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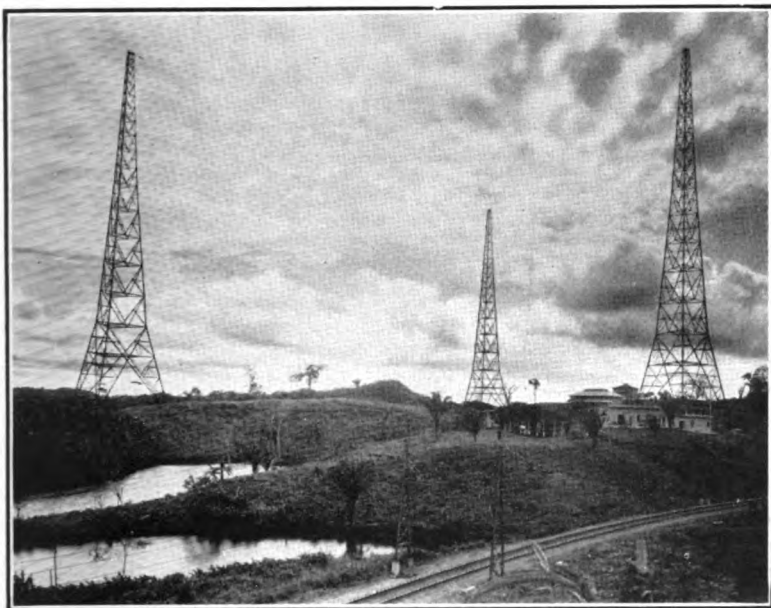


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THE DARIEN RADIO STATION OF THE U. S. NAVY (PANAMA CANAL ZONE)*

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DARIEN RADIO STATION OF THE U. S. NAVY

In its system of radio communication for the Canal Zone, the Navy has maintained the high standard set by the Canal in general in having thoroly modern equipment. The layout comprises one coastal station at each end of the Canal for ship to shore work, and one high power station for long distance work.

The Darien radio station is located just twenty-five miles

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south of Colon on the Panama Railroad. The railroad forms the east boundary of the reservation which contains eighty-seven and one half acres. The southwest boundary is the Canal itself from which runs a channel twenty feet deep and seventy-five wide into the center of the station plot. Those who may have visited the Canal before the water was allowed to rise may remember this site as being adjacent (to the southeastward) to the old town of San Pablo. On the "relocation" of the railroad, the nearest stop was Caimito Cabin at the North end of the dumps; and the site was known variously as the San Pablo or Caimito radio, or simply as *Radio*, in the early stages. Finally the Department assigned the name Darien when, by request, the Governor named the railroad stop here Darien. Until the name was well known, mail frequently went stray to the southernmost province of the Panama Republic, which is known as the Darien section.

Work was started on construction in December, 1913, by the Quartermaster Department of the Panama Canal. The site was far removed from any of the Canal Zone towns and was mostly jungle. A spur from the railroad was put in, laborers' barracks built; and, as it is unsafe to load cement in the open due to the sudden rains, a cement shed was erected close to the spur. With a hoisting engine on the hill, all material was hauled up a narrow gauge road in De Cauville dump cars. This narrow gauge road continued around the station site for the delivery of material for the buildings and towers. The small locomotives, cars and track were relics of the French construction days. Water for the station was pumped to a tank on a hill by a Worthington pump, which obtained its steam from a boiler of an old Belgian locomotive side-tracked for that purpose. Drinking water was distilled at this pump station. This equipment supplied the station until the arrival of the electric turbine pump. The Gatun Lake water is now used and merely sterilized for drinking and cooking purposes.

The dwellings on the site are the house for the Radio Officer, cottage for the chief electrician in charge, and barracks for the operators equipped to house seventeen men. Servants' quarters are also provided in the barracks building. Rations are commuted at a dollar a day per man, and a mess is run by the operators.

