

RADIO AND SOUND BULLETIN

NAVY DEPARTMENT,
BUREAU OF SHIPS,
July 1, 1944.

SOME NOTES ON THE EARLY HISTORY OF THE RADIO DIVISION

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These notes are by Mr. Lawrence J. Haslett, Clerk, CAF-4, whose employment in the Radio Division extended from 27 July, 1903 to 31 January, 1944 when, after having rendered faithful service throughout this period, he retired. Mr. Haslett was the first full time civilian employee of the Radio Division. His duties as stenographer and clerk afforded unique opportunities for observing matters pertaining to the establishment and early growth of Navy Radio as reflected in the notes published herewith.

J. B. Dow,
Captain, U.S.N.

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In order to assist in dating events listed in these notes, the Roster of Officers-in-Charge of the Radio Division for the period 1903-1944 follows:

Bureau of Equipment

Lieut A. M. Beecher.....	1903.
Lieut. J. M. Hudgins.....	1903-1904.
Lieut. J. L. Jayne.....	1903-1904.
Lieut. S. S. Robison.....	1904-1906.
Lt. Comdr. Cleland Davis.....	1906-1910.

Bureau of Steam Engineering and Bureau of Engineering

Lt. Comdr. D. W. Todd.....	1910-1913.
Lt. Comdr. A. J. Hepburn.....	1913-1915.
Lieut. S. C. Hooper.....	April 1915-July 1917.
Lt. Comdr. H. P. LeClair.....	July 1917-August 1918.
Comdr. S. C. Hooper.....	August 1918-July 1923.
Capt. R. W. McNeely.....	July 1923-March 1926.
Comdr. S. C. Hooper.....	March 1926-July 1928.
Comdr. E. C. Raguet.....	July 1928-December 1930.
Comdr. S. A. Manahan.....	December 1930-October 1933.
Comdr. W. J. Ruble.....	October 1933-June 1938.
Lt. Comdr. J. B. Dow.....	June 1938-January 1940.
Comdr. A. J. Spriggs.....	January 1940-June 1940.

Comdr. A. J. Spriggs..... June 1940-December 1941.
 Comdr. J. B. Dow..... December 1941-

The first naval officers detailed in the Bureau of Equipment to devote their attention to wireless telegraphy were Lieut. A. M. Beecher and Lieut. J. M. Hudgins. During the tour of duty of Lieut. Hudgins, he prepared the first naval text book on the subject, "Instructions for the Use of Wireless Telegraph Apparatus." Reference to the Bureau's files may still find a report by him detailing the efforts made and the difficulties encountered and finally overcome in accomplishing wireless communication between Washington and Annapolis, the intervening distance being 30 miles. The Annapolis and Washington test stations were established in 1902 for the purpose of testing equipment of Slaby-Arco and Braun-Siemens-Halske manufactured in Berlin, Rochefort and Ducretet manufactured in Paris, and Lodge-Muirhead manufactured in London and imported into the United States for this purpose. DeForest equipment manufactured in the United States also was used. Tests between Annapolis and a ship in Chesapeake Bay, and between two ships at sea at "a considerable distance from land" were made also. The tests were made under the supervision of a board of five naval officers. The report of the board, received in the Bureau on 23 Sept. 1903, found that the Slaby-Arco apparatus was superior to the others. Thereupon, the Bureau ordered 20 Slaby-Arco sets, to be imported into the United States from Germany, for further tests during forthcoming fleet maneuvers.

Although not named in the roster of officers detailed in the Bureau, mention should be made of Commander F. M. Barbour, U S. Navy (retired), who was residing in Paris and in October 1901 was, at the request of the Bureau, especially detailed for duty in connection with the investigation of wireless on the Continent of Europe and who contributed largely in securing the cooperation of foreign governments, notably the French, in the early developments of wireless. For a number of years, Commander Barbour kept the Bureau advised of the latest developments and inventions in Europe.

Lieut. S. S. Robison during his stay in the Bureau, where he was associated with Lieut. J. L. Jayne, prepared in 1906 his first "Manual of Wireless Telegraphy for the Use of Naval Electricians", several editions of which have since been issued. From its initial publication in 1906 it was recognized as the Navy's standard text book on the subject.

Wireless stations were established at all the navy yards and

naval stations and at many other places on both the Atlantic and Pacific coasts of the United States, including stations on a number of lightships. Wireless stations were also established at various locations in the West Indies and the Pacific Ocean area. Eventually all the larger naval vessels were similarly equipped and the smaller ones when suitable apparatus became available.

The ships and shore stations which first were fully equipped with wireless apparatus, and operators furnished for service use, are listed below:

		1903
		<i>Shore Stations</i>
Baltimore.	Prairie.	Cape Elizabeth, Maine.
Kearsage.	Texas.	Newport, R. I.
Illinois.	Topeka.	Montauk Point, N. Y.
Olympia.		Navy Yard, New York ¹
		Highlands of Novesink, N. J.
		1904
		<i>Shore Stations</i>
Alabama.	Maine.	Portsmouth, N. H. ¹
Atlanta.	Newark.	Cape Ann, Mass.
Boston.	Cincinnati.	Boston, Mass. ¹
Brooklyn.	Rainbow.	Cape Cod, Mass.
New York.	San Francisco.	Annapolis, Md.
Yankee.	Massachusetts.	Washington, D. C. ¹
Oregon.	Mayflower.	Norfolk, Va. ¹
Wisconsin.	Minneapolis.	Cape Henry, Va.
Columbia.	Missouri.	Key West, Fla. ¹
Detroit.	Solace.	Dry Tortugas, Fla.
Iowa.	New Orleans.	Pensacola, Fla.
	Raleigh.	San Juan, P. R.
		Culebra, W. I.
		Mare Island, Calif. ¹
		Yerba Buena Isl., Calif.
		1905
		<i>Light Vessels</i>
Chicago.	Dolphin.	Nantucket Shoals Lightship Nos. 58
Cleveland.	Tacoma.	& 56.
Des Moines.	Chattanooga.	Diamond Shoals Lightships Nos. 71
Maryland.	Denver.	& 72.
Whipple.	Galveston.	Charleston Lightship No. 34.
Kentucky.	West Virginia.	Guantanamo, Cuba.
Colorado.		Colon, C. Z.
		Cape Henlopen, Del.
		Charleston, S. C.
		St. Augustine, Fla.

¹In 1905, the Shore Stations marked with figure 1 began the practice of sending out noon time signals by wireless telegraph for use in comparing chronometers.

