

and better ideas and gadgets.

After we had been using our high spark frequency for about a year, we began to hear the new deForest coastal stations using 60-cycle sparks. One outstanding station at Galilee, New Jersey, was using 120 cycles, which sounded much like the buzz of a mosquito. And at about this time, the middle of 1906, the ALABAMA and ILLINOIS came out of the Brooklyn Navy Yard with the new Fessenden sets. The spark sounded more like a hiss than a tone. Those two ships also used the Fessenden "Liquid Barreter" detector, which in principle was precisely the same as the electrolytic detectors we had made and were than using. As previously stated, the ALABAMA was the flagship of the 2nd Division, and when the two divisions were separated for maneuvers, the ALABAMA had to do the long-distance wireless work. As her signals lacked tone, she always had trouble getting through, making it necessary to use all of her available power. As a result, the glass condenser plates would puncture. After one of these maneuvers in the Caribbean Sea, Chief Gallagher of the ALABAMA told me that he had to use most of the glass panes from the windows of the pilot house to keep his transmitter in operation.

The coastal stations and new ships of the fleet were by this time equipped with AC generators. As we were pretty well fed up with direct-current interrupters, I persuaded my navigating officer to requisition an entire new transmitter of the deForest type, but we received only a Northern Electric motor-generator with starting rheostat and reactance regulator. Thus it was necessary for us to rewind the primary of our old spark coil, then build a new spark gap to handle the increased power, and provide a larger and better condenser. We did all of these things ourselves - and wound up with the best transmitter in the fleet, in spite of the fact that all the new battleships had been coming out of the yards with the latest deForest, Stone, and Fessenden sets, all employing 2-kw transmitters of the latest design.

I believe the excellence of our "home-made" transmitter was due largely to our ability to adjust it, and keep it adjusted for maximum efficiency. On the other hand, the new and modern transmitters on the new ships were equipped with tuning clips soldered in place before they left the Navy Yard. Practically all condensers then in use were of the Leyden Jar type and were not at all uniform in individual capacity. Hence, when one or more of these jars became punctured and then replaced, exact resonance was lost. On the KENTUCKY, while Guthrie and I were aboard, we were able to change our tuning clips each time a new condenser was installed. Thus we were always able to maintain resonance.

I did not like the T-type antennas installed by the Navy Yards because the fanned-out lead-in from the flat top came down fairly close to, and on some ships supported by, one of the ship's funnels. Almost as soon as I was placed in charge on the KENTUCKY, I replaced the "T" antenna with one of the "L" type, with the lead-in being a single wire only, brought down into the radio room free and clear of all obstacles. Our antenna was always so "hot" that on a clear night we could go out on deck and not only hear the rippling hiss of the antenna while sending, but we could actually see the four wires of the flat-top portion of the antenna glow.

Our navigating officer joined our efforts wholeheartedly and always provided us with the necessary cash to purchase ashore any special equipment needed for our experiments. Guthrie and I were both excused from participating in any ship's drills. When the junior officers learned that I would soon take the entrance examinations for Harvard, they tutored me in various subjects, particularly mathematics, during the entire last year of my tour on

the KENTUCKY. We were proud of our relations with our officers. I was particularly happy when, on the last day of my service on the KENTUCKY, I was summoned to the flagship MAINE, and led to the quarterdeck, where Admiral Robley D. Evans said some very kind things to me, then said goodbye, and later sent me a letter of commendation for presentation to the Dean of Harvard.

When I was about to leave the KENTUCKY for the last time, my navigating officer presented me with a box of ten of the Slaby-Arco coherers which came with the original installation in 1904, and I still have several of these in my possession as precious reminders of my happy experiences in those first days of radio in the United States Navy.

By the late fall of 1907, Guthrie and I were both getting to be "short-timers." I had been promoted to the rating of permanent Chief in 1907, and Guthrie was due for a similar appointment. He was sent to Philadelphia to put the new Navy Yard station there in commission, and I was transferred to San Juan, Puerto Rico.

