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## HISTORY OF RADIO IN RELATION TO THE WORK OF THE WEATHER BUREAU.

By E. B. CALVERT, Meteorologist in Charge, Forecast Division.

[Weather Bureau, Washington, February 20, 1923.]

### SYNOPSIS.

The purpose of this paper is to assemble facts relating to the history, progress, and present usage of radio in relation to the work of the Weather Bureau. The Weather Bureau was the pioneer of all agencies of the United States Government in investigations and experiments in wireless telegraphy. The investigations were undertaken because it was foreseen that this form of communication presented a field of opportunity to meteorology in securing current weather information from inaccessible places and ships, the providing of storm warnings to vessels at sea, and supplementing or replacing the Weather Bureau system of collecting weather reports by telegraph and cable.

Radio has been utilized continuously by the Weather Bureau for more than 20 years, and it now plays a large and indispensable part in its activities.

### CHRONOLOGY.

- 1895 Marconi begins his investigations in wireless telegraphy.
- 1899 Marconi succeeds in transmitting wireless messages across the English Channel.
- 1900 (Jan. 19). Professor R. A. Fessenden engaged by the Weather Bureau to conduct wireless telegraph experiments.
- 1902 (July). First application of radio communication to storm-warning work.
- 1904 (June 24). Inter-Departmental Board on Wireless Telegraph appointed by the President.
- 1904 (July 29). Weather Bureau discontinued radio experiments and operations.
- 1904 (Nov. 30). Navy takes up radio work for the Weather Bureau.
- 1905 (July 1). Lighthouse Board cooperates with Weather Bureau in collecting messages from observers at sea.
- 1905 (Dec. 1). First weather map prepared at sea from radio reports.
- 1905 (Dec. 3). First observation by radio from vessel in the Atlantic Ocean.
- 1906 Establishment of vessel-weather service.
- 1906 (June 28). International Conference on wireless telegraphy at Berlin.
- 1907 (July 18). First observation by radio from a vessel in the Pacific Ocean.
- 1907 (Nov. 1). Radio first used in securing reports from Alaska.
- 1909 (Aug. 26). First radio report from vessel in vicinity of hurricane.
- 1912 (June-July). International Radio Telegraph Conference, London.
- 1913 (July 15). Inauguration of broadcasting of daily Weather Bureau bulletins by naval radio stations.
- 1914 (January). First daily broadcasts of forecasts in the several States by radiotelegraph.
- 1914 (July 1). Similar service begun for the region of the Great Lakes.
- 1915 (Oct. 21). Inter-Departmental Committee on radio legislation.

- 1919 (Jan. 17). First weather reports to France by radio.
- 1920 (Sept. 14). Conference with delegates to Radio Protocol.
- 1920 (Nov. 20). Inauguration of radio weather broadcasting for the hurricane season at San Juan, P. R.
- 1921 (Jan. 1). First daily radiophone broadcasts of forecasts.
- 1921 (May 17). Inter-Departmental Board to consider radio and telegraph service for the Government.
- 1921 (June 1). First radio weather bulletins for benefit of aviation.
- 1921 (June 1). United States Shipping Board cooperates in obtaining daily meteorological observations on all its ships and forwarding the reports by radio to the Weather Bureau.
- 1921 (June 10). Localized radio weather broadcast service begun for the Atlantic and Gulf coasts and the Great Lakes.
- 1923 (Feb. 15). Inauguration of radiophone weather broadcasting through United States naval radio station at Arlington.

### EARLY HISTORY AND EXPERIMENTS.

Marconi began his investigations in wireless telegraphy in 1895, and in March, 1899, he succeeded in transmitting messages by this means across the English Channel from Dover to Boulogne. The Weather Bureau was interested immediately in these investigations because wireless communication presented a field of opportunity to meteorology in the obtaining of current weather information from places inaccessible by telegraph, telephone, or cable, in the transmission of forecasts and warnings to such places, and, further, because it offered a prospect of supplementing or replacing at less cost its extensive system of collecting weather reports by telegraph circuits. Therefore, a few months after Marconi had demonstrated the practicability of wireless communication, the Weather Bureau formulated plans for investigation looking toward the development of apparatus and extension of knowledge of the underlying principles of the science.

Prof. Reginald A. Fessenden, then a member of the faculty of the Western University of Pennsylvania, at Allegheny, was employed by the Weather Bureau to conduct the experiments. They were begun January 19, 1900. Thus the Weather Bureau became the pioneer of all agencies of the United States Government in investigations and experimentations in wireless telegraphy.

Special stations for the work were established at Hatteras and Roanoke Island, N. C., 47 miles apart. These points were selected because of the advantages

presented by the intervening space being entirely water, and for the further reason that the Weather Bureau owned and operated cable and land-line connections between the two points, which provided immediate means of checking the results of the work. A number of forms of receivers were devised and tested, and communication between the two stations was accomplished in 1901 by means of a hot-wire receiver or boloscope, and without the use of the "coherer" which Marconi had utilized. During the winter and early spring it gave excellent results and messages were transmitted with a rapidity almost equal to that of the ordinary telegraph. Successful tests were made in the spring of 1902 before representatives of the Army and Navy. It was thought that this receiver would replace all others in use. However, during the summer the atmospheric electric conditions frequently caused the minute platinum loops, on which the action of the boloscope depended, to burn out when connection was made with a vertical wire.