All the buildings are screened, including the porches. There is such a large breeding area for mosquitoes about the site that the cost would prohibit sufficient sanitation work to keep the

mosquitoes down entirely, and the means adopted are (1) to keep the screening as tight as possible; (2) each morning a sanitary inspector makes the rounds, and catches the mosquitoes inside the living quarters and office; (3) no containers are allowed to collect water; in which there may be breeding on the station site; (4) all drains are kept clear so no water stands in puddles; (5) around the edge of the water the bank is kept skinned to allow the small fish to eat the mosquito larvae (this means is remarkably effective); (6) the force of five laborers allowed the station is kept at work on the grounds to keep the jungle growth cut down as well as possible. When one case of malaria appeared, the whole station was put on a quinine diet for ten days, in order to prevent an epidemic.

The other buildings of the station, with the exception of the boat-house, are of concrete. The boat-house is of old form lumber left over from the concrete work, and corrugated iron roofing robbed from old, abandoned shacks on the site, one of which was a distillery.

The power-house is sixty feet by thirty feet, and contains the motor generators for the main transmitting set.

The main distributing and controlling switchboards are here, with the auxiliary transformers. This building also houses the machine tools, a small lathe, a drill press, milling machine, and emery grinder, and is fitted with a five-ton overhead travelling crane. All wiring is in conduit in wire trenches.

The operating building contains the arc room (where is located the main transmitting set with its auxiliary electric controlling devices), the receiving room and the office, besides a spare room for an auxiliary sending set if needed later. The arc room and the receiving room both have wire mesh embedded in their walls, floor and ceiling, in order to prevent induction from the transmitting set injuring the receivers. The building is fireproof, which is necessary on account of the action of the continuous oscillations used at such high voltage. The charging current into iron in the vicinity of any live lead heats the iron quickly. Some of the reinforcing had to be taken out of one concrete base because the current jumped to it; and one wall 19 inches (47 centimeters) away from the end of the helix heats so that the hand cannot be kept on it after a twenty-minute run. The reinforcement in this wall is merely metal lathing, but it is directly in the field of the main helix.

The contract for the towers was let to the Penn Bridge Co. which in turn sublet the fabrications to the Toledo Bridge and

Iron Works, and the erection to Mr. J. O. Childers. In all three towers there are about 1000 tons of structural steel. They are 600 feet (183 meters) high each; the feet form a triangle 150 feet (46 meters) on a side, and the tower tapers to a 10-foot (3 meters) triangle at the top. An iron ladder runs up the outside of one leg on each tower, having rest platforms about every 50 feet (15.2 meters).

When first erected there was considerable swaying in the bottom long diagonals, but these and others above were stiffened up by cross bracing, and now they are perfectly rigid. When the antenna was hoisted and adjusted to the sag which would give a pull of about 13000 pounds (5500 kilograms), the top of each tower was pulled over only 4 inches (10 centimeters) during hoisting, and settled back to 2 inches (5 centimeters) when hoisting stopped. All the bend was in the upper 200 feet (60 meters).

As mentioned earlier in this article, it was the first intention to locate the towers on the tops of the hills, but on making the actual location it was found that the thrusts (which come on to the footings at the angle of slightly over sixteen degrees from the vertical) would be nearly too parallel to the face of the hills to give solid backing for the footings. They were finally located so that all footings except one butt into the hills. In order to do this, however, the footings were put on about the 120-foot (36 meters) level instead of the 170-foot (52 meters). The surface of Gatun Lake is normally at the 85-foot (26 meters) level. The block for each footing is 16 feet (5 meters) deep and 20 feet (6 meters) square, heavily reinforced with old railroad rail. Each block filled entirely the hole excavated for it without back filling in order to have it bearing in undisturbed earth. The distance between towers is: one and two, 897 feet (273 meters); two and three, 751 feet (254 meters); one and three, 969 feet (295 meters); the antenna covering about six acres.

The Darien Towers, being farther apart, and not so directly beneath the antenna seem not to affect the capacity as at Arlington. Darien evidently has a greater effective height than Arlington.

