MARINE WEATHER DISSEMINATION SYSTEMS STUDY

Prepared for
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by

COMPUTER SCIENCES CORPORATION
16 August 1971

DEPARTMENT OF TRANSPORTATION ● UNITED STATES COAST GUARD

VOLUME II - SYSTEMS CHARACTERIZATION

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Major Offices and Facilities Throughout the World

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16. Abstract

Systems for disseminating weather information to marine users are described in detail. Coast Guard and National Weather Service transmitting facilities are listed, giving location, name, call sign, transmitting power, mode and frequency, and antenna height. Coastal display stations and telephone facilities are also listed. Facilities serving off-shore and high-seas areas are described. Operating policies and procedures for all systems are documented.

The work described was performed in the first phase of a study aimed at improving the dissemination of weather information to marine users and at establishing guidelines for future Coast Guard research and development efforts in this field.

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FOREWORD

This is the first of four reports prepared by Computer Sciences Corporation for the U.S. Coast Guard during the course of a Study of How Best to Utilize Coast Guard Communication Facilities for Weather Dissemination to Marine Users. The study was performed under Contract DOT-CG-00,579-A, which was awarded to CSC on August 31, 1970 and completed August 16, 1971.

The study was divided into four phases:

- Task 1 - Familiarization of the study team with existing marine weather dissemination systems, and the characterization of these systems in terms of their facilities, policies and procedures.
- Task 2 - Measurement of effectiveness of existing and planned weather dissemination systems, following the development of standards and criteria against which to measure this effectiveness.
- Task 3 - Formulation of recommendations for changes in the facilities, policies and procedures of the U.S. Coast Guard and other government and nongovernment agencies considered necessary to improve the dissemination of weather information to marine users.
- Task 4 - Generation of guidelines for future USCG research and development effort in the area of weather dissemination and alerting techniques in terms of operational constraints, performance requirements and cost data.

CSC wishes to acknowledge the assistance of CDR B. F. Hollingsworth, USCG, as Technical Representative to this study and also of LCDR E. Jones and CWO R. J. Williams in making data available for the study.

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SECTION 1

THE ENVIRONMENT

1.1 GROWTH

The recreational boatman is subject to a number of hazards when he operates his boat. One group of such hazards is that caused by weather phenomena. A number of recent incidents have served to emphasize his vulnerability to, and the tragic loss of life which can result from, these weather hazards. These same incidents have also served to highlight the difficulty of providing the recreational boatman with effective and timely warnings of impending weather hazards.

All mariners are, of course, subject to these hazards. The recreational boatman, however, is in general less knowlegable and not so well prepared or informed as the professional mariner. This is particularly true of the "weekend sailor," who operates a small boat often of 16 feet or less in length. Unfortunately, he represents the vast majority of the more than eight million boatmen on United States waters. The rapid growth in this segment of the boating population serves only to aggravate the existing situation.

1.2 CHANGE

The problem is not only growing in magnitude but also changing in character. The Federal Communications Commission (FCC) has recently implemented the first in a series of regulatory moves aimed at relieving the "congestion of the airwaves." This is to be accomplished by requiring the operators of marine two-way radio stations to utilize VHF-FM systems in coastal regions in preference to MF-AM systems, which have greater range but which (partly as a result of their greater range) are more susceptible to interference from other users. Two-way radio sets will, therefore, be predominantly VHF-FM in the future. The most significant impact

of this change on the users is that a large percentage of them will in the future be served by disseminators limited in range to about 25 or 40 miles.

Rule changes also affect the transmission characteristics of MF systems, requiring a change from double sideband to single sideband emission. Transcriptions of the FCC reports which outline these policy changes are given in Appendix A.

1.3 DIVISION OF AUTHORITY

Compounding the problem is the division of authority in matters pertaining to marine weather dissemination. Although the Coast Guard is charged with the safety of mariners operating in United States waters, statutory responsibility for weather forecasting and dissemination of weather information products to the public lies with the National Weather Service (NWS) of the National Oceanic and Atmospheric Administration. Because of the specialized nature of meteorological forecasting, the NWS discourages other agencies from adopting this role.

Communications by non-government stations are controlled by the FCC. This body has responsibilities in licensing and frequency allocation and its actions are governed by a need to work within the overall communications framework. The Interdepartment Radio Advisory Committee (IRAC) under the Office of Telecommunications Policy (OTP) is the coordinating body which prescribes technical standards and allocates radio frequencies to government agencies.

This then is the environment in which current marine weather dissemination systems operate, and it is within this framework that the characterizations which follow are generated.

SECTION 2

COASTAL SYSTEMS CHARACTERIZATION

2.1 NATIONAL WEATHER SERVICE VHF WEATHER TRANSMISSION SYSTEM

2.1.1 Introduction

The National Weather Service (NWS) Plan for VHF Radio Service revises and augments the continuous VHF radio transmissions portion of the Nationwide Natural Disaster Warning System (NADWARN) of October 1965. The Plan was formulated by the NWS (then the Weather Bureau of ESSA) in August 1970, and proposes the development of a network of stations designed to serve the general public.

The NWS is a massive disseminator of weather information. Continued specialization in the field of meteorology, along with increased precision in the products which are disseminated, places a heavy strain upon the existing means of dissemination.

There are two primary means of dissemination which are used by the NWS:

1. Automatic telephone answering systems--providing general information available to the user when required.

2. Commercial broadcast industry--providing general information at relatively infrequent intervals using information provided over NOAA Weather Wire (NWW) systems.

According to the NWS, monetary limitations dictate that sufficient telephone lines never could be provided by NWS to satisfy the massive demands for weather information to the public, especially large metropolitan areas. The broadcast industry is forced to tread a delicate economic line between the amount of public service time that can be devoted to weather information and the amount of information the public requires.

The weather sensitive user - that individual or organization requiring more detail than can be obtained through general telephone information or more frequently than can be dispensed by commercial broadcasters - has no means of obtaining his information. Though NWW provides sufficient detail, the costs involved negate its use for most individuals and many smaller companies. Telephone lines into offices are often busy, and high priority duties restrict the hours that the telephone can be answered personally.

A radio system operated by the NWS, it is claimed, can fill the gap that exists in the dissemination framework. It provides unrestricted access beyond that possible by telephone - only a special radio receiver is necessary - and, unlike commercial broadcast stations, the time available for weather information and the type of information are unrestricted.

2.1.2 Policies

The aim of the NWS VHF-FM radio system is to offer to users in the listening area access to complete weather information. Emphasis in the program content is on the "now and near future" in weather. Although the system is designed to serve the general public, products for special users may be presented for a limited time during certain periods of the day.

Where stations cover areas of significant boating activity, the NWS has emphasized the dissemination of marine weather information. Any site on or close to a coastal location may, therefore, be regarded as a potential element for the dissemination of this type of information.

System requirements defined by the NWS are:

1. A broadcast range which is adequate to cover most metropolitan areas, but restricted enough to enable the message scripts to be directed specifically toward the user needs over a limited size area of approximately 40 miles radius.

2. Two frequencies (162.55 and 162.40 MHz) to allow complete coverage without frequency interference between closely adjacent metropolitan areas.

3. Continuous operation and repetitive cycling of information, at least every 5 minutes, or more often if desired.

4. Fast and easy programming and recording ability.

5. Emergency communications capabilities with commercial broadcast stations.

6. Tone alert capabilities to permit the activation of muted receivers during times of emergencies.

2.1.3 Facilities

As of January 1971, there are 29 operational NWS VHF-FM transmitting stations broadcasting on 162.55 MHz or 162.40 MHz. The broadcasts are continuous and are made at 330 watts transmitter power with 5-kHz peak deviation. A list of the stations currently in operation is given in Table 2-1, which includes station location and station height.

A "master system" is defined as the primary equipment operated by a WSO/WSFO to serve the immediate community. The information to be transmitted is conveyed to the transmitter sites via land lines or UHF radio links.

In some areas it is necessary to provide service to a nearby neighboring community, defined for these purposes as a remote location. The audio from the WSO/WSFO will be transmitted

to remote location by land lines, UHF radio link (or a combination of both, or slave techniques. The slave technique is defined as an additional remote transmitter directly controlled by the carrier emanating from the master transmitter. Essentially, a radio receiver picls up the audio from the master system and injects this signal into the remote transmitter which radiates on the alternate frequency from the master system.

The area served by each transmitter is nominally defined as a circle of 40 miles radius. However, the effective range of a given transmitter will be governed by local terrain and topology as well as the sensitivity, selectivity and antenna height of the receivers using the transmission. The characteristics of certain inexpensive receivers may limit the effective range for users so equipped to 20 miles or less.

The plan proposes a system of transmitters to be established on a priority basis, and will eventually comprise approximately 160 stations by the end of FY 1976, providing adequate funds are authorized by the Congress. The priority for establishing these stations is based upon weighted values assigned to each location. Largest values are assigned to locations with the most frequent occurrences of severe weather, extensive recreational activities, and high transient count (based upon the number of Interstate Highways in the area). Population is considered in determining the priority listing, but is not an overriding factor.

2.1.4 Procedures

All stations broadcast weather and appropriate environmental data continuously by means of taped voice messages repeated every 5 to 7 minutes. The message content varies according to the area being served but typically includes a 1 to 5 day weather forecast for surrounding states, observations from selected sites, and Radar Station reports. In addition,marine forecasts, small

craft warnings, and other special interest information such as selected notices to mariners, are included where and when appropriate.

The message originates at the WSO/WSFO as a printed page which is read onto a tape, incorporated with other tapes, and relayed via telephone land line or UHF radio link to the frequency modulator at the transmitter site. Message tapes are revised and updated periodically, but the revision procedure may not be standard or uniform among the various offices. Pre-prepared Emergency Warning tapes may be used in areas where unusual weather phenomena, such as hurricanes or tornadoes, are a common occurrence.

When warnings are required for any portion of the listening area, the warnings will take precedence over regular programming and may take the form of live voice interruption or pre-prepared tapes. Dissemination of warnings via NWS VHF radio takes second priority to dissemination on NWW. In many instances, dissemination of warnings on both systems will be simultaneous.

Telephone communications from the weather office to the commercial broadcast media are most prone to break down during periods of hazardous or severe weather. These periods are the most critical time for the NWS to disseminate the latest information to the general public via radio/TV. To assure transmission of information during these periods, medium wattage transceivers are required, one to be placed in the weather office and the second located at a key commercial radio station. The equipment enables two-way communication between the NWS and the radio/TV media, since the radio station having the transceiver will be required to distribute the information so received to other nearby studies.

All commercial broadcast stations which are able to receive NWS VHF transmissions are urged to monitor these broadcasts, especially during emergency situations. Each station is encouraged to obtain tone-alert receivers which will demute

upon transmission of a 1050-Hertz tone by the weather office. Tone-alert receivers generally cost about $125. Transmissions from NWS should be simulcast during warning periods, or recorded for immediate transmission when this mode of warning is employed by commercial stations.

TABLE 2-1

NATIONAL WEATHER SERVICE

VHF/FM TRANSMITTERS IN OPERATION

(January 1971)

STATION	ANTENNA LOCATION	ANTENNA HEIGHT AMSL
Portland	43°-45'-45"N 70°-19'-30"W	735
Boston	42°-21'-31"N 71°-3'-15"W	485
Hartford	41°-26'-27"N 72°-08'-29"W	460
New York	40°-45'-32"W 73°-58'-47"W	940
Atlantic City	39°-22'-42"N 74°-26'-53"W	305
Washington	38°-57'-59"N 76°-41'-00"W	364
Norfolk	36°-48'-56"N 76°-28'-00"W	502
Charleston	32°-47'-44"N 79°-50'-27"W	505
Cleveland	41°-31'-22"N 81°-19'-43"W	1530
Sandusky	41°-24'-11"N 82°-49'-05"W	965
Akron	41°-03'-52"N 81°-35'-00"W	1760
Chicago	41°-49'-30" 87°-39'-48"	801
Jacksonville	30°-20' 81°-39'	374
Miami	25°-41'-12" 80°-16'-43"	325
Tampa	27°-57'-48" 82°-48'-10"	181
New Orleans	29°-57' 90°-04'	250

TABLE 2-1. (Continued)

STATION	ANTENNA LOCATION	ANTENNA HEIGHT AMSL
St.Louis	38°-45' 90°-23'	324
Kansas City	39°-07' 94°-36'	308
Lake Charles	30°-07' 93°-13'	120
Galveston	29°-18' 94°-49'	211
Corpus Christi	27°-47'-44" 97°-23'-41"	350
Brownsville	25°-57'-15" 97°-23'-12"	226
Seattle	47°-33' 122°-48'	1704
Portland	45°-34' 122°-47'	1096
Eugene	44°-07' 123°-13'	460
San Francisco	37°-27' 122°-22'	2100
Los Angeles	34°-14' 118°-04'	5709
Mt. Kaala	21°-31' 158°-09'	4025
Mt. Haleakala	20°-43' 156°-16'	approx 10,000

TABLE 2-1. (Continued)

In addition NWS transmitters are expected to be operational by the end of CY 1971 in the following locations:

Dallas, Texas
Atlanta, Georgia
Sacramento, California
Erie, Pennsylvania
Milwaukee, Wisconsin
Mobile, Alabama
San Diego, California
Detroit, Michigan
Minneapolis, Minnesota
Wilmington, North Carolina
Monterey, California
Eugene, Oregon
Eureka, California
Cape Cod, Massachusetts
Bangor, Maine
Chesapeake Bay (MD or VA)
Indianapolis, Indiana
Des Moines, Iowa
Denver, Colorado
St. Joseph, Missouri
Keval, Hawaii
Salt Lake City, Utah
Oxnard, California
Fort Worth, Texas
Anchorage, Alaska
Homer, Alaska
Jobet, Illinois
Wichita, Kansas

Precise transmitter sites and technical parameters are not known at this time. Moreover, the above list is still subject to change and confirmation of any of the aforementioned sites should be solicited from N.W.S. if required.

2.2 MARINE WEATHER DISSEMINATION BY COMMERCIAL AM/FM RADIO

2.2.1 Introduction

Many commercial radio stations located in coastal areas and in inland areas where there is significant boating activity provide marine forecast and warnings broadcasts. Due to the large area coverage of high powered commercial transmitters, and the large number of portable radio receivers in the hands of the public, these facilities have considerable potential as weather disseminators. However, due to their commercial nature and the requirement that they operate profitably, there is a constraint on the amount of time which these enterprises can donate to public service.

Nevertheless, some stations make regular broadcasts of marine weather information as frequently as once every 30 minutes, and many more make regularly scheduled (though less frequent) broadcasts directly from local Weather Service Offices (WSO) of NOAA. The approbation of local boatmen for many of these stations is evidence of the utility of the service which they provide.

2.2.2 Policies

Because most individual stations (or co-owned groups of stations) operate independently, and because there is no legislative requirement for them to make broadcasts of marine weather information, it is not possible to define an overall policy with respect to this type of service.

Some stations exhibit a total disinterest in marine-oriented services, even though they may provide considerable over-water coverage. In contrast, there are several stations which may legitimately be regarded as "marine specialists," making frequent broadcasts of marine weather information, hydrographic bulletins and notices to mariners accompanied by special features of interest to boatmen. They are often supported by sponsors whose interests lie in the marine segment of the station's market.

2.2.3 Facilities

There are approximately 4,300 AM stations and over 2,000 FM stations currently licensed by the FCC to broadcast in the United States. A complete listing of these stations is given in Reference 1, which also contains pertinent operational and management information. Of these, more than 1,000 make broadcasts which are considered to be of interest to the marine user. The most comprehensive listing of these stations is given in the Marine Weather Services Charts published by NOAA (previously known as Coastal Warning Facilities Charts). These publications list two categories of commercial stations: those making broadcasts directly from NOAA facilities, and others providing scheduled NOAA marine forecasts from their own facilities. Although these charts are updated approximately once each year, changes in the commercial broadcasting community and in individual station policies introduce errors into the listings of current charts. Moreover, the procedures for identifying and including stations of interest are not sufficiently rigorous to preclude omissions nor to accurately reflect all changes, a fact which NOAA recognizes. Nevertheless, these charts represent the most comprehensive compilation available to the public, and the listings from the current (January 1971) charts are reproduced in Tables 2-2 through 2-13. This listing was used as the baseline system definition for this study. The chart for Alaska does not include a listing of commercial broadcast stations, and the chart for Hawaiian waters states that "most of Hawaii's commercial AM and FM radio and television stations include marine forecasts and warnings in news brodcasts."

2.2.4 Procedures

Procedures used by commercial stations are as diverse as the policies which dictate them, but it is possible to generalize two types of procedural operation.

Stations making direct marine broadcasts maintain equipment at a local WSO or Weather Service Forecast Office (WSFO) by means of which NOAA personnel can remotely key the station's transmitter. The equipment generally takes the form of a receiver by means of which the forecaster may monitor the sponsoring station to receive a cue signal and an audio amplifier/microphone set linked to the broadcast station via telephone land line. Adhering rigidly to a prearranged schedule, the station announces the imminent direct weather broadcast. The forecaster then operates a switch which mutes his monitor and connects him directly to the station's transmitter, and proceeds to read the forecast. At the conclusion of the announcement, he returns the equipment to the monitor mode and the station resumes its regular broadcast. The precise timing requires adherence to the schedule within about 15 seconds.

Stations making indirect broadcasts obtain the weather information from NOAA in two ways. By far the most common is by use of the Weather Wire Service, under which the station is connected with the Weather Service Center by rented teleprinter carrying continual weather information updates. At appointed times the station announcer reads the latest forecast from the printer; the message may be given in toto or selected portions only may be read. This procedure also provides for the possibility of editorializing on the part of the announcer.

A number of stations monitor the NOAA VHF radio transmissions on 162.55 MHz, relaying them directly or recording them for subsequent rebroadcast. All or portions of the message may be used in this procedure, which does not enable the station to editorialize. Both of these procedures allow considerably greater flexibility in schedule than that used by stations making direct broadcasts.

TABLE 2-2. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Eastport, Me. to Montauk Pt., N.Y.

MARINE FORECASTS AND WARNINGS BROADCAST DIRECT FROM ESSA WEATHER BUREAU OFFICES

Time	Station		AM Freq. (kHz)	FM Freq. (MHz)	AM Antenna Coordinates	Remarks
10 min. past each hour	WHDH	Boston, Mass.	850	---	42°16'41" N 71°16'02" W	May 15-Oct 15, Fri.-Sun.
10 min. past each hour (6:10 am-10:10 pm)	WHDN	Boston, Mass.	850	---	" " "	May 15-Oct 15, Mon.-Thurs.
40 min past each hour	WHDN-FM	Boston, Mass.	--	94.5	---	May 15-Oct 15, Fri.-Sun.
40 min past each hour (6:40 am-10:40 pm)	WHDH-FM	Boston, Mass.	--	94.5	---	May 15-Oct 15, Mon.-Thurs.
7:25 am	WCSN	Portland, Me.	+970	---	43°36'21" N 70°19'25" W	Daily
7:25 am	WPOR WPOR-FM	Portland, Me.	1490	101.9	43°39'50" N 70°16'12" W	Mon.-Sat.
7:37 am	WTVL WTVL-FM	Waterville, Me.	1490	98.3	44°33'51" N 69°36'32" W	Daily
7:40 am	WRKO WRKD-FM	Rockland, Me.	1450	93.5	44°06'22" N 69°06'31" W	Daily
7:40 am	WHDH	Boston, Mass.	850	---	42°16'41" N 71°16'02" W	Mon.-Sat.
7:55 am	WRDO	Augusta, Me.	1400	---	44°17'56" N 69°46'26" W	Mon.-Sat.
8:00 am	WHDN	Boston, Mass.	850	---	42°16'41" N 71°16'02" W	Sun. only
8:05 am	WLBZ	Bangor, Me.	+620	---	44°49'44" N 68°47'08" W	Sat.-Sun.
8:15 am	WLBZ	Bangor, Me.	+620	---	44°49'44" N 68°47'08" W	Mon.-Fri.
8:40 am	WPOR WPOR-FM	Portland, Me.	1490	101.9	43°39'50" N 70°16'12" W	Sun. only
8:40 am	WEAN	Providence, R.I.	790	---	41°50'03" N 71°21'56" W	Sun. only
9:55 am	WHDN	Boston, Mass.	850	---	42°16'41" N 71°16'02" W	Sat. & Sun.
12:10 pm	WEAN	Providence, R.I.	790	---	41°50'03" N 71°21'56" W	Daily
12:35 pm	WELI	New Haven, Conn.	+960	---	41°22'15" N 72°56'15" W	Daily
12:55 pm	WNDN	Boston Mass.	850	---	42°16'41" N 71°16'02" W	Daily
6:10 pm	WPOR WPOR-FM	Portland, Me.	1490	101.9	43°39'50" N 70°16'12" W	Mon.-Sat.
6:10 pm	WELI	New Haven, Conn.	+960	---	41°22'15" N 72°56'15" W	Daily
6:20 pm	WEAN	Providence, R.I.	790	---	41°50'03" N 71°21'56" W	Mon.-Sat.
6:20 pm	WPJ8-FM	Providence, R.I.	--	105.1	---	Daily
6:25 pm	WRDO	Augusta, Me.	1400	---	44°17'56" N 69°46'26" W	Mon.-Fri.
6:25 pm	WTVL WTVL-FM	Waterville, Me.	1490	98.3	44°33'51" N 69°36'32" W	Mon.-Fri.
6:25 pm	WHDN	Boston, Mass.	850	---	42°16'41" N 71°16'02" W	Daily
11:15 pm	WHDH	Boston, Mass.	850	---	42°16'41" N 71°16'02" W	Daily

NOTE: In addition to the direct broadcasts listed above, these radio stations generally broadcast marine weather forecasts and warnings at other times, usually as part of news programs.

OTHER AM AND FM RADIO STATIONS BROADCASTING WEATHER BUREAU MARINE FORECASTS AND WARNINGS

Local newspapers should be consulted to determine the latest weather broadcast schedules of the radio stations listed below.

City	Station	Freq. AM/FM kHz/MHz	AM Antenna Location
MAINE			
Augusta	WFAU	1340	44°19'43" N
	WFAU-FM	101.3	69°45'53" W
Bangor	WABI	+910	44°46'44" N
			68°44'22" W
Bath	WJTO	730	43°52'39" N
			69°50'49" W
Brunswick	WCME	900	43°55'40" N
	WCME-FM	98.9	69°59'43" W
Calais	WQDY	1230	45°10'55" N
			67°15'59" W
Ellsworth	WDEA	1370	44°28'05" N
			68°28'11" W
Lewiston	WLAM	1470	44°03'48" N
			70°14'50" W
Poland Spring	WMTW-FM	94.9	---
Portland	WCAN	560	43°41'22" N
			70°19'00" W
NEW HAMPSHIRE			
Portsmouth	WHEB	750	43°03'00" N
	WHEB-FM	100.3	70°46'00" W
Rochester	WWNH	+930	43°17'19" N
			70°57'02" W
MASSACHUSETTS			
Boston	WBZ	1030	42°16'41" N
	WBZ-FM	106.7	70°52'36" W
Boston	WEEI	590	42°24'24" N
	WEEI-FM	103.3	71°05'14" W
Boston	WEZE	+1260	42°16'30" N
			71°02'31" W
Boston	WXHR-FM	96.9	---
Brockton	WOKW	1410	42°03'30" N
			71°02'40" W
Cambridge	WCAS	740	42°23'13" N
			71°08'21" W
Fall River	WALE	1400	41°42'08" N
			71°09'19" W
New Bedford	WBSM	1420	41°39'02" N
			70°54'58" W
New Bedford	WNBH	1340	41°38'12" N
	WNBH-FM	98.1	70°54'40" W
Newburyport	WNBF	1470	42°49'23" N
			70°51'42" W
Plymouth	WPLM	1390	41°58'05" N
	WPLM-FM	99.1	70°42'03" W
Quincy	WJDA	1300	42°15'35" N
			70°58'36" W
Salem	WESX	1230	42°31'06" N
			70°51'41" W
Waltham	WCRB	1330	42°21'16" N
	WCRB-FM	102.5	71°15'44" W
West Yarmouth	WOCB	1240	41°38'07" N
	WOCB-FM	94.9	70°14'06" W
RHODE ISLAND			
Newport	WADK	1540	41°29'48" N
			71°16'33" W
Pawtucket	WXTR	+550	41°54'15" N
			71°23'54" W
Providence	WCRQ-FM	101.5	---
Providence	WHIM	1110	41°49'09" N
	WHIM-FM	94.1	71°22'15" W
Providence	WICE	1290	41°51'21" N
			71°26'41" W
Providence	WJAR	+920	41°46'53" N
			71°19'55" W
Providence	WLKW	990	41°57'18" N
			71°35'39" W
Providence	WPRO	+630	41°46'28" N
	WPRO-FM	92.3	71°19'23" W
Warwick	WYNG	1590	41°40'28" N
			71°26'31" W
Westerly	WERI	1230	41°21'57" N
			71°50'11" W
West Warwick	WWRI	1450	41°41'38" N
			71°31'26" W
Wickford	WKFD	1370	41°33'57" N
			71°27'19" W
Woonsocket	WNRI	1380	42°00'59" N
			71°29'31" W
Woonsocket	WWON	1240	41°59'32" N
	WWON-FM	106.3	71°30'40" W
CONNECTICUT			
Groton	WSUB	980	41°23'05" N
			72°04'13" W
Hamden	WCDQ	1220	41°22'32" N
			72°55'54" W
Hartford	WTIC	+1080	41°46'39" N
	WTIC-FM	96.5	72°48'19" W
Manchester	WINF	1230	41°46'34" N
			72°33'27" W
Meriden	WMMW	1470	41°33'04" N
			72°48'17" W
Middletown	WCNX	1150	41°33'26" N
			72°37'13" W
New Haven	WAVZ	+1300	41°17'16" N
			72°56'48" W
New Haven	WNHC	1340	41°17'32" N
			72°57'12" W
New London	WNLC	1510	41°22'38" N
			72°10'02" W
Norwich	WICH	1310	41°33'10" N
			72°04'34" W
Old Saybrook	WLIS	1420	41°19'05" N
			72°21'32" W
Putnam	WINY	1350	41°54'10" N
			71°53'43" W

TABLE 2-3. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Montauk Pt., N.Y. to Manasquan, N.J.

MARINE FORECASTS AND WARNINGS BROADCAST DIRECT FROM ESSA WEATHER BUREAU OFFICES

Time	Station		AM Freq (kHz)	FM Freq (MHz)	Antenna Coordinates	Remarks
6 25 am	WNBC	New York, N Y	660	97 1	40°51'35"N 73°47'09"W	Mon -Fri
7 00 am	WNYC	New York, N Y	‡830	93 9	40°53'45"N 73°57'40"W	Daily
7 25 am	WFPG	Atlantic City, N J	1450	—	39°22'42"N 74°26'53"W	Mon -Sat
7 45 am	WFPG-FM	Atlantic City, N J	—	96 9		Mon -Sat
7 45 am	WNYC	New York N Y	‡830	93 9	40°43'45"N 73°57'40"W	Daily
7 55 am	WTTM	Trenton N J	‡920	—	40°15'14"N 74°51'34"W	Mon -Fri
8 40 am	WEAN	Providence, R I	‡790	—	41°50'03"N 71°21'56"W	Sun only
11 30 am	WNBC	New York, N Y	660	97 1	40°51'35"N 73°47'09"W	Sat only
12 10 am	WEAN	Providence, R I	‡790	—	41°50'03"N 71°21'56"W	Mon -Sat
12 10 am	WPJB-FM	Providence R I	—	105 1	—	Mon -Sat
1 45 pm	WNYC	New York N Y	‡830	93 9	40°43 45"N 73°57'40"W	Daily
4 20 pm	WKDN	Camden N J	†800	—	39°54 33"N 75°06'00"W	Mon -Fri
6 20 pm	WEAN	Providence R I	‡790	—	41°50'03"N 71°21'56"W	Mon -Sat
6 20 pm	WPJB-FM	Providence, R I	—	105 1	—	Daily
6 45 pm	WNYC	New York N Y	‡830	93 9	40°43'45"N 73°57 40"W	Daily

NOTE In addition to the direct broadcasts listed above these radio stations generally broadcast marine weather forecasts and warnings at other times usually as part of news programs

OTHER AM AND FM RADIO STATIONS BROADCASTING WEATHER BUREAU MARINE FORECASTS AND WARNINGS

Local newspapers should be consulted to determine the latest weather broadcast schedules of the radio stations listed below

City	Station	Freq AM or FM kHz or MHz	Antenna Location
NEW JERSEY			
Asbury Park	WJLK	†1310	40°13 09"N 74°02 47" W
	WJLK-FM	94 3	
Atlantic City	WLDB	1490	39°22'28"N 74 26'25 W
Atlantic City	WMID	1340	39°22'34"N 74°27 08 W
Camden	WCAM	1310	39°57'28"N 75°06 54 W
New Brunswick	WCTC	1450	40°29'32"N 74°25 11 W
	WCTC FM	98 3	—
Ocean City - Somers Point	WSLT	†1520	39°19'05"N 74°37'09"W
Pleasantville	WOND	1400	39°23'38"N 74°30'34"W
Princeton	WHWH	‡1350	40°22'00"N 74°44'38"W
Trenton	WBUD	‡1260	40°15'58"N 74°45'46" W
Wildwood	WCMC	1230	39°00'09"N 74°48'46"W
NEW YORK			
Babylon	WBAB	1440	40°42 32"N 73°21'53"W
	WBAB FM	102 3	—
Babylon	WGLI	‡1290	40°43'03"N 73°20'03" W
Bay Shore (Islip)	WLIX	540	40°45 04"N 73°12'52"W
Freeport	WGBB	1240	40°38 44"N 73°34'38"W
Hempstead	WHLI	†1100	40°41'06 N 73°36'38"W
	WHLI FM	98 3	—
Huntington	WGSM	†740	40°51'04"N 73°26'16" W
Mineola	WTHE	1520	40°44'59"N 73°38'79"W
	WTHE-FM	92 7	—
New Rochelle	WVOX	1460	40°55'42"N 73°46'30" W
	WVOX-FM	93 5	—
New York	WABC	770	40°52'50"N 74°04'12" W
New York	WCBS	880	40°51 35 N 73°47'09" W
	WCBS FM	101 1	—
New York	WHN	‡1050	40°48 26"N 74°04 11 W
New York	WINS	‡1010	40°48'16 N 74°06'25"W
New York	WMCA	‡570	40°45'10"N 74°06 15"W
New York	WOR	‡710	40°47'30"N 74°05 38 W
	WOR FM	98 7	—
New York	WREM FM	105 1	—
Patchogue	WALK	1370	40°45 14 N 72°59 14 "W
	WALK FM	97 5	—
Patchogue	WPAC	1580	40°47'45"N 72°59'32" W
	WPAC-FM	106 0	—
Riverhead	WHRF	†1570	40°54 48 N 72°39'16 "W
	WHRF FM	103 9	—
White Plains	WFAS	1230	41°01 34 N 73°49'41" W
CONNECTICUT			
Ansonia	WADS	†690	41°20'48"N 73°06'56 W
Bridgeport	WICC	‡600	41°09'36"N 73°09'53" W
Bridgeport	WJZZ FM	99 9	—
Bridgeport	WNAB	1450	41°12'40"N 73°11'28 W
Greenwich	WGCH	1490	41°01'37"N 73°37 59 W
Groton	WSUB	980	41°23'05"N 72 04'13 W
Hartford	WTIC	† 1080	41 46 39"N 72°48 19 W
	WTIC FM	96 5	—
Manchester	WINF	1230	41°46'34"N 72°33 27 "W
Meriden	WMMW	1470	41°33'04"N 72°48 17 W
Middletown	WCNX	1150	41°33'26"N 72°37'13"W
Milford	WFIF	†1500	41°11'33"N 73°06'05 W
New Haven	WAVZ	† 1300	41°17'16"N 72 56 48 W
New Haven	WELI	† 960	41°22'14"N 72°56 15 W
New Haven (Hamden)	WCDO	†1220	41°22 32 N 72 55 54 W
New Haven	WNHC	1340	41 17 32 N 72 57 12 W
New Haven	WKCI FM	101 1	—
New London	WNLC	‡1510	41 22 38 N 72 10 02 W
Norwalk	WNLK	† 1350	41 06 50 N 73 26 05 W
Norwich	WICH	†1310	41 33 10 N 72 04 34 W
Old Saybrook	WLIS	1420	41 18 50 N 72 21 48 W
Putnam	WINY	1350	41 54 10 N 71 53 44 W
Stamford	WSTC	1400 †	41 04 15 N 73 32 07 W
	WSTC FM	96 7	—
Westport	WMMM	†1260	41 07 40 N 73 23 16 "W
	WMMM FM	107 9	—
RHODE ISLAND			
Newport	WADK	1540	41 30 13 N 71 18'43 "W
Pawtucket	WFTR	† 550	41 54 15 N 71 23'54 "W
Providence	WLKW FM	101 5	—
Providence	WHIM	†1110	41 49 40"N 71 22 09 "W
	WHIM FM	94 1	—
Providence	WICE	‡1290	41°51'21 "N 71°26'41"W
Providence	WIAR	† 920	41°46 53 N 71°19'55 W
Providence	WLKW	†990	41 57'18 "N 71 35'39 W
Providence	WPRO	† 630	41 46 28 "N 71°19'23 W
	WPRO FM	92 3	—
Warwick - East Greenwich	WARV	1590	41 40'28"N 71°26'31 W
Westerly	WFRI	1230	41 21 57 N 71°50'11 W
West Warwick	WWRI	1450	41 41 38 N 71°31'26 W
Wickford	WKFD	1370	41°33 57 N 71 27 19 W
Woonsacket	WNRI	1380	42°00 59"N 71°29 31 W
Woonsocket	WWON	1240	41 59 32"N 71°30 40 "W
	WWON FM	106 3	—

TABLE 2-4. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Manasquan, N.J. to Cape Hatteras, N.C.