The Navy's ship and shore wireless stations in the vicinity of San Francisco were of special value during the San Francisco disaster in April 1906, by furnishing for a considerable period a means of rapid communication with the outside world.

Jupiter Inlet, Fla.
 New Orleans, La.
 Pt. Arguello, Calif.
 Pt. Loma, Calif.
 Navy Yard, Puget Sound.
 Navy Yard, Pearl Harbor.
 Guam, Mariana Islands.

1906

<i>Ships</i>		<i>Shore Stations</i>
Brutus.	Lawton.	Fire Island, N. Y.
Caesar.	Lebanon.	Beaufort, N. C.
Charleston.	Marietta.	Tatoosh Island.
Don Juan de Aistria.	Paducah.	North Head, Wash.
Dubuque.	Supply.	Cape Blanco, Ore.
		Eureka, Calif. (Table Bluff).
		Farallon Islands.
		Cavite, P. I.

In the early days, wireless apparatus was not always received on board a vessel with enthusiasm, and more than once it was heard to be classed as a "luxury". Instances were known when commanding officers were pleased if they could leave port without having on board such means of communication.

During the tour of duty of Lieut. Comdr. Cleland Davis, who succeeded Lieut. Comdr. Robison, great progress was made in the wireless art. Consideration was given to the establishment of a chain of high power stations, which eventually were located at Arlington, Va., Darien, Canal Zone, San Diego (Chollas Heights), Calif., Pearl Harbor (Navy Yard), T. H., and Cavite (Sangley Point), P. I. Close and cordial relations were established with other government agencies in furthering the common good. Efforts were made to secure the passage of legislation to afford wireless a legal status. The many inventors who appeared were welcomed and afforded every facility and encouragement in explaining their ideas and demonstrating their inventions. Experiments were conducted with wireless compasses (or direction finders) and with the submarine bell. A contract was entered into in 1909 for the 100 KW, synchronous rotary spark, transmitter for the projected Arlington Station, this transmitter being installed at Brant Rock, Mass. in 1910 for conducting preliminary experiments in conjunction with the Wireless Laboratory at the Bureau of Standards in Washington.

It has been said that the success and favorable attention gained by Navy wireless during this early period was in no small measure due to the vision and forceful personality of Lieut. Comdr. Davis, who was stated by the Chief of Bureau to be "the beau ideal naval officer."

Lieut. J. J. Hyland (now Captain and Inspector of Naval Material at Boston) was assistant to Lieut. Comdr. Davis during this period. He systematized the blanks and forms used and the reports on wireless required from the ships and stations, and was recognized as being entitled to great credit in his efforts to bring order in that line and make the results readily obtainable and of value in a study of conditions and policies to be pursued. At that time all matters pertaining to Navy wireless, including the sending and receiving of messages, were under the cognizance of the Bureau of Equipment and all messages went through the wireless station at the Navy Yard Washington. Among the records kept was that of the number of messages and words sent and received by each wireless station. The forms, including those relating to messages, originated by Lieut. Hyland, changed to meet different conditions, are still in use. Some have been called for in court proceedings.

The following table, giving the number of messages received and transmitted by each shore station, then in commission, from July 1, 1906 to July 1, 1907 illustrates the volume of traffic handled in the early days of Navy wireless:

<i>Name</i>	<i>Messages sent</i>	<i>Messages received</i>	<i>Words sent</i>	<i>Words received</i>
Cape Elizabeth, Maine.....	48	166	892	2,935
Portsmouth, N. H.....	531	840	8,078	12,922
Boston, Mass.....	373	1,183	14,169	17,835
Cape Cod, Mass.....	2,673	2,304	56,186	53,903
Newport, R. I.....	397	2,701	9,022	35,315
Fire Island, N. Y.....	81	159	1,334	872
Navy Yard, N. Y.....	861	1,121	22,202	31,364
Cape Henlopen, Del.....	39	115	594	2,121
Annapolis, Md.....	482	573	11,432	13,333
Washington, D. C.....	525	786	9,335	14,577
Norfolk Va.....	1,923	2,171	31,463	33,224
Cape Henry, Va.....	1,465	1,289	22,149	23,120
Light Ship No. 71.....	247	114	3,086	1,192
Light Ship No. 72.....	578	169	6,570	2,813
Beaufort, N. C.....	42	537	967	6,720
Charleston, S. C.....	111	196	2,466	4,407
Light Ship No. 34.....	7	35	188	930
St. Augustine, Fla.....	122	121	2,602	2,571
Jupiter Inlet, Fla.....	53	273	845	2,902
Key West, Fla.....	950	1,550	18,920	27,497
Dry Tortugas, Fla.....	1,228	2,703	29,278	101,902
Pensacola, Fla.....	110	174	2,054	2,677
New Orleans, La.....	583	1,255	1,449	1,221
San Juan, P. R.....	585	1,343	13,365	18,081
Culebra, P. R.....	674	458	11,614	9,893
Guantanamo, Cuba.....	1,359	706	17,577	14,132

Name	Messages sent	Messages received	Words sent	Words received
Colon.....	216	140	2,130	3,551
Puget Sound, Wash.....	230	237	5,735	5,073
Tatoosh Island.....	17	61	902	1,176
North Head.....	100	101	2,215	2,362
Cape Blanco.....	22	15	421	250
Table Bluff, Cal.....	42	19	1,060	373
Mare Island, Cal.....	1,898	2,334	47,735	75,687
Farallon Islands.....	1,889	1,221	45,338	28,768
Yerba Buena Island.....	1,265	1,836	30,094	42,190
Point Arguello, Cal.....	1,040	978	27,533	19,962
Point Loma, Cal.....	1,672	1,532	26,528	24,384
Honolulu.....	16	27	351	600
Cavite, P. I.....	2,025	2,013	47,081	34,247
Guam.....	454	517	6,959	8,525
Totals.....	26,936	34,073	541,519	685,607

As indicated by this table, the service at this time, comprised only messages exchanged between ships at sea and coastal stations of the Navy's "Coast Signal Service."

Lieut. Hyland prepared the first edition of "List of Wireless Telegraph Stations of the World," which, on account of the meager information received and the conflicting statements regarding call letters, wave lengths, etc., was a by no means inspiring task. Several editions of this publication were issued by the Bureau before the importance of the subject was recognized by legislation which placed it under the Department of Commerce with the call letters, wave lengths, etc., covered by legal requirements.

