctic ice. And the reporter wrote:

> William Meloney, Pt. Reyes marine operator, had two tankers torpedoed out from under him off the east coast during 1942. He was radio operator on both. Both times frustration cast its pall over the sinking ships. The force of the explosions ripped away antennae and left Meloney with a dead key.
>
> But progress has changed the profession, and today the dramatic dispatch is a rarity among routine shipping and tonnage dispatches. The vast radio networks which rings the globe has ended the days of the faint signal from a long overdue plane while the world waited.
>
> But at Pt. Reyes, the key still clicks.[113]

At the time, RCA's circuits included Papeete, Sydney, Wellington, Seoul, Taipei, Shanghai, Tokyo and Manila. Antennas for each circuit had their place in the pastures at Bolinas, aimed and finely tuned for the loudest broadcast. The two Papeete antennas, erected in 1964, were the first to be built in the hills across Mesa Road at the Bolinas site; they would be the last to be shut off in the 1970s.[114]

Bolinas had an extensive store room which held almost anything the technicians needed to maintain the transmitters and power equipment, and a storekeeper to tend shop. Emma Benevenga took the job in 1958, the first woman to work at the Bolinas station: "There were 39 men working there and I was the only woman -- there was nothing like you'd call harassment today, they all treated me very well!" As they should -- she often brought the bounty of her large garden and orchard at Five Brooks to share with her coworkers.

Mrs. Benevenga, working for engineer-in-charge Paul Gray at the time, kept stocks of tubes, attenuators, capacitors and the like, and if she didn't have it, she would order it. Her store room on the bottom floor of Building 2A was an image of organization; although she had no experience with radio transmitting at the time she was hired, Mrs. Benevenga picked up the trade quickly, crediting her upbringing on a ranch where here father taught her everything mechanical. The store room (originally located in a smaller room in Building 2) had specially-made shelves for holding vacuum tubes of various sizes and shapes, labeled drawers for hardware and electrical items, and large shelves for other components and equipment. RCA ended the storekeeper position when the point-to-point system went out of operation in

the early 1970s.[115]

VI. The 1960s and 1970s

A. Frank Geisel and the 1960s at KPH

Frank Geisel managed KPH from its reopening in 1945 until his retirement in 1967. He is credited with building KPH into the best CW coastal station on the Pacific, and was much loved and feared by his operators. His widow spoke about his management style:

> He was a perfectionist as far as work goes. But he had a great understanding and a love for the boys that worked with him. He helped them in many ways though, even personal problems he would quietly try to help them. And he never bawled a man out in front of other people. If he had any gripes with the men and he had anything to talk to them about, it was done privately man-to-man in their office. And they appreciate that. Nobody likes to be made a fool of as you might say, like some employers might do.[116]

Geisel ran a tight ship but allowed the practical jokes and lightheartedness that many considered necessary for stress relief. He trained operators well and expected the most from them. Jack Martini, KPH manager from 1986 to the station's closing in 1997, credits Geisel with his own ability to run the station efficiently but fairly. Geisel no doubt felt that his men came first, but that business had to be the best. Retired CW operator Warren Simpson described Geisel somewhat whimsically in his reminiscences of KPH:

> In the center of the operating room Frank Geisel leaned on his sabre like a general surveying the field of battle. He was known throughout the radio world as "Mister KPH". Reportedly he chose men like a pirate chief selecting his one-eyed and pegged legged crew. Occasionally he shouted encouragement, or roared in pain. He was deeply admired and respected not only for his professional ability, but for his man-to-man honesty, and additionally for his wild sense of humor. (He went around collecting cartoons by his disciples, even those of himself, with gloating enthusiasm.) He boasted that his men were the finest in the business and defended their transgressions with expedient logic, for they not only allegedly confiscated traffic from competing shore stations, but stole ships from one another for the sheer joy of it all.[117]

Geisel's decades of work in marine radio brought respect from around the world. His common sense and disdain for inexperienced or inept management awed many who crossed his path. Jack Martini illustrated the sense of experience and control that Geisel impressed on the station employees: "[He was] the man who wrote the book. There was the right way, the wrong way, and the Geisel Way. You did it the Geisel Way. He was a legend."

According to Geisel's widow, the people in the head offices wanted Geisel to transfer up into management, to go to New York and run the nationwide marine services. "He said, 'I'm not interested in titles; I'm not interested in anything but taking care of my family and doing my work. I'm doing what I like and what I can do well.' He never compromised with quality -- no matter who it hurt. If he felt something was wrong he would just tell you. But he was just as good with his praise, too. He gave credit to anybody that did anything right. So he had a wonderful relationship right up to the last."

