

RADIO SERVICE BULLETIN

ISSUED MONTHLY BY RADIO DIVISION

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ABBREVIATIONS

The necessary corrections to the list of Commercial and Government Radio Stations of the United States and to the International List of Radiotelegraph Stations, appearing in this bulletin under the heading "Alterations and corrections," are published after the stations affected in the following order:

Name	= Name of station.
Loc.	= Geographical location. O=west longitude. N=north latitude. S=south latitude.
Call	= Call signal (letters) assigned.
System	= Radio system used and sparks per second.
Range	= Normal range in nautical miles.
W. l.	= Wave lengths assigned: Normal wave lengths in italics.
Service	= Nature of service maintained:
	FX=Point-to-point (fixed service).
	PG=General public.
	PR=Limited public.
	RC=Radio compass.
	AB=Aviation beacon.
	B=Beacon.
	P=Private.
	O=Government business exclusively.
Hours	= Hours of operation:
	N=Continuous service.
	X=No regular hours.
F. T. Co.	= Federal Telegraph Co.
I. R. T. Co.	= Intercity Radio Telegraph Co.
I. W. T. Co.	= Independent Wireless Telegraph Co.
K. & C.	= Kilbourne & Clark Manufacturing Co.
M. R. T. Co.	= Mackay Radio and Telegraph Co.
R. C. A.	= Radio Corporation of America.
R. M. C. A.	= Radiomarine Corporation of America.
T. R. T. Co.	= Tropical Radio Telegraph Co.
U. R. Corp.	= Universal Radio Corp.

W. S. A. Co.	=	Wireless Specialty Apparatus Co.
C. w.	=	Continuous wave.
I. c. w.	=	Interrupted continuous wave.
Kc.	=	Kilocycles.
Fy.	=	Frequency.
A. c.	=	Alternating current.
V. t.	=	Vacuum tube.
U. S. L.	=	Used only to the list of Commercial and Government Radio Stations of the United States.

NEW STATIONS

Commercial land stations, alphabetically, by names of stations

[Additions to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to the International List of Radiotelegraph Stations published by the Berne bureau]

Station	Call signal	Wave lengths	Service	Hours	Station controlled by—
Butuan, P. I. ¹	KZBT	42.9	P	-----	Philippine insular government.
Cebu, P. I. (KZCN) ¹	KZCN	47	P	X	MacLeod & Co.
Davao, P. I. (KZCK) ²	KZCK	50	P	X	Do.
Drier Bay, Alaska ³	KTT	86.55	FX	X	Gorman Packing Corporation.
Fordson, Mich. ⁴	WMD	116.1	P	X	Ford Motor Co.
Lumarso, P. I. ⁵	KZAP	550	P	-----	Hercules Lumber Co.
Manila, P. I. (KZMM) ⁶	KZMM	41, 54.5, 60	P	X	Panabutan Lumber & Plantation Co.
Manila, P. I. (KZCP) ²	KZCP	44	P	X	MacLeod & Co.
Minneapolis, Minn. ⁷	KQP	1100, 1800	P	X	Inland Waterways Corporation.
Mustang Island, Tex. ⁸	WNC	600, 650, 1000	P	X	Humble Oil & Refining Co.
Panabutan, P. I. ⁹	KZPL	20, 54.5, 60	P	X	Panabutan Lumber & Plantation Co.
Pasay, P. I. ⁹	KZCM	46.5, 600, 750, 1000	PG	-----	Philippine insular government.
Tolong, P. I. ¹⁰	KZTL	42.8	P	-----	Do.
Uganik, Alaska (KVF) (Port O'Brien, Kodiak Island.) ¹¹	KVF	600, 700	P	X	San Juan Fishing & Packing Co.

¹ Loc. 125° 32' 02" E., 8° 55' 58" N., range, 150; system, v. t., c. w.; hours, 8 a. m. to 12 noon, 2 to 5.30 p. m., daily; 9 to 11 a. m., Sundays and holidays.

² Range, 400; system, v. t., c. w.

³ Loc. 147° 47' 20" W., 60° 18' 30" N.; system, composite, v. t. telegraph.

⁴ Loc. (approximately) 83° 10' 00" W., 42° 18' 00"; system, composite, v. t. telephone.

⁵ Range, 100.

⁶ Range, 500; system, v. t., c. w.

⁷ System, composite, v. t., c. w., and i. c. w.

⁸ Range, 200; system, R. C. A. v. t., a. c. w.; 1,000 meters used for private beacon.

⁹ Loc. 121° 00' 30" E., 14° 31' 50" N.; range, 250; system, v. t., c. w., and i. c. w.; hours, 7 a. m. to 8 p. m. daily; 7 a. m. to 7 p. m., Sundays and holidays; ship service first 10 minutes of each hour; rates, 6 cents per word.

¹⁰ Loc. 122° 48' 40" E., 9° 22' 15" N.; range, 75; system, v. t., c. w.; hours, 8 a. m. to 12 noon, 2 to 5.30 p. m., daily; 9 to 11 a. m., Sundays and holidays.

¹¹ Range, 200; system, K. & O., 1000.

Commercial ship stations, alphabetically, by names of vessels

[Additions to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to the International List of Radiotelegraph Stations published by the Berne bureau]

Name of vessel	Call signal	Rates	Service	Hours	Owner of vessel	Station controlled by--
Borongan ¹	KZPD	8	PG	X	Juan Sandoval Go Juanco	Owner of vessel.
Capitan Luis ²	KZCL	8	PG	X	Teodoro R. Yangco	Do.
Chester O. Swain (RC)	WRBK	8	PG	X	Standard Shipping Co.	R. M. C. A.
Christy Payne (RC)	WRBM	8	PG	X	do.	Do.
City of St. Ignace ³	WQBY		PG	X	Cleveland, Canada Navigation Co.	Do.
Coronet	WRBD				Irving T. Bush	Do.
Everett ⁴	KZCJ		PG	X	Vicente Madrigal	Owner of vessel.
Gulfbird	WRBF	8	PG	X	Gulf Refining Co.	
John Purroy Mitchell ⁵	WRBE		P	X	City of New York, fire department.	Do.
Macaria ⁶	KZBQ				Vicente Madrigal	Do.
Montanes ⁷	KZCQ	8	PG	X	Teodoro R. Yangco	Do.
Ntra. Sra. de la Paz ⁸	KZMD	8	PG	X	Genato & Co.	Do.
Ntra. Sra. del Carmen ⁹	KZCR	8	PG	X	Compania Maritima	Do.
Paz ⁴	KZCG	8	PG	X	Vicente Madrigal	Do.
Rescue	WRBG	8	PG	X	Alfred J. Moran	R. M. C. A.
Salvador ¹⁰	KZBJ	8	PG	X	Visayan Stevedore-Transportation Co.	Owner of vessel.
San Antonio ¹¹	KUCM	8	PG	X	Southern S. S. Co.	Do.
Sorsogon ¹²	KZCB	8	PG	X	Ynchausti & Co.	Do.
Titania ¹³	KZCS		PG	X	Vicente Madrigal	Do.
Waegwoltic	WRBA		PG	X	Savannah Ship, Chandlery & Supply Co.	

¹ System, v. t., telegraph; w. l., 600.

² Range, 300; system, K. & C., 1000; w. l., 600.

³ Range, 150; system, R. C. A. v. t., telegraph; w. l., 715, 800, 875; rates, Great Lakes service, 4 cents per word.

⁴ Range, 300; w. l., 600.

⁵ System, R. C. A. v. t. telegraph; w. l., 600, 640, 705, 730, 750, 800.

⁶ Range, 300; system, composite, 1000; w. l., 600.

⁷ Range, 200; system, Navy-Lowenstein, 1000; w. l., 476, 600.

⁸ Range, 250; system, W. S. A., 1000; w. l., 450, 600, 800, 952.

⁹ Range, 150; system, Marconi, 120; w. l., 600.

¹⁰ Range, 200; system, Navy-Lowenstein, 1000; w. l., 600.

¹¹ Range, 150; system, Navy-Simon, 1000; w. l., 600, 705, 800.

¹² Range, 300; system, K. & C., 1000; w. l., 450, 525, 600.

¹³ System, composite spark; w. l., 600.

Commercial land and ship stations, alphabetically, by call signals

[b, ship station; c, land station]

Call signal	Name of station	Call signal	Name of station
KQP	Minneapolis, Minn.....c	KZCR	Ntra. Sra. del Carmen.....b
KTT	Drier Bay, Alaska.....c	KZCS	Titania.....b
KUCM	San Antonio.....b	KZMD	Ntra. Sra. de la Paz.....b
KVF	Uganik, Alaska (Port O'Brien-Kodiak Island).....c	KZMM	Manila, P. I.....c
KZAP	Lumarso, P. I.....c	KZPD	Borongan.....b
KZBJ	Salvador.....b	KZPL	Panabutan, P. I.....c
KZBQ	Macaria.....b	KZTL	Tolong, P. I.....c
KZBT	Butuan, P. I.....c	WMD	Fordson, Mich.....c
KZCB	Sorsogon.....c	WNC	Mustang Island, Tex.....c
KZCG	Paz.....b	WQBY	City of St. Ignace.....b
KZCJ	Everett.....b	WRBA	Waegwoltic.....b
KZCK	Davao, P. I.....c	WRBD	Coronet.....b
KZCL	Capitan Luis.....b	WRBE	John Purroy Mitchell.....b
KZCM	Pasay, P. I.....c	WRBF	Gulfbird.....b
KZCN	Cebu, P. I.....c	WRBG	Rescue.....b
KZCP	Manila, P. I.....c	WRBK	Chester O. Swain.....b
KZCQ	Montanes.....b	WRBM	Christy Payne.....b

Broadcasting stations, alphabetically, by names of States and cities

[Additions to the List of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to lists published in Radio Service Bulletin Nos. 130 and 131, January and February, 1928, respectively]

Station and city	Call signal	Wave length (meters)	Frequency (kilo-cycles)	Power (watts)
Arkansas:				
Little Rock.....	KGHI			15
Do.....	KGJF			250
McGehee.....	KGHG			50
Georgia:				
Columbus.....	WRBL			50
Tifton.....	WRBI			50
Mississippi:				
Greenville.....	WRBQ			100
Hattiesburg.....	WRBJ			10
Montana:				
Billings.....	KGHL	222.1	1,350	250
Missoula.....	KGHD	232.4	1,290	5
New Hampshire: Manchester	WRBH			500
North Carolina: Wilmington	WRBT			50
South Carolina:				
Columbia.....	WRBW			15
Gastonia.....	WRBU			50
Texas:				
Fort Stockton.....	KGHO			50
Georgetown.....	KGKL			100
Goldthwaite.....	KGKB			50
Richmond.....	KGHX			50
Wichita Falls.....	KGKO			250
Virginia: Richmond.....	WRBX			250

NOTE.—Where wave length is not shown in the above list, stations have been issued a construction permit without the wave length being specified. When wave length is determined and license issued, notice of assignment will be shown in a future edition of this publication under the heading "Alterations and corrections."