Wireless telephony was tested on board a number of ships in 1906, but it did not prove a valuable or satisfactory means of communication. The *Connecticut* and *Virginia* were equipped with wireless telephone equipment for further experimental purposes in 1909 in connection with the round-the-world cruise of the Fleet. So important was the experiment considered that some boxes of additional accessories were despatched after the sailing of the fleet in order to intercept it at a South American port. This action did not meet with the approval of the Commander-in-Chief of the Fleet and he freely admitted to being at a loss to know what had prompted the Bureau to forward freight at a time when the Fleet's attention was fully occupied in matters of diplomatic importance and he himself was calling upon the president of a South American country. Incidentally the experiments were not very satisfactory but paved the way to successful developments.

Halley's Comet paid the earth a visit at this time and efforts were made to ascertain if, as anticipated by some scientists, its proximity affected the wireless field. No special results were noted,

but a plan of action was tentatively decided upon for use on the occasion of its next visit.

Serious consideration was given to the possible use of the Washington Monument as a base for contemplated wireless experiments. The utilization of the monument for this purpose involved only the placing of a cap on the apex and stringing wires therefrom, and the proponents of the idea referred to the similar use of the Eiffel Tower for that purpose and the value such had been to the French in their experiments. It was also put forward as an argument in favor of the project that to receive messages emanating from the memorial to the Father of his Country would appeal most agreeably to the American people. However, the idea did not strike a responsive chord among the high officials, and the matter was dropped.

On his detachment Lieut. Hyland was succeeded by Lieut. George C. Sweet, who had been associated with the Navy wireless from its beginning. He took an active part in many experiments, and, in addition to his wireless work, was the officer of the Bureau detailed to observe and report on airplane developments and their possible utilization by the Navy. On one of his early flights with one of the Wright brothers at Fort Myer the airplane crashed and he sustained a broken arm. Undeterred by this mishap, he prepared a requisition for the construction of an airplane strong enough to hold four persons, which requirement many individuals gravely stated was entirely beyond reasonable expectations. The requisition did not gain official approval, but it is not too much to state that it was at least a factor in developing and crystalizing a sentiment which finally resulted in the creation of the Bureau of Aeronautics. Ensign C. H. Maddox designed and built the first radio transmitter used in a Navy airplane and tested the equipment in flight, its effective range being about ten miles.

On a later tour of duty Lieut. Sweet (then Commander) had charge of the radio installation features of the Lafayette 100 kw Arc Radio Station in France.

During the administration of Lieut. Comdr. Davis the Navy Department considered itself fortunate in having the cooperation of Dr. Louis W. Austin, noted physicist and international authority, then conducting tests under the auspices of the Bureau of Standards. Later, in order to devote his entire time in endeavoring to solve the many pressing problems arising in naval communications, Dr. Austin resigned from the Bureau of Standards and became attached to the Navy Department. He was head of the U. S. Naval Radiotelegraphic Laboratory at the Bureau of Standards from 1908 to 1923. He made several trips to Europe in fur-

therance of the Navy's interests and was a representative of this country at the International Radiotelegraphic Conference at Paris in 1921.

Dr. Austin was the author of numerous pamphlets on radio measurements and devices, and was especially active in the study of atmospheric interference, its source and causes. Many of these articles, which received world-wide acclaim, were published in the Bulletin of the Bureau of Standards, in the Proceedings of the Washington Academy of Science, and in the Proceedings of the Institute of Radio Engineers. He was a fellow of the latter organization and was its president in 1914.

George H. Clark was appointed as Subinspector of Wireless Telegraph Stations in 1908, and was stationed at the Navy Yard, Washington. The title of his position was subsequently changed to Expert Radio Aide and a number of technical assistants with similar titles were appointed at various navy yards. As originally directed when these positions were created, the time of these assistants was not to be taken up with the preparation of correspondence.

Being the first practical wireless man in the service of the Navy Department, and being stationed at the Navy Yard, Washington, Mr. Clark was in close touch with the administrative officers of the Department and was called upon constantly to assist in solving the problems that arose. He specialized in the preparation of specifications for wireless apparatus, and all Navy wireless material up to the close of World War I was purchased in accordance with these specifications. He took an active part in a number of tests between naval vessels and shore stations, and accompanied the President on several trips to the Canal Zone. He alone conducted the transatlantic acceptance tests of the Arlington Naval Radio Station (NAA). These tests required the cruiser *Salem*, on board of which Mr. Clark directed the tests, to go as far as the coast of Europe. In his report to the Department on this subject, Lieut. Comdr. Hepburn stated that Mr. Clark had very satisfactorily conducted tests which ordinarily would have required the appointment of a board of naval officers. Mr. Clark later resigned from the Navy Department to accept a position with a commercial radio company.

Lieut. Comdr. Davis was succeeded by Lieut. Comdr. D. W. Todd, under whose administration the importance of wireless became more and more recognized and great strides were made in relation to its use by the Navy; the outstanding features of which might be considered as the completion of the Arlington, Va. 100 KW rotary synchronous spark station of the Navy's chain of

high power stations Arlington, Darien, San Diego, Pearl Harbor and Cavite, and the establishment of the office of Superintendent of Radio Service. (The Arlington Station was placed in commission on 13 February 1913.)



FIGURE 1.—Photograph of personnel of the Arlington station.

The Radio Division as such was established at this time (1910) when the Bureau of Equipment was abolished and the administration of its duties concerning radio were taken over by the Bureau of Steam Engineering. At the recommendation of the Bureau the substitution of the word "Radio" for "Wireless," in conformity with international usage, was authorized and directed by the Department.

The functions of the office of Superintendent of Radio Service were designed to administer the executive details of the ever-expanding features of Navy radio previously handled solely by the Bureau, the latter retaining only the features relating to the apparatus and its installation and maintenance. At first the office of Superintendent was considered as a "field" service and was located at the Arlington Radio Station. Legislation was subsequently enacted which permitted the office to be transferred to the Navy Department Building, and the title of its head changed to Director of Naval Communications.

Several sets of portable radio apparatus were purchased in 1910 and tested on the *North Carolina*, *Montana* and *Chester*. These were designed for a maximum range of 20 miles and were intended for landing parties and use during battle; upon clearing ship for battle, the main aerial to be taken down, the portable set to be used with a wire hoisted to the yard arm, the operator and his small portable outfit being in any protected position.

In 1911 a working party from the Navy Yard, Mare Island, arrived in Alaskan waters on the *U. S. S. Buffalo* and established shore radio stations at St. Paul, Unalaska (later Dutch Harbor), and Kodiak. These stations were intended to serve not only the Navy but also the Departments of Commerce, Treasury and Agriculture. They also served commercial interests in Alaska by providing for the exchange of messages between outlying points and the Alaska terminal of the Washington and Alaskan military cable system.