Warren Simpson, in his detailed and humorous reminiscence of "the golden years" at KPH, wrote of life in the Point Reyes facility in the 1960s:[118]

> It is no news to old bug and deep-sea bucket men that KPH has always been one of the most dynamic and spectacular ship-to-shore stations in the history of radio telegraphy. Its cowboy sweep and round-up style at "Observer time" was more authentic than any pseudo Western on celluloid film. Even from as far back as its ancient "Spark" days the bellowing tones of KPH became famous throughout the Pacific. It stood on the seacoast like the gates of Hercules . . . .
>
> Occasionally formal visitors were ushered in [to the KPH operating room] expecting to view an efficient mechanized science-fiction array of sophisticated equipment manned by thoughtful looking men in long white coats. Instead they found themselves suddenly thrust into an 18th century den of thieves, all dressed like something out of the lower pages of Charles Dickens. The shrieking scanner and the pyramid message rack karate-kicked by leaping operators wearing horned headphones was as startling as the shouting manager waving his cane and trying profanely to break up the fighting between two operators, sometimes three, who had unhappily all seized upon the same ship . . . .
>
> The manually rotated message rack, shaped somewhat like a pyramid, was a homemade device constructed by the maintenance staff. Like the first wheel its primitive value was incalculable. It contained all outgoing ship traffic alphabetically arranged in rows of slotted apertures, revealing at a glance the call signs on the traffic list. It was stacked by the teletype men, primarily Jack Martini who, like a man tossing confetti, festooned its sloping sides with the rapid strokes of an artist. Sometimes, with the collision of leaping operators, an important ship diversion message wound up in the dead files, to be discovered hours later.

Simpson described the rotating V-belt as the "heart-beat" of KPH. Actuated by an old Boehme keying head, it transmitted a continuous signal, "V V V DE KPH KPH KPH . . .", attracting communication from ships all over the world. "Every shipboard operator since the beginning of radio has picked it up on his stethoscope," Simpson wrote.

Simpson also provided his impressions of fellow operators, for example:

> . . . There were men like Bill Meloney, one of the most fantastic professional operators of modern times that I have ever seen (and I have worked in Eastern stations that contained such men as Joe Chaplin, one time world champion). There was Rhio Blair the radio operator's radio operator; Earl Brand who was on a first name basis with every shipboard operator from Oslo to Chichiboo; Ray Smith the thoughtful hunter from the hills of Petaluma; Bill Gibbons the fisherman of both air and sea . . . .

> Among the great hunters of the mid-watch were men like Earle Foster, veteran chief operator of trans-Atlantic passenger liners. He gave a certain cool dignity to the profession. His operating technique was one of easy precision, effortless and with the quiet politeness of a genie from an Arabian Nights bottle. Summoned forth he rose to answer the magic call with the booming voice of KPH.

Simpson summarized what made a KPH operator during the busy 1960s:

> It took an iron man, a very special kind of man, to endure the gruelling, whip-lash rigors of working ship after ship in an endless procession from the Seven Seas.[119]

B. The Vietnam War

KPH played an important role during the Vietnam War as contract radio station for hundreds of ships at sea. The staff was increased during the 1960s to handle traffic resulting from the war, peaking in the early 1970s. Much of the communications was with freighters hauling supplies and ammunition to Vietnam. Retired KPH operator Earle Foster wrote of the dangers aboard the ships, with Viet Cong "hide-aways who would work cargo on American ships part time, and try to blow up the ship later. At KPH we were in close contact with many of these freighters involved."

> It was too dangerous for these freighters to stay anchored at night, they had to circle out to sea until daybreak. This was the time they would call KPH. They were a nice bunch of fellows, and sitting in the comforts of a coastal station like KPH, you could only wish them the best.[121]

According to Jack Martini, the Department of Defense ordered the demothballing of around 100 Victory ships, which were put into service shipping supplies and personnel to Southeast Asia.[122] Each ship needed radio operators, whose common role was to contact shore to report breakdowns in the old ships that had not been in use for more than 20 years. Occasionally KPH operators responded to emergencies, "flash" messages not for commercial use; if no official response from military channels was heard, ships contacted the commercial stations such as KPH or KFS for aid. KPH had a long history of providing rescue and emergency medical communication services, as Jack Martini related:

> Phil Diehl did a ship that had gone aground up in the Aleutian chain. The ship called in on SITOR for assistance, because they couldn't raise the Coast Guard, couldn't raise anybody on CW or anybody up in the Alaska area, so they called him and he got on the horn to NMC; they found a Polish factory ship on the other side of the island where he went aground. They got those people off within very few minutes. From the time of the distress to the time that they got him off, I think it was seven minutes. It saved their lives. It was quite an exciting

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Frank Geisel

"Mister KPH" was born in Austrian Hungary on March 4, 1902. In 1906 the family moved to Canada and then Southern California. Geisel began to work at age 13, first as a messenger, electrician's apprentice and handyman. At the Southern Pacific Railroad he learned telegraphy and Morse code. At the age of 17 he received his first Commercial Radio Operator's license. He soon obtained work with RCA as a ship's wireless operator.

Geisel worked for six years on ships, including the well-known steam schooner Wapama, now owned by the San Francisco Maritime National Historic Park. When he married, his father-in-law insisted that he obtain work on shore so as to provide a good life to his new wife. As a result, Geisel went to work as Chief Operator for KPH at Marshall in November of 1926.

After almost 41 years with RCA, Frank Geisel retired in April, 1967. His retirement dinner at the Green Mill in Petaluma attracted 200 people, including former and current employees, RCA brass, marine radio competitors and old friends. His staff presented Frank and his wife Mary with a portable typewriter and a trip to Hawaii.