Broadcasting stations, alphabetically, by call signals

Call signal	Location of station (address)	Owner of station	Power (watts)	Wave length (meters)	Frequency (kilo-cycles)
KGHD	Missoula, Mont., 542 South Third Street west.	Raymond S. Nash.....	5	232.4	1,290
KGHG	McGehee, Ark.....	Charles W. McCollum.....	50		
KGHI	Little Rock, Ark., 1201 Louisiana Street.	Berean Bible Class.....	15		
KGHL	Billings, Mont., Fifth Avenue and North Broadway.	Northwestern Auto Supply Co.....	250	222.1	1,350
KGHO	Fort Stockton, Tex.....	John M. Baldwin.....	50		
KGHX	Richmond, Tex.....	Fort Bend County School Board.....	50		
KGJF	Little Rock, Ark.....	First Church of the Nazarene.....	250		
KGKB	Goldthwaite, Tex.....	Eagle Publishing Co.....	50		
KGKL	Georgetown, Tex., 1263 Brushy Street.	M. L. Cates.....	100		
KGKO	Wichita Falls, Tex., 2146 Avenue H.	Highland Heights Christian Church.....	250		
WRBH	Manchester, N. H., 33 Kimball Street.	New Hampshire Broadcasting Corporation.....	500		
WRBI	Tifton, Ga.....	Kents Furniture & Music Store.....	20		
WRBJ	Hattiesburg, Miss., 119 West Pine Street.	Woodruff Furniture Co.....	10		
WRBL	Columbus, Ga.....	R. E. Martin.....	50		
WRBQ	Greenville, Miss.....	J. Pat Scully.....	100		
WRBT	Wilmington, N. C., 720 North Fourth Street.	Wilmington Radio Association.....	50		
WRBU	Gastonia, S. C., 221 East Main Street.	A. J. Kirby Music Co.....	50		
WRBX	Richmond, Va., 20 Salem Avenue SE.	Richmond Development Corporation.....	250		
WRBW	Columbia, S. C., 2011 Green Street.	Paul S. Pearce.....	15		

NOTE.—Where wave length is not shown in the above list, stations have been issued a construction permit without the wave length being specified. When wave length is determined and license issued, notice of assignment will be shown in a future edition of this publication under the heading "Alterations and corrections."

Government land stations, alphabetically, by names of stations

[Additions to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to the International List of Radiotelegraph Stations published by the Berne bureau]

Station	Call signal	Wave length	Service	Hours	Station controlled by—
Fernandina, Fla.....	NFB	-----	O	-----	U. S. Coast Guard.

Government land and ship stations, alphabetically, by call signals

[b, ship station; c, land station]

Call signal	Name of station	Call signal	Name of station
NFB	Fernandina, Fla.....c		

Special land stations, alphabetically, by names of stations

Additions to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927]

Station	Call signal	Wave length (meters)	Frequency (kilocycles)	Power (watts)	Station controlled by—
California:					
Bollnas.....	6XB	16.67, 21.91, 33.33	18,000, 13,690, 9,000	80,000	R. C. A.
Do.....	6XU	14.55, 21.82, 43.64	20,620, 13,750, 6,875	80,000	Do.
Orange.....	6XE	Variable	Variable	500	John E. Waters, R. R. 2, Box C.
Hawaii: Honolulu.....	6XP	do.....	do.....	1,000	Mutual Telephone Co.
Illinois: Chicago.....	9XF	288.3	1,040	(¹)	Great Lakes Broadcasting Corporation, 310 South Michigan Avenue.
Indiana: Culver.....	9XB	10.2, 17.37, 22.06, 31.1.	29,270, 17,270, 13,600, 9,645.	1,000	Culver Military Academy.
Maryland: Baltimore	3XA	22.7, 54.7	13,325, 5,483	250	Bull Insular Line.
New York:					
Rocky Point.....	2XAR	16.80, 25.75, 33.59	17,860, 11,650, 8,930	80,000	R. C. A.
Do.....	2XAS	16.75, 21.62, 43.23	17,900, 13,870, 6,935	80,000	Do.
Sayville.....	2XBL	4,800	62.5	100,000	Commercial Wireless (Inc.), 253 Broadway, New York, N. Y.
Water Mill.....	2XBM	7.2, 10.7, 22.06, 31.1, 40.3, 79.3, 85.3, 104.7, 145.	41,900, 27,900, 13,600, 9,645, 7,439, 3,783, 3,518, 2,864, 2,062.	5,000	Western Union Telegraph Co. (195 Broadway, New York, N. Y.).
Pennsylvania: Narbeth.	3XB	Variable	Variable	100	Merrill D. Beam, 214 Merion Avenue.
Portable:					
New York American (No. 4473-airplane).	2XBK	120	2,500	100	R. C. A.
San Diego, Calif..	6XJ	7.2, 10.7, 22.06, 31.1, 40.3, 79.3, 85.3, 104.7, 145.	41,900, 27,900, 13,600, 9,645, 7,439, 3,783, 3,518, 2,864, 2,062.	500	Pacific Coast Crystals Laboratories, 4814 Idaho Street.
New York, N. Y.	2XAY	Variable up to 10..	Variable up to 30,000.	75	Robert A. Fliess, 225 West Sixty-ninth Street.

¹ Variable.

Special land stations, grouped by districts

Call signal	District and station	Call signal	District and station
2XAR	Second district:	6XB	Sixth district:
2XAS	Rocky Point, N. Y.	6XE	Bolinas, Calif.
2XAY	Do.	6XJ	Orange, Calif.
2XBY	New York, N. Y. (portable).	6XP	San Diego, Calif. (portable).
2XBL	New York American (airplane).	6XU	Honolulu, Hawaii.
2XBM	Sayville, N. Y.		Bolinas, Calif.
	Water Mill, N. Y.		Ninth district:
3XA	Third district:	9XB	Culver, Ind.
3XB	Baltimore, Md.	9XF	Chicago, Ill.
	Narbeth, Pa.		

ALTERATIONS AND CORRECTIONS

COMMERCIAL LAND STATIONS

[Alterations and corrections to be made to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to the International List of Radiotelegraph Stations, published by the Berne bureau]

- ALABAT, P. I.—W. l., 600–1100, 750 normal working wave.
- APARRI, P. I.—Loc., longitude changed to $121^{\circ} 36' 09''$ E.; w. l., 550–1100, 850 normal working wave.
- BALABAC, P. I.—Hours, strike out 2–3.30 p. m. on Sundays and holidays.
- BASCO, P. I.—W. l., 600, 952, 1200, 1500, 1900; ship service last 10 minutes of each hour, only.
- BATANGAS, P. I.—W. l., add 3000.
- CALAPAN, P. I.—Hours, strike out 2–3.30 p. m. on Sundays and holidays.
- CARAMOAN, P. I.—System, K. & C., 1000; hours, change daily hours to 8 a. m.—12 noon and 2–5.30 p. m.
- CATANAUAN, P. I.—Loc., Change latitude to $19^{\circ} 39' 30''$ N.
- CEBU, P. I. (KPI).—System, R. C. A., 1000 and v. t., c. w.; w. l., 43.5, 600, 1000, 1200, 1600, 2400.
- CULION, P. I.—Loc., latitude changed to $11^{\circ} 53' 46''$ N.
- CUYO, P. I.—Hours, strike out 2–3.30 p. m. on Sundays and holidays.
- DAVAO, P. I. (KIF).—Loc., latitude changed to $7^{\circ} 04' 18''$ N.; range, 300; system, R. C. A., 1000 and v. t., c. w.; add 47; hours, 7 a. m.—8 p. m., daily; 7 a. m.—7 p. m., Sundays and holidays.
- ILOILO, P. I.—System, R. C. A., 1000 and v. t., c. w., and i. c. w.; w. l., 44, 600, 950, 1000, 1200, 1600, 1950, 2400.
- INFANTA, P. I.—W. l., drop 2100, add 2400; 1400 normal working wave.
- KAHUKU, HAWAII (KIO).—Additional call signals KEIO and KSIO assigned; w. l., 25.66, 37.52, 51.33.
- LEGASPI, P. I.—System, v. t., c. w., and i. c. w.; w. l., 44.5, 600, 1000.
- MALITA, P. I.—W. l., 450, 600, 750.
- MANILA, P. I. (KZRC).—Loc. $121^{\circ} 03' 15''$ E., $14^{\circ} 37' 15''$ N.; range, 500.
- MATI, P. I.—W. l., 600, 952.
- QUADRA, ALASKA (KHD).—Service, P.
- SAGINAW BAY, ALASKA.—Loc. (approximately) $134^{\circ} 15' 00''$ W., $57^{\circ} 23' 00''$ N.; w. l., add 705; hours, 6.30 a. m.—12 midnight; owner, Port Walter Herring & Packing Co.
- SAN FRANCISCO, P. I.—W. l., 300, 600.
- SIASI, P. I.—Loc., longitude changed to $120^{\circ} 48' 35''$ E.
- SOGOD, P. I.—Loc., longitude changed to $124^{\circ} 58' 00''$ E.
- SURIGAO, P. I.—W. l., add 43.
- VIRAC, P. I.—Hours, strike out 2–3.30 p. m. Sundays and holidays.
- WILMINGTON, CALIF.—Range, 150; w. l., 114.9.
- ZACHAR BAY, ALASKA.—W. l., 600, 800.
- ZAMBOANGA, P. I.—System, composite, 240 and v. t., c. w., and i. c. w.; w. l., 50, 600, 1000, 1250.
- Strike out all particulars of the following-named stations: Baler, P. I.; Detroit, Mich. (WJF); Evansville, Ind.; Icy Bay, Alaska; Lawton, Okla.; Malangas, P. I.; Naga-Naga, P. I.; Oklahoma, Okla. (portable KPK); Oklahoma, Okla. (KPR); San Vicente, P. I.; Yacutaga Beach, Alaska.
- NOTE.—Wave lengths for Philippine stations which are underscored, other than 600 meters, are the normal working waves.

