

1650. Nagaono Hana.

FREQ.: 295 kc., A2.

CHARACTERISTIC SIGNAL:

(a) Circular wave (non-directional).

OB (- - - - -) twice - - - - - } 6 times - - - - - 3
Long dash twice - - - - - }

(b) Rotating wave (directional).

OB (- - - - -) twice - - - - - } 6 times - - - - - 6
A (- - -) twice - - - - - } 6 times - - - - - 6
Dot (-) 100 times - - - - - }

Period - - - - -

HOURS OF TRANSMISSION: At 09, 24, 39, and 54 minutes past each hour.

CALIBRATED SECTOR: 270° to 090°.

REMARKS: See sec. 155.

35°32'02"N., 134°00'37"E.

POWER: 450 watts.

Minutes

Calibration Table for Nagaono Hana

Dots	True direction	Dots	True direction	Dots	True direction	Dots	True direction
1	354	26	52	51	280	76	327
2	356	27	54	52	282	77	328
3	358	28	56	53	284	78	330
4	0	29	59	54	286	79	332
5	2	30*	62	55	288	80*	334
6	4	31	64	56	290	81	336
7	8	32	66	57	292	82	338
8	12	33	68	58	294	83	340
9	14	34	70	59	296	84	342
10*	16	35	72	60*	298	85	344
11	18	36	74	61	300	86	346
12	20	37	76	62	302	87	348
13	22	38	78	63	304	88	349
14	24	39	80	64	306	89	350
15	26	40*	82	65	308	90*	352
16	28	41	84	66	310	91	354
17	30	42	86	67	311	92	356
18	32	43	88	68	312	93	358
19	34	44	90	69	314	94	0
20*	38	45		70*	316	95	2
21	42	46	270	71	318	96	4
22	44	47	272	72	320	97	8
23	46	48	274	73	322	98	12
24	48	49	276	74	324	99	14
25	50	50*	278	75	326	100*	16

* - - - - Dot in higher tone.

Including N.M. 22/66
May 28, 1966

(Chg 12)

1651.5 Echizen Misaki.

FREQ.: 310 kc., A2.

CHARACTERISTIC SIGNAL:

(a) Rotating wave (directional)

Rotating wave (invention)
ZN (— — • • — •) 2 times

A (•) 2 min

Dot (•) 100 t

(b) Circular wave (nondirectional)

ZN (—•—•—•) 2 times

Long dash (-)

Period

HOURS OF TRANSMISSION: For 5 minutes commencing at 05, 20, 35 and 50 minutes past each hour.

HOURS OF TRANSMISSION: 10:30 AM
CALIBRATED SECTOR: 170°-350°.

CALIBRATED SECTOR.
REMARKS: See sec. 155.

35°58' 15"N., 135°57' 59"E.

POWER: 300 watts.

Minutes

Calibration Table for Echizen Misaki

| True Direction |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| True Direction |
182	26	232	51	282	76	332	
184	27	234	52	284	77	334	
186	28	236	53	286	78	336	
188	29	238	54	288	79	338	
190	30*	240	55	290	80*	340	
192	31	242	56	292	81	342	
194	32	244	57	294	82	344	
196	33	246	58	296	83	346	
198	34	248	59	298	84	348	
200	35	250	60*	300	85	170	350
202	36	252	61	302	86	172	
204	37	254	62	304	87	174	
206	38	256	63	306	88	176	
208	39	258	64	308	89	178	
210	40*	260	65	310	90*	180	
212	41	262	66	312	91	182	
214	42	264	67	314	92	184	
216	43	266	68	316	93	186	
218	44	268	69	318	94	188	
220	45	270	70*	320	95	190	
222	46	272	71	322	96	192	
224	47	274	72	324	97	194	
226	48	276	73	326	98	196	
228	49	278	74	328	99	198	
230	50*	280	75	330	100*	200	

* Dot in higher tone.

H. O. PUB. NO. 117B
RADIO NAVIGATIONAL AIDS

RADIOBEACONS

1652. Hekura Jima.

FREQ.: 310 kc., A2.

CHARACTERISTIC SIGNAL:

(a) Circular wave (non-directional)

HA (•••• •—) 2 times-----
Long dash (—) 2 times-----} 4 times ----- 2

(b) Rotating wave (direction)

HA (•••• •—) 2 times-----
A (•—) 2 times-----} 3 times ----- 3
Dot (•) 100 times-----

37°50'58"N., 136°55'24"E.

POWER: 450 watts.

Minutes

Period----- 5

HOURS OF TRANSMISSION: For 5 minutes commencing at 10, 25, 40, and 55 minutes past each hour.

REMARKS: See sec. 155

Calibration Table for Hekura Jima

Dots	True Direction						
1	2	182	26	52	232	51	102
2	4	184	27	54	234	52	104
3	6	186	28	56	236	53	106
4	8	188	29	58	238	54	108
5	10	190	30*	60	240	55	110
6	12	192	31	62	242	56	112
7	14	194	32	64	244	57	114
8	16	196	33	66	246	58	116
9	18	198	34	68	248	59	118
10*	20	200	35	70	250	60*	120
11	22	202	36	72	252	61	122
12	24	204	37	74	254	62	124
13	26	206	38	76	256	63	126
14	28	208	39	78	258	64	128
15	30	210	40*	80	260	65	130
16	32	212	41	82	262	66	132
17	34	214	42	84	264	67	134
18	36	216	43	86	266	68	136
19	38	218	44	88	268	69	138
20*	40	220	45	90	270	70*	140
21	42	222	46	92	272	71	142
22	44	224	47	94	274	72	144
23	46	226	48	96	276	73	146
24	48	228	49	98	278	74	148
25	50	230	50*	100	280	75	150

*..... Dot in higher tone.

1652.2 Fushiki Ko West Breakwater.

FREQ 9310 mc., Pl.

DIRECTIONAL RANGE 209°.

CHARACTERISTIC SIGNAL Continuous sound on range.

N (—•) right side of range.

A (•—) left side of range.

HOURS OF TRANSMISSION Continuous.

36° 47' 32"N., 137° 04' 15"E.

RANGE: 10 miles.

1652.3 Shinminato Ko West Breakwater.

FREQ 9310 mc., Pl.

DIRECTIONAL RANGE 197°.

CHARACTERISTIC SIGNAL Continuous sound on range.

D (—••) right side of range.

U (•—•) left side of range.

HOURS OF TRANSMISSION Continuous.

36° 47' 05"N., 137° 05' 13"E.

RANGE: 10 miles.

1652.5 Maki.

FREQ 300 kc., A2.

CHARACTERISTIC SIGNAL

(a) Rotating wave (directional).

NY (—•—•—) twice } 3 times 3

A (•—) twice }

Dot (•) 100 times }

(b) Circular wave (non-directional).

NY (—•—•—) twice } 4 times 2

Long dash (—) twice }

Period 5

HOURS OF TRANSMISSION For 5 minutes commencing at 03, 24, 39, and 54 minutes past each hour.

REMARKS: See sec. 155.

NOTE: A calibration table will be published when available.

37° 50.1 N., 138° 52.3"E.

POWER: 300 watts.

Minutes

H. O. PUB. NO. 117B
RADIO NAVIGATIONAL AIDS

RADIOPACONS

1654. Sakata.

FREQ.: 300 kc., A2.

CHARACTERISTIC SIGNAL:

(a) Circular wave (non-directional).

ST (••—) 2 times -----
Long dash (—) 2 times ----- } 4 times -----

Minutes

2

(b) Rotating wave (directional).

ST (••—) 2 times -----
A (•—) 2 times ----- } 3 times -----
Dot (•) 100 times -----

38° 56' 36" N., 139° 49' 34" E.

POWER: 300 watts.

Period -----

HOURS OF TRANSMISSION: For 5 minutes commencing at 04, 19, 34, and 49 minutes past each hour

CALIBRATED SECTOR: 210°-010°.

REMARKS: See sec. 155.

Calibration Table for Sakata

Dots	True direction						
1	2	26	232	51	282	76	332
2	4	27	234	52	284	77	334
3	6	28	236	53	286	78	336
4	8	29	238	54	288	79	338
5	10	30*	240	55	290	80*	340
6		31	242	56	292	81	342
7		32	244	57	294	82	344
8		33	246	58	296	83	346
9		34	248	59	298	84	348
10*		35	250	60*	300	85	350
11		36	252	61	302	86	352
12		37	254	62	304	87	354
13		38	256	63	306	88	356
14		39	258	64	308	89	358
15	210	40*	260	65	310	90*	0
16	212	41	262	66	312	91	2
17	214	42	264	67	314	92	4
18	216	43	266	68	316	93	6
19	218	44	268	69	318	94	8
20*	220	45	270	70*	320	95	10
21	222	46	272	71	322	96	
22	224	47	274	72	324	97	
23	226	48	276	73	326	98	
24	228	49	278	74	328	99	
25	230	50*	280	75	330	100*	

* Dot in higher tone.

RADIOBEACONS

H. O. PUB. NO. 117B
RADIO NAVIGATIONAL AIDS

1655. Nyudo Saki.

FREQ.: 300 kc., A2.

CHARACTERISTIC SIGNAL:

(a) Rotating wave (directional).

DO (—•—) twice
A (—•—) twice
Dot (•) 100 times

Minutes

3

(b) Circular wave (non-directional).

DO (—•—) twice
Long dash (—) twice

2

5

Period

HOURS OF TRANSMISSION: For 5 minutes commencing at 14, 29, 44, and 59 minutes past each hour.

CALIBRATED SECTOR: 220°-060°.

REMARKS: See sec. 155.

Calibration Table for Nyudo Saki

Dots after "A"	True Bearings	Dots after "A"	True Bearings	Dots after "A"	True Bearings	Dots after "A"	True Bearings
1	2	26	52	232	51	282	76
2	4	27	54	234	52	284	77
3	6	28	56	236	53	286	78
4	8	29	58	238	54	288	79
5	10	30*	60	240	55	290	80*
6	12	31	242		56	292	81
7	14	32	244		57	294	82
8	16	33	246		58	296	83
9	18	34	248		59	298	84
10*	20	35	250		60*	300	85
11	22	36	252		61	302	86
12	24	37	254		62	304	87
13	26	38	256		63	306	88
14	28	39	258		64	308	89
15	30	40*	260		65	310	90*
16	32	41	262		66	312	91
17	34	42	264		67	314	92
18	36	43	266		68	316	93
19	38	44	268		69	318	94
20*	40	220	45	270	70*	320	95
21	42	222	46	272	71	322	96
22	44	224	47	274	72	324	97
23	46	226	48	276	73	326	98
24	48	228	49	278	74	328	99
25	50	230	50*	280	75	330	100*

* Dot in higher tone.

() Unreliable.

OKINAWA GUNTO

27°22' N., 128°34' E.

1655.5 Okino-erabu Shima Aeronautical Radiobeacon.

FREQ.: 380 kc., A2.

CHARACTERISTIC SIGNAL: NO (—•—).

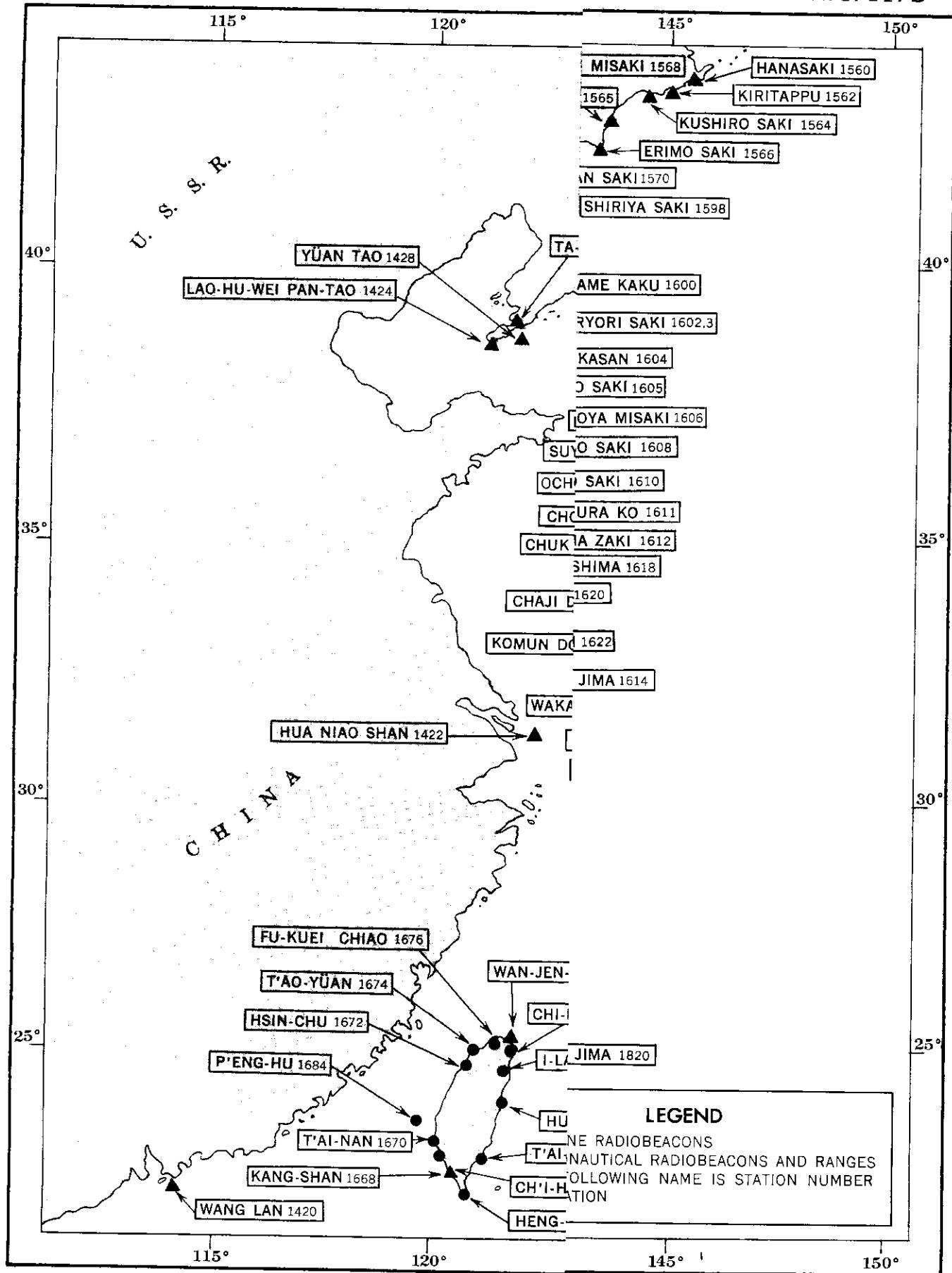
NOTE: Unreliable sunrise to sunset. maintenance period 0600-0700Z Thursdays.

26°05' N., 127°39' E.

1656. Okinawa Jima Aeronautical Radiobeacon.

FREQ.: 308 kc., A2.

CHARACTERISTIC SIGNAL: OK (——).



1658. **Okuma Aeronautical Radiobeacon.** $26^{\circ}44'N.$, $128^{\circ}10'E.$
 FREQ.: 287 kc., A2.
 CHARACTERISTIC SIGNAL: AU (— •— •—).
 HOURS OF TRANSMISSION: Continuous.

1659. **Kadena Aeronautical Radiobeacon.** $26^{\circ}20'N.$, $127^{\circ}45'E.$
 FREQ.: 335 kc., A2.
 CHARACTERISTIC SIGNAL: KO (— •— — ••).

1660. **Miyako Jima Aeronautical Radiobeacon.** $24^{\circ}46'N.$, $125^{\circ}20'E.$
 FREQ.: 340 kc., A2.
 CHARACTERISTIC SIGNAL: MY (— — — •—).

TAIWAN (FORMOSA)

1676. **Fu-kuei Chiao Aeronautical Radiobeacon.** 25°17'N., 121°32'E.
FREQ.: 250 kc., A0, A2.
CHARACTERISTIC SIGNAL: FK (•—• ——).

1678. **Wan-jen-t'u Pi Light Station.** 25°09' 27"N., 121°44' 22"E.
FREQ.: 302 kc., A2.
CHARACTERISTIC SIGNAL:
A group of 0.5 second dashes —————
Silent —————
Period—
HOURS OF TRANSMISSION: Continuous.
REMARKS: Carrier signal (see sec. 100A).

Seconds	9.5
Seconds	20.5
Period	30.0

1680. **Chi-lung Aeronautical Radiobeacon.** 25°08'N., 121°48'E.
FREQ.: 280 kc., A0, A2.
CHARACTERISTIC SIGNAL: LU (•—• •—•).

1682. **I-lan Aeronautical Radiobeacon.** 24°45'N., 121°46'E.
FREQ.: 435 kc., A0, A2.
CHARACTERISTIC SIGNAL: MS (— — •••).

P'ENG-HU LIEH-TAO

1684. **P'eng-hu Aeronautical Radiobeacon.** 23°33'N., 119°36'E.
FREQ.: 275 kc., A0, A2.
CHARACTERISTIC SIGNAL: QC (— — •— — — •).
POWER: 2,500 watts day,
500 watts night.

PHILIPPINES

1686. **Cubi Point (Subic Bay) Aeronautical Radiobeacon.** 14°46'N., 120°14'E.
FREQ.: 366 kc., A2.
CHARACTERISTIC SIGNAL: NCP (— • — — • — — •).
POWER: 200 watts.
NOTE: Unreliable 360°-020° and 230°-240°.

1688. **Rosario Aeronautical Radiobeacon.** 14°24'N., 120°52'E.
FREQ.: 285 kc., A2, A3.
CHARACTERISTIC SIGNAL: RS (•—• •••).
POWER: 10 kilowatts.
NOTE: Voice transmissions on test.

1690. **San Jose Aeronautical Radiobeacon.** 12°22'N., 121°03'E.
FREQ.: 304 kc., A2.
CHARACTERISTIC SIGNAL: SJ (••• — — —).
HOURS OF TRANSMISSION: Irregular.