In retirement Geisel was a co-founder of the Society of Wireless Pioneers and worked towards preserving the history of wireless. He died on July 12, 1984, not long after making a last visit to his beloved KPH.[120]

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period for him and he deserved [and got] a write up in the newspapers.

KPH operators took numerous emergency calls, and often acted as calming influences to people in distress. "Medico traffic" as described previously occurred only occasionally, but the role of being a reassuring voice on shore became almost routine. Long-time CW operator Ray Smith described a number of events where operators on land and aboard ships forged a bond, either brief and tragic or long-term. For instance, a large freighter found itself stranded on an Aleutian reef during a storm; the Coast Guard could not reach them because of the storm's ferocity. Smith and fellow operator Arnold Hansen kept in constant contact with the terrified crew of 35, only to find later, after contact ceased, that the panicked seamen abandoned ship and died in the surf. The personal effect was unavoidable. Other incidents tended to be less dramatic but potentially as life-threatening, such as ships left to drift with mechanical problems and fear caused by the dangers of incessant storms. Ship-to-shore traffic led to many friendships, and an occasional date with the rare female ship operator.[123]

C. Telex technology

The 1960s saw the development of RCA's commercial teletype service, usually called Telex but later improved to SITOR and ATOR systems.[124] RCA Communications management had been reluctant to back new radio service due to the advent of their Maritime Satellite (MariSat) service, but when a number of shipping companies urged RCA to offer Telex, Jack Martini and technician Steve Elliot took on the task. Encouraged by KPH manager Bill Hayton (Geisel, a dyed-in-the-wool CW man, resisted Telex during his reign) and later Ed Brennan, they implemented an uncorrected Telex system in 1968, connecting ships of the Pacific Far East Lines and P&O Lines with the mainland through KPH. Uncorrected Telex technology proved problematic as it was subject to interference and garbling during transmission. Testing and improvements of an error-corrected high frequency radio telex led to the SITOR system, tested by the station with the Maritime Administration in 1972 and put into use at KPH in 1975. In the years following, SITOR traffic increased and only surpassed CW in profitability in 1996.[125]

D. The 1970s

In the early 1970s, KPH employed seventeen CW operators and six teletype operators. Business was great, although it took a dip at the end of the war. At the time, major competitors included KFS at Half Moon Bay, Globe Wireless' KTK which merged with KFS, and Mackay Radio's KOK in Dairy Valley (near Los Angeles) and KLB in Marysville, Washington. RCA also operated KSE out of Torrance (also near Los Angeles) at the time. Soon the RCA services would be known as RCA Global Communications, or RCA

Globcom.[126]

KPH manager Bill Hayton hired ex-point-to-point technician Dick Flint in the mid-1970s as a CW operator, an occupation that just happened to be Flint's hobby. Flint provided a description of a typical morning at an operating station at KPH in the 1970s:

> The traffic list ran every two hours, which would take about ten or twelve minutes; we'd broadcast the call signs of each ship that we have a message for. Then when it was over you'd go crazy, that's when it really got hectic. Each operator is out there at sea on his ship and he knows that at such and such a time KPH is going to send a list of all the traffic they have. So he's tuning in and if he hears his call sign, he's all ready to go when the traffic list is over to call us. But he's not the only one, there's a whole bunch of them, especially at Christmastime or Easter, so sometimes you'd really get piled up.
>
> The traffic list would finish and there would be this cacophony of signals piled one on top of the other and you sat there and tried to pick out a call sign you could understand . . . they're all sending "KPH" first, a cacophony of KPHes, and you send "DE" that means "from", so they know that we got their call sign; there are a whole lot of call signs coming in . . . .
>
> We used a Q signal, QRY which means you're number so and so on my list to work, so you pick out the ones you can, and you tell that one QRY 1, next one QRY 2 and so on. You could line up 22 or 23 ships and then when you feel that you have as many as you can handle then you turn around to the traffic rack and grab the first guy's messages and call him on his working frequency.
>
> You might not quite finish your list when they start the traffic list again two hours later, so you'd just have to broadcast to those guys to stand by, they'd be first before we started the next list . . . . It was a busy place at times.
>
> This one morning the very first ship I worked was an oil tanker in the Gulf of Aden in Arabia; I finished up with him, and the very next ship was another oil tanker, but this one happened to be leaving Valdez Alaska; the next ship I worked was an old freighter that had just left Hong Kong. So, I sat down there and within about five or six minutes I had talked to ships located in almost three quarters of the world, and all of them with real good signals.
>
> You're working with those shipboard operators at sea and some of them are lousy operators, some are good; quite often you don't even speak the same language, trying to get this stuff through and get it through right . . . they might be Greek or Indian, Filipino, or messages in phonetic Japanese. With good operators there were really no problems as long as they space between words.[127]

Flint pointed out that the CW operators provided their own personal keys and earphones for the job, as each operator had a certain style and feel for his particular key. A number of operators collected historic Morse code keys. The earliest keys were simple affairs, but improvements over the years brought semi-automatic "bugs" and fully automatic keys for faster operation. Until the late 1980s, CW operators continued to type out the messages received on a "mill", the standard large-type typewriter; computers replaced the venerable mills.