MARINE FORECASTS AND WARNINGS BROADCAST DIRECT FROM ESSA WEATHER BUREAU OFFICES

Time	Station		AM Freq (kHz)	FM Freq (MHz)	AM Antenna Coordinates	Remarks
15 min past each hour (5 am-mdnt)	WGH	Newport News Va	+ 1310	—	36°57'47"N 76°24'42"W	Daily (taped)
6 00 am	WMFD	Wilmington, N C	‡ 630	—	34°13'31"N 77°59'17"W	Daily
6 30 am	WNAV WNAV-FM	Annapolis, Md	+ 1430	99.1	38°59'00"N 76°31'21"W	Mon -Sat
7 05 am	WILM	Wilmington, Del	1450	—	39°43'46"N 75°33'07"W	Sun. only
7 10 am	WBAL	Baltimore, Md	+ 1090	—	39°22'34"N 76°46'18"W	Mon -Sat
7 25 am	WNAV WNAV FM	Annapolis, Md	+ 1430	99 1	38°59'00"N 76°31'21"W	Mon -Sat
7 25 am	WFPG	Atlantic City, N J	1450	—	39°22'42"N 74°26'53"W	Mon -Sat
7 35 am	WPIK	Alexandria, Va	† 730	—	38°44'41"N 77°05'57"W	Mon -Sat
7 35 am	WXRA FM	Woodbridge Va	—	105 9	—	Mon -Sat
7 45 am	WFPG-FM	Atlantic City, N J.	—	96 9	—	Mon -Sat
7 45 am	WNRK	Newark, Del	†1260	—	39°38'39"N 75°41'33"W	Daily
7 50 am	WDOV WDOV-FM	Dover, Del	+ 1410	94 7	39°12'03"N 75°33'55"W	Sun only
7 55 am	WTTM	Trenton, N J	‡ 920	—	40°15'14"N 74°51'34"W	Mon -Fri
11 45 am	WCAO FM	Baltimore, Md	—	102 7	—	Mon Sat
12 08 pm	WBAL	Baltimore, Md	+ 1090	—	39°22'34"N 76°46'18"W	Daily
12 10 pm	WPIK	Alexandria, Va.	† 730	—	38°44'41"N 77°05'57"W	Mon Sat
12 10 pm	WXRA-FM	Woodbridge, Va		105 9	—	Mon -Sat
12 10 pm	WNAV WNAV-FM	Annapolis, Md	+ 1430	99 1	38°59'00"N 76°31'21"W	— Mon Sat
12 20 pm	WGNI	Wilmington, N C	1340	—	34°12'35"N 77°56'53"W	Mon Sat
1 45 pm	WMTR	Morristown, N J	†1250	—	40°48'45"N 74°27'36"W	Mon -Sat
2 15 pm	WNAV WNAV-FM	Annapolis, Md	+ 1430	—	38°59'00"N 76°31'21"W	Sat only
4 20 pm	WTMR	Camden, N J	† 800	—	39°54'33"N 75°06'00"W	Mon Fri.
5 55 am	WBAL FM	Baltimore, Md	—	97 9	—	Mon Fri
6 45 pm	WMTR	Morristown, N J	†1250	—	40°48'45"N 74°27'36"W	Mon Fri (Summer)
12 mdnt	WMFD	Wilmington, N C	‡ 630	—	34°13'31"N 77°59'17"W	— Daily

NOTE In addition to the broadcasts direct from Weather Bureau offices listed above, these radio stations generally broadcast marine weather forecasts and warnings at other times, usually as part of news programs.

OTHER AM AND FM RADIO STATIONS BROADCASTING WEATHER BUREAU MARINE FORECASTS AND WARNINGS

Local newspapers should be consulted to determine the latest weather broadcast schedules of the radio stations listed below.

City	Station	Freq AM/FM kHz/MHz	AM Antenna Location
NEW JERSEY			
Asbury Park	WJLK	†1310	40°13'09"N 74°02'47"W
	WJLK-FM	94 3	
Atlantic City	WLDB	1490	39°22'23"N 74°26'18"W
Atlantic City	WMID	1340	39°22'34"N 74°27'08"W
Camden	WCAM	1310	39°57'28"N 75°06'54"W
New Brunswick	WCTC	1450	40°29'32"N 74°25'11"W
	WCTC-FM	98 3	
Ocean City – Somers Point	WSLT	†1520	39°19'05"N 74°37'09"W
Princeton	WHWH	‡1350	40°22'00"N 74°44'38"W
Trenton	WBUD	‡1260	40°15'58"N 74°45'46"W
Wildwood	WCMC	1230	39°00'09"N 74°48'46"W
Pleasantville	WOND	1400	39°23'38"N 74°30'34"W
PENNSYLVANIA			
Philadelphia	KYW	‡1060	40°06'16"N 75°14'56"W
Philadelphia	WIP	‡ 610	39°51'56"N 75°06'43"W
DELAWARE			
Dover	WDOV	+ 1410	39°12'03"N 75°33'55"W
	WDOV FM	94 7	
Dover	WKEN	+ 1600	39°10'11"N 75°33'13"W
Georgetown	WJWL	900	38°42'31"N 75°24'25"W
Wilmington	WAMS	‡1380	39°48'12"N 75°37'42"W
Wilmington	WDEL	‡1150	39°48'54"N 75°31'47"W
Wilmington	WSTW-FM	93 7	—
Wilmington	WILM	1450	39°43'46"N 75°33'07"W
Wilmington	WJBR FM	99 5	—
Wilmington	WTUX	1290	39°43'04"N 75°33'30"W
MARYLAND			
Aberdeen	WAMD	‡ 970	39°30'35"N 76°11'38"W
Annapolis	WYRE	810	38°58'13"N 76°30'28"W
Annapolis	WANN	†1190	38°56'32"N 76°28'54"W
Baltimore	WCAO	‡ 600	39°23'09"N 76°43'09"W
Cambridge	WCEM	1240	38°35'02"N 76°04'56"W
Chestertown	WCTR	1530	39°13'35"N 76°05'20"W
Havre de Grace	WASA	1330	39°33'54"N 76°07'08"W
Salisbury	WBOC	‡ 960	38°23'03"N 75°34'48"W
Salisbury	WJDY	†1470	38°23'30"N 75°38'48"W
DISTRICT OF COLUMBIA			
Washington	WMAL	‡ 630	39°00'55"N 77°08'30"W
	WMAL-FM	107.3	
Washington	WRC	+ 980	38°57'41"N 76°58'27"W
	WRC-FM	93 9	
Washington	WTOP	‡1500	39°02'30"N 77°02'45"W
	WTOP-FM	96 3	
VIRGINIA			
Hampton	WVEC	1490	37°01'46"N 76°22'35"W
	WVEC-FM	101 3	
Newport News	WTID	1270	37°01'52"N 76°21'58"W
Norfolk	WCMS	†1050	36°49'44"N 76°12'26"W
	WCMS-FM	100 5	
Norfolk	WNOR	1230	36°50'03"N 76°16'12"W
	WNOR-FM	98 7	
Norfolk	WTAR	+ 790	36°50'25"N 76°12'43"W
	WTAR-FM	95 7	
Norfolk	WRAP	‡ 850	36°51'39"N 76°21'13"W
Norfolk	WRVC-FM	102 9	—
Portsmouth	WCVU	‡1350	36°53'00"N 76°22'22"W
Portsmouth	WHIH	1400	36°49'45"N 76°19'23"W
Suffolk	WLPM	1450	36°45'03"N 76°35'04"W
Virginia Beach	WVAB	1550	36°49'20"N 76°05'30"W
NORTH CAROLINA			
Burgaw	WPGF	1470	34°14'04"N 77°58'20"W
Morehead City	WMBL	740	34°42'51"N 76°41'11"W
New Bern	WHIT	1450	35°06'03"N 77°04'33"W
Wallace	WLSE	1400	34°45'10"N 78°00'03"W
Washington	WITN	+ 930	35°31'34"N 77°04'43"W
Whiteville	WENC	1220	34°18'30"N 78°43'00"W
Wilmington	WHSL	1490	34°14'04"N 77°58'20"W
Wilmington	WKLM	980	34°14'53"N 78°00'04"W

TABLE 2-5. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Cape Hatteras, N.C. to Savannah, Ga.

MARINE FORECASTS AND WARNINGS BROADCAST DIRECT FROM NATIONAL WEATHER SERVICE OFFICES

Time	Station		AM Freq (kHz)	FM Freq (MHz)	AM Antenna Location	Remarks
15 min past each hr., 5 am-mdnt	WGH	Newport News Va	+ 1310	—	36°57'47"N 76°24'42"W	Daily (taped)
6 00 am	WMFD	Wilmington, N C	‡630	—	34°13'31"N 77°59'17"W	Daily
6 06 am	WSAV	Savannah, Ga	+ 630	—	32°03'51"N 81°00'52"W	Mon-Sat
6 06 am	WTOC	Savannah, Ga	+ 1290	—	32°05'26"N 81°08'55"W	Mon-Sat
6 35 am	WJAX	Jacksonville Fla	+ 930	95 1	30°17'09"N 81°44'52"W	Sat only
6 55 am	WSAV	Savannah, Ga	+ 630	—	32°03'51"N 81°00'52"W	Mon-Sat
6 55 am	WTOC	Savannah, Ga	+ 1290	—	32°05'26"N 81°08'55"W	Mon-Sat
7 25 am	WJAX	Jacksonville, Fla	+ 930	95 1	30°17'09"N 81°44'52"W	Sun only
8 03 am	WSAV	Savannah Ga	+ 630	—	32°03'51"N 81°00'52"W	Mon-Sat
8 10 am	WTOC	Savannah Ga	+ 1290	—	32°05'26"N 81°08'55"W	Sun only
12 05 pm	WJAX	Jacksonville Fla	+ 930	95 1	30°17'09"N 81°44'52"W	Sat & Sun
12 10 pm	WJAX	Jacksonville Fla	+ 930	95 1	30°17'09"N 81°44'52"W	Daily
12 12 pm	WSAV	Savannah Ga	+ 630	—	32°03'51"N 81°00'52"W	Mon-Sat
12 15 pm	WTOC	Savannah Ga	+ 1290	—	32°05'26"N 81°08'55"W	Mon-Fri
12 20 pm	WGNI	Wilmington, N C	1340	—	34°12'35"N 77°56'53"W	Mon-Sat
6 05 pm	WJAX	Jacksonville Fla	+ 930	95 1	30°17'09"N 81°44'52"W	Sun only
6 10 pm	WJAX	Jacksonville Fla	+ 930	95 1	30°17'09"N 81°44'52"W	Mon-Sat
6 38 pm	WSAV	Savannah, Ga	+ 630	—	32°03'51"N 81°00'52"W	Mon-Sat
11 05 pm	WSAV	Savannah, Ga	+ 630	—	32°03'51"N 81°00'52"W	Sun only
11 05 pm	WJAX WJAX-FM	Jacksonville, Fla	+ 930	95 1	30°17'09"N 81°44'52"W	Daily
11 10 pm	WJAX	Jacksonville Fla	+ 930	95 1	30°17'09"N 81°44'52"W	Sat only
11 50 pm	WTOC	Savannah Ga	+ 1290	—	32°05'26"N 81°08'55"W	Mon-Fri
Midnight	WMFD	Wilmington N C	‡630	—	34°13'31"N 77°59'17"W	Daily
Midnight	WSAV	Savannah, Ga	+ 630	—	32°03'51"N 81°00'52"W	Daily
12 10 am	WTOC	Savannah, Ga	+ 1290	—	32°05'26"N 81°08'55"W	Mon-Fri

NOTE In addition to the broadcast direct from National Weather Service office these radio stations generally broadcast marine weather forecasts and warnings at other times usually as part of news programs

OTHER AM AND FM RADIO STATIONS BROADCASTING MARINE WEATHER FORECASTS AND WARNINGS

Local newspapers should be consulted to determine the latest weather broadcast schedules of the radio stations listed below

City	Station	Freq AM-FM kHz/MHz	AM Antenna Location
VIRGINIA			
Hampton	WVEC	1490	37°01'46"N 76°22'35"W
	WVEC-FM	101 3	
Newport News	WTID	1270	37°01'52"N 76°21'58"W
Norfolk	WCMS	‡1050	36°49'44"N 76°12'26"W
	WCMS-FM	100 5	
Norfolk	WNOR	1230	36°50'03"N 76°16'12"W
	WNOR-FM	98 7	
Norfolk	WTAR	+ 790	36°50'25"N 76°12'43"W
	WTAR-FM	95 7	
Norfolk	WRAP	‡850	36°51'39"N 76°21'13"W
Norfolk	WRVC-FM	102 9	—
Portsmouth	WCV	‡1350	36°53'00"N 76°22'22"W
Portsmouth	WHIH	1400	36°49'45"N 76°19'23"W
Suffolk	WLPM	1450	36°45'03"N 76°35'04"W
Virginia Beach	WVAB	1550	36°49'20"N 76°05'30"W
NORTH CAROLINA			
Burgaw	WPGF	1470	34°14'04"N 77°58'20"W
Morehead City	WMBL	740	34°42'51"N 76°41'11"W
New Bern	WHIT	1450	35°06'03"N 77°04 33 W
Wallace	WLSE	1400	34°45'10"N 78°00'03"W
Washington	WITN	+ 930	35°31'34"N 77°04 43"W
Whiteville	WENC	1220	34°18'30"N 78°43 00"W
Wilmington	WHSL	1490	34°14'04 N 77°58'20"W
Wilmington	WKLM	980	34°14'53"N 78°00'04"W
SOUTH CAROLINA			
Beaufort	WBEU	960	32°26'18"N 80°42 38 W
Beaufort	WSIB	1490	32°26'08 N 80°41'54"W
Charleston	WCSC	+ 1390	32°49'26"N 80°00'06" W
	WCSC-FM	96 9	
Charleston	WOKE	1340	32°49'07"N 79°57 42"W
Charleston	WTMA	+ 1250	32 49'20"N 79°58 45"W
	WTMA-FM	95 1	
Columbia	WIS	+ 560	34°02'00"N 81°08'32"W
Columbia	WNOK	1230	33 59 25 N 81 02 41"W
Conway	WLAT	+ 1330	33°51 02"N 79°04 04"W
	WLAT-FM	104 1	
Georgetown	WGTN	1400	33°22'02"N 79°17'16"W
Kingstree	WDKD	1310	33 42 11 N 79°49'08"W
	WDKD-FM	100 1	
Myrtle Beach	WMYB	1450	33°42 40"N 78°52'04"W
	WMYB-FM	92 1	
Orangeburg	WTND	920	33 30 45 N 80°52'11 W
Walterboro	WALD	1060	32°52 52 N 80°41'24 W
GEORGIA			
Brunswick	WGIG	+ 1340	31 10 07 N 81 32 14 W
	WGIG-FM	100 7	
Brunswick	WMOG	+ 1490	31 14 55 N 81 28 28 W
Savannah	WTOC-FM	97 3	
Savannah	WEAS	900	32 05 13 N 81 05 35 W

TABLE 2-6. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Savannah, Ga. to Apalachicola, Fla.

MARINE FORECASTS AND WARNINGS BROADCAST DIRECT FROM ESSA WEATHER BUREAU OFFICES

Time		Station	AM Freq (kHz)	FM Freq (mHz)	Antenna Coordinates	Remarks
6 06 am	WSAV	Savannah, Ga	+ 630	-	32°03 51 N 81 00 52 W	Mon Sat
6 06 am	WTOC	Savannah, Ga	+ 1290	-	32°05 26 N 81 08 55 W	Mon Sat
6 35 am	WJAX	Jacksonville Fla	+ 930	95 1	30°17 09 N 81°44 52 W	Sat only
6 55 am	WSAV	Savannah, Ga	+ 630	-	32°03 51 N 81°00 52 W	Mon Sat
6 55 am	WTOC	Savannah Ga	+ 1290	-	32°05 26 N 81 08 55 W	Mon Sat
7 25 am	WJAK	Jacksonville Fla	+ 930	95 1	30°17 09°N 81°44 52 W	Sun only
7 30 am	WINZ	Miami, Fla	940	-	25°57 36 N 80°16 20 W	Mon Fri
7 45 am	WKWF	Key West Fla	1600	-	24°34 30 N 81 44 01 W	Daily
7 45 am	WKIZ	Key West, Fla	1500	-	24°34 01 N 81°44 54 W	Mon Sat
7 56 am	WNDB	Daytona Beach, Fla	+ 1150	-	29°13 44 N 81°03 03 W	Daily
8 03 am	WSAV	Savannah Ga	630		32°03 51 N 81°00 52 W	Daily
8 10 am	WMYR	Ft Myers Fla	+ 1410	-	26°37 23 N 81 51 18 W	Mon Sat
8 10 am	WCAI	Ft Myers, Fla	1350	-	26°37 31 N 81 50 29 W	Mon Sat
8 10 am	WTOC	Savannah, Ga	+ 1290	-	32°05 26 N 81°08 55 W	Sun only
8 16 am	WQXY	West Palm Beach, Fla	1340	-	26°36 41°N 80°02 17 W	Mon Sat
8 20 am	WINK	Ft Myers Fla	1240	-	26°39 03°N 81 51 20 W	Mon Sat
11 00 am	WIOD	Miami Fla	-	97 3	Mon Fri (Aug Oct) Fri only	(Nov July)
11 50 am	WVCG	Coral Gables, Fla	1080	105 1	25°43 42°N 80°18°20 W Mon Sat	Mon Sat
11 50 am	WWPB	Miami Fla	-	101 5	Mon Sat	
12 05 pm	WMYR	Ft Myers Fla	+ 1410	-	26°37 23°N 81°51 18 W	Mon Sat
12 05 pm	WJAX	Jacksonville, Fla	+ 930	95 1	30 17 09 N 81°44 52 W	Sat Sun
12 06 pm	WNDB	Daytona Beach Fla	+ 1150	-	29°13 44 N 81°03 03 W	Daily
12 10 pm	WJAX	Jacksonville Fla	+ 930	95 1	30°17 09°N 81 44 52 W	Daily
12 10 pm	WLAK	Lakeland, Fla	1430	95 1	28°03 00° N 81 56 20 W	Daily
12 11 pm	WMYR	Ft Myers Fla	+ 1410	-	26 37 23 N 81 51 18 W	Sun only
12 11 pm	WCAI	Ft Myers, Fla	1350	-	26 37 31° N 81 50 29 W	Sun only
12 11 pm	WINK	Ft Myers Fla	1240	96 9	26 39 03 N 81 51 20°W	Sun only
12 12 pm	WSAV	Savannah, Ga	+ 630	-	32 03 51 N 81 00 52 W	Mon Sat
12 15 pm	WTOC	Savannah, Ga	+ 1290	-	32 05 26 N 81 08 55 W	Mon Fri
12 15 pm	WCAI	Ft Myers, Fla	1350		26 37 31 N 81°50 29 W	Mon Sat
12 15 pm	WINK	Ft Myers Fla	-	96 9		Mon Sat
12 20 am	WINK	Ft Myers Fla	1240		26 39 03 N 81 51 20°W	Mon Sat
12 20 pm	WKIZ	Key West Fla	1500	-	24°34 01°N 81 44 54 W	Daily
12 30 pm	WKWF	Key West Fla	1600	-	24 34 30°N 81 44 01°W	Daily
5 35 am	WWPB	Miami, Fla	-	101 5		Mon Sat
5 40 pm	WINK	Ft Myers, Fla	1240	96 9	26°39 03 °N 81 51 20°W	Mon Fri (Nov Mar)
6 01 pm	WNDB	Daytona Beach, Fla	+ 1150	-	29°13 44 °N 81°03 03°W	Daily
6 05 pm	WJAK	Jacksonville, Fla	+ 930	95 1	30°17 09°N 81°44 52°W	Sun only
6 10 pm	WJAX	Jacksonville, Fla	+ 930	95 1	30°17 09°N 81°44 52°W	Mon Sat
6 30 pm	WKIZ	Key West, Fla	1500	-	24°34 01 N 81°44 54 W	Daily
6 30 pm	WKWF	Key West, Fla	1600	-	24°34 30°N 81°44 01°W	Daily
6 38 pm	WSAV	Savannah, Ga	+ 630	-	32°03 51°N 81°00 52°W	Mon Sat
10 50 pm	WWPB	Miami, Fla	-	101 5		Mon Sat Daily
11 05 pm	WSAV	Savannah, Ga	+ 630	-	32°03 51°N 81°00 52°W	Sun only
11 05 pm	WJAK	Jacksonville, Fla	+ 930	95 1	30°17 09 °N 81°44 52 °W	Daily
11 10 pm	WJAX	Jacksonville, Fla	+ 930	95 1	30°17 09 °N 81°44 52°W	Sat only
11 50 pm	WTOC	Savannah, Ga	+ 1290	-	32°05 26 N 81°08 55°W	Mon Fri
Midnight	WSAV	Savannah, Ga	+ 630	-	32°03 51 °N 81°00 52°W	Daily
12 10 am	WTOC	Savannah, Ga	+ 1290	-	32°05 26°N 81 08 55°W	Mon Fri

OTHER AM AND FM RADIO STATIONS BROADCASTING WEATHER BUREAU MARINE FORECASTS AND WARNINGS

Local newspapers should be consulted to determine latest weather broadcast schedules of the radio stations listed below

City	Station	Freq AM/FM (kHz/mHz)	Antenna Location
FLORIDA			
Arlington	WDCJ	1220	30°19 30°N 81°34 15°W
Atlantic Beach	WKTX	1600	30°19 30 N 81°25 42°W
Belle Glade	WSWN	900	26°42 54 N 80°40 58°W
Belle Glade	WSWN-FM	93 5	
Bora Raton	WSBR	740	26°20 46 N 80°12 32 °W
Bradenton	WBRD	1420	27°28 32 N 82°32 10 W
Bradenton	WTRL	1490	27°30 00°N 82°34 25 W
Brooksville	WWJB	1450	28°33 20 N 82°22 35°W
Chattahoatche	WSBP	1580	30°40 14°N 84°50 08 W
Chipley	WBGC	1240	30°46 19°N 85°33 31 W
Clearwater	WTAN	1340	27°57 50°N 82°48 15 W
Cocoa	WEZY	+ 1350	28°21 58 N 80°45 08 W
Cocoa	WKKO	+ 860	28°21 08°N 80°45 37 W
Cocoa Beach	WRKT	1300	28°20 38°N 80°46 06 W
Cocoa Beach	WKBR FM	101 1	
Cypress Gardens	WGTO	540	28°08 04°N 81°43 08°W
Dade City	WDCF	1350	28°20 16°N 82°11 25°W
Deland	WOOO	1310	28°59 57°N 81°17 55 W
Delray Beach	WDBF	1420	26°27 22°N 80°05 58°W
Englewood	WENG	1530	26°57 55°N 82°19 15°W
Ft Lauderdale	WFLM FM	105 9	
Ft Lauderdale (Oakland Park)	WIKK	1520	26°10 30°N 80°09 27°W
Ft Lauderdale	WSRF	1580	26°04 54°N 80°13 34 W
Ft Lauderdale	WWIL FM	103 5	
Ft Pierce	WIRA	1400	27°26 47°N 80°19 16°W
Ft Pierce	WIRA-FM	95 5	
Hollywood	WGMA	1320	26°01 53°N 80°16 42°W
Homestead	WIII	1430	25°27 09°N 80°30 57°W
Jacksonville	WAPE	+ 690	30°18 27 N 81°56 28 W
Jacksonville	WAPE	+ 690	30°07 52°N 81°41 55 W
Jacksonville (Orange Park)	WAYR	550	30°08 50°N 81°45 14 W
Jacksonville	WIVY	1050	30°21 58°N 81°41 21 W
Jacksonville	WMBR	+ 1460	30°19 41°N 81°44 50°W
Jacksonville	WOBS	1360	30°16 33°N 81°38 12 W
Jacksonville	WPOQ	+ 600	30°18 00 N 81°45 34°W
Jacksonville	WQIK	1280	30°21 14°N 81°44 21°W
Jacksonville	WVOJ	+ 1320	30°17 50°N 81°44 35 W
Jacksonville Beach	WRIX	1010	30°17 42°N 81°33 11°W
Marathon	WFFG	1300	24°41 28°N 81°06 30°W
Marianna	WTYS	1340	30°45 49°N 85°13 52°W
Melbourne	WMMB	1240	28°04 40°N 80°35 55°W
Miami	WFUN	790	25°41 28°N 80°24 02°W
Miami	WGBS	710	25°58 07°N 80°22 44°W
Miami	WGBS-FM	96 3	
Miami	WIOD	610	25°50 58°N 80°09 18°W
Miami	WOCN	1450	25°46 11°N 80°11 54°W
Miami	WQAM	560	25°47 20°N 80°11 04°W
Miami Beach	WAEZ FM	94 9	
Miami Beach	WKAT	1360	25°47 34°N 80°08 38°W
Miami Beach	WKAT FM	93 1	
Naples	WNOG	+ 1270	26°09 08°N 81°45 07°W
New Port Richey	WGUL	1500	28°15 32°N 82°43 54°W
Ormand Beach	WQKQ	1380	29°15 27°N 81°03 22°W
Orlando	WDBO	+ 580	28°33 17°N 81°24 42°W
Orlando	WDBO FM	92 3	
Orlando	WKIS	+ 740	28°32 53°N 81°25 37 W
Orlando	WKIS FM	100 3	
Panama City	WDLP	+ 590	30°10 20°N 85°36 49°W
Panama City	WDLP-FM	92 5	
Panama City	WMAJ FM	107 9	
Panama City	WPCF	1430	30°09 38°N 85°43 43°W
Panama City Beach	WGNE	1480	30°10 33°N 85°48 03°W
Panama City Beach	WSCM	1290	30°10 54°N 85°46 55°W
Perry	WPBY	1400	30°07 35°N 83°35 20°W
Pinellas Park	WFSO	570	27°50 44°N 82°46 22°W
Plant City	WPLA	910	28°00 01°N 82°07 20 W
Pompano Beach	WLOD	980	26°14 25 N 80°10 06°W
Pompano Beach	WRBD	1470	26°10 47°N 80°13 13°W
Port Saint Joe	WJOE	1080	29°47 23°N 85°17 14 W
Punta Gorda	WCCF	1580	26°53 33°N 82°03 02°W
Quincy	WCNH	1230	30°34 55°N 84°35 59°W
Quincy	WCNH FM	101 7	
Riviera Beach	WHEW	+ 1600	26°45 43°N 80°06 19°W
St Petersburg	WILZ	1590	27°44 03°N 82°41 08°W
St Petersburg	WLCY	+ 1380	27°52 16°N 82°37 03°W
St Petersburg	WPIN	680	27°49 45°N 82°40 18°W
St Petersburg	WSUN	+ 620	27°52 38°N 82°35 45°W
St Petersburg	WWBA	680	27°49 45°N 82°40 18°W
Sarasota	WKXY	930	27°20 37°N 82°31 10°W
Sarasota	WSAF	1220	27°19 27°N 82°29 47°W
South Daytona Beach	WELE	1590	29°09 34°N 80°59 42°W
Stuart	WSTU	1450	27°12 58°N 80°15 19°W
Tallahassee	WBGM-FM	98 9	
Tallahassee	WFSU-FM	91 5	
Tallahassee	WMEN	1330	30°29 03°N 84°17 13°W
Tallahassee	WQNS	1410	30°29 35°N 84°17 00°W
Tallahassee	WQMA FM	94 9	
Tallahassee	WTAL	1450	30°26 20°N 84°15 30°W
Tallahassee	WTNT	+ 1270	30°25 38°N 84°19 46°W
Tampa	WALT	1110	28°01 28°N 82°22 27°W
Tampa	WOAE	1250	28°00 42°N 82°29 52°W
Tampa	WFLA	+ 970	27°57 56°N 82°33 07°W
Tampa	WFLA-FM	93 3	
Tampa	WINQ	1010	27°59 25°N 82°15 06°W
Tampa	WSOL	1300	27°58 29°N 82°21 17 W
Tampa	WTMP	1150	27°56 51°N 82°23 50°W
Tampa	WYQU	1550	27°55 16°N 82°23 41°W
Tampa	WPKM-FM	104 7	
Titusville	WRMF	1050	28°35 47°N 80 49 10°W
Valparaiso-Niceville	WFSH	1340	30°30 36°N 86°28 40°W
Venice	WAMR	1320	27°06 18°N 82°26 09°W
Vero Beach	WAKE	1370	27°36 17°N 80°22 54°W
Vero Beach	WTTB	1490	27°37 12°N 80°25 01°W
West Palm Beach	WEAT	850	26°38 28 N 80°05 09°W
West Palm Beach	WIRK	+ 1290	26°37 55 N 80°07 07°W
GEORGIA			
Brunswick	WGIG	+ 1440	31°10 07 N 81°32 14 W
Brunswick	WGIG FM	100 7	
Brunswick	WMOG	1490	31°09 55°N 81°28 28°W
Savannah	WTOC-FM	97 3	
Savannah	WEAS	900	32°05 13°N 81°05 35 °W

TABLE 2-7. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Apalachicola, Fla. to Morgan City, La.