COMMERCIAL SHIP STATIONS, ALPHABETICALLY, BY NAMES OF VESSELS

[Alterations and corrections to be made to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to the International List of Radiotelegraph Stations, published by the Berne Bureau]

- AFEL.—Station controlled by I. W. T. Co. (U. S. L.).
 ANTONIO.—W. 1., 600 only.
 ARGOSY.—Owner of vessel, American Scanting Line.
 ARIZONAN.—Owner of vessel, Hammond Lumber Co.
 BARRALLTON.—Station controlled by R. C. A.
 BUSTAMENTE.—W. 1., 450, 600; rates, 4 cents per word; owner of vessel, Bureau of Commerce and Industry.
 CAMPEADOR.—W. 1., 600, 756, 952.
 CATALINA.—W. 1., add 114.9.
 CEBU.—W. 1., 450, 600, 800.
 CLAVARACK.—Station controlled by R. M. C. A. (U. S. L.).
 COLONEL JAMES PICKANDS.—Station controlled by R. C. A.
 COLUMBINE.—Owner of vessel, Union Shipbuilding Co.
 COMERIS.—Correct orthography Comerio.
 DAVID C. THOMPSON.—*Read*, David P. Thompson.
 DON JOSE.—W. 1., 600, 800.
 ESPERANZA.—W. 1., 600, 952.
 EUZKADI.—W. 1., 600, 952.
 FLORENCE D.—W. 1., 600.
 GRIFFCO.—Name changed to Kaala.
 LAKE ELLITHORPE.—Owner of vessel, Fox Bros. & Co.
 LEYTE.—W. 1., 450, 600, 800.
 LUZON.—W. 1., 600, only.
 MANATAWNY.—Owner of vessel, Manatawny S. S. Corporation.
 MARINDUQUE.—W. 1., 600, only.
 MAUBAN.—System, v. t., c. w., and i. c. w.
 MUNAMI.—Owner of vessel, Chas. R. McCormick Lumber Co.
 NTRA. SRA. DE ALBA.—W. 1., 600, only.
 OAKPARK.—Station controlled by R. M. C. A. (U. S. L.).
 PACIFIC SPRUCE.—Owner of vessel, Dimon S. S. Corporation.
 POLILLO.—W. 1., 600, 800; owner of vessel, Bureau of Commerce and Industry.
 POMPEY.—W. 1., 450, 600, 800.
 ROBERT HOBSON.—Station controlled by R. C. A.
 SALVAGER.—W. 1., 600, only.
 SAVARONA (KFZT).—Name changed to Sequoia.
 SUSANA II.—W. 1., 600, only.
 VENUS (WPBI).—Station controlled by R. C. A.
 VIZCAYA.—W. 1., 600, 952.
 WILLIAM McLAUGHLAN.—Station controlled by R. C. A.
 Strike out all particulars of the following-named vessels, Azalea, Charles Brower, Chase, Chuky, Comet, D. P. Thompson, El Sol, Haihong, Josefina, Mariner.

COMMERCIAL LAND AND SHIP STATIONS, ALPHABETICALLY, BY CALL SIGNALS

- KDFN, *read* Kaala; KEIO, *read* Kahuku, Hawaii; KFZT, *read* Sequoia; KGBP, *read* David P. Thompson; KSIO, *read* Kahuku, Hawaii; KWN, *read* Comerio; strike out all particulars following the call signals KFHO, KFSP, KFW, KGBM, KKB, KOKQ, KPK, KPP, KPR, KPV, KTJ, KYJ, KZAG, KZBC, KZBR, KZBS, KZCC, WJF, WOFB, WQBW, WTI.

BROADCASTING STATIONS, BY CALL SIGNALS

[Alterations and corrections to be made to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to lists published in Radio Service Bulletin Nos. 130 and 131, January and February, 1928]

- KFAD (Phoenix, Ariz.).—W. 1., 322.4, fy. kc., 930.
 KFBC (San Diego, Calif.).—Call changed to KGB.
 KFJI (Astoria, Oreg.).—Owner of station, George Kincaid; power, 50.
 KFJZ (Fort Worth, Tex.).—Owner of station, Henry C. Allison, 2121 Refugio Street.
 KFQU (Alma (Holy City), Calif.).—W. 1., 220.4, fy. kc., 1,360.
 KFVD (San Pedro, Calif.).—Change to Venice, Calif.
 KFWB (Hollywood, Calif.).—Power, 1,000; w. l., 361.2, fy. kc., 830.

- KHJ (Los Angeles, Calif.)—Power, 1,000.
 KJBS (San Francisco, Calif.)—W. l., 245.6, fy. kc., 1,220.
 KKP (Seattle, Wash.)—W. l., 272.6, fy. kc., 1,100.
 KLIT (Portland, Oreg.)—Call changed to KORE, location changed to Eugene, Oreg.; owner of station, Eugene Broadcast Station; power, 50.
 KMTR (Los Angeles, Calif.)—W. l., 516.9, fy. kc., 580.
 KOOS (Eugene, Oreg.)—Changed to Marshfield, Oreg.; owner of station, Koos Radio Sales & Service (Inc.); w. l., 206.8, fy. kc., 1,450.
 KRE (Berkeley, Calif.)—W. l., 230.6, fy. kc., 1,300.
 KRSC (Seattle, Wash.)—W. l., 272.6, fy. kc., 1,100.
 KTAP (San Antonio, Tex.)—Power, 250.
 KTBR (Portland, Oreg.)—Power, 500.
 KTHS (Hot Springs, Ark.)—W. l., 499.7, fy. kc., 600.
 KUOA (Fayetteville, Ark.)—Power, 1,000.
 KVL (Seattle, Wash.)—W. l., 272.6, fy. kc., 1,100.
 KWKH (Kennonwood, La.)—Power, 3,500.
 KXA (Seattle, Wash.)—W. l., 535.4, fy. kc., 560.
 KYA (San Francisco, Calif.)—W. l., 352.7, fy. kc., 830.
 KZIB (Manila, P. I.)—W. l., 260, fy. kc., 1,153.
 KZM (Oakland, Calif.)—Changed to Hayward, Calif.; owner of station, Leon P. Tenney; w. l., 230.6, fy. kc., 1,300.
 KZRQ (Manila, P. I.)—Owner of station, Radio Corporation of the Philippines; power, 1,000; w. l., 413, fy. kc., 726.
 WBRC (Birmingham, Ala.)—W. l., 302.8, fy. kc., 990.
 WBRB (Brooklyn, N. Y.)—Consolidation of this station and WCDA no longer exists; WBRB now located at Greenville, N. Y.; owner, Westchester Broadcasting Corporation; power, 250; w. l., 211.1, fy. kc., 1,420; WCDA still located in Brooklyn; other data the same as heretofore.
 WBT (Charlotte, N. C.)—Power, 1,000.
 WCDA (Brooklyn, N. Y.)—See notice shown above for WBRB.
 WCGU (Coney Island-Sea Gate (Brooklyn), N. Y.)—Owner of station, U. S. Broadcast Corporation.
 WCOC (Columbus, Miss.)—Power, 500.
 WDEL (Wilmington, Del.)—Owner of station, WDEL (Inc.).
 WFDF (Flint, Mich.)—Address, 513 South Saginaw Street.
 WFIW (Hopkinsville, Ky.)—Power, 1,000.
 WJPW (Ashtabula, Ohio)—Call changed to WEDH, location changed to Erie, Pa.; owner of station, Erie Dispatch-Herald.
 WKBH (La Crosse, Wis.)—W. l., 230.6, fy. kc., 1,300.
 WKBW (Buffalo, N. Y.)—Changed to Amherst, N. Y.; power, 5,000.
 WLBN (La Prairie, Ill., portable)—Changed to Little Rock, Ark., 210 Center Street; owner of station, Arkansas Broadcasting Co.
 WMAK (Tonawanda, N. Y.)—Changed to Martinsville, N. Y., Shawnee Road; owner of station, WMAK Broadcast Station.
 WMBA (Newport, R. I., portable)—No longer portable; address, 19 Broadway.
 WMC (Memphis, Tenn.)—Power, 5,000.
 WNJ (Newark, N. J.)—Owner of station, Radio Investment Co.
 WOAI (San Antonio, Tex.)—W. l., 280.2, fy. kc., 1,070.
 WOBV (Charleston, W. Va.)—Power, 250.
 WPTF (Raleigh, N. C.)—Power, 1,000.
 WRAC (Escanaba, Mich.)—Change to Erie, Pa., 1931 State Street; owner of station, C. R. Cummins; power, 30; w. l., 218.8, fy. kc., 1,370.
 WREC (Memphis (Whitehaven), Tenn.)—Power, 500.
 WRPI (Terre Haute, Ind.)—Call changed to WBOW; owner of station, Banks of Wabash Broadcasting Association.

GOVERNMENT LAND STATIONS, ALPHABETICALLY, BY NAMES OF STATIONS

[Alterations and corrections to be made to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to the international List of Radiotelegraph Stations, published by the Berne Bureau]

NAVAL LAND STATIONS.—Insert on page 96, list of Commercial and Government Radio Stations of the United States, "Naval land stations—any or all, NQO."
 NEW LONDON, CONN. (NGH).—Location should read New London, Conn. (Coast Guard Academy).

GOVERNMENT SHIP STATIONS, ALPHABETICALLY, BY NAMES OF STATIONS

[Alterations and corrections to be made to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to the International List of Radiotelegraph Stations, published by the Berne Bureau]

FATHOMER.—System, Navy, 1,000; w. l., 600.

LEXINGTON.—Call changed to NIKM, effective May 1, 1928.

NAVAL SHIP STATIONS.—Insert on page 104, list of Commercial and Government Radio Stations of the United States, "Naval ship stations—any or all, NOB."

PATHFINDER.—W. l., 600.

TINGARD.—Owner, U. S. Coast Guard (U. S. L.).

