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NOAA Technical Memorandum ERL RFC-12



AN EMPIRICAL STUDY OF HF AIR TO GROUND COMMUNICATIONS AT THE
RESEARCH FACILITIES CENTER BASED ON RADIO LOGS: 1973-1982

Francis J. Merceret

Research Facilities Center
Miami, Florida
May 1983

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AN EMPIRICAL STUDY OF HF AIR TO GROUND COMMUNICATIONS AT THE RESEARCH
FACILITIES CENTER BASED ON RADIO LOGS: 1973-1982

Francis J. Merceret
National Oceanic and Atmospheric Administration
Research Facilities Center
P.O. Box 520197
Miami, Florida 33152

ABSTRACT. Radio logs documenting HF air to ground radio transmissions between the RFC and its aircraft are examined for frequency usage. A wide range of frequencies is necessary to maintain reliable communications. Certain frequencies are shown to be more useful than others at certain ranges and times of day. Details are given.

1. INTRODUCTION

The Research Facilities Center (RFC) is one of the Environmental Research Laboratories of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. Its special mission is to provide instrumented long-range aircraft for the collection of atmospheric and oceanographic measurements in support of scientific research programs and hurricane reconnaissance. The RFC presently operates two WP3D Orion aircraft (Figure 1). During the period of this study, C-130 and DC-6 type aircraft were also operated, but these were retired in 1982 and 1975, respectively.

Research and reconnaissance missions typically involve up to ten hours of flight time at distances up to more than a thousand nautical miles from the base of operations and may be conducted many thousand miles from the permanent home station in Miami, Florida. During some scientific programs and during all hurricane reconnaissance activities it is necessary for the air crews and on-board scientists to talk with operational and scientific personnel on the ground. While air-traffic control communications and scheduled RECCO and VORTEX messages may usually be transmitted through civilian and military facilities established for these purposes, the scientific and special operational communications require RFC to have its own dedicated air to ground radio capability. This capability is also used as a back-up for RECCO and VORTEX communications. Accordingly, the RFC is authorized by the Inter-departmental Radio Advisory Committee of the National Telecommunications and Information Administration, U.S. Department of Commerce to operate a radio station in the Aeronautical Mobile Service. The assigned call sign is KJY-74, the authorized station location is Miami International Airport, Miami, Florida, and the authorized HF carrier frequencies during the period covered by this report were: 4668, 6645, 8962, 11396, 13260 and 17901 KHz, upper sideband (A3J).

Equipment used on the aircraft and at KJY-74 has varied through the period of the study but has always consisted of a single sideband transceiver in the 400 watt power output class with a wire antenna on the aircraft and until 1982, a wire antenna on the ground. In 1982 a log periodic antenna with

a gain of 8-13 dBi was placed in service at KJY-74 (Figure 2). Phone patch capability is available. The present station at KJY-74 is shown in Figure 3.

The purpose of this study is to examine RFC's usage of its HF communications facilities as documented in its radio log sheets. Through this examination it may be determined which of the assigned frequencies are most useful under a variety of circumstances. Guidance may be obtained for both RFC radio operators and those requesting future frequency allocations for the organization. Only communications between RFC aircraft and the ground station KJY-74 at Miami are considered.

2. DESCRIPTION OF THE DATA SET AND ITS STRATIFICATION

The RFC maintains log sheets documenting its radio communications on major projects (Figure 4). While there is no legal or administrative requirement for such logging, it provides a convenient record of radio usage. The logs for the years 1972 through 1983 were collected from our files and the following data extracted from each log:

- Year
- Date
- Time of beginning of operation on each frequency
- Time of ending of operation on each frequency
- Frequency
- Aircraft position (converted to range)
- Type of operation (hurricane or non-hurricane)

The data were placed in a computer file so that they could be sorted, stratified, combined and examined conveniently. The complete data set is appended as Appendix A.

The data set is necessarily incomplete since not all operations are logged, and over the last decade some of the logs have been misplaced or discarded (e.g., the 1975 hurricane operations). Nonetheless, the data well represent RFC's major operations and usage and encompass the major part of mission-significant communications from KJY-74. The accuracy of the data depends on the diligence of the radio operator. Over the decade covered here, nine RFC radio operators generated logs: S. Calvert, A. Clark, R. DeVivo, B. Fennell, W. Freedman, W. Mallinger, J. McFadden, F. Merceret, and H. T. Nunn. A careful and detailed examination of these logs during the data extraction process revealed no significant difference in accuracy among these operators despite considerable difference in logging style. Times appear to be accurate within three minutes, positions within ten nautical miles, and the other data (date, frequency, and mission) are recorded without apparent error.

Two stratifications are used in examining the information. The first separates hurricane operations from other operations. Hurricane operations are unique in that they involve the safety of life and property and require immediate reliable communications not merely for convenience, but frequently for mission critical requirements. The second stratification divides the data into range groupings. Local operations (within 200 nautical miles) overlap VHF radio coverage at higher altitudes but require HF radio when low altitude missions are flown. Short range operations (between 201 and 500 nautical

miles) account for 34% of all operations beyond 200 nautical miles and at this distance reliable communication is expected more than 90% of the time. Medium range operations (between 501 and 1000 nautical miles) account for 45% of communications beyond 200 nautical miles. In this region reliable communication is usually achieved, but ionospheric conditions require careful attention to frequency selection and monitoring. Long range operations (beyond 1000 nautical miles) account for 21% of communications beyond the local area. Reliable communication is frequently achieved but cannot be expected in all cases. Ionospheric conditions play a dominant role at this range. Figure 5 shows the range circles centered on KJY-74 for these categories.

3. ANALYSIS AND RESULTS

3.1 Frequency Usage as a Function of Range

The first question which comes to mind is "which frequencies, if any, are the predominant working frequencies overall?" Table 1 presents frequency usage for hurricane and non-hurricane operations for the whole data set and yearly. The individual entries for each frequency are in percent of the total hours for each operations category. The totals shown are in minutes. Overall, two frequencies seem to predominate: 6645 and 13260. This remains true for the hurricane operations taken separately and is nearly true for other operations, although 4668 plays a significant role there as well. The annual breakdowns shown that this pattern is relatively stable from year to year, but there are significant deviations from it.

When the effect of range is considered, things change drastically. Table 2 shows frequency usage in the local area. Here 6645 and 4668 dominate. This pattern is generally stable except for the increasing use of higher frequencies in recent years for non-hurricane operations. This is probably a simple matter of preference by the more recent operators, since there is no particular technical reason for it.

For short range communications, Table 3 shows that 6645 and 8962 are the frequencies of choice. The data in this range are somewhat sparse and the stability of this pattern will not be assessed.

In the intermediate range the use of frequencies is more even as shown in Table 4. There is a clear preference for 13260, but 6645, 8962 and 11396 carry about an even share of the remaining workload. This pattern has proved stable for both hurricane and non-hurricane operations.

Long-range operations use the highest frequencies. Table 5 indicates that 13260 is the principal frequency and 17901 carries most of the remainder. Surprisingly, 6645 also carries significant traffic even at these long distances although the use of this frequency has not been as extensive in recent years as it was in the mid-1970's. The declining solar cycle may cause a return to the earlier pattern again in the mid-1980's.

The overall usage of frequencies as a function of range is summarized in Table 6.

Table 1. Summary of Frequency Usage - All Range Bins

Frequency	All Years	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
<u>Non-Hurricane Operations:</u>											
4668	21	63	0	0	0	0	0	0	0	0	0
6645	39	24	82	42	81	34	45	24	0	9	0
8962	10	0	0	0	0	12	24	40	52	0	0
11396	6	0	0	4	0	5	4	35	0	0	0
13260	22	13	18	54	19	38	16	0	48	91	0
17901	2	0	0	0	0	11	1	0	0	0	0
Total	36215	11930	825	1545	4080	7315	8250	1445	495	330	0
<u>Hurricane Operations:</u>											
4668	6	0	0	0	0	12	0	26	2	0	0
6645	29	0	0	0	2	14	9	41	4	56	22
8962	16	0	0	0	0	1	63	33	7	17	10
11396	12	0	0	0	0	66	29	0	20	2	7
13260	33	100	0	0	98	8	0	0	64	19	47
17901	5	0	0	0	0	0	0	0	3	6	14
Total	32454	180	0*	0**	2415	2840	1050	5475	5454	9205	5835
<u>All Operations:</u>											
4668	14	62	0	0	0	3	0	21	2	0	0
6645	34	24	82	42	52	29	41	37	3	55	22
8962	13	0	0	0	0	9	28	35	10	16	10
11396	9	0	0	4	0	22	15	7	18	2	7
13260	27	14	18	54	48	30	15	0	63	21	47
17901	3	0	0	0	0	8	0	0	3	6	14
Total	68669	12110	825	1545	6495	10155	9300	6920	5949	9535	5835

*No hurricane operations in 1974 due to RFC participation in the GATE experiment in North Africa.