The value of kites as supports for aerials of ships for temporary long-distance communications were tested with indifferent results.

Contracts for construction of the Darien, C. Z., high power station were awarded in 1913.

No legislation covering the use of radio was enacted until after the *Titanic* disaster, when installation of radio on all ocean-going steamers and the control of such apparatus on sea and shore was required by law. Up to that time, cooperation between the different radio companies and with the Navy was not always what could have been desired. One company refused to work with vessels and stations equipped with apparatus other than its own; even with naval vessels when requesting information regarding the whereabouts of a derelict which was being sought to be destroyed as a menace to navigation. This attitude justified the necessity for some positive law covering the humanitarian features of radio.

The notable achievements attained by the Navy in radio developments and the growing importance it assumed during this

period might properly be considered as in no small degree due to the tireless energy and devotion to duty of Lieut. Comdr. Todd. He later returned to the Department as Captain and Director of Naval Communications.

Lieut. Comdr. A. J. Hepburn succeeded Lieut. Comdr. Todd, and under his administration the radio compass (afterwards called direction finder) was largely developed. A number of experimental radio compasses were established first on ships and later on shore, and finally over fifty stations were in successful operation. Most of the stations were later turned over to the Coast Guard, the Navy retaining only those at Naval Air Stations and at strategic points.

In addition to the marked progress made in radio which characterized Lieut. Comdr. Hepburn's administration, there was established at this time the system of co-ordinating and numbering radio drawings. This system was found to greatly simplify and facilitate the work involved. In this system the Bureau and each navy yard is given an identifying letter, so that there is no confusion between the prints of one yard and those of another. The drawings of any yard can be used at any other yard without renumbering. As an example, one drawing issued by the Bureau is numbered RE 42A 125. The center figures show the class of apparatus involved, and the final figures indicate the serial number of the drawing relating to that type of apparatus. Also by use of this system, castings and parts made at any yard could be used without confusion at any other yard.

The above system of numbering, wholly originating in the Radio Division, was approved and adopted by the Navy Filing Manual Permanent Committee in its preparation of a filing manual for the Naval Establishment, which in turn was given official approval by the Secretary of the Navy.

While this system has been discarded in the Bureau of Ships with respect to classification and numbering of radio correspondence, it is still in current use for type numbers and drawing number assignments, and is being used by the Bureau of Aeronautics in connection with correspondence relating to aircraft radio.

With the question of permanency of stations being determined and owing to the fire hazards involved, the policy was established in 1914 of replacing wood lattice guyed masts with self-supporting steel towers and also replacing wood frame operating buildings with reinforced concrete buildings.

Proposals were issued in 1914 for the remaining high power stations, San Diego (Chollas Hts.) Pearl Harbor (Navy Yard) and Cavite (Sangle Point); and plans were formulated for sim-

ilar stations, but of lower power, at Tutuila, Samoa and Guam, Mariana Islands. These five stations were eventually established within the statutory limit of cost of \$1,500,000.

In the face of adverse reports by the world's greatest authorities, the Poulsen "Arc" continuous wave type transmitter was adopted by the Navy for its chain of high power radio stations.

Lieut. Comdr. Hepburn was succeeded by Lieut. S. C. Hooper, who came to the Bureau from duty as the Fleet Radio Officer. It should be stated that he has the distinction of being the first officer to have had this duty. He was Head of the Radio Division during the early part of the first World War. Up to the time he took charge, the Radio Division had consisted of but one or two officers and one civilian, but during his incumbency it speedily expanded and in time numbered nearly one hundred officers and civilians.

The publication now known as "Radio and Sound Bulletin" made its initial appearance during the administration of Lieut. Hooper in 1915. It was in blueprint form entitled "Semi-Monthly Radio Report" and had a limited circulation, but its importance was soon recognized and resulted in its appearance as a printed publication. Still later it was combined with the "Bulletin of Engineering Information," issued for years by the Bureau of Steam Engineering. It has since been re-established as a separate publication and issued quarterly. It is widely distributed and from its beginning has been of inestimable value in disseminating and coordinating radio information throughout the Naval Service. It has frequently been of assistance in litigation and copies of its pages have been called for by the courts.

The Darien high power station was completed and placed in commission in May 1915. The service performance of this 100 KW station on the Balboa-Washington circuit exceeded expectations and assured the success of the remaining high power stations—Chollas Heights, Pearl Harbor, Cavite. Owing to the greater distances over land-water paths, these stations eventually received Arc transmitters of 200 KW, 300 KW and 350 KW rated power respectively.

Decision was made to supplement the spark type transmitter with Arc type transmitter of from 20 to 30 KW rated power at the Charleston, Key West, Puget Sound, Mare Island and San Juan stations and to provide 30 KW Arc transmitters for the new stations at Cordova, Alaska and Pt. Isabel, Tex.

In 1915-1916 the first aircraft radio laboratory in the world was established by the Navy at Anacostia, D. C.

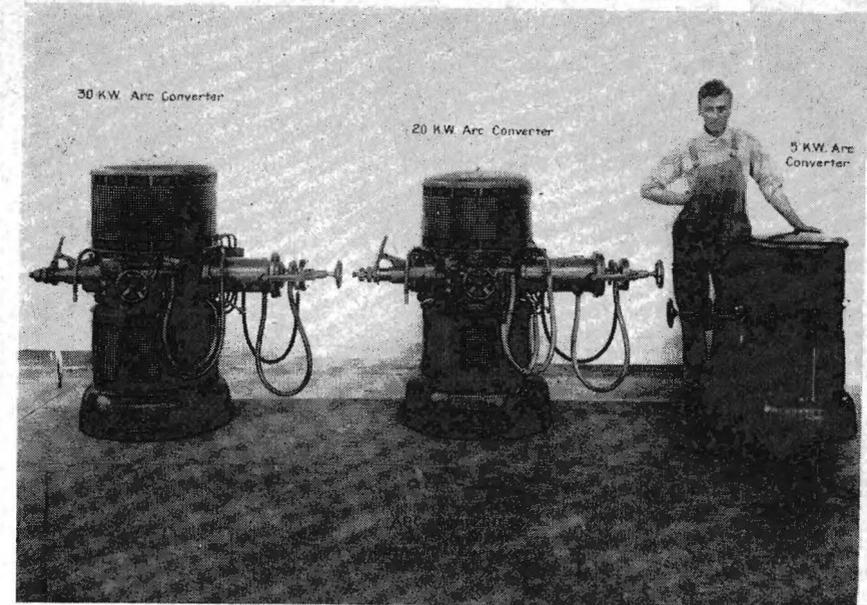


FIGURE 2.—Early arc converters.