GOVERNMENT LAND AND SHIP STATIONS, ALPHABETICALLY, BY CALL SIGNALS

NEBD, call changed to NIKM; NGH, read New London, Conn. (Coast Guard Academy).

SPECIAL LAND STATIONS, BY NAMES OF STATIONS

[Alterations and corrections to be made to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927]

SAN FRANCISCO, CALIF. (portable), 6XAR).—W. l., 8.2, 10.9, 16.4, 22, 33.2, 45.6, 65.6, 131.2.

WINTER PARK, FLA. (4XE).—Power, 2,000.

MISCELLANEOUS

Vessels equipped with a radio compass

[Additions to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to the International List of Radiotelegraph Stations published by the Berne bureau]

Name	Call signal	Owner
Commercial:		
American Banker.....	WEC	U. S. Shipping Board.
American Farmer.....	WEG	Do.
American Merchant.....	WTP	Do.
American Shipper.....	WTB	Do.
American Trader.....	WTU	Do.
Boston.....	WEL	Eastern S. S. Lines.
Frank H. Goodyear.....	KFEG	American S. S. Co.
George F. Rand.....	KFCT	Do.
Hugh Kennedy.....	KFCJ	Do.
Mary Ellen O'Neill.....	WQBV	California Petroleum S. S. Corporation.
Theodore H. Wickwire, Jr.....	KDUL	American S. S. Co.
William T. Roberts.....	KDUJ	Do.

¹ Vessels which do not have a call signal are not equipped with apparatus for communication.

CHANGES IN RADIOBEACON STATIONS OF THE UNITED STATES

[Additions to the list of Commercial and Government Radio Stations of the United States, edition of June 30, 1927, and to the International List of Radiotelegraph Stations published by the Berne Bureau]

Execution Rocks Light Station, N. Y.—Beacon established. Will transmit every 180 seconds, groups of 1 dot and 1 dash for 60 seconds, silent 120 seconds, thus:

$\frac{\dots \dots \dots \text{etc.}}{60 \text{ seconds}}$
 $\frac{\text{Silent}}{120 \text{ seconds}}$

Will be operated on a frequency of 290 kilocycles (wave length, 1,034 meters) continuously during thick or foggy weather, and daily in clear weather from 5 to 6 a. m. and from 6.30 to 7.30 p. m.; seventy-fifth meridian time. Location: 73° 44' 17" W., 40° 52' 41" N. Radio communication service will not be maintained.

Marquette Light Station, Mich.—Beacon established. Will transmit every 180 seconds, groups of 1 dot and 2 dashes for 60 seconds, silent 120 seconds, thus:

$\frac{\dots \dots \dots \text{etc.}}{60 \text{ seconds}}$
 $\frac{\text{Silent}}{120 \text{ seconds}}$

Will be operated on a frequency of 305 kilocycles (wave length, 984 meters) during thick or foggy weather, and daily in clear weather from 12 to 12.30 and 6 to 6.30 a. m. and p. m., ninetieth meridian time. Location: 87° 22' 34" W., 46° 32' 48" N. Radio communication service will not be maintained.

Chicago Harbor Light Station, Ill.—Beacon established. Will transmit every 180 seconds, groups of 1 dot, 1 dash, 1 dot, 1 dash for 60 seconds, silent 120 seconds, thus:

. etc.

 60 seconds Silent
120 seconds

Will be operated on a frequency of 305 kilocycles (wave length, 984 meters) during thick or foggy weather, and daily in clear weather from 2.30 to 3 and 8.30 to 9 a. m. and p. m., ninetieth meridian time. Location: 87° 35' 26" W., 41° 53' 31" N. Radio communication service will not be maintained.

San Francisco (Calif.) Lightship.—Operating period changed to the second 15 minutes of each hour.

The following-named radiobeacons on the Great Lakes have been assigned frequencies and corresponding wave lengths, effective about May 10, as follows:

Location	Fre- quency (kilo- cycles)	Wave length (meters)	Location	Fre- quency (kilo- cycles)	Wave length (meters)
Buffalo, N. Y.	290	1,034	Devils Island, Wis.	300	1,000
Detroit River, Mich.	310	968	Duluth, Minn.	290	1,034
Lake Huron Lightship, Mich.	310	968	Lansing Shoal, Mich.	310	968
Thunder Bay Island, Mich.	300	1,000	Point Betsie, Mich.	295	1,017
Detour, Mich.	290	1,034	Manitowoc, Wis.	290	1,034
Whitefish Point, Mich.	300	1,000	Ludington, Mich.	305	984
Manitou Island, Mich.	290	1,034	Milwaukee, Wis.	300	1,000
Passage Island, Mich.	310	968	Grand Haven, Mich.	310	968
La Pointe, Wis.	310	968	Calumet, Ill.	290	1,034

SERVICE OF OPERATORS AT FOREIGN STATIONS NOT CONSIDERED IN THE ISSUANCE OF RENEWAL LICENSES

The following amendment has been made to paragraph 7, subparagraph d, of the regulations governing the issuance of radio operators' licenses, published in Radio Service Bulletin No. 130, January 31, 1928: "Service at a foreign station will not be taken in consideration in the issuance of renewal licenses. The service record is based only on service at stations of the United States."

GENERAL ORDERS OF THE FEDERAL RADIO COMMISSION

Definition of an amateur station—New wave band assigned (General Order No. 24, March 7, 1928).—For the purpose of clarifying the amateur situation the Federal Radio Commission has adopted the following definition and regulation: An amateur station is a station operated by a person interested in radio technique solely with a personal aim and without pecuniary interest. Amateur licenses will not be issued to stations of other classes.

In accordance with the channels designated for amateur use under the new International Radiotelegraph Convention, the Federal Radio Commission has opened for amateur use the new additional band between 30,000 and 28,000 kilocycles (9.99 to 10.71 meters). The radio division of the Department of Commerce is hereby authorized to open this band immediately for amateur use. The Federal Radio Commission has revised the list of radiotelephone bands open for amateur operation to read as follows:

Kilocycles	Meters
64,000 to 56,000	4.69 to 5.35.
3,550 to 3,500	84.5 to 85.7.
2,000 to 1,715	150 to 175.

Extension of broadcasting station licenses (General Order No. 25, March 27, 1928).—All existing licenses to broadcast, subject to such modifications and extensions as may be appended thereto, are hereby further extended for 30 days to terminate at 3 a. m., May 1, 1928, unless otherwise modified.

Termination of commercial land, technical and training school, experimental, ship, and amateur station licenses (General Order No. 26, March 27, 1928).—All licenses covering coastal, point to point, technical and training, experimental, ship, and amateur radio transmitting stations, extended by the Federal Radio Commission General Orders 1 and 3, dated March 15 and 29, 1927, respectively, are hereby terminated on August 31, 1928. Applications for new licenses or renewals in these classes must be filed with the Federal Radio Commission not later than July 31, 1928, through the supervisors of radio of the Department of Commerce, unless already filed. All formal licenses in these classes issued by the Federal Radio Commission for definite periods subsequent to General Orders 1 and 3 are not affected by this order.

General Orders of the Federal Radio Commission which have not been heretofore published in the Radio Service Bulletin and are published now merely as a matter of record.

Public hearings regarding reducing interference within the broadcasting band (General Order No. 2).—For the purpose of providing opportunity for the presentation to the Federal Radio Commission of general suggestions as to methods for reducing interference within the broadcasting band, but not for hearing individual claims or complaints, the Federal Radio Commission hereby sets the dates of Tuesday, March 21, Wednesday, March 30, Thursday, March 31, and Friday, April 1 (1927), for public hearings, to be held in the offices of the Federal Radio Commission, Commerce Building, Washington, D. C., beginning each morning at 10 o'clock.

Extension of broadcasting station licenses (General Order No. 18, October 12, 1927).—For the purpose of bringing the 60-day license periods for broadcasting stations into conformity with the calendar months, all broadcasting licenses dated August 15, 1927, and issued for the period of 60 days to October 14, 1927, except as subsequently modified by Special Orders Nos. 79 to 128, inclusive, or by later licenses already issued, are hereby extended and continued in force until October 31, 1927, at which time new 60-day licenses will be issued. Special Orders Nos. 79 to 128, inclusive, remain effective as of the dates specified in such orders and until October 31, 1927, at which time new 60-day licenses will be issued.

Designating band of channels to be cleared of heterodynes and providing procedure for clearing heterodyning channels, first, by cooperation between stations now on these channels and by public hearings to determine which station or stations shall be relicensed January 1 (1928) for operation on the channel (General Order No. 19, November 14, 1927).—In order to improve radio reception throughout the United States, particularly for the very large audience of rural and remote listeners who are situated far outside of the local service range of any broadcasting station, as well as to reduce generally interference from heterodyning between stations, the Federal Radio Commission hereby designates channels from 600 kilocycles to 1,000 kilocycles, inclusive, as frequencies to be maintained free from heterodynes or other interference.

Stations now operating on any of the channels so designated which are not free of interference as of December 1 are ordered to clear these channels of heterodyning during the present license period by sharing of time, control of power, control of frequency, or any other method which will eliminate mutual interference on their respective channels.

In the case of each channel not freed of heterodyning by such mutual action between stations now sharing that channel, the commission, before the expiration of the present license period, will, as provided by law, call a public hearing at Washington for the purpose of determining which stations, in the public interest, shall be relicensed to continue on the channel so as to preserve it in a clear and nonheterodyning condition.

Extension of broadcasting station licenses (General Order No. 22, January 16, 1928).—All existing station broadcasting licenses and renewals are hereby extended until and will terminate at 3 a. m. March 1, 1928.

CHANGES IN LIST OF MASTER CONTROL AND ALTERNATE CONTROL STATIONS OF THE NAVAL COMMUNICATION RESERVE

The following change should be made to the list published in the January 31, 1928, No. 130, edition of this publication: Addition, eleventh naval district, NRRW, Los Angeles, Calif., amateur call, 6NR, master reserve control station.

REVISED REGULATIONS GOVERNING THE OPERATION OF AMATEUR STATIONS

The Federal Radio Commission has established the following regulations governing the licensing and operation of amateur radio stations. These regulations, dated March 6, 1928, supersede those dated October 28, 1927, and published in Radio Service Bulletin No. 130, January, 1928.