**Hurricane operations were undertaken but logs are not available.

Table 2. Summary of Frequency Usage - Range Bin < 200 Miles

Frequency	All Years	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
<u>Non-Hurricane Operations:</u>											
4668	32	64	0	0	0	0	0	0	0	0	0
6645	43	23	82	100	86	93	54	0	0	9	0
8962	8	0	0	0	0	0	23	100	52	0	0
11396	4	0	0	0	0	7	14	0	0	0	0
13260	13	13	18	0	14	0	0	0	48	91	0
17901	0	0	0	0	0	0	0	0	0	0	0
Total	23320	11795	825	285	2715	1295	5295	285	495	330	0
<u>Hurricane Operations:</u>											
4668	3	0	0	0	0	0	0	44	0	0	0
6645	86	0	0	0	100	100	0	56	71	87	100
8962	5	0	0	0	0	0	0	0	29	5	0
11396	6	0	0	0	0	0	0	0	0	9	0
13260	0	0	0	0	0	0	0	0	0	0	0
17901	0	0	0	0	0	0	0	0	0	0	0
Total	3355	0	0*	0**	60	70	0	240	210	2265	510
<u>All Operations:</u>											
4668	29	64	0	0	0	0	0	20	0	0	0
6645	49	23	82	100	86	93	54	26	21	77	100
8962	7	0	0	0	0	0	23	54	45	4	0
11396	4	0	0	0	0	7	14	0	0	8	0
13260	12	13	18	0	14	0	10	0	34	12	0
17901	0	0	0	0	0	0	0	0	0	0	0
Total	26675	11795	825	285	2775	1365	5295	525	705	2595	510

*No hurricane operations in 1974 due to RFC participation in the GATE experiment in North Africa.

**Hurricane operations were undertaken but logs are not available.

Table 3. Summary of Frequency Usage - Range Bin 201 to 500 Miles

Frequency	All Years	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
<u>Non-Hurricane Operations:</u>											
4668	0	0	0	0	0	0	0	0	0	0	0
6645	67	100	0	0	100	86	36	49	0	0	0
8962	14	0	0	0	0	0	16	42	0	0	0
11396	8	0	0	0	0	3	18	8	0	0	0
13260	12	0	0	0	0	11	29	0	0	0	0
17901	0	0	0	0	0	0	0	0	0	0	0
Total	3095	135	0	0	330	1095	825	710	0	0	0
<u>Hurricane Operations:</u>											
4668	12	0	0	0	0	9	0	26	0	0	0
6645	39	0	0	0	0	0	0	41	0	57	21
8962	25	0	0	0	0	4	0	33	0	26	26
11396	6	0	0	0	0	83	0	0	10	0	0
13260	17	0	0	0	0	4	0	0	90	17	53
17901	0	0	0	0	0	0	0	0	0	0	0
Total	11080	0	0*	0**	0	705	0	5055	945	3805	570
<u>All Operations:</u>											
4668	10	0	0	0	0	3	0	23	0	0	0
6645	45	100	0	0	100	53	36	42	0	57	21
8962	23	0	0	0	0	2	16	34	0	26	26
11396	6	0	0	0	0	34	18	1	10	0	0
13260	16	0	0	0	0	8	29	0	90	17	53
17901	0	0	0	0	0	0	0	0	0	0	0
Total	14175	135	0	0	330	1800	825	5765	945	3805	570

*No hurricane operations in 1974 due to RFC participation in the GATE experiment in North Africa.

**Hurricane operations were undertaken but logs are not available.

Table 4. Summary of Frequency Usage - Range Bin 501 to 1000 Nautical Miles

Frequency	All Years	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
<u>Non-Hurricane Operations:</u>											
4668	0	0	0	0	0	0	0	0	0	0	0
6645	20	0	0	0	53	0	32	0	0	0	0
8962	26	0	0	0	0	34	34	0	0	0	0
11396	12	0	0	13	0	14	14	0	0	0	0
13260	43	0	0	88	47	52	21	0	0	0	0
17901	0	0	0	0	0	0	0	0	0	0	0
Total	4830	0	0	480	645	1830	1875	0	0	0	0
<u>Hurricane Operations:</u>											
4668	3	0	0	0	0	13	0	0	3	0	0
6645	14	0	0	0	0	16	9	0	1	44	21
8962	15	0	0	0	0	0	63	100	7	25	15
11396	21	0	0	0	0	62	29	0	23	1	14
13260	43	100	0	0	100	9	0	0	62	24	41
17901	4	0	0	0	0	0	0	0	4	7	9
Total	14134	180	0*	0**	1410	2065	1050	180	4299	1920	3030
<u>All Operations:</u>											
4668	2	0	0	0	0	7	0	0	3	0	0
6645	15	0	0	0	17	8	24	0	1	44	21
8962	17	0	0	0	0	16	44	100	7	25	15
11396	19	0	0	13	0	39	19	0	23	1	14
13260	43	100	0	88	83	29	13	0	62	24	41
17901	3	0	0	0	0	0	0	0	4	7	9
Total	18964	180	0	480	2055	3895	2925	180	4299	1920	3030

*No hurricane operations in 1974 due to RFC participation in the GATE experiment in North Africa.

**Hurricane operations were undertaken but logs are not available.

Table 5. Summary of Frequency Usage - Range Bin > 1000 Nautical Miles

Frequency	All Years	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
<u>Non-Hurricane Operations:</u>											
4668	0	0	0	0	0	0	0	0	0	0	0
6645	20	0	0	46	69	12	0	0	0	0	0
8962	5	0	0	0	0	8	0	0	0	0	0
11396	9	0	0	0	0	0	0	100	0	0	0
13260	50	0	0	54	31	55	82	0	0	0	0
17901	17	0	0	0	0	24	18	0	0	0	0
Total	4970	0	0	780	390	3095	255	450	0	0	0
<u>Hurricane Operations:</u>											
4668	0	0	0	0	0	0	0	0	0	0	0
6645	5	0	0	0	0	0	0	0	0	17	0
8962	0	0	0	0	0	0	0	0	0	0	0
11396	0	0	0	0	0	0	0	0	0	0	0
13260	71	0	0	0	100	0	0	0	0	51	69
17901	24	0	0	0	0	0	0	0	0	32	31
Total	3885	0	0*	0**	945	0	0	0	0	1215	1725
<u>All Operations:</u>											
4668	0	0	0	0	0	0	0	0	0	0	0
6645	14	0	0	46	20	12	0	0	0	17	0
8962	3	0	0	0	0	8	0	0	0	0	0
11396	5	0	0	0	0	0	0	100	0	0	0
13260	59	0	0	54	80	55	82	0	0	51	69
17901	20	0	0	0	0	25	18	0	0	32	31
Total	8855	0	0	780	1335	3095	255	450	0	1215	1725

*No hurricane operations in 1974 due to RFC participation in the GATE experiment in North Africa.

**Hurricane operations were undertaken but logs are not available.

Table 6. Frequency Usage Summary (Minutes) - Data for 1973-1982 Combined

Frequency	Ranges (Nautical Miles)			
	0-200	201-500	501-1000	> 1000
<u>Non-Hurricane Operations:</u>				
4668	7525	0	0	0
6645	10095	2060	945	990
8962	1755	435	1245	240
11396	825	240	570	450
13260	3120	360	2070	2465
17901	0	0	0	825
Total	23320	3095	4830	4970
Total Minutes = 36215				
<u>Hurricane Operations:</u>				
4668	105	1380	395	0
6645	2890	4365	1930	210
8962	165	2820	2069	0
11396	195	675	3035	0
13260	0	1840	6105	2745
17901	0	0	600	930
Total	3355	11080	14134	3885
Total Minutes = 32454				
<u>All Operations:</u>				
4668	7630	1380	395	0
6645	12985	6425	2875	1200
8962	1920	3255	3314	240
11396	1020	915	3605	450
13260	3120	2200	8175	5210
17901	0	0	600	1755
Total	26675	14175	18964	8855
Total Minutes = 68669				

3.2 Frequency Usage as a Function of Time of Day

The optimum frequency for working any particular distance varies with time of day due to the effect of the sun's radiation on the ionosphere. This is reflected in the RFC radio logs. The logs are maintained in Universal Time (GMT or "Z" time) which is used throughout this report. Local standard time at KJY-74 is five hours earlier than GMT. Appendix B contains hour by hour totals of frequency usage stratified by range and type of operation. In general, the stratification by type of operation does not result in major differences.

The local data show 6645 to be the frequency of choice at all times of day except for 2100-2300 Z for which 4668 is preferred. As may be expected, there is a broad range of usable frequencies at this range but minimization of interference to and by other users of the frequencies suggests limiting daytime operations to the lowest frequency providing good solid signals.

The short range data show that 6645 is preferred between 0200 and 1700 Z, 8962 from 1900 to 0200 Z and 13260 from 1700 to 1900. Here again, a wide range of usable frequencies is available during much of the day and some consideration should be given to interference problems.

In the intermediate range from 501 to 1000 nautical miles, a more marked diurnal pattern appears. 6645 and 8962 are clearly the frequencies of choice between 0000 and 1200 Z while 11396 and 13260 are used extensively between 1400 and 2200. The periods 1200 to 1400 and 2200 to 2400 are transition periods with all frequencies between 6645 and 13260 being used. In this range and the long range, the ionosphere is a much stronger factor than operator preference in selecting a frequency than at shorter ranges.

The long range data show 13260 to be distinctly the frequency of choice between 1300 and 0500 Z. 17901 is useful between about 1500 and 2200 Z. 6645 has been used even during the daylight hours, but is the frequency of choice at this range only between 1000 and 1300 Z. No data are available between 0500 and 1000 Z.