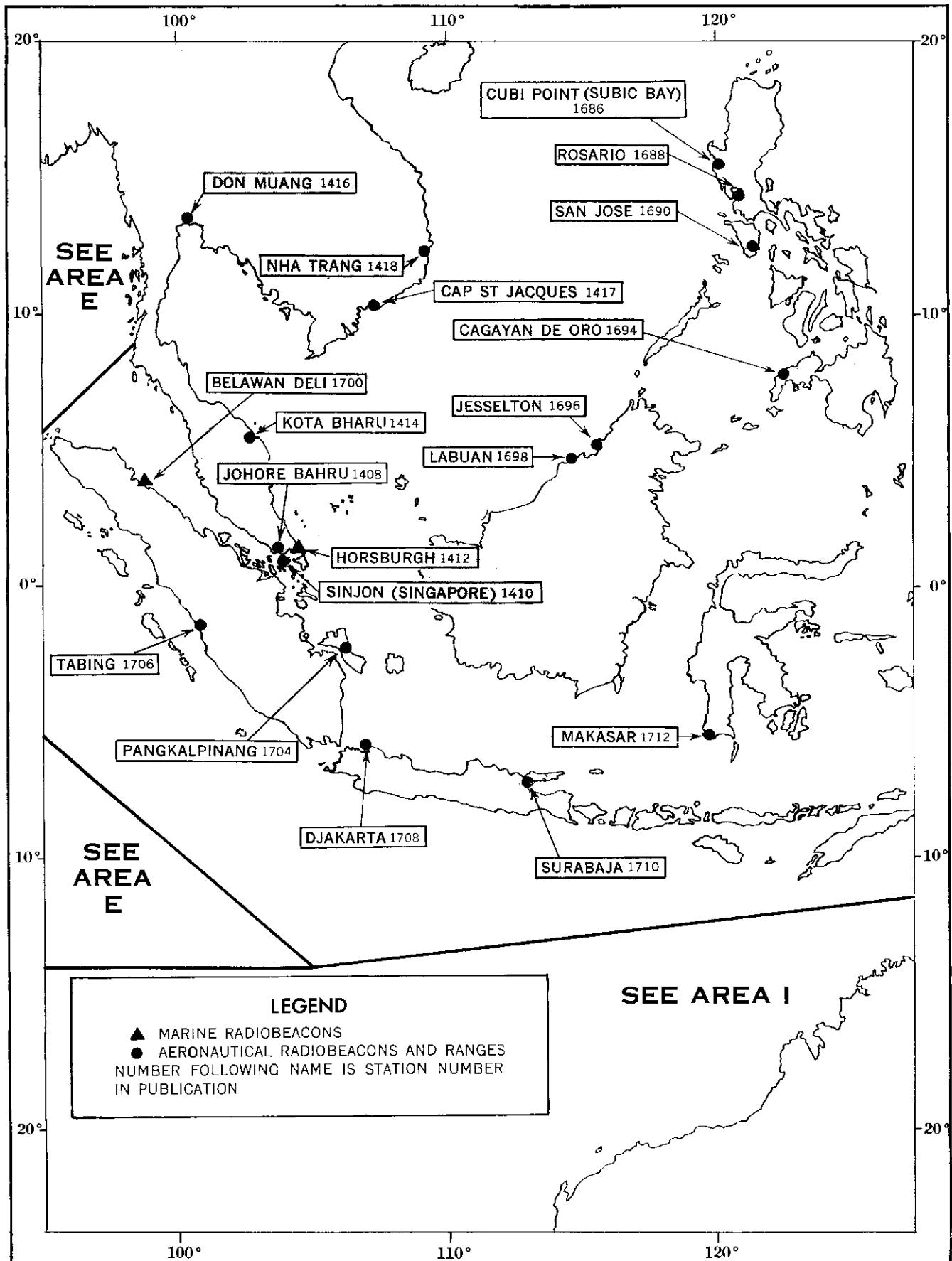
1694. **Cagayan de Oro Aeronautical Radiobeacon.** 8°25'N., 124°36'E.
FREQ.: 345 kc., A2.
CHARACTERISTIC SIGNAL: CG (— •—• — — •).
POWER: 200 watts.
HOURS OF TRANSMISSION: Irregular.

MALAYSIA (SABAH)

1696. **Jesselton Aeronautical Radiobeacon.** 5°55'N., 116°03'E.
FREQ.: 319 kc., A2.
CHARACTERISTIC SIGNAL: JN (•— — — — •).
POWER: 500 watts.
HOURS OF TRANSMISSION: Daylight.

1698. **Labuan Aeronautical Radiobeacon.** 5°18'N., 115°15'E.
FREQ.: 374 kc., A1.
CHARACTERISTIC SIGNAL: LB (•—• •—•••).
POWER: 500 watts.

Including N.M. 15/67
15 April 1967



INDONESIA (SUMATRA)

1700. **Belawan Deli Radiobeacon.**
FREQ.: 315 kc., A2.
CHARACTERISTIC SIGNAL: YEK (—•— • —•—).
HOURS OF TRANSMISSION: Continuous from 00 to 10 minutes past each hour.
3°47'14"N., 98°42'10"E.
RANGE: 50 miles.

1704. **Pangkalpinang Aeronautical Radiobeacon.**
FREQ.: 260 kc., A0, A2.
CHARACTERISTIC SIGNAL: OI (—•— ••).
HOURS OF TRANSMISSION: For scheduled aircraft and on request.
2°10'S., 106°08'E.
POWER: 750 watts.

1706. **Tabing (Padang) Aeronautical Radiobeacon.**
FREQ.: 295 kc., A0, A2.
CHARACTERISTIC SIGNAL: OQ (—•— —•—).
HOURS OF TRANSMISSION: Sunrise to sunset.
00°55'S., 100°22'E.
POWER: 750 watts.

INDONESIA (JAVA)

1708. **Djakarta (Kemajoran) Aeronautical Radiobeacon.**
FREQ.: 310 kc., A0, A2.
CHARACTERISTIC SIGNAL: BB (—••— —••—).
HOURS OF TRANSMISSION: 2230-1030, unreliable.
5°57'S., 106°50'E.
POWER: 750 watts.

1710. **Surabaja (Perak) Aeronautical Radiobeacon.**
FREQ.: 335 kc., A0, A2.
CHARACTERISTIC SIGNAL: OD (—•— —••).
HOURS OF TRANSMISSION: Sunrise to sunset and on request.
7°13'S., 112°43'E.
POWER: 750 watts.

INDONESIA (CELEBES)

1712. **Hassanudin (Makasar) Aeronautical Radiobeacon.**
FREQ.: 375 kc., A0, A2.
CHARACTERISTIC SIGNAL: OJ (—•— • —•—).
HOURS OF TRANSMISSION: Sunrise to sunset.
5°04'S., 119°33'E.
POWER: 750 watts.

INDONESIA (WEST NEW GUINEA)

1714. **Utarom Aeronautical Radiobeacon.**
FREQ.: 310 kc., A0, A1.
CHARACTERISTIC SIGNAL: ZV (—••— •••—).
HOURS OF TRANSMISSION: Sunrise to sunset, scheduled flights and prior arrangements.
3°40'S., 133°45'E.
POWER: 1.5 kilowatts.

AUSTRALIA

172. CALIBRATION SERVICE: Special calibration transmissions are available from certain Australian radiobeacons from 1 hour after sunrise to 1 hour before sunset. Prior notice should be given to the Director of Lighthouses, Melbourne, or to the Deputy Director of Lighthouses and Navigation in other states, stating the expected time service is required. Upon arriving off the radiobeacon station, the vessel should show a black ball at the masthead, and make a whistle signal of 3 long blasts followed by 3 short blasts. Ship shall notify station it has completed calibration by lowering black ball and sounding 3 long blasts.

Should fog arise during calibration, the radiobeacon will revert to normal operation.

Vessels are cautioned to calibrate at a distance of more than 1 mile from the radiobeacon.

Calibration service is charged for at the rate of 10 shillings per half-hour or fraction thereof.

1720. **Cooktown Aeronautical Radiobeacon.** 15°28'S., 145°14'E.
FREQ.: 260 kc., A0, A2.
CHARACTERISTIC SIGNAL: CKN (—•— • —— —•).
HOURS OF TRANSMISSION: Daylight only.

1721. **Cairns Aeronautical Radiobeacon.** 16°53'S., 145°45'E.
FREQ.: 364 kc., A0, A2.
CHARACTERISTIC SIGNAL: CS (—•— • ••).

1722. **Townsville Aeronautical Radiobeacon.** 19°15'S., 146°49'E.
FREQ.: 276 kc., A0, A2.
CHARACTERISTIC SIGNAL: TL (— •— ••).

1723. **Mackay Aeronautical Radiobeacon.** 21°11'S., 149°11'E.
FREQ.: 308 kc., A0, A2.
CHARACTERISTIC SIGNAL: MK (— — —•—).
HOURS OF TRANSMISSION: As required by aircraft.

1724. **Coolangatta Aeronautical Radiobeacon.** 28°10'S., 153°31'E.
FREQ.: 278 kc., A0, A2.
CHARACTERISTIC SIGNAL: CG (—•— • —— —•).

1726. **Coffs Harbor Aeronautical Radiobeacon.** 30°19'S., 153°07'E.
FREQ.: 311 kc., A0, A2.
CHARACTERISTIC SIGNAL: CH (—•— • •••).

1728. **Sydney Aeronautical Radiobeacon.** 33°56'S., 151°14'E.
POWER: 3 kilowatts.
FREQ.: 317 kc., A0, A2, A3.
CHARACTERISTIC SIGNAL: SY (••• —— ——).

1731.	Gobo Island Light Station. FREQ.: 308 kc., A0, A2. CHARACTERISTIC SIGNAL: VNE (•••— —• •) 3 times Long dash - - - - - VNE (•••— —• •) - - - - - Long dash - - - - -	37°34'15"S., 149°55'05"E. (approx.). RANGE: 200 miles. Seconds 22.5 15.0 7.5 15.0
	Period - - - - - HOURS OF TRANSMISSION: Continuous.	60.0 (1 min.)
1732.	Flinders Island Aeronautical Radiobeacon. FREQ.: 296 kc., A0, A2, A3. CHARACTERISTIC SIGNAL: FI (•—•• • •).	40°06'S., 148°01'E.
1734.	Wynyard Aeronautical Radiobeacon. FREQ.: 302 kc., A0, A2, A3. CHARACTERISTIC SIGNAL: WY (•—•— —•—•—).	41°00'S., 145°43'E.
1735.	Strahan Aeronautical Radiobeacon. FREQ.: 257 kc. CHARACTERISTIC SIGNAL: SN (••• —•).	42°09'S., 145°17'E.
1736.	Wonthaggi Aeronautical Radiobeacon. FREQ.: 383 kc., A0, A2. CHARACTERISTIC SIGNAL: WON (•—•— —•—•— —•).	38°35'S., 145°35'E.
1738.	Cape Schanck. FREQ.: 314 kc., A2. CHARACTERISTIC SIGNAL: L (•—••) 4 times - - - - - 3 long dashes - - - - - L (•—••) 4 times - - - - - Silent - - - - - Repetition of above signal - - - - - Silent - - - - -	38°29'45"S., 144°53'15"E. RANGE: 100 miles. GROUP SEQUENCE: III, IV. Seconds 10 30 10 10 60 240
	Period - - - - - HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing at 02 minutes past each hour. (b) Clear weather, sunrise to sunset, one emission of the whole characteristic signal at 02 and 32 minutes past each hour. Sunset to sunrise, as for (a) low visibility.	360 (6 mins.)
	CALIBRATION SERVICE: Available on request (See Sec. 172). REMARKS: Grouped with Cape Otway (1742) and Cape Wickham (1746).	

1742.	Cape Otway Light Station. FREQ.: 314 kc., A2.	38°51'36"S., 143°30'55"E. RANGE: 100 miles. GROUP SEQUENCE: I, II. Seconds
	CHARACTERISTIC SIGNAL: Q (- - - -) 4 times - - - - - 3 long dashes - - - - - Q (- - - -) 4 times - - - - - Silent - - - - - Repetition of above signal - - - - - Silent - - - - -	10 30 10 10 60 240
	Period - - - - -	360 (6 mins.)
	HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing on each hour. (b) Clear weather, 1 emission of the whole characteristic commencing at 00 and 30 minutes past each hour.	
	CALIBRATION SERVICE: Available on request. (See sec. 172).	
	REMARKS: Grouped with Cape Schanck (1738) and Cape Wickham (1746).	
1744.	King Island Aeronautical Radio beacon. FREQ.: 332 kc., A0, A2, A3.	39°54'S., 143°52'E.
	CHARACTERISTIC SIGNAL: KI (- - - - -)	
1746.	Cape Wickham Light Station. FREQ.: 314 kc., A2.	39°35'40"S., 143°46'50"E. RANGE: 100 miles. GROUP SEQUENCE: V, VI. Seconds
	CHARACTERISTIC SIGNAL: B (- - - - -) 4 times - - - - - 3 long dashes - - - - - B (- - - - -) 4 times - - - - - Silent - - - - - Repetition of above signal - - - - - Silent - - - - -	10 30 10 10 60 600
	Period - - - - -	720 (12 mins.)
	The following radio beacon signal will be transmitted if Cape Wickham Light is extinguished, flashing irregularly, or operating at reduced power:	
	B (- - - - -) 20 times - - - - - Silent - - - - - Repetition of above signal - - - - - Silent - - - - -	50 10 60 600
	Period - - - - -	720 (12 mins.)
	HOURS OF TRANSMISSION: Continuous, commencing at 04 minutes past each hour.	
	REMARKS: Grouped with Cape Schanck (1738) and Cape Otway (1742).	
1748.	Adelaide Aeronautical Radio beacon. FREQ.: 362 kc., A0, A2.	34°57'S., 138°32'E.
	CHARACTERISTIC SIGNAL: AD (- - - - -)	
1750.	Cape Borda. FREQ.: 317 kc., A2.	35°45'45"S., 136°35'15"E. RANGE: 200 miles. Seconds
	CHARACTERISTIC SIGNAL: AXC (- - - - -) 3 times - - - - - Long dash - - - - - AXC (- - - - -) 3 times - - - - - Long dash - - - - - AXC (- - - - -) 3 times - - - - - Long dash - - - - - AXC (- - - - -) 3 times - - - - - Silent - - - - -	22.5 22.5 7.5 22.5 7.5 15.0 7.5 615.0
	Period - - - - -	720.0 (12 mins.)
	HOURS OF TRANSMISSION: Continuous, commencing at 08 minutes past each hour.	

1752. **Whyalla Aeronautical Radiobeacon.** 33°04' S., 137°32' E.
FREQ.: 371 kc., A0, A2.
CHARACTERISTIC SIGNAL: WHA (•— ••• •—).

1754. **Ceduna Aeronautical Radiobeacon.** 32°08' S., 133°42' E.
FREQ.: 293 kc., A0, A2.
CHARACTERISTIC SIGNAL: CD (—•••—•••).

1756. **Cape Leeuwin.** 34°21'54"S., 115°08'03"E.
FREQ.: 304 kc., A2.
CHARACTERISTIC SIGNAL:
AXB (•— ••— •••) 3 times -----
Long dash -----
AXB (•— ••— •••) -----
Long dash -----
AXB (•— ••— •••) -----
Long dash -----
AXB (•— ••— •••) -----
Silent -----
Period -----
HOURS OF TRANSMISSION: Continuous, commencing at 06 minutes past each hour.
RANGE: 200 miles.
Seconds
22.5
22.5
7.5
22.5
7.5
15.0
7.5
615.0
720.0 (12 mins.)

1758. **Perth Aeronautical Radiobeacon.** 32°01' S., 115°49' E.
FREQ.: 400 kc., A0, A2.
CHARACTERISTIC SIGNAL: PH (•— ••• •••).

1760. **Geraldton Aeronautical Radiobeacon.** 28°47' S., 114°40' E.
FREQ.: 360 kc., A0, A2.
CHARACTERISTIC SIGNAL: GN (—•— •—•).

1762. **Carnarvon Aeronautical Radiobeacon.** 24°53' S., 113°40' E.
FREQ.: 380 kc., A0, A2.
CHARACTERISTIC SIGNAL: CR (—•— •—•).

1764. **Port Hedland Aeronautical Radiobeacon.** 20°22' S., 118°38' E.
FREQ.: 260 kc., A0, A2.
CHARACTERISTIC SIGNAL: PD (•— ••• •—•).

1766. **Broome Aeronautical Radiobeacon.** 17°57' S., 122°13' E.
FREQ.: 320 kc., A0, A2.
CHARACTERISTIC SIGNAL: BR (—••• •—•).

1768. **Troughton Island Radiobeacon.** 13°45'18"S., 126°09'00"E. (approx.).
FREQ.: 289 kc., A2.
CHARACTERISTIC SIGNAL:
AXA (•— ••— •—) 2 times -----
Long dash -----
AXA (•— ••— •—) -----
Long dash -----
AXA (•— ••— •—) -----
Long dash -----
AXA (•— ••— •—) -----
Silent -----
Period -----
HOURS OF TRANSMISSION: Continuous, commencing at 10 minutes past each hour.
POWER: 3.4 kilowatts.
Seconds
18
20
9
20
9
20
9
615
720 (12 mins.)

1770.	Darwin Aeronautical Radiobeacon. FREQ.: 344 kc., A0, A2. CHARACTERISTIC SIGNAL: DN (--- - - - -).	12°26' S., 130°58' E. POWER: 3 kilowatts.
1771.	Booby Island. FREQ.: 320 kc., A0, A2. CHARACTERISTIC SIGNAL: VND (••• - - - -) 3 times Long dash (—) ----- VND (••• - - - -) Long dash (—) ----- Period ----- HOURS OF TRANSMISSION: Continuous.	10°36' 17" S., 141°54' 26" E. RANGE: 200 miles. Seconds 22.5 15.0 7.5 15.0 60.0 (1 min.)