As David Sarnoff's health began to fail in the late 1960s he relied on his son, Robert, to fulfill his legacy. However, Bob Sarnoff was not the same man as his father, and David Sarnoff watched as his son

made changes to the company that he did not approve. One example was the development of a modern corporate logo. The elder Sarnoff insisted on keeping his old letterhead with the "RCA" in a circle with a lightning bolt while the company adopted a streamlined version. Sarnoff also watched as the development of the transistor changed the world of electronics and corporate structure no longer accepted the absolute rule that he had enjoyed for so many decades. David Sarnoff died December 12, 1971. He did not have to witness the subsequent decline and fall of his beloved company.[128]

In an event which would have both local and national repercussions, a major oil spill in 1971 darkened the beaches of Marin County, including those at Bolinas. Hundreds of volunteers rushed to the area to save stricken waterfowl and clean oil off the beaches. Chevron obtained permission from RCA to bury 4,000 cubic yards of oil-contaminated sand in seven unlined trenches, averaging 15 feet deep, on the southwest corner of RCA property. Concerns arose in 1990 about oil contamination from the disposal site, leading to a four-year monitoring program. Overall, the oil spill incident further encouraged the strengthening safety and environmental regulations nationwide, and brought a new contingent of residents to settle in the Bolinas area. Many "hippies" set up camp on RCA's land and stayed until evicted by the county sheriff. Evidently much of the materials taken from the old Marconi residences and hotels found use as shelters on the Bolinas property.[129]

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E. Technological Changes of the 1970s and 1980s

By 1970 advances in wireless engineering threatened RCA's historic point-to-point service. Satellite technology, developed mainly during the Cold War, became available for commercial use and the communications industry. RCA held patents on this technology and intended to become a leader in commercial satellite communications. The point-to-point system at Point Reyes was phased out in 1973, with all but two of the receiving circuits removed; the two would be gone within a year. By 1974 racks of modern equipment replaced the archaic receivers upstairs, although the heavy copper doors (called 'museum pieces" by local historian Jack Mason) and the classic RCA logo imbedded in the linoleum survived, thanks to a vigilant veteran supervisor. The rhombic antennas for receiving were either removed or switched over for use by KPH. Technicians installed three large satellite antennas, or "dishes", in the yard, as well as a modern power plant in a new cinder block building. The dishes stood 33 to 44 feet high and changed the landscape of the area. A new logo appeared on the building: RCA Americom.

The satellite business went well at first, handling various communications including live television feeds from around the world, but employees alleged that the company made poor corporate decisions towards making full use the service and technology. Within two years the competition began to outpace RCA, despite the fact that they had the best technology in their hands.[130]

Some improvements occurred at KPH during the 1970s. RCA installed new, improved ITT receivers around 1975, which did away with the old dials and allowed the operator to latch onto the exact desired

frequency, like a car radio. These receivers featured what is called selectivity, wherein the operator receives the desired signal without interference and can easily switch frequencies. The receivers continued to be improved over the following years.[131]

F. RCA Sells Its Point Reyes Properties

The creation of Point Reyes National Seashore in 1962 would have little effect on the operations at RCA. Occasionally park visitors complained about the presence of radio towers in the park, although the antennas sat mostly on private land. RCA retained its Point Reyes property as an inholding within authorized park boundaries, as did neighboring AT&T. The Lunny family continued to lease the dairy ranch.

It was not until the satellite systems were in place in the 1970s that RCA decided to rid itself of surplus properties. With the point-to-point system out of use, and KPH being given few years to live because of advancing technology, RCA no longer needed the vast antenna fields for transmitting and receiving. In January of 1977 RCA sold most of the Point Reyes and all of the Bolinas properties to the Trust for Public Land (TPL), a property conservation organization headed by Huey D. Johnson. RCA Globcom president Eugene F. Murphy noted that "satellite communications and modern coaxial cables have superseded the high frequency radio equipment and antenna facilities formerly used on this land for communicating with the Far East. Under these circumstances, transferring the land to [TPL] presents the best opportunity of preserving a unique coastal area." RCA sold the property at less than market value, obtaining a tax advantage in the process. The company predicted that marine station KPH would last no more than ten years.[132]

RCA Globcom divided the Point Reyes property, retaining 23.1 acres surrounding the receiving buildings and the driveway, and sold the remaining 1191.54 acres for a bargain price to TPL in January, 1977. TPL would hold and then resell the land to the Federal government on November 21, 1978 for $1,370,000. RCA signed a three-year lease with the National Park Service, with an additional ten years provided for if needed, for 100 acres of KPH antenna lands now in the park. The lease stated that RCA would likely phase out service "as permitted by the FCC and other governing regulatory agencies."