The San Juan station was part of a network which included Guantanamo, Colon, and Key West. The transmitters were made by deForest; 60-cycle, 35-kw outfits of the spark type, the highest powered sets in the Navy. The spark gap was enclosed in a heavy wooden box, and even when tightly closed the sound of the spark could be heard clear off the reservation. When the box was opened, the spark could be heard a mile away in San Juan. The primary power for the transformer had to be keyed with a large solenoid whose contacts were one-inch in diameter, immersed in oil. One contact was made of steel, the other of brass. Frequently these contacts "froze" when operated by the hand key, making it necessary for us to pry them apart with a stick. We actually used this stick as a substitute for a telegraph key at times, and we were able to send as fast as twelve words per minute, which was actually the maximum speed at which the transmitter proper could be operated. Only Key West could send faster, yet his speed never reached twenty words per minute, and the tone of his spark was not up to par.

When I took charge at San Juan in 1907, no signals from Colon had ever been heard there, and Key West was received only on rare occasion. All traffic had to be relayed via Guantanamo. I busied myself with the receiving equipment, duplicating what we had done on the KENTUCKY, and soon we were able to communicate directly with Colon and Key West.

A lot of interesting events occurred while I was at San Juan. One morning before dawn, one of our operators was working Key West. The rest of us were asleep in the same building when we were awakened by dense smoke and the sound of crackling flames. When we dashed into the operating room, the sending operator was wholly unaware of the fire, nor could he hear the crackling of the flames because of the racket made by his spark gap. The insulation on one of the high-voltage leads had broken down and had set fire to the oil-soaked wooden floor. The fire caused one of the big crockery condenser "bath tubs" to crack, with the result that much of the condenser oil leaked to the floor. Soon the fire spread through the transmitter room and under the floor. Fortunately it was a Saturday morning, and only the day previously we had connected-up all of the fire hoses for the customary Saturday fire drill in the Navy Yard. We managed to save the building, but it was a shambles for weeks later until we repaired the "bath tub" condensers. They consisted of large glass plates covered on both sides with tin foil. Many of these were punctured and broken.

Static was terrific at all times. We never dared touch our big antenna unless it was well grounded,

as otherwise it would literally tear our pants off.

We had a telegraph circuit that was interesting. It connected us with the San Juan office of the Insular Telegraph Service for accepting and delivering commercial ship traffic, for we were the only radio station on the island. It was a loop circuit which ran completely around the island, and we were but one of many stations on this loop. There was so much leakage on this circuit that we never knew when any other station was calling us unless the San Juan city office first notified us. Then we would have to adjust our main line relay until it responded to the calling station. Each station on the loop had its own main line battery, and each operator had to adjust his relay constantly to know whether he was being called or not.

Life at old "SA" in 1907 was a tough assignment, but it had its compensations. We had a fine bunch of operators, and the best mess on the island. We had many friends. We all had motorcycles. On Sundays, we exchanged visits with the plantation owners who kept us well supplied with the pick of the best tropical fruits I have ever eaten.

All of my four years in the Navy were happy, interesting, and instructive. They proved most helpful to me, both during my engineering course in college and throughout my after-life in radio work. It is interesting to note that practically every Navy radio operator whom I knew and worked with in those first days of radio in this country has become prominent in some branch of the science ever since.

For the information of old-timers who may have lost the record, and for other Navy men who may be interested, I append the following list of U.S. Navy Shore Radio Stations on the Atlantic Coast and in the Caribbean area, together with their call-letters as of 1904-1908:

PORTLAND, ME.	"PA"
PORTSMOUTH, N.H.	"PC"
BOSTON NAVY YARD	"PG"
CAPE COD, MASS.	"PH"
NEWPORT, R. I.	"PK"
NANTUCKET LIGHTSHIP	"PT"
MONTAUK POINT	"PR"
BROOKLYN NAVY YARD	"PT"
HIGHLANDS OF NAVESINK	"PV"
CAPE HENLOPEN	"PX"
ANNAPOLIS, MD.	"QG"
WASHINGTON, DC	"QI"
NORFOLK NAVY YARD	"QL"
CAPE HENRY	"QN"
DIAMOND SHOAL LIGHTSHIP	"QP"
BEAUFORT, N.C.	"QS"
CHARLESTON, S.C.	"QU"
CHARLESTON LIGHTSHIP	"QV"
ST. AUGUSTINE, FLA.	"QX"
PENSACOLA, FLA.	"RK"
NEW ORLEANS, LA.	"RO"
JUPITER INLET, FLA.	"RA"
KEY WEST, FLA.	"RD"
DRY TORTUGAS	"RF"
GUANTANAMO	"SI"
SAN JUAN, P.R.	"SA"
CULEBRA, V.I.	"SD"
COLON, R.P.	"SL"