NEW ZEALAND

1772.	Cape Reinga (ZLOC). FREQ.: 314 kc., A2. CHARACTERISTIC SIGNAL: ZLOC (— - - - - - - - - -) followed by C (— - - -) Long dash ----- Repetition of above signal ----- Silent ----- Period ----- HOURS OF TRANSMISSION: (a) Low visibility, continuous commencing on each hour. (b) Clear weather, continuous, sunset to 0600 Local Standard Time and on request to Auckland (ZLD) on 500 or 2182 kc. NOTE: Auckland (ZLD) communicates every 3 hours, commencing at 0010 LST, with the radiobeacon. Request should be made at least 15 minutes in advance of these times.	34°25' 40" S., 172°40' 40" E. RANGE: 100 miles. GROUP SEQUENCE: I, II. Seconds 45 10 55 250 360 (6 mins.)
1774.	Burgess Islet (Moko Hinav I.) (ZLOM). FREQ.: 294.5 kc., A2. CHARACTERISTIC SIGNAL: ZLOM (— - - - - - - - - -) followed by M (— - -) Long dash ----- Repetition of above signal ----- Silent ----- Period ----- HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing on each hour. (b) Clear weather, sunset to 0600 Local Standard Time and on request to Auckland (ZLD) on 500 or 2182 kc. REMARKS: Grouped with Cuvier Island (1776). NOTE: Auckland (ZLD) communicates every 3 hours, commencing at 0005 LST, with the radiobeacon. Request should be made at least 15 minutes in advance of these times.	35°54' 30" S., 175°07' 00" E. RANGE: 100 miles. GROUP SEQUENCE: I, II. Seconds 45 10 55 250 360 (6 mins.)
1776.	Cuvier Island (ZLOV). FREQ.: 294.5 kc., A2. CHARACTERISTIC SIGNAL: ZLOV (— - - - - - - - - -) followed by V (••• - - -) Long dash ----- Repetition of above signal ----- Silent ----- Period ----- HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing at 02 minutes past each hour. (b) Clear weather, commencing at 02 minutes past each hour sunset to 0600 Local Standard Time and on request to Auckland (ZLD) on 500 or 2182 kc. REMARKS: Grouped with Burgess Islet (1774). NOTE: Auckland (ZLD) communicates at 0605, 1205, and 1805 LST with the radiobeacon. Request should be made at least 15 minutes in advance of these times.	36°26' 20" S., 175°46' 30" E. RANGE: 100 miles. GROUP SEQUENCE: III, IV. Seconds 45 10 55 250 360 (6 mins.)

1780. **Tauranga Aeronautical Radiobeacon.** $37^{\circ}40' S.$, $176^{\circ}12' E.$
FREQ.: 378 kc., A2.
CHARACTERISTIC SIGNAL: TG (— — — •).

1782. **East Cape (ZLOK).** $37^{\circ}41'36"S.$, $178^{\circ}32'54"E.$ (approx.).
FREQ.: 300 kc., A2.
CHARACTERISTIC SIGNAL:
ZLOK (— — • • — — — — — —) followed by K (— • —) 37.5
Long dash 15.0
ZLOK (— — • • — — — — — —) followed by K (— • —) 45.0
Long dash 15.0
Silent 247.5
Period 360.0 (6 mins.)
HOURS OF TRANSMISSION: Continuous, commencing at 02 minutes past each hour.
REMARKS: Grouped with Portland Island (1786).

1784. **Gisborne Aeronautical Radiobeacon.** $38^{\circ}40' S.$, $177^{\circ}59' E.$
FREQ.: 346 kc., A2.
CHARACTERISTIC SIGNAL: GS (— — • • • •).

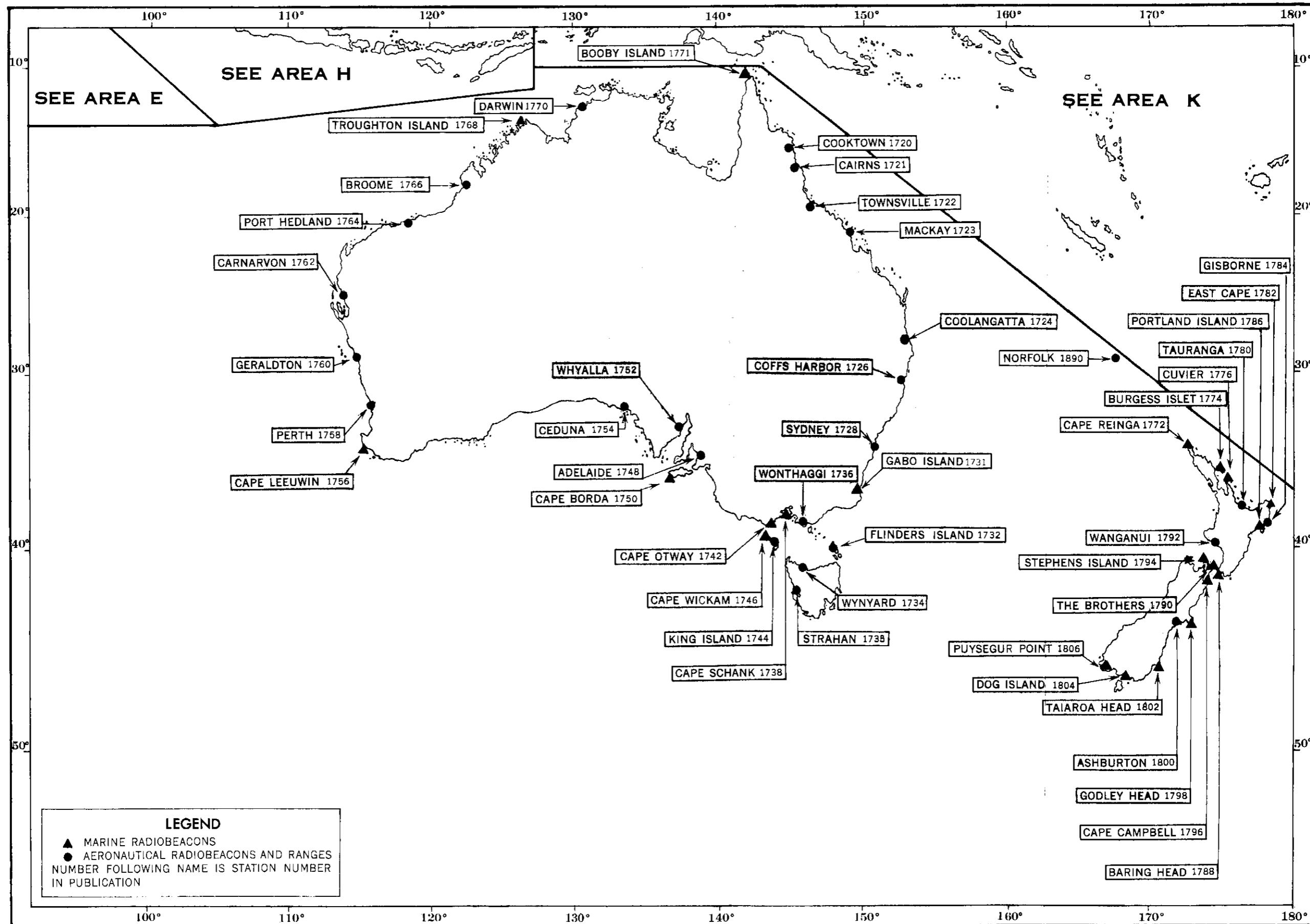
1786. **Portland Island Light Station (ZLOE).** $39^{\circ}18' S.$, $177^{\circ}52' E.$ (approx.).
FREQ.: 300 kc., A2.
CHARACTERISTIC SIGNAL:
ZLOE (— — • • — — — — — —) followed by O (— — —) 37.5
Long dash 15.0
ZLOE (— — • • — — — — — —) followed by O (— — —) 45.0
Long dash 15.0
Silent 247.5
Period 360.0 (6 mins.)
HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing on each hour. (b) Clear weather, sunset to 0600 Local Standard Time, and on request to Wellington (ZLW) on 500 or 2182 kc.
REMARKS: Grouped with East Cape (1782).
NOTE: Wellington (ZLW) communicates with the radiobeacon at 0605, 0915, 1155, 1500 (except Sundays), and 1810 LST. Request should be made at least 15 minutes in advance of these times.

1788. **Baring Head Light Station (ZLOA).** $41^{\circ}24'30"S.$, $174^{\circ}52'18"E.$ (approx.).
FREQ.: 297.5 kc., A2.
CHARACTERISTIC SIGNAL:
ZLOA (— — • • — — — — — —) followed by A (— —) 45
Long dash 10
Repetition of above signal 55
Silent 250
Period 360 (6 mins.)
HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing on each hour. (b) Clear weather, sunset to 0600 Local Standard Time and on request to Wellington (ZLW) on 500 or 2182 kc. The call station communicates with the radiobeacon via telephone.
REMARKS: Grouped with Godley Head (1798).

1790. **The Brothers Marine and Aeronautical Radiobeacon.** $41^{\circ}06'01"S.$, $174^{\circ}26'30"E.$
FREQ.: 317 kc., A2.
CHARACTERISTIC SIGNAL: BR (— • • • — — —).
HOURS OF TRANSMISSION: Continuous.

1792. **Wanganui Aeronautical Radiobeacon.** $39^{\circ}58' S.$, $175^{\circ}05' E.$
FREQ.: 382 kc., A2.
CHARACTERISTIC SIGNAL: WU (— — — • — —).
NOTE: Unreliable 325°—065°.

Including N.M. 15/67
15 April 1967



1794.	Stephens Island Light Station. FREQ.: 305 kc/s, A2.	40° 40' 07"S., 173° 59' 54"E. RANGE: 100 miles. GROUP SEQUENCE: I, II.
	CHARACTERISTIC SIGNAL:	Seconds
	ZLOD (—•—• •—•— —— ——•—), followed by a succession of D's (—••—).....	37.5
	Long dash (—).....	15.0
	ZLOD and D's	45.0
	Long dash (—).....	15.0
	Silent.....	247.5
	Period	360.0 (6 min.)
	HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing on each hour. (b) Clear weather continuous at night, commencing on each hour; on request in daytime to Wellington (ZLW) on 500 or 2182 kc/s.	
	NOTE: Wellington (ZLW) communicates with the radiobeacon at 0550, 0905, 1205, and 1750 LST. Request should be made at least 15 minutes in advance of these times.	
1796.	Cape Campbell. FREQ.: 286 kc/s, A2.	41° 44' 08"S., 174° 16' 20"E. RANGE: 100 miles.
	CHARACTERISTIC SIGNAL: CC (—•—• •—•—•—).	
	HOURS OF TRANSMISSION: Continuous.	
1798.	Godley Head. FREQ.: 297.5 kc/s, A2.	43° 35' 25"S., 172° 48' 05"E. RANGE: 100 miles. GROUP SEQUENCE: V, VI.
	CHARACTERISTIC SIGNAL:	Seconds
	ZLON (—•—• •—•— —— ——•—), followed by a series of N's (—•—)	37.5
	Long dash (—).....	15.0
	ZLON and N's	45.0
	Long dash (—).....	15.0
	Silent.....	247.5
	Period	360.0 (6 min.)
	HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing at 04 minutes past each hour. (b) Clear weather, continuous at night, commencing at 04 minutes past each hour; on request in daytime to Wellington (ZLW) or Awarua (ZLB) on 500 or 2182 kc/s. Call stations communicate with the radiobeacon via telephone.	
	REMARKS: Grouped with Baring Head (1788).	
1800.	Ashburton Aeronautical Radiobeacon. FREQ.: 254 kc/s, A2.	43° 54'S., 171° 48'E. RANGE: 50 miles.
	CHARACTERISTIC SIGNAL: AS (•— —••—).	
1802.	Taiaroa Head. FREQ.: 291.5 kc/s, A2.	45° 47' 09"S., 170° 43' 50"E. RANGE: 100 miles. GROUP SEQUENCE: V, VI.
	CHARACTERISTIC SIGNAL:	Seconds
	ZLOQ (—•—• •—•— —— ——•—), followed by a series of Q's (—•—•—).....	37.5
	Long dash (—).....	15.0
	ZLOQ and Q's	45.0
	Long dash (—).....	15.0
	Silent.....	247.5
	Period	360.0 (6 min.)
	HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing at 04 minutes past each hour. (b) Clear weather, continuous at night, commencing at 04 minutes past each hour; on request in daytime to Awarua (ZLB) on 500 or 2182 kc/s. The call station communicates with the radiobeacon via telephone.	
	REMARKS: Grouped with Dog Island (1804) and Puysegur Point (1806).	

1804. **Dog Island Light Station.**
FREQ.: 291.5 kc/s, A2.

CHARACTERISTIC SIGNAL:
ZLOJ (— • • • — • — — — —), followed by a series of J's (• — — —)
Long dash (—)
ZLOJ and J's
Long dash (—)
Silent
Period

46° 39' 05"S., 168° 24' 25"E.
RANGE: 100 miles.
GROUP SEQUENCE: III, IV.
Seconds
37.5
15.0
45.0
15.0
247.5
360.0 (6 min.)

HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing at 02 minutes past each hour. (b) Clear weather, continuous, at night, commencing at 02 minutes past each hour; none by day.
REMARKS: Grouped with Taiaro Head (1802) and Puysegur Point (1806).

1806. **Puysegur Point Light Station.**
FREQ.: 291.5 kc/s, A2.

CHARACTERISTIC SIGNAL:
ZLOP (— • • • — • — — — —), followed by a series of P's (• — — •)
Long dash (—)
ZLOP and P's
Long dash (—)
Silent
Period

46° 10' 06"S., 166° 37' 08"E. (approx.).
RANGE: 100 miles.
GROUP SEQUENCE: I, II.
Seconds
37.5
15.0
45.0
15.0
247.5
360.0 (6 min.)

HOURS OF TRANSMISSION: (a) Low visibility, continuous, commencing on each hour. (b) Clear weather, continuous at night, commencing on each hour; on request in daytime to Awarua (ZLB) on 500 or 2182 kc/s.
REMARKS: Grouped with Taiaroa Head (1802) and Dog Island (1804).
NOTE: Awarua (ZLB) communicates with the radiobeacon every 3 hours commencing at 0250 local time. Request should be made at least 15 minutes in advance of these times.

NORTH PACIFIC OCEAN ISLANDS

1810. **Koror (Palau Islands) Aeronautical Radiobeacon.**
FREQ.: 371 kc/s, A0, A2.
CHARACTERISTIC SIGNAL: ROR (• — • — — — — •).
HOURS OF TRANSMISSION: On request.

7° 21' N., 134° 29' E.

1815. **Yap Aeronautical Radiobeacon.**
FREQ.: 317 kc/s, A0, A2.
CHARACTERISTIC SIGNAL: YP (— • — — — — •).
HOURS OF TRANSMISSION: On request.

9° 30' N., 138° 08' E.
POWER: 1,000 watts.

1820. **Iwo Jima Aeronautical Radiobeacon.**
FREQ.: 360 kc/s, A1, A2.
CHARACTERISTIC SIGNAL: OX (— — — — • • —).
HOURS OF TRANSMISSION: On request.

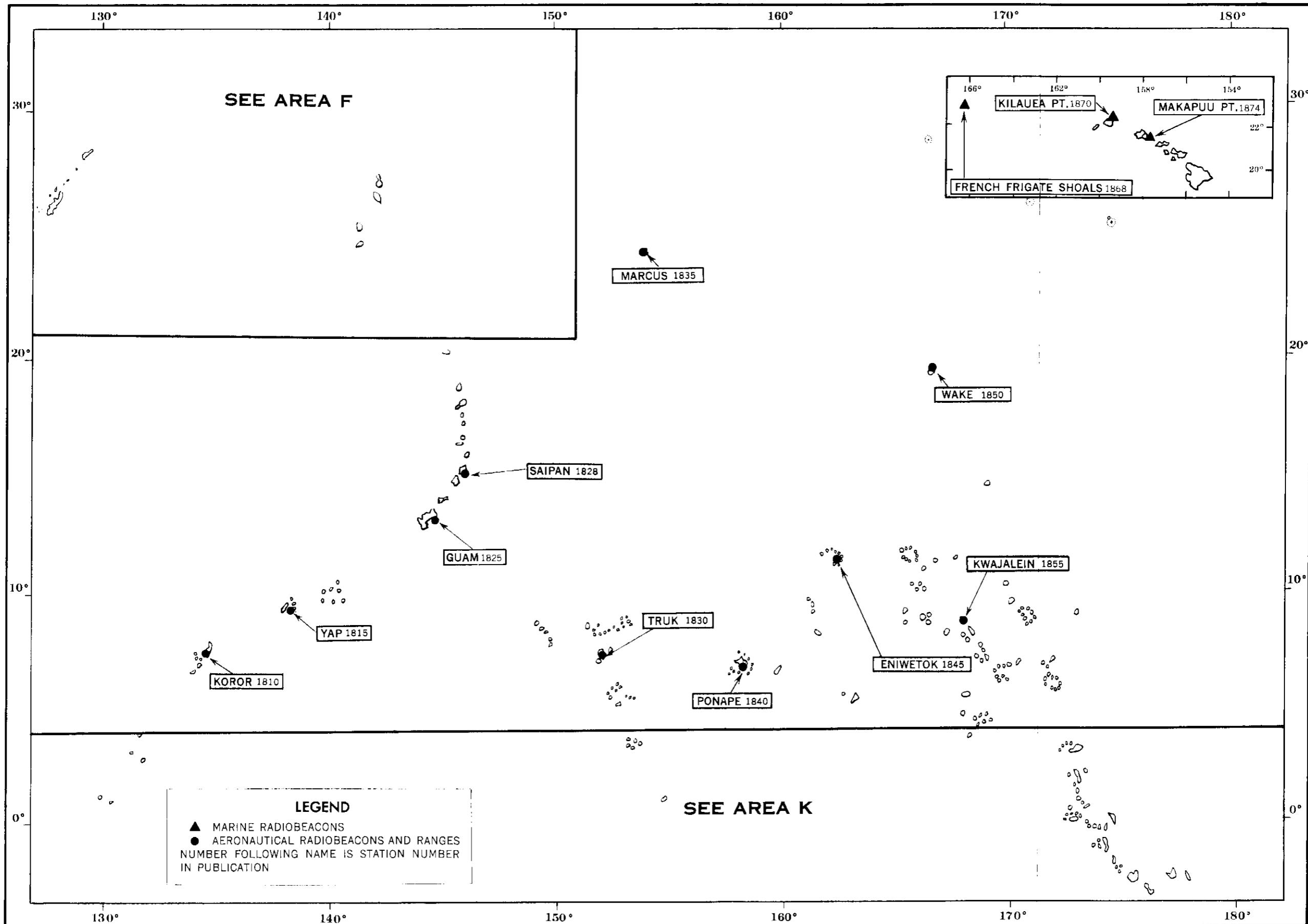
24° 46' N., 141° 19' E.

1825. **Guam Aeronautical Radiobeacon.**
FREQ.: 385 kc/s, A1.
CHARACTERISTIC SIGNAL: GUM (— — • • — — —).
NOTE: Weather broadcast at 15 and 45 minutes past each hour.

13° 22' N., 144° 44' E.
POWER: 6 kilowatts.

1828. **Saipan Aeronautical Radiobeacon.**
FREQ.: 312 kc/s, A0, A2.
CHARACTERISTIC SIGNAL: SN (• • • — — •).
HOURS OF TRANSMISSION: On request.

15° 08' N., 145° 42' E.