These results are summarized and extended in Table 7. They compare favorably with recommendations published in the Flight Information Handbook published quarterly by the Defense Mapping Agency except that at close range (less than 750 nautical miles) we use slightly higher frequencies than they recommend. This is largely due to the environment in which we operate. Our severe weather flying places us in a heavy atmospheric static regime which is worse at low frequencies, so we often use the next higher frequency from that we would use under quieter conditions.

4. CONCLUSIONS

The RFC HF radio logs from station KJY-74 represent more than 1140 hours of air to ground communication spread over a decade at all hours of the day at distances from a few miles to a few thousand miles. The results show that for reliable communications to be dependably maintained, a wide selection of frequencies is required. Frequencies from 4-7 MHz are especially important at close range and at night while frequencies from 11 to 18 MHz are essential for

Table 7. Most Useful Frequencies (MHz) Based on Past Usage

Time of Day (Z)	Ranges (Nautical Miles)			
	<u>≤</u> 200	201-500	501-1000	> 1000
2300 - 0500	6-12	6-10	6-10	11-18
0500 - 1100	6-12	4-7	4-12	8-14
1100 - 1700	4-7	4-10	6-14	10-18
1700 - 2300	4-7	6-14	8-18	12-18

daytime communications beyond 500 nautical miles. Frequencies in the 6 and 13 MHz bands are especially useful. Table 7 may be used as guidance for selection of initial contact frequencies if desired.

POSTSCRIPT

Effective beginning 1 February 1983, the RFC/KJY-74 frequency assignments were replaced by the following: 3407, 5562, 6673, 8876, 10015, 13354, 17901 and 21937 KHz.

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APPENDIX A: The Data

Set No.	Year	Date	Time On (Z)	Time Off (Z)	Time (Min.)	Frequency (KHz)	Range* (N. Mi.)	Hurricane?
1	1973	19 Oct	1200	1415	135	6645	210	---
2	1973	15 Oct	1400	1600	120	13260	200	---
3	1973	5 Oct	1300	2000	420	13260	200	---
4	1973	2 Oct	1300	2200	540	13260	200	---
5	1973	12 Sep	1630	2230	360	4668	200	---
6	1973	10 Sep	1630	2230	360	4668	200	---
7	1973	9 Sep	1700	2200	300	4668	200	---
8	1973	3 Sep	1600	1900	180	13260	578	Hurricane
9	1973	31 Aug	1300	1415	75	4668	200	---
10	1973	28 Aug	1700	2300	360	4668	200	---
11	1973	27 Aug	1630	2030	240	4668	200	---
12	1973	25 Aug	1630	2215	345	4668	200	---
13	1973	23 Aug	1630	1945	195	4668	200	---
14	1973	22 Aug	1900	2330	270	4668	200	---
15	1973	22 Aug	1700	1900	120	6645	200	---
16	1973	17 Aug	1700	2000	180	6645	200	---
17	1973	16 Aug	1630	1900	150	6645	200	---
18	1973	14 Aug	1630	1715	45	6645	200	---
19	1973	13 Aug	1630	2130	300	4668	200	---
20	1973	12 Aug	1500	2100	360	4668	200	---
21	1973	8 Aug	1630	2200	330	4668	200	---
22	1973	5 Aug	1500	2230	450	6645	200	---
23	1973	7 Aug	1700	1900	120	4668	200	---
24	1973	4 Aug	1530	2100	330	6645	200	---
25	1973	2 Aug	1500	2130	390	4668	200	---
26	1973	30 Jly	1645	1645	300	4668	200	---
27	1973	26 Jly	1445	1645	120	4668	200	---
28	1973	26 Jly	1715	2000	165	6645	200	---
29	1973	29 Jly	1500	2130	390	6645	200	---
30	1973	25 Jly	1700	2300	360	4668	200	---
31	1973	20 Jly	1430	2330	540	4668	200	---
32	1973	24 Jly	1445	2215	450	4668	200	---
33	1977	1 Sep	2150	2220	30	13260	260	Hurricane
34	1977	1 Sep	2345	2415	30	6645	660	Hurricane
35	1977	2 Sep	0300	0735	275	4668	840	Hurricane
36	1977	20 Sep	1800	1830	30	11396	745	---
37	1977	20 Sep	2245	2300	15	13260	965	---
38	1977	22 Sep	1425	1445	20	13260	1170	---
39	1977	22 Sep	1600	2100	300	17901	1170	---
40	1976	8 Aug	1430	1630	120	6645	340	---
41	1976	19 Jly	1630	1900	150	6645	1485	---
42	1976	19 Jly	1900	2000	60	13260	1485	---
43	1976	19 Jly	2000	2200	120	6645	1485	---
44	1976	29 Jun	1900	2000	60	13260	1220	Hurricane
45	1976	10 Jun	1800	1900	60	6645	200	Hurricane
46	1976	10 Jun	2000	2030	30	13260	1350	Hurricane
47	1976	30 Sep	1400	2000	360	13260	1305	Hurricane
48	1976	30 Sep	1800	1930	90	13260	885	Hurricane

Set No.	Year	Date	Time On (Z)	Time Off (Z)	Time (Min.)	Frequency (KHz)	Range* (N. Mi.)	Hurricane?
49	1976	28 Sep	1430	1900	270	13260	1100	Hurricane
50	1976	1 Sep	1615	1930	195	13260	670	Hurricane
51	1976	31 Aug	1245	1400	75	13260	1040	Hurricane
52	1976	30 Aug	1600	1830	150	13260	1440	Hurricane
53	1976	25 Aug	1445	1600	75	13260	930	Hurricane
54	1976	24 Aug	1300	1600	180	13260	880	Hurricane
55	1974	17 May	1530	2030	300	6645	200	---
56	1975	7 Feb	1630	2130	300	13260	810	---
57	1975	22 Feb	2030	2230	120	13260	700	---
58	1975	6 Feb	1815	1930	75	6645	200	---
59	1975	6 Feb	2000	2100	60	11396	580	---
60	1975	21 Feb	1515	1645	90	6645	200	---
61	1975	14 Jan	1600	2300	420	13260	1145	---
62	1975	12 Jan	1500	2100	360	6645	1050	---
63	1975	5 Apr	1400	1600	120	6645	200	---
64	1974	19 Apr	1230	1400	90	6645	200	---
65	1974	19 Apr	1400	1630	150	13260	200	---
66	1974	10 May	1515	2000	285	6645	200	---
67	1977	20 Sep	1600	1745	105	6645	200	---
68	1977	20 Sep	1745	1915	90	11396	200	---
69	1977	20 Sep	1915	2300	225	13260	1080	---
70	1977	12 Sep	1920	2105	105	6645	200	---
71	1977	3 Sep	1500	2000	300	11396	470	Hurricane
72	1977	2 Sep	1500	1930	270	11396	630	Hurricane
73	1977	1 Sep	1630	1740	70	6645	200	Hurricane
74	1977	1 Sep	1900	2000	60	11396	740	Hurricane
75	1977	19 Aug	1430	1900	270	6645	290	---
76	1976	12 Aug	1430	2000	330	6645	200	---
77	1977	21 Jly	1100	1800	420	8962	690	---
78	1977	19 Jly	1710	2025	195	8962	955	---
79	1976	4 Mar	1700	2000	180	6645	200	---
80	1977	14 Jan	1600	2100	300	13260	700	---
81	1977	22 Sep	1615	2000	225	13260	1095	---
82	1977	30 Aug	0945	1045	60	4668	255	Hurricane
83	1977	30 Aug	1200	1300	60	6645	540	Hurricane
84	1977	30 Aug	1430	1600	90	11396	560	Hurricane
85	1977	24 Aug	1430	1500	30	8962	245	Hurricane
86	1977	24 Aug	1600	2045	285	11396	500	Hurricane
87	1977	1 Mar	1400	1600	120	13260	1070	---
88	1977	25 Feb	1100	1345	165	6645	490	---
89	1977	25 Feb	1345	1615	150	13260	935	---
90	1977	28 Feb	1300	1400	60	13260	1075	---
91	1977	28 Feb	1500	1530	30	17901	1075	---
92	1977	10 Mar	1300	1500	120	13260	1000	---
93	1977	7 Mar	1300	1530	150	13260	1150	---
94	1977	8 Mar	1300	1600	180	13260	1160	---
95	1977	31 Aug	1330	1400	30	11396	635	Hurricane
96	1977	31 Aug	2010	2030	20	13260	577	Hurricane