BROADCASTS OF WEATHER BUREAU MARINE FORECASTS AND WARNINGS BY AM AND FM RADIO AND TV STATIONS

Local newspapers should be consulted to determine latest weather broadcast schedules of the radio stations listed below.

City	Station	Freq. kHz/mHz	Antenna Location
ALABAMA			
Bay Minette	WBCA	1110	30°52'10" N 87°46'09" W
Fairhope	WABF	1220	30°30'38" N 87°54'13" W
Foley	WHEP	1310	30°26'06" N 87°41'00" W
Mobile	WABB	+1480	30°46'26" N 88°07'08" W
Mobile	WUNI	+1410	30°40'52" N 88°00'02" W
Mobile	WALA-TV	Ch. 10	
Mobile	WCOK	900	30°42'30" N 88°03'54" W
Mobile	WKRC	+710	30°43'13" N 88°03'34" W
Mobile	WKRG-FM	99.9 mHz	
Mobile	WKRG-TV	Ch. 5	
Mobile	WLIQ	1360	30°41'36" N 88°01'33" W
Mobile	WLPR-FM	96.1 mHz	
Mobile	WMOO	1550	30°35'51" N 87°52'57" W
Mobile (Prichard)	WZAM	1270	30°44'44" N 88°05'40" W
Mobile	WTUF	840	30°42'26" N 88°05'12" W
FLORIDA			
Chattahootchee	WSBP	1580	30°40'14" N 84°50'08" W
Chipley	WBCC	1240	30°46'19" N 85°33'31" W
Crestview	WCNU	1010	30°42'36" N 86°34'15" W
Crestview	WJSB	1050	30°45'56" N 86°35'06" W
DeFuniak Springs	WDSP	1280	30°42'41" N 86°06'25" W
DeFuniak Springs	WZEP	1460	30°43'43" N 86°07'03" W
DeFuniak Springs	WZEP-FM	103.1 mHz	Daily
Fort Walton Beach	WFTW	1260	30°25'00" N 86°37'47" W
Fort Walton Beach	WFTW-FM	99.3 mHz	
Fort Walton Beach	WNUE	1400	30°25'26" N 86°38'22" W
Marianna	WTYS	1340	30°46'00" N 85°12'26" W
Milton	WEBY	1330	30°17'13" N 87°01'20" W
Milton	WEBY-FM	102.3 mHz	
Milton	WSRA	1490	30°37'30" N 87°02'54" W
Panama City	WDLP	+590	30°10'23" N 85°36'39" W
Panama City	WDLP-FM	92.5 mHz	
Panama City	WJHC-TV	Ch.7	
Panama City	WMAI-FM	107.9 mHz	
Panama City	WPCF	1430	30°09'38" N 85°43'43" W
Panama City Beach	WGNE	1480	30°10'33" N 85°48'03" W
Panama City Beach	WSCM	1290	30°10'59" N 85°46'38" W
Pensacola	WBOP	980	30°23'54" N 87°15'17" W
Pensacola	WCOA	+1370	30°23'50" N 87°15'10" W
Pensacola	WCOA-FM	100.7 mHz	
Pensacola	WEAR-TV	Ch.3	
Pensacola	WMEL	610	30°26'52" N 87°15'30" W
Pensacola	WNVY	1230	30°24'18" N 87°12'56" W
Pensacola	WPEX-FM	94.1 mHz	
Pensacola	WPFA	790	30°26'49" N 87°15'12" W
Perry	WPRY	1400	30°07'35" N 83°35'20" W
Port St. Joe	WJOE	1080	29°47'23" N 85°17'14" W
Quincy	WCNH	1230	30°34'55" N 84°35'59" W
Quincy	WCNH-FM	101.7 mHz	
Tallahassee	WBGM-FM	98.9 mHz	
Tallahassee	WCTV-TV	Ch.6	
Tallahassee	WFSU-FM	91.5 mHz	
Tallahassee	WFSU-TV	Ch.11	
Tallahassee	WMEN	1330	30°29'03" N 84°17'13" W
Tallahassee	WONS	1410	30°29'35" N 84°17'00" W
Tallahassee	WOMA-FM	94.9 mHz	
Tallahassee	WTAL	1450	30°26'20" N 84°15'30" W
Tallahassee	WTNT	+1270	30°25'38" N 84°19'46" W
Valparaiso-Niceville	WFSH	1340	30°30'36" N 86°28'40" W
GEORGIA			
Bainbridge	WMGR	+930	30°54'25" N 84°33'02" W
Bainbridge	WAZA	1360	30°54'40" N 84°33'20" W
Cairo	WCRA	790	30°54'06" N 84°14'03" W
Thomasville	WLOR	730	30°50'57" N 83°57'08" W
Thomasville	WPAX	1240	30°50'10" N 83°59'19" W
LOUISIANA			
Colden Meadow	KLEB	1600	29°22'41" N 90°15'50" W
Colden Meadow	KLEB-FM	94.3 mHz	
Morgan City	KMRC	1430	29°41'12" N 91°10'44" W
New Orleans	WBOK	1230	29°59'18" N 90°02'45" W
New Orleans	WDSU	1280	29°53'43" N 90°00'16" W
New Orleans	WDSU-FM	93.3 mHz	
New Orleans	WDSU-TV	Ch.6	
New Orleans	WNNR	990	29°57'24" N 90°04'34" W
New Orleans	WNNR-FM	97.1 mHz	
New Orleans	WNOE	1060	29°52'43" N 89°59'39" W
New Orleans	WNPS	1450	29°57'40" N 90°05'19" W
New Orleans	WSHO	800	29°50'42" N 90°06'39" W
New Orleans	WSMB	+1350	29°55'15" N 90°02'00" W
New Orleans	WTIX	690	29°57'53" N 89°57'31" W
New Orleans	WWMT-FM	95.7 mHz	
New Orleans	WVUE-TV	Ch.12	
New Orleans	WWL	870	30°02'20" N 90°14'37" W
New Orleans	WWL-TV	Ch.4	
New Orleans	WWOM	600	29°57'01" N 90°09'16" W
New Orleans	WYLD	940	29°54'00" N 90°00'17" W
Slidell	WBGS	1560	30°15'27" N 89°47'23" W
MISSISSIPPI			
Biloxi	WLOX	1490	30°23'33" N 88°53'37" W
Biloxi	WLOX-TV	Ch.13	
Biloxi	WVMI	570	30°24'19" N 88°47'25" W
Gulfport	WGCM	1240	30°22'28" N 89°04'45" W
Gulfport	WROA	1390	30°22'11" N 89°07'10" W
Moss Point	WACY	1460	30°23'15" N 88°31'00" W
Moss Point	WACY-FM	104.9 mHz	
Pascagoula (Moss Point)	WPMP	1580	30°23'00" N 88°32'06" W

TABLE 2-8. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Morgan City, La. to Brownsville, Tex.

MARINE FORECASTS AND WARNINGS BROADCAST DIRECT FROM NATIONAL WEATHER SERVICE OFFICES

Time	Station		Frequency (kHz)	Antenna Location	Remarks
6:20 am	KRGV	Weslaco, Texas	+1290	26°12'36"N 97°54'33"W	Mon.-Sat.
6:20 am	KURV	Edinburg, Texas	+710	26°19'42"N 98°09'36"W	Mon.-Sat.
6:20 am	KBOR	Brownsville, Texas	‡1600	25°55'53"N 97°30'35"W	Mon.-Sat.
7:00 am	KEYS	Corpus Christi, Texas	+1440	27°48'38"N 97°27'20"W	Mon.-Sat.
7:10 am	KPLC	Lake Charles, Louisiana	+1470	30°15'32"N 93°16'08"W	Mon.-Sat
7:55 am	KBOR	Brownsville, Texas	‡1600	25°55'53"N 97°30'35"W	Daily
8:15 am	KPLC	Lake Charles, Louisiana	+1470	30°15'32"N 93°16'08"W	Mon.-Fri
12:10 pm	KPLC	Lake Charles, Louisiana	+1470	30°15'32"N 93°16'08"W	Mon.-Fri
12:25 pm	KBOR	Brownsville, Texas	‡1600	25°55'53"N 97°30'35"W	Daily
5:10 pm	KPLC	Lake Charles, Louisiana	+1470	30°15'32"N 93°16'08"W	Mon.-Sat
6:00 pm	KBOR	Brownsville, Texas	‡1600	25°55'53"N 97°30'35"W	Daily
10:15 pm	KBOR	Brownsville, Texas	‡1600	25°55'53"N 97°30'35"W	Daily

NOTE In addition to the direct broadcasts listed above, these radio stations generally broadcast marine weather forecasts and warnings at other times, usually as part of news programs

OTHER AM AND FM RADIO STATIONS BROADCASTING MARINE WEATHER FORECASTS AND WARNINGS

Local newspapers should be consulted to determine the latest weather broadcast schedules of the radio stations listed below

City	Station	Freq. AM/FM kHz/MHz	AM Antenna Location
LOUISIANA			
Abbeville	KROF	960	30°00'40"N 92°07'21"W
Baton Rouge	WAFB-FM	98.1	—
Baton Rouge	WAIL	1260	30°27'40"N 91°14'39"W
Baton Rouge	WIBR	‡1300	30°28'06"N 91°11'03"W
Baton Rouge	WJBO	‡1150	30°27'47"N 91°16'10"W
	WJBO-FM	102.5	—
Baton Rouge	WLCS	‡910	30°34'48"N 91°07'50"W
Baton Rouge	WLUX	1550	30°30'01"N 91°12'39"W
Baton Rouge	WQXY-FM	100.7	—
Baton Rouge	WXOK	+1460	30°25'13"N 91°08'34"W
Baton Rouge	WYNK	†1380	30°28'23"N 91°12'20"W
Baton Rouge	WYNK-FM	101.5	—
Crowley	KSIG	1450	30°13'50"N 92°21'45"W
Golden Meadow	KLEB	1600	29°22'41"N 90°15'50"W
	KLEB-FM	94.3	—
Lafayette	KPEL	+1420	30°13'28"N 92°03'30"W
Lafayette	KXKW	+1520	30°16'51"N 92°00'53"W
*Lake Charles	KAOK	1400	30°12'35"N 93°12'43"W
Lake Charles	KLOU	+1580	30°15'28"N 93°11'55"W
Lake Charles	KPLC	+1470	30°15'32"N 93°16'08"W
Lake Charles	KPLC FM	99.5	—
Morgan City	KMRC	1430	29°41'12"N 91°10'44"W
New Orleans	WBOK	1230	29°59'18"N 90°02'45"W
New Orleans	WDSU	‡1280	29°53'43"N 90°00'16"W
New Orleans	WDSU-FM	93.3	—
New Orleans	WJMR	990	29°57'24"N 90°04'34"W
New Orleans	WJMR-FM	97.1	—
New Orleans	WNOE	‡1060	29°52'43"N 89°59'39"W
New Orleans	WNPS	1450	29°57'40"N 90°05'19"W
New Orleans	WSHO	‡800	29°50'42"N 90°06'39"W
New Orleans	WSMB	+1350	29°55'15"N 90°02'04"W
New Orleans	WTIX	‡690	29°57'53"N 89°57'31"W
New Orleans	WWMT-FM	95.7	—
New Orleans	WWL	‡870	30°02'20"N 90°14'36"W
New Orleans	WWOM	600	29°57'01"N 90°09'16"W
New Orleans	WYLD	‡940	29°54'00"N 90°00'17"W
Slidell	WBGS	1560	30°15'27"N 89°47'23"W
Sulphur	KIKS	†1310	30°12'36"N 93°22'36"W
TEXAS			
Alice	KOPY	+1070	27°46'39"N 98°04'53"W
Bay City	KIOX	+1270	28°59'51"N 95°54'42"W
Baytown	KWBA	‡1360	29°46'28"N 95°00'55"W
Beaumont	KAYC	1450	30°03'52"N 94°07'12"W
Beaumont	KAYD-FM	97.5	—
Beaumont	KJET	1380	30°02'09"N 94°08'31"W
Beaumont	KLVI	+560	30°02'42"N 93°52'07"W
Beaumont	KBPO-FM	94.1	—
Beaumont	KTRM	‡990	30°07'25"N 94°09'25"W
Beeville	KIBL	1490	28°23'10"N 97°43'53"W
Clear Lake City	KMSC-FM	102.1	—
Corpus Christi	KCCT	†1150	27°52'49"N 97°27'06"W
Corpus Christi	KIOU-FM	96.5	—
Corpus Christi	KRYS	1360	27°48'01"N 97°27'41"W
Corpus Christi	KSIX	1230	27°48'19"N 97°27'15"W
Corpus Christi	KTOD-FM	101.3	—
Corpus Christi	KUNO	1400	27°48'00"N 97°26'45"W
Corpus Christi	KZFM-FM	95.5	—
El Campo	KULP	1390	29°12'34"N 96°15'50"W
Freeport	KBRZ	1460	28°58'59"N 95°20'00"W
Galveston	KGBC	+1540	29°18'51"N 94°48'16"W
Galveston	KILE	1400	29°17'24"N 94°50'12"W
Harlingen	KGBT	+1530	26°22'29"N 97°53'40"W
Houston	KBNO-FM	93.7	—
Houston	KCOH	1430	29°45'21"N 95°16'41"W
Houston	KIKK-FM	95.7	—
Houston	KILT	‡610	29°55'03"N 95°25'31"W
	KILT-FM	100.3	—
Houston	KLEF-FM	94.5	—
Houston	KNUZ	1230	29°45'32"N 95°20'21"W
Houston	KODA	†1010	29°53'47"N 95°17'25"W
Houston	KPRC	+950	29°48'18"N 95°16'42"W
Houston	KTHT	‡790	29°43'41"N 95°04'36"W
*Houston	KTRH	‡740	29°47'01"N 94°53'17"W
	KTRH-FM	101.1	—
Houston	KXYZ	+1320	29°42'37"N 95°10'29"W
	KXYZ-FM	96.5	—
Houston	KYOK	+1590	29°50'38"N 95°26'51"W
Kingsville	KINE	1330	27°36'36"N 97°47'42"W
McAllen	KRIO	‡910	26°18'02"N 98°12'38"W
McAllen	KQXX FM	98.5	—
Orange	KOGT	+1600	30°08'25"N 93°45'11"W
Pasadena	KIKK	650	29°41'18"N 95°10'29"W
Port Arthur	KFMP FM	93.4	—
Port Arthur	KOLE	1340	29°54'15"N 93°56'10"W
Port Arthur	KPAC	+1250	29°57'05"N 93°52'48"W
	KPAC-FM	98.5	—
Port Neches	KPNG	†1150	30°04'58"N 93°57'46"W
Raymondville	KSOX	1240	26°27'28"N 97°46'55"W
Robstown	KROB	1510	27°47'40"N 97°39'20"W
	KROB-FM	99.9	—
Sinton	KTOD	1590	28°01'15"N 97°28'14"W
Texas City	KTLW	920	29°25'03"N 94°56'12"W
Victoria	KNAL	+1410	28°46'48"N 97°00'08"W
Victoria	KVIC	1340	28°49'49"N 97°00'33"W

*NOTE Frequently rebroadcasts NOAA VHF-FM continuous weather transmissions

TABLE 2-9. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Mexican Border to Pt. Conception, Cal.

MARINE FORECASTS AND WARNINGS BROADCAST DIRECT FROM ESSA WEATHER BUREAU OFFICES

Time	Station		AM Freq kHz	FM Freq MHz	Antenna Coordinates	Remarks
7:25 am	KUHL	Santa Maria	+ 1440	—	34°59'02" N 120°27'10" W	Mon.-Sat.
7:40 am	KSMA	Santa Maria	1240	102.5	34°56'51" N 120°29'51" W	Mon.-Fri
	KSMA-FM			—		
8:00 am	KTMS	Santa Barbara	‡ 1250	97.5	34°25'00" N 119°49'15" W	Mon.-Fri
	KTMS-FM					
8:25 am	KUHL	Santa Maria	+ 1440	—	34°59'02" N 120°27'10" W	Mon.-Sat
12:15 pm	KUHL	Santa Maria	+ 1440	—	34°59'02" N 120°27'10" W	Mon.-Sat.
12:15 pm	KSMA	Santa Maria	1240	102.5	34°56'51" N 120°29'51" W	Mon.-Fri.
4:00 pm	KUHL	Santa Maria	+ 1440	—	34°59'02" N 120°27'10" W	Mon.-Fri.

OTHER AM AND FM RADIO STATIONS BROADCASTING WEATHER BUREAU MARINE FORECASTS AND WARNINGS

Local newspapers should be consulted to determine latest weather broadcast schedules of the radio stations listed below.

City	Station	Freq AM/FM (kHz/MHz)	Antenna Location
Anaheim	KEZY	+ 1190	33°54'03" N - 117°52'09" W
Avalon	KBIG	† 740	33°21'36" N - 118°22'18" W
El Cajon	KDEO	‡ 910	32°51'37" N - 116°58'09" W
El Cajon	KECR-FM	93.3	—
Escondido	KOWN	1450	33°07'03" N - 117°06'14" W
Glendale	KHOF-FM	99.5	—
Glendale	KIEV	870	34°08'45" N - 118°14'50" W
Glendale	KUTE-FM	101.9	—
Inglewood	KTYM	† 1460	34°00'24" N - 118°21'52" W
Inglewood	KTYM-FM	103.9	—
Long Beach	KFOX	1280	33°45'56" N - 118°07'10" W
Long Beach	KFOX-FM	102.3	—
Long Beach	KGER	+ 1390	33°53'20" N - 118°11'10" W
Los Angeles	KABC	+ 790	34°01'40" N - 118°22'20" W
Los Angeles	KABC-FM	95.5	—
Los Angeles	KBBI-FM	107.5	—
Los Angeles	KBIG-FM	104.3	—
Los Angeles	KFAC	+ 1330	34°01'10" N - 118°20'42" W
Los Angeles	KFAC-FM	92.3	—
Los Angeles	KFI	640	33°52'48" N - 118°00'48" W
Los Angeles	KFWB	980	34°04'11" N - 118°11'36" W
Los Angeles	KFMU-FM	97.1	—
Los Angeles	KGBS	‡ 1020	33°54'55" N - 118°10'45" W
Los Angeles	KGFJ	1230	34°02'15" N - 118°16'35" W
Los Angeles	KXLU-FM	89.1	—
Los Angeles	KHJ	+ 930	34°02'26" N - 118°22'18" W
Los Angeles	KHJ-FM	101.1	—
Los Angeles	KLAC	+ 570	34°04'11" N - 118°11'36" W
Los Angeles	KMLA-FM	100.3	—
Los Angeles	KMPC	+ 710	34°10'24" N - 118°24'24" W
Los Angeles	KNX	† 1070	33°51'36" N - 118°20'55" W
Los Angeles	KNX-FM	93.1	—
Los Angeles	KPOL	‡ 1540	34°04'43" N - 118°11'06" W
Los Angeles	KRKD	1150	34°05'05" N - 118°12'10" W
Los Angeles	KRKD-FM	96.3	—
Oceanside	KUDE	‡ 1320	33°12'08" N - 117°20'17" W
Ontario	KSOM	‡ 1510	34°05'41" N - 117°36'46" W
Oxnard	KOXR	‡ 910	34°16'58" N - 119°07'36" W
Pasadena	KWKW	‡ 1300	34°09'39" N - 118°04'46" W
Pasadena	KRLA	‡ 1110	34°02'13" N - 118°03'10" W
Pomona	KWOW	1600	34°01'49" N - 117°43'33" W
Port Hueneme	KACY	‡ 1520	34°10'02" N - 119°08'02" W
San Diego	KCBQ	‡ 1170	32°50'22" N - 116°59'31" W
San Diego	KFMB	+ 760	32°50'32" N - 117°01'29" W
San Diego	KFMB-FM	100.7	—
San Diego	KGB	1360	32°43'47" N - 117°05'02" W
San Diego	KGB-FM	101.5	—
San Diego	KOGO	‡ 600	32°43'17" N - 117°04'11" W
San Diego	KSDO	‡ 1130	32°47'58" N - 117°06'40" W
San Diego	KSON	1240	32°41'40" N - 117°07'17" W
San Fernando	KGIL	‡ 1260	34°14'58" N - 118°27'15" W
San Gabriel	KALI	‡ 1430	34°07'10" N - 118°04'57" W
Santa Ana	KWIZ	‡ 1480	33°54'06" N - 117°54'36" W
Santa Ana	KWIZ-FM	96.7	—
Santa Barbara	KDB	1490	34°24'57" N - 119°41'01" W
Santa Barbara	KIST	1340	34°25'15" N - 119°41'58" W
Santa Barbara	KMUZ-FM	103.3	—
Santa Maria	KEYM-FM	99.1	—
Santa Maria	KSMA-FM	102.5	—
Santa Monica	KDAY	‡ 1580	34°00'56" N - 118°25'41" W
Santa Monica	KSRF-FM	103.1	—
Ventura	KUDU	‡ 1590	34°14'12" N 119°12'11" W
Ventura	KUDU-FM	95.1	—
Ventura	KVEN	† 1450	34°15'38" N 119°14'29" W
Ventura	KVEN-FM	100.7	—

TABLE 2-10. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Pt. Conception, Cal. to Eureka, Cal.

MARINE FORECASTS AND WARNINGS BROADCAST DIRECT FROM ESSA WEATHER BUREAU OFFICES

City	Station	Freq. AM/FM KHz/MHz	Antenna Coordinates	Broadcast times (Local)
		CALIFORNIA		
Eureka	KRED	+1480	40°48'09" N 124°08°20" W	Daily 6:50 11:47 am 4:05 8:30 pm
Santa Maria	KCOY	+1440	34°59'02" N 120°27'10" W	Mon.-Sat. 7:25 8:25 am 12:15 pm
Santa Maria	KSMA	1240	34°56'34" N 120°26'29" W	Mon.-Fri. 7:40 am 12:15 pm
		OREGON		
Astoria	KAST	+1370	46°10'30" N 123°50'50" W	Mon.-Fri. 5:15 pm
Astoria	KVAS	1230	46°11'15" N 123°49'30" W	Mon.-Sat. 11:35 am
Eugene	KASH	+1600	44°03'05" N 123°03'48" W	Mon.-Sat. 7:25 am Daily 12:45 pm
Medford	KMED	1440	42°21'00" N 122°54'00" W	Mon.-Sat 7:15 am 12:15 12:45pm Mon.-Fri. 5:45pm Sun. 12:30 pm
Medford	KYJC	1230	42°19'00" N 122°50'08" W	Mon.-Sat. 7:15 am Sun. 12:30 pm
Portland	KOIN KOIN-FM	+970 101.1	45°30'56" N 122°43'56" W	Mon.-Fri. 12:15 am Same as KOIN
Portland	KPOJ KPOJ-FM	1330 98.5	45°27'13" N 122°32'45" W	Mon.-Sat. 8:00 am Mon.-Fri. 2:30 5:00 pm

OTHER AM AND FM RADIO STATIONS BROADCASTING WEATHER BUREAU MARINE FORECASTS AND WARNINGS

Local newapapers should be consulted to determine the latest weather broadcast schedules of the radio stations listed below.

City	Station	Freq. AM/FM KHz/MHz	Antenna Location
		CALIFORNIA	
Arcata	KATA	1340	40°51'12" N 124°05'00" W
Berkeley	KPAT	1400	37°51'04" N 122°17'42" W
Berkeley	KPAT-FM	102.9	---
Carmel	KRML	1410	36°32'11" N 121°53'47" W
Eureka	KINS	+980	40°48'05" N 124°07'31" W
Fort Bragg	KDAC	1230	39°26'30" N 123°47'30" W
Monterey	KMBY	1240	36°36'56" N 121°53'53" W
Oakland	KABL	960	37°49'40" N 122°18'53" W
Oakland	KABL-FM	98.1	---
Oakland	KDIA	1310	37°49'27" N 122°19'10" W
Oakland	KNEW	+910	37°53'42" N 122°19'24" W
Salinas	KDON	1460	36°52'11" N 121°49'05" W
Salinas	KSBW	1380	36°41'49" N 121°37'22" W
San Francisco	KCBS	740	38°08'23" N 122°31'45" W
San Francisco	KCBS-FM	98.9	---
San Francisco	KGO	810	37°31'39" N 122°06'05" W
San Francisco	KNBR	680	37°32'50" N 122°14'00" W
San Francisco	KNBR-FM	99.7	---
San Francisco	KSFO	560	37°44'43" N 122°22'43" W
San Jose	KEEN	1370	37°23'10" N 121°53'55" W
Santa Barbara	KDB	1490	34°24'57" N 119°41'01" W
Santa Barbara	KIST	1340	34°25'15" N 119°41'58" W
Santa Barbara	KMUZ-FM	103.3	---
Santa Barbara	KTMS	1250	34°25'00" N 119°49'15" W
Santa Cruz	KSCO KSCO-FM	+1080 99.1	36°57'42" N 121°58'54" W
Santa Maria	KEYM-FM	99.1	---
Santa Maria	KSMA-FM	102.5	---
		OREGON	
Brookings	KURY	910	42°02'08" N 124°15'16" W
Coquille	KWRO	630	43°10'19" N 124°11'52" W
Grants Pass	KAGI	+930	42°25'24" N 123°20'04" W
Grants Pass	KAJO	1270	42°26'18" N 123°21'29" W
Medford	KBOY KBOY-FM	730 95.3	42°18'53" N 122°49'24" W
Roaeburg	KQEN	1240	43°11'44" N 123°21'33" W

TABLE 2-11. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Eureka, Cal. to Canadian Border

MARINE FORECASTS AND WARNINGS BROADCAST DIRECT FROM ESSA WEATHER BUREAU OFFICES

City	Station	Freq. AM/FM kHz/MHz	Antenno Coordinates	Broadcost Times - Locol
		CALIFORNIA		
Eureka	KRED	+ 1480	40°48'09" N 124°08'20" W	Daily 1:00 6:50 am 12:05 5:05 9:05 pm
		OREGON		
Astorio	KAST	+ 1370	46°10'30" N 123°50'50" W	Mon.-Fri. 5:15 pm
Astorio	KVAS	1230	46°11'15" N 123°49'30" W	Man.-Sot. 11:35 om
Eugene	KASH	+ 1600	44°03'05" N 123°03'48" W	Mon.-Sat. 7:25 am Daily 12:45 pm
Medford	KMED	1440	42°21'00" N 122°54'00" W	Mon.-Sat. 7:15 am 12:15 12:45 pm Man.-Fri. 5:45 pm Sun. 12:30 pm
Medford	KYJC	1230	42°19'00" N 122°50'08" W	Man.-Sot. 7:15 om Sun. 12:30 pm
Portlond	KOIN	+ 970	45°30'56" N 122°43'56" W	Man.-Fri. 12:15 am
	KOIN-FM	101.1		
		WASHINGTON		
Aberdeen	KXRO	+ 1320	46°57'28" N 123°48'26" W	Mon.-Sat. 12:15 pm
Centralio-Chehalis	KELA	1470	46°41'47" N 122°57'23" W	Daily 12:16 pm
Everett	KWYZ	1230	47°59'01" N 122°10'25" W	Mon.-Sat. 7:45 am 12:15 5:45 pm Sun. 10:30 am 5:45 pm
Olympia	KGY	1240	47°03'31" N 122°54'09" W	Daily 12:30 pm
Tocomo	KTNT	1400	47°14'28" N	Mon.-Sot. 7:15 8:15 om
	KTNT-FM	97.3	122°28'04" W	12:15 5:55 pm Sun 10:05 om

OTHER AM AND FM RADIO STATIONS BROADCASTING WEATHER BUREAU MARINE FORECASTS AND WARNINGS

Local newspapers shauld be consulted ta determine the latest weather braadcast schedules af the radia statians listed belaw.