An amateur station is a station operated by a person interested in radio technique solely with a personal aim and without pecuniary interest. Amateur licenses will not be issued to stations of other classes.

Amateur radio stations are authorized for communication only with similarly licensed stations, except as indicated below, and on wave lengths or frequencies within the following bands, and at all times unless interference is caused with other radio services, in which event a silent period must be observed between the hours of 8 and 10.30 p. m., local time, and on Sundays during local church services.

Kilocycles	Meters	Kilocycles	Meters
401,000 to 400,000.....	0.7477 to 0.7496.	8,000 to 7,000.....	37.5 to 42.8.
64,000 to 56,000.....	4.69 to 5.35.	4,000 to 3,500.....	75 to 85.7.
30,000 to 28,000.....	9.99 to 10.71.	2,000 to 1,500.....	150 to 200.
16,000 to 14,000.....	18.7 to 21.4.		

Amateur radiotelephone operation will be permitted only in the following bands:

Kilocycles	Meters
64,000 to 56,000.....	4.69 to 5.35.
3,550 to 3,500.....	84.5 to 85.7.
2,000 to 1,715.....	150 to 175.

Spark transmitters will not be authorized for amateur use.

Amateur stations must use circuits loosely coupled to the radiating system or devices that will produce equivalent effects to minimize key impacts, harmonics, and plate supply modulations. Conductive coupling, even though loose, will not be permitted, but this restriction shall not apply against the employment of transmission line feeder systems to Hertzian antennae.

Amateur stations are not permitted to communicate with commercial or Government stations unless authorized by the licensing authority except in an emergency or for testing purposes. This restriction does not apply to communication with small pleasure craft, such as yachts and motor boats, holding limited commercial station licenses which may have difficulty in establishing communication with commercial or Government stations.

Amateur stations are not authorized to broadcast news, music, lectures, sermons, or any form of entertainment, or to conduct any form of commercial correspondence.

No person shall operate an amateur station except under and in accordance with an operator's license issued to him by the Secretary of Commerce.

TRANSMISSION OF WEATHER REPORTS, FORECASTS, AND WARNINGS BY NAVAL STATION AT SAN FRANCISCO, CALIF.

The Weather Bureau broadcasts weather reports, forecasts, and warnings in International Morse Code, in accordance with the schedule given hereunder. The broadcasts are made directly from the Weather Bureau office in San Francisco, Calif., in cooperation with the office of communications of the Navy Department, by distant control connection with the naval station at San Francisco (NPG).

Schedules in Pacific standard time

[One hundred and twentieth meridian time]

(a) 6.15 a. m.: Current weather observations from stations in the United States, Canada, and Alaska. Broadcast simultaneously on frequencies of 4,175 and 8,350 kilocycles (71.8 and 35.9 meters, respectively).

(b) 7.30 a. m.: Bulletin containing weather reports, information, forecasts, and storm warnings for the benefit of marine and aviation interests. Broadcast simultaneously on frequencies of 42.8, 108, and 8,350 kilocycles (7,005, 2,778, and 35.9 meters, respectively).

(c) 6.15 p. m.: Current weather observations from stations in the United States, Canada, and Alaska. Broadcast simultaneously on frequencies of 4,175 and 8,350 kilocycles (71.8 and 35.9 meters, respectively).

(d) 7.30 p. m.: Bulletin containing weather reports, information, forecasts, and storm warnings for the benefit of marine and aviation interests. Broadcast simultaneously on frequencies of 42.8, 108, and 8,350 kilocycles (7,005, 2,778, and 35.9 meters, respectively).

The 6.15 a. m. (a) and 6.15 p. m. (c) broadcasts are made in the regular Weather Bureau word code, which can be easily translated by means of a code book (Weather Bureau Code, 1924, W. B. No. 814), copies of which may be procured from the Superintendent of Documents, Washington, D. C., at \$1.25. They consist of weather observations of current date taken, respectively, at 5 a. m. and 5 p. m., Pacific standard time, at about 130 stations in the United States, Canada, and Alaska, and show sea-level barometric pressure, current temperature, wind direction, temperature (minimum in a. m. reports and maximum in p. m. reports), wind velocity, amount of precipitation, clouds (kind, direction, and rate of movement), and other data. These broadcasts are made for the benefit of Army, Navy, and commercial aviation fields, for business organizations and as a general public service.

The 7.30 a. m. (b) and 7.30 p. m. (d) broadcasts are the regular marine and aviation bulletins heretofore broadcast at 9 a. m. and 7.30 p. m. A detailed description of these broadcasts appears in Weather Bureau Radio Circular No. 10, dated April 15, 1926, but amended as follows: Kodiak, Alaska, and Dutch Harbor, Alaska, observations are taken at 4 a. m. and 4 p. m., one hundred and twentieth meridian time.

Aerological data are included in the surface reports of the following stations: Seattle, San Francisco, Los Angeles, San Diego, Spokane, Boise, Reno, Salt Lake City, and Modena.

Weather reports from ships in the North Pacific Ocean will follow the reports from land stations as heretofore, but 4 a. m. (one hundred and twentieth meridian time) reports hereafter will be broadcast in the 7.30 a. m. bulletin of the same day and the 4 p. m. (one hundred and twentieth meridian time) reports in the 7.30 p. m. bulletin of the same day.

Schedules of naval stations transmitting time, weather, hydrographic, ice, and press bulletins

Time (Greenwich civil)	Station	Call signal	Frequency (kilocycles) and type of emission	Wave length (meters)	Material broadcast
0000	Brownsville, Tex.	NAY	132 i. c. w	2, 273	Weather, hydrographic.
0045	San Juan, P. R.	NAU	48 c. w	6, 250	Weather (July 1 to Nov. 15).
0100	Norfolk, Va.	NAM	122 i. c. w	2, 459	Weather.
	Puget Sound, Wash.	NPC	118 c. w	2, 542	Do.
0115	Arlington, Va.	NAA	4,015 a. c. w	74. 72	Aviation weather and upper-air reports.
	Eureka, Calif.	NPW	104 i. c. w	2, 885	Weather, hydrographic.
0130	Norfolk, Va.	NAM	122 i. c. w	2, 459	Weather.
	Cavite, P. I.	NPO	56 c. w	5, 357	Press (for naval vessels only).
			112 a. c. w	2, 679	
0200	Guantanamo Bay, Cuba.	NAW	113 c. w	2, 655	Weather (June 1 to Nov. 15).
	San Juan, P. R.	NAU	108 i. c. w	2, 778	Weather (July 1 to Nov. 15).
0215	San Francisco, Calif.	NPG	4,175 c. w	71. 85	Aviation weather.
			8,350 c. w	35. 9	
			112 a. c. w	2, 679	
			690 r. t	435	
	Arlington, Va.	NAA	4,015 a. c. w	74. 72	Time signals.
0255 to 0300	Annapolis, Md.	NSS	8,030 a. c. w	37. 36	Do.
			12,045 a. c. w	24. 9	
	Cavite, P. I.	NPO	56 c. w	5, 357	Do.
			112 a. c. w	2, 679	
	Arlington, Va.	NAA	68 c. w ¹	4, 412	Marine weather, hydrographic, ice reports (in season).
			112 a. c. w	2, 679	
0300	Cavite, P. I.	NPO	56 c. w	5, 357	Weather, hydrographic.
			112 a. c. w	2, 679	
	Key West, Fla.	NAR	102 i. c. w	2, 941	Do.
	Puget Sound, Wash.	NPC	118 c. w	2, 542	Hydrographic.

This frequency is discontinued at 0400 G. C. T.

Schedules of naval stations transmitting time, weather, hydrographic, ice, and press bulletins—Continued