Set No.	Year	Date	Time On (Z)	Time Off (Z)	Time (Min.)	Frequency (KHz)	Range* (N. Mi.)	Hurricane?
97	1977	29 Nov	1800	2100	180	17901	3930	---
98	1977	25 Nov	1530	2130	360	6645	1960	---
99	1977	22 Nov	1500	1700	120	13260	500	---
100	1977	22 Nov	1800	1830	30	11396	270	---
101	1977	22 Nov	1830	2000	90	6645	200	---
102	1977	21 Nov	1800	2130	210	13260	1005	---
103	1977	20 Nov	1800	2030	150	13260	1010	---
104	1977	18 Nov	1530	1945	255	6645	200	---
105	1977	16 Nov	1900	2100	120	13260	1100	---
106	1977	13 Nov	1415	1545	90	6645	305	---
107	1977	13 Oct	1845	2030	105	11396	625	---
108	1977	13 Oct	1300	1430	90	6645	240	---
109	1977	13 Oct	1430	1630	120	11396	600	---
110	1977	6 Oct	1945	2030	45	13260	1315	---
111	1977	5 Oct	1400	1800	240	8962	1120	---
112	1977	5 Oct	1945	2030	45	13260	1310	---
113	1977	3 Oct	1930	2000	30	6645	200	---
114	1977	31 Aug	1300	1800	300	11396	605	Hurricane
115	1977	31 Aug	1800	2045	165	13260	605	Hurricane
116	1977	31 Aug	2045	2200	75	11396	605	Hurricane
117	1977	30 Aug	0950	1135	105	6645	575	Hurricane
118	1977	30 Aug	1135	1205	30	11396	575	Hurricane
119	1977	30 Aug	1205	1415	130	6645	575	Hurricane
120	1977	30 Aug	1425	2130	425	11396	575	Hurricane
121	1977	22 Aug	1225	1845	380	6645	200	---
122	1977	26 Oct	1400	1930	330	6645	290	---
123	1977	31 Oct	1730	2130	240	6645	200	---
124	1977	22 Sep	1330	1945	375	13260	830	---
125	1977	21 Sep	1330	1615	165	13260	1200	---
126	1977	21 Sep	1615	2045	270	17901	1200	---
127	1978	23 Aug	1500	1600	60	6645	200	---
128	1978	23 Aug	1600	2000	240	8962	200	---
129	1978	22 Aug	1415	1500	45	8962	200	---
130	1978	22 Aug	1500	1600	60	11396	200	---
131	1978	21 Aug	1415	1500	45	6645	200	---
132	1978	21 Aug	1500	1800	180	13260	200	---
133	1978	21 Aug	1800	2000	120	8962	200	---
134	1978	14 Aug	1430	1815	225	11396	200	---
135	1978	13 Aug	1415	1500	45	6645	200	---
136	1978	13 Aug	1700	1800	60	11396	200	---
137	1978	11 Aug	1700	2030	210	6645	200	---
138	1978	10 Aug	1800	1900	60	11396	200	---
139	1978	8 Aug	1330	1600	150	6645	200	---
140	1978	7 Aug	1630	1730	60	6645	200	---
141	1978	7 Aug	1730	2030	180	13260	200	---
142	1978	3 Aug	1715	2030	195	6645	200	---
143	1978	28 Jly	1500	1600	60	6645	770	---

Set No.	Year	Date	Time On (Z)	Time Off (Z)	Time (Min.)	Frequency (KHz)	Range* (N. Mi.)	Hurricane?
144	1978	28 Jly	1700	2000	180	13260	770	---
145	1978	27 Jly	1500	1600	60	6645	200	---
146	1978	27 Jly	2000	2100	60	6645	200	---
147	1978	27 Jly	1700	1900	120	13260	850	---
148	1978	26 Jly	1430	2030	360	6645	200	---
149	1978	30 May	1430	2300	510	6645	200	---
150	1978	22 May	0715	1445	450	6645	200	---
151	1978	22 May	1445	1715	150	13260	200	---
152	1978	22 May	1715	1815	60	6645	200	---
153	1978	2 May	1600	1700	60	6645	700	---
154	1978	2 May	1700	1830	90	13260	700	---
155	1978	8 Apr	1500	1900	240	13260	280	---
156	1978	8 Apr	1900	2045	105	6645	280	---
157	1978	7 Apr	1515	2045	330	6645	575	---
158	1978	3 Apr	1500	1800	180	6645	200	---
159	1978	29 Mar	1830	1930	60	6645	200	---
160	1980	7 Aug	1730	2130	240	13260	385	Hurricane
161	1980	5 Aug	1026	1100	34	8962	785	Hurricane
162	1980	5 Aug	1245	1915	390	13260	780	Hurricane
163	1980	6 Aug	2100	2300	120	13260	425	Hurricane
164	1980	7 Aug	0000	0030	30	6645	200	Hurricane
165	1979	11 Sep	1015	1800	465	6645	255	Hurricane
166	1979	14 Sep	1615	1715	60	6645	390	Hurricane
167	1979	14 Sep	1715	2545	510	8962	330	Hurricane
168	1979	13 Sep	0630	0900	150	6645	455	Hurricane
169	1979	13 Sep	1135	2535	840	4668	265	Hurricane
170	1976	29 Oct	1700	1900	120	6645	200	---
171	1976	14 Oct	1800	2000	120	13260	200	---
172	1976	15 Oct	1600	1900	180	13260	200	---
173	1976	23 Sep	2100	2400	180	6645	200	---
174	1976	11 Sep	1515	1700	105	6645	200	---
175	1976	24 Aug	1300	1930	390	13260	890	Hurricane
176	1976	25 Aug	1200	2000	480	13260	905	Hurricane
177	1976	12 Aug	1900	2100	120	6645	200	---
178	1976	12 Aug	1150	1235	45	6645	200	---
179	1976	12 Aug	1615	1730	75	13260	200	---
180	1976	1 Jun	1545	1830	165	6645	200	---
181	1976	15 Jun	1530	1845	196	6645	200	---
182	1976	14 Jun	0000	0545	345	6645	525	---
183	1976	6 Jun	1645	1945	180	6645	200	---
184	1976	10 Jun	2315	2645	210	6645	345	---
185	1976	7 Jun	1600	2100	300	6645	200	---
186	1976	21 May	1830	2000	90	6645	200	---
187	1976	14 Apr	1700	1915	135	6645	200	---
188	1976	24 Mar	1745	2030	165	6645	200	---
189	1976	21 Jan	1930	2030	60	13260	1870	---
190	1976	8 Jan	1915	1945	30	6645	200	---
191	1976	15 Oct	1600	2100	300	13260	820	---

Set No.	Year	Date	Time On (Z)	Time Off (Z)	Time (Min.)	Frequency (KHz)	Range* (N. Mi.)	Hurricane?
192	1979	14 Sep	1330	1515	105	4668	200	Hurricane
193	1979	14 Sep	1515	1730	135	6645	200	Hurricane
194	1979	14 Sep	1730	2030	180	8962	510	Hurricane
195	1979	13 Sep	0430	1030	360	6645	480	Hurricane
196	1979	13 Sep	1030	1330	180	4668	480	Hurricane
197	1979	13 Sep	0000	0430	270	8962	480	Hurricane
198	1979	12 Sep	1900	2400	300	8962	365	Hurricane
199	1979	12 Sep	1400	1900	300	6645	365	Hurricane
200	1979	12 Sep	0900	1400	300	4668	365	Hurricane
201	1979	12 Sep	0200	0900	420	6645	365	Hurricane
202	1979	12 Sep	0000	0200	120	8962	365	Hurricane
203	1979	11 Sep	1630	2400	450	8962	260	Hurricane
204	1979	11 Sep	1100	1630	330	6645	260	Hurricane
205	1978	28 Sep	1200	1430	150	6645	640	---
206	1978	28 Sep	1500	2030	330	8962	604	---
207	1978	19 Sep	1400	1545	105	6645	325	---
208	1978	19 Sep	1600	1815	135	8962	325	---
209	1978	19 Sep	1815	2230	255	11396	655	---
210	1978	18 Sep	1130	1300	90	6645	380	---
211	1978	18 Sep	1300	1800	300	8962	670	---
212	1978	18 Sep	1800	2030	150	11396	380	---
213	1978	16 Sep	2130	2200	30	6645	590	Hurricane
214	1978	16 Sep	2200	2900	420	8962	590	Hurricane
215	1978	12 Sep	1500	2030	330	8962	200	---
216	1978	11 Sep	1400	1530	90	6645	200	---
217	1978	11 Sep	1530	1930	240	8962	200	---
218	1978	7 Sep	1600	1800	120	6645	200	---
219	1978	7 Sep	1800	1900	60	8962	200	---
220	1978	7 Sep	1900	2030	90	11396	200	---
221	1978	3 Sep	1230	1330	60	6645	655	Hurricane
222	1978	3 Sep	1330	1730	240	8962	655	Hurricane
223	1978	3 Sep	1730	2230	330	11396	655	Hurricane
224	1978	28 Aug	1600	1700	60	6645	200	---
225	1978	28 Aug	1700	2000	180	8962	200	---
226	1978	24 Aug	1400	1500	60	6645	200	---
227	1978	24 Aug	1500	1900	240	11396	200	---
228	1973	17 Jly	1535	2015	280	6645	200	---
229	1973	17 Jly	2125	2300	95	4668	200	---
230	1973	19 Jly	1925	2245	200	4668	200	---
231	1973	16 Jly	1645	1730	45	6645	200	---
232	1973	16 Jly	1730	2215	285	4668	200	---
233	1973	15 Jly	1530	2030	300	6645	200	---
234	1973	15 Jly	1600	1630	30	4668	200	---
235	1973	15 Jly	1630	2100	270	6645	200	---
236	1973	11 Jly	1215	2000	465	13260	200	---
237	1973	9 Jly	1700	2045	225	4668	200	---
238	1973	7 Jly	1645	2215	330	4668	200	---
239	1973	6 Jly	1645	1900	135	4668	200	---