City	Station	Freq. AM/FM kHz/MHz	Antenno Locotion
		CALIFORNIA	
Arcata	KATA	1340	40°51'12"N 124°05'00"W
Crescent City	KPOD	1310	41°45'34"N 124°09'49"W
Eureka	KINS	+ 980	40°48'05"N 124°07'31"W
		OREGON	
Braakings	KURY	910	42°02'08" N 124°15'16" W
Caquille	KWRO	630	43°10'19" N 124°11'52" W
Eugene	KERG	+ 1280	44°04'47" N 123°04'12" W
Eugene	KPNW	‡1120	43°57'24" N 123°02'10" W
Eugene	KUGN	+ 590	44°05'48" N 123°04'18" W
Eugene	KZEL-FM	96.1	—
Grants Pass	KAGI	+ 930	42°25'24" N 123°20'04" W
Grants Pass	KAJO	1270	42°26'18" N 123°21'29" W
Medford	KBOY	730	42°18'53" N 122°49'24" W
	KBOY-FM	95.3	
Reedspart	KRAF	1470	43°42'54" N 124°05'37" W
		WASHINGTON	
Bellingham	KGMI	+ 790	48°43'09" N 122°26'43" W
Bremertan	KBRO	1490	47°33'52" N 122°39'26" W
Mt. Vernan	KBRC	+ 1430	48°25'22" N 122°21'10" W
Port Angeles	KAPY	†1290	48°05'55" N 123°24'21" W
Raymond	KAPA	1340	46°40'15" N 123°46'27" W
Seattle	KING	‡1090	47°23'38" N 122°25'25" W
Seattle	KIRO	+ 710	47°23'58" N 122°26'06" W
Seattle	KOMO	+ 1000	47°27'54" N 122°26'27" W
Seattle	KVI	570	47°25'19" N 122°25'44" W
Tacama	KTAC	‡850	47°13'56" N 122°23'22" W
Tacama	KTNT	1400	47°14'28" N 122°28'04" W

TABLE 2-12. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Great Lakes: Michigan & Superior

MARINE FORECASTS AND WARNINGS BROADCAST DIRECT FROM ESSA WEATHER BUREAU OFFICES

City	Station	Freq. (kHz)	Antenna Location	Broadcast Times-Local
Alpena, Mich.	WATZ	1450	45°03'44" N 83°28'23" W	Mon.-Sat. - 7:35 am 12:45 6:45 pm Sun. - 10:10 am 12:25 pm
Evanston, Ill.	WEAW	† 1330	42°08'14" N 87°53'08" W	Daily 8:35 11:35 am 1:35 2:35 3:35 4:35 5:35 6:35 7:35 pm Sat. - 6:35 10:35 am 12:35 pm Sun. - 8:00 9:00 10:00 am 12:35 pm
Green Bay, Wis.	WBAY	+ 1360	44°25'51" N 88°04'51" W	Mon.-Sat. 7:50 am 12:45 pm
Sault Ste. Marie, Mich.	WSOO	1230	46°26'16" N 84°22'42" W	Daily 7:55 am 12:15 pm

OTHER AM AND FM RADIO STATIONS BROADCASTING WEATHER BUREAU FORECASTS AND WARNINGS

Local newspapers should be consulted to determine the latest weather broadcast schedules of the radio stations listed below.

City	Station	Freq AM/FM kHz/MHz	Antenna location
MINNESOTA			
Duluth	WEBC	‡ 560	46°38'37"N 91°59'09"W
Duluth	KDAL	+ 610	46°43'13"N 92°10'34"W
WISCONSIN			
Appleton	WAPL	1570	44°13'04"N 88°24'33"W
Green Boy	WDUZ	1400	44°29'36"N 87°59'13"W
Green Boy	WNFL	‡ 1440	44°28'40"N 88°00'00"W
Manitowoc	WOMT	1240	44°05'09"N 87°41'40"W
Marinette	WMAM	570	45°06'02"N 87°37'30"W
Milwaukee	WISN	‡ 1130	42°45'18"N 88°04'53"W
	WISN-FM	97.3	
Milwaukee	WOKY	‡ 920	42°57'13"N 88°00'19"W
Milwaukee	WRIT	1340	43°02'49"N 87°58'52"W
Milwaukee	WTMJ	+ 620	43°02'15"N 88°08'10"W
	WTMJ-FM	94.5	
Neenah-Menasha	WNAM	‡ 1280	44°09'36"N 88°27'57"W
Racine	WRJN	1400	42°42'39"N 87°49'48"W
	WRJN-FM	100.7	
Sheboygan	WHBL	‡ 1330	43°43'14"N 87°44'04"W
Sturgeon Bay	WDOR	910	44°49'38"N 87°21'27"W
Superior	WDSM	+ 710	46°39'14"N 92°08'51"W
ILLINOIS			
Chicago	WAIT	820	41°55'33"N 87°57'00"W
Chicago	WBBM	780	41°59'32"N 88°01'36"W
	WBBM-FM	96.3	
Chicago	WCFL	1000	41°49'09"N 87°59'14"W
Chicago	WGN	720	42°00'42"N 88°02'07"W
Chicago	WIND	‡ 560	41°33'49"N 87°23'44"W
Chicago	WJJD	‡ 1160	42°02'30"N 87°51'57"W
	WJJD-FM	104.3	
Chicago	WKFM-FM	103.5	
Chicago	WLS	890	41°33'21"N 87°50'54"W
	WLS-FM	94.7	
Chicago	WMAQ	670	41°56'01"N 88°04'23"W
	WMAQ-FM	101.1	
Evanston	WNMP	1590	42°02'07"N 87°42'12"W
Waukegan	WKRS	† 1220	42°20'59"N 87°52'53"W
INDIANA			
Hammond	WJOB	1230	41°35'46"N 87°28'42"W
Michigan City	WIMS	‡ 1420	41°40'26"N 86°55'58"W
MICHIGAN			
Battle Creek	WBCK	‡ 930	42°17'40"N 85°11'00"W
Battle Creek	WKFR	1400	42°18'15"N 85°11'31"W
Battle Creek	WVOC	† 1500	42°17'30"N 85°10'08"W
Benton Harbor-St. Joseph	WHFB	1060	42°04'44"N 86°28'00"W
	WHFB-FM	99.9	
Big Rapids	WBRN	1460	43°39'57"N 85°28'59"W
Cadillac	WWAM	‡ 1370	44°13'54"N 85°24'45"W
Cadillac	WWTV-FM	92.9	
Cheboygan	WCBY	1240	45°39'38"N 84°29'26"W
Dowagiac	WDOW	1440	41°59'35"N 86°05'10"W
Escanaba	WDBC	‡ 680	45°45'52"N 87°05'48"W
Escanaba	WLST	† 600	45°40'28"N 87°08'41"W
Fremont	WSHN	1550	43°28'15"N 85°56'25"W
Grand Haven	WGHN	+ 1370	43°02'17"N 86°13'46"W
Grand Rapids	WFUR	1570	42°57'14"N 85°41'52"W
	WFUR-FM	102.9	
Grand Rapids	WGRD	1410	42°59'14"N 85°37'26"W
Grand Rapids	WJEF	1230	42°59'42"N 85°40'36"W
Grand Rapids	WLAV	1340	42°57'05"N 85°41'55"W
	WLAV-FM	96.9	
Grand Rapids	WOOD	+ 1300	42°51'24"N 85°39'03"W
	WOOD-FM	105.7	
Grand Rapids	WXTO-FM	97.9	
Hastings	WBCH	1220	42°37'36"N 85°16'39"W
Holland	WJBL	1260	42°43'56"N 86°06'06"W
	WJBL-FM	94.5	
Houghton	WHDF	1400	47°08'06"N 88°33'53"W
Ionia	WION	† 1430	43°00'16"N 85°05'09"W
Ishpeming	WCKD	970	46°29'31"N 87°47'56"W
Ishpeming	WJPD	1240	46°30'16"N 87°40'46"W
Kalamazoo	WKMI	+ 1360	42°19'36"N 85°31'39"W
Kalamazoo	WKPR	† 1420	42°18'46"N 85°37'02"W
Kalamazoo	WKZO	+ 590	42°21'00"N 85°33'43"W
Ludington	WKLA	1450	43°57'12"N 86°25'43"W
Manistee	WMTE	1340	44°14'07"N 86°19'05"W
Marquette	WDMJ	1320	42°32'45"N 87°26'38"W
	WDMJ-FM	95.7	
Munising	WGON	1400	46°24'30"N 86°38'38"W
Muskegan	WKBZ	‡ 850	43°08'05"N 86°15'41"W
Muskegan	WMUS	1090	43°16'35"N 86°15'10"W
	WMUS-FM	106.9	
Muskegon	WTRU	+ 1600	43°11'50"N 86°13'22"W
Muskegon Heights	WKJR	1520	43°11'23"N 86°14'40"W
Newberry	WNBY	1450	46°18'41"N 85°30'44"W
Niles	WNIL	1290	41°49'22"N 86°17'03"W
Petoskey	WJML	† 1110	45°20'05"N 84°55'34"W
	WJML-FM	98.9	
Petoskey	WMBN —	1340	45°20'50"N 84°58'01"W
	WMBN-FM	96.7	
Rockford	WJPW	810	43°07'03"N 85°34'06"W
St. Joseph	WSJM	1400	42°06'15"N 86°28'19"W
	WSJM-FM	107.1	
South Haven	WJOR	† 940	42°24'34"N 86°16'01"W
Three Rivers	WLKM	1510	41°55'41"N 85°38'18"W

TABLE 2-13. COMMERCIAL STATIONS BROADCASTING MARINE WEATHER INFORMATION

Marine Weather Services Chart, Great Lakes: Huron, Erie & Ontario

MARINE FORECASTS AND WARNINGS BROADCAST
DIRECT FROM NATIONAL WEATHER SERVICE OFFICES

City	Station	Freq (kHz)	Antenna Location	Broadcast Times - Local
Alpena, Mich	WATZ	1450	45°03 44 N 83°28'23 W	Mon-Sat 7 35 am 12 45 6 45 pm Sun 10 10 am 12 25 pm
Cleveland, Ohio	WGAR	‡1220	41°18'26''N 81°41'21'' W	Daily - 8 10 am 6 30 pm
Sault Ste Marie, Mich	WSOO	1230	46°26 16' N 84°22 42 W	Daily - 7 55 am 12 15 pm

NOTE In addition to the broadcast direct from National Weather Service office, these radio stations generally broadcast marine weather forecasts and warnings at other times, usually as part of news programs

OTHER AM AND FM RADIO STATIONS BROADCASTING
MARINE WEATHER FORECASTS AND WARNINGS

Local newspapers should be consulted to determine the latest weather broadcast schedules of the radio stations listed below

City	Station	Freq AM-FM kHz/MHz	AM Antenna Location
MICHIGAN			
Adrian	WABI	1490	41°52'33''N 84°01 12' W
Alma	WFYC	1280	43°22'08''N 84°36'19' W
Alma	WFYC FM	104 9	—
Alpena	WHSB-FM	107 7	—
Bay City	WBCM	1440	43°35'09''N 83°51 30' W
Caro	WKYO	1360	43°28'30''N 83 20 35' W
Cheboygan	WCBY	1240	45°39'38''N 84°29 26' W
Dearborn	WKNR	‡1310	42°15'15''N 83 15 14 W
Dearborn	WKNR-FM	100 3	—
Detroit	WCAR	‡1130	42°06'39''N 83°11 52 W
Detroit	WCAR-FM	92 3	—
Detroit (Royal Oak)	WEXL	‡1340	42°28 25''N 83°06 56 W
Detroit	WJBK	‡1500	42°13'51''N 83 11 55 W
Detroit	WJBK-FM	93 1	—
Detroit	WJR	760	42°10'07' N 83 13 00 W
Detroit	WJR-FM	96 3	—
Detroit	WWJ	+ 950	42°26'47''N 83 10 23' W
Flint	WTAC	‡600	42°56'22''N 83°37 41 W
Flint	WFDF	‡910	42°58'12''N 83 37 24 W
Manroe	WQTE	‡560	41°53'27''N 83°25 55 W
Mt Clemens	WBRB	‡1430	42°32'42''N 82°54 04 W
Newberry	WNBY	1450	46°18 41''N 85°30 44 W
Port Huron	WHLS	1450	42°58'37''N 82°27 58 W
Rogers City	WHAK	960	45°23'23''N 83°55 21' W
Saginaw	WKNX	‡1210	43°20 30''N 83°53 52 W
St Ignace	WIDG	940	45°52'04''N 84°47 09''W
Southfield	WXYZ	+ 1270	42°27'58''N 83°15'00''W
Southfield	WXYZ-FM	101 1	—
Tawas City-East Tawas	WIOS	‡1480	44°15'48''N 83°32 42''W
OHIO			
Akron	WAKR	+ 1590	41°01 14 N 81°30'20' W
Akron	WHLO	‡640	41°08 35 N 81°33'30' W
Akron	WSLR	‡1350	41°10 05 N 81°30 45' W
Ashtabula	WREO	‡970	41°48 58 'N 80°46 52' W
Bowling Green	WMGS	‡730	41°31 57 N 83°33'55 W
Cleveland	WKYC	‡1100	41°23 10 N 81°41 23' W
Cleveland	WKYC FM	105 7	—
Cleveland	WIXY	‡1260	41°24 30''N 81°40'24' W
Cleveland	WGAR FM	99 5	—
Cleveland	WHK	+ 1420	41°21 30 N 81°40'03 W
Cleveland	WMMS-FM	100 7	—
Cleveland (Cleveland Heights)	WJMO	1490	41°30 46 'N 81°36'05''W
Cleveland	WJW	‡850	41°19'00''N 81°43'43''W
Cleveland	WCJW FM	104 1	—
Conneaut	WWOW	1360	41°55 32' N 80°32'32''W
Cuyohaga Falls	WCUE	‡1150	41°07 34 N 81°31'16''W
Elyria	WEOL	‡930	41°16 10''N 82°00 21' W
Elyria	WBEA FM	107 3	—
Painesville	WPVL	‡1460	41°44'23''N 81°14'09''W
Port Clinton	WRWR FM	94 5	—
Sandusky	WLEC	1450	41°26'29''N 82°41'10 'W
Sandusky	WLEC-FM	102 7	—
Toledo	WCWA	1230	41°38 13''N 83°33'52''W
Toledo	WMHE-FM	92 5	—
Toledo	WOHO	‡1470	41°37'55''N 83°28 45' W
Toledo	WSPD	+ 1370	41°36'03 N 83°32'11''W
Toledo	WSPD-FM	101 5	—
Toledo	WTOD	‡1560	41°36'59''N 83°37 22' W
PENNSYLVANIA			
Erie	WRIE	‡1330	41°59 32' N 80°01 44''W
Erie	WJET	1400	42°07 28 N 80°03 54 W
Erie	WWGO	1450	42°07 26 N 80°04'52 W
Erie	WWYN	‡1260	42°03 17 N 80°02 31 W
Erie	WWFM FM	99 9	—
North East	WHYP	1530	42°12 05' N 79°51'43' W
NEW YORK			
Buffalo	WBEN	+ 930	42°58 42 'N 78°57 27''W
Buffalo	WBEN-FM	102 5	—
Buffalo	WEBR	‡970	42°44 41' N 78°53'13 'W
Buffalo	WEBR-FM	94 5	—
Buffalo	WGR	+ 550	42°46 04 N 78°50'39''W
Buffalo	WGR FM	96 9	—
Buffalo	WKBW	‡1520	42°46 04 N 78°50 39 'W
Buffalo	WBNY FM	96 1	—
Fultan	WOSC	1300	43°17 36 N 76°26 31''W
Lockport	WUSJ	1340	43°10 26 N 78°42 35''W
Niagara Falls	WHLO	‡1270	43°00 18 N 78°59 35' W
Niagara Falls	WHLO FM	98 5	—
Niagara Falls	WJJL	1440	43 04 41 N 79°00'05 W
Oswego	WSGO	1440	43 28 09 N 76°29 00 W
Rochester	WHAM	1180	43 04 55 N 77°43 30 W
Rochester	WROC	- 1280	43 05 54 N 77°35 00' W
Rochester	WROC FM	97 9	—
Rochester	WSAY	- 1370	43 06 01 N 77°34 23 W
Syracuse	WFBL	- 1390	43 05 30 N 76°05 19 W
Syracuse	WHEN	- 620	43 05 35 N 76°11 19 W
Syracuse	WNDR	- 1260	43 01 29 N 76 03 53 W
Syracuse	WSYR	‡570	42°59 13 N 76°09 09 W

2.3 COAST GUARD WEATHER DISSEMINATION BY RADIO

2.3.1 Introduction

Although the National Weather Service (formerly the U.S. Weather Bureau) has statutory responsibility for providing weather information to the public, it seeks the cooperation of other agencies and organizations in disseminating this information. The United States Coast Guard, with its extensive communication capabilities and close contact with the marine environment, maintains close coordination with the NWS and is involved in all phases of marine weather reporting and dissemination.

This section describes Coast Guard activities in dissemination of marine weather information by radio. The role of the Coast Guard in the Coastal Warning Display System is described in Paragraph 2.5.

2.3.2 Policies

Current Coast Guard policy for weather dissemination and reporting is established in Commandant Instruction 3140.2 of August 1969, a copy of which is included as Appendix C. The Instruction defines the Coast Guard program objectives as follows:

a. To assist the National Weather Service (NWS) in its weather reporting and dissemination program.

b. To establish future requirements for marine weather information.

It recognizes an urgent need for the development of a long-range plan for weather reporting and dissemination by the Coast Guard, calls for close coordination between Coast Guard District Commanders and NWS regional directors and instructs District Commanders to develop weather reporting and disseminating plans for their districts.

The policy statement on radio dissemination supports a broadcast program which provides timely information tailored to the local area. It authorizes (by reference) the use of the Distress,

Safety and Calling frequencies (500 kHz, 2182 kHz, and 156.8 MHz) to announce scheduled marine information broadcasts and to transmit urgency and safety signals and urgency messages. It indicates that safety messages, wherever possible, should be transmitted on a working frequency assigned for broadcast purposes, but authorizes the transmission of short safety messages on 2182 kHz and 156.8 MHz when the situation warrants such action.

The general policy outlined is to make scheduled marine information broadcasts in the 2-MHz band, but to limit the use of VHF-FM frequencies (except in designated areas) to the transmission of warning messages. The exceptions are in the 9th District (Great Lakes Area) where scheduled weather broadcasts are made on the VHF-FM working frequency of 156.6 MHz, and in the Mississippi Valley (2nd District) where the Environmental Channel (156.75 MHz) is used to make scheduled transmissions of marine information.

2.3.3 Facilities

Regularly scheduled broadcasts of marine weather information are made at 2670 kHz from 15 Coast Guard radio stations at powers between 1 kW and 3 kW. In addition to the broadcasts from radio stations, scheduled transmissions of weather information are made at limited power (50 to 100 W) from 12 other Coast Guard facilities. These stations are identified in Table 2-14 by name and call sign; times at which scheduled broadcasts are made are also given. Two other radio stations broadcast hydrographic information and Notices to Mariners on this frequency, but do not currently make weather broadcasts.

There are approximately 250 Coast Guard shore stations equipped with VHF/FM transmitters. Altough the majority of these do not operate in the broadcast mode, they represent a potential for communications in the VHF/FM band. These stations are listed

by name in Table 2-15, which also gives the call sign, location, and antenna height of each station.

All transmitters have multiple channel capability and are equipped to operate on 156.8 MHz (national distress, safety, and calling frequency, Channel 16) and 156.6 MHz (port operations frequency, Channel 12). Many stations also have Channel 14 at 156.7 MHz. Channels 21, 22, and 23 (157.05, 157.10, and 157.15 MHz) are assigned as working frequencies. Operation on other frequencies requires the installation of an additional crystal at a cost of approximately $50 per channel.

Transmitting power is generally limited to 25 watts (radiated) which precludes the effective use of low-cost, tuneable, portable receivers. Reception range is dependent upon heights of transmitting and receiving antennas, receiver performance, and propagation conditions, but is typically about 20 miles for average quality installed marine radiotelephones.

2.3.4 Procedures

Weather warning and forecast information is relayed from the local Weather Service Office to Coast Guard facilities via teletypewriter or telephone land line.

Warnings or urgency messages are broadcast at the earliest available time on the distress, safety, and calling frequencies (2182 kHz and 156.8 MHz). Scheduled broadcasts in the 2-MHz band are announced on 2182 kHz prior to transmission on 2670 kHz.

Stations authorized to initiate small craft visual warning displays based on locally observed conditions also make unscheduled broadcasts on 2182 kHz and 156.8 MHz. The broadcast states that small craft warnings are in effect for the local area based on observed weather conditions and includes wind and sea conditions.

TABLE 2-14. COAST GUARD RADIO STATIONS
MAKING SCHEDULED WEATHER BROADCASTS ON 2670 kHz
(Information Correct to January 1971)

STATION NAME	CALL SIGN	SCHEDULED BROADCAST TIMES (GMT Unless Otherwise Noted)
Boston	NMF	0440, 1040, 2240
New York	NMY	0920, 1220, 1520, 1820, 2120, 0020[1]
Cape May	NMK	1100, 2300 0945, 1245, 1545, 1845, 2145, 0045[1]
Baltimore	NMX	1750
Fort Macon	NMN37	1130, 1700
Jacksonville	NMV	0620, 1120, 1320, 1520, 1820
Miami	NMA	0100, 0450, 0500, 1000, 1100, 1200, 1300, 1400, 1500, 1650, 1700, 2000, 2200
San Juan	NMR	0300, 1500
New Orleans	NMG	0550, 0950, 1150, 1350, 1750, 1950, 2150, 2350
Galveston	NOY	0520, 0920, 1120, 1320, 1720, 1920, 2120, 2320
Port Isabel	NCH	1300, 1700, 2300
St. Louis	NML	0300, 1230 (CST)
Long Beach	NMQ	0500, 1430, 1900, 2300
Westport	NMW	0530, 1730
Port Angeles	NOW	0545, 1745
Seattle	NMW43	1715
Saulte St. Marie	NOG	0800, 1400 (EST)[2]
Belle Isle	NMD20	Odd Hour + 55 min.[2]
Buffalo	NMD47	Odd Hour + 35 min.[2,3]

TABLE 2-14. (CONTINUED)

STATION NAME	CALL SIGN	SCHEDULED BROADCAST TIMES (GMT Unless Otherwise Noted)
Marblehead	NMD15	Hourly + 10 min.[2]
Kodiak	NOJ	0200, 0900, 1400, 2100, 0700, 1900
Ketchikan	NMJ	0115, 0815, 1315, 2015
Ocean Cape	NMJ19	0145, 0845, 1345, 2045
Cape Sarichef	NRW	0515, 1215, 1715, 2315
Biorka	NMJ18	0100, 0800, 1300, 2000
Adak	NMJ21	0530, 1130, 1730, 2330
Honolulu	NMO	0000, 0300, 0600, 0900, 1200, 1500, 1800, 2100

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[1]Scheduled broadcasts active 15 May - 15 October.

[2]During Shipping Season Only.

[3]This frequency not used for broadcast schedules between the hours 2135-0355 EST.

TABLE 2-15

COAST GUARD VHF-FM TRANSMITTING FACILITIES AS OF 1 JANUARY 1971

STATION NAME	CALL SIGN	STATION LOCATION		ANTENNA HEIGHT*
Southwest Harbor GRU	NMF44	44°16'N	68°18'W	76
West Jonesport STA	NMF47	44°31'N	67°37'W	104
Quoddy Head (Remote)		44°49'N	66°57'W	220
Rockland STA	NMF40	44°06'N	69°06'W	66
Portland STA	NMF31	43°38'N	70°14'W	70
Boothbay Harbor STA	NMF24	43°50'N	69°38'W	102
Kennebec River STA	NMF25	43°45'N	69°47'W	35
Fletchers Neck STA	NMF33	43°26'N	70°20'W	43
Portsmouth Harbor STA	NMF18	43°02'N	70°42'W	106
Bostom GRU	NMF07	42°21'N	71°03'W	469
Merrimac River STA	NMF15	42°48'N	70°48'W	65
Gloucester STA	NMF13	42°35'N	70°41'W	65
Point Allerton STA	NMF04	42°18'N	70°55'W	125
Scituate STA	NMF05	42°11'N	70°33'W	86
Woods Hole GRU	NMF02	41°30'N	70°39'W	180
Cape Cod STA	NMF08	41°46'N	70°31'W	62
Race Point STA	NMF03	42°04'N	70°13'W	80
Chatham STA	NMF06	41°40'N	69°57'W	104
Brant Point STA	NMF09	41°17'N	70°05'W	60
Gay Head STA	NMF14	41°20'N	70°50'W	160
Castle Hill STA	NMF21	41°27'N	71°21'W	89
Point Judith STA	NMF36	41°21'N	71°28'W	100
Block Island STA	NMF35	41°11'N	71°35'W	63
New London COTP	NMY12	41°21'N	72°06'W	36
Fishers Island STA	NMY13	41°17'N	71°56'W	70
Eatons Neck STA	NMY33	40°57'N	73°23'W	144
Shinnecock STA	NMY41	40°51'N	72°40'W	58
Montauk STA	NMK37	41°02'N	71°55'W	44
East Moriches STA	NMY00	40°44'N	72°45'W	59
Rockaway STA	NMY51	40°33'N	73°52'W	110
Short Beach STA	NMY54	40°35'N	73°33'W	55
Atlantic Beach STA	NMY46	40°36'N	73°44'W	15
Fire Island GRU	NMY45	41°36'N	73°13'W	75
Ambrose LTSTA		40°27'N	73°50'W	108
Governors Island GRU				
Manhattan (Remote)		40°42'N	74°01'W	600
Fort Totten STA	NMY30	40°47'N	73°47'W	40
Execution Rocks LTSTA	NMY29	40°52'N	73°44'W	40
Sandy Hook STA	NMY52	40°28'N	74°01'W	150
Shark River STA	NMY53	40°11'N	74°00'W	40
Manasquan STA	NMY49	40°06'N	74°02'W	30
Atlantic City STA	NMK03	39°21'N	74°24'W	40
Barnegat Light STA	NMK04	39°45'N	74°06'W	62
Beach Haven STA	NMK05	39°32'N	74°15'W	23
Great Egg STA	NMK29	39°17'N	74°33'W	27
Cape May GRU	NMK00	38°57'N	74°58'W	189
Townsends Inlet	NMK33	39°07'N	74°42'W	25
Indian River	NMK21	38°38'N	75°04'W	65
Gloucester BASE	NMK02	39°52'N	75°46'W	69

TABLE 2-15 (Continued)

STATION NAME	CALL SIGN	STATION LOCATION		ANTENNA HEIGHT*
Delaware Bridge (Remote)		39°42'N	75°30'W	475
Baltimore GRU	NMX00	39°12'N	76°34'W	64
Washington D.C. (Remote)		38°47'N	77°05'W	150
Stillpond STA	NMN11			100
Annapolis STA	NMN33	38°59'N	76°29'W	112
Thomas Point LTSTA	NMN61	38°53'N	76°26'W	55
Taylors Island STA	NMN75	38°28'N	76°17'W	60
Dahlgren STA	NMN70	38°56'N	75°23'W	66
Piney Point STA	NMN32	38°08'N	76°32'W	100
Chincoteague STA	NMN70	38°56'N	75°23'W	45
Ocean City STA	NMN77	38°19'N	75°05'W	65
Parramore Beach STA	NMN79	37°34'N	75°37'W	105
Crisfield LAS	NMN35	37°59'N	75°52'W	55
Norfolk STA	NMN80	36°56'N	76°23'W	113
Smith Point LTSTA	NMN56	37°52'N	76°11'W	76
Wolf Trap LTSTA	NMN66	37°23'N	76°11'W	76
Milford Haven STA	NMN08	37°29'N	76°19'W	92
Little Creek STA	NMN85	36°55'N	75°55'W	100
Chesapeake LTSTA	NMN06	36°54'N	75°42'W	108
Cape Hatteras STA	NMN13	35°14'N	75°31'W	62
Oregon Inlet STA	NMN78	35°46'N	75°31'W	73
Hatteras STA	NMN29	35°13'N	75°41'W	58
Diamond Shoals STA	NMN07	35°09'N	75°17'W	114
Ocracoke STA	NMN29	35°06'N	75°59'W	79
Fort Macon GRU	NMN37	34°41'N	76°40'W	73
Wrightsville Beach STA	NMN76	34°12'N	77°48'W	105
Swansboro STA	NMN34	34°38'N	77°05'W	78
Cape Lookout STA	NMN12	34°36'N	76°32'W	82
Hobucken STA	NOZ03	35°15'N	76°35'W	108
Oak Island STA	NMN72	33°53'N	78°02'W	94
Frying Pan LTSTA	NMN20	33°29'N	77°35'W	100
Wilmington COTP	NMN81	34°13'N	77°57'W	116
Charleston BASE	NMB00	32°46'N	79°57'W	100
Sullivans Island (Remote)		32°45'N	79°50'W	160
Savannah COTP	NMB05	32°24'N	81°42'W	150
St. Simons Island STA	NMB03	31°09'N	81°22'W	45
Jacksonville COTP	NMV02	30°18'N	81°24'W	130
Jacksonville RADSTA	NMV00	30°18'N	81°24'W	80
Port Canaveral STA	NMA12	28°24'N	80°35'W	150
Ponce de Leon STA	NMA03	29°04'N	80°55'W	150
Fort Pierce STA	NMA02	27°28'N	80°18'W	70
Miami Beach BASE	NCF00	25°47'N	80°11'W	100
Miami RADSTA (Remote)		25°47'N	80°10'W	150
Lake Worth STA	NMA06	26°46'N	80°03'W	45
Fort Lauderdale STA	NMA14	26°10'N	80°07'W	95
Key West STA	NOK00	24°33'N	82°48'W	50
Islamorada STA	NMA08	24°57'N	80°37'W	65
Marathon STA	NMA11	24°44'N	81°07'W	65
St. Petersburg CGAS	NOF00	27°45'N	82°38'W	60
Fort Myers Beach STA	NMA15	26°39'N	81°52'W	45

TABLE 2-15. (Continued)

STATION NAME	CALL SIGN	STATION LOCATION		ANTENNA HEIGHT*
Mobile BASE	NOQ00	30°40'N	90°02'W	483
Panama City STA	NOQ07	30°10'N	85°42'W	57
Santa Rosa STA	NOQ06	30°19'N	87°15'W	60
Pascagoula STA	NOQ04	30°21'N	88°33'W	25
New Orleans BASE	NMG02	30°00'N	90°05'W	380
New Canal STA	NMG03	30°02'N	90°07'W	69
Grand Isle STA	NMG15	29°13'N	89°59'W	25
Sabine STA	NOY06	29°42'N	93°51'W	40
Calcasieu RBNSTA	NMG04	29°46'N	93°20'W	170
Galveston COTP	NOY01	29°20'N	94°46'W	90
Houston STA	NOY04	29°45'N	95°22'W	175
Freeport STA	NOY07	28°56'N	95°18'W	42
Port Arkansas STA	NOY03	27°50'N	97°03'W	87
Port O'Connor STA	NOY05	28°26'N	96°26'W	61
Port Isabel STA	NCH00	26°04'N	97°09'W	52
.				
Buffalo STA	NMD47	42°55'N	78°55'W	85
Alexandria Bay STA	NMD35	44°20'N	75°54'W	70
Galloo Island STA	NMD48	43°54'N	76°23'W	102
Oswego STA	NMD04	43°28'N	76°29'W	75
Sodus Point STA	NMD18	43°17'N	76°59'W	85
Rochester STA	NMD07	43°16'N	77°36'W	85
Niagara STA	NMD06	43°15'N	79°03'W	85
Cleveland STA	NMD02	41°30'N	81°43'W	
District Office (Remote)				440
Erie STA	NMD11	42°09'N	80°00'W	65
Ashtabula STA	NMD29	41°54'N	80°48'W	105
Fairport STA	NMD12	41°45'N	81°16'W	85
Lorain STA	NMD13	41°28'N	82°10'W	80
Sandusky STA	NMD16	41°29'N	82°42'W	85
Marblehead STA	NMD15	41°32'N	82°43'W	100
Toledo STA	NMD10	41°42'N	83°17'W	65
Detroit LTSTA	NMD19	42°00'N	83°08'W	55
Belle Isle STA	NMD20	42°20'N	82°59'W	480
St. Clair Shores STA	NMD52	42°33'N	82°39'W	85
St. Clair Flats STA	NMD21	43°31'N	82°41'W	79
Port Huron STA	NMD22	43°00'N	82°25'W	175
Harbor Beach STA	NMD23	43°51'N	82°38'W	85
Saginaw River STA	NMD09	43°38'N	83°51'W	65
Tawas STA	NMD24	45°19'N	83°50'W	88
Charlevoix STA	NMD34	45°19'N	85°15'W	180
Beaver Island STA	NMD33	45°44'N	85°30'W	65
St. Ignace STA	NMP17	41°51'N	84°42'W	85
White Shoal LTSTA	NMD37	45°50'N	85°08'W	120
Grays Reef LTSTA	NMD36	45°46'N	85°09'W	80
Lansing Shoal LTSTA	NMD14	44°54'N	85°34'W	70
Ludington STA	NMD41	43°57'N	86°27'W	85
N. Manitou LTSTA	NMD05	45°01'N	85°57'W	84
Frankfort STA	NMD39	44°37'N	86°14'W	110
Manistee STA	NMD40	44°15'N	86°20'W	85
Muskegon STA	NMD42	43°13'N	86°20'W	85