1830.	Truk Island Aeronautical Radiobeacon. FREQ.: 375 kc/s, A0, A2. CHARACTERISTIC SIGNAL: TKK (— — • — —). HOURS OF TRANSMISSION: On request.	7°28' N., 151°51' E. POWER: 1,000 watts.
1835.	Marcus Island Aeronautical Radiobeacon. FREQ.: 320 kc/s, A0, A2. CHARACTERISTIC SIGNAL: MR (— — • — —).	24°18' N., 153°58' E.
1840.	Panape Aeronautical Radiobeacon. FREQ.: 366 kc/s, A0, A2. CHARACTERISTIC SIGNAL: PNI (— — • — — • —). HOURS OF TRANSMISSION: On request.	6°58' N., 158°13' E. POWER: 1,000 watts.
1845.	Eniwetok Aeronautical Radiobeacon. FREQ.: 345 kc/s, A0, A2. CHARACTERISTIC SIGNAL: GY (— — • — — — —).	11°21' N., 162°21' E.
1850.	Woke Island Aeronautical Radiobeacon. FREQ.: 254 kc/s, A0, A2. CHARACTERISTIC SIGNAL: AWK (• — — — — — —).	19°18' N., 166°38' E.
1855.	Kwajalein Aeronautical Radiobeacon. FREQ.: 359 kc/s, A2, A3. CHARACTERISTIC SIGNAL: NDJ (— • — — • — — —).	8°45' N., 167°44' E.
1860.	Midway (Sand Island) Aeronautical Radiobeacon. FREQ.: 379 kc/s, A0, A2. CHARACTERISTIC SIGNAL: NQM (— • — — — — — —).	28°12' N., 177°23' W.
1865.	Johnston Island Aeronautical Radiobeacon. FREQ.: 388 kc/s, A0, A2. CHARACTERISTIC SIGNAL: JON (• — — — — — — •).	16°44' N., 169°31' W.

HAWAIIAN ISLANDS

All U. S. Marine Radiobeacons are equipped with a continuous carrier (See sec. 100A).

1868.	French Frigate Shoals (Tern Island). FREQ.: 320 kc/s CHARACTERISTIC SIGNAL: FSS (• — — • — — • —). HOURS OF TRANSMISSION: Continuous.	23°52'00.9" N., 166°17'13.7" W. RANGE: 160 miles.
1870.	Kilauea Point Light Station. FREQ.: 300 kc/s, A2. ANTENNA LEAD-IN: 62 feet 254° from light tower. CHARACTERISTIC SIGNAL: M (— —). HOURS OF TRANSMISSION: Continuous.	22°14.1' N., 159°24.3' W. RANGE: 160 miles.
1874.	Makapuu Point Light Station. FREQ.: 290 kc/s, A2. ANTENNA LEAD-IN: 670 feet 230° from the light tower. CHARACTERISTIC SIGNAL: Z (— — • •). HOURS OF TRANSMISSION: Continuous.	21°18'43" N., 157°39'14" W. RANGE: 160 miles.

1876. **Diamond Head Light Station Calibration Radio beacon.** 21°15' 32"N., 157°48'44"W.
RANGE: 10 miles.
Seconds
10
20
30 (½ min.)
FREQ.: 310, 480 kc/s, A2.
CHARACTERISTIC SIGNAL:
P2 (•—• •—•) 2 times
Long dash (—)
Period
HOURS OF TRANSMISSION: For special calibration service only, between 1800-0300Z weekdays, on request to the Commander, 14th Coast Guard District, Honolulu. (See sec. 100D).
REMARKS: When requesting this service specify frequency or frequencies desired.

SOUTH PACIFIC OCEAN ISLANDS

1880. **Kavieng (New Ireland) Aeronautical Radio beacon.** 2°35'S., 150°50'E.
FREQ.: 368 kc/s, A0, A2.
CHARACTERISTIC SIGNAL: KAV (—•— •— ••—).
HOURS OF TRANSMISSION: For scheduled flights.

1885. **Nauru Aeronautical Radio beacon.** 0°32'S., 166°55'E.
FREQ.: 355 kc/s
CHARACTERISTIC SIGNAL: NI (—• ••).
HOURS OF TRANSMISSION: When flights are enroute.

1890. **Norfolk Island Aeronautical Radio beacon.** 29°01'S., 167°55'E.
FREQ.: 376 kc/s, A0, A2.
CHARACTERISTIC SIGNAL: NF (—• •—•—•).

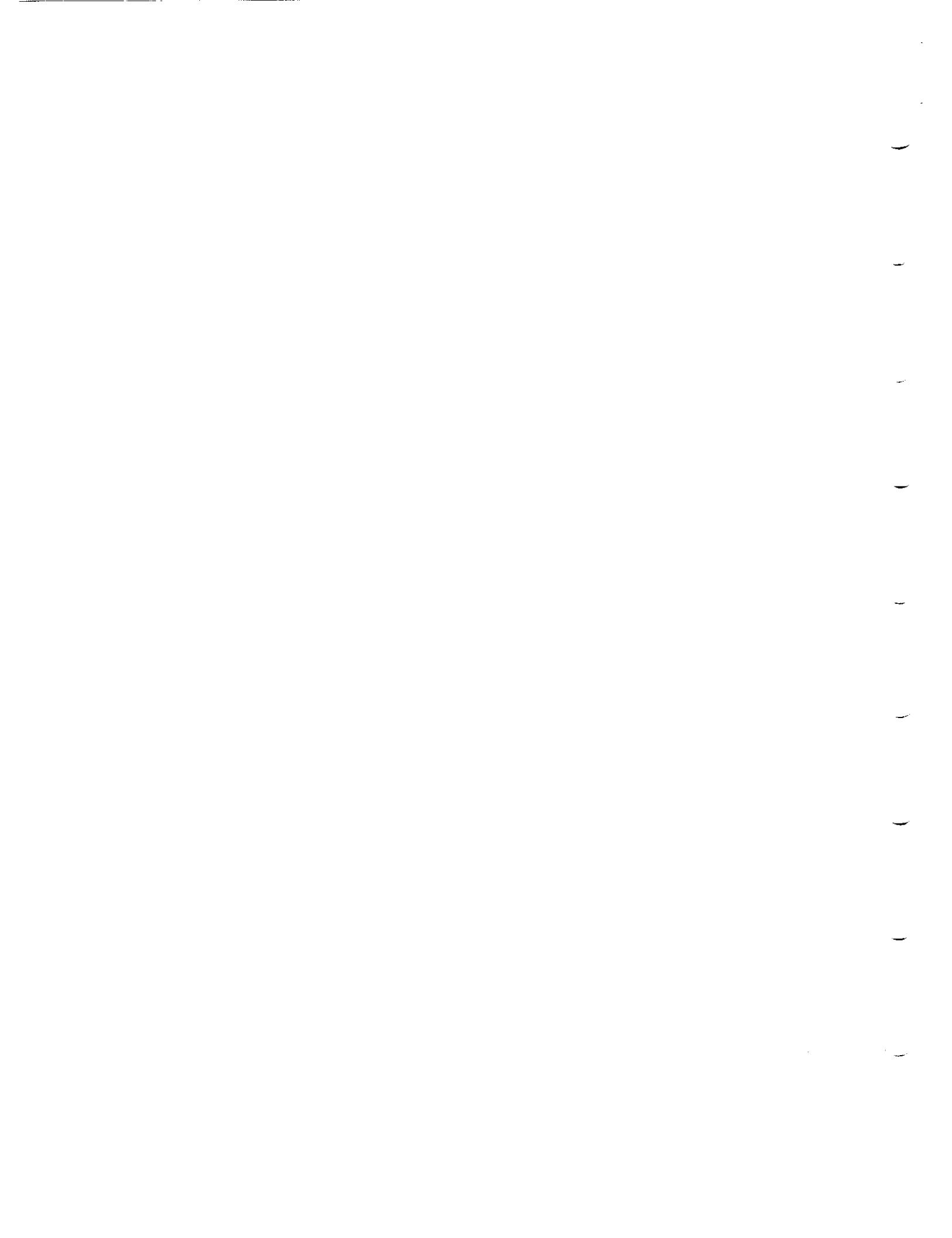
1895. **Vila Aeronautical Radio beacon (Efate, New Hebrides).** 17°44'S., 168°19'E.
FREQ.: 300 kc/s, A1, A2.
CHARACTERISTIC SIGNAL: YJX (—•— •— —•— —•—).
HOURS OF TRANSMISSION: On request to Nandi.

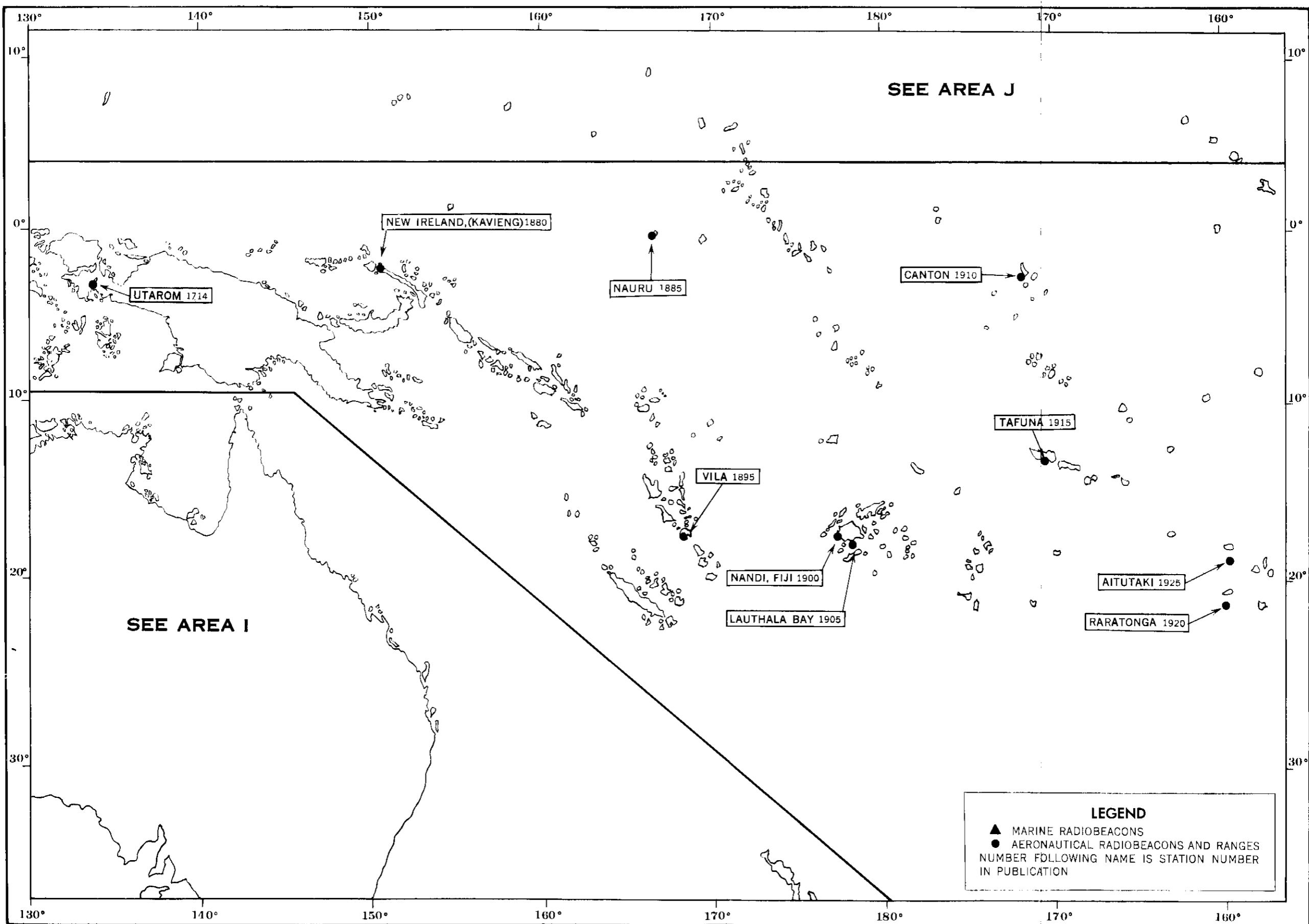
1900. **Nandi, Fiji Aeronautical Radio beacon.** 17°48'S., 177°26'E.
FREQ.: 290 kc/s, A2.
CHARACTERISTIC SIGNAL: FN (•—•— •—•).
NOTE: Unreliable 043°-090° beyond a range of 25 miles.

1905. **Lauthala Bay (Suva), Fiji Aeronautical Radio beacon.** 18°09'S., 178°27'E.
FREQ.: 330 kc/s, A2.
CHARACTERISTIC SIGNAL: LB (•—•— •—•—•).
HOURS OF TRANSMISSION: Irregular.

1910. **Canton Island Aeronautical Radio beacon.** 2°48'S., 171°43'W.
FREQ.: 371 kc/s, A0, A2.
CHARACTERISTIC SIGNAL: CIS (—•—•— •— ••—).

1915.	Tafuna (Pago Pago) Aeronautical Radiobeacon. FREQ.: 335 kc/s CHARACTERISTIC SIGNAL: TUT (— •— —). HOURS OF TRANSMISSION: Continuous.	14° 21'S., 170° 44'W. RANGE: 25 miles.
1920.	Rarotonga Aeronautical Radiobeacon. FREQ.: 352 kc/s, A2. CHARACTERISTIC SIGNAL: RG (•— • —— •). HOURS OF TRANSMISSION: On request through ZKR Rarotonga. NOTE: Unreliable 120°—170°.	21° 12'S., 159° 49'W.
1925.	Aitutaki Aeronautical Radiobeacon. FREQ.: 320 kc/s, A2. CHARACTERISTIC SIGNAL: AI (— •— ••). HOURS OF TRANSMISSION: On request through ZQO Nandi.	18° 51'S., 159° 45'W.
1930.	Papeete Marine and Aeronautical Radiobeacon. FREQ.: 393 kc/s, A1. CHARACTERISTIC SIGNAL: HYO (•••• —•— —— —). Long dash (—) Period HOURS OF TRANSMISSION: Continuous.	17° 31.5'S., 149° 33.8'W. RANGE: 200 miles. Seconds 6 24 30





Chapter 2

DIRECTION-FINDER AND RADAR INFORMATION

200. GENERAL

Radio bearings may be employed for fixing a ship's position in the same manner as other lines of position if due regard is given to the facts that they, like other lines of position, may not be absolutely accurate, and that the bearings are portions of great circles not rhumb lines.

Radio bearings are obtained by means of radio direction-finder sets which may be installed on either shore stations or ships, and by means of certain special radiobeacons which are described in the section on radiobeacons.

Radio direction-finder stations are stations equipped with special apparatus for determining the direction of radio signals transmitted by ships and other stations.

SECTOR OF CALIBRATION: The sector of calibration of a direction-finder station is the sector about the receiving coil of the station in which the deviation of radio bearings is known. In this book the sectors are measured clockwise from 0° (true north) to 360° and are given looking from the station to seaward. Bearings which do not fall within the sector of calibration of a station should be considered unreliable.

200A. Accuracy of Bearings furnished by Direction-Finder Stations

The bearings taken by radio direction-finder stations, and reported by them to ships, are corrected for all determinable errors except the difference between a great circle and a rhumb line (see sec. 200E) and are normally accurate within 2° for distances under 150 miles. However, this error may be increased by various circumstances, some of which are given herein.

STRENGTH OF SIGNALS: The best bearings can be taken on ships whose signals are steady, clear and strong. If the signals are too weak, accurate bearings cannot be taken.

TRANSMITTER ADJUSTMENT: The transmitter of the ship requesting bearings should be tuned sharply to the frequency of the station. If the transmitter is not tuned sharply, it is difficult for the station to obtain bearings sufficiently accurate for navigational purposes.

COASTAL REFRACTION (LAND EFFECT): In the case of bearings which cut an intervening coastline at an oblique angle or cross high intervening land, errors of from 4° to 5° have been reported. Normally, radio direction-finder stations know the sectors in which such refraction may be expected. Such sectors may not be included in the published sectors of calibration or are marked "sectors of uncertain calibration."

SUNRISE, SUNSET, OR NIGHT EFFECTS: Bearings obtained from about half an hour before sunset to about half an hour after sunrise are occasionally unreliable on account of the error introduced. Changes in the intensity of the signals received also occur at sunset and sunrise, apart from the above-mentioned variation.

CAUTIONS: When radio direction-finder stations use such words as doubtful, approximate, second-class, or the equivalents in foreign languages, the bearings reported must be treated with grave suspicion as considerable error may exist in the bearings.

DANGER FROM RECIPROCAL BEARINGS: When a single station furnishes a bearing there is a possibility of an error of approximately 180°, as the operator at the station cannot always determine on which side of the station the ship lies. Certain direction-finder stations, particularly those on islands or extended capes, are equipped to furnish two corrected true bearings for any observation. Such bearings may differ by approximately 180°, and whichever bearing is suitable should be used.

CAUTION: Mariners receiving bearings which are evidently the approximate reciprocal of the correct bearings should never attempt to correct these bearings by applying a correction of 180°, as such correction would not include the proper correction for deviation at the direction-finder station. An error as large as 30° may be introduced by an arbitrary correction of 180° to such bearings. Ships receiving bearings requiring an approximate 180° correction should request the other bearing from the direction-finder station.

200B. Obligations of Administrations Operating Direction-Finder Stations

The obligations of nations and other administrations which operate radio direction-finder stations are given in article 43, Sections I and II of the Radio Regulations of the International Telecommunication Union, Geneva, 1959, which reads:

ARTICLE 43 RADIODETERMINATION SERVICE SECTION I. GENERAL PROVISIONS

1576 § 1. Administrations which have established a radiodetermination service shall take the necessary steps to ensure the effectiveness and regularity of that service; however they accept no responsibility for the consequences that might arise from the use of inaccurate information furnished, defective working, or failure of their stations.

1577 § 2. In the case of doubtful or unreliable observations, the station taking the bearing or fixing the position shall, whenever possible, notify the station for which the information is being obtained of any such doubt or unreliability.

1578 § 3. Administrations shall notify to the Secretary General the characteristics of each radiodetermination station providing an international service of value to the maritime mobile service and, if considered necessary, for each station or group of stations, the sectors in which the information furnished is normally reliable. This information is published in the List of Radiodetermination and Special Service Stations, and the Secretary General shall be notified of any change of a permanent nature.

1579 § 4. The method of identification of radiodetermination stations shall be chosen as to avoid any doubt as to their identity.