Time (Greenwich civil)	Station	Call signal	Frequency (kilocycles) and type of emission	Wave length (meters)	Material broadcast
0305	Navy Yard, Wash., D. C.	NAA	690 r. t.	435	Weather.
			42.8 c. w.	7,009	Weather, hydrographic.
0330	San Francisco, Calif.	NPG	108 i. c. w.	2,778	
			8,350	35.9	Aviation weather.
	Tutuila, Samoa	NPU	66 c. w.	4,545	Hydrographic.
0355	Balboa, Canal Zone	NBA	46 c. w.	6,522	Time signals.
0400	Colon, Canal Zone	NAX	132 i. c. w.	2,273	Do.
0400	Arlington, Va.	NAA	4,015 a. c. w.	74.72	Weather broadcast to Europe.
	Great Lakes, Ill.	NAJ	132 i. c. w.	2,273	Weather, hydrographic.
0430	Puget Sound, Wash.	NPC	118 c. w.	2,542	Weather.
	San Juan, P. R.	NAU	48 c. w.	6,250	Do.
0430	Astoria, Oreg.	NPE	112 a. c. w.	2,679	Hydrographic.
	San Diego, Calif.	NPL	102 a. c. w.	2,941	Weather.
0500	Brownsville, Tex.	NAY	132 i. c. w.	2,273	Weather, hydrographic.
0555 to 0600	San Francisco, Calif.	NPG	62 c. w.	4,839	Time signals.
0600	do.		108 i. c. w.	2,778	
0630	Honolulu, Hawaii	NPM	108 i. c. w.	2,778	Weather, hydrographic.
0700	Annapolis, Md.	NSS	54 a. c. w.	5,555	Do.
	Arlington, Va.	NAA	17.6 c. w.	17,045	Press (for naval vessels only).
0730	Tutuila, Samoa	NPU	112 a. c. w.	2,679	Do.
	Balboa, Canal Zone	NBA	66 c. w.	4,545	Hydrographic.
1000	do.		46 c. w.	6,522	Hydrographic Press (for naval vessels only).
	Colon, Canal Zone	NBA	118 c. w.	2,542	Press (for naval vessels only).
1300	San Diego, Calif.	NPL	132 i. c. w.	2,273	Hydrographic.
	Puget Sound, Wash.	NPC	30.6 c. w.	9,804	Press (for naval vessels only).
1315	Arlington, Va.	NAA	118 c. w.	2,542	Weather.
			4,015 a. c. w.	74.72	Aviation weather and upper-air reports.
1330	Norfolk, Va.	NAM	8,030 a. c. w.	37.36	
1355 to 1400	Cavite, P. I.	NPO	12,045 a. c. w.	24.9	Weather.
1400	do.		122 i. c. w.	2,459	
			56 c. w.	5,357	Time signals.
1415	San Francisco, Calif.	NPG	112 a. c. w.	2,679	
			36 c. w.	8,333	Weather, hydrographic.
1500	Arlington, Va.	NAA	112 a. c. w.	2,679	
			4,175 c. w.	71.85	Aviation weather.
1505	New Orleans, La.	NAT	8,350 c. w.	35.9	Marine weather, ice reports (in season).
	Arlington, Va.	NAA	112 a. c. w.	2,679	Weather.
1530	New York, N. Y.	NAH	16,060 a. c. w.	18.68	Do.
			106 c. w.	2,830	Weather, hydrographic, ice reports (in season).
1530	Charleston, S. C.	NAO	690 r. t.	435	Weather, hydrographic.
			108 i. c. w.	2,778	Weather.
1545	San Francisco, Calif.	NPG	122 i. c. w.	2,459	
			42.8 c. w.	7,000	Weather.
1600	Philadelphia, Pa.	NAI	108 c. w.	2,778	Aviation weather.
	Great Lakes, Ill.	NAJ	8,350 c. w.	35.9	Weather, hydrographic.
1630	Norfolk, Va.	NAM	104 i. c. w.	2,885	Do.
			132 i. c. w.	2,273	Weather, hydrographic, ice reports (in season).
1645	Boston, Mass.	NAD	122 i. c. w.	2,459	Do.
	Newport, R. I.	NAF	102 a. c. w.	2,941	Do.
1655 to 1700	Arlington, Va.	NAA	118 i. c. w.	2,542	Weather broadcast to Europe.
	New Orleans, La.	NAT	12,045 a. c. w.	24.9	Weather, hydrographic.
1700	San Juan, P. R.	NAU	106 c. w.	2,830	Weather.
	Savannah, Ga.	NEV	48 c. w.	6,250	Do.
1700	Jupiter, Fla.	NAQ	132 i. c. w.	2,273	Do.
	San Diego, Calif.	NPL	do.	2,273	Do.
1700	St. Augustine, Fla.	NAP	102 i. c. w.	2,941	Do.
	Pensacola, Fla.	NAS	128 spark	2,344	Do.
1700	do.		112 i. c. w.	2,679	Do.
			112 a. c. w.	2,679	Time signals.
1700	Arlington, Va.	NAA	690 r. t.	435	
			4015 a. c. w.	74.72	
1700	Annapolis, Md.	NSS	8030 a. c. w.	37.36	Do.
	Great Lakes, Ill.	NAJ	12045 a. c. w.	24.9	Do.
1700	Key West, Fla.	NAR	17.6 c. w.	17,045	Do.
	New Orleans, La.	NAT	132 i. c. w.	2,273	Do.
1700	San Diego, Calif.	NPL	102 i. c. w.	2,941	Do.
			30.6 c. w.	9,804	Do.
1700	Arlington, Va.	NAA	102 a. c. w.	2,941	Hydrographic.
	Brownsville, Tex.	NAY	112 a. c. w.	2,679	Weather, hydrographic.
1700	Eureka, Calif.	NPW	132 i. c. w.	2,273	Do.
	Key West, Fla.	NAR	104 i. c. w.	2,885	Do.
1700	Puget Sound, Wash.	NPC	102 i. c. w.	2,941	Do.
	San Francisco	NPG	118 c. w.	2,542	Do.
			42.8 c. w.	7,009	Do.

Schedules of naval stations transmitting time, weather, hydrographic, ice, and press bulletins—Continued

Time (Greenwich civil)	Station	Call signal	Frequency (kilocycles) and type of emission	Wave length (meters)	Material broadcast
1755 to 1800	Balboa, Canal Zone..... Colon, Canal Zone.....	NBA NAX	46 c. w..... 132 i. c. w.....	6, 522 2, 273	Time signals. Do.
1800	Balboa, Canal Zone.....	NBA	46 c. w.....	6, 522	Hydrographic.
1830	Honolulu, T. H.....	NPM	54 a. c. w.....	5, 555	Weather, hydrographic.
1930	Tutuila, Samoa..... Astoria, Oreg.....	NPU NPE	66 c. w..... 112 a. c. w.....	4, 545 2, 679	Hydrographic. Time signals.
1955 to 2000	Eureka, Calif..... San Francisco, Calif.....	NPW NPG	104 i. c. w..... 42.8 c. w..... 62 c. w..... 108 c. w.....	2, 885 7, 009 4, 839 2, 778	Do. Do.
2045	Arlington, Va.....	NAA	690 r. t.....	435	Weather.
2100	Norfolk, Va..... Puget Sound, Wash.....	NAM NPC	122 i. c. w..... 118 c. w.....	2, 459 2, 542	Weather, hydrographic. Do.
2130	Astoria, Oreg..... Boston, Mass.....	NPE NAD	112 a. c. w..... 102 i. c. w.....	2, 679 2, 941	Hydrographic. Weather, hydrographic, ice reports (in season).
	Newport, R. I..... New York, N. Y.....	NAF NAH	118 i. c. w..... 108 i. c. w.....	2, 542 2, 778	Do. Do.
2200	Philadelphia, Pa..... Eureka, Calif..... Great Lakes, Ill..... New Orleans, La..... San Diego, Calif.....	NAI NPW NAJ NAT NPL	104 i. c. w..... 104 i. c. w..... 132 i. c. w..... 106 c. w..... 102 a. c. w.....	2, 885 2, 885 2, 273 2, 830 2, 941	Weather, hydrographic. Do. Hydrographic. Weather, hydrographic. Weather.
2230	Honolulu, T. H..... Charleston, S. C.....	NPM NAO	54 a. c. w..... 122 i. c. w.....	5, 555 2, 459	Weather, hydrographic. Do.
2300	Jupiter, Fla..... Pensacola, Fla..... Savannah, Ga.....	NAQ NAS NEV	132 i. c. w..... 112 i. c. w..... 132 i. c. w.....	2, 273 2, 679 2, 273	Weather. Do. Do.
2330 to 2400	Tutuila, Samoa..... Honolulu, T. H.....	NPU NPM	66 c. w..... 26.1 c. w..... 106 i. c. w.....	4, 545 11, 494 2, 830	Hydrographic. Time signals.

Mexican broadcasting stations

Location	Call signal	Wave length (meters)	Frequency (kilocycles)	Location	Call signal	Wave length (meters)	Frequency (kilocycles)
Chihuahua.....	CZF	310	260	Mexico City.....	CZE	350	500
Mazatlan.....	CYR	475	250	Monterey.....		311	250
Merida.....	CYY	548	100	Oaxaca.....	CYF	265	100
Mexico City.....	OYA	300	500	Puebla.....	CYL	312	100
Do.....	CYB	275	500	Tampico.....	CYQ	322	100
Do.....	CYH	375	100	Do.....	CYZ		20
Do.....	CYJ	400	2, 000	Torreón.....	CYM	225	1, 500
Do.....	CYL	400	500	Vera Cruz.....	CYC	337	50
Do.....	CYO	425	100	Do.....	CYD		
Do.....	CYX	325	500				

NEW INTERNATIONAL LIST OF RADIO STATIONS

The twelfth edition of the International List of Radiotelegraph Stations, dated December, 1927, published by the International Bureau of the Telegraph Union, Radiotelegraph Service, Berne, Switzerland, is now available for distribution. The price of this list is 12 francs, Swiss (gold), including postage, and all supplements which will be issued up to the time the thirteenth edition is published. All remittances should be forwarded direct to the Berne bureau. The list does not contain data relative to broadcasting stations.

Table of air-line distances in statute miles

From/To—	Carson, Nev.	Charleston, W. Va.	Cheyenne, Wyo.	Concord, N. H.	Dover, Del.	Hartford, Conn.	Indianapolis, Ind.	Jackson, Miss.	Madison, Wis.	Montgomery, Ala.	Montpelier, Vt.	Providence, R. I.	Raleigh, N. C.	Topeka, Kans.	Trenton, N. J.
Carson, Nev.	—	2,040	800	2,488	2,346	2,451	1,782	1,717	1,595	1,922	2,425	2,513	2,248	1,288	2,367
Charleston, W. Va.	2,040	—	1,243	625	334	529	262	638	521	489	622	591	242	758	389
Cheyenne, Wyo.	800	1,243	—	1,699	1,546	1,056	984	1,012	801	1,187	1,640	1,719	1,458	504	1,568
Concord, N. H.	2,488	625	1,699	—	348	115	792	1,262	895	1,097	90	95	637	1,284	265
Dover, Del.	2,346	334	1,546	348	—	234	569	948	769	753	384	284	269	1,078	84
Hartford, Conn.	2,451	529	1,056	115	234	—	718	1,163	856	990	173	65	523	1,221	153
Indianapolis, Ind.	1,782	262	984	792	569	718	—	563	283	511	762	783	495	510	603
Jackson, Miss.	1,717	638	1,012	1,262	948	1,163	563	—	746	227	1,258	1,223	703	558	1,016
Madison, Wis.	1,595	521	801	895	766	856	283	746	—	758	842	918	762	430	779
Montgomery, Ala.	1,922	489	1,187	1,097	763	990	511	227	758	—	1,105	1,046	497	699	839
Montpelier, Vt.	2,425	622	1,640	90	384	173	782	1,258	842	1,105	—	178	667	1,241	301
Providence, R. I.	2,513	591	1,719	95	284	65	783	1,223	918	1,046	178	—	570	1,286	207
Raleigh, N. C.	2,248	242	1,458	637	289	523	495	703	702	497	667	570	—	960	372
Topeka, Kans.	1,288	758	504	1,284	1,078	1,221	510	558	430	699	1,241	1,286	960	—	1,113
Trenton, N. J.	2,367	389	1,568	265	84	153	603	1,016	779	839	301	207	372	1,113	—

NOTE.—A table giving the air-line distances between 50 cities other than those shown above may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents per copy.

BEACON ESTABLISHED ON AMRUM BANK LIGHT VESSEL, GERMANY

This new light vessel, located in approximately longitude $7^{\circ} 53' E.$, latitude $54^{\circ} 33' N.$, is equipped with a radiobeacon, a submarine fog signal, and an above-water fog signal.