TABLE 2-15. (Continued)

STATION NAME	CALL SIGN	STATION LOCATION		ANTENNA HEIGHT*
Grand Haven STA	NMD43	43°03'N	86°14'W	85
Holland STA	NMD44	42°46'N	86°12'W	85
Chicago COTP	NMP00	41°53'N	87°36'W	537
South Haven STA	NMD45	42°24'N	86°17'W	85
St. Joseph STA	NMD46	42°06'N	86°29'W	85
Michigan City STA	NMP02	41°43'N	86°54'W	85
Calumet Harbor STA	NMP03	41°43'N	87°31'W	80
Wilmette STA	NMP06	42°04'N	87°41'W	85
Two Rivers STA	NMP12	44°08'N	87°33'W	85
Kenosha STA	NMP07	42°35'N	87°49'W	85
Racine STA	NMP08	42°44'N	87°46'W	33
Milwaukee STA	NMP09	43°03'N	87°53'W	85
Sheboygan STA	NMP11	43°45'N	87°42'W	85
Sturgeon Bay STA	NMP14	44°47'N	87°18'W	110
Plum Island STA	NMP15	45°18'N	86°56'W	82
Sault Ste. Marie BASE	NOG00	46°30'N	84°20'W	305
Detour LTSTA	NOG19	45°57'N	83°54'W	90
Portage STA	NOG17	47°13'N	88°37'W	625
Grand Marais STA	NOG03	46°40'N	85°58'W	80
Munising STA	NOG04	46°27'N	86°28'W	75
Marquette STA	NOG05	46°32'N	87°22'W	75
Manitou Island LTSTA	NOG09	47°25'N	87°35'W	84
Rock of Ages LTSTA	NOG16	47°52'N	89°19'W	115
Passage Island LTSTA	NOG18	48°13'N	88°21'W	119
Duluth STA	NOG14	46°46'N	92°05'W	85
North Superior STA	NOG15	47°44'N	90°20'W	85
Devils Island LTSTA	NOG24	46°48'N	90°49'W	72
St. Mary's River Lookout	NOG07	46°17'N	84°13'W	130
San Diego CGAS	NMQ26	32°43'N	117°10'W	394
Long Beach STA	NMQ09	33°42'N	118°15'W	219
Long Beach RADSTA	NMQ00	33°45'N	118°20'W	1450
Santa Barbara GRU	NMQ04	34°24'N	119°41'W	234
Port Hueneme STA	NMQ08	34°08'N	119°12'W	208
Point Conception LTSTA	NMQ05	34°27'N	120°29'W	232
Point Arguello LORAN STA	NMQ06	34°35'N	120°39'W	170
Monterey STA	NMC06	36°36'N	121°54'W	75
Big Sur LTSTA (Remote)		36°18'N	121°54'W	150
Bodega Bay STA	NMC51	38°20'N	123°03'W	62
Appraisers Building (Remote)		37°45'N	122°27'W	274
Mount Diablo (Remote)		37°52'N	121°52'W	3849
Rio Vista STA	NMC02	38°09'N	121°41'W	112
Tahoe City STA	NMC07	39°20'N	120°00'W	
Humbolt Bay STA	NMC11	40°46'N	124°13'W	87
Coos Bay GRU	NMW08	43°20'N	124°19'W	85
Port Oxford (Remote)		43°44'N	124°30'W	255
Chetco River STA	NMW07	42°02'N	124°16'W	65
Coquille River STA	NMW05	43°07'N	124°24'W	150
Umpqua River STA	NMW09	43°39'N	124°11'W	183

TABLE 2-15. (Continued)

STATION NAME	CALL SIGN	STATION LOCATION		ANTENNA HEIGHT*
Suislaw River STA	NMW11	44°00'N	124°07'W	75
Yaquina Bay STA	NMW12	44°37'N	124°03'W	650
Depoe Bay STA	NMW10	44°50'N	124°03'W	85
Astoria CGAS	NMW51	46°12'N	123°46'W	61
Cape Disappointment STA	NMW15	46°16'N	124°03'W	323
Tillamook Bay STA (Remote)		45°34'N	123°56'W	77
Willapa Bay STA	NMW17	46°43'N	124°02'W	72
Grays Harbor STA	NMW18	46°54'N	124°06'W	37
Portland GRU	NMW44	45°34'N	122°47'W	1150
Rainier (Remote)				800
Kennewick STA	NMW45	46°13'N	119°06'W	2380
Port Angeles GRU	NOW00	48°08'N	123°24'W	73
Mt. Constitution (Remote)		48°40'N	122°50'W	2515
Bohukus Peak (Remote)		48°22'N	124°41'W	1590
Quillayute River STA	NMW41	47°54'N	124°38'W	80
Neah Bay STA	NMW40	48°22'N	124°36'W	85
Seattle STA	NMW43	47°45'N	122°25'W	710

* Antenna height above mean sea (lake) level.

2.4 PUBLIC COAST STATIONS VHF/FM - MF/AM

2.4.1 Introduction

Collectively, Public Coast Stations form a network which is an extension of the land telephone wire-line system to marine users. A boatman equipped with a marine radio telephone may place a call through such a station to any land-based location, and is billed for this service according to the established land phone rates plus an "air-service" fee established by the station.

FCC regulations require all such stations to maintain a listening watch on the distress and calling frequency (2182 kHz or 156.8 MHz), and to make emergency and safety broadcasts on request. There is no requirement, however, for these operations to provide public service time nor to make any form of scheduled weather information broadcasters.

2.4.2 Policies

Although not specifically required to do so, a number of Public Coast Stations provide marine weather information services of some kind. The policies under which such services are provided vary from station to station, and no general rule is observed even within the major affiliate groups (such as the Bell System).

Two basic types of service are provided, however; the dissemination of marine weather information in a broadcast mode, and the provision of specific weather information to individual users on request. The latter service may be satisfied in a number of ways. Some stations, through cooperative arrangements with other agencies, can connect callers with recorded local and/or marine weather forecasts and in some cases with local observations; others will connect the caller to the local Weather Service telephone weather number. It would also be possible for such a station to monitor and relay the NWS VHF weather radio broadcast to individual users on request, although no documented instance of this type of service has been established.

In the Chesapeake Bay area a trial program was initiated in which a marine forecaster was made accessible to boatmen to give the latest information and answer specific questions. Because of concern that the forecaster would be overloaded with requests, the program was not widely publicized and the access number was provided only to a single marine operator in the area. Consequently the service received little demand and no conclusions were reached regarding its utility or viability. It is possible that a more extensive trial may be made in the future.

2.4.3 Facilities

As of September 1970 there were 191 stations in operation, 41 Public Class II B Coast Stations operating in the medium frequency (2 MHz) band and 150 Public Class III B Coast Stations in the VHF/FM band. A list of these stations is given in Tables 2-16 and 2-17. The system is subject to considerable growth, especially in the VHF/FM band, and this list should not be regarded as current. Up-to-date information is available from the Aviation and Marine Division of the FCC.

Class III B Stations are limited by FCC regulations to transmitter power of 50 watts, giving them a nominal range of 20 to 30 miles. Based upon need, higher powers may be authorized, possibly resulting in an increase in range. Range will also be affected by other parameters, notably antenna height, but generally falls within the values indicated above. All stations are equipped to operate on Channel 16, 156.8 MHz (distress, safety, and calling frequency), and a working or correspondence (duplex) channel. The most commonly used channels are 24 through 28 (161.8 to 162.0 MHz coastal frequencies); the recently created Channels 84 through 87 (lying within the same frequency band) are also authorized for public correspondence use.

Stations in the MF band (Class II B) provide similar service to users in the range 60 to 360 miles over sea water paths, depending on transmitter power and atmospheric noise levels;

service over fresh water paths is more limited and generally ranges between 40 and 100 miles. Communications in this band are more susceptible to interference and fading than those in the VHF/FM band, and a considerable problem exists as a result of this susceptibility and the heavy traffic carried. Anomalous propagation conditions, which become prevalent in late evening and at night, cause "skip" transmissions which preclude communication with adjacent zones and degrade reception in areas thousands of miles from the point of origin.

2.4.4 Procedures

The diversity of ownership, and therefore in policy, precludes the establishment of a general procedural description of those stations providing marine weather services.

Generally, however, stations making marine weather broadcasts obtain their information from NOAA by means of the Weather Wire Service. The marine operator announces that a broadcast is to be made via the distress, safety, and calling channel, and advises users to switch to their local working frequency. The weather message is then read in part or in full as local requirements dictate. Such broadcasts are rarely made more than twice each day. The procedures adopted by stations providing weather information on request are tailored to the particular operation and policy of that station. Some of these were discussed briefly in Paragraph 2.4.2.

TABLE 2-16

PUBLIC COAST STATIONS OPERATING
IN THE 2-MHz BAND

(September 1970)

Boston, Massachusetts	WOU
Chatham, Massachusetts	WCC
Amagansett, New York	WSL
New York, New York	WOX, WSF
Ocean Gate, New Jersey	WOO, WAQ
Tuckerton, New Jersey	WSC
Wilmington, Delaware	WEH, WLF
Baltimore, Maryland	WMH
Norfolk, Virginia	WGB
Charleston, South Carolina	WJO
Jacksonville, Florida	WNJ
Ojus (Miami), Florida	WAX, WOM
Lantana (Miami), Florida	WOE
Miami, Florida	WDR
Tampa, Florida	WPD, WFA
Mobile, Alabama	WLO
New Orleans, Louisiana	WAK, WNU
Port Arthur, Texas	WPA
Galveston, Texas	KLC, KQP
Corpus Christi, Texas	KCC
Swan Island	WSG
San Juan, Puerto Rico	WCT
Seattle, Washington	KOW
Astoria, Oregon	KFX
Portland, Oregon	KQX
Coos Bay, Oregon	KTJ
Eureka, California	KOE
San Francisco, California	KPH
San Francisco, California	KFS
San Francisco, California	KLH
San Francisco (Dixon), California	KMI
Los Angeles, California	KOK
San Pedro, California	KOU
Galveston, Texas	KLC

TABLE 2-17

LOCATIONS OF MARINE PUBLIC COAST STATIONS
OPERATING IN THE VHF BAND 156-162 MHz

(September 1970)

CALL SIGN	ALABAMA	COORDINATES
WLO	Calvert, Alabama	88 02 28W 31 10 08N
WLO	Coden, Alabama	88 12 20W 30 22 34N
WLO	Mobile, Alabama	88 02 29W 30 42 12N
WLO	Myrtlewood, Alabama	87 57 00W 32 12 40N
WLO	S. Grove Hill. Alabama	87 47 20W 31 40 30N
	ARKANSAS	
Pending	S. Fort Smith, Arkansas	94 26 15W 35 20 47N
KFL353	Blue Mountain, Arkansas	93 40 44W 35 09 45N
KGW348	Blytheville, Arkansas	89 55 53W 35 45 54N
KFT281	Little Rock, Arkansas	92 21 33W 34 46 23N
	CALIFORNIA	
KMB828	Oakland, California ("San Francisco")	122 11 30W 37 51 02N
KMB394	San Diego, California	117 09 29W 32 44 52N
KMB394	San Diego, California	117 14 54W 32 42 28N
KMB393	San Pedro, California	118 18 33W 33 43 29N

TABLE 2-17. (Continued)

CALL SIGN	CALIFORNIA (cont.)	COORDINATES
KGW464	Vacaville, California ("Stockton")	121 59 30W 38 19 09W
	CONNECTICUT	
KWB437	Groton, Connecticut ("New London")	73 13 05W 41 23 05N
KLU785	Monroe, Connecticut ("Bridgeport')	73 13 05W 41 19 35N
KLU787	Monroe, Connecticut	73 13 05W 41 19 35N
	DELAWARE	
WEH	Odessa, Delaware ("Wilmington")	75 39 59W 39 27 43N
	FLORIDA	
KQU544	Belle Glade, Florida	80 39 44W 26 40 56N
KSK208	Boca Raton, Florida	80 05 22W 26 20 49N
KFT308	Cape Coral, Florida	81 57 49W 26 33 04N
KFT315	Cocoa Beach, Florida	80 36 36W 28 20 28N
KWB447	Crystal River, Florida (CP)	82 36 00W 28 54 10N
KEW823	Ft. Lauderdale, Florida	80 10 38W 26 09 14N
KWB455	Ft. Walton Beach, Florida	86 37 09W 30 24 42N
KQU532	Islamorada, Florida	80 37 55W 24 55 15N

TABLE 2-17. (Continued)

CALL SIGN	FLORIDA (cont.)	COORDINATES
KFT304	Jacksonville, Florida	81 39 42W 30 19 54N
KLU791	Homestead, Florida (CP)	80 28 07W 25 32 24N
KQU411	Key West, Florida	81 47 58W 24 33 38N
KSK210	Marathon, Florida	
KQU410	Naples, Florida	81 47 38W 26 07 55N
KII295	Panama City, Florida	85 39 30W 30 09 30N
KII294	Pensacola, Florida	87 13 03W 30 25 02N
KFT300	Tallahassee, Florida	84 18 04W 30 27 46N
KWB426	Tampa, Florida	82 30 16W 27 57 34N
KGW294	West Palm Beach, Florida	80 03 07W 26 42 42N
	HAWAII	
KGW423	Honolulu, Hawaii (CP)	157 51 25W 21 18 05N
KLU758	Wailuku, Hawaii	156 15 26W 20 42 43N
	IOWA	
KFT292	Asbury, Iowa ("Dubuque")	90 44 42W 42 30 52N
KFT290	Davenport, Iowa	90 34 25W 41 31 45N

TABLE 2-17. (Continued)

CALL SIGN	ILLINOIS	COORDINATES
KGW322	Beardstown, Illinois	90 26 53W 40 05 53N
KGW320	Cairo, Illinois	89 10 16W 37 00 14N
WAY	Chicago, Illinois	87 38 02W 41 53 01N
WGK	Dupo, Illinois ("St. Louis Radio")	90 11 13W 38 30 28N
KGW405	Fowler, Illinois ("Quincy")	91 20 20W 39 58 41N
KLU732	Grafton, Illinois (CP)	90 30 31W 38 59 52N
WGK	Granite City, Illinois ("St. Louis Radio")	90 07 30W 38 46 38N
KGW318	Ottawa, Illinois ("Ottawa")	88 49 18W 41 22 56N
KFT288	Peoria, Illinois	89 36 05W 40 45 45N
KFT288	Peoria Hts., Illinois	89 35 31W 40 45 28N
	INDIANA	
KGW329	Evansville, Indiana	87 40 23W 37 56 21N
WFN	Jefferson, Indiana	85 42 54W 38 16 55N
KLU757	Michigan City, Indiana	86 53 50W 41 43 20N
	Portage, Indiana	87 11 28W 41 37 28N
KGW321	Tell City, Indiana	86 46 11W 37 56 56N

TABLE 2-17. (Continued)

CALL SIGN	KENTUCKY	COORDINATES
KFT289	Paducah, Kentucky	88 35 22W 37 04 45N
	LOUISIANA	
KKM648	Baton Rouge, Louisiana	91 11 06W 30 26 59N
KJC784	Buras, Louisiana	89 31 56W 29 21 20N
KKM649	Erath, Louisiana	92 02 39W 29 21 20N
KKD736	Estelle, Louisiana	90 05 59W 29 49 06N
KKO382	Grand Isle, Louisiana	89 59 53W
KEW821	Houma, Louisiana	90 42 30W 29 34 26N
KKD735	Lake Charles, Louisiana	93 16 50W 30 06 20N
KKD735	Lake Charles, Louisiana	93 06 45W 30 00 30N
KKD732	Morgan City, Louisiana	91 12 00W 29 41 27N
KKD736	New Orleans, Louisiana	90 04 21W 29 56 58N
KKD736	New Orleans, Louisiana	90 05 54W 29 57 14N
	Grand Chenier, Louisiana (CP)	92 58 04W 29 45 56N
	MASSACHUSETTS	
KCD817	Boston, Massachusetts	71 03 42W 42 21 42N
KJC737	New Bedford, Massachusetts	70 55 02W 41 38 27N

TABLE 2-17. (Continued)

CALL SIGN	MICHIGAN	COORDINATES
KQB666	Detroit, Michigan	83 03 14W 42 19 57N
WLC	Roger City, Michigan	83 46 16W 45 24 19N
KQB667	Sault Ste. Marie, Michigan	84 21 25W 46 29 08N
KQU546	Muskegon Heights, Michigan	86 14 17W 43 11 49N
	MARYLAND	
KGD518	Bodkin Point, Maryland (Baltimore)	76 26 08W 39 07 29N
KAQ383	Ridge, Maryland (Pt. Lookout)	76 22 30W 38 07 16N
KSK223	Ocean City, Maryland	
KRS907	Cambridge, Maryland	
	MINNESOTA	
KFQ902	Hastings, Minnesota	92 47 02W 44 49 30N
KFQ902	St. Paul, Minnesota	93 10 56W 44 57 58N
WAS	Duluth, Minnesota	91 59 05W 46 51 15N
WAS	Duluth, Minnesota	91 59 14W 46 51 24N

TABLE 2-17. (Continued)

CALL SIGN	MISSISSIPPI	COORDINATES
KFT286	Greenville, Mississippi	91 02 30W 33 22 00N
KKM650	Gulfport, Mississippi	89 05 21W 30 22 19N
KFT287	Natchez, Mississippi	91 24 05W 31 33 31N
KLU775	Pascagoula, Mississippi	88 32 40W 30 20 22N
KFT302	Vicksburg, Mississippi	90 52 50W 32 21 05N
	MISSOURI	
KGW380	Crystal City, Missouri	90 21 52W 38 12 06N
KFT310	Kansas City, Missouri	94 34 58W 39 06 12N
KLU812	Osage Beach, Missouri (CP)	92 42 05W 38 03 16N
	NORTH CAROLINA	
KFT301	Wilmington, North Carolina	77 50 00W 34 12 42N
	NEVADA	
KQU378	Crystal Bay, Nevada (Lake Tahoe) (CP)	120 00 13W 39 13 41N
KLU743	Overton, Nevada (Lake Mead)	114 34 45W 36 10 24N

TABLE 2-17. (Continued)

CALL SIGN	NEW JERSEY	COORDINATES
KGW292	Pt. Pleasant, New Jersey	74 03 58W 40 04 59N
KQU556	Atlantic Highlands, New Jersey	74 00 45W 40 24 37N
KGW378	Sea Isle City, New Jersey	74 41 36W 39 09 17N
	NEW YORK	
KLG325	Fishkill, New York	73 56 55W 41 29 20N
WBL	Martinsville, New York	78 50 10W 43 04 00N
KEA693	New York, New York	70 00 18W 40 43 12N
KGW418	Newark, New York	77 02 22W 43 01 22N
KLU786	Riverhead, New York	72 41 34W 40 53 07N
KLG348	Rochester, New York	77 36 57W 43 09 25N
KLU788	Rochester, New York	77 36 12W 43 09 15N
KFL993	Schenectady, New York	74 03 45W 42 50 57N
KGW416	Syracuse, New York	76 11 53W 42 58 15N
KGW415	Utica, New York	75 11 43W 43 02 13N
KGW417	West Beckmantown, New York	73 36 45W 44 46 15N

TABLE 2-17. (Continued)

CALL SIGN	NEW HAMPSHIRE	COORDINATES
KQU555	New Castle, New Hampshire	70 43 29W 43 03 38N
	OHIO	
KQU421	Toledo, Ohio (CP)	83 32 05W 41 39 02N
KJC732	Cincinnati, Ohio	84 34 24W 39 06 44N
KQB668	Geneva, Ohio	80 56 34W 41 45 52N
KGW317	Ironton, Ohio	82 40 21W 38 32 10N
WMI	Lorain, Ohio	82 13 45W 41 26 25N
KQU440	Cleveland, Ohio	81 36 18W 41 29 00N
KGW301	Mingo Junction, Ohio	80 38 07W 40 19 58N
	OKLAHOMA	
KFL352	Tulsa, Oklahoma	95 46 01W 35 51 43N
KQU545	Tulsa, Oklahoma	95 44 40W 36 09 22N
	OREGON	
KOF209	Astoria, Oregon	123 50 47W 46 11 05N
KTJ	Coos Bay, Oregon	124 14 32W 43 21 15N

TABLE 2-17. (Continued)

CALL SIGN	OREGON (cont.)	COORDINATES
KOE815	Portland, Oregon	122 42 45W 45 31 36N
KBA333	Rainier, Oregon	122 57 26W
	PENNSYLVANIA	
KEW833	Glenwillard, Pennsylvania	80 13 32W 40 30 20N
WCM	Greenock, Pennsylvania	79 45 30W 40 18 20N
KLU836	Freedom, Pennsylvania (CP)	80 15 03W 40 41 34N
KGB738	Philadelphia, Pennsylvania	75 09 33W 39 57 04N
KGW323	Uniontown, Pennsylvania	79 39 47W 39 50 42N
KLU745	Erie, Pennsylvania (CP)	80 04 48W 42 07 11N
	PUERTO RICO	
WCT	Loiza, Puerto Rico	65 51 53W 18 16 53N
	SOUTH CAROLINA	
KFT303	Charleston, South Carolina	79 56 13W 32 47 09N
KLU725	Myrtle Beach, South Carolina	78 40 40W 33 49 30N

TABLE 2-17. (Continued)

CALL SIGN	TENNESSEE	COORDINATES
WJG	Memphis, Tennessee	90 03 10W 35 08 25N
WJG	Memphis, Tennessee	89 55 18W 35 09 06N
KQU377	Knoxville, Tennessee (CP)	83 56 20W 36 00 21N
KLG281	Nashville, Tennessee	86 40 09W 36 10 37N
	TEXAS	
KGW304	Bay City, Texas	95 59 42W 28 59 50N
KLG376	Brownsville, Texas	97 23 12W 25 57 15N
KWB424	Corpus Christi, Texas	97 23 12W 27 45 15N
KKD742	La Marque, Texas ("Galveston')	94 58 44W 29 21 05N
KKD739	La Porte, Texas ("Houston")	95 02 51W 29 42 02N
KKD741	Port Arthur, Texas	93 55 06W 29 57 26N
KGW295	Port Lavaca, Texas	96 36 59W 28 36 25N
	VIRGIN ISLANDS	
KQU403	St. Thomas, Virgin Islands	64 56 43W 18 21 23N

TABLE 2-17. (Continued)

CALL SIGN	VIRGINIA	COORDINATES
KIC631	Hampton, Virginia	76 20 34W 37 01 35N
KIC631	Norfolk, Virginia	76 17 25W 36 51 11N
	WASHINGTON	
KOH840	Bellingham, Washington	122 23 36W 48 42 22N
KOH841	Port Angeles, Washington	123 26 10W 48 07 21N
KOH630	Seattle, Washington	122 24 30W 47 39 09N
KOH627	Tacoma, Washington	122 30 34W 47 16 21N
	WISCONSIN	
KWB425	La Crosse, Wisconsin	91 11 05W 43 48 48N
WAD	Port Washington	87 53 00W 43 21 00N
	WEST VIRGINIA	
KFQ901	Charleston, West Virginia	81 42 09W 38 22 36N
KJC806	Moundsville, West Virginia	80 43 24W 39 56 48N
KEW837	Pt. Pleasant, West Virginia	82 07 34W 38 50 52N

2.5 COASTAL WARNING DISPLAY SYSTEM

2.5.1 Introduction

Prior to the widespread use of radio communication, the visual display system was the primary dissemination medium for marine weather information. Using a system of flags and pennants by day and lights by night, the system displays a hierarchy of signals which warns of existing or impending hazardous weather conditions. The system has the advantage of being available to a large segment of the boating population (since no special equipment is needed to receive the warnings) but is limited in visibility and information content.

2.5.2 Policies

The control of the coastal warning display system is the responsibility of the National Weather Service (NWS) of NOAA, but responsibility for operation of individual sites is delegated to on-site "displaymen." In general, policy dictates that the NWS determines the criteria for issuing warnings, determines when conditions satisfy or exceed these criteria and issue notices to initiate and discontinue displays. A special delegation of authority, however, permits a small number of Coast Guard stations to initiate displays based on observation of local conditions to ensure more prompt reaction to hazardous conditions.

Overall system policy currently envisions the eventual abandonment of the system because of the increased reliance on other dissemination media, but recognizes a continuing need for the system in the immediate future due to the existence of a large number of boatmen without radio equipment. The Weather Bureau Operations Manual defining the Marine Weather Service Program (November 1969) states:

> "....existing displays will be retained so long as it is possible for standards to be maintained and the local requirement continues. New displays will be authorized when (1) there is a strong requirement

expressed by local interests; (2) arrangements have been made by local interests to supply the pole or mast, as well as all other expenses, except for pennants and flags; (3) dependable communications are arranged, which will be without cost to the Weather Service; and (4) the new display is approved by Weather Service Regional Headquarters."

2.5.3 Facilities

A Coastal Warning Display Station consists essentially of a pole from which the signals may be flown, and the necessary flags, pennants, and lights. A communications link is also required, and may be a telephone or teletypewriter link.

490 Coastal Warning Display Stations are currently in operation, some on a seasonal, but most on a year round basis. Almost 30 percent of these stations are located in Coast Guard facilities and are operated by Coast Guard personnel. The remainder are designated "civilian" display stations and are operated by municipal authorities, yacht clubs, small commercial establishments, etc. Stations are generally located in areas of considerable boating activity, such as at harbor or river mouths, at yacht clubs and marinas, and at public launching sites. A list of these stations, published by the (then) U.S. Weather Bureau in April 1970 and corrected to January 1971, is given in Appendix B.

2.5.4 Procedures

Initiation of warning displays is made by the issuance of a notice to displaymen by the appropriate supervising office of the NWS. The notice may require immediate display of the warning, or may be issued prior to the effective time of the warning. The notice is transmitted to all affected stations by telephone or teletypewriter. Upon receipt of the notice (or at the effective time of the warning), the displayman causes the appropriate warning signal to be displayed and maintains the signal until he receives notice that the display is to be discontinued.

Coast Guard Stations with the appropriate authority may initiate warnings based on observation of local conditions, but must immediately notify the supervising office of the NWS of the display and the conditions pertaining. The office then issues a warning notice or modifies the existing warning to reflect the reported conditions. Special arrangements are made to ensure that civilian stations within the area affected by the self-initiated Coast Guard display are immediately notified. The authority for discontinuance of the display lies with the NWS in the customary manner.

At stations displaying flags and pennants only, warning signals are flown from sunrise to sunset while the warning is in effect. Flags may be floodlit during nighttime hours, provided the cooperator can furnish these facilities. At stations equipped to display flags, pennants, and lights, the displayman turns on the lights at night (or whenever visibility conditions make them effective) when a warning is in effect. Flags and pennants need not be lowered at any time during the warning provided they do not obstruct the light signals.

The notice to the displayman indicates which type of warning is in effect (or is to go into effect at a specified time). It is the responsibility of the displayman to ensure that the specified warning is displayed. The signals employed and the conditions which occasion their display are described by the Weather Service as follows:

> "SMALL CRAFT WARNING: One RED pennant displayed by day and a RED light ABOVE a WHITE light at night to indicate that wind and sea conditions, or sea conditions alone, considered hazardous to small craft operations are forecast. Winds may range as high as 33 knots.
>
> IMPORTANT! The SMALL CRAFT WARNING covers a wide range of wind speeds and/or sea conditions. Also, "small craft" include boats of many designs and sizes. Therefore, boaters should regard the SMALL CRAFT WARNING display signal as an alert that wind and/or sea conditions potentially dangerous to their boats exist or are forecast. For more specific information they should obtain

a detailed forecast by telephone or by listening to coastal weather forecasts and warnings over the local radio stations, Coast Guard radio, or the Weather Bureau continuous VHF-FM broadcasts on 162.55 megahertz as listed on this chart.

GALE WARNING: Two RED pennants displayed by day and a WHITE light ABOVE a RED light at night to indicate that winds within the range 34 to 47 knots are forecast for the area.

STORM WARNING: A single square RED flag with a BLACK center displayed during daytime and two RED lights at night to indicate that winds 48 knots and above, no matter how high the speed, are forecast for the area. However, if the winds are associated with a tropical cyclone (hurricane) the STORM WARNING display indicates that winds within the range 48 to 63 knots are forecast.

HURRICANE WARNING: Displayed only in connection with a tropical cyclone (hurricane). Two square RED flags with BLACK centers displayed by day and a WHITE light between two RED lights at night to indicate that winds 64 knots and above are forecast for the area.

NOTE: A "HURRICANE WATCH" is an announcement issued by the Weather Bureau via press and radio and television broadcasts whenever a tropical storm or hurricane becomes a threat to a coastal area. The "Hurricane Watch" announcement is not a warning, rather it indicates that the hurricane is near enough that everyone in the area covered by the "Watch" should listen to their radios for subsequent advisories and be ready to take precautionary action in case hurricane warnings are issued."

The criteria established above are currently under review in some regions. A trial program in the Florida area recognizes a need to warn of hurricane aftermath conditions; warnings are related to a hierarchy of "conditions" numbered one through five. Beginning in 1971, National Weather Service will issue a "SPECIAL MARINE WARNING BULLETIN" whenever a severe local storm or strong wind of brief duration is imminent, and is not covered by existing warnings or advisories. No visual displays will be used with the Special Marine Warning Bulletin; boaters will be able to receive these special warnings by keeping tuned to a NOAA VHF-FM, Coast Guard, or a commercial radio station carrying marine weather.