1580 § 5. Signals sent by radiodetermination stations shall be such as to permit accurate and precise measurements.

1581 § 6. Any information concerning modification or irregularity of working of a radiodetermination station shall be notified without delay in the following manner:

1582 (a) Land stations of countries operating a radiodetermination service shall send out daily, if necessary, notices of modifications or irregularities in working until such time as normal working is restored or, if a permanent alteration has been made, until such time as it can reasonably be taken that all navigators interested have been warned.

1583 (b) Permanent alterations or irregularities of long duration shall be published as soon as possible in the relevant notices to navigators.

1584 § 7. Where radiocommunication by telegraphy or telephony is part of a radiodetermination service, such communication shall be subject to the provisions of these Regulations.

SECTION II. RADIO DIRECTION-FINDING STATIONS

1585 § 8. (1) In the maritime radionavigation service, the radiotelegraph frequency normally used for radio direction-finding is 410 kc/s. All direction-finding stations of the maritime radionavigation service using radiotelegraphy shall be able to use this frequency. They shall, in addition, be able to take bearings on 500 kc/s, especially for locating stations sending signals of distress, alarm and urgency.

1586 (2) Where a radio direction-finding service is provided in the authorized bands between 1605 and 2850 kc/s, the radio direction-finding stations should be able to take bearings on the radiotelephone distress and calling frequency 2182 kc/s.

1587 § 9. The procedure to be followed by radio direction-finding stations is given in Appendix 23. (See sec. 200C.)

1588 § 10. In the absence of prior arrangements, an aircraft station which calls a radio direction-finding station for a bearing shall use for this purpose a frequency on which the station called normally keeps watch.

1589 § 11. In the aeronautical radionavigation service, the procedure contemplated for radio direction-finding in this section is applicable, except where special procedures are in force as a result of arrangements concluded between the administrations concerned.

200C. International Procedure to Obtain Radio Direction-Finder Bearings¹

A. (1) The mobile station shall call the radio direction-finding station on the frequency indicated as being its watch frequency. The station calling shall transmit the abbreviation QTE (followed, if the radio direction-finding station is a mobile station, by the abbreviation QTH) and indicate, if necessary, the frequency it is going to use to have a bearing determined. The station calling shall then await instructions. (See sec. 920 Q Code)

(2) The radio direction-finding station called shall direct the calling station to transmit.

¹Coast stations, as a general rule, do not give positions.

(3) After having changed, if necessary, its new transmitting frequency, the calling station shall transmit two dashes of approximately ten seconds each followed by its call sign. It shall repeat this signal as often as the radio direction-finding station requires.

(4) The radio direction-finding station shall determine the direction and, if possible, the sense of the bearing, and transmit the information to the calling station in the following order:

- (a) the abbreviation QTE;
- (b) the true bearing in degrees from the radio direction-finding station;
- (c) class of bearing;
- (d) the time of observation;
- (e) if the radio direction-finding station is a mobile station, its own position in latitude and longitude, preceded by the abbreviation QTH.

If the radio direction-finding station is not satisfied with the operation, it shall request the calling station to repeat the transmission indicated under (3).

(5) As soon as the calling station has received the result of the observation, it shall repeat the message to the radio direction-finding station. The latter shall then confirm the accuracy of the repetition or, when necessary, shall correct it by again repeating the message. When the radio direction-finding station is certain that the mobile station has received the message correctly, it shall transmit the signal "end of work." The signal shall then be repeated by the calling station, as an indication that the operation is completed.

B. To obtain a position from two or more direction-finding stations organized as a group:

If the calling station wishes to be informed of its position by the control station of a group of radio direction-finding stations, it shall call the control station and request a position, using the abbreviation QTF.²

The control station shall reply to the call and, when the radio direction-finding stations are ready, shall direct the calling station to transmit. When it has determined the position, it shall transmit it to the calling station in the following order:

- (a) the abbreviation QTF;
- (b) the position, in latitude and longitude or, if appropriate, in relation to a known geographical position;
- (c) class of position;
- (d) time of observation.

C. To obtain simultaneous bearings from two or more radio direction-finding stations organized as a group:

Upon receiving a request for bearings, the control station of a group of radio direction-finding stations shall proceed as in B above, and then transmit the bearings observed by each station of the group, each bearing being preceded by the call signal of the station which has taken it.

Classification of Bearings and Positions

	A	B	C	D
Bearing error (degrees)	± 2	± 5	± 10	More than ± 10
Position error (reasonably expected to be within listed nautical miles)	5	20	50	Not with- in 50 miles

²For procedures in use by each country see text preceding list of stations.

200D. Plotting Radio Bearings

Radio bearings may be used in the same manner as other lines of position to obtain a fix if due regard is always given to the fact that, like lines of position obtained from celestial bodies, radio bearings are subject to possible errors. Some of the uses of radio bearings in obtaining a fix are: cross bearings taken on two or more stations, a single bearing crossed with a line of position of a celestial body, a bearing and a sounding, a bearing and a synchronized air or submarine signal (see sec. 100G under Radio Beacons), and two bearings on the same station and the distance run between bearings.

WEIGHT TO BE GIVEN TO RADIO BEARINGS: Before using a radio bearing for navigational purposes, a mariner should consider the conditions under which it was taken and should compare the conditions with those given in sections 200A and 100D on accuracy.

TRANSMITTERS AND RECEIVERS: Bearings reported by a direction-finder station ashore must be plotted from the geographical position of the receiving antenna of the station. Bearings taken by a ship on a shore station must be plotted from the geographical position of the station's transmitting antenna.

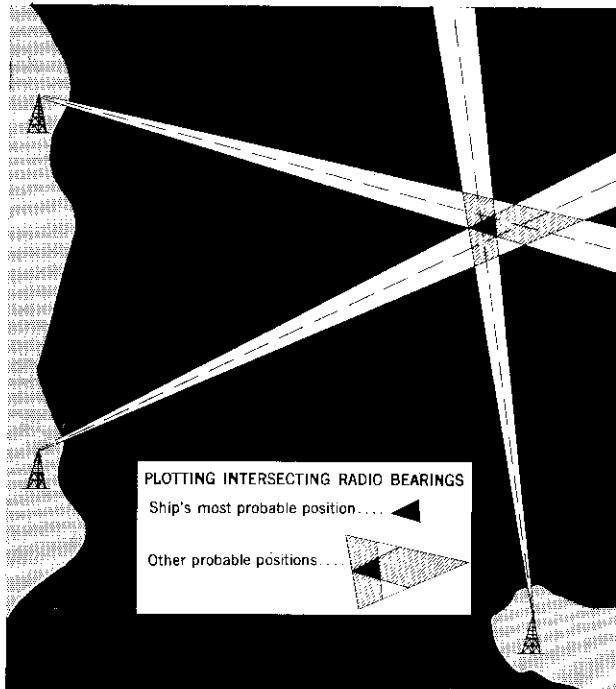


Figure 1.

CAUTION: These two positions are not the same for all stations.

TRACK OF RADIO WAVES: The track of a radio wave is a great circle; the radio bearing is the angle between the meridian of the ship or station taking the bearing and the great circle, not the rhumb line. Radio bearings cannot be plotted on a Mercator chart without first being corrected as described in section 200E, "Radio Bearing Conversion."

SHIP'S PROBABLE POSITION: As radio bearings are not absolutely accurate, it is suggested that lines be drawn on both sides of each radio bearing at an angular distance from the bearing equal to the estimated probable error. In the case of intersecting radio bearings, the ship's most probable position is the area enclosed by these outer lines.

In figure 1 the broken lines are radio bearings obtained by a ship on three radio stations. The solid lines are drawn at angles of 2° from the bearings (it being assumed that all the bearings are probably accurate within 2°). The black area in the illustration lies within the 2° error of all the bearings and is consequently the most probable position of the ship assuming the bearings are accurate.

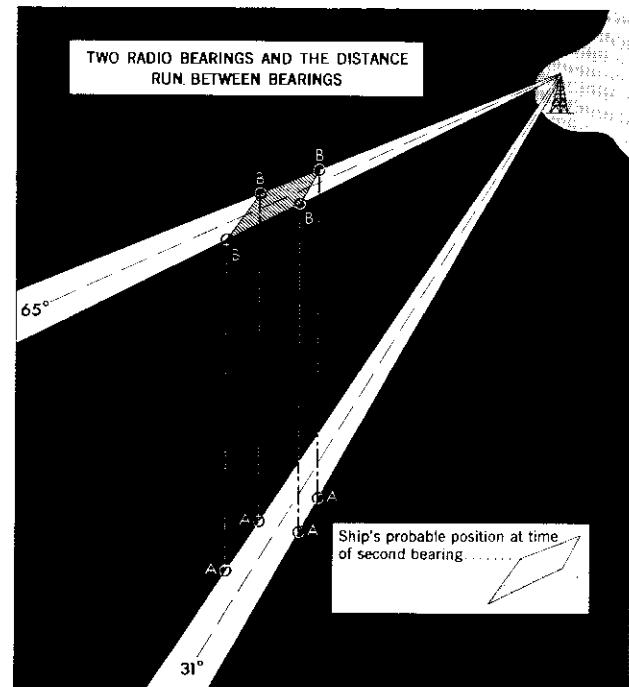


Figure 2.

ing that none of the bearings are more than 2° in error. However, as there is the possibility that one of the bearings may be out more than 2° , the areas shaded with parallel lines give other probable positions. If it is known which of the bearings is probably the least accurate, the outer lines should be offset from this bearing the same number of degrees as the estimated error and the area or areas partially enclosed by these lines should be given less weight than the other areas.

If it is necessary to obtain the ship's position by two radio bearings and the distance run between bearings, it is desirable to solve the problem by graphic method rather than by some mathematical rule such as doubling the angle on the bow, as in the graphic method allowance can be made for possible inaccuracies in the bearings.

In figure 2 a ship on course north obtained bearings of 31° and 65° on a radio station. The lines drawn as long dashes show the bearings and the continuous lines are their limits of accuracy, it being assumed that the bearings are both accurate within 2° . The lines AB drawn with dashes and dots are the distance which the ship ran between bearings. As shown in the figure the distance run is fitted to the lines showing the limits of accuracy of the bearings. This can be done easily by means of parallel rulers and dividers. The shaded quadrilateral shows the ship's probable position at the time of the second bearings, provided both bearings were accurate within 2° .

200E. Radio Bearing Conversion

The table in section 200F is used to convert radio or great circle bearings into Mercator bearings when it is desired to plot the bearings on a Mercator chart. It should be used when the distance between the ship and station is over 50 miles. The arguments used to find the correction are the middle lati-

tude and the difference of longitude between the position of the radio station and the D. R. position of the vessel.

EXAMPLE: A vessel in D. R. lat. $56^\circ 04' N.$, long. $142^\circ 43' W.$ takes a bearing on the radiobeacon at Cape Spencer Light Station in lat. $58^\circ 12.0' N.$, long. $136^\circ 38.3' W.$ The bearing observed is 057.5° . Find the Mercator bearing.

Mid lat. (to nearest whole degree) = 57° .

Dlo (to nearest half degree) = 6° .

With Mid. lat. 57° and Dlo 6° enter the conversion table and extract the correction 2.5° . The receiver (ship) is in N. latitude; the transmitter (radiobeacon) is eastward. Following the rule given at the bottom of the table, the correction is to be added:

Great circle bearing - - - - -	57.5°
Correction - - - - -	+ 2.5°

Mercator bearing - - - - - 60.0°

To obtain bearing to plot add 180° to mercator bearing giving 240° , the rhumb line bearing of the ship from the radiobeacon.

EXAMPLE: A vessel in D. R. lat. $42^\circ 20' N.$, long. $66^\circ 14' W.$ requests a bearing from a direction-finder station in lat. $42^\circ 08' N.$, long. $70^\circ 42' W.$ The bearing given is 81° . Find the mercator bearing.

Mid. lat. (to nearest whole degree) = 42° .

Dlo (to nearest half degree) = 4.5° .

With Mid. lat. 42° and the Dlo 4.5° enter the conversion table and extract the correction 1.5° . The receiver (D. F. station) is in N. latitude; the transmitter (ship) is eastward. Following the rule given at the bottom of the table, the correction is to be added.

Great circle bearing - - - - -	81°
Correction - - - - -	+ 1.5°

Mercator bearing - - - - - 82.5°

200F. Radio Bearing Conversion Table

Correction to be applied to radio bearing to convert to Mercator bearing
Difference of longitude

Mid. lat.	0.5°	1°	1.5°	2°	2.5°	3°	3.5°	4°	4.5°	5°	5.5°	6°	6.5°	7°	7.5°	Mid. lat.
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	...	...	...	...	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	4
5	...	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	5
6	...	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	6
7	...	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	7
8	...	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	8
9	...	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	9
10	...	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	10
11	...	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	11
12	0.1	0.1	0.1	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	12
13	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.8	13
14	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.9	14
15	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.9	15
16	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8	0.8	0.9	1.0	16
17	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.0	17
18	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.2	18
19	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.2	19
20	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.2	1.3	20
21	0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.2	1.4	21
22	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.8	0.8	0.9	1.0	1.1	1.2	1.3	1.4	22
23	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	23
24	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	24
25	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	25
26	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	26
27	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	27
28	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	28
29	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.4	1.5	1.6	29
30	0.1	0.2	0.3	0.4	0.5	0.6	0.8	0.9	1.0	1.1	1.2	1.4	1.5	1.6	1.8	30
31	0.1	0.2	0.4	0.5	0.6	0.8	0.9	1.0	1.2	1.3	1.4	1.6	1.7	1.8	1.9	31
32	0.1	0.3	0.4	0.5	0.7	0.8	0.9	1.1	1.2	1.3	1.4	1.6	1.7	1.8	2.0	32
33	0.1	0.3	0.4	0.6	0.7	0.8	1.0	1.1	1.2	1.4	1.5	1.6	1.8	1.9	2.1	33
34	0.1	0.3	0.4	0.6	0.7	0.8	1.0	1.1	1.2	1.4	1.5	1.7	1.8	2.0	2.1	34
35	0.1	0.3	0.4	0.6	0.7	0.9	1.0	1.1	1.2	1.3	1.4	1.6	1.7	1.8	2.0	35
36	0.1	0.3	0.4	0.6	0.7	0.9	1.0	1.2	1.3	1.3	1.4	1.6	1.7	1.9	2.0	36
37	0.2	0.3	0.4	0.6	0.8	0.9	1.1	1.2	1.4	1.5	1.6	1.8	1.9	2.1	2.2	37
38	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	1.5	1.7	1.8	2.0	2.1	2.2	38
39	0.2	0.3	0.5	0.6	0.8	1.0	1.1	1.2	1.4	1.6	1.7	1.9	2.1	2.2	2.4	39
40	0.2	0.3	0.5	0.6	0.8	1.0	1.1	1.3	1.4	1.6	1.8	1.9	2.1	2.2	2.4	40
41	0.2	0.3	0.5	0.6	0.8	1.0	1.2	1.3	1.5	1.6	1.8	2.0	2.1	2.3	2.5	41
42	0.2	0.3	0.5	0.7	0.8	1.0	1.2	1.3	1.5	1.7	1.8	2.0	2.2	2.3	2.5	42
43	0.2	0.3	0.5	0.7	0.8	1.0	1.2	1.4	1.5	1.7	1.9	2.1	2.2	2.4	2.6	43
44	0.2	0.4	0.5	0.7	0.9	1.1	1.2	1.4	1.6	1.7	1.9	2.1	2.2	2.4	2.6	44
45	0.2	0.4	0.5	0.7	0.9	1.1	1.2	1.4	1.6	1.8	2.0	2.1	2.3	2.5	2.6	45
46	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.3	2.5	2.7	46
47	0.2	0.4	0.6	0.7	0.9	1.1	1.3	1.5	1.7	1.8	2.0	2.2	2.4	2.6	2.8	47
48	0.2	0.4	0.6	0.8	0.9	1.1	1.3	1.5	1.7	1.8	2.1	2.2	2.4	2.6	2.8	48
49	0.2	0.4	0.6	0.8	1.0	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.6	2.8	49
50	0.2	0.4	0.6	0.8	1.0	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	50
51	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.1	2.3	2.5	2.7	2.9	51
52	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	52
53	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	53
54	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	54
55	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.1	2.2	2.4	2.7	2.9	3.1	55
56	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.1	2.2	2.4	2.7	2.9	3.1	56
57	0.2	0.4	0.6	0.8	1.1	1.2	1.4	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.2	57
58	0.2	0.4	0.6	0.8	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.6	2.8	3.0	3.2	58
59	0.2	0.4	0.6	0.8	1.1	1.3	1.5	1.7	1.9	2.2	2.4	2.6	2.8	3.0	3.2	59
60	0.2	0.4	0.6	0.9	1.1	1.3	1.5	1.7	2.0	2.2	2.4	2.6	2.8	3.0	3.2	60

Receiver (latitude)	Transmitter (direction from receiver)	Correction Sign	Receiver (latitude)	Transmitter (direction from receiver)	Correction Sign
North North	Eastward Westward	+	South South	Eastward Westward	—

200G. Radar Information

Radar information in this chapter includes coast radar stations, radar beacons (racon or ramark), and port radio stations which include radar information in their broadcasts. Mariners are cautioned that the radar information supplied is given only as a navigational assist and may be unreliable, subject to suspension without notice, and does not relieve the master of his responsibility for the safety of his ship.

RADAR BEACONS—Transmitters operating in the marine radar frequency band designed to produce a distinctive design on the receiving radar set within range enabling the receiver to determine bearing and/or range of the transmitter. Under certain circumstances, the transmitting beacon can cause interference on the receiving radar display. Adjustment of the "clutter" control may alleviate this situation.

RACON—A radar transponder which emits a characteristic signal when triggered by emissions of another radar. The signal may be emitted on the same frequency as that of the triggering radar, in which case it is superimposed on the receiving radars' normal display automatically. It may be emitted on a separate frequency, in which case the "Flash" on the receiving radar may be selected, excluding all other echoes, by tuning the receiver to that frequency. The only racons presently in service are "in band" racons, racons which transmit in one of the marine radar bands, usually only the 3 cm. band.

Usually the racon "flash" shows on the P.P.I. as a single line or narrow sector extending radially towards the circumference of the P.P.I. from a point slightly beyond the spot (if any) formed by the echo from the lighthouse or racon site. Distance off may be measured to this point, but the distance obtained will be several hundred feet greater than the actual distance from the racon due to response delay in the transponder apparatus. Racon response may be coded to facilitate identification and this information will then be listed under station remarks.