The antenna was made at the New York Navy Yard and shipped to Darien, each wire on a separate reel and tagged to mark the points where other wire crossed. The cables are all phosphor-bronze; the outside ones being $\frac{3}{4}$ -inch (1.9 centimeter) diameter, the four strain cables thru the mast, $\frac{3}{8}$ -inch (0.9 centimeter) diameter, and the sixty-six radiating wires of regular

antenna wire. The first 150 feet (48 meters) of the down land of twenty-six wires is a fan and is then grouped by spacing hoops to form the rattail. Each corner is insulated with the Arlington type of Locke insulators with, however, two strings in parallel, as the strain was too near the mechanical breaking limit of the insulators. Lightning has already struck the antenna twice without damage, because of the safety gap feature of these insulators and the towers being grounded. An electric winch on each tower furnishes the power needed for handling the antenna. The feet of each tower are insulated.

The feet rest on 10 porcelain block insulators 11 inches (27.9 centimeters) high, having each three petticoats. Insulators are also placed under the yokes, which secure to the anchor bolts for taking the upward thrusts; and others are placed between the footing and the channel irons projecting from the block to take the side thrusts. However the arc "pulls" better with the towers grounded; so they are operated in that condition by being grounded thru large knife switches to the ground system of the station.

The general ground conditions of this site are excellent, since the Gatun Lake lies on three sides of it, with an arm reaching into the center of the station plot. An artificial ground was laid in addition to cover all the land as follows: 100,000 feet (30,000 meters) of annealed copper wire was laid in the shape of a grid forming rectangles about 50 feet (15 meters) on a side. All inter-sections were soldered; the ends of all wires, on reaching the water's edge were run 100 feet (30 meters) into the lake, and the main ground plate and the ground plate for each tower are tied into the large grid by busses reaching well out into it. This ground system is buried about 4 inches (10 centimeters) for protection.

The main transmitting set was furnished by the Federal Telegraph Company, and the arc generator is their type of the Poulsen arc.

The signalling is done by short circuiting or opening a compensating helix in series in the antenna circuit. The key for accomplishing this contains 13 pairs of points mounted on a yoke in parallel, so that each pair of points breaks only the voltage due to one turn of the auxiliary helix. This yoke is on the armature of a solenoid, the current controlling which is broken in a strong magnet field; and the key is thus positive and fast in action. The D. C. supply is protected from the radio frequency current by having air core choke coils in both

positive and negative lead to the machines. The arc field spools are in the negative lead, and carbon rod protection in the powerhouse guards further against high voltages getting into the D. C. generators. This set gives Arlington a signal easily readable thru all but the worst electrical storms.*

The arc can be controlled entirely from the operator's seat; the main generator voltage being controlled there, circuit breakers closed or tripped, the arc struck and starting resistance short-circuited. While running, the arc is regulated to take up the wear of the carbon by foot pedals, so that the operator may not have to interrupt his sending. All circuits are electrically interlocked so that on starting, the correct sequence must be followed.

The regular receiving cabinets with tikkers, as used by the Federal Telegraph Co., were provided with the outfit.

For short wave work, an oscillating audion detector is used on one of the Federal Company's cabinets.

Only government work is handled by this station, and at present there is not enough of this to demand continuous watch so that schedules are run. The complement requires eight operators on watch, two at a time, a chief radio electrician in general charge, a hospital steward of the Navy in charge of sanitation and general health work, a yeoman (who is a clerk for the station and for the Radio Officer), and a machinist. Five laborers are employed on the grounds, which were high jungle when the station was built. The Radio Officer of the Canal Zone lives here, having his office in that of the station. With excellent telegraph and telephone service to all parts of the Isthmus, the station, tho isolated, is in close touch with the Canal Government.

When the Navy Department decided upon the kind of set and the general features of this station most of them were in the experimental stage, and the excellent results obtained at this station have been watched with keen interest and gratification.

SUMMARY: The buildings, sanitary arrangements, towers, ground connection, antenna, and some features of the transmitter and receiver of the Darien radio station of the United States Navy are described.

* (The distance from Arlington to Darien is 1,900 miles (3,000 km.), practically due south.—EDITOR.)