2.6 WEATHER INFORMATION BY TELEPHONE

2.6.1 Introduction

The provision of weather information by telephone is conceptually attractive because of the ease with which a broad segment of the public may use such a system. Following the popularity of general weather systems operated by the major telephone companies and the National Weather Service (NWS), the past few years have seen the introduction of specialized marine weather services by telephone.

These have been operated, with some success, by the NWS and selected Coast Guard facilities. Mitigating against the wide availability of such services is the rapid growth in demand following service inauguration and the associated escalation in cost. An even greater danger, claims one telephone company, is that of completely overloading the exchange in areas where a minimal service is introduced.

2.6.2 Policies

Most telephone companies provide heavy-duty weather systems in many major cities as a public service. These systems (known as the WE-1212 type service) are scaled to handle the massive public demand for general weather information. Telephone companies do not, as a matter of policy, provide specialized services to groups such as marine users.

The NWS, in an attempt to meet the demands for weather information by telephone, has for many years maintained single-line services in many field offices but has found it impossible to meet those demands completely. A recent Weather Bureau document estimates that average demand exceeds their response capacity by a factor of 20 to 25. This same document (OML 70-13, May 11, 1970) sets down the policy for implementation of Multiline Automatic Telephone Answering Systems by the Weather Bureau (now NWS).

NWS policy calls for the installation of such systems in most field offices as funds become available. In cities where the local telephone company operates a WE-1212-type service, the NWS will regard this as an integral part of its system. The main recording on the system is a local forecast section, with messages to serve special interests (such as marine users) listed under separate numbers. The criterion for establishment of such special services is determined by each office or forecast office based on the major categories of information normally requested on publicly listed telephone lines. The implementation of these services is not publicized since experience has shown that such publicity leads to a drastic increase in the number of calls and a decrease in service effectiveness.

The Coast Guard has also experienced a growing demand for weather information by telephone. In areas of low population density such service is provided via the listed Coast Guard telephone, often to interested groups such as yacht clubs, marinas, and marine sales outlets. These groups in turn disseminate the information to their members and customers and the demand for service remains within tolerable limits. Specially listed marine weather telephone numbers have also been operated successfully in low population areas, often serving as a useful extension to the NWS system.

In areas of greater population density, however, the demand for weather information by telephone has begun to interfere with normal station operations, such as search and rescue activities. A survey taken in the Ninth District in August 1970 indicated a total of more than 18,000 requests during that month for the whole district, requiring the expenditure of almost 370 hours of time in response (Table 2-18). At two stations monthly calls totaled 2,178 and 1,671 and occupied almost 41 and 56 hours respectively in response. Most calls were received during daylight hours during weekends and holidays which are the peak periods for search and rescue operations.

Efforts to meet the demand have included the consideration of automatic telephone answering systems, but potentially prohibitive costs (as much as $30,000 per month per installation based on projected use) have precluded their implementation at this time. Coast Guard policy is currently awaiting the results of the Weather Dissemination Study (of which this document is a part) prior to the establishment of precise operational procedures and long term policy.

2.6.3 Facilities

Telephone company-operated systems are in operation in most large cities in the United States, but, as indicated above, do not generally provide marine weather information. The NWS operates telephone services listed under "marine weather" at eight locations, two of them seasonal. These are:

Baltimore, Md.	Chicago, Ill.
Washington, D. C.	Juneau, Alaska
Los Angeles, Calif.	Boston, Mass.*
Seattle, Wash.	Providence, R.I.*

Services at a further 26 locations listed generally as "Weather" also contain a marine weather segment. Most of these are currently single-line offices providing a "minimum automatic answering service." Such services are defined in Weather Bureau OML 70-3 as having the following characteristics:

> "1. A recording device which can be used at certain hours on the telephone line listed for general public service;
>
> 2. A provision to receive severe weather reports from the public, either by separate line specifically listed in the directory for that purpose, or by special arrangements with the telephone company for a priority interruption procedure on other lines;

---

*seasonal operation

3. An unlisted telephone line to serve the mass news media; and

4. Satisfactory arrangement with the Federal Aviation Administration for a nearby Flight Service Station to handle all routine pilot weather briefings, or the office is equipped with a special telephone to serve aviation interests."

In the more advanced multiline system several recordings are provided, each separately listed in the telephone directory according to message content.

The number and type of services provided on these systems varies with location and is determined according to local needs and demands.

2.6.4 Procedures

Procedures adopted by the NWS in operating minimum automatic answering systems are defined in OML 70-3 as follows:

"When a minimum automatic answering system is installed, general public service lines will be personally answered only during an 8 to 10 hour period each day. This period will coincide with normal business hours for each area. Normal business hours, as here used, refer to those hours in which business firms in the area normally operate during a standard weekday. The periods during weekends and holidays may be reduced to 4 hours a day as scheduled by the Regional Director. At all other times the general public service line will be in automatic status.

During the periods when the telephone is in automatic status, recorded message scripts containing the local forecast and observation will be used. The following message will be appended at the end of message scripts:

'THE METEOROLOGIST IS BUSY WITH THE OBSERVATIONAL AND FORECASTING PROGRAM AND IS UNABLE TO ANSWER THIS PHONE PERSONALLY UNTIL (time) O'CLOCK (day) MORNING. THANK YOU.'"

The message script generally consists of a local synopsis covering a 2-day period and lasts about 1 minute. Where the synopsis includes temperature, precipitation, and/or humidity, these figures are updated hourly. Other information is updated as necessary. Special segments such as marine weather information may be included where there is sufficient demand, but these must be of short duration as the total script length is limited to about 2 minutes by the equipment.

Operation of the multiline systems is essentially the same as for minimum automatic systems; each segment of the service, however, is carried on a separate tape and is listed separately in the telephone book. None of these segments is operated in the "personally answered" mode, instead, a separate line is provided and listed along with the other numbers as "administrative calls only." The marine weather segment of such a service will be updated about three or four times each day or more frequently as needed.

Operational procedures prior to the installation of these systems at existing offices require that callers known to make regular use of the system be advised of the proposed change in service and of the reasons necessitating the change, and be advised of the available means for obtaining the information they require.

TABLE 2-18. NINTH COAST GUARD DISTRICT SURVEY
TELEPHONE REQUESTS FOR WEATHER INFORMATION DURING AUGUST 1970

TELEPHONE REQUESTS FOR WEATHER INFORMATION SURVEY

	CALLS RECD.	TIME USED HRS.	MIN.
Group Two Rivers			
Station Kenosha	173	1	24
Station Racine	202	4	2
Station Milwaukee	395	7	0
Ltsta. Port Washington	3	0	7
Station Sheboygan	133	1	37
Ltsta. Manitowoc	9	0	22
Station Two Rivers	130	1	20
Ltsta. Rawley Point	0	0	0
Station Kewaunee	51	1	14
Station Algoma	13	0	17
Station Sturgeon Bay	217	6	5
Ltsta. Sherwood Point	13	0	43
Ltsta. Minominee	4	0	4
Station Green Bay	0	0	0
Lasta. Fox River	0	0	0
Station Plum Island	24	0	57
	1,367	25	12
Group Detroit			
Station Belle Isle	202	5	33
Station St. Clair Shores	33	0	36
Station St. Clair Flats	112	4	36
Station Port Huron	216	2	44
Station Harbor Beach	104	2	36
Station Saginaw River	374	5	24
Station Tawas	194	3	14
	1,235	24	3
Group Ludington			
Station Holland	490	10	20
Station Grand Haven	681	5	21
Station Muskegon	2,178	40	48
Station Ludington	921	13	46
Station Manistee	331	5	51
Station Frankfort	215	5	35
Ltsta. North Manitou	35	0	59
Ltsta. Traverse City	10	0	24
	4,861	83	5
Group Duluth			
Station Bayfield	190	3	45
Station Duluth	23	0	23
Station North Superior	60	1	0
Station Two Harbors	0	0	0
	273	5	8

TABLE 2-18. (Continued)

	CALLS RECD.	TIME USED HRS.	MIN.
Group Chicago			
Station Wilmette Harbor	257	3	35
Station Calumet Harbor	36	1	38
Station Michigan City	445	8	30
Station St. Joseph	743	6	12
Station South Haven	82	1	25
Ltsta. Indiana Harbor	1	0	11
Group Office Chicago	57	1	24
	1,621	22	45
Group Sault Ste. Marie			
Base Sault Ste. Marie	8	0	11
Ltsta. Detour Reef	1	0	3
CGC NAUGATUCK	0	0	0
	9	0	14
Group Charlevoix			
Ltsta. Thunder Bay	55	1	13
Ltsta. Martin Reef	0	0	0
Station St. Ignace	167	3	42
Ltsta. Cheboygan River	58	1	50
Ltsta. Spectacle Reef	0	0	0
Station Charlevoix	691	15	4
	971	21	49
Group Portage			
Station Portage	248	5	38
Ltsta. Keweenaw	23	0	27
Station Marquette	258	4	42
Ltsta. Eagle Harbor	39	0	53
Ltsta. Escanaba	15	0	57
Station Grand Marais	51	1	24
Ltsta. Seul Choix Point	2	0	4
Station Munising	27	0	52
	663	14	57
Group Buffalo			
Ltsta. Tibbetts Point	12	0	10
CGC POINT STEELE	0	0	0
Station Rochester	578	16	42
Station Galloo Island	102	3	53
Lasta. Cape Vincent	4	0	12
Station Alexandria Bay	151	3	10
Station Sodus Point	61	1	36
Base Buffalo	583	11	6
Station Oswego	1,671	55	42
	3,162	92	21

TABLE 2-18. (Continued)

	CALLS RECD.	TIME USED HRS.	MIN.
Group Cleveland			
Station Lorain	565	9	56
Station Cleveland Harbor	605	11	39
Station Erie	311	5	0
Ltsta. Conneaut	42	1	24
Station Ashtabula	315	6	20
Station Fairport	264	4	42
CGC KAW	0	0	0
Ltsta. Huron	48	0	58
Station Sandusky	573	9	55
Station Marblehead	609	11	21
CG-42045 (Houseboat)	38	1	30
Station Toledo	425	10	5
	3,795	72	50
Miscellaneous District Units			
CCGD9 - Search and Rescue Branch	88	1	18
MIO Detroit	7	0	7
MIO Cleveland	11	0	8
MIO Chicago	0	0	0
MIO Duluth	0	0	0
MIO Toledo	10	0	10
Air Station Chicago	11	0	11
Air Station Detroit	78	2	9
Air Station Traverse City	111	1	51
CGC WOODBINE	40	1	20
	356	7	23
Grand Totals For District	18,313	369	46

SECTION 3

OFF-SHORE SYSTEMS CHARACTERIZATION

3.1 GENERAL

The geographical definition of "off-shore" in this report refers to that area about 25 to 250 miles from the coastline. Vessels in the off-shore areas include those on voyages between coastal points, those in transit through this intermediate area in the course of oceanic passages, or those working in off-shore areas. As a general characteristic, vessels in the off-shore area may not require as frequent weather updating as those operating in coastal waters, but they do require a more frequent interest than vessels on the high seas. This stems from the relative time and distance impacts upon course decisions in which weather is a factor.

The coastal VHF radio telephone is too limited in range to serve the off-shore region. Although broadcast stations may be heard, their value for weather dissemination in this region is limited by spotty reception and the difficulty in knowing program schedules. Although high frequencies above 4 MHz may serve the off-shore region, reliabilities are subject to minimum distance conditions associated with the skip zone. The radio communication means normally serving the off-shore region are medium frequency radio telegraph, and medium frequency radio telephone. Dissemination by these means are discussed in the following subsections.

3.2 MEDIUM FREQUENCY RADIO TELEGRAPH TRANSMISSIONS

3.2.1 Introduction

Radio telegraph transmissions in the 405-525 kHz marine frequency band are characterized by high dependability of radio

coverage extending to a maximum range. This marine band is characterized also by high operational density of commercial domestic and international maritime communications including watch keeping on the distress and calling frequency. However, the users concerned are vessels having radio officers trained for radio telegraph operations and which generally means vessels above 1600 gross tons.

Commercial coastal stations transmit weather by medium frequency radio telegraph as a courtesy service in the public interest, and also to insure that their contract subscribers are served. The reports originate with the National Weather Service, and are transmitted "to all ships" on schedule or, if of an urgent nature, promptly on receipt.

3.2.2 Policies

The U.S. policy is to promote adequate provision of weather information in off-shore waters, and to encourage transmission by coastal telegraph stations that are capable of providing appropriate coverage.

Although there is a high standard of cooperation from commercial coastal stations, there are no contract or financial obligations controlling their retransmission of weather to shipping. The Rules and Regulations of the Federal Communications Commission, under which United States commercial coastal telegraph stations are licensed, stress general obligations of such stations to assist in all safety communications (81.178).

3.2.3 Facilities

The number of U.S. radio telegraph stations transmitting scheduled weather broadcasts in the 405-525 kHz band and which address off-shore weather areas are as follows:

New England Waters	2
West Central North Atlantic	5
Southwest North Atlantic	5
Caribbean	6
Gulf of Mexico	6
Eastern North Pacific	3

The day time coverage of these stations are shown by Figures 3-1 , 3-2 , and 3-3 . The day time coverage indicated is a technical estimate, and represents a minimum coverage condition since night operation would be greater.

The instantaneous number of vessels with radio telegraph means within the off-shore region on a typical day have been estimated as follows:

New England Waters	29
West Central N. Atlantic	36
Southwest N. Atlantic	57
Florida Straits	26
Gulf of Mexico	51
Pacific Off-Shore	37

The above estimate was based on a synthesis of ship distribution contained in Reference 2, related to the off-shore region, and adjusted to those vessels of a mandatory telegraph category.

Coastal stations operate on a continuous 24-hour per day basis. A significant majority of commercial vessels have single operators; the exception being passenger vessels. Single operator

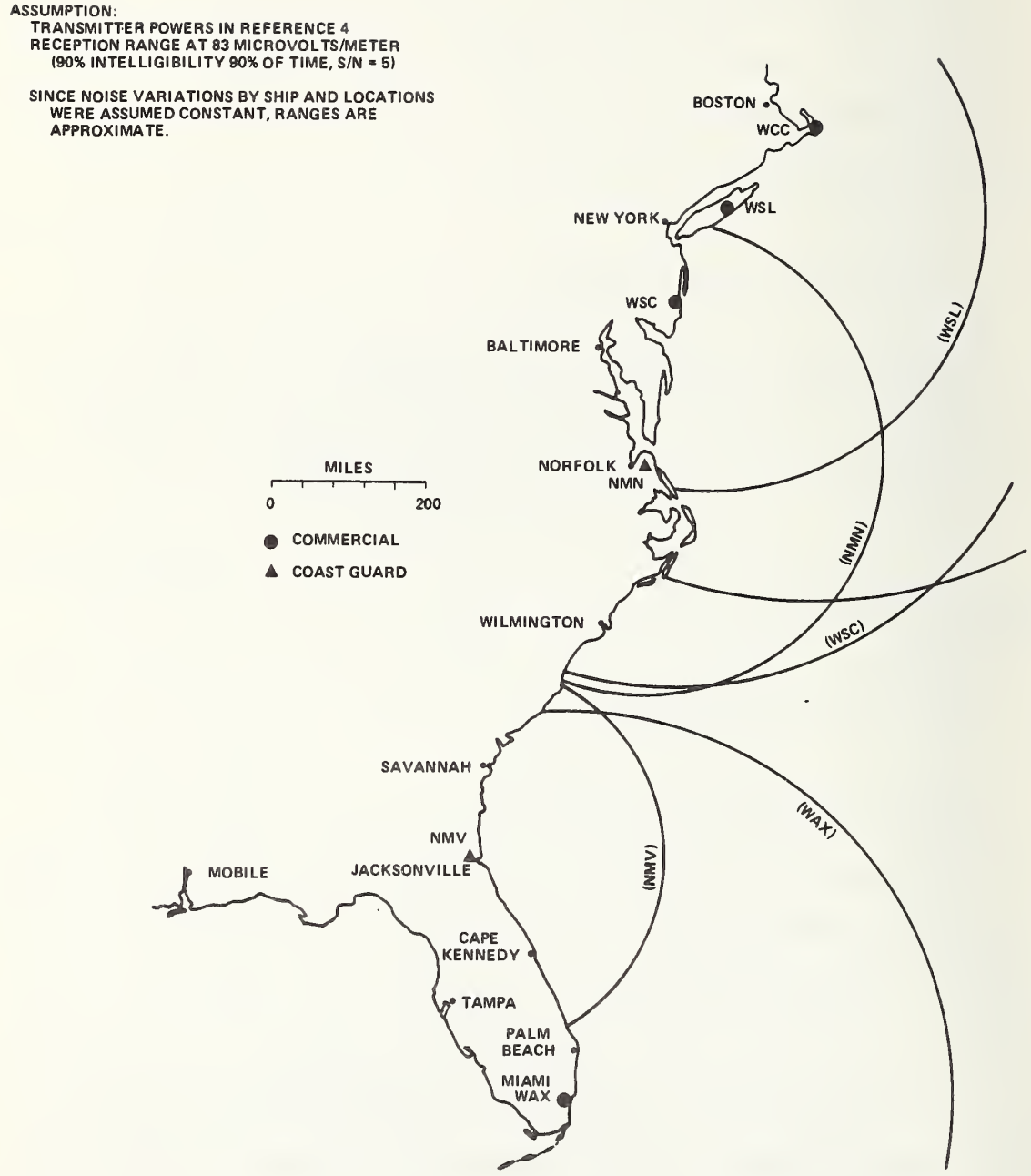

Figure 3-1. Atlantic Coast Daytime Telegraph Coverage

ASSUMPTION:
TRANSMITTER POWER IN REFERENCE 4
RECEPTION RANGE AT 83 MICROVOLTS/METER.
(90% INTELLIGIBILITY 90% OF TIME, S/N = 5)

SINCE NOISE VARIATIONS BY SHIP AND LOCATIONS
WERE ASSUMED CONSTANT, RANGES ARE
APPROXIMATE.

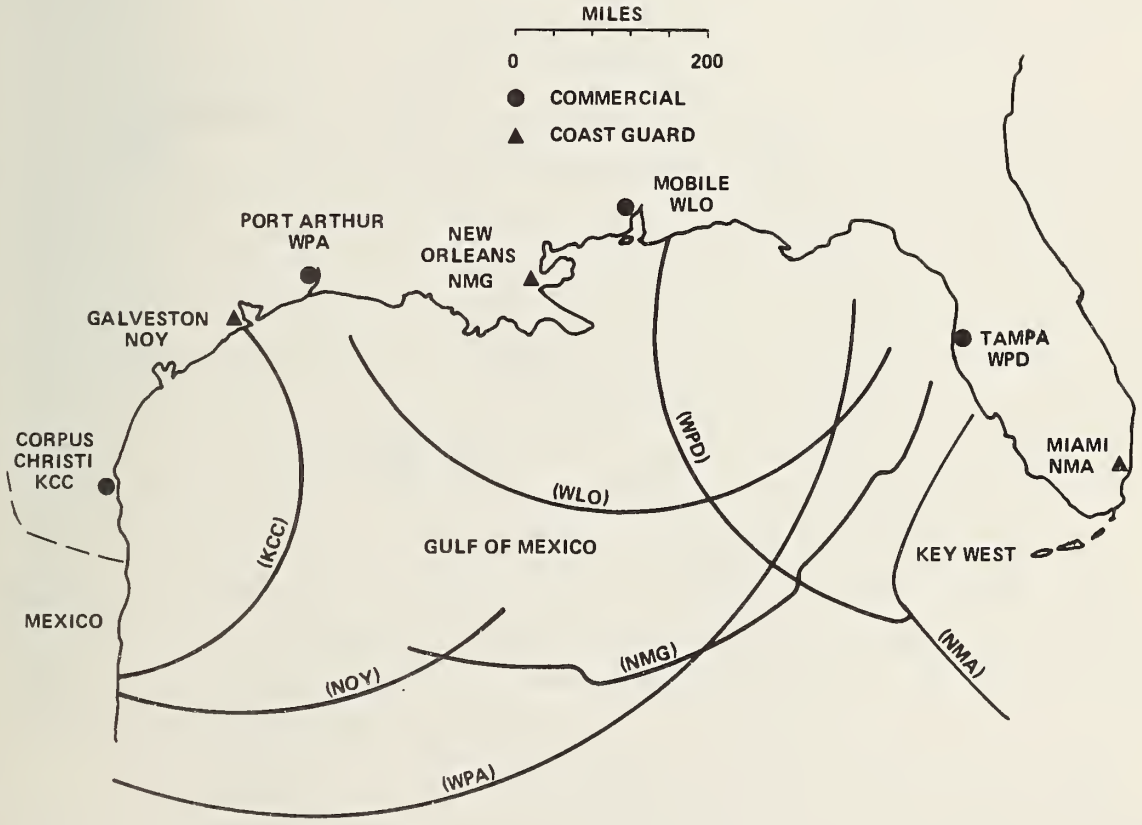

Figure 3-2. Gulf of Mexico Daytime Telegraph Coverage

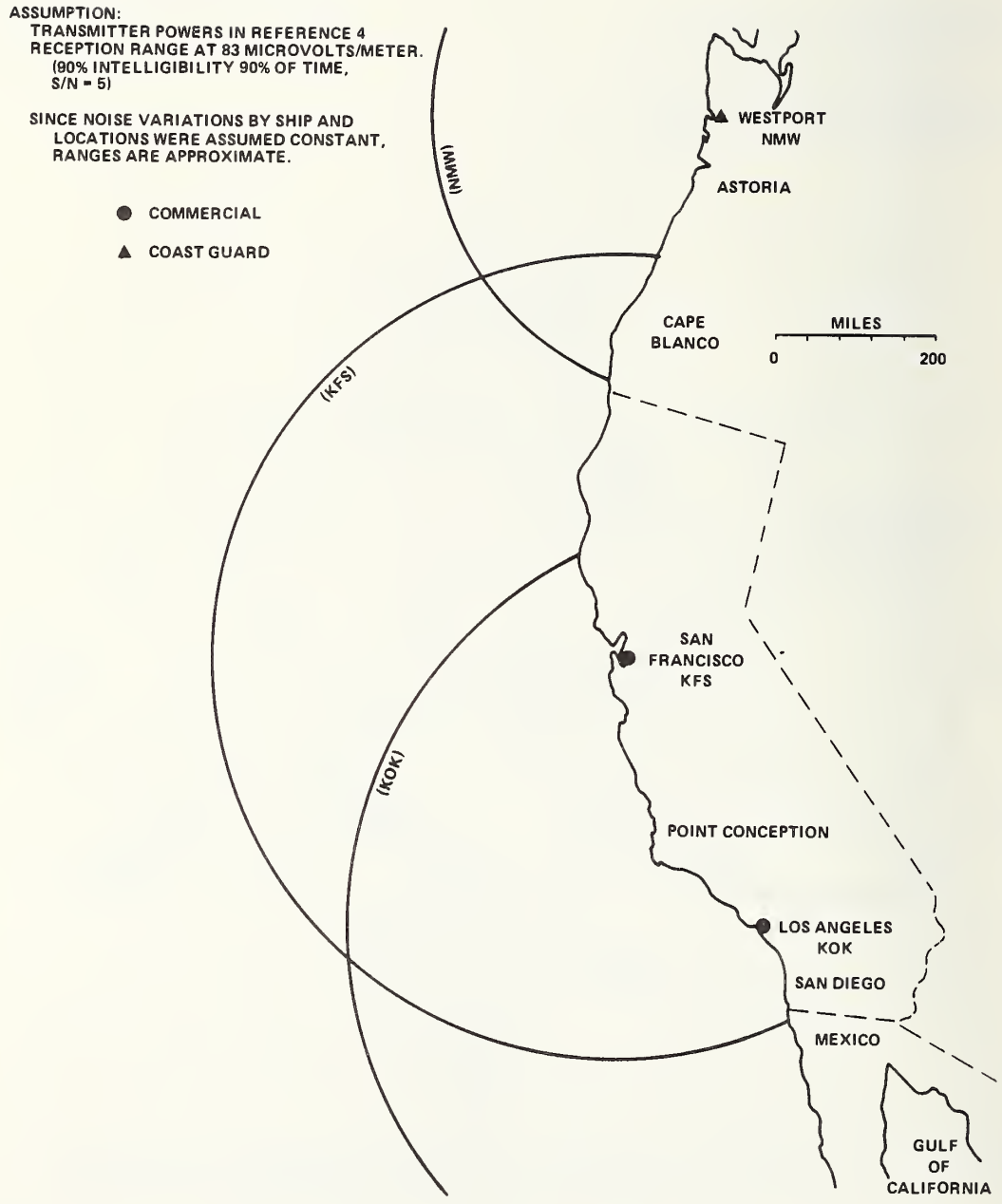

Figure 3-3. Pacific Coast Daytime Telegraph Coverage

vessels schedule radio operations to total eight hours per day, but endeavor to spread this throughout the 24-hour day under routine oepration. Work periods are scheduled specifically to cover more frequent weather reports in approaching constrained passages or deteriorating weather conditions. Ships with radio telegraph capabilities have professional operators who will seek weather information if an expected broadcast is not heard on schedule.

3.2.4 Procedures

Coastal station schedules are published so that radio operators may cover desired broadcasts. All transmissions start with a general call on 500 kiloHertz (distress and calling) indicating that weather is to be broadcast immediately upon the coastal station's working frequency. The coastal station identifies its working frequency in the initial broadcast, and then shifts its frequency to the working frequency. The general call on the working frequency is then followed by the text of the weather report. The radio officer, having retuned his receiver from the calling to the indicated working frequency, copies the report on a typewriter. The report is immediately provided to the watch officer in the bridge or wheelhouse area. The usual practice is to retain the report in a designated spot in the chartroom for reference.

Operating procedures are sufficiently standardized that foreign vessels have no difficulty in being alerted to broadcasts, or in their receipt. The nature of radio telegraph characters permit receipt of the text regardless of the nationality of the radio officer. All weather transmissions from U.S. coastal stations are in English.

3.3 WEATHER DISSEMINATION BY MEDIUM FREQUENCY RADIO TELEPHONE

3.3.1 Introduction

Medium frequencies utilized for maritime voice communications are in the 2-MHz area of the radio spectrum, and are characterized propagationally by a relative continuous coverage to maximum range. It provides coverage not limited to line-of-sight (as VHF is), but because of technical transmission characteristics in handling voice signals, it offers less range than telegraph. Operations are upon specific indicated radio frequency channels in the 2-MHz band.

Although transmission properties may be more susceptible to electrical noise and range than telegraph, voice radio terminals may be operated by the user. The user-operated property of voice communication has resulted in a tremendous growth; in fact, interference among users has become a matter of concern.

3.3.2 Policies

Weather dissemination by medium frequency radio telephone continues to be supported in view of the number of vessels using this off-shore as well as in coastal waters.

The radio interference affecting these users became so severe in recent years because of the total radio population (199,011 FCC licensed as of December 1970) that a policy change is being implemented. The FCC has taken action to discourage use of 2-MHz sets except for off-shore purposes. Effective in 1972, no further licenses for 2-MHz equipment will be granted for a vessel unless it has a VHF radio telephone set installed. Operating practices will be encouraged to use VHF where feasible in near coastal areas, and to utilize 2-MHz telephone only where the additional range provided is essential.

As with commercial telegraph stations, weather transmissions are made by commercial coastal telephone stations as a public service, and without contractual arrangements.

3.3.3 Facilities

The number of coastal telephone stations in the 2-MHz band broadcasting scheduled weather reports are tabulated as follows, by weather regions:

Eastport to Block Island	3
Block Island to Cape May	6
Cape May to Virginia Beach	7
Virginia Beach to Cape Fear	5
Cape Fear to Savannah	5
Savannah to Cape Kennedy	2
Cape Kennedy to Key West	2
Florida Straits	4
Cape Sable to Tarpon Springs	5
Tarpon Springs to Apalachicola	3
Apalachicola to Pensacola	1
Pensacola to Morgan City	3
Morgan City to Port Arthur	6
Port Arthur to Port O'Connor	4
Port O'Connor to Brownsville	4
Gulf of Mexico	8
Tatoosh Island to Point St. George	4
Point St. George to Point Conception	3
Point Conception to U.S.-Mexico Border	2

The vessels off-shore on a typical day (1969) with medium frequency radio telephone installations are synthesized as follows: (similar process as for telegraph but using 66% as an estimate of vessels off-shore with telephone equipment Reference 2):

New England Waters	70
West Central North Atlantic	73
Southwest North Atlantic	105
Gulf of Mexico	100
Pacific	75

3.3.4 Procedures

Coastal stations in this voice band transmit coastal and off-shore weather as announced in pertinent publications. Each transmission is preceeded by a general broadcast on 2182 kilo-Hertz (emergency and common calling channel) alerting all listeners that weather will be broadcast upon that station's working frequency. The frequency is given in the alerting broadcast. The listener then switches to the designated channel.

Although each coastal telegraph and commercial telephone station broadcasts upon an assigned working frequency not otherwise assigned in that geographical area, it should be noted that weather broadcasts by Coast Guard stations utilize a common frequency, 2670 kiloHertz. The chance of radio interference from other Coast Guard stations has a higher probability than in the case of commercial telephone stations, however, operational coordination endeavors to respect scheduled transmissions. Interference possibilities may increase at night because of increased propagation ranges.

SECTION 4

HIGH SEAS SYSTEMS CHARACTERIZATION

4.1 GENERAL

Radio means for dissemination of weather over oceanic areas involve both technical and operational considerations. The technical considerations include transmission characteristics for the path as affected by frequency, effective power, equipment and modulation technique, noise, and information rate. Operational considerations include schedules, the degree and type of equipment justified to meet the requirements, and operator proficiency. The transmission characteristics involved in long-range or oceanic coverage represent a wider span of path distances and propagational varients than are present in coastal or off-shore systems. The transmission subsystem therefore represents a more complex situation in the case of long-distance coverage. The transmission input/output forms available for weather dissemination are manual telegraph, telephone, teleprinter, and facsimile.

While the above forms of intelligence transfer represent technical influences upon radio transmission ranges, the most significant parameter is that of the radio frequency band and its propagation characteristics. Frequencies in the medium frequency band (405-525 kiloHertz) are feasible for moderate distances. The high frequencies (3-30 MegaHertz) offer the greatest distance ranges but these ranges vary with frequency, time, and season. Coverage of large areas is therefore achieved by simultaneous transmission on several frequencies with the user selecting the strongest signal being heard.

Operational needs for weather information and operator work schedules also are factors in considering weather dissemination.