Set No.	Year	Date	Time On (Z)	Time Off (Z)	Time (Min.)	Frequency (KHz)	Range* (N. Mi.)	Hurricane?
240	1973	5 Jly	1700	2200	300	4668	200	---
241	1973	2 Jly	1700	1930	150	4668	200	---
242	1980	8 Aug	1545	2435	530	13260	610	Hurricane
243	1980	7 Aug	1530	2230	420	13260	390	Hurricane
244	1980	7 Aug	2300	2415	75	6645	200	Hurricane
245	1980	6 Aug	1330	2230	540	13260	905	Hurricane
246	1980	6 Aug	2230	2400	90	11396	335	Hurricane
247	1980	5 Aug	0930	1030	60	8962	200	Hurricane
248	1980	5 Aug	1100	1900	480	13260	905	Hurricane
249	1980	4 Aug	1815	1930	75	13260	335	Hurricane
250	1980	1 Aug	1300	1600	180	8962	200	---
251	1980	1 Aug	1600	2000	240	13260	200	---
252	1980	1 Aug	2000	2115	75	8962	200	---
253	1979	1 Nov	1330	2100	450	11396	1045	---
254	1979	17 Oct	1120	4140	200	6645	360	---
255	1979	17 Oct	1515	1615	60	11396	360	---
256	1979	16 Oct	1100	1330	150	6645	455	---
257	1979	16 Oct	1330	1830	300	8962	455	---
258	1979	14 oct	2100	2545	285	8962	200	---
259	1978	10 Jan	1800	2130	210	13260	1365	---
260	1978	3 Jan	2015	2100	45	17901	4600	---
261	1980	9 Aug	1545	1915	210	13260	850	Hurricane
262	1980	9 Aug	1915	2215	180	17901	850	Hurricane
263	1980	9 Aug	2215	2400	105	13260	850	Hurricane
264	1980	10 Aug	0100	0845	465	11396	800	Hurricane
265	1980	10 Aug	0845	0930	45	6645	800	Hurricane
266	1980	10 Aug	0930	1030	60	11396	800	Hurricane
267	1980	10 Aug	1030	1100	30	8962	800	Hurricane
268	1980	10 Aug	1100	1600	300	11396	800	Hurricane
269	1980	10 Aug	1600	1700	60	13260	800	Hurricane
270	1980	10 Aug	1700	1730	30	11396	800	Hurricane
271	1980	12 Aug	1400	1630	150	11396	880	Hurricane
272	1980	12 Aug	1630	2030	240	13260	800	Hurricane
273	1980	6 Sep	0645	0745	60	8962	580	Hurricane
274	1980	6 Sep	0745	0945	120	4668	580	Hurricane
275	1980	6 Sep	0945	1245	180	8962	580	Hurricane
276	1980	6 Sep	1245	1415	90	13260	580	Hurricane
277	1980	6 Sep	1600	1645	45	6645	200	Hurricane
278	1981	15 Aug	2215	2400	105	8962	200	Hurricane
279	1981	16 Aug	0000	0315	195	11396	200	Hurricane
280	1981	16 Aug	0315	0800	285	6645	200	Hurricane
281	1981	16 Aug	1345	1815	270	6645	200	Hurricane
282	1981	17 Aug	0000	0945	585	6645	200	Hurricane
283	1981	17 Aug	1000	1930	570	6645	200	Hurricane
284	1981	17 Aug	0930	1345	255	6645	200	Hurricane
285	1981	4 Sep	1330	1830	300	13260	200	---
286	1981	4 Sep	2000	2030	30	6645	200	---
287	1981	7 Sep	1000	1345	225	6645	610	Hurricane

Set No.	Year	Date	Time On (Z)	Time Off (Z)	Time (Min.)	Frequency (KHz)	Range* (N. Mi.)	Hurricane?
288	1981	7 Sep	1345	1515	90	8962	610	Hurricane
289	1981	7 Sep	1515	1600	45	13260	610	Hurricane
290	1981	7 Sep	1600	1815	135	17901	610	Hurricane
291	1981	7 Sep	1815	1945	90	13260	610	Hurricane
292	1981	10 Sep	1100	1300	120	6645	345	Hurricane
293	181	10 Sep	1300	2400	660	8962	345	Hurricane
294	1981	11 Sep	0000	0400	240	8962	340	Hurricane
295	1981	11 Sep	0400	1415	615	6645	340	Hurricane
296	1981	11 Sep	1415	1545	90	8962	340	Hurricane
297	1981	11 Sep	1600	1615	15	11396	600	Hurricane
298	1981	11 Sep	1615	2135	320	13260	600	Hurricane
299	1981	11 Sep	2135	2400	145	8962	600	Hurricane
300	1981	12 Sep	0010	0410	240	8962	625	Hurricane
301	1981	12 Sep	0415	1430	615	6645	625	Hurricane
302	1981	25 Sep	1540	1930	230	13260	370	Hurricane
303	1981	26 Sep	1045	1315	150	6645	1270	Hurricane
304	1981	26 Sep	1315	1430	75	13260	1270	Hurricane
305	1981	26 Sep	1430	2100	390	17901	1270	Hurricane
306	1981	27 Sep	1145	1245	60	6645	1270	Hurricane
307	1981	27 Sep	1245	2145	540	13260	1270	Hurricane
308	1981	29 Sep	1635	1910	155	13260	370	Hurricane
309	1981	5 Nov	0930	1430	300	6645	410	Hurricane
310	1981	5 Nov	1430	1900	270	13260	410	Hurricane
311	1981	5 Nov	2100	2400	180	6645	315	Hurricane
312	1981	6 Nov	0000	0715	435	6645	315	Hurricane
313	1981	6 Nov	1040	1910	510	6645	300	Hurricane
314	1982	4 Jun	0230	1100	510	6645	200	Hurricane
315	1982	24 Sep	1815	1900	45	13260	2755	Hurricane
316	1982	24 Sep	1900	2215	195	17901	2755	Hurricane
317	1982	24 Sep	2215	2715	300	13260	2755	Hurricane
318	1982	23 Sep	1700	2015	195	13260	2110	Hurricane
319	1982	23 Sep	2015	2200	105	17901	2110	Hurricane
320	1982	23 Sep	2200	2830	390	13260	2110	Hurricane
321	1982	15 Sep	1815	2000	105	13260	990	Hurricane
322	1982	15 Sep	2000	2130	90	8962	990	Hurricane
323	1982	15 Sep	2130	2200	30	13260	990	Hurricane
324	1982	15 Sep	2200	2445	165	17901	990	Hurricane
325	1982	16 Sep	0045	0230	105	6645	990	Hurricane
326	1982	14 Sep	1730	1845	75	13260	785	Hurricane
327	1982	14 Sep	1845	2330	285	11396	785	Hurricane
328	1982	14 Sep	2330	2700	210	6645	785	Hurricane
329	1982	13 Sep	2215	2430	135	8962	510	Hurricane
330	1982	14 Sep	0030	0545	315	6645	510	Hurricane
331	1982	5 Sep	1645	1900	135	13260	670	Hurricane
332	1982	5 Sep	1900	2015	75	8962	385	Hurricane
333	1982	4 Sep	1700	1800	60	13260	905	Hurricane
334	1982	4 Sep	1800	1915	75	8962	905	Hurricane

Set No.	Year	Date	Time On (Z)	Time Off (Z)	Time (Min.)	Frequency (KHz)	Range* (N. Mi.)	Hurricane?
335	1982	4 Sep	1915	2015	60	13260	905	Hurricane
336	1982	24 Aug	1545	2045	300	13260	830	Hurricane
337	1982	24 Aug	2100	2215	75	8962	290	Hurricane
338	1982	22 Aug	2115	2530	255	13260	1590	Hurricane
339	1982	22 Aug	1130	1200	30	11396	905	Hurricane
340	1982	22 Aug	1200	1430	150	8962	905	Hurricane
341	1982	22 Aug	1430	1630	120	11396	905	Hurricane
342	1982	22 Aug	1630	1830	120	17901	905	Hurricane
343	1982	22 Aug	1830	2115	165	13260	905	Hurricane
344	1982	18 Aug	1945	2200	135	13260	370	Hurricane
345	1982	22 Jly	1715	2000	165	13260	370	Hurricane
346	1982	21 Jly	0930	1130	120	6645	370	Hurricane
347	1982	21 Jly	1130	1630	300	13260	890	Hurricane
348	1982	21 Jly	1630	2030	240	17901	1520	Hurricane

*All ranges less than or equal to 200 nautical miles are listed as 200 in the data base.

APPENDIX B: Hourly Listings of Frequency Usage

Frequency Usage Summary for all Ranges Combined. Data for 1973-1982 Combined.