The radiobeacon operates on 1,050 meters, c. w. The characteristic of the station is as follows: A group of signals is transmitted for 30 seconds and is repeated 7 times in $3\frac{1}{2}$ minutes, followed by a silent interval of 4 minutes; total period, $7\frac{1}{2}$ minutes. The group of signals is as follows:

•••••	•••••	Silent	16 dashes (— — — etc.)	Silent
6.6 seconds	1.253 seconds		each of 1 second duration, with intervals of 0.253 second between each dash	2.352 seconds
19.795 seconds				

The group of 7 signals will be transmitted 6 times between the fifteenth and fifty-sixth minutes of every hour, simultaneously with the beacon signals transmitted from Borkum Riff and Weser light vessels.

Description of the submarine fog signal.—Electric membrane transmitter sounding 4 notes every 30 seconds, thus: Note 1 second, silent 1 second; note 1 second, silent 1 second; note 3 seconds, silent 1 second; note 1 second, silent 21 seconds.

These signals commence after the last dot of the radiobeacon signal and are transmitted continuously, including the period in which no radiobeacon signal is sent, viz, from the fifty-sixth to the fifteenth minute of the hour.

Description of above-water fog signal.—An electric membrane transmitter, sounded similarly to the submarine fog signal. These signals are sounded after the submarine signal at an interval of one second.

The bearing of the light vessel can be determined either by means of the radio compass (direction finder) or the submarine fog-signal receiver.

The distance from the light vessel can be determined by using the radiobeacon signals in conjunction with the submarine fog signal by either of the following methods: (a) When the 16 dashes of the radiobeacon signal are being transmitted, count the number of dashes until the signal synchronizes with the receipt of the first dot of the submarine signal. The number of the dash is the required distance in miles. (b) Count the number of seconds which elapse between receiving the final dot of the submarine signal; multiply this number by 0.8, and the product is the required distance in miles.

Until further notice the radiobeacon will be operated daily during clear weather between the following periods: 0815–0856, 1315–1356, 1815–1856, G. M. T.

If a vessel desires to determine her distance during these periods, or to receive the radiobeacon and submarine fog signals at times other than those specified,

she should transmit a request to this effect to the light vessel (KAF). The radio telegraph station is engaged during the first 15 minutes of every hour between 0700 and 1000 and between 1300 and 1900.

METEOROLOGICAL REPORTS TRANSMITTED BY FLORIANOPOLIS (BRAZIL) STATION

This station transmits meteorological reports in plain language on 600 meters every four hours, beginning at 0315. Call signal, SPF; location, longitude 48° 30' W., latitude 27° 36' S.

WEATHER REPORTS TRANSMITTED BY RIO DE JANEIRO (ARPOADOR), BRAZIL, STATION

This station transmits weather reports in plain language on 600 meters at 1200, 1500, and 2100. Call signal, SPY; location, longitude 43° 10' W., latitude 22° 56' S.

CHANGES IN TRANSMISSION OF WEATHER REPORTS AND TIME BY PARIS (EIFFEL TOWER) STATION

The weather bulletins previously transmitted from this station on 75 meters, c. w., are now broadcast on 73.5 meters, c. w.

The 0940 bulletin is transmitted simultaneously by this station on a wave length of 7,300 meters, and Issy-les-Moulineaux, call signal OCDJ, on 32.5 meters.

At 0945 a weather bulletin, preceded by the words "Météo Syrie," consisting of 0600 observations from Syrian stations in Zurich Trial Code, is transmitted from this station. The weather bulletin transmitted at 2100 also contains, in addition to the 1,800 observations from Europe-North Africa, the 1,800 observations from Syrian stations in Zurich Trial Code preceded by the words "Météo Syrie."

Meteo Angot bulletins: Weather bulletins consisting of a repetition of the Washington-Arlington 0400 and 1600 bulletins are transmitted from this station at 0620 and 2110, respectively, on a wave length of 7,300 meters, c. w., in the same form and code, except that the temperature given is centigrade. The message commences with the words "Météo Amérique." The 2110 bulletin follows immediately after the 2100 Meteo Europe bulletin. Time signals are transmitted on 32.5 c. w., and 2,650 i. c. w.

CHANGE IN WAVE LENGTHS OF ITALIAN STATIONS TRANSMITTING WEATHER REPORTS AND STORM WARNINGS

The weather bulletins and storm warnings previously transmitted on 600 meters are now transmitted on 750 meters, spark, in as far as the following-named stations are concerned: Maddalena (Sardinia), Vittoria (Sicily), Rome-S. Paolo, Taranto, and Ancona.

BEACON ESTABLISHED AT HOLYHEAD BAY, ENGLAND

A beacon operating on 1,000 meters, call signal, G GK, has been established at Holyhead Bay Lighthouse in approximately longitude 4° 36' W., latitude 53° 25' N.

During fog signals will be transmitted for one minute, every four minutes; thus: The call signal G GK (— . — . — . —) at the rate of 15 words per minute, repeated for 48 seconds, approximately. A long dash (—) of 10 seconds duration, approximately. The call signal G GK made once, of 2 seconds duration, approximately. (The whole transmission of the above will take 60 seconds.) A silent interval of 3 minutes.

During clear weather three emissions of the whole of the signal described above will be made consecutively at half-hour intervals, approximately commencing at 7 minutes past the hour.

Although this beacon is intended to be permanent, it may be found necessary to make some adjustment after establishment, and the station should be considered as under test for a period of three months, during which time the signals may be subject to temporary interruptions.

METEOROLOGICAL INFORMATION TRANSMITTED BY HONG KONG (CHINA) STATION

The information broadcast by Hong Kong Observatory is as follows: Meteorological observations from various stations in the Far East. These messages will be followed immediately by weather reports and forecasts. The names of the observing stations are given below, together with the hours at which the observations are taken at each station.

As it has been found impossible to secure complete synchronism, the morning barometer readings will be reduced approximately to 2200 and the afternoon observations to 0600 G. M. T.

The first four figures of each group will give the barometer reduced to 32° Fahrenheit, sea level, and gravity at 45°. The fifth and sixth figures the temperature of the air in degrees Fahrenheit, the seventh and eighth the temperature of evaporation, the ninth and tenth the direction of the wind (00=North; 04=East; 08=South; 12=West), the eleventh the force of the wind on the Beaufort scale, 9 meaning 9 or above. The twelfth the weather according to the following code: 1=fine, blue sky or detached clouds; 2=cloudy or overcast; 3=rain; 4=fog; 5=thunderstorm; Z=no observation.

List of observation stations

Code No.	Station	Time of observation (G.M.T.)	Code No.	Station	Time of observation (G.M.T.)
	Broadcast at 0400:			Broadcast at 0400—Continued.	
1	Nagasaki.....	2100	24	Tacloban.....	2200
2	Oshima.....	2100	25	Iloilo.....	2200
3	Naha.....	2100	26	Surigao.....	2200
4	Ishigakijima.....	2100		Broadcast at 1200:	
5	Ichang.....	2200	1	Shanghai.....	0600
6	Hankow.....	2200	2	Sharp Peak.....	0600
7	Changsha.....	2200	3	Amoy.....	0600
8	Shanghai.....	2200	4	Swatow.....	0600
9	Sharp Peak.....	2300	5	Taihoku.....	0300
10	Amoy.....	2200	6	Koshun.....	0300
11	Swatow.....	2200	7	Pescadores.....	0300
12	Taihoku.....	2100	8	Hong Kong.....	0600
13	Koshun.....	2100	9	Pratas Island.....	0600
14	Pescadores.....	2100	10	Phulien.....	0700
15	Hong Kong.....	2200	11	Tourane.....	0700
16	Pratas Island.....	2200	12	Cape St. James.....	0700
17	Phulien.....	2300	13	Basco.....	0600
18	Tourane.....	2300	14	Aparri.....	0600
19	Cape St. James.....	2300	15	Manila.....	0600
20	Basco.....	2200	16	Legaspi.....	0600
21	Aparri.....	2200	17	Tacloban.....	0600
22	Manila.....	2200	18	Iloilo.....	0600
23	Legaspi.....	2200	19	Surigao.....	0600

Masters of vessels fitted with radiotelegraph installations are earnestly requested to cooperate with the meteorological work of the observatory, by arranging for meteorological observations to be made at 0300, 0600, 0900, and 2200, G. M. T., and transmitted to the observatory without delay when within range of the station.

The message should contain the following information: Ship's name, position, and time of observation (G. M. T.); barometer reading corrected; thermometer reading; wind direction and force; state of sea; state of weather (in plain language, fine meaning 0—3 cloud; fair, 4—6 cloud; cloudy, 7—8; overcast, 9—10.

The report should be addressed to the Royal Observatory, Hong Kong. The message will be free of coast, ship, and land charges.

Hong Kong Observatory station keeps watch on 800 meters (I. C. W.) continuously, except when engaged on long-wave reception at the following periods, G. M. T.: 2355—0006, 0055—0100, 0155—0210, 0254—0315, 0755—0806, 1255—1300.

Ships not fitted for transmission on 800 meters should send their weather reports on 600 meters through a ship fitted for 800 meters transmission.

METHODS, FORMULAS, AND TABLES FOR THE CALCULATION OF ANTENNA CAPACITY

A paper just issued by the Bureau of Standards gives a discussion of methods and formulas for the calculation of the capacity of various common types of antennæ. In the past two different basic methods have been used for such calculations, but the two methods have not always given the same result. The present paper shows that results of calculations by the two methods agree if appropriate formulas are used. One method, however, is the more general and useful. A set of working formulas for calculating the capacity of the more common types of antennæ is developed. Tables of constants for facilitating numerical calculations are given, together with tables for the capacity of single-wire horizontal and vertical antennæ and two-wire antennæ. This paper, Bureau of Standards Scientific Paper No. 568, Methods, Formulas, and Tables for the Calculation of Antenna Capacity, by F. W. Grover, may be obtained for 20 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.

RADIO AIDS TO CIVIL AIRWAYS

The Bureau of Standards has now in operation two experimental radio stations for aeronautic work carrying on active development work on aids to air navigation. These two stations are located at College Park, Md., a suburb of Washington, D. C., and Bellefonte, Pa., which is located on the transcontinental airway midway between New York and Cleveland. The services of both stations are available to all aircraft able to make use of them.