Vessels embarking upon oceanic passages are specifically interested in longer range forecasts which would influence tracks taken, more favorable routes for economical passage, impacts upon tows or passenger comfort, or comparative risks as influenced by weather or seas. Having made route decisions, vessels are then more interested in trends or warnings, and the frequency of oceanic weather needs become more routine with at least a morning and evening report. Ships with single radio officers aboard endeavor to spread the work day to minimize the span of time that information is lacking. The International Telecommunications Union (ITU) has considered the hours of service of "single radio operator" ships, and its recommendations are shown by Figure 4-1 . (Extracted only for primary areas of interest to this report). The recommended work schedule of radio operators aboard single operator vessels influences favorable scheduling of oceanic weather broadcasts. It should be recognized however that many ships do not adhere to these recommended schedules and actual watch schedules are established by the Master of the vessel.

The modes of transmission utilized in high seas weather dissemination are discussed in this section. The areas of U.S. responsibilities for shipping forecasts are shown in Figure 4-2.

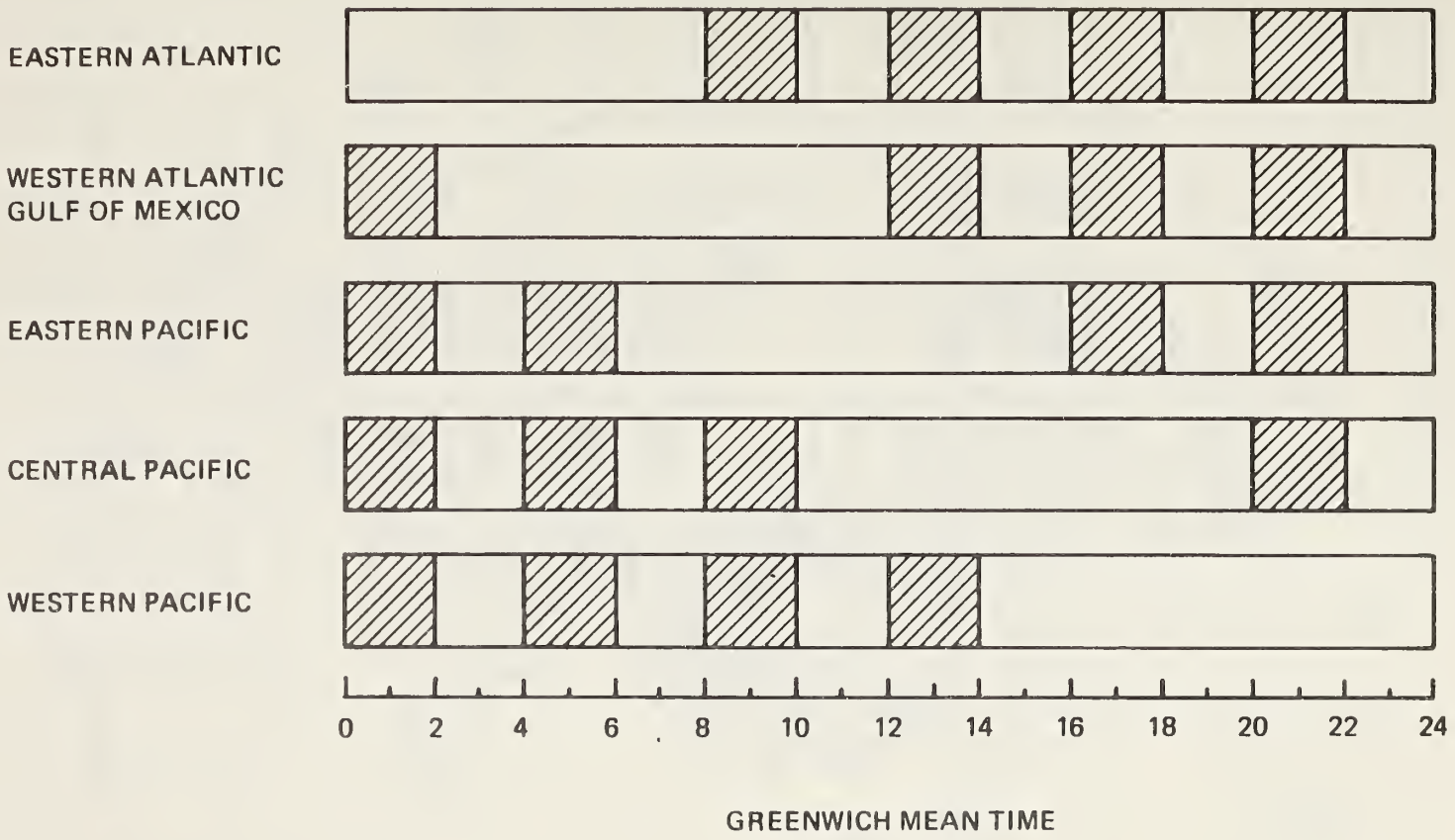

Figure 4-1. Hours of Service Recommended for Single Radio Operator Vessels (Source: Reference 6)

Figure 4-2. Areas of United States Responsibilities for Shipping Forecasts and Warnings Under International Agreements

4.2 HIGH SEAS RADIO TELEGRAPH BROADCASTS

4.2.1 Introduction

All vessels on ocean passages have radio communication facilities. With the exception of a small percentage under 1,600 gross tons in the high seas area, these vessels carry radio officers and primarily utilize radio telegraph operation.

Radio telegraph has greater immunity to interference and weak signals because of human acumen to distinguish the desired intelligence, and concentration of the intelligence in its signal form. The disadvantages are the relatively slow rate of information transfer, and the need for specialized training.

The use of radio telegraph for high seas weather dissemination is more extensively applied than any other transmission form. This is because of the longer period for universal adoption since the United States Navy first installed radio facilities in 1901, and the U.S. Weather Bureau first experimented with weather broadcasts in 1906. Radio telegraph aboard ships received emphasis from Safety of Life at Sea Conventions and immediate demands for installations for safety, early widespread military installations, and the first 45 years of marine radio in which telegraph was the only means of communication. Further, it provides excellent technical performance for modest traffic demands.

4.2.2 Policies

As long as provisions of the Safety of Life at Sea Conventions are oriented to radio telegraph mandatory installations, any change must stem through international planning and regulatory actions. These can be expected to be slow-moving, and unchanged until universal means can be demonstrated for distress and emergency communication coverages. Even with expanding user-operated

communications, the Radio Officer provides technical experience and capabilities to assist in operation and maintenance of electronics aboard modern shipping. Therefore there is no immediate prospect that radio telegraphy will decrease its role in high seas weather except as other forms are demonstrated as being more cost-effective.

The United States policy continues to stress adequate provision of weather information by radio telegraphy, and coastal stations with appropriate coverage of high seas areas are encouraged to provide the transmission service. As with off-shore coverage, there are no contractual obligations in providing broadcast dissemination on the part of participating coastal stations.

4.2.3 Facilities

Coastal facilities considered in this category are those broadcasting ocean area weather information by telegraph, using multiple high frequencies above 3,000 kiloHertz with powers in excess of 1 kilowatt, and/or transmitting simultaneously upon frequencies lower than 525 kiloHertz with powers between 1 and 20 kilowatts. The number of coastal stations with radio telegraph capability total 244 for the Atlantic area, 123 for the Pacific, and 22 for the Indian Ocean area. The United States operated stations which meet the criteria in the first paragraph total eight for the Atlantic and ten for the Pacific. The characteristics of these U.S. coastal stations are summarized by Table 4-1.

The number of active maritime mobile telegraph terminals can only be estimated because of numerous variations, but can be averaged with reasonable accuracy.

The Safety of Life at Sea (SOLAS) Convention requires all passenger vessels and all vessels over 1,600 gross tons to have radio telegraph facilities. Merchant vessels over 1,600 gross

TABLE 4-1. HIGH SEAS RADIO TELEGRAPH WEATHER BROADCASTS (U.S. OPERATED)

Station Location	Call Sign	High Frequencies (MegaHertz Bands)	Low or Medium Frequency*	Scheduled Times (GMT)
Boston	NIK	5, 8, 12		0018,1218 (in ice season)
Chatham	WCC	6	426	0050,1250,1650
Amagansett	WSL	8,12,13,16,17,22	418	1100,1350,1700,2150,2300
Tuckerton	WSC	4,6,8,12,17	460	1418,2318
Annapolis	NSS	5,8,12,16,20,25	88	0030,0600,1230,1830
Miami	WAX	4,6,8,13,17		0135,1335
Miami	WOE	6,8,12,17		0105,1605
San Francisco	KPH	4,6,8,13,17,22		0500,1700,2300
San Francisco	KFS	6,8,12,17,22		0420,1620,2200,2300
San Francisco	NPG	4,6,9,12,16,22	114.95	0400,1100,1600,2300
Los Angeles	KOK	6,8,12,17,22		0450,1650
Canal Zone	NBA	5,11,12	147	0530,1030,1700,2230
Honolulu	KHK	8,13,16		0530,2030
Honolulu	NPM	4,9,13,16,20,22	131.05	0400,1000,1600,2200
Guam	NPN	4,8,13,17,21		0000,0500,1230,1730
Philippines	NPO	4,12,15		0215,0700,1430,1930
			*if over 15 kW	

Source: Reference 4

tons total about 18,500 (interpolation from data in Reference 2). The number on sea voyages at any time has been computed as 42 percent, or 7,770 vessels in the category requiring radio telegraph facilities. Based upon WMO distribution data, 44 percent are in the Atlantic and 14 percent are in the Pacific. Accordingly, the average number of vessels with radio telegraph facilities on ocean passages at any time is computed to be as follows:

Atlantic	3,418
Pacific	1,087

4.2.4 Procedures

The commercial coastal station is provided weather reports by TELEX or local arrangement with the nearest weather station member of a teleprinter net of the National Weather Service. The station transmits the report in accordance with its published schedule, or in event of an urgent warning, upon receipt.

The broadcast schedules currently utilized for the Atlantic and Pacific areas are shown by Figures 4-3 and 4-4.

The radio officer, having knowledge of the intended track and weather areas of interest, arranges to copy weather broadcasts as scheduled and required. Stations providing the desired information are obtained from publications and company instructions. Based upon his experience with radio propagation characteristics, the Radio Officer will receive either the medium frequency or high frequency scheduled transmissions. Received copies are delivered to the watch officer promptly upon receipt.

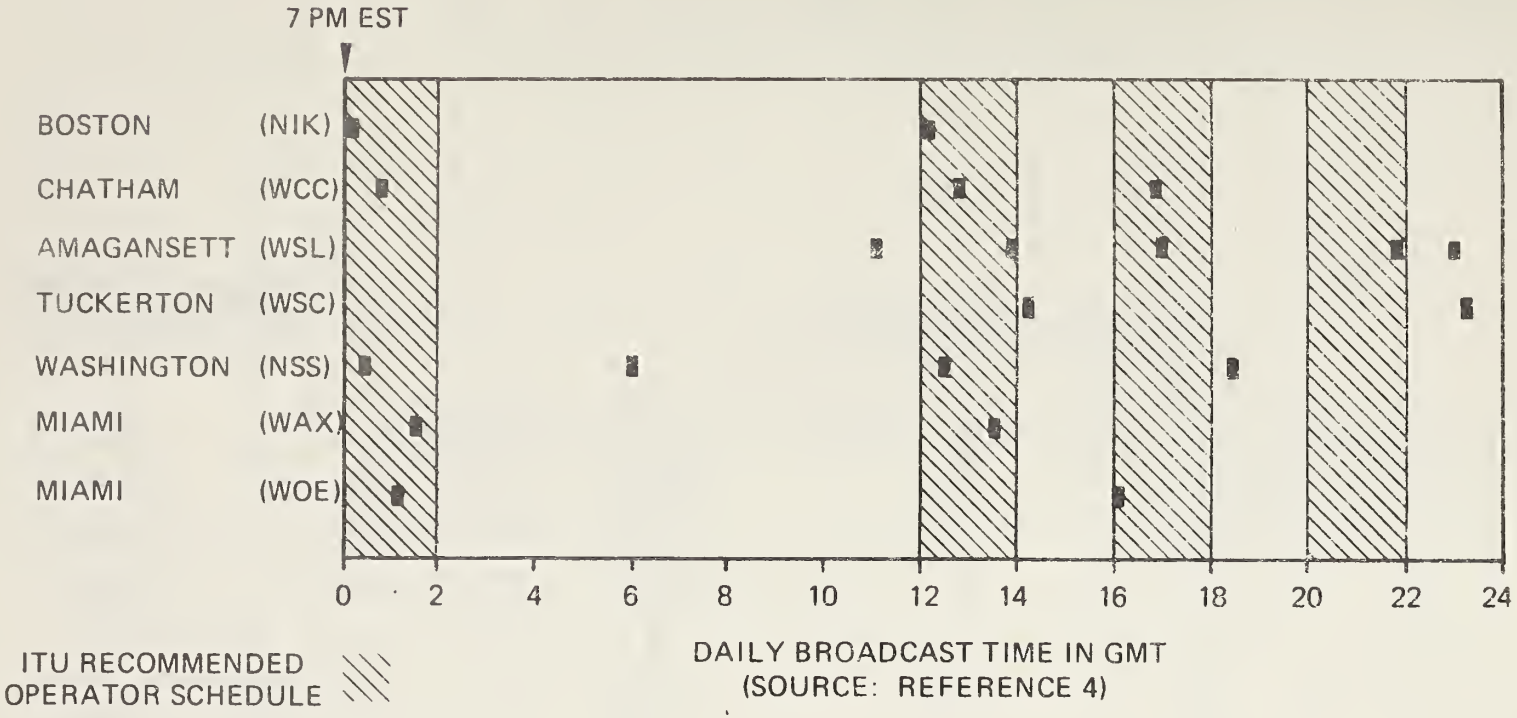

Figure 4-3. Time Distribution of Daily Radio Telegraph Weather Broadcasts, Atlantic Area (High Frequencies)

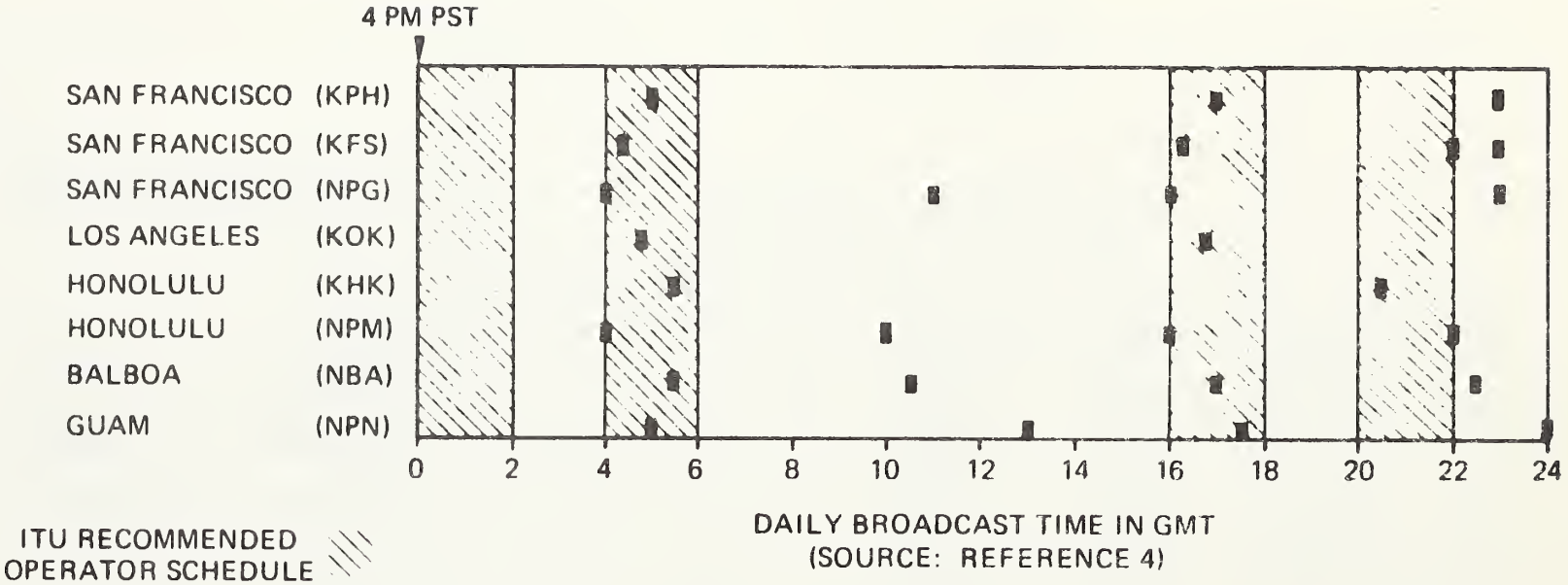

Figure 4-4. Time Distribution of Scheduled Weather Broadcasts by Radio Telegraph, Eastern and Central Pacific (High Frequencies)

4.3 HIGH SEAS TELEPHONE BROADCASTS

4.3.1 Introduction

Radio telephone does not require specialized skills. Use of amplitude modulation (double sideband), however, is more susceptible to transmission power needs and also requires greater spectrum. Significant telephone advantages in performance over longer paths are technically available in the form of single sideband emission. However, equipment installed must be technically designed to include SSB reception. Unless specific formats or brevity notes are used, the total transmission speed becomes limited to dictation speeds.

Although coastal stations have provided radio telephone service to high seas shipping since 1929, the dissemination of oceanic weather by voice broadcast is a relatively recent development. This stems from three factors:

a. The tremendous expansion of marine installed voice equipment capable of user operation.

b. The growth of "limited coastal stations" permitted under FCC Rules and Regulations 81.351 under which shipping lines may communicate with their fleet using high frequency single sideband.

c. The increasing demands by the above group of maritime mobile users for weather and safety information at off-shore ranges.

Marine stations specifically intended to be served by high seas telephone are those not having radio officers aboard, however, any vessel with high frequency receivers may copy the broadcasts.

4.3.2 Policies

The expanding need for oceanic coverage beyond coastal telephone range has been recognized by both the Coast Guard and the Weather Service in the United States. User requirements

have been expressed by shipping lines, and specialized communication user groups such as the Radio Technical Commission for Marine (RTCM) and the North Pacific Marine Council. The service provided not only serves an expanding maritime community of user-operated radio telephones, but strengthens the responsive capability of the Coast Guard for general surveillance of the safety of these off-shore vessels. In addition, the need for further improvements in off-shore broadcasts has been supported by the Federal Plan for Marine Meteorological Services (May 1968), and the United States support of the World Meteorological Organization (WMO).

The provision of adequate radio telephone coverage to vessels involves establishment and operation of suitable coastal facilities, public information as to what is available, and examination of optimum formats of transmission. Policy level coordination between the Coast Guard and the National Weather Service has affirmed policy support in the general objectives, and pilot programs to develop the system.

4.3.3 Facilities

Weather information intended for oceanic coverage (3-30 MHz) is broadcast by radio telephone using either double sideband or single sideband on a scheduled basis. The September 1970 edition of Weather Service for Merchant Shipping lists five. stations. These stations utilize frequencies in the high frequency band with powers up to 12 kilowatts. Summary listing of these stations are as follows:

Atlantic:	NMF	Boston, Mass. (CG)	4 times daily
	WOO	Ocean City, N.J. (AT&T)	2 times daily
	WOM	Ojus, Fla. (AT&T)	4 times daily
Pacific:	KMI	San Francisco (AT&T)	7 times daily
	KQM	Honolulu (RCA)	2 times daily

In addition to those listed in Weather Service for Merchant Shipping, the National Weather Service reports that weather for the Great Lakes is broadcast every six hours by Station WMI, Lorain, Ohio. This station transmits upon four and eight MegaHertz frequencies which would be receivable by ocean shipping prior to entering the Saint Lawrence Seaway.

The broadcast by the commercial coastal telephone stations (Ocean Gate, Ojus, and Dixon), and the initiation of Coast Guard broadcasts from Boston have been taken since 1968. Coast Guard broadcasts from Boston (Otis, Massachusetts) were activated 17 November 1969 on a carrier frequency of 8764 kiloHertz. The facilities and services continue under evaluation with expansion of broadcasts planned for stations at San Francisco, Honolulu and Portsmouth. Broadcasts at San Francisco will commence mid-1972.

A statistical analysis of ships which have high frequency radio facilities only is not available. The records of the FCC indicate that 26,115 licenses have been granted within the U.S. for radio transmitters in the 3-30 MegaHertz band as of January 1971. Since Safety of Life Conventions expect all passenger vessels and all cargo ships over 1,600 gross tons to have radio telegraph installations, voice broadcasts are of most value to vessels of less than 1,600 gross tons. Vessels of this size or less making ocean passages or operating some distance off-shore would include research vessels, tugs, fishing vessels, and some yachts.

The National Weather Service and the National Bureau of Standards have explored for some time the use of the time signal stations WWV and WWVH for announcements of severe weather. The new broadcast format of these stations is more amenable to the inclusion of storm warnings than the previous one. The NWS, therefore, in cooperation with the Bureau of Standards, will implement an hourly program of broadcasting storm and hurricane warnings over WWV and WWVH about August 1, 1971. The warnings will cover the areas for which the U.S. has warning responsibilities under international agreements.

4.3.4 Procedures

Voice broadcasts are on a scheduled basis and are made known by notices, shipping publications, and public press announcements.

Operation is relatively simple in adjusting the receiver for the announced frequency, and peaking the receiver to the signal. In the case of single sideband, adjustment of the beat oscillator (or carrier injection) controls may be necessary to assure intelligibility.

Where several frequencies are utilized in simultaneous broadcast (e.g., Ocean Gate, Dixon,or Ojus), the operator must seek the optimum frequency being received at his location for that time and season. He may do this by quickly checking each frequency, consulting radio propagation guides, or by his experience 24 hours previously.

The visualization of scheduled broadcasts by American stations is shown by two diagrams. Figure 4-5 shows Atlantic broadcasts, and Figure 4-6 shows Pacific broadcast schedules.

Procedures adopted for weather broadcasts via time stations WWV and WWVH are as follows:

Between the 16th and 17th minutes after each hour, around the clock, WWV will carry a voice broadcast listing hurricanes and major storms in the western North Atlantic. Frequencies are 2.5, 5, 10, 15, 20, and 25 MHz.

WWVH will list hurricanes and major storms in the eastern and central North Pacific between the 49th and 50th minute after each hour on 2.5, 5, 10, 15, and 20 MHz.

The format allows about 42 seconds for the weather broadcast, which limits the information concerning each of the severe weather areas. The list of hurricane and storm centers should, however, enable a mariner to quickly note one that would be of concern to him and to check one of the regular marine broadcasts for more details.

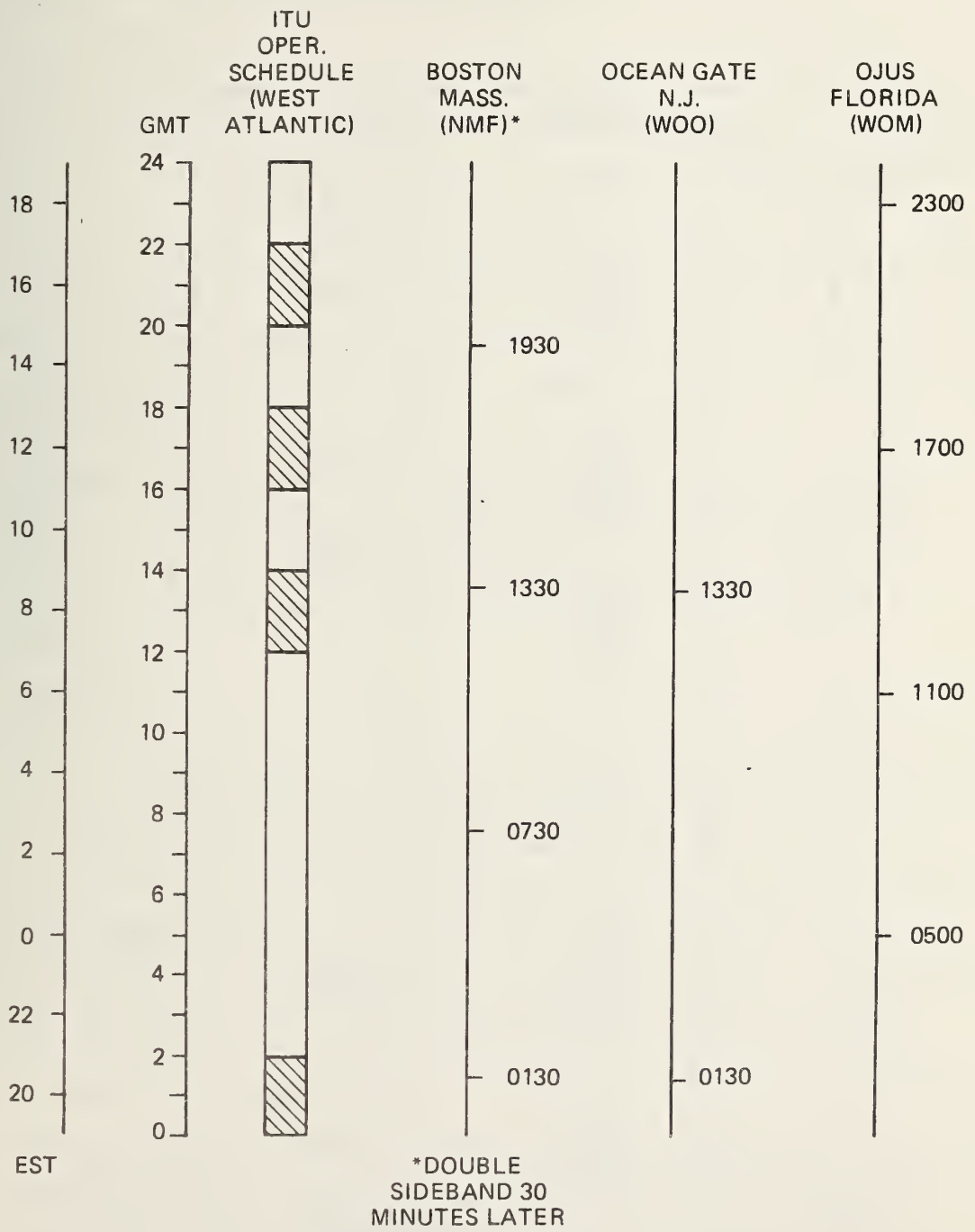

Figure 4-5. Daily Voice Broadcasts for the Atlantic

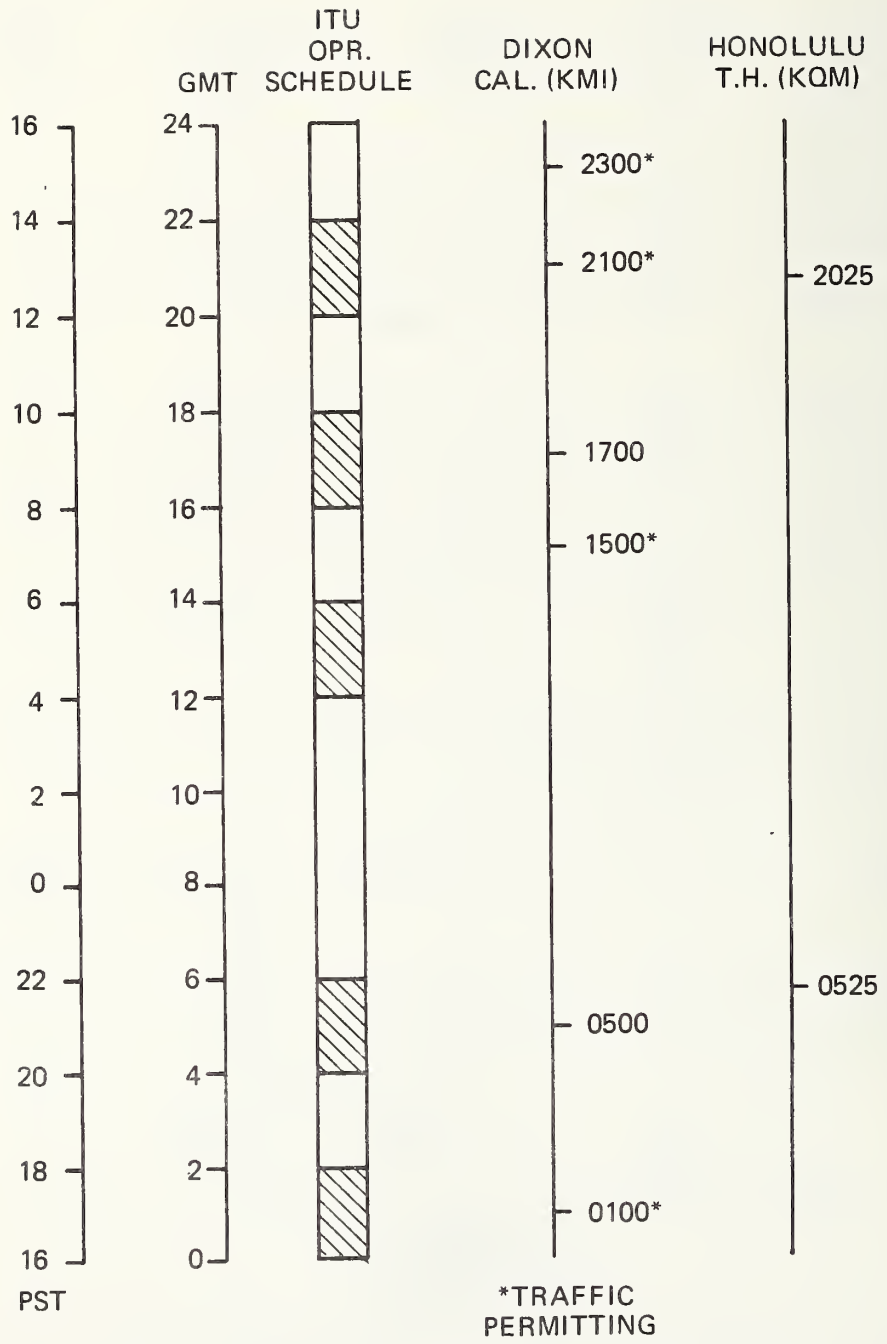

Figure 4-6. Daily Voice Broadcasts for the Pacific

4.4 RADIO TELEPRINTER WEATHER BROADCASTS

4.4.1 Introduction

Radio teleprinter provides a means of transmitting printed copy at rates greatly in excess of human writing speeds. Operational skills required are relatively simple. Transmission is subject to radio path factors and interference since the discrimination ability is more mechanical than that which exists when the human is in the chain. However, techniques of error correction are now available, as well as compact terminal equipment. The spectrum needs are only slightly greater than those for manual telegraph.

Although the teleprinter offers excellent advantages in reception by record means, its application to marine use has developed very slowly. The recent availability of compact printers may increase their future application to maritime communications

4.4.2 Policies

There is no current program of teleprinter weather dissemination to high seas shipping specifically sponsored by the National Weather Service. The transmissions being made by designated coastal stations of the ITT Corporation and RCA Global Communications are primarily offered as a convenience to affiliated subscriber ship stations having teleprinter terminal equipment. Teleprinter equipment of these subscriber ships is utilized for message traffic and press, and receipt of weather information alone was not the basis for installation.