RAMARK—A radar beacon which transmits independently without being "triggered" by another radar. Distance off a ramark cannot be measured, otherwise ramark is similar to racon.

FREQUENCY COVERAGE—Radar beacons usually are arranged to "sweep" a range of frequencies so reception is not limited to radar sets operating on one particular frequency.

SWEEP PERIOD—That period of time required for the radar beacon to sweep the range of frequencies covered. The system sweeps slowly through the frequency range in one direction and then quickly returns. A high rate of sweep (50 times per second) results in a continuous painting of the "flash" on the receiving radar display.

AZIMUTH COVERAGE—Azimuth coverage will be considered as "all around the horizon" unless stated otherwise in the station details. In such case, the sectors will be given from seaward towards the beacon, clockwise.

RANGE—An approximate range which the signal may be received. This depends upon the effective range of the receiving radar and the power and elevation of the radar beacon apparatus.

PERU

2000. Callao (OAT52) Radar Station.

Lat. 12°03'30"S., Long. 77°09'00"W. (approx.)
FREQ.: 2100, 2150, 2182, 2190, 2200, 2250, 2300 kcs., A3.
RANGE: 40 miles.

HOURS OF TRANSMISSION: On request.

UNITED STATES

Note.—The U.S. Coast Guard keeps a continuous watch on channel 16, F3. Coast Guard ships have channels 6, 12, 14, 16; F3. The following stations give Radar advice:

Long Beach C.G., channel 16.

Los Angeles C.G., channels 12, 14, 16.

2100. Ocean Station Vessels. (For individual stations see Radio-beacon section Nos. 1280-1284.)

A vessel's range and bearing from an Ocean Weather Ship, derived from radar observations, may be obtained on request. The observations will be passed in the following form:—

"Radar plot. At (G.M.T.), your position: range yards, bearing true from Ocean Station Vessel ou grid (grid letters)."

For particulars of Ocean Station Vessels in the Pacific Ocean, and Position Indicating Grid, see pages 1-25, 1-26.

CANADA

2200. Vancouver Radar Station (VAS).

Lat. 49°18'56"N., Long. 123°08'15"W.
FREQ.: Calling; 2182 kc., A3, channel 16, F3.
Working; 1650, 2318, 2366 kcs., A3 and channels 12, 14; F3.

HOURS OF TRANSMISSION: On request. Continuous watch maintained on 1650, 2182, 2366 kcs. A3, and channel 16, F3.

REMARKS: Vessels entering or leaving Vancouver Harbor may obtain radar navigational assistance as follows: On entering, call station before coming within 2 miles of First Narrows beacon; on leaving, before Brockton Point is abeam.

2210. Vancouver Harbor (VAS) Port Radio.

FREQ.: Calling; 2182 kc., A3, channel 16, F3.
Working; 2366, 2318, 1650 kcs., A3; channels 6, 12, 14, F3.

POSITION: First Narrows Bridge signal station.

HOURS OF TRANSMISSION: Continuous.

NOTE: Radar advice on channel 16.

PAKISTAN—West

2300. Karachi (ASK) Direction Finder.

RECEIVER: Lat. 24°52'44"N., Long. 67°09'50"E.
FREQ.: 410 kc., A1.

REMARKS: Bearings are taken on the ship's call transmitted for 1 minute. Service is free of charge. Vessels entering Karachi are requested to use this service as much as possible and report results periodically.

INDIA

2350. Calcutta (VWC) Direction Finder.

RECEIVER: Lat. 22°28'56"N., Long. 88°21'26"E.
FREQ.: 410 kc., 500 kc., A1, A2.
TRANSMITTER: Lat. 22°33'31"N., Long. 88°20'16"E.

PAKISTAN—East

2370. Chittagong (ASC) Direction Finder.

Lat. 22°21'39"N., Long. 91°48'27"E.
FREQ.: 410 kc., 500 kc., A1.
NOTE: Not yet in operation.

BURMA

2400. Rangoon Pilot Vessel (XYCZ) Direction Finder.

Lat. 16°09'N., 96°18'E. (approx.)
FREQ.: 500 kc.
RANGE: 350 miles (approx.)

REMARKS: Watch is maintained daily during every other two-hour period commencing at 0000 and ending at 1400 (GCT). Vessels requiring service outside watch hours should inform the Pilot Vessel the previous day. Arrangements will then be made for the operator to be on duty. The Relief Pilot Vessel is equipped with radio, but is not fitted with D/F equipment. When on station it will use the same call sign and observe the same watch hours.

CHINA

Note.—The location and operation of Chinese Radio Direction Finder stations are not to be relied upon.

2450. Hu-ku-tao (MRGL) Direction Finder.

RECEIVER: Lat. 40°40'05"N., Long. 121°01'00"E.
FREQ.: 500 kc., 375 kc., A2, B; 310 kc., A2.

2460. Ying-k'ou (Newchang) (MRGK) Direction Finder.

RECEIVER: Lat. 40°40'45"N., Long. 122°14'10"E.
FREQ.: 500 kc., 375 kc., A2, B; 310 kc., A2.

JAPAN

250. The following operating details are common to all Japanese Direction-Finder Stations except where information to the contrary is given in station description:

FREQ.: For calling station 410 or 500 kc., for making signals required for taking bearings; and for receiving report of bearings 410 kc., A1, A2.

SIGNAL TO BE MADE WHILE BEARINGS ARE TAKEN: Ship repeats its own call signal for 50 seconds, prolonging the dashes. Minimum power compatible with determination of bearings should be used.

RANGE: 111 miles in the daytime for all Japanese stations.

HOURS OF OPERATION: Continuous unless stated otherwise.

NOTE: During the time when radiobeacon service is in progress, radio direction-finding service is not available.

2500. **Hamasaki Byachi (JHU) Direction Finder.**

RECEIVER: Lat. 43°17'13"N., Long. 145°35'43"E.

FREQ.: 1675 kc., A1, A3; 1676.5 kc., A3H, A3J.

CALIBRATED SECTOR: 80°-190°.

HOURS OF TRANSMISSION: 0430-2000.

2520. **Erimo Misaki Light, Ramark.**

Lat. 41°56'26"N., Long. 145°14'51"E.

FREQ.: 9335-9415 mc.

HOURS OF TRANSMISSION: Continuous.

REMARKS: Signals appear on radar screen as a dotted line on the bearing of the ramark.

2535. **Inubo Saki Light Station (JLH) Direction Finder.**

RECEIVER: Lat. 35°42'17"N., Long. 140°52'19"E.

CALIBRATED SECTOR: 357°-208°.

2540. **Inubo Saki Light, Ramark.**

Lat. 35°42'17"N., Long. 140°52'19"E.

FREQ.: 9335-9415 mc.

HOURS OF TRANSMISSION: Continuous.

REMARKS: Signals appear on radar screen as a dotted line on the bearing of the ramark.

2545. **Kannon Saki Light, Ramark.**

Lat. 35°15'11"N., Long. 139°44'54"E.

LOCATION: 33 feet 090° from the Light.

FREQ.: 9335-9415 mc.

HOURS OF TRANSMISSION: Continuous.

REMARKS: Signals appear on radar screen as a dotted line on the bearing of the ramark.

2550. **Nojima Zaki Light Station (JLA) Direction Finder.**
RECEIVER: Lat. 34°53'54"N., Long. 139°53'30"E.
SECTORS OF RELIABLE CALIBRATION: 071°-275°.
NOTE: Reported unreliable 210°-227° and 241°-260°.

2555. **Nojima Saki Light, Ramark.**
Lat. 34°53.9'N., Long. 139°53.5'E.
FREQ.: 9335-9415 mc.
HOURS OF TRANSMISSION: Continuous.
REMARKS: Signals appear on radar screen as a dotted line on the bearing of the ramark.

2560. **Hachijo Jima (JLT) Direction Finder.**
RECEIVER: Lat. 33°04'36"N., Long. 139°51'18"E.
SECTORS OF RELIABLE CALIBRATION: 000°-205°.

2565. **Izu O Shima Light Station (JLI) Direction Finder.**
RECEIVER: Lat. 34°47'39"N., Long. 139°22'31"E.
SECTORS OF RELIABLE CALIBRATION: 210°-111°.
NOTE: Reported unreliable 040°-077°.

2570. **Iro Saki Light Station (JLJ) Direction Finder.**
RECEIVER: Lat. 34°35'58"N., Long. 138°50'53"E.
SECTORS OF RELIABLE CALIBRATION: 061°-276°.
NOTE: Reported unreliable 061°-069°, 211°-232°, 235°-262°.

2575. **Shiono Misaki, Ramark.**
Lat. 33°26'00"N., Long. 135°45'25"E.
LOCATION: 100 feet 180° from Shiono Misaki Light.
FREQ.: 9335-9415 mc.
HOURS OF TRANSMISSION: Continuous.
REMARKS: Signals appear on radar screen as a dotted line on the bearing of the ramark.

2580. **Osaka Harbor Port Radio.**
FREQ.: Calling, channel 16, F3.
Working; channels 14, 22; F3.
PROCEDURE: Gives radar advice on channels 14 and 22.

2590. **Sada Misaki Light, Ramark.**
Lat. 33°20.4'N., Long. 132°01.0'E.
FREQ.: 9375 Mc. Ps.
POWER: 0.6 W.
CALIBRATED SECTOR: All round.
HOURS OF TRANSMISSION: Continuously.
REMARKS: Directional rotating wave will be transmitted wobbling between 9,335 Mc and 9,415 Mc. Signals appear on PPI as dotted line.

AUSTRALIA

2700. Troughton Island (AXA) Direction Finder.
RECEIVER: Lat. 13°45' 00"S., Long. 126°08' 49"E.
FREQ.: 4177-4187 kc., A1, A3; 6265.5-6280.5 kc., A1,
8354-8374 kc., A1.
HOURS OF SERVICE: 0000-0100
0400-0500
1200-1300
REMARKS: On request contact Darwin Radio (VID). No charge.

NEW ZEALAND

2800. Mount Victoria (Auckland) Radar Station (ZLEA).
Lat. 36°49' 42"S., Long. 174°47' 57"E.
FREQ.: 2182 kc., A3 (calling), 2012 or 2162 kc., A3 (working).
RANGE: 45 miles.
REMARKS: Bearings and range given from Mount Victoria
upon request during low visibility.
NOTE: Information to be used with caution.

2810. Auckland (Mount Victoria) (ZLEA) Port Radio.
FREQ.: 2182, 2012 kc., A3.
HOURS OF TRANSMISSION: Continuous.
NOTE: Gives radar advice on request.

2830. Westport Radar Station (ZLAZ).
Lat. 41°43' 54"S., Long. 171°35' 15"E.
RANGE: 15 miles.
FREQ.: 2162 kc., A3 (after call on 2182 kc., A3).
REMARKS: On request to Westport (ZLAZ). Vessels may re-
quest particulars of their range and bearing during low
visibility.

2840. Westport (ZLAZ) Port Radio.
FREQ.: 2182, 2162 kc., A3.
HOURS OF TRANSMISSION: 0130-0145, 0330-0415, 0800-
0815, 1200-1215, 1600-1615, 2000-2015, 2330-2345.
NOTE: Gives radar advice on request.

2850. Timaru Harbor Light Radar Station.

Lat. 44°23' 45"S., Long. 171°15' 12"E.
RANGE: 25 miles.
FREQ: 2162 kc., A3 (after call on 2182 kc., A3);
Channel 12, F3 (after call on channel 12 or 16, F3).
HOURS OF TRANSMISSION: On request (radiotelephone only).
during restricted visibility.
REMARKS: Information will be given in following form:
"According to my observation you are bearing degrees miles (or cables) from the Timaru Harbor
Lighthouse."

CAUTION: Vessels using this information must do so cau-
tiously.

2860. Timaru (ZLSD) Port Radio.

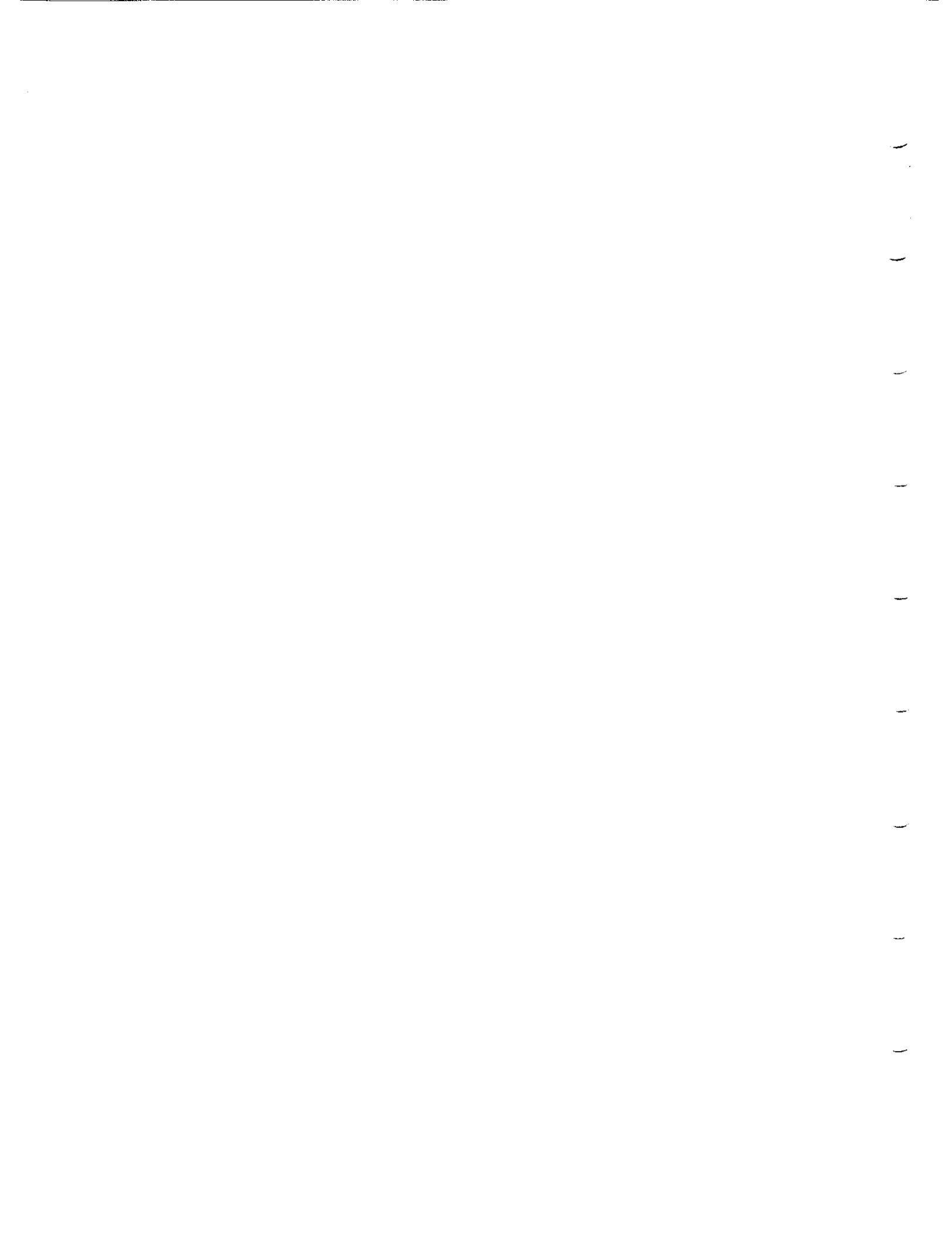
FREQ.: (a) 2182, 2162 kc., A3.
(b) Channels 12, 16; F3.
HOURS OF TRANSMISSION: (a) 15 min. from 0345, 0745, 1145,
1545, 1945, 2345 and by arrangement.
(b) 15 minutes from 0345 and every 4 hours thereafter.
NOTE: Gives radar advice on request.

2870. Taiaroa Head (Otago Harbor) Radar Station (ZLES).

Lat. 45°46' 35"S., Long. 170°43' 34"E.
RANGE: 20 miles.
FREQ.: 2162 kc., A3 (after call on 2182 kc., A3).
HOURS OF TRANSMISSION: Bearing and range given on re-
quest during low visibility.
NOTE: Information to be used with caution.

2880. Dunedin (Taiaroa Head) (ZLES) Port Radio.

FREQ.: 2182, 2162 kc., A3.
HOURS OF TRANSMISSION: Continuous.
NOTE: Gives radar advice on request.



Chapter 3
RADIO TIME SIGNALS

300. GENERAL

Under the radio stations listed as sending radio time signals, the time shown is the Greenwich civil time of the beginning and ending of the transmission of the time signal proper.

ACCURACY OF SIGNALS: The majority of radio time signals are transmitted automatically, being controlled by the standard clock of an astronomical observatory. Absolute reliance may be had in these signals, and they should be correct to 0.05 second. Some stations transmit by a combination of hand and automatic signals, and care should be exercised to differentiate between the two at the time of actual comparison of the chronometer.

Other radio stations, however, have no automatic transmission system installed, and the signals are given by hand. In this instance the operator is guided by the standard clock at the station. The clock is checked by either astronomical observations or by reliable time signals. The hand transmission should be correct to 0.25 second.

STATIONS TO AVOID INTERFERENCE: During the transmission of time signals, stations are prohibited from making any transmissions which might interfere with the reception of these signals by other stations.

301. RADIO TIME SIGNAL SYSTEMS

At the present time there is a lack of uniformity in the systems employed for the broadcast of radio time signals. The systems most frequently used and more likely to be heard in most parts of the world are as follows:

- A. The United States system.
- B. The International (ONOGO) system.
- C. The New International (modified ONOGO) system.
- D. The rhythmic (coincidence) system.
- E. U.S.S.R. ordinary time signals.
- F. The Japanese ordinary system.
- G. The Japanese "NDB" system.
- H. The English system ordinary time signals.

Special systems not related to the above mentioned categories are described in detail under their respective stations.

301A. The United States System

The transmission of signals begins at 55 minutes 0 seconds of some hour, and continues for 5 minutes. Signals are trans-

mitted on every second during that time, except that there is no signal on the 29th second of any minute, nor on certain seconds at the ends of the minutes, as shown in the diagram below.

The dashes in the diagram below indicate seconds on which signals are transmitted. The seconds marked "60" are the zero seconds of the following minutes. All seconds from 0 to 50, inclusive, are transmitted except the 29th second, as explained above. The dash on the beginning of the hour (shown as 59 minutes 60 seconds below) is much longer than the others (i.e., 1.3 seconds).