	Non-Hurricane Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	120	60	0	0	0	180
0100-0159	0	120	45	0	0	0	165
0200-0259	0	105	0	0	0	0	105
0300-0359	0	60	0	0	0	0	60
0400-0459	0	60	0	0	0	0	60
0500-0559	0	45	0	0	0	0	45
0600-0659	0	0	0	0	0	0	0
0700-0759	0	45	0	0	0	0	45
0800-0859	0	60	0	0	0	0	60
0900-0959	0	60	0	0	0	0	60
1000-1059	0	60	0	0	0	0	60
1100-1159	0	260	60	0	0	0	320
1200-1259	0	520	60	0	45	0	625
1300-1359	60	525	210	30	525	0	1350
1400-1459	75	865	345	120	815	0	2220
1500-1559	300	1480	450	345	930	30	3535
1600-1659	570	1815	540	225	1020	105	4275
1700-1759	1290	2220	650	255	1095	120	5630
1800-1859	1320	2130	525	435	1200	180	5790
1900-1959	1250	1855	390	315	1170	180	5160
2000-2059	1155	1095	145	270	720	210	3595
2100-2159	980	335	75	60	330	0	1780
2200-2259	465	150	60	30	165	0	870
2300-2359	60	105	60	0	0	0	225

Total Minutes = 36215

Frequency Usage Summary for all Ranges Combined. Data for 1973-1982 Combined.

	Hurricane Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	60	285	380	60	215	45	1045
0100-0159	35	300	345	120	150	0	950
0200-0259	0	360	240	120	120	0	840
0300-0359	60	345	240	75	75	0	795
0400-0459	60	495	100	60	30	0	745
0500-0559	60	525	0	60	0	0	645
0600-0659	60	510	15	60	0	0	645
0700-0759	50	495	45	60	0	0	650
0800-0859	60	435	0	45	0	0	540
0900-0959	120	415	45	30	0	0	610
1000-1059	135	650	154	30	0	0	969
1100-1159	145	740	60	115	90	0	1150
1200-1259	180	850	105	65	240	0	1440
1300-1359	180	630	165	150	615	0	1740
1400-1459	120	450	285	275	660	30	1820
1500-1559	75	405	180	480	860	60	2060
1600-1659	60	510	150	375	1210	180	2485
1700-1759	60	385	225	360	1485	240	2755
1800-1859	60	255	300	315	1785	165	2880
1900-1959	60	40	375	390	1255	225	2345
2000-2059	60	0	345	240	680	255	1580
2100-2159	60	90	355	210	510	180	1405
2200-2259	60	60	465	120	410	90	1205
2300-2359	60	165	480	90	300	60	1155

Total Minutes = 32454

Frequency Usage Summary for all Ranges Combined. Data for 1973-1982 Combined.

	All Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	60	405	440	60	215	45	1225
0100-0159	35	420	390	120	150	0	1115
0200-0259	0	465	240	120	120	0	945
0300-0359	60	405	240	75	75	0	855
0400-0459	60	555	100	60	30	0	805
0500-0559	60	570	0	60	0	0	690
0600-0659	60	510	15	60	0	0	645
0700-0759	50	540	45	60	0	0	695
0800-0859	60	495	0	45	0	0	600
0900-0959	120	475	45	30	0	0	670
1000-1059	135	710	154	30	0	0	1029
1100-1159	145	1000	120	115	90	0	1470
1200-1259	180	1370	165	65	285	0	2065
1300-1359	240	1155	375	180	1140	0	3090
1400-1459	195	1315	630	395	1475	30	4040
1500-1559	375	1885	630	825	1790	90	5595
1600-1659	630	2325	690	600	2230	285	6760
1700-1759	1350	2605	875	615	2580	360	8385
1800-1859	1380	2385	825	750	2985	345	8670
1900-1959	1310	1895	765	705	2425	405	7505
2000-2059	1215	1095	490	510	1400	465	5175
2100-2159	1040	425	430	270	840	180	3185
2200-2259	525	210	525	150	575	90	2075
2300-2359	120	270	540	90	300	60	1380

Total Minutes = 68669

Frequency Usage Summary for Ranges $\leq$ 200 Nautical Miles. Data for 1973-1982 Combined.

	Non-Hurricane Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	0	60	0	0	0	60
0100-0159	0	0	45	0	0	0	45
0200-0259	0	0	0	0	0	0	0
0300-0359	0	0	0	0	0	0	0
0400-0459	0	0	0	0	0	0	0
0500-0559	0	0	0	0	0	0	0
0600-0659	0	0	0	0	0	0	0
0700-0759	0	45	0	0	0	0	45
0800-0859	0	60	0	0	0	0	60
0900-0959	0	60	0	0	0	0	60
1000-1059	0	60	0	0	0	0	60
1100-1159	0	70	0	0	0	0	70
1200-1259	0	160	0	0	45	0	205
1300-1359	60	210	60	0	210	0	540
1400-1459	75	525	105	30	375	0	1110
1500-1559	300	1015	150	180	480	0	2125
1600-1659	570	1395	180	120	555	0	2820
1700-1759	1290	1860	240	195	495	0	4080
1800-1859	1320	1770	360	195	450	0	4095
1900-1959	1250	1585	270	75	360	0	3540
2000-2059	1155	825	90	30	90	0	2190
2100-2159	980	245	75	0	60	0	1360
2200-2259	465	150	60	0	0	0	675
2300-2359	60	60	60	0	0	0	180

Total Minutes = 23320

Frequency Usage Summary for Ranges $\leq$ 200 Nautical Miles. Data for
1973-1982 Combined.

	Hurricane Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	105	0	60	0	0	165
0100-0159	0	60	0	60	0	0	120
0200-0259	0	90	0	60	0	0	150
0300-0359	0	165	0	15	0	0	180
0400-0459	0	180	0	0	0	0	180
0500-0559	0	180	0	0	0	0	180
0600-0659	0	180	0	0	0	0	180
0700-0759	0	180	0	0	0	0	180
0800-0859	0	120	0	0	0	0	120
0900-0959	0	135	30	0	0	0	165
1000-1059	0	180	30	0	0	0	210
1100-1159	0	120	0	0	0	0	120
1200-1259	0	120	0	0	0	0	120
1300-1359	30	120	0	0	0	0	150
1400-1459	60	120	0	0	0	0	180
1500-1559	15	165	0	0	0	0	180
1600-1659	0	255	0	0	0	0	255
1700-1759	0	190	0	0	0	0	190
1800-1859	0	135	0	0	0	0	135
1900-1959	0	30	0	0	0	0	30
2000-2059	0	0	0	0	0	0	0
2100-2159	0	0	0	0	0	0	0
2200-2259	0	0	45	0	0	0	45
2300-2359	0	60	60	0	0	0	120

Total Minutes = 3355

Frequency Usage Summary for Ranges < 200 Nautical Miles. Data for 1973-1982 Combined.

	All Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	105	60	60	0	0	225
0100-0159	0	60	45	60	0	0	165
0200-0259	0	90	0	60	0	0	150
0300-0359	0	165	0	15	0	0	180
0400-0459	0	180	0	0	0	0	180
0500-0559	0	180	0	0	0	0	180
0600-0659	0	180	0	0	0	0	180
0700-0759	0	225	0	0	0	0	225
0800-0859	0	180	0	0	0	0	180
0900-0959	0	195	30	0	0	0	225
1000-1059	0	240	30	0	0	0	270
1100-1159	0	190	0	0	0	0	190
1200-1259	0	280	0	0	45	0	325
1300-1359	90	330	60	0	210	0	690
1400-1459	135	645	105	30	375	0	1290
1500-1559	315	1180	150	180	480	0	2305
1600-1659	570	1650	180	120	555	0	3075
1700-1759	1290	2050	240	195	495	0	4270
1800-1859	1320	1905	360	195	450	0	4230
1900-1959	1250	1615	270	75	360	0	3570
2000-2059	1155	825	90	30	90	0	2190
2100-2159	980	245	75	0	60	0	1360
2200-2259	465	150	105	0	0	0	720
2300-2359	60	120	120	0	0	0	300

Total Minutes = 26675

Frequency Usage Summary for Ranges from 201 to 500 Nautical
Miles. Data for 1973-1982 Combined.

	Non-Hurricane Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	60	0	0	0	0	60
0100-0159	0	60	0	0	0	0	60
0200-0259	0	45	0	0	0	0	45
0300-0359	0	0	0	0	0	0	0
0400-0459	0	0	0	0	0	0	0
0500-0559	0	0	0	0	0	0	0
0600-0659	0	0	0	0	0	0	0
0700-0759	0	0	0	0	0	0	0
0800-0859	0	0	0	0	0	0	0
0900-0959	0	0	0	0	0	0	0
1000-1059	0	0	0	0	0	0	0
1100-1159	0	190	0	0	0	0	190
1200-1259	0	300	0	0	0	0	300
1300-1359	0	255	30	0	0	0	285
1400-1459	0	310	60	0	0	0	370
1500-1559	0	270	60	45	120	0	495
1600-1659	0	150	120	15	120	0	405
1700-1759	0	120	120	0	60	0	300
1800-1859	0	120	45	90	60	0	315
1900-1959	0	90	0	60	0	0	150
2000-2059	0	45	0	30	0	0	75
2100-2159	0	0	0	0	0	0	0
2200-2259	0	0	0	0	0	0	0
2300-2359	0	45	0	0	0	0	45

Total Minutes = 3095

Frequency Usage Summary for Ranges from 201 to 500 Nautical
Miles. Data for 1973-1982 Combined.