Prominent commercial coastal stations of the United Wireless Telegraph Company, as of 1907-1908, who handled personal messages as a courtesy for Navy ships in the Atlantic were the following: No. 42 Broadway, New York City "NY" - Bridgeport, Connecticut "BG" - Galilee, N. J. "G" - Atlantic City, N. J. "AX" - Cape Hatteras N.C. "HA".

Call-letters beginning with the letter P were later transferred to commercial wireless shore stations

along the Pacific Coast, while the stations of the U.S. Navy in this same area were given call-letters beginning with the letter T. Still later, when three-letter calls were assigned, the Navy stations of the Pacific were given NP as the first two letters, while on the Atlantic the first two letters were NA, thus making it easy to distinguish between the two coastal regions.

Upon graduation from Harvard in 1912, I joined the National Electric Signaling Company of Brooklyn as Research Engineer. My work with this company was devoted exclusively to the development of the Fessenden heterodyne for reception, using the Chaffee arc as a generator.

From 1913, to 1916, I was Pacific Coast Radio Inspector for the Department of Commerce with headquarters at San Francisco. The famous Ship Act of August 13, 1912, designed to promote the safety of life at sea, had just gone into effect, and it was during this period that occurred the long drawn out strike of the Radio Operators Union.

From 1916 to the Spring of 1918, I was Radio and Electrical Engineer with the Federal Telegraph Company at San Francisco, in which position I first assisted in the design of the high powered arc transmitters for the U.S. Navy, and then installed the 250-kw station at San Diego, and the 500-kw stations at Pearl Harbor, Hawaii, and Cavite, P.I.

Upon my return from Cavite in the Spring of 1918, I offered my services to the Army and was commissioned a Captain in the Signal Corps, O.R.C., and after a short period of duty in the office of the Chief Signal Officer in Washington, proceeded overseas in August and was at once assigned as Army Radio Officer, Second American Army, with headquarters at Toul, France, and continued in that capacity until the Armistice.

Returning to the United States in May, 1919, I served as Pacific Coast Radio Supervisor for the United States Shipping Board until July, 1920, when I returned to the Signal Corps as radio engineer in the office of the Chief Signal Officer. It was while in this position that Washington founded the Army Radio Net, later known as the War Department Radio Net, connecting the War Department with the nine Corps Area headquarters of the United States. In November, 1920, I accepted a commission in the Regular Army as Captain, Signal Corps, and became Officer in Charge of all Army radio stations, ashore and afloat. In 1927 I became Officer in Charge, Second Section, Alaska Communication System, with headquarters at Seward, Alaska.

Returning from Alaska in 1929, I was assigned as Radio Officer, Ninth Corps Area, with headquarters at the Presidio of San Francisco, and remained on this assignment until July, 1935, when I was transferred to Omaha as Executive Officer, Signal Office, Seventh Corps Area.

In July 1938, I was again assigned to the Alaska Communication System. In September, 1938, I was promoted to Major, and on June 12, 1941, to Lieut. Colonel, and became officer in charge of the Alaska system during its tremendous expansion under the emergency.

On October 17, 1941, I was transferred to Hawaii and was assigned as Department Radio Officer with headquarters at Fort Shafter, Oahu.

In January, 1943, I was ordered to South America where I was assigned as Theater Signal Officer, South Atlantic Theater, with headquarters at Recife, Brazil. During this assignment I was promoted to Colonel on June 16, 1943. By the beginning of 1944,

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