In all cases the beginnings of the dashes indicate the beginnings of the seconds, and the ends of the dashes are without significance.

It will be noted that the number of dashes sounded in the group at the end of any minute indicates the number of minutes of the signal yet to be sent.

REPETITIONS: In the event of a failure or an error occurring in any of the time signals another time signal will be transmitted one hour later on the same frequency.

HIGH PRECISION: For ordinary navigational purposes no special precautions need be observed in receiving the signals other than to avoid those signals which are marked in the station schedule as unsatisfactory for navigational purposes.

However, in work which requires a knowledge of time to the hundredth of a second certain precautions must be observed in receiving the signals.

When tuning in the radio time signals, especially when automatic recorders are used, great care must be exercised to insure reception at the beginning of the signal on each second. Apparently the 121.95 kilocycle Annapolis signals build up in strength each time the circuit is keyed, the process requiring several hundredths of a second. If the signals are faintly received, the recorder may operate with considerable delay. The obvious remedy is to increase the amplification, so as to insure operation at the beginning of each signal.

In the case of the high-frequency or short-wave signals, a different difficulty exists. Although the signals on each second begin full strength, there is evidently a slight shift of frequency taking place each time the circuit is keyed. A sharply tuned receiver may appear to receive the signals perfectly, when, as a matter of fact, it is out of tune with the beginning of all the signals, and consequently operating with a delay of several hundredths of a second.

The United States System

Minute	Second											
	50	51	52	53	54	55	56	57	58	59	60	
55	—	—	—	—	—	—	—	—	—	—	—	
56	—	—	—	—	—	—	—	—	—	—	—	
57	—	—	—	—	—	—	—	—	—	—	—	
58	—	—	—	—	—	—	—	—	—	—	—	
59	—	—	—	—	—	—	—	—	—	—	—	

301B. The International (ONOGO) System

This system was adopted at the Conference Internationale de l'Heure, 1912. It is better known as the ONOGO system because of the sequence of the Morse letters used in the time code. The transmission of the actual time signals lasts for three minutes.

As transmitted by the majority of stations, the signals proper are preceded by the preparatory signals as shown under the respective stations.

The signal proper lasts three minutes and is sent as follows: In the transmission of the signals ONOGO, each dash (—)=1 second, and each dot (•)=0.25 second.

The particular signal of this series, that is accepted as the time signal, varies. In some cases the end of the final dash in the letter O (— — —), representing an even minute, is used; while another country specifically mentions the dot of the letters N (— •) and G (— — •). As the exactitude of the signals O, N, G, can be depended upon, either method can be safely employed.

The international system is used in Turkey, India, Ceylon, West Australia, and South Australia.

Signal	Times				Diagram			
	m.	s.	m.	s.	55	56	57	etc.
Series of X's sent every 5 seconds -----	57	00	to	57	49	—	—	
Letter O -----	57	55	to	58	00	55	56	57
Letter N -----	58	08	to	58	10	08	09	10
Letter N -----	58	18	to	58	20	18	19	20
Letter N -----	58	28	to	58	30	28	29	30
Letter N -----	58	38	to	58	40	38	39	40
Letter N -----	58	48	to	58	50	48	49	50
Letter O -----	58	55	to	59	00	55	56	57
Letter G -----	59	06	to	59	10	06	07	08
Letter G -----	59	16	to	59	20	16	17	18
Letter G -----	59	26	to	59	30	26	27	28
Letter G -----	59	36	to	59	40	36	37	38
Letter G -----	59	46	to	59	50	46	47	48
Letter O -----	59	55	to	00	00	55	56	57

301C. The New International (Modified ONOGO) System

The International Time Commission, July 1925, recommended that the International (Onogo) System of radio time signals be amended, by the substitution of 6 dots (•) sent at the fifty-fifth, fifty-sixth, fifty-seventh, fifty-eighth, fifty-ninth, and sixtieth, seconds of each minute, instead of the 3 one-second dashes that commence at the fifty-fifth, fifty-seventh, and fifty-ninth

seconds of the last 3 minutes, and which constitute the time signals.

The New International System of radio time signals has now been adopted by Germany, France, South Africa, China, Java, Australia, and New Zealand.

The signal proper is as follows:

Signal	Times				Diagram			
					55	56	57	etc.
Series of X's sent every 5 seconds -----	57	00	to	57	50	—	—	
A dot each second (time signals) -----	57	55	to	58	00	55	56	57
Letter N (time signal) -----	58	08	to	58	10	8	9	10
Letter N (time signal) -----	58	18	to	58	20	18	19	20
Letter N (time signal) -----	58	28	to	58	30	28	29	30
Letter N (time signal) -----	58	38	to	58	40	38	39	40
Letter N (time signal) -----	58	48	to	58	50	48	49	50
A dot each second (time signals) -----	58	55	to	59	00	55	56	57
Letter G (time signal) -----	59	06	to	59	10	6	7	8
Letter G (time signal) -----	59	16	to	59	20	16	17	18
Letter G (time signal) -----	59	26	to	59	30	26	27	28
Letter G (time signal) -----	59	36	to	59	40	36	37	38
Letter G (time signal) -----	59	46	to	59	50	46	47	48
A dot each second (time signals) -----	59	55	to	00	00	55	56	57

301D. The Rhythmic (Coincidence) System

The International Time Commission of 1925 adopted the New International System of rhythmic wireless time signals, which is described herein. This system has been adopted by Australia, Brazil, France, Germany, Japan, U.S.S.R. and other countries.

The rhythmic system consists of 306 signals transmitted in the space of 300 seconds or 5 minutes of mean time. The signals falling exactly on the minute are short dashes (—) of 0.4 second duration. Between the dashes 60 dots (•) of 0.1 second each are transmitted. Each minute therefore is divided into 61 intervals. This vernier arrangement permits coincidence to be obtained between the chronometer beat (tick) and the radio

signal. Chronometers beating half seconds will afford two coincidences each minute, while those beating only on the second will give one coincidence each minute. Due to the vernier arrangement, these signals permit chronometer comparisons of accuracy approaching 0.01 second.

PROCEDURE: To permit adjustment of the receiving apparatus, the Signal proper is preceded by a preparatory signal or by 30 or 45 seconds of dots. As some stations neither begin nor end their signals on the hour, the minutes given in the following table are relative only, the 0 minute representing the time that the signal starts and the 5 minute representing the time that it ends.

- 00 m. 00s.—first signal, a dash (—) followed by 60 dots (••• etc.).
- 01 m. 00s.—sixty-second signal, a dash (—) followed by 60 dots (••• etc.).
- 02 m. 00s.—one hundred and twenty-third signal, a dash (—) followed by 60 dots (••• etc.).
- 03 m. 00s.—one hundred and eighty-fourth signal, a dash (—) followed by 60 dots (••• etc.).
- 04 m. 00s.—two hundred and forty-fifth signal, a dash (—) followed by 60 dots (••• etc.).
- 05 m. 00s.—three hundred and sixth signal, a dash (—).

The beginnings of the dots and dashes must be used, not their endings.

FOR ORDINARY NAVIGATING: As the beginning of each short dash is exactly at the beginning of the minute, the chronometer may be compared as in any other system without attention to the dots transmitted. This is normally accurate enough for ordinary navigational purposes. If the signals are used in this manner, five comparisons may be obtained.

FOR HIGH PRECISION: If greater accuracy is required, the error to the nearest second is obtained from the beginning of the dash that marks the exact minute and the fractions of the second

are obtained by counting the dots from this dash to the dot which exactly coincides with some chronometer beat, and entering the appended table. With a chronometer beating to the half second, ten coincidences may be obtained, and the errors of these coincidences as given in the table should be averaged to reduce observational errors. When the greatest possible accuracy is desired, the above results should be corrected for the error in the time signal itself as published in correction sheets, notices to mariners, or similar papers.

Rhythmic correction table

Number of radio signal	Chronometer faster	Number of radio signal	Chronometer faster	Number of radio signal	Chronometer slower
	<i>Second</i>		<i>Second</i>		<i>Second</i>
1	0.016	21	0.344	41	0.328
2	.033	22	.361	42	.312
3	.049	23	.377	43	.295
4	.066	24	.393	44	.279
5	.082	25	.410	45	.262
6	.098	26	.426	46	.246
7	.115	27	.443	47	.230
8	.131	28	.459	48	.213
9	.148	29	.475	49	.197
10	.164	30	.492	50	.180
11	.180	31	.492	51	.164
12	.197	32	.475	52	.148
13	.213	33	.459	53	.131
14	.230	34	.443	54	.115
15	.246	35	.426	55	.098
16	.262	36	.410	56	.082
17	.279	37	.393	57	.066
18	.295	38	.377	58	.049
19	.312	39	.361	59	.033
20	.328	40	.344	60	.016

NOTE.—Care should be taken to identify the precise moment of coincidence as accurately as possible. The limits within which erroneous readings are probable are considerable (several seconds on either side); a coincidence recorded too early tends to give a low value for the corrected time, and vice versa (approximately one-sixtieth second for each unit of displacement).

301E. The U. S. S. R. Ordinary System

These signals are used by certain stations in the Union of Soviet Socialist Republics.

For the majority of stations, the preparatory signals and the signal proper take five minutes to transmit. The preparatory

signals for the majority of the stations consist of the call signal of the station and a series of dashes as shown under the stations concerned. The signal proper is as follows:

Signal	Times				Diagram							
A dot each second (time signal) - - - - -	m.	s.	m.	s.	55	56	57	58	59	60		
	57	55	58	00	•	•	•	•	•	•		
Series of M's - - - - -	58	14	to	58	46	55	56	57	58	59	60	etc.
A dot each second (time signal) - - - - -	58	55	to	59	00	•	•	•	•	•	•	
Series of O's - - - - -	59	14	to	59	46	55	56	57	58	59	60	etc.
A dot each second (time signal) - - - - -	59	55	to	00	00	•	•	•	•	•	•	

301F. The Japanese "NDB" System

The time signal proper occupies 3 minutes, each exact minute being marked by the beginning of a one-second dash. A continuous dash is transmitted from the 5th to the 15th second of the first minute. From the 30th to the 55th second of each minute a Morse letter is transmitted; "N" in the first minute, "D" in the second minute, and "B" in the third minute, as shown in the following diagram.

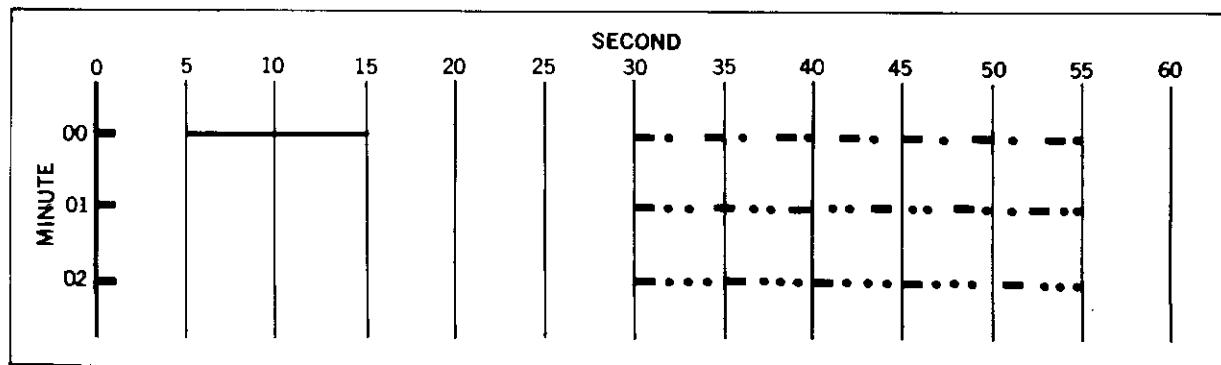
As some stations do not commence the time signal on the hour, the minutes shown in the diagram are relative only.

301G. The Japanese Ordinary System

The time signal consists of 60 pulses per minute. Time is indicated by short interruption of the radio wave, 0.02 second for each whole minute.

The exact time is indicated by the resumption of transmission after these brief interruptions.

The Japanese NDB System



301H. The English System Ordinary Time Signals

The transmission of time signals commences at 55 minutes 00 seconds before the scheduled hour and continues for a period of 5 minutes with a 0.1 second dot at each second, 1 through

59, and a 0.4 second dash at the exact minute. The beginning of each dot or dash is the time reference point.

MINUTE	SECOND												
	1	2	3	4	5	6	(7 thru 54)	55	56	57	58	59	60
55	•	•	•	•	•	•	•	•	•	•	•	•	-
56	•	•	•	•	•	•	•	•	•	•	•	•	-
57	•	•	•	•	•	•	•	•	•	•	•	•	-
58	•	•	•	•	•	•	•	•	•	•	•	•	-
59	•	•	•	•	•	•	•	•	•	•	•	•	-

CHILE

302. Where information to the contrary is not given under station details the following system is in effect:
A dot is transmitted every second for 5 minutes except that the 29th, the last 5 seconds in the first four minutes and the last 10 seconds in the last minute are omitted. The time signal concludes with a one-second dash, the beginning of which marks the exact hour. In case of irregularity or error, the signal "Senal Nula" will be transmitted 3 times one minute after the end of the time signal.

302B. Certain Chilean broadcasting stations offer 3-minute time signals in which a dot is transmitted each second. Whole minutes are indicated by a 1-second dash, and the even hour is marked by the beginning of a 3-second dash which ends the time signal.

3020. Punta Arenas Broadcasting Station (CE 113).

HOURS OF TRANSMISSION: 1557-1600 ----- FREQ.: 1130 kc., A3.

3030. Puerto Montt Broadcasting Station (CE 101).

HOURS OF TRANSMISSION: 1557-1600 ----- FREQ.: 1010 kc., A3.

3040. Valdivia Broadcasting Station (CE 59).

HOURS OF TRANSMISSION: 1557-1600 ----- FREQ.: 590 kc., A3.

3050. Temuco Broadcasting Station (CE 125).

HOURS OF TRANSMISSION: 1557-1600 ----- FREQ.: 1250 kc., A3.

3060. Concepcion Broadcasting Station (CC 141).

HOURS OF TRANSMISSION: 1557-1600 ----- FREQ.: 1410 kc., A3.

3070. Santiago Station (CB 73, CB 76, CD 970, CB 154).

HOURS OF TRANSMISSION: 1557-1600 ----- FREQ.: 730 kc., 760
1540 kc.,
9699 kc., A3.

3080. Valparaiso-Las Salinas (CCV).

HOURS OF TRANSMISSION: 0055-0100 ----- FREQ.:
1155-1200 ----- } 2841, 8205,
1355-1400 ----- } 12960 kc., A2.
1555-1600 ----- }
2155-2200 ----- }

REMARKS: United States Systems (See Sec. 301A.).

PERU

310. Peruvian Time Signals originate at the Transmitter Clock at the Naval School of Peru, controlled by observation of Washington time signals.

3110. Callao (OBC).

HOURS OF TRANSMISSION: 0055-0100 ----- FREQ.:
1555-1600 ----- } 490 kc., 8650 kc.,
1855-1900 ----- } 12307 kc., A1.

REMARKS: Time signal consists of a dot for each second except that during the first four minutes from the 56th to 59th seconds and for the fifth minute from the 51st to 58th seconds the dots are omitted. The last signal begins at the 59th second of the 5th minute (lasting 1 second) and its end indicates the exact time.

PANAMA CANAL ZONE

3120. **Balboa (NBA).**

HOURS OF TRANSMISSION:

0455-0500	-----	FREQ.:
0955-1000	-----	
1655-1700	-----	
2255-2300	-----	

REMARKS: Station uses United States system. (see sec. 301A). Rebroadcast of Washington time signal by automatic relay; error normally less than 0.5 second.

UNITED STATES

3130. **San Francisco, Cal. (NPG).**

HOURS OF TRANSMISSION:

0555-0600	-----	FREQ.:
1155-1200	-----	
1755-1800	-----	
2355-2400	-----	

REMARKS: Second-order time signals; normally correct to less than 0.5 second, having generally a constant lag.

REPUBLIC OF SOUTH AFRICA

3300. **Johannesburg (ZUO).**

HOURS OF TRANSMISSION:

H + every 15 min. (except 0630-0700)	-----	FREQ.:

REMARKS: A .005 sec. pulse transmitted every second. The first second of each minute is .5 sec. pulse. Time announcement is made in Morse code between 14-15, 29-30, 44-45 and 59-60 minutes in the following form: GMT (at next minute) ZUO ZUO ZUO 1415.
Source: Union Observatory, Johannesburg.

MOZAMBIQUE

3350. **Lourenco Marques (CRO).**

HOURS OF TRANSMISSION:

0757-0800	-----	FREQ.:
1857-1900	-----	

REMARKS: New International (Modified ONOGO) System. (See sec. 301C.)
SOURCE: Campos Rodriguez Observatory.

INDIA

3400. **Poona (VWR).**

HOURS OF TRANSMISSION:

0837-0840	-----	FREQ.:
-----------	-------	--------

REMARKS: International (ONOGO) System. (See sec. 301B.)

3410. **Calcutta (VWC)**

HOURS OF TRANSMISSION:

0827-0830	-----	FREQ.:
1627-1630	-----	

REMARKS: International (ONOGO) System. (See sec. 301B). Preparatory signals transmitted by hand as follows: 25⁰⁰ 27⁰⁰ "CQ CQ CQ DE VWC VWC VWC Ordinary Time Signals, Wait(•—•••)." In the event the signal fails, a series of eight or more dots, "Erase", is followed by "signal failed."

CEYLON

3450. Colombo (4PB).

HOURS OF TRANSMISSION:

0555-0600 -----
1325-1330 ----- } 500 kc., A2; 8742 kc., A1.

REMARKS: English system (see sec. 301H). transmitted automatically from Colombo Observatory. Preparatory signal of CQ DE 4PB TIME SIGNALS followed by wait signal (•—•••) is sent 02 minutes prior to commencement of the time signal proper.

HONG KONG

3500. Tai Long Head (Cape d'Agulhas) (VPS).

HOURS OF TRANSMISSION:

0000, 0400, 0800, 1200, 1600, 2000	VPS	FREQ:
0000, 0400, 0800, 1200, 1600	VPS 35	527.5 kc/s, A1.
2000	VPS 30	8535 kc/s, A1.
0000, 0400, 0800	VPS 60	6404 kc/s, A1.

REMARKS: BBC System. The time signal consists of 6 dots, one for each second from the 55th to 60th inclusive. The final dot is the time signal.
Delete all details and amend to read:

REMARKS: Source is Royal Observatory, Hong Kong.
NOTE: Duration of each dot is about 0.2 second.