At Bolinas, a slightly different situation presented itself. A proposed boundary expansion of Point Reyes National Seashore would include the entire RCA property, but must first clear legislative hurdles. Commonweal, a Bolinas non-profit health and environmental research organization incorporated in September of 1976, approached RCA with the wish to buy or lease the soon-to-be-defunct transmitting station as a headquarters for their work with environmental illness, cancer and recovery. Commonweal's president, Michael Lerner, negotiated with RCA but the TPL purchase took precedent over Commonweal's offer. Convinced of the merit of Commonweal's program, TPL gave Commonweal a 50-year lease on most of the buildings and much of the property, insuring its survival after park purchase. TPL bought the 1049-acre property in January, 1977, then resold it to the National Park Service on December 12, 1978, for

$1,650,000. RCA had moved out of Building 2 and half of Building 1, leaving the facilities partly empty. The old water-cooled transmitters and power equipment in Building 2 were partially salvaged, but most was junked.[133]

In keeping with a commitment to providing a use compatible with park service values for the property, Commonweal entered a Coastal Access Program Agreement in 1979 which would provide a trail through the leasehold between Mesa Road and the beaches below the facilities. And, at the time of the TPL/NPS negotiations, TPL sold 58 acres to the Bolinas Community Public Utility District for water storage reservoirs called Woodrat Nos. 1 and 2.

A controversy had erupted at the time of negotiations when the local community perceived a threat to Commonweal's tenure at the site as a result of the park purchase. Typically, agricultural operations would be offered continuing leases under park management; there was no provision for such an offering to organizations like Commonweal. A petition and letter writing drive commenced, encouraging local and national politicians to support Commonweal's lease at the site. In the end, the park service honored an amended 50-year lease and allowed Commonweal to continue its operations on the site. The lease runs to 2029.[134]

Since 1976, Commonweal has spent almost a million dollars in rehabilitating the old Marconi hotel, the two Marconi cottages and Building 2, all used for their retreat and research programs. Commonweal restored the exterior of RCA-era Building 2 and gutted the interior, which was then tastefully remodeled into offices for the organization. RCA Globcom and its successors continued to use Building 2A, part of the garage and the north half of Building 1 for KPH transmitting operations.[135]

Veteran RCA employee Ed Brennan became manager at Point Reyes in 1977 following Bill Hayton's retirement. Brennan had worked at the CTO in San Francisco as superintendent of 175 sending and receiving teletype operators, then as coast manager of the RCA Americom satellite facilities. The sale to TPL had been accomplished and so Brennan oversaw the park purchases and lease negotiations. Brennan hired the station's first female operator, Denice Korbein. Radio telex continued to expand under Brennan's direction, while technology improved and many of the smaller RCA operations were transferred to New Jersey and New York. Brennan retired in 1981, to be succeeded by Norm Santos (1981-1984) and then Charles Derapelian (1984-1986). Longtime Point Reyes employee Jack Martini served as KPH manager from 1986 until the station's closure in 1997.[136]

Eric Dollard, a long-time local radio scientist and historian, operated a research laboratory in Building 1 from 1980 to 1981, installing and repairing cables to earn his stay. Dollard hoped to restore the historic building and demonstrate various aspects of radio technology including the Tesla and Marconi theories. According to Dollard, his efforts were "thwarted" by managers at the site. He remains a steadfast interpreter and defender of the site's historic significance and has published a number of articles and a video production about the site.[137]

VII. The Last Decade of Wireless

A. RCA Bought by General Electric; MCI Follows

The fortunes of RCA slid downhill dramatically after David Sarnoff's death. Their failure to compete in the satellite business was especially evident at Point Reyes, as employees watched helplessly as the corporation made poor use of its state-of-the-art technology. RCA fell from being one of the country's most successful and well-managed corporations to one of the worst. RCA (later GE) Americom, the satellite business located upstairs at Point Reyes, closed its doors in 1991, consolidating its operations to South Mountain, Ventura County; Point Reyes satellite manager Dave Westlund followed the business to Southern California.

Company leaders announced the sale of RCA to General Electric, its old nemesis and "mother company", on December 11, 1985. The price, more than six billion dollars, made it the largest non-oil merger in industry history; General Electric had paid only 3.5 million dollars for controlling stock in Marconi Wireless back in 1919. Shareholders approved the final merger on June 6, 1986; RCA was no more.[138]

Shortly after the sale, KPH manager Ed Brennan retired. Jack Martini became manager on July 15, 1986. He would endure almost two years of indifference from the new management.

General Electric's ownership of the marine stations was brief. RCA Americom became GE Americom, while the name RCA Globcom was retained. The marine communications business apparently did not interest the corporate leaders and, after 23 months of neglect at KPH, GE sold RCA Globcom to MCI International, Inc. in May of 1988, to be operated by MCI's wholly-owned subsidiary, Western Union International. The company sent representatives out to KPH to see what they had obtained. As Jack Martini recalled,