Inventions and developments in the Radio Compass and Radio Direction Finder for naval and maritime use and also for use in aircraft were sponsored and encouraged by the Navy.

Steps were taken in 1915 to equip Naval Militia Organizations with field sets for training purposes and for use in the field.

Beginning in 1915 and for some time thereafter, some of the equipment required by the Navy was manufactured in Navy Yards from the Bureau's design and specifications in an effort to bring about standardization of Navy equipment.

In 1916, contracts were entered into for the radio equipment for the San Diego (Chollas Hts.) and Pearl Harbor high power radio stations and for both the radio and power equipment for the Cavite station. Also, distant control of stations, to permit simultaneous sending and receiving was established in connection with the Arlington, Mare Island, Boston and Navy Yard Washington Stations.

The Naval Radio Service was mobilized for tests on May 6, 7, and 8, 1916 when, in conjunction with the American Telephone and Telegraph Co., the Navy Department was connected by telephone and telegraph with all Navy Yards and naval radio stations in the United States. On 6 May, communication was established by wireless telephone between the Secretary of the Navy and the Captain of the battleship *New Hampshire*, then at anchor off



FIGURE 3.—Photograph showing Secretary of the Navy Daniels in communication with the U.S.S. *New Hampshire* by wireless telephone.

Fortress Monroe. On 7 May, communication was again carried out with the *New Hampshire* cruising between Hampton Roads and the Southern drill grounds, and the communication was extended to include Mare Island; the Commandant conversing for some time with the Captain of the *New Hampshire*. This was done by land line from Mare Island to Arlington and thence by wireless telephone to the *New Hampshire*; returning wireless telephone from the *New Hampshire* to Norfolk Radio thence by land line to Mare Island via the Navy Department. Earlier, in 1915, trans-Atlantic radio telephone experiments were carried on between the Arlington Station and the Eifel Tower Station in Paris.

On being detached from his first tour of duty in the Radio Division, Lieut. Comdr. Hooper, detailed to command the destroyer *Fairfax*, was succeeded by Lieut. Comdr. H. P. LeClair. During Lt. Comdr. LeClair's administration, the Navy definitely established the policy of equipping ships of the fleet with continuous wave type of transmitters with a view to the gradual replacement of all "spark" or "damped wave" type of transmitters, which previously had been in general use throughout the fleet. Upon learning of the Navy's intentions, vigorous protests by several manufacturers of the "spark" equipment were lodged with the Secretary of the Navy. They contended that the damped wave "spark"

type transmitter was superior to the continuous wave type for the then present and future shipboard use.

At this time the Navy Department purchased from the Marconi Wireless Telegraph Company of America at a cost of \$1,450,000 all their equipments on American vessels installed on a rental basis and all of their shore radio stations situated within the United States and Alaska, the Marconi Company retaining only its high power trans-oceanic and trans-Pacific stations. All of the Marconi stations were equipped with "spark" type transmitters. During this time also all of the shore radio stations and the "Arc" patents of the Federal Telegraph Company of California were purchased for \$1,600,000. All of the Federal Stations were equipped with "Arc" type, continuous wave, transmitters. This included the terminals of their trans-Pacific circuit between San Francisco and Honolulu, via., the South San Francisco and the Heeia, (T.H.) high power radio stations.

The purchase of the Marconi and Federal Radio Stations proved to be of outstanding importance. The later formation of the Radio Corporation of America which finally brought about full American ownership and control of all radio stations within the United States and its insular possessions stemmed from these purchases.

On the detachment of Lieut. Comdr. LeClair, Commander Hooper was again ordered to head the Radio Division. It was during this tour of duty that officers were assigned to duty in the field as Radio Material Officers. District Communication Officers thereafter handled only the personnel-operation features and Radio Material Officers the material features of the Naval Communication Service in the field.

The approval in principle of the Chief of Naval Operation was obtained by the Bureau prior to the assignment of officers to various Navy Yards for duty as Radio Material Officers. However, upon the issuance by the Bureau of instructions to Commandants concerning the duties and functions of Radio Material Officers, some opposition to this move developed on the ground that the District Communication Officers could readily continue to handle all material matters in addition to their supervising the personnel-operation functions of the Naval Communication Service. The Chief of Naval Operations thereupon withdrew his approval. Since, by that time, a number of officers had been detailed, and were functioning as Radio Material Officers, and as the Bureau's instructions, widely distributed ashore and afloat, were in effect, it was impracticable for the Bureau to withdraw and informal agreement was reached to let matters stand as they then were. As a consequence, Radio Material Officers are not yet fully

recognized in Navy Regulations. The necessary action in this regard is now being initiated by the Bureau.

The Navy encouraged in every way possible the development of the three element vacuum tube, it being felt that no other generator of high frequency oscillations offered the solution to the problem of providing a sufficient number of frequency channels for intra- and interfleet communications.

On his own detachment when his tour of shore duty had expired, Commander Hooper became the Radio Officer of the United States Fleet with station on board the cruiser *Seattle*. At this juncture Captain R. W. McNeely, then commanding the battleship *Delaware*, was detailed to head the Division. He was the first officer of that rank to become its head, and his appointment was considered to be quite an asset to the Radio Division and signally enhanced its standing. Consolidation of design and research work at the new Naval Experimental and Research Laboratory, Bellevue, D. C., was effected in 1923, under the supervision of Doctor Taylor and Doctor Hays. The advent of high frequency radio in the Navy; equipping ships for simultaneous transmission and reception; and the beginning of conversion of spark, damped wave, transmitters into vacuum tube, continuous wave, transmitters occurred during this period.

Concluding his duty as staff officer, Commander Hooper, upon the detachment of Captain McNeely, returned a third time to head the Radio Division. His three administrations were replete with outstanding achievements, one of the most prominent of which being his part, together with Rear Admiral Bullard, Director of Naval Communications, and Rear Admiral Griffin, Chief of the Bureau of Steam Engineering, and other officers, in bringing about the formation of the Radio Corporation of America. This corporation acquired the remaining property of the Marconi Wireless Telegraph Company of America, including its high power trans-Atlantic and trans-Pacific radio stations. This action, together with the previous acquirement by American companies of the high power trans-Atlantic stations at Sayville (Long Island) and Tuckerton, (N. J.) eliminated from the United States and its possessions all transoceanic radio stations of other than American ownership and control.