Professor Fessenden developed and patented a number of valuable devices which were used in wireless telegraphy for many years. Unfortunately for the Government, the contract entered into between the Secretary of Agriculture and Professor Fessenden provided that only the Weather Bureau should have free use and right to the latter's patents. The Weather Bureau received no substantial benefits from the patents because it was disengaged from wireless experimentations and transmission activities in 1904, and litigation efforts to secure free use of them by other branches of the Government were unsuccessful.

Professor Fessenden continued his investigations until August 31, 1902, when he resigned. After that date they were continued under the direction of Mr. Alfred H. Thiessen, who had been Professor Fessenden's assistant. Mr. Thiessen's experimental work was transferred to the Pacific coast and wireless stations were established at Point Reyes Light, Calif., and on southeast Farallon Island. Regular communication was established between these points and effectively used in the transmission of weather observations and reports of ships bound for the Golden Gate.

*Inter-departmental Board on Wireless Telegraphy.*—In the meantime the Army and Navy became engaged in wireless telegraph work and investigations. Developments were rapid and it soon became apparent that confusion and unsatisfactory conditions would arise should many Government agencies work independently along the same lines. Under date of June 24, 1904, President Roosevelt appointed Rear Admiral Robley D. Evans, representing the Department of Commerce and Labor; Rear Admiral Henry N. Manney and Lieut. Commander Joseph L. Jayne, representing the Navy Department; Brig. Gen. Adolphus W. Greely, representing the War Department; and Prof. Willis L. Moore, Chief of the Weather Bureau, representing the Department of Agriculture, as a board "to consider the entire question of wireless telegraphy in the service of the National Government," with directions that it submit a full report to him.

The board submitted a unanimous report on July 12, 1904. By order of July 29, 1904, the President directed that "the several departments concerned put its recommendations into effect." Under the terms of the order the Weather Bureau ceased its wireless experiments and operations. Such work was assigned to the Navy on coasts and the Great Lakes, and to the Army in the interior. It provided that "the Navy

Department shall, without charge to the Agricultural Department, receive and promptly transmit to the oceans or to islands, or to other places where the information can be made useful, the storm warnings of the Weather Bureau."

The members of this board, as shown by their report, had such a clear vision of the potentialities of radio communication and of the necessity for its regulation, and were so prophetic of the confused conditions that now confront this country and how to remedy them, that it is quoted in full.

REPORT OF INTER-DEPARTMENTAL BOARD APPOINTED BY  
PRESIDENT ROOSEVELT.

LIGHTHOUSE BOARD ROOM,  
Washington, July 12, 1904.

The board first met in the Lighthouse Board room, in obedience to the order of the President and pursuant to the call of the chairman, at 11 a. m., July 6, 1904. Present, all the members.

The chairman requested Lieutenant Commander Jayne to act as recorder, and then read the letter appointing the board, a copy of which is prefixed and marked "A," and the inclosures, marked "B" to "J," inclusive.

After the reading of the memorandum from the Secretary of Agriculture, marked "D," Professor Moore stated that Mr. Fessenden had, since it was written, made a satisfactory settlement of the claims against him by assigning the patent rights in question to the Department of Agriculture, Weather Bureau.

The board thoroughly discussed and maturely considered the questions before it at its meetings held from time to time, all the members being present at each meeting.

The following was found to be the status regarding Government wireless telegraph stations:

(a) The Department of Commerce and Labor has established no stations, but permission has been granted to other departments to erect 10 on lighthouse reservations and on the Nantucket Shoals Lightship and its relief.

(b) The Army has operated six stations and is preparing to install two others in Alaska. The urgent necessity for the stations in Alaska has caused the temporary removal of the apparatus from two of the first mentioned, but it is in process of replacement. Four other Army stations have been proposed, but for two of these the Chief Signal Officer thinks that the proposed naval stations in the same localities, if available to the Army, would make duplication unnecessary. The Army also has one portable train for use in maneuvers or for other military purposes.

(c) The Department of Agriculture made valuable and extensive experimentation, and has established two stations and contemplated establishing others at prominent points along the coast lines.

(d) The Navy Department has established 20 shore stations. The apparatus has been removed from 1 of these but it will be replaced in a few days. Arrangements are being made for the establishment of 10 more in the near future, a complete equipment, or some portion of it, having been ordered for each one. This includes the 2 lightships that take turns on Nantucket Shoals. In addition to these 30 stations, it is proposed to establish about 50 more on shore and to start on the more important of these at an early date.

The Navy Department has entered into a very important contract for the equipment of long-distance stations at Key West, Guantanamo, points to be determined in Porto Rico and in the Panama Canal Zone, and Pensacola. Satisfactory communication is to be established between all of the first four and between Key West and Pensacola. Communication from any one of these stations to ships at any points between it and a communicating station is also to be established.

Twenty-four naval ships have already been equipped and 10 others are to be equipped immediately, or before the completion of the repairs which they are undergoing. It is proposed to equip 68 others after the report of the board which is now conducting test of various systems has been acted upon, making a total of 102.

One torpedo-boat outfit has been ordered for trial. If this apparatus is successful a number of torpedo-boat destroyers and small gunboats may be equipped, making the total number considerably larger.

With these small vessels provided with wireless apparatus, there would be about 200 naval stations on shore and afloat.

(e) The Treasury Department, while having under consideration wireless installations for the Life Saving Service and the Revenue Marine Service, has established no stations, but has relied on a leased commercial wireless system.

The following was found to be the status of private stations:

The Marconi Co. has a long-distance station on Cape Cod for communicating across the Atlantic, and two others of comparatively short