> Fred Briggs was a VP of Western Union International at the time, and [Tony Migliaro] in Traffic Operations was an old Western Union Message Center type of fellow. They first came out here and started salivating because it was just like the old days. You know, the old RCA was the same as the Message Center. And this was a throwback to 25 years ago, with tape all over the place and messages hanging here and there, and it's kind of dingy, the operators with eye shades and stuff like that. So they loved it, and Fred Briggs tasked me with showing him around. He said, "I want you to walk me through this place and show me exactly what you do." Now this was pretty important because it was either they were going to keep us or get rid of us. So he asked me for the revenue figures Well, it just so happened that year we made almost exactly two million dollars in gross revenues and our bottom line expenses including everything were 1.2 million, so we had $800,000 of clear profit. He kind of liked that and said, "I'm going to look at this a little more carefully." In the meantime I was showing him around, and the telegram business is still going pretty good at that time. I started picking up a stack of telegrams maybe a couple of inches high and I said, "$13, $27, $48...", I just started clicking them off. I took them over to the packages of SITOR traffic and said, "Look at this." And I showed him the rate sheets. So he got the picture, he's an astute business man. He saw

> there was a potential there, so they kept us and right then and there I started getting money. This company, MCI, is not a cheap outfit. The first thing that I had them do was a paint job; the building, the grounds hadn't been taken care of. Paint was peeling off the place, it was a mess.[139]

MCI invested upwards of two million dollars (including about $100,000 for painting the main building and more for landscaping) in the operations at KPH but only to a limited extent, probably seeing that the future of the somewhat archaic CW and telex operations would soon come to a close as had been predicted for many decades. The Globcom name was dropped and substituted with Western Union International.

Around 1990 KPH began to offer direct telex circuits which required no intermediary work on the part of the station other than maintaining the Thrane and Thrane modems. Dewey Snyder, a talented MCI engineer, worked for a number of years improving the technology at Point Reyes and Bolinas. With SITOR and radio telex booming, MCI invested in the Bolinas plant, replacing the aging RCA T3 transmitters with new, but cheap, Henry transmitters. Warren Reese, longtime KPH CW operator and transmitting technician, and rigger Abe Palu replaced the directional rhombic transmitting antennas at Bolinas with four-element broadside arrays (called "H over 2"), at a cost of approximately $100,000. The landmark 300-foot International distress frequency antenna had to be removed due to rust; Reese suggested replacing it with an old design, the Marconi "T", and received a generous cash award for his idea. In 1993, KPH turned off the old BL-10 transmitter in historic Building 1, disconnected the power to the building and turned its half over to the National Park Service.[140]

MCI upgraded CW operations as well, although shipping companies replaced their Morse code systems with satellites at a rapid pace during the mid-1990s (the Global Marine Distress and Safety System, which would effectively end Morse code operations at sea by requiring satellite systems on board ships, carried an implementation date of 1999). Digital systems, computer terminals and a Local Access Network (LAN) all brought KPH more up-to-date. In a cost-cutting move, MCI remoted WCC at Chatham, itself a historical operation with international significance, to Point Reyes in 1992. An operator handled Atlantic traffic in the KPH operating room, making the place a true "around-the-world" station. Business continued to shrink, as cellular phones replaced marine radio for ships close to shore. Consumers clamored for wireless computers and personal communications, leaving little room for the dot-and-dash messages that had revolutionized the world 100 years earlier.[141]

In 1989 a service for commercial airline communication systems, Aeronautical Radio Inc. (ARINC) from Annapolis, Maryland, installed a receiving system and antennas at Point Reyes under lease from MCI and the NPS. The service continues as of this writing but its future is in doubt.[142]

KPH and WCC continued to operate on a shoestring, bringing in profits but not large ones, and these continued to shrink. MCI put KPH up for sale in 1995. The time would be a tense one for the employees:

> We were scared all the time . . . always going to lose our job. It was 20 years of fear of not being able to finish out your career or getting laid off. And something was always coming up. We used to say at the coast stations, we lived from crisis to crisis. If it wasn't a strike like in '68 or '78, there were rumors that they were going to close us or we're going to be sold. That's why it was like the boy who called wolf. People did not believe that this place was going to be closed -- even up to June 29th, they were hoping for some sort of miracle.

B. The Last Days

KPH manager Martini spoke of the hardships of working under a cloud of industry progress pointing to obsolescence of their livelihoods. But the operators at coastal stations were a unique breed, still fascinated by the magic of wireless communication, by the human aspects of dialogue with strangers at sea and people of other lands; they stayed on despite the treats of closing:

> [The operators] lasted because they were professionals, and they loved what they were doing. You have to love this business in order to stay with it. To paraphrase Mr. Bill Meloney, where else can you practice your hobby and get paid for it? . . . and get paid a good living wage for it. Actually it was so much fun; I used to love to come to work to operate. Then you forget about all the other people trying to close you. Sitting down there and dealing one on one with a guy three or four thousand miles away . . . see if you can copy his best stuff (and there were a lot of good operators 15 or 20 years ago). They liked to work with operators and that's why they came to us; we had some first rate telegraphers. And we had first rate teletype people who were well trained and knew how to take care of the people. Not just for money's sake but to provide some sort of service, make arrangements for them. See if you could find a new electronic key for them, and get back to them. That's what creates a loyal customer base, that sort of thing. That's what we did. That's what we did all the time.