At College Park there is a directive radiobeacon which has heretofore been equipped to send signals of the aural interlocking variety. Recently this beacon has been rebuilt to also send signals modulated at two low frequencies necessary for the visual indicator system that the bureau has recently developed. The College Park station is equipped with other special types of equipment for the sending of signals for experimental purposes. At Bellefonte the directive radiobeacon is being remodeled, so that it can send signals for use of the visual system in addition to the aural system. By May 15 three airplanes of the National Air Transport (Inc.), using the Bellefonte station, and three airplanes of Pitcairn Aviation (Inc.), using the College Park station, will be equipped with suitable radio receiving sets, including visual indicators, so that practical flying tests by these air-mail contractors may be carried out. Much valuable information is expected to result following the inauguration of these service flights.

The College Park station is also equipped to transmit telephone or telegraph messages to airplanes. This station, which is remotely controlled from the field, is available for experimental work through the courtesy of the American Telephone & Telegraph Co. The Bellefonte station is also provided with a remotely controlled 1-kilowatt set, whereby telephone or telegraph messages can be sent to airplanes in flight. The practical operation of the handling of weather broadcasts to aircraft in flight by radiotelephony is to be included in the service flights mentioned, using these two stations.

The beacons operate in the frequency band 285 to 315 kilocycles, and the telephone stations in the band 315 to 350 kilocycles. These are allocated to air service by the 1927 International Radio Convention. For the present the beacons are adjusted to the frequency of 290 kilocycles and the telephone stations to 333 kilocycles.

The directive radiobeacon is a special kind of radio station, usually located at an airport, just off the landing field. Instead of having a single antenna like an ordinary radio station, it has two loop antennæ at an angle with each other. Each of these emits a set of waves which is directive; that is, it is stronger in one direction than others. When an airplane flies along the line exactly equidistant from the two beams of radio waves, it receives signals of equal intensity from the two. If the airplane gets off this line, it receives a stronger signal from one than the other.

The indicator connected to the receiving set on the airplane shows when the signals from the two beams are received with equal intensity by means of two vibrating reeds which are tuned to different modulating frequencies used on the two antennæ at the directive radiobeacon station. When the beacon signal is received the two reeds vibrate. The tips of these reeds are white in a dark background, so that when vibrating they appear as a vertical white line. The reed on the pilot's right is tuned to a frequency of 65 cycles and the one on the left to 85 cycles. It is only necessary for the pilot to watch the two white lines produced by the vibrating reeds. If they are equal in length, he is on his correct course. If the one on his right becomes longer than the other, the airplane has

drifted off the course to the right (into the region where there is more of the 65 cycles). If he drifts off the course to the left, the white line on the left becomes longer.

The visual indicator system comprises a small indicator unit and a receiving set weighing between 12 and 16 pounds with batteries weighing an additional 16 pounds. Very successful flights have been made up to 135 miles. To a large extent the device is little affected by interference. It is only partially affected by airplane engine ignition interference. Such interference does not change the operating characteristic of the indicator signal but merely reduces the distance range from the beacon station. The system was recently demonstrated to representatives of the various Government departments.

During the latter part of 1927 several flights were made from Bellefonte in order to test the reliability of the directive type of beacon. There were both day and night flights. It was found that at night up to 50 miles from the beacon the directions were reliable, between 50 and 75 miles they were usually accurate but uncertain at times, from 75 to 100 they were frequently unreliable, and beyond 100 miles the beacon could not be used. No such discrepancies were found during daylight hours. Two solutions are under investigation. Placing the beacons closer together and using a vertical antenna on the aircraft are expected to assist greatly. The greatest use of the beacon is within 30 miles of the field, where it is always reliable. A paper describing these night effects in detail will be published in an early issue of the Proceedings of the Institute of Radio Engineers.

Special receiving sets and antennas for use on airplanes in connection with the beacon system have been developed. They are even simpler than those in use hitherto. The familiar trailing wire, with its possible dangers and its directive effect introducing apparent variation of the course, is eliminated. It is replaced by a short vertical metal rod. The use of this improved antenna is made possible by a special receiving set which is highly sensitive, light in weight, and exceptionally proof against the engine ignition interference. This receiving set and antenna system can be used to receive telegraphy, telephony, aural interlocking beacon signals, or to operate the visual indicator mentioned. The visual indicator plugs into the set in place of the headphones. No other change is required.

While there are no commercial receiving sets at present available which are suitable for use on aircraft at the new frequencies for the air services, close cooperation is being maintained between the bureau and several commercial companies working on various problems related to radio aids for air navigation. It appears that suitable receiving sets and auxiliaries will soon be offered on the market. Publications describing the bureau's work on radio aids to air navigation in detail are in preparation. When issued, they will be announced in the Radio Service Bulletin.

REFERENCES TO CURRENT RADIO LITERATURE

This is a monthly list of references prepared by the radio laboratory of the Bureau of Standards and is intended to cover the more important papers of interest to professional radio engineers which have recently appeared in periodicals, books, etc. The number at the left of each reference classifies the reference by subject, in accordance with the scheme presented in A Decimal Classification of Radio Subjects—An Extension of the Dewey System, Bureau of Standards Circular No. 138, a copy of which may be obtained for 10 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C. The various articles listed below are not obtainable from the Government. The various periodicals can be secured from their publishers and can be consulted at large public libraries.

R100.—Radio principles

- R113 Appleton, E. V., and Ratcliffe, J. A. On a method of determining the state of polarization of downcoming wireless waves. Proc. Royal Soc. (London), 117, pp. 576-588; February, 1928.
An experimental method of determining the polarization constants of downcoming waves. Use of this method for series of measurements made in England.
- R113 Mizushima, S. On the anomalous dispersion and absorption of electric waves. Scientific Papers Inst. Physics and Chemistry Research, Tokyo, 5, pp. 201-248. Abstract in Experimental Wireless (London), p. 164; March, 1928.
Results of measurements of the anomalous dispersion and absorption at various temperatures and frequencies.
- R113 Austin, L. W. Report of the chairman of the commission on radio wave propagation of the International Union of Scientific Radiotelegraphy. Proc. Inst. Radio Engrs., 16, pp. 348-358; March, 1928.
Report on work of this commission presented at the 1927 meeting of the U. R. S. I.
- R113 Hulbert, E. O. On round-the-world signal. Proc. Inst. Radio Engrs., 16, pp. 287-289; March, 1928.
Method of calculation of time required for signals to travel round the world.

- R113 Hollingworth, J., and Naismith, R. Polarization of radio waves. *Nature* (London), p. 171; February 4, 1928. Abstract in *Experimental Wireless* (London), p. 163; March, 1928.
Results of investigation of propagation of long waves.
- R113 Deviation of wireless waves at a coastal boundary. *Nature* (London), p. 35; January 7, 1928. *Experimental Wireless* (London), p. 162; March, 1928.
Calibration of direction-finding station near coast line showed shifts of 4° or 5° on 1,000 meters.
- R113.2 Lewer, S. L. The effect of weather conditions on long distance reception. *Experimental Wireless* (London), 5, pp. 152-161; March, 1928.
Correlation of reception with atmospheric pressure distribution over transmission path.
- R113.5 Anderson, C. N. Correlation of long-wave trans-Atlantic radio transmission with other factors affected by solar activity. *Proc. Inst. Radio Engrs.*, 16, pp. 297-347; March, 1928.
Correlation of radio data with data on occurrence of sun spots, solar activity, earth currents etc.
- R113.7 Dahl, O., and Gebhardt, L. A. Measurements of the effective heights of the conducting layer and the disturbances of August 19, 1927. *Proc. Inst. Radio Engrs.*, 16, pp. 290-296; March, 1928.
Uses reflection method of measuring effective heights of reflecting layer and gives values of height at various times of day from August 15 to 25, 1927. Shows abrupt change on August 19, 1927.
- R125.6 Clapp, J. K., and Chinn, H. A. Directional properties of transmitting and receiving antennæ. *QST*, 12, pp. 17-30; March, 1928.
Experimental work on various types of directive antennæ for high frequencies.
- R125.6 Eisenberg, J. G. What is the Marconi beam? *Radio* (San Francisco), 10, pp. 12-15; March, 1928.
Description of the Australian beam installation for high-frequency communication with England.
- R127 Waserman, M. Note sur le choix preliminaire des constantes electriques d'une antenne pseudo-symetrique (note on the choice of electric constants of a pseudosymmetric antenna). *L'Onde Electrique*, 7, pp. 40-44; January, 1928.
Calculation of proper antenna constants for frequency to be used.
- R127 Wilmotte, R. M. Generalized theory of antennæ. *Experimental Wireless* (London), 5, pp. 119-131; March, 1928.
Theory of antenna constants for receiving and transmitting antennæ.
- R145.5 Howe, G. W. O. Potential difference and capacity in A. C. problems. *Experimental Wireless* (London), 5, pp. 113-118; March, 1928.
Nonmathematical discussion of calculations of capacity in radio problems.
- R149 Benham, W. E. A study of the rectification of thermionic valves at moderately high frequencies. *Philosophical Magazine* (London), 5, pp. 323-334; February, 1928.
Experiments described are of measurements on a Moullin diode type voltmeter to investigate frequency error.
- R200.—Radio measurements and standardization*
- R210 Braillard, R., and Divoire, E. How broadcasting wave lengths are checked. *Wireless World and Radio Review*, 27, pp. 219-222; February 29, 1928.
Station at Brussels for checking European stations' frequency. Description of apparatus used includes heterodyne frequency meters and multivibrator.
- R214 Jammet, J. Stabilisateurs de frequence piezoelectriques pour emmetteurs d'ondes courtes (Piezoelectric frequency stabilizers for short-wave transmitters). *L'Onde Electrique*, 7, pp. 5-20; January, 1928.
Description of a 50-meter crystal-controlled transmitting set showing method of mounting the crystal.
- R270 Barfield, R. H. The attenuation of wireless waves over land. *Jour. Inst. Elec. Engrs. (London)*, 66, pp. 204-218; February, 1928.
Intensity measurements on transmission of 2LO (London), giving results of investigation which showed greater attenuation than that expected from the Sommerfeld theory.
- R300.—Radio apparatus and equipment*
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NOTE.—In future lists it is proposed to eliminate the number given at the left of each reference. Before doing this, however, the radio division would appreciate receiving an expression from readers of the Bulletin as to the feasibility of this proposal.

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