Upon our entrance into World War I, Commander Hooper made arrangements with officials of the United States Shipping Board whereby the Navy radio organization in the Radio Division and that in the field at navy yards and stations, undertook the work of procuring and installing all radio equipment on Shipping Board vessels requisitioned or constructed, and also the maintenance of

the installations for the duration of the war. This relieved the Shipping Board of all responsibility for radio material matters in connection with their vessels, numbering approximately 1800.

The establishment by the Navy, in conjunction with the French government, of a high power (1,000 KW) arc type transmitter station (Lafayette Radio Station) at Croix d'Hins near Boreadux, was finished under the supervision of Commander Hooper. This station in conjunction with a similar station at Annapolis, Md., was intended to augment the then available meager trans-Atlantic communication facilities between the American Expeditionary

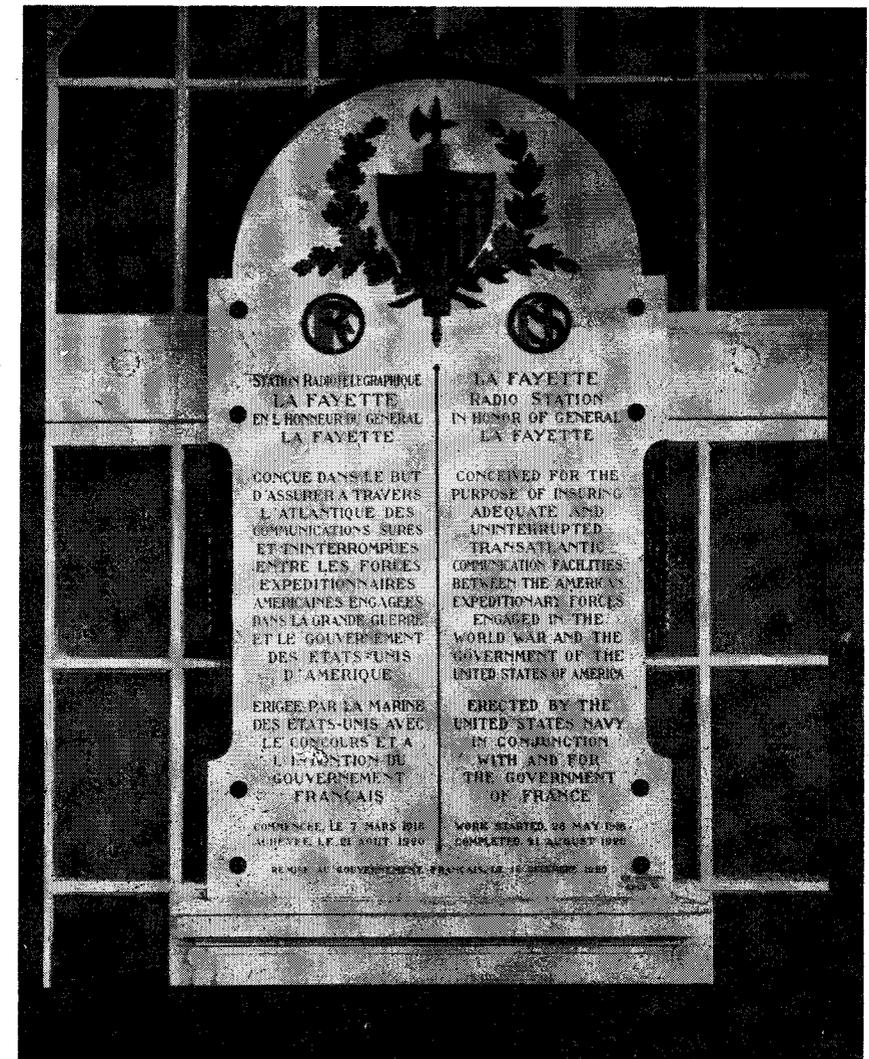


FIGURE 4.—Photograph of tablet erected on Lafayette radio station.

Force and the United States and to provide for an emergency means of communication in the event that the trans-Atlantic cables were cut by German submarines.

For his achievements during the war Commissioner Hooper was awarded the Victory Medal and Navy Cross. He was also decorated by the French government and made a chevalier in the Legion of Honor, receiving the decoration personally from General Neville of the French army at Fort Myer, December 6, 1920.

On the occasion of his second tour of duty in the Bureau, Commander Hooper's duties were greatly increased when the work of conducting underwater sound activities was transferred to the Radio Division. This was a development of the experiments conducted with the submarine bell by the Radio Division during the administration of Lieut. Comdr. Davis. Ships were fitted with microphones mounted within the hull for receiving the bell signals. The first means of calculating distances from obscure stations was by means of a submarine bell, combined with radio, in which signals were sent out simultaneously. By knowing the time of transit of the sound impulses under water, the distance was ascertained. The technique arising from the use of the submarine bell in locating a vessel's position relative to a lightship was the basis from which all of the developments of submarine detection by underwater sound sprung during the first World War.

When the German submarine menace during this period became serious, at an urgent recommendation initiated by the Radio Division, several large groups of scientists from the leading electrical companies and technical universities began work on the development of devices for submarine detection. Navy sponsored laboratories at New London and Pasadena were centers of development by these scientific groups. Full cooperation of the Radio Division engineering facilities was provided.

First developing the multi-spot sound receiver as the acceptable detection equipment for the Navy, the Radio Division, working in conjunction with the Sound Laboratory at the Washington Navy Yard and the Experiment Station at Annapolis and later with the Naval Research Laboratory at Bellevue, eventually developed an underwater sound detection equipment. This was installed at first on a limited number of ships—not exceeding thirty. Later the Radio Division embarked on a major program of equipping all new destroyers and submarines with this equipment. In 1936 the number was less than one hundred; it is now increased to approximately three thousand.

Underwater sound is now recognized as a necessary equipment for submarine detection and submarine listening. It is the only

known means at the present time whereby a submarine submerged can be detected.

The Department has lately approved the use of the coined word "Sonar" as a short title covering the art of equipment for the purpose of submarine detection and navigation by United States naval vessels involving the use of underwater sound principles. This word is derived from the terms "sound," "navigation" and "ranging."

Reference to the events transpiring during Commander Hooper's regime would be incomplete without an allusion to the experiments conducted with piloting cable. As an outgrowth of wartime experiments in Great Britain and the United States, the Radio Division promoted the laying of piloting cable at the shore station entrance of New York Harbor. This was used experimentally for four years and then turned over to the Bureau of Lighthouses of the Department of Commerce. While in use by the Navy, tests were made both by surface vessels and low-flying seaplanes, and these tests showed promise for it as a piloting system.