Martini continued:

> You had legacies to live up to from the old operators. This station was more of a living entity than it was a sterile place of work. You had to think back on who you succeeded, what they did, and the reputation of the station and the reputation of the company. Long before these new buzz words like "empowerment" came out in the contemporary business world, we were already empowered. We took ownership of our stations. We were intimately involved in the success or failure of the place because without us there would be no business and we knew that, so you provided the best possible service, did the favors and got the business -- got them to come back. Repeat business was the name of the game, if you had the loyalty of your customer. They'll wait for two days if you're off the air, won't work anybody else, they'll just wait: that's customer loyalty. So, if you can develop that, then you've got yourself a successful business.

Warren Simpson, a KPH operator from the 1960s, wrote a prophetic ending to his memoirs in 1974, almost 25 years before KPH was closed:

> Today KPH stands alone at the gates of the Pacific. Almost all of the competing stations who fought the wars of the '60's are gone. Like Alexander the Great it lounges on the throne drinking wine and roses. There are no more worlds to conquer.[143]

The looming demise of the station became more real when MCI announced a merger agreement with international communications giant British Telecom, an ironic closing of a circle: the station had been born under the British-owned Marconi Wireless Telegraph Company. A number of times MCI sent pink slips to the employees but rescinded them, as the corporation faced delays including FCC approval and union negotiations. Finally in the spring of 1997 MCI announced that KPH would close, the frequencies and call letters to be sold to their long-time competitor, Globe Wireless of Half Moon Bay, California. Globe (not to be confused with the original Globe Wireless Telegraph Co. of the 1930s) would transfer the call letters and frequencies to the former Voice of America station site at Dixon, California. The staff at KPH numbered twenty-one; all but one would finally lose their jobs.

The news, while long expected, sent waves of sadness throughout the CW community. A few former operators visited the station for a last time and current operators began searching for jobs. On June 29, 1997, KPH sent out its last message and turned off its transmitters and receivers. Veteran operator Ray Smith, a 38-year employee, tapped the final message on his venerable key:

> CQ DE KPH=
>
> FROM ALL OF THE STAFF AT BOLINAS RADIO KPH TO OUR COLLEAGUES ASHORE AND AT SEA THIS ANNOUNCEMENT MARKS THE END OF BROADCASTING FROM OUR LOCATION AT BOLINAS/POINT REYES AFTER 85 YEARS OF SERVICE. TO THE MARITIME COMMUNITY WE WISH YOU FAIR WINDS AND FOLLOWING SEAS 73/88 DE KPH SK

The following day the San Francisco Chronicle eulogized KPH as "the oldest maritime radio station on the West Coast . . . dating back to the earliest days of radio communication." Under a headline that read, "Voice to Ships at Sea Stilled by Technology," reporter Carl Nolte noted that while KPH had gone through four corporate changes over the years, it was one of the oldest businesses in the San Francisco Bay Area. KPH was especially busy during World War II and the Vietnam conflict, when up to 1,000 messages a day went out over the waves. Jack Martini was quoted in the article as saying, "Now, we are lucky to get 100 messages a day . . . it's the end of an era."[144]

Martini, himself a 37-year veteran, stayed on with the lonely task of packing up the station. MCI hired a security company to guard the buildings full time. As of this writing (May, 1998) the future of the facility, with its operating rooms left just as they were on the last day of operation, is unknown. MCI has

announced a new merger agreement with WorldCom, Inc., an ambitious company just 16 years old and already a communications giant; shades of Marconi but of another era and style.

* * *

> There was a special bond between us, I guess. A group of people who still believed in making beautiful music, using international Morse code. We continued the spirit of service to the customer and of helping safeguard souls at sea. There was always more to our jobs than just "making money".
>
> --retired KPH CW operator William F. Gibbons[145]

VI. Extant Historic Resources

A. Bolinas Transmitting Station -- NPS-owned

1. General Description

The Bolinas Transmitting Station, built and operated by Marconi Wireless Telegraph Company of America, Ltd. and later owned and operated by Radio Corporation of America, is located on a lightly sloping plain overlooking the Pacific Ocean about three miles north of the small coastal town of Bolinas and about 30 miles northwest of San Francisco. Its address is 451 Mesa Road. The site is bounded by gulches on the north and south, the slopes of the southern extent of Inverness Ridge on the east, and steep, unstable bluffs dropping to the Pacific Ocean on the west. It is reached by Mesa Road, a narrow, two-lane county-maintained road, which ends about a mile past the facility. The land on which the station stands was originally treeless, open grazing land consisting of native and introduced species of grasses and native coastal scrub. The windswept nature of the site prompted the owners to plant windbreaks of monterey pine, monterey cypress and eucalyptus, most of which have now grown to maturity.

The property was originally divided into a number of dairy ranch parcels in the 1860s on the Mexican-era land grant Rancho Las Baulines. By the time of the last land purchases by RCA, three dairy ranches operated on the property, under leases from RCA to dairymen and their families. Portions of two of the dairy ranch complexes remain. Much of the land is now leased by the federal government to private ranchers for grazing beef cattle.

The original seven buildings of the station, four built in 1913-1914 (Marconi era) and three built in 1929-31 (RCA era), and all of which survive, are spread across an area of about 40 acres and are connected by paved and dirt access roads. Each building was designed according to its specific function, whether it be technical, operational or residential, although they exhibit a continuity of design and were meant to be attractive. All are sturdily constructed of concrete and steel and retain their original exterior decoration. The buildings are operated on a long-term lease between the National Park Service and Commonweal, a non-profit health research organization, and a five-year lease with MCI International, Inc., successor to RCA.