	Hurricane Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	60	60	240	0	0	0	360
0100-0159	35	60	225	0	0	0	320
0200-0259	0	120	120	0	0	0	240
0300-0359	0	120	120	0	0	0	240
0400-0459	0	210	30	0	0	0	240
0500-0559	0	240	0	0	0	0	240
0600-0659	0	270	0	0	0	0	270
0700-0759	0	255	0	0	0	0	255
0800-0859	0	240	0	0	0	0	240
0900-0959	75	180	0	0	0	0	255
1000-1059	135	275	0	0	0	0	410
1100-1159	145	390	0	0	0	0	535
1200-1259	180	360	0	0	0	0	540
1300-1359	150	300	60	0	0	0	510
1400-1459	60	285	135	0	30	0	510
1500-1559	60	240	105	60	110	0	575
1600-1659	60	255	90	120	205	0	730
1700-1759	60	195	165	120	315	0	855
1800-1859	60	120	180	120	405	0	885
1900-1959	60	10	300	120	265	0	755
2000-2059	60	0	255	45	180	0	540
2100-2159	60	60	300	0	220	0	640
2200-2259	60	60	255	30	110	0	515
2300-2359	60	60	240	60	0	0	420

Total Minutes = 11080

Frequency Usage Summary for Ranges from 201 to 500 Nautical
Miles. Data for 1973-1982 Combined.

	All Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	60	120	240	0	0	0	420
0100-0159	35	120	225	0	0	0	380
0200-0259	0	165	120	0	0	0	285
0300-0359	0	120	120	0	0	0	240
0400-0459	0	210	30	0	0	0	240
0500-0559	0	240	0	0	0	0	240
0600-0659	0	270	0	0	0	0	270
0700-0759	0	255	0	0	0	0	255
0800-0859	0	240	0	0	0	0	240
0900-0959	75	180	0	0	0	0	255
1000-1059	135	275	0	0	0	0	410
1100-1159	145	580	0	0	0	0	725
1200-1259	180	660	0	0	0	0	840
1300-1359	150	555	90	0	0	0	795
1400-1459	60	595	195	0	30	0	880
1500-1559	60	510	165	105	230	0	1070
1600-1659	60	405	210	135	325	0	1135
1700-1759	60	315	285	120	375	0	1155
1800-1859	60	240	225	210	465	0	1200
1900-1959	60	100	300	180	265	0	905
2000-2059	60	45	255	75	180	0	615
2100-2159	60	60	300	0	220	0	640
2200-2259	60	60	255	30	110	0	515
2300-2359	60	105	240	60	0	0	465

Total Minutes = 14175

Frequency Usage Summary for Ranges from 501 to 1000 Nautical
Miles. Data for 1973-1982 Combined.

	Hurricane Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	120	140	0	35	45	340
0100-0159	0	180	120	60	0	0	360
0200-0259	0	150	120	60	0	0	330
0300-0359	60	60	120	60	0	0	300
0400-0459	60	105	70	60	0	0	295
0500-0559	60	105	0	60	0	0	225
0600-0659	60	60	15	60	0	0	195
0700-0759	50	60	45	60	0	0	215
0800-0859	60	75	0	45	0	0	180
0900-0959	45	100	15	30	0	0	190
1000-1059	0	180	124	30	0	0	334
1100-1159	0	155	60	115	90	0	420
1200-1259	0	265	105	65	210	0	645
1300-1359	0	195	105	150	450	0	900
1400-1459	0	45	150	275	450	0	920
1500-1559	0	0	75	420	570	0	1065
1600-1659	0	0	60	255	765	90	1170
1700-1759	0	0	60	240	870	120	1290
1800-1859	0	0	120	195	1065	45	1425
1900-1959	0	0	75	270	750	45	1140
2000-2059	0	0	90	195	395	60	740
2100-2159	0	30	55	210	200	60	555
2200-2259	0	0	165	90	135	75	465
2300-2359	0	45	180	30	120	60	435

Total Minutes = 14134

Frequency Usage Summary for Ranges from 501 to 1000 Nautical Miles. Data for 1973-1982 Combined.

	Non-Hurricane Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	60	0	0	0	0	60
0100-0159	0	60	0	0	0	0	60
0200-0259	0	60	0	0	0	0	60
0300-0359	0	60	0	0	0	0	60
0400-0459	0	60	0	0	0	0	60
0500-0559	0	45	0	0	0	0	45
0600-0659	0	0	0	0	0	0	0
0700-0759	0	0	0	0	0	0	0
0800-0859	0	0	0	0	0	0	0
0900-0959	0	0	0	0	0	0	0
1000-1059	0	0	0	0	0	0	0
1100-1159	0	0	60	0	0	0	60
1200-1259	0	60	60	0	0	0	120
1300-1359	0	60	120	0	105	0	285
1400-1459	0	30	120	30	180	0	360
1500-1559	0	105	180	60	120	0	465
1600-1659	0	120	180	30	225	0	555
1700-1759	0	60	230	0	420	0	710
1800-1859	0	60	120	90	390	0	660
1900-1959	0	60	120	120	285	0	585
2000-2059	0	45	55	150	210	0	460
2100-2159	0	0	0	60	90	0	150
2200-2259	0	0	0	30	45	0	75
2300-2359	0	0	0	0	0	0	0

Total Minutes = 4830

Frequency Usage Summary for Ranges from 501 to 1000 Nautical Miles. Data for 1973-1982 Combined.

	All Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	180	140	0	35	45	400
0100-0159	0	240	120	60	0	0	420
0200-0259	0	210	120	60	0	0	390
0300-0359	60	120	120	60	0	0	360
0400-0459	60	165	70	60	0	0	355
0500-0559	60	150	0	60	0	0	270
0600-0659	60	60	15	60	0	0	195
0700-0759	50	60	45	60	0	0	215
0800-0859	60	75	0	45	0	0	180
0900-0959	45	100	15	30	0	0	190
1000-1059	0	180	124	30	0	0	334
1100-1159	0	155	120	115	90	0	480
1200-1259	0	325	165	65	210	0	765
1300-1359	0	255	225	150	555	0	1185
1400-1459	0	75	270	305	630	0	1280
1500-1559	0	105	255	480	690	0	1530
1600-1659	0	120	240	285	990	90	1725
1700-1759	0	60	290	240	1290	120	2000
1800-1859	0	60	240	285	1455	45	2085
1900-1959	0	60	195	390	1035	45	1725
2000-2059	0	45	145	345	605	60	1200
2100-2159	0	30	55	270	290	60	705
2200-2259	0	0	165	120	180	75	540
2300-2359	0	45	180	30	120	60	435

Total Minutes = 18964

Frequency Usage Summary for Ranges > 1000 Nautical Miles. Data
for 1973-1982 Combined.

	Non-Hurricane Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	0	0	0	0	0	0
0100-0159	0	0	0	0	0	0	0
0200-0259	0	0	0	0	0	0	0
0300-0359	0	0	0	0	0	0	0
0400-0459	0	0	0	0	0	0	0
0500-0559	0	0	0	0	0	0	0
0600-0659	0	0	0	0	0	0	0
0700-0759	0	0	0	0	0	0	0
0800-0859	0	0	0	0	0	0	0
0900-0959	0	0	0	0	0	0	0
1000-1059	0	0	0	0	0	0	0
1100-1159	0	0	0	0	0	0	0
1200-1259	0	0	0	0	0	0	0
1300-1359	0	0	0	30	210	0	240
1400-1459	0	0	60	60	260	0	380
1500-1559	0	90	60	60	210	30	450
1600-1659	0	150	60	60	120	105	495
1700-1759	0	180	60	60	120	120	540
1800-1859	0	180	0	60	300	180	720
1900-1959	0	120	0	60	525	180	885
2000-2059	0	180	0	60	420	210	870
2100-2159	0	90	0	0	180	0	270
2200-2259	0	0	0	0	120	0	120
2300-2359	0	0	0	0	0	0	0

Total Minutes = 4970

Frequency Usage Summary for Ranges > 1000 Nautical Miles. Data
for 1973-1982 Combined.

	Hurricane Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	0	0	0	180	0	180
0100-0159	0	0	0	0	150	0	150
0200-0259	0	0	0	0	120	0	120
0300-0359	0	0	0	0	75	0	75
0400-0459	0	0	0	0	30	0	30
0500-0559	0	0	0	0	0	0	0
0600-0659	0	0	0	0	0	0	0
0700-0759	0	0	0	0	0	0	0
0800-0859	0	0	0	0	0	0	0
0900-0959	0	0	0	0	0	0	0
1000-1059	0	15	0	0	0	0	15
1100-1159	0	75	0	0	0	0	75
1200-1259	0	105	0	0	30	0	135
1300-1359	0	15	0	0	165	0	180
1400-1459	0	0	0	0	180	30	210
1500-1559	0	0	0	0	180	60	240
1600-1659	0	0	0	0	240	90	330
1700-1759	0	0	0	0	300	120	420
1800-1859	0	0	0	0	315	120	435
1900-1959	0	0	0	0	240	180	420
2000-2059	0	0	0	0	105	195	300
2100-2159	0	0	0	0	90	120	210
2200-2259	0	0	0	0	165	15	180
2300-2359	0	0	0	0	180	0	180

Total Minutes = 3885

Frequency Usage Summary for Ranges > 1000 Nautical Miles. Data
for 1973-1982 Combined.