NAVOCEANO 32/67.

3500. Hong Kong Broadcasting Station (ZBW).

HOURS OF TRANSMISSION:

Winter: 0100, 0300, 0515, 1000, 1100, 1200, 1300, 1500, 1600, 2300, 2400	FREQ:
Summer: 0200, 0415, 0800, 1000, 1100, 1300, 1400, 1500, 2200, 2300, 2400	860 kc/s, A3; 91 Mc/s, F3.
Winter: 0400, 0500, 1000, 1400, 2300	
Summer: 0300, 0400, 0600, 1100, 2200	640, 3940 kc/s, A3; 94 Mc/s, F3.

REMARKS: BBC System. The time signal consists of 6 dots, one for each second from the 55th to 60th inclusive. The final dot is the time signal.

NAVOCEANO 32/67.

0000	860 kc/s, A3.
0500	
0515	
1100	
1300	
1500	
2300 (except Sundays and Holidays)	640, 3940 kc/s, A3.
0400	
0500	
1000	
1400	
2300	

3650 **Radio Australia (Overseas Service of Australian Broadcasting Commission.)**

NATURE OF BROADCAST: The time signal consists of a transmission of 6 dots, one for each second from the 55th to the 60th inclusive. The final dot is the time signal. A warning signal consisting of a single dot is transmitted 5 seconds before the first of the series of 6 dots (at 10 seconds before the hour.).

ERROR: Accurate ± 0.05 second.

HOURS OF TRANSMISSION:

	FREQUENCY (mcs.)
0000.....	15.22, 15.24, 17.715, 17.87.
0100.....	15.22, 15.24, 17.84, 17.87, 21.52.
0200.....	
0300.....	15.22, 15.24, 17.84, 17.87, 21.54.
0400.....	
0500.....	15.22, 15.24, 17.82, 17.87, 21.54.
0600.....	11.71, 15.18, 15.22, 15.24, 17.82, 17.87, 21.54.
0700.....	
0800.....	7.19, 9.56, 11.71, 15.22, 17.82, 17.87, 21.54.
0900.....	
1000.....	7.19, 9.56, 9.57, 11.71, 11.81, 11.88, 15.22, 17.87.
1100.....	
1200.....	7.19, 7.22, 9.57, 9.58, 11.74, 11.81, 11.88.
1300.....	
1400.....	7.22, 9.54, 9.57, 9.58, 11.74, 11.79, 11.88.
1500.....	
1600.....	7.22, 9.57.
1700.....	
1800.....	
1900.....	9.6, 11.84.
2000.....	
2100.....	9.6, 11.84, 15.24, 17.715.
2200.....	15.24, 17.715.
2300.....	11.78, 15.22, 15.24, 15.33, 17.715, 17.87.

N.M. 32/66

3665 **Canberra (Belconnen) (VHP).**

Amend HOURS OF TRANSMISSION and FREQ. to read:

HOURS OF TRANS-

MISSION:	FREQ.:
0025-0030*	44, 4286, 6428.5, 8478, 12907.5, 17256.8, 22485 kc., A1.
0755-0800.....	Do
1355-1400.....	
1955-2000.....	4286, 6428.5, 8478, 12907.5, 17256.8 kc., A1.

N.M. 32/66

Delete all details and amend to read:

3655 **Sydney (VIS).**

HOURS OF TRANS-

MISSION:	FREQ.:
0257.....	500 kc., A2.
1057.....	

REMARKS: The New International (Modified ONOGO) System (See sec. 301C.).

N.M. 32/66

INDONESIA

3640. Djakarta (PKI) (PLC).

HOURS OF TRANSMISSION:

FREQ.:

0057-0100 ----- 8542, 11440 kc., A1.

PREPARATORY SIGNALS: 55^m00^s to 56^m50^s ----- Dot (.) every second.

56^m55^s to 57^m00^s ----- Dash (-).

REMARKS: The New International (modified ONOGO) System. (See sec. 301C.)

AUSTRALIA

3650. Radio Australia (Overseas Service of Australian Broadcasting Commission.)

NATURE OF BROADCAST: The time signal consists of a transmission of 6 dots, one for each second from the 55th to the 60th inclusive. The final dot is the time signal. A warning signal consisting of a single dot is transmitted 5 seconds before the first of the series of 6 dots (at 10 seconds before the hour.).

ERROR: Accurate to plus or minus 0.05 second.

HOURS OF TRANSMISSION:

FREQUENCY (mcs.)

0000 -----	15.22, 15.24, 17.715, 17.87.
0100 -----	15.22, 15.24, 17.84, 17.87, 21.52.
0200 -----	15.22, 15.24, 17.84, 17.87, 21.54.
0300 -----	15.22, 15.24, 17.84, 17.87, 21.54.
0400 -----	15.22, 15.24, 17.82, 21.54.
0500 -----	11.71, 15.18, 15.22, 15.24, 17.82, 17.87, 21.54.
0600 -----	7.19, 9.56, 11.71, 15.22, 17.82, 17.87, 21.54.
0700 -----	7.19, 9.56, 11.71, 11.81, 11.88, 15.22, 17.87.
0800 -----	7.19, 9.56, 9.57, 11.71, 11.81, 11.88, 15.22, 17.87.
0900 -----	7.19, 9.56, 9.57, 11.71, 11.81, 11.88, 15.22, 17.87.
1000 -----	7.19, 9.56, 9.57, 11.71, 11.81, 11.88, 15.22, 17.87.
1100 -----	7.19, 9.56, 9.57, 11.71, 11.81, 11.88, 15.22, 17.87.
1200 -----	7.19, 9.56, 9.57, 11.71, 11.81, 11.88, 15.22, 17.87.
1300 -----	7.22, 9.54, 9.57, 9.58, 11.74, 11.79, 11.88.
1400 -----	7.22, 9.54, 9.57, 11.74, 11.79, 11.88.
1500 -----	7.22, 9.57.
1600 -----	7.22, 9.57.
1700 -----	7.22, 9.57.
1800 -----	9.6, 11.84.
1900 -----	9.6, 11.84, 15.24, 17.715.
2000 -----	15.24, 17.715.
2100 -----	11.78, 15.22, 15.24, 15.33, 17.715, 17.87.
2200 -----	
2300 -----	

3655. **Sydney (VIS).**

HOURS OF TRANSMISSION:

0257 - - - - -
1057 - - - - - } 500 kc., A2.

FREQ.:

REMARKS: The New International (Modified ONOGO) System (See sec. 301C.).

3660. **Sydney (VIX).**

NOTE: Canberra (Belconnen) (VHP) (3665) and Sydney (VIX) share the same frequencies. (VIX) transmits from 0001 to 0200, (VHP) from 0200 to 0400 and similarly for each ensuing 4 hours.

3665. **Canberra (Belconnen) (VHP).**

HOURS OF TRANSMISSION:

0025-0030* - - - - -
0755-0800 - - - - - } 44, 4286, 6428.5, 8478, 12907.5, 17256.8,
1355-1400 - - - - - } 22485 kc., A1.
1955-2000 - - - - - } 4286, 6428.5, 8478, 12907.5, 17256.8 kc., A1.

* Not on Tuesdays and Thursdays.

REMARKS: United States System (see sec. 301A). Source is Commonwealth Observatory, Mt. Stromlo. Most closely controlled signals are on 8478 kc. Signals transmitted on other frequencies tend to have systematic differences of about one millisecond, except for the signals on 44 kc. which will begin about 15 milliseconds late.

NOTE: Canberra (Belconnen) (VHP) and Sydney (VIX) share the above frequencies. (VIX) transmits from 0001 to 0200, (VHP) from 0200 to 0400 and similarly for each ensuing 4 hours.

3670. **Melbourne (VIM).**

HOURS OF TRANSMISSION:

0157-0200 - - - - -
1357-1400 - - - - - } 500 kc., A2.

FREQ.:

REMARKS: New International System. (See sec. 301C.).

3680. **Adelaide (VIA).**

HOURS OF TRANSMISSION:

0027-0030 - - - - -
1227-1230 - - - - - } 500 kc., A2.

FREQ.:

REMARKS: International System. (See sec. 301B.) Except that the first minute consists of a series of the letter X (- - - -) commencing at the 5th and finishing at the 50th second, followed by 0 (- - - -) each dash commencing at the 55th, 57th, and 59th seconds. Automatic transmission; source is Adelaide Observatory.

3690. **Perth (VIP).**

HOURS OF TRANSMISSION:

0057-0100 - - - - -
1257-1300 - - - - - } 500 kc., A2.

FREQ.:

REMARKS: International System. (See sec. 301B.). Source is Perth Observatory.

NEW ZEALAND

3700. Wellington (ZLW) (ZMO).

HOURS OF TRANSMISSION:

2255-2300	FREQ.:	417.5 kc., A1, A2 after preliminary call on 500 kc.
-----------	--------	---

REMARKS: English System. (See sec. 301H.) Automatic transmission from standard clock of the New Zealand Time Service, Wellington (ZMO). A preparatory signal of "Attention" (- - - -) transmitted at 2254 and ZMO(- - - - - - - -), repeated four times, transmitted from 22h. 54m. 10s. to 22h. 54m. 40s., precedes the time signal. Error does not exceed 0.05 seconds.

3710. Wellington Broadcasting Station (ZLYA) (ZLYZ).

HOURS OF TRANSMISSION:

0400, 1000, 1300**	FREQ.:	570 kc., A3.
1500**, 1600**, 1700,		570, 760, 690, 780 kc., A3.
2258, 2259, 2300		570, 760, 690, 780, 800, 860, 920, 720 kc., A3.
1100, 1800		
0030, 0600, 0630, 0700,		
0900*, 1900, 2000, 2100		

* Not on Sunday.

** Not on Monday.

REMARKS: Each time signal consists of 6 dots, separated by 1 second intervals, with the last dot representing the exact minute. Accuracy plus or minus 0.05 second.

GUAM

3800. Guam (NPN).

HOURS OF TRANSMISSION:

0555-0600	FREQ.:	484 kc., 4955 kc., 8150 kc.,
1155-1200		13530 kc., 17530 kc., 21760 kc., A1.
1755-1800		
2355-2400		

REMARKS: Station uses United States System. (See sec. 301A.) Rebroadcast of Washington time signal by automatic relay; error normally less than 0.5 second.

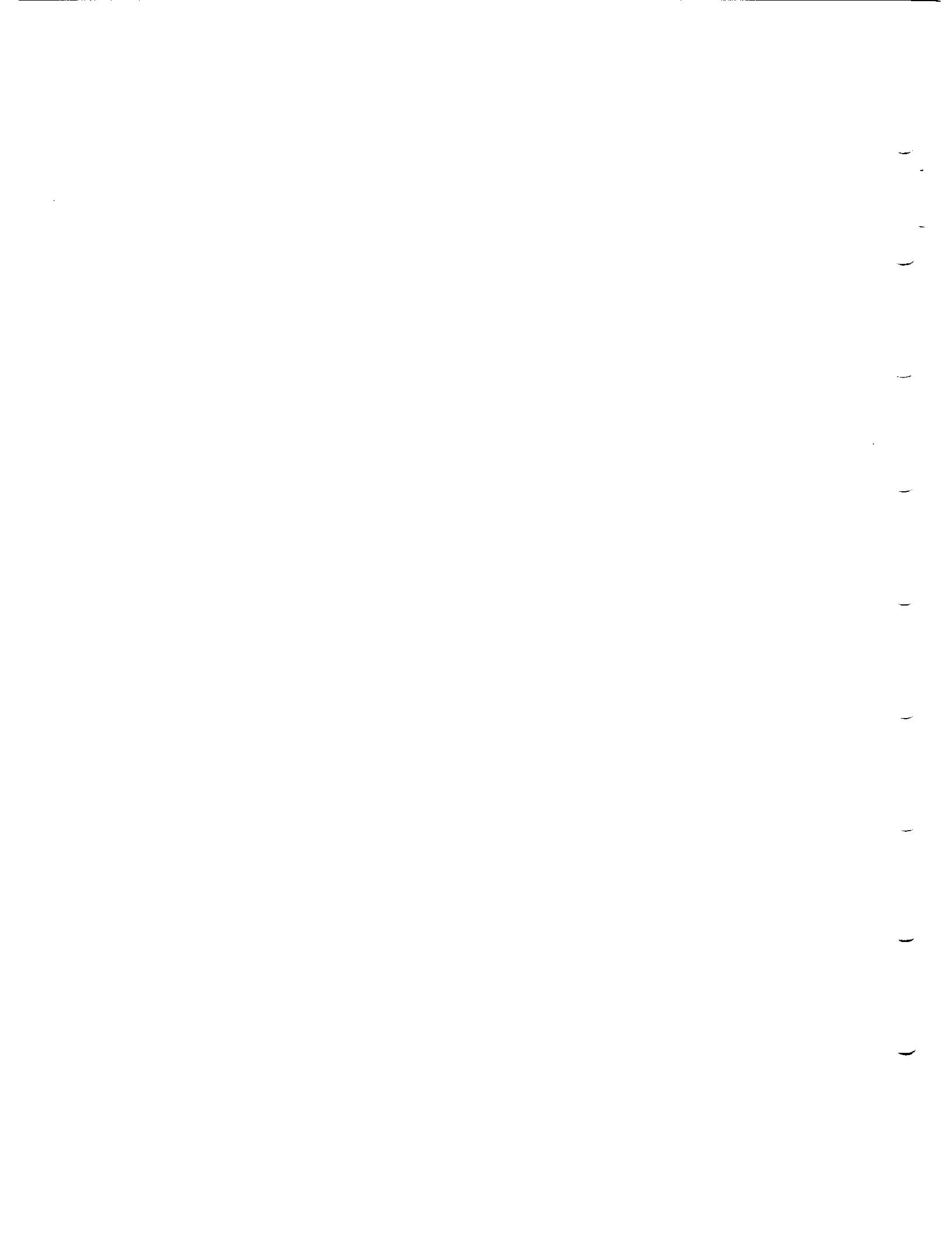
HAWAIIAN

3900. Honolulu, Oahu (NPM).

HOURS OF TRANSMISSION:

0555-0600	FREQ.:	131.05, 4525, 9050, 13655,
1155-1200		16457.5, 20575 kc., A1.
1755-1800		
2355-2400		

REMARKS: Second-order time signals; normally correct to less than 0.5 second, having generally a constant lag.



Chapter 4 RADIO NAVIGATIONAL WARNINGS

400. GENERAL

In general, radio broadcasts of navigational warnings contain information of importance to the safety of navigation, such as the position of ice and derelicts, defects and changes to aids to navigation, and mine fields. As a general rule, each nation broadcasts only such navigational warnings as affect its own coasts.

Section 500 contains pertinent extracts from international agreements concerning the broadcasting of these warnings.

EMERGENCY BROADCASTS BY COASTAL STATIONS: When information is received relative to imminent dangers to navigation, emergency broadcasts are normally made by coastal stations on 500 kc. immediately on receipt of the information and at the end of the first silent period thereafter. They are preceded by the safety signal (TTT). (See secs. 500A,B,C,D, E,F,G, and H for additional details.)

INFORMATION ON REQUEST: Provisions are made by some countries whereby ships may obtain navigational warnings on request. In the majority of cases this information is a repetition of scheduled broadcasts.

400A. Mercast System

A broadcast system, known as MERCAST is used for the delivery of official Government messages originated by Government agencies addressed to Government-owned, leased, or chartered merchant ships. Complete information about the MERCAST system is given in Chapter 10 of this publication, EMERGENCY PROCEDURES AND COMMUNICATION INSTRUCTIONS FOR U.S. MERCHANT SHIPS.

Masters and Radio Officers are urged to become familiar with the instructions contained in this Chapter in order to receive maximum protection from U.S. Naval Forces.

400A5. Hydrographic Information Broadcasts

HYDROLANTS: Information relating to the Atlantic Ocean, Gulf of Mexico and Caribbean Sea is broadcast from Naval Radio Washington (NSS) and other U.S. Navy and Coast Guard Stations in a series numbered consecutively on an annual basis. (See Chartlet, Page 4-2).

HYDROLANTS are navigational warnings for deficiencies or changes in aids to navigation, drifting menaces to navigation, firing and operational exercises involving pyrotechnics or are otherwise dangerous to nonparticipating vessels, and other information of an urgent nature affecting safe navigation. HYDROLANTS remain in force until sufficiently promulgated

or are canceled by the termination of the danger involved.

All HYDROLANTS are published in the East Coast Edition of the *Daily Memorandum* and in the *Weekly Notice to Mariners*, Section II. Pertinent HYDROLANTS are published in the *Canal Zone Summary of HYDROLANTS*.

HYDROPACS: Information relating to the Pacific Ocean is originated by the U.S. Naval Oceanographic Office, Washington, D.C., and broadcast from U.S. Navy and Coast Guard Radio Stations in the Pacific in a series numbered consecutively on an annual basis (See Chartlet, Page 4-3). These messages are similar to HYDROLANTS.

All HYDROPACS are published in the Pacific Edition of the *Daily Memorandum* and in the *Weekly Notice to Mariners*, Section II. Pertinent HYDROPACS are published in the Far East and West Coast Editions of the *Daily Memorandum*, and in the *Canal Zone Summary of HYDROPACS*.

A weekly list of messages in force of HYDROLANTS and HYDROPACS is broadcast.

SPECIAL WARNINGS: A limited series broadcast by all U.S. Navy and Coast Guard Radio Stations primarily for the dissemination of official government proclamations affecting shipping.

SPECIAL WARNINGS are published in all editions of the *Daily Memorandum*, in the *Canal Zone Summaries of Effective Hydrolants and Hydropacs*, in the *Weekly Notice to Mariners*, and in the *Special Notice to Mariners*.

Masters are urged to provide themselves with these publications so that they may have an accurate list of these messages and their status prior to sailing.

The attention of Masters is invited to the necessity for making arrangements to insure that all radio messages received concerning navigational warnings or other matters relating to safety of life at sea are brought to their notice immediately on receipt, or to that of the navigating officer on watch at the time.

NAVEAMS: Information relating to the eastern Atlantic and Mediterranean Waters. They are broadcast from Portishead Radio and are rebroadcast by Halifax and are numbered consecutively. Important NAVEAMS are selected by "NAVOCEANO" Washington for rebroadcast on NSS.

All NAVEAMS are printed in the East Coast Edition of the *Daily Memorandum* and in the weekly issue of *Notice to Mariners*, Section II. Masters are urged to provide themselves with these publications so that they may have an accurate list of these messages and their status prior to sailing.