The structures at the Bolinas station complemented contemporary buildings at its sister receiving station at Marshall, some 20 miles to the north, and are nearly identical to those of its fellow transmitting station at Kahuku, Oahu, Hawaii. The Hawaiian facility is under private ownership and most of the buildings are in serious disrepair after many years of abandonment. The two cottages at Bolinas are identical with the cottages at Marshall. From the RCA era, an almost identical station building exists at the RCA receiving station at Point Reyes, about 20 miles northwest of the Bolinas site. The historic integrity of the Bolinas Marconi/RCA complex is very good.

The buildings and features at Bolinas are:

2. Marconi Era (1914-1920)

a. Building 1

The transmitting building and powerhouse, constructed in 1913-1914, is a massive, concrete-steel-and-glass utility building with touches of Mission Revival design. Measuring 85 by 100 feet, the two-story building is divided into major sections, resulting in a split-level roof, the north section being the lower. Each flat roof level has a long, hipped-roof clerestory lighting vent with a red tile roof. The tiles are flat with a ripple pattern, and the gable corners have half-round mission tiles with decorative finials at either end of the hip; the tiles along the gable between the finials has a distinctive double-humped pattern.

The east and west facades of the building are decorated with Mission Revival false fronts at the roof line on two levels, reflecting the bi-level roof. Four large loading doors, two on the west and two on the east, have been infilled with cinder block. One large door opening, closed with plywood double doors with a standard door insert in the left door, was cut into a former window opening some time after 1960. Large 60-to-72-light wood frame windows on all elevations of the building provided a great deal of natural light. All window and door openings on the ground level had been secured with chain-link cages bolted into the concrete walls. Other openings of various sizes, for antenna and power access, occur on the east and west facades.

The interior of Building 1 is almost empty. The sturdy steel framework of the roof and balcony structures is evident. In the south part of the building, concrete platforms in the floor show the former location of various equipment, and three pits once housing components of the Alexanderson alternators are covered by wood planks. A large traveling winch remains in this part of the building. One piece of RCA equipment, the transmitter called BL-10 which was installed in 1959 and was in use until recently, remains in the north part of the building. Otherwise the building is empty and now used for minor storage by Commonweal. It is susceptible to vandalism, and a severely leaking roof has caused mold and deterioration in many parts of the structure.

The building was painted in the winter of 1994 and plywood was installed to cover all window openings. As of this writing, roof repair is being contracted and should be completed by winter 1998-99.

It is recommended that a qualified structural engineer examine Building 1 to determine its condition. Cracks are evident in the thick walls, and concrete is and spalling around the windows resulting in the loss of many sills and edges, and many windows need sash and glass repair.

The building sits on a receding bluff above the beach and is threatened by coastal erosion typical of this area. This erosion was documented by RCA employees between the years 1914 and 1946, and a study using RCA data may determine the rate of erosion. The erosion was no doubt caused in part by the installation of thirty two ground cables that were buried in the cliff face in 1914. It is doubtful that any reasonable action can be taken to stabilize the cliff. As it stands, the threat to Building 1 appears to be not critical but may become so if a major part of the cliff moves.

Despite its few alterations, Building 1 possesses good historical integrity.

b. Marconi Hotel

The small "hotel" was built by Marconi Wireless Telegraph Company in 1913-1914 to house technicians and visitors, and to provide meals and recreation for the staff. It is an attractive, el-shaped, two-story concrete building with a hipped red tile roof and an five-port open porch along the south side. The tile motif on the roof is identical to Building One but on a larger scale. The hotel is 60 by 66 feet including the el. A stuccoed chimney is located on the east facade.

The hotel provided 18 rooms for staff and guests, with a kitchen, recreation room and lobby/ library. The building stood vacant for about 25 years and suffered from theft and vandalism. Commonweal has rehabilitated the building, repairing the roof, constructing a wooden fire escape on the west side, painting, and replacing vandalized wood sash with aluminum sash. A dormer was added on the east-facing roof. The hotel is leased by Commonweal and has been named Pacific House. It is in good condition, it possesses fairly good integrity despite the alterations noted above.

c. Cottage #1

This cottage, located across a gully from the transmitting building, is an attractive reinforced concrete residence with a hipped red tile roof (in the same motif as the other Marconi structures) and substantial porch which faces the ocean, a view now obscured by trees. It measures 40 by 50 feet, with 1-over-1 wood sash windows and a brick chimney. Possibly because of its location, hidden in the trees this structure avoided much vandalism, and most of its original decoration remains intact. The cottage is leased by Commonweal and has been named Bothin House. It is in good condition, and it possesses excellent integrity.

d. Cottage #2

This cottage, located near the hotel, is identical to Cottage #1, except that its porch faces south and it has been remodeled with non-historic components such as aluminum sash windows and hollow core doors. The cottage is leased by Commonweal and has been named Kohler House. It has been painted recently and is in good condition. It possesses fairly good integrity despite the remodeling, alterations which are reversible.