	All Operations						Total
	4668	6645	8962	11396	13260	17901	
0000-0059	0	0	0	0	180	0	180
0100-0159	0	0	0	0	150	0	150
0200-0259	0	0	0	0	120	0	120
0300-0359	0	0	0	0	75	0	75
0400-0459	0	0	0	0	30	0	30
0500-0559	0	0	0	0	0	0	0
0600-0659	0	0	0	0	0	0	0
0700-0759	0	0	0	0	0	0	0
0800-0859	0	0	0	0	0	0	0
0900-0959	0	0	0	0	0	0	0
1000-1059	0	15	0	0	0	0	15
1100-1159	0	75	0	0	0	0	75
1200-1259	0	105	0	0	30	0	135
1300-1359	0	15	0	30	375	0	420
1400-1459	0	0	60	60	440	30	590
1500-1559	0	90	60	60	390	90	690
1600-1659	0	150	60	60	360	195	825
1700-1759	0	180	60	60	420	240	960
1800-1859	0	180	0	60	615	300	1155
1900-1959	0	120	0	60	765	360	1305
2000-2059	0	180	0	60	525	405	1170
2100-2159	0	90	0	0	270	120	480
2200-2259	0	0	0	0	285	15	300
2300-2359	0	0	0	0	180	0	180

Total Minutes = 8855

APPENDIX C: Figures



Fig. 1: The NOAA P-3 aircraft

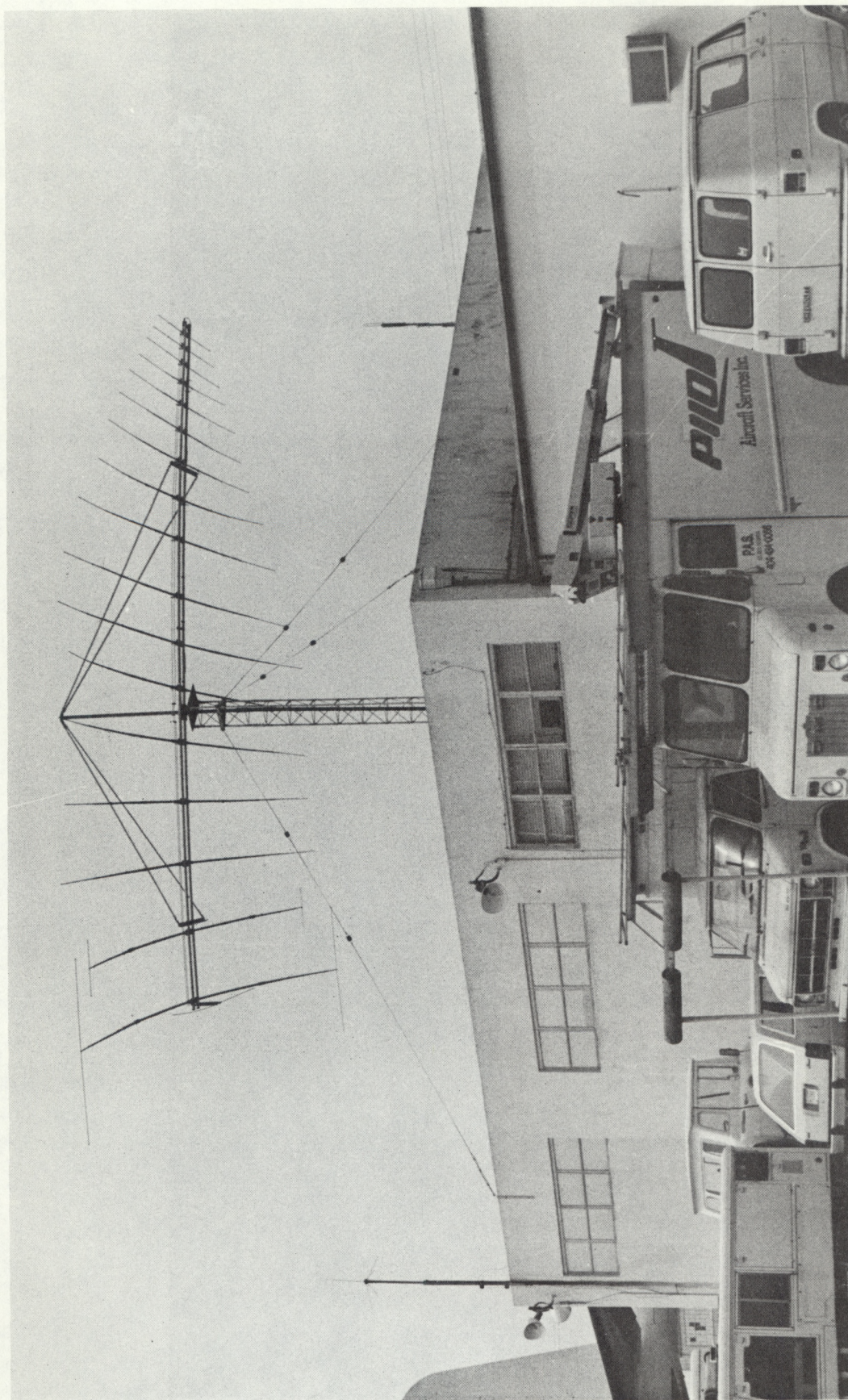


Fig. 2: The log periodic antenna at KJY-74

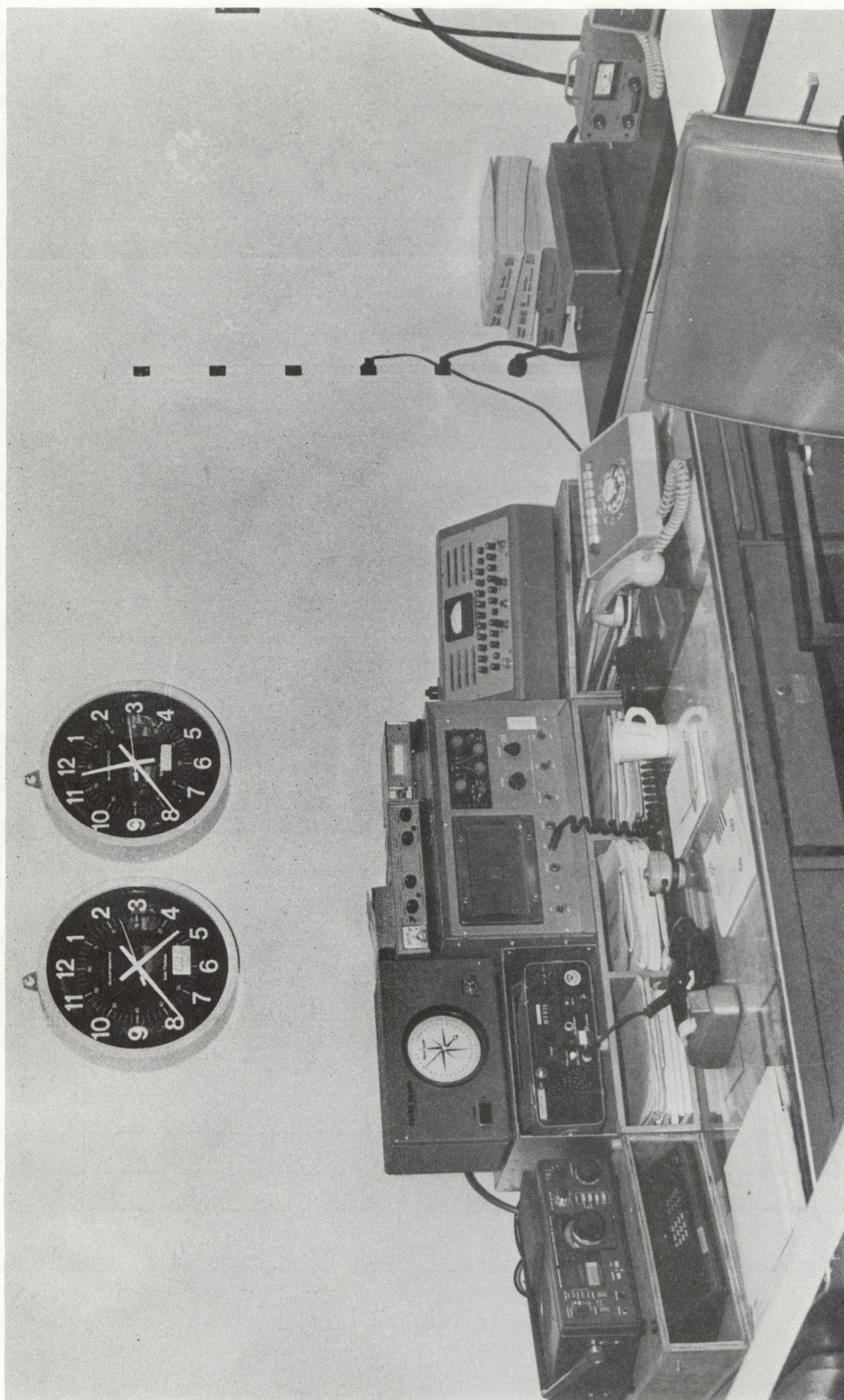


Fig. 3: The operating position at KJY-74



Fig. 5: The location of KJY-74 with 200, 500 and 1000 nautical mile range circles.