The Army's need for radio for the transmission of their traffic increased to such an extent that they were considering the establishment of a separate station at Fort Myer, Va. Since this appeared to be a duplication of the functioning of the Arlington Radio Station, the Navy offered to supply such radio facilities as might be required under an agreement of mutual satisfaction to both the Army and Navy. This equipment was maintained by the Navy and all control of the transmitter assigned to the Army was accomplished from the Army Radio Center in Washington.

Commander Hooper reached the grade of Captain while attached to the Radio Division. He was succeeded by Commander E. C. Raguette, whose administration continued the policy of using high power low frequency service, in lieu of discarding low frequency in favor of high frequency service for long distance communications as had been done by the commercial radio companies on their point-to-point circuits. Decision was therefore made and action taken to procure and install 300 KW low frequency vacuum tube transmitters at the Cavite and Pearl Harbor stations as replacements for similar powered arc type transmitters of semi-obsolete type.

The installation of these sets definitely proved the practicability of a vacuum tube transmitter of such large outputs. The Cavite transmitter has since been destroyed by bombing by the Japanese. The Pearl Harbor transmitter later was modified for 500 KW rated power and installed at Lualualei, T. H., where it is now oper-

ating and where it has rendered valuable service. At Annapolis there is now a similar 500 KW installation.

Extensive developments in and installations of high frequency radio on the Navy's point-to-point circuits and on ships took place during this period. High speed automatic transmission and recording on the Navy's point-to-point circuits also was introduced during this period.

On his detachment Commander Raguet was succeeded by Commander S. A. Manahan, who had already served two tours of duty in the Radio Division, first in charge of Ship Installations and later as head of the Shore Station Section.

During this period there developed the need for a more extensive receiving and monitor stations than that in use at the Naval Research Laboratory at Bellevue. Cheltenham, Md., was selected as the most suitable site. The reservation comprised 550 acres. The station was not finally completed until 1939. Its facilities have been greatly increased from time to time.

During Commander Manahan's administration the cognizance of visual signaling searchlights was transferred from the Electrical Division to the Radio Division and placed in the Underwater Sound Section, where it remained until 1940. During this period of control of small incandescent searchlights and 24" searchlights a complete modernization of all such equipment in the fleet was accomplished. The work was turned back to the Electrical Division with the design and procurement in such condition that very little work was necessary other than increasing the volume and distribution of equipment to meet the emergency. During Commander Manahan's tour of duty as head of the Shore Station Section, efforts were made to acquire, on a rental basis, the service use of the RCA Bolinas, Calif., and Kahuku, T. H. Alexanderson alternator low frequency equipment for Navy trans-Pacific communications. The rental terms proposed were unacceptable and the matter was dropped. The Navy subsequently installed the high power vacuum tube low frequency transmitters at Pearl Harbor and Cavite as previously referred to. Low frequency receivers of restricted low frequency range were developed for exclusive use on the Navy's low frequency circuits.

Commander W. J. Ruble succeeded Commander Manahan in charge of the Radio Division, and after him came Lieut. Comdr. J. B. Dow and Commander A. J. Spriggs. Commander Dow, since promoted to the grade of Captain, returned to head the Division, which now numbers over a thousand members.

While the events of the latest administrations of the Radio Division might perhaps be considered as too recent for allusion

at this time, it would still be appropriate to refer to the erection of the higher power station, Lualualei, Hawaiian Islands, and the fact that the energy with which the Division undertook in bringing this project to an early completion, while under charge of Commander Ruble, was a matter of special notice and commendation by the Department.

During the first World War the value of pigeons as a means of limited communication was recognized by the Navy, and as this comprised a material part of communications, their cognizance logically fell under the supervision of the Radio Division. Lofts were established at Pensacola, Lakehurst, Anacostia, Parris Island and other locations. The acquisition and training of pigeons continued for a number of years following the war. The Navy at the Anacostia loft bred a number of nationally known birds which established several interesting records for flights and endurance. Owing to the advance in the radio art, however, interest and the need for pigeons in the Navy diminished. Finally what remained of this branch of the communication service was transferred to the Bureau of Aeronautics and the Marine Corps, the latter retaining lofts of their own at several locations.

The Radio Division has a distinction which probably no other divisions of a Naval Bureau has attained in that two of its heads reached the grade of Admiral and became Commanders-in-Chief of the Fleet. They are Admiral S. S. Robison and Admiral A. J. Hepburn.

Following its policy of cooperation and in addition to its long period of work with the Army Signal Corps, the Radio Division has worked in close relationship with Radio officials of the Department of Commerce to facilitate the establishment and functioning of installations required from time to time by legislation; has assisted the Coast Guard (in peacetime under the Treasury Department) in the procurement and installation of apparatus; has furnished radio sets for use by the State Department in distant countries; and worked with the Agriculture Department in assisting in certain experiments conducted by the Weather Bureau and furnishing radio sets for use in fighting forest fires and establishing communications destroyed by floods.

The Arlington Radio Station as a regular Navy traffic station has since been dismantled and its towers have disappeared. The removal of the station, long a landmark of early naval radio and presenting a striking and pleasing sight across the Potomac River from Washington, with the tracery of its towers outlined against the sky, was seemingly necessitated by the hazards they presented to aerial navigation.

Among others who served in the Radio Division at different times may be mentioned the following:

Guy Hill, radio aide and later Captain, U. S. Signal Corps, who rendered notable service, particularly in design work. He made a specialty of wave changers and was a joint inventor of the Navy's standard device.

A. M. Trogner, radio aide, who deserves special mention for his work in establishing standard plans for installations on various types of vessels. Upon visiting several British warships and drawing up plans for similar equipment on American vessels, especially the acceptor-rejector and the 120-meter equipment, the ships of both navies were equipped for mutual signaling.

Radio Aide E. D. Forbes, who supervised the design of radio compasses at the Philadelphia Navy Yard, and Radio Aide Stuart Ballentine who was engaged in similar work, particularly in the mathematical study of these devices.

Haraden Pratt, vice president and chief engineer of the Mackay Radio & Telegraph Co., who served for several years as radio aide. His services were especially useful in connection with the building of the high power station at Annapolis.

B. R. Cummings, now with the Farnsworth Television Company; A. A. Isbell, formerly west coast manager of the Radio Corporation of America; T. Johnson, Jr., now with the General Electric Company and while with the Radio Division the author of 'Naval Aircraft Radio,' recognized as a standard treatise on the subject; George Lewis, who served during the first World War as Lieutenant, USNR.

Comdr. William A. Eaton, USNR., who served in the Navy for years prior to the first World War and is now in the Radio Division in charge of ship radar installations and maintenance; Lieut. Comdr. A. P. Van Dyck, USNR., a radio aide during the first war and now an officer again attached to the Radio Division; Lieut. Harry Sadenwater, USNR., a member of the crew of the NC-4 on its trans-Atlantic flight; Ensign Alfred Crossley, USNR., who specialized in submarine and subterranean antenna experiments.

While not attached to the Radio Division, the list would be incomplete without including Charles J. Pannill, who was in close contact with its officers for years both before and during his service as assistant to the Director of Naval Communications. He is now president of the Radiomarine Corporation of America.

Arthur O'Brien, John M. Stewart and James E. Parker have the distinction of serving in the Radio Division during both World Wars, while Walter H. Floyd has a service record embracing the

same period, most of which was spent in the Radio Division. Any list of the older employes should also include the names of Harold Abbey and Philip T. Russell, both long identified with the development and installation of underwater sound equipment, the latter being associated with a number of inventions covering the same apparatus.

A record of the Radio Division would be incomplete without allusion to those who have passed away and who, by their attainments and example, afford an inspiration to those who have taken up the work where they left off. Among those who have died are Rear Admiral Joseph L. Jayne, head of the Radio Division in its early days and a member of the Inter-Departmental Wireless Telegraph Board appointed by the President, and later became Superintendent of the Naval Observatory; Lieut. John M. Hudgins, another of the pioneers, who left the Bureau only to meet death shortly thereafter in an explosion on board the battleship *Missouri*; Lieut. Herbert C. Rodd, remembered for his energetic work in aircraft radio and his participation in the memorable trans-Atlantic flight of the NC-4, and who died in an airplane crash at Norfolk; Lieut. Marcus H. Esterly, who perished in the ZR-2 dirigible disaster at Hull, England, in 1921; Captain William F. Grimes, USNR., who served for several years as radio aide in the Division and who died lately while holding the position of District Communication Officer of the Eleventh Naval District; Dr. Louis W. Austin, the noted physicist, whose death left a distinct void in the field of radio research; and Albert L. Young, radio aide in the Bureau since 1919 and well known to the service as an authority on ship installations.

Nor would reference to the Radio personnel be complete without mention of Frank C. Warman who was well known to all the officers and civilians who successfully were on duty in the Division, and all of whom would gladly express their appreciation of his outstanding ability and the assistance he rendered. A veritable genius in the details of filing, he was made senior member of a departmental board appointed to coordinate the various filing systems in use throughout the Naval Establishment. He was delegated to visit the several yards and stations to inaugurate a uniform system, and received tangible evidence of the Department's recognition and appreciation. There were innumerable instances of his ability in aiding the Radio officers in their search for papers involving matters then in litigation or otherwise of great importance. A man of remarkable memory, on being requested to furnish a paper from the files even twenty or more years back, he would be able to state the contents of the same

before locating it, and later produce the paper to corroborate his statements. Although not himself a member of the Radio Division, any recounting of incidents relating thereto would be incomplete without a closing tribute to the memory of Frank C. Warman.

REVISED FAILURE REPORT FORM

In order to facilitate the prompt report of all failures in Naval Radio Equipment, Failure Report Form NBS 383 has been revised. The multiple-copy form has been replaced by a single card accompanied by a franked return-addressed envelope. The face and reverse of the card are reproduced in figure 1.

FAILURE REPORT		NOTICE.—Read notes on reverse side. Additional forms or envelopes may be obtained from nearest RMO.	
NBS-383—NAVSHIPS (250) REVISED 4-44		DATE _____	
SHIP NUMBER AND NAME OR STATION USING EQUIPMENT WHEN FAILURE OCCURRED _____			
NAME AND RANK OR RATING OF PERSON MAKING REPORT (PREFERABLY REPAIRMAN) _____			
EQUIPMENT INVOLVED			
CHECK WHICH EQUIPMENT: <input type="checkbox"/> RADIO <input type="checkbox"/> RADAR <input type="checkbox"/> SONAR <input type="checkbox"/> OTHER			
MODEL NO.	NAME OF CONTRACTOR	SERIAL NO. (CONSULT NAMEPLATE)	
TYPE NUMBER AND NAME OF MAJOR UNIT INVOLVED			SERIAL NO. (CONSULT NAMEPLATE)
CONTRACT NO. (CONSULT NAMEPLATE)			DATE INSTALLED (IF KNOWN)
ITEM OR PART WHICH FAILED			
GIVE BRIEF DESCRIPTION OF PART _____			
CIRCUIT SYMBOL	NAVY TYPE IF AVAILABLE	APPROXIMATE LIFE	
BRIEF DESCRIPTION OF FAILURE (USE OTHER SIDE OR SEPARATE SHEET IF ADDITIONAL SPACE IS NECESSARY) _____			
INSERT IN ENVELOPE—SEAL—MAIL			
16-38322-1			

FIGURE 1a.—Face of new failure report form.

1. This new simplified failure report form has been prepared to make the submission of these reports quicker and easier. Franked envelope (Form NBS 383A) is supplied for your convenience in submitting card form—if not available mail to BUSHIPS, Attn.: Code (970).
2. The purpose of this report is to inform BUSHIPS of the cause and rate of failures.
3. This report MUST be filled out and forwarded for EVERY DERANGEMENT of equipment (less tubes) whether caused by DEFECTIVE PARTS, WORN PARTS, IMPROPER OPERATION, or EXTERNAL INFLUENCES.
4. This report is not a requisition. You must request the replacement part from your Tender, Supply Officer, or Radio Material Officer.
5. This report may be filled out with TYPEWRITER, PEN, or PENCIL.
6. If CONFIDENTIAL information is included in description of failure, mail in accordance with NAVY REGS. TYPE and MODEL DESIGNATIONS ARE NOT CONFIDENTIAL.
7. This revised Form NBS 383 supersedes the old septuplicate form. No copies are required. Previous instructions pertaining to preparation and submission of the old form (including sect. VIII, part 2, of chap. 67, BUSHIPS Manual, not yet distributed, April 1944) are hereby canceled. Adjustments of contractual matters will be made between BUSHIPS, INSMATS, and CONTRACTORS.

16-38322-1 U. S. GOVERNMENT PRINTING OFFICE

FIGURE 1b.—Reverse of new failure report form.

The primary purposes of this form are:

(a) To advise the Radio Division of the Bureau of Ships of failures occurring in equipments under its cognizance. The information requested in NBS 383 (revised April 1944) is essential