The Coast Guard has indicated that transmission of teleprinter emissions is being incorporated in the technical capability of its new radio stations. The National Weather Service policy is that it would encourage this means of weather dissemination at such time as it appears useful. The manager of radio marine systems of one major communication organization

offers the thought that shipping lines would not assume teleprinter installation costs since telegraph can provide the service.

However, where the teleprinter installation is justified by traffic such as press, public correspondence, or company business, weather information by teleprinter is justified. From a technical viewpoint of future data and satellite broadcasts, the transition to teleprinter input/output devices will be required.

4.4.3 Facilities

The publication "Weather Service for Merchant Shipping" lists no coastal transmissions of weather data for radio teletype. However, investigation indicates the following teleprinter transmission of oceanic weather:

> Amagansett, WSL, transmits North Atlantic weather with teletype emission daily at 1750 GMT. Frequencies are the alternate working frequencies in the 4, 6, 8, 13, and 17 MegaHertz marine bands.

Press and traffic transmissions by teleprinter are currently made by Chatham (WCC) and San Francisco (KPH).

The number of U.S. merchant vessels equipped with teleprinter installations is quite small. In consultations with ITT and RCA Marine representatives it was indicated that this number is less than 15. Most of the installations are aboard passenger vessels and large containerships.

4.4.4 Procedures

Coastal stations currently transmitting weather reports by teleprinter also transmit by telegraph at separate times. The coastal station practice is to prepare the teleprinter transmitting tape from the incoming weather text received for telegraph transmission. Reception aboard the ship is machine printed, and requires an operator only for tuning adjustments and operational measures.

4.5 HIGH SEAS WEATHER BROADCASTS BY RADIO FACSIMILE

4.5.1 Introduction

Radio facsimile for weather dissemination provides the highest information transfer, and a format immediately adaptable to decision processes. Since only a black or white signal is involved in any instantaneous signal, its transmission characteristics are relatively easy to satisfy. As with any graphic reconstruction, it requires scan synchronization between the transmitting and receiving terminal device. Modern equipment can achieve this synchronization automatically, provided compatible technical standards exist. Equipment use requires no specialized or lengthy training. Its spectrum demands are similar to single channel radio teleprinter. Facsimile may be transmitted also over voice facilities where voice transmission means are available.

Although weather information has been transmitted by radio-facsimile since about 1962, there are few stations currently transmitting radio-facsimile expressly for merchant vessels at sea (Quickborn, Germany, and CG Radio Station Boston). Most weather facsimile transmissions which include oceanic areas are intended for broadcast reception by fixed weather stations, and their reception by shipping, while invited, is secondary.

4.5.2 Policies

The U.S. Weather Service and the Coast Guard agree that graphical presentation means are one of the best methods for providing weather information for large areas. Accordingly, they have instituted a joint program for facsimile transmissions in the North Atlantic. This support results from a view that radio-facsimile represents an ideal method of visual display of weather prognosis and surface analysis. The same facilities may be applied to ice information and plots of navigational hazards. The transmission sequence, having once been set in synchronization,

provides data automatically which otherwise would require an operator to transcribe and plot numerous data points. Being a visual record, it permits the mariner to interpret significant trends upon which he may make timely operational decisions.

Policy implications involve two aspects:

a. Technical Standardization

b. Information Standardization

The first must achieve a compatible facsimile terminal with technical specifications applicable to all merchant vessels and coastal stations. The second involves operational agreement as to the formats and data which best serves merchant shipping. Information standardization must consider the user's ability to interpret the charts transmitted. The current pilot program aims to provide the operational data needed for such standardization.

Whereas current weather facsimile broadcasts address upper air analyses and upper-air prognosis in numerous examples, the mariner is interested in surface forecasts, sea wave analysis and prognosis, sea - ice positions, visibility or fog conditions, ocean current and currents in sea approaches, and location and temperature gradients of defined currents such as the Gulf Stream. Further, storm centers and magnitudes of wind and waves should be provided. Lastly, the charts must recognize that the ship's captain or deck officers are not trained meteorologists.

The International Convention for Safety of Life at Sea, 1960, which has been ratified by the United States, also advocates the use of radio-facsimile. Regulation 4, Chapter 5, encourages the daily transmission of suitable facsimile weather charts.

4.5.3 Facilities

A summary of stations which transmit oceanic weather by facsimile, and reported to merchant shipping, is as follows:

Ocean Area	Total Stations Listed	U.S. Stations Listed
North Atlantic	8	3
South Atlantic	2	0
North Pacific	2	2
Central Pacific	1	1
Western Pacific	3	1

All stations summarized above transmit simultaneously upon two or more frequencies in the high frequency band. While they may be intercepted in most of the areas indicated, the transmissions in several cases are directed by antenna patterns towards specific fixed weather stations. The signal quality may be less than optimum in such situations unless the ship's track is within the antenna pattern. For example, the Weather Service transmissions from Brentwood, New York, (Radio Call Signs WFH, WFK) originate at Suitland, Maryland, go directly to the transmitter, and are transmitted so as to serve land weather stations in the Caribbean, Central America, and South America. Another example is station KWAF, Washington, D.C., which is primarily operated to transmit weather facsimile data to air weather stations in the Azores and Panama. This is shown by Figure 4-7.

Coast Guard Radio Station Boston (NMK) initiated facsimile transmissions in June 1971 which are particularly designed to serve maritime needs. The weather information and formats are prepared by the National Weather Service. Initial broadcasts will receive evaluation so as to improve the service and transmission format. Action also has been taken to provide facsimile transmission equipment in the new Coast Guard Radio Station at San Francisco, and which will serve as a similar pilot program in the Pacific area.

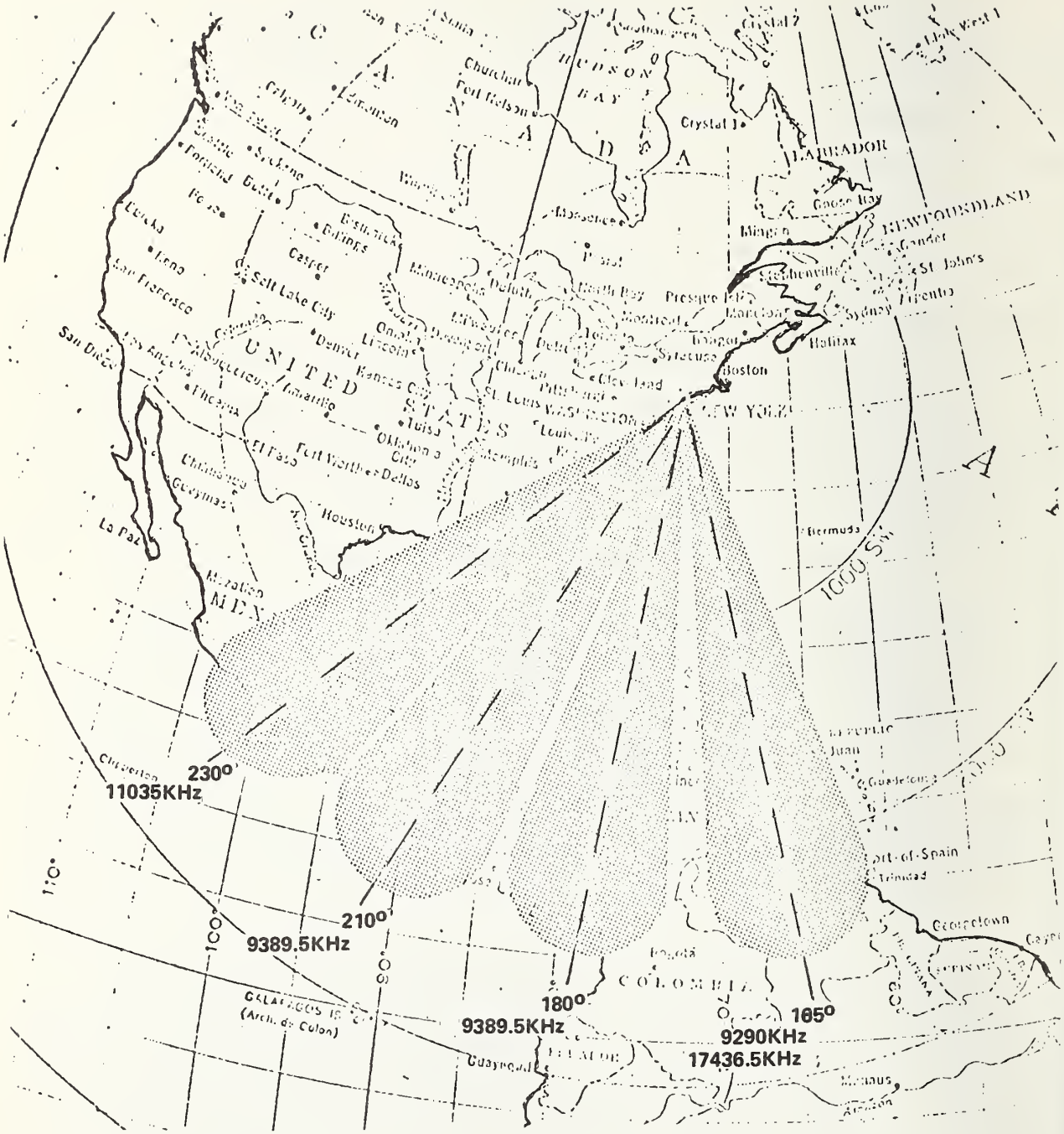

Figure 4-7. Optimum Coverage Areas as Determined by Technical Antenna Pattern Characteristics (from Brentwood, as provided by the National Weather Service)

The Radio Technical Commission for Marine (RTCM) conducted a study in 1970 of American shipping with radio-facsimile receiving equipment. The sampling response pertained to 697 vessels, both commercial and government. Pertinent data of this sampling is as follows:

Operator	Ships	No. With Facsimile	Percent with Facsimile
Commercial	491	54	11%
Government	206	157	76%

The World Meteorological Organization surveyed the radio-facsimile situation in early 1968, and reported the following world distribution by ship types (Reference 3).

Type	Number with Facsimile
Merchant	845
Fishing	412
Research	34
Others	25
TOTAL	1,325

4.5.4 Procedures

Weather charts utilized in radio-facsimile broadcasts are prepared by meteorological groups for transmittal to the transmitting site or sites. Distribution to these sites is usually achieved via land-line communication links.

Knowing the time and radio frequency of the surface weather chart transmission, the shipboard operator must achieve proper tuning of the radio signal and have the facsimile recorder ready for receiving the starting synchronization signals. (It is assumed that technical compatibility of equipment exists.) Each chart

transmission includes a starting signal of five seconds and a phasing signal for 20 to 30 seconds which is followed by the graphic transmission. Older equipment using a mechanical clutch to start the facsimile drum required a specific "drum start" signal. However, newer electronic techniques are not transmitting the "drum start" signal since terminal equipment is automatic in its synchronization process. The transmission requires about 10 minutes per chart for standard transmissions.

The finished chart has a resolution of 96 lines per inch which provides a fully adequate visual display provided that lettered information is not too small. Figure 4-8 shows an example of too small and too many figures for proper definition. Figure 4-9 shows the effect of longer lettering. Both these figures are extracted reproductions to scale of actual facsimile transmissions.

Figure 4-10 is an example of the charts transmitted in conjunction with the North Atlantic Maritime Weather Service initiated in June 1971 and jointly operated by the Coast Guard and the National Weather Service.

The service consists of two weather maps prepared by the Weather Service - a component of the Commerce Department's National Oceanic and Atmospheric Administration - and transmitted daily at 1730 Greenwich Mean Time by the Coast Guard Radio Station at Boston, Mass., on frequencies of 8502 kHz and 12750 kHz.

The maps cover almost the entire North Atlantic and include all major shipping lanes between United States and Europe. The first one gives the weather, wind,and sea conditions over the area for 1200 GMT on the day of the Broadcast. The second provides a 24-hour forecast of those elements for 1200 GMT the following day. Both give storm centers, heights of waves, speed and direction of wind, isobars, and major fronts. Time required for transmission is approximately 20 minutes.

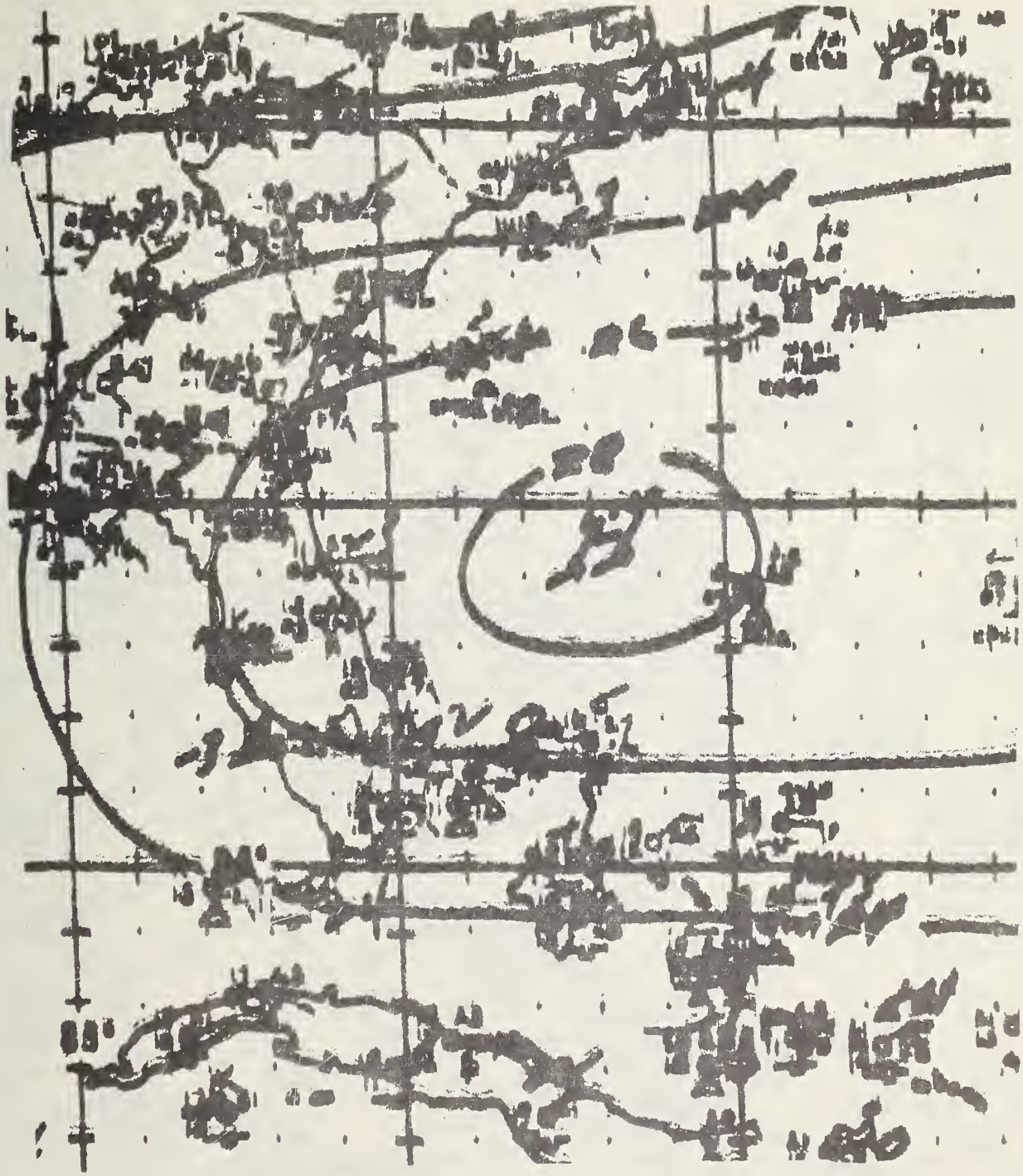

Figure 4-8. Example of Surface Chart Printed Characteristics Being too Small for Proper Resolution (Source: Surface Weather Chart Transmitted Over Brentwood, 22 January 1971)

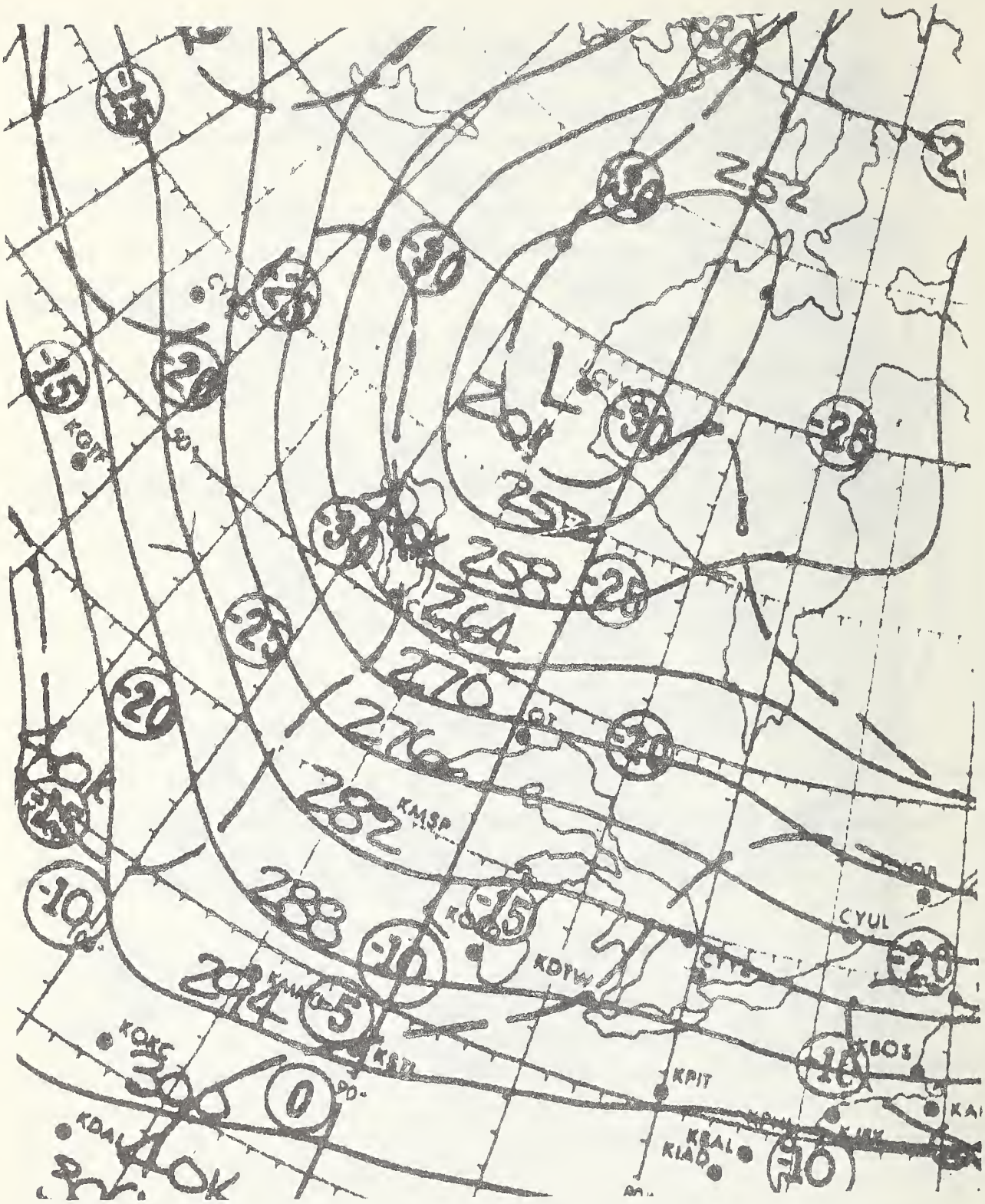

Figure 4-9. Chart Improvement With Larger Print. (Source: National Weather Service, monitored copy of Brentwood, 22 January 1971, segment of transmission at actual copy scale.)

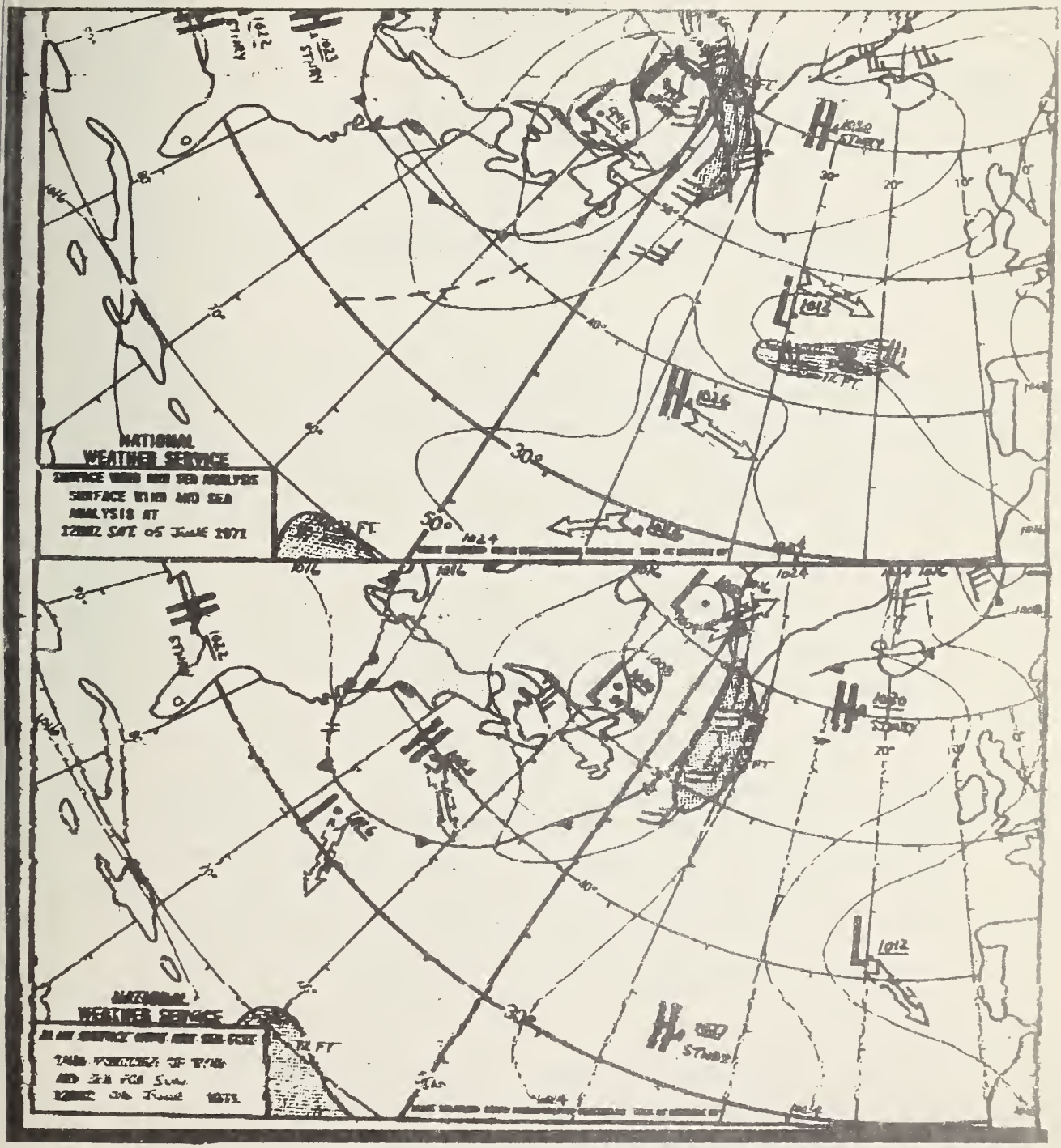

Figure 4-10. Examples of National Weather Service Surface Wind and Sea Analysis Charts. (Copied by Station NMH 8502 kHz, 1730 GMT, 5 June 1971)

APPENDIX A

FCC RULE CHANGES

Report No. 3058 September 6, 1968 - S

NONBROADCAST AND GENERAL ACTION

RULES PROPOSED IN MARITIME MOBILE SERVICE TO IMPLEMENT SINGLE SIDEBAND FREQUENCIES IN THE BAND 1605 - 4000 KC/S

The Commission has proposed amendments to its maritime mobile service rules to implement international radio agreements by changing from double sideband (DSB) operations to single sideband (SSB) in the band 1605-4000 kc/s. Completion of the program is scheduled for Janaury 1, 1977.

FCC Rules affected by the current proposals are in Parts 2 (frequency allocations), 81 (maritime land stations), and 83 (maritime ship stations) in geographic areas other than Alaska and the Great Lakes.

The purpose of the program is to make improvements in communications, to enhance the maritime radio safety system, and to provide for future use of radiotelephony by vessels unable to fulfill their communication needs by other means. Single side band is a more modern, sophisticated method of operation. It permits utilization of a greater number of channels reducing congestion. It also substantially limits interference.

As proposed, availability of 2 Mc/s to ship stations would be limited to those vessels which are equipped with VHF and which operate at distances from shore which are beyond VHF range. This is fitted into the schedule of conversion to SSB as follows:

Until January 1, 1971, DSB will continue to be authorized as at present.

After January 1, 1971, new installations aboard ship stations will be authorized use of SSB only where such ship stations are equipped also with VHF.

During the period January 1, 1971, to January 1, 1977, installations of 2 Mc/s DSB, authorized prior to January 1, 1971, will be amortized.

After January 1, 1977, use of 2 Mc/s radiotelephony will be limited to SSB and will be available only to vessels which are equipped also with VHF.

For coast stations the effect of the various amendments proposed is:

To continue to authorize installation of DSB until January 1, 1970.

Until January 1, 1970, transmission of SSB would be permissive; after January 1, 1970, capability to use full carrier, reduced carrier and suppressed carrier emissions would be required.

On the international distress and calling frequency 2182 kc/s, until January 1, 1970, require capability to transmit and receive with SSB full carrier emission and, until January 1, 1977, receive DSB emission.

After January 1, 1977, except for safety communications and where communications requirements cannot be fulfilled by VHF, SSB will not be available for use in ports and harbors, on lakes or rivers, or for communication involving passage of ships through locks, bridge areas, or Government controlled waterways.

The program, in addition, would establish revised technical standards, including those concerning emissions, frequency tolerances and transmitter power.

Comments by interested parties are due by October 16, 1968, and reply comments October 28, 1968.

Action by the Commission September 5, 1968, by Notice of Proposed Rule Making. Commissioners Hyde (Chairman), Bartley, Lee, Cox, and Wadsworth; with Commissioner Johnson concurring in the result.

RULES AMENDED TO SHIFT DOUBLE AND SINGLE SIDEBAND FREQUENCIES IN MARITIME MOBILE SERVICE TO CONFORM WITH INTERNATIONAL REVISIONS

Amendments to bring FCC rules for maritime mobile radiotelephone stations into line with international changes have been adopted by the Commission in a Third Report and Order (Docket No. 18271). The changes deal with single and double sideband assignments in the high frequency bands between 4 and 23 Mc/s. The proposed double sideband shifts are interim in nature, because the maritime mobile service has been in transition to single sideband since 1964.

FCC rules affected by the amendments are in Part 2 (frequency allocations), 81 (maritime land stations), 83 (maritime ship stations), and 85 (maritime services in Alaska). The amendments will:

• Shift ship stations on public correspondence channels to new DSB frequencies between March 1 and May 1, 1970.

• Shift limited coast and ship stations operating between 4 and 23 Mc/s to new SSB frequencies between December 1969 and April 1, 1970.

• Prohibit new DSB equipment in ship stations after January 1, 1972.

• Discontinue DSB at coast stations that have not already converted to SSB on January 1, 1972.

• Permit coast stations that need to communicate with foreign ship stations not equipped for SSB to employ A3H emission between January 1, 1974 (U.S. deadline for conversion to SSB) and January 1, 1978 (world deadline for conversion).

• Continue the present prohibition against use of DSB in ship stations after January 1, 1974, after which only A3A and A3J emissions will be authorized.

• Require SSB transmitters to be capable of all three SSB emissions, A3A, A3H and A3J, but permit older ones not capable of A3A to continue in operation.

• Reduce the authorized bandwidth for SSB from 3.5 kc/s to 3.0 kc/s and various other necessary technical standards.

• Expand the number of frequencies available for use by public correspondence coast and ship stations in the high seas service, in the Mississippi River System, in the Gulf of Mexico, and in the Alaska area.

The amendments in the Third Report and Order stem from changes in International Telecommunication Union regulations adopted at the World Administrative Radio Conference (WARC), held in Geneva, September 18th to November 3rd, 1967.

Changes adopted in the Commission's First and Second Report and Orders are now codified in the FCC's Third Report and Order, which terminates the proceeding and closes the record.

Action by the Commission December 17, 1969, by Third Report and Order. Commissioners Burch (Chairman), Bartley, Robert E. Lee and Wells with Commissioner Johnson concurring in the result.

NONBROADCAST AND GENERAL ACTION

RULES ADOPTED IN MARITIME MOBILE SERVICE TO IMPLEMENT SINGLE SIDEBAND FREQUENCIES IN THE BAND 1605 - 4000 KHZ

Amendments to FCC Rules for maritime mobile service radiotelephone stations to meet the growing national boating needs and to bring the Rules into line with international changes have been adopted by the Commission in a First Report and Order (Docket 18307). The changes deal with use of single (SSB) and double (DSB) sideband emissions in the medium frequency bands between 1605 and 4000 kHz. Completion of this second phase of a two phase program is scheduled for January 1, 1977. The first phase was completed by the Commission in a Report and Order released July 25, 1968 (Docket 17295) which dealt with the use of VHF.

FCC Rules affected by the amendments are in Parts 2 (frequency allocations), 81 (maritime land stations) and 83 (maritime ship stations) in geographic areas other than Alaska and the Great Lakes.

The purpose of the program is to make improvements in communications, to enhance the maritime radio safety system, and to provide for future use of radiotelephony by vessels unable to fulfill their communication needs by other means. Single sideband is a more modern, sophisticated method of operation. It permits utilization of a greater number of channels reducing congestion. It also substantially limits interference.

Under the new rules, availability of frequencies in the band 1605-4000 (commonly referred to as 2 MHz) will be limited to those vessels which are equipped with VHF. Conversion to SSB will take place on the following schedule:

• Until January 1, 1972, DSB will continue to be authorized as at present. After January 1, 1971, the Commission will not type accept any new types of DSB transmitters.

• After January 1, 1972, new installations aboard ship stations will be authorized use of SSB only where such ship stations are equipped also with VHF.

• After January 1, 1977, use of 2 MHz radiotelephony will be limited to SSB, will be available only to vessels which are equipped also with VHF, and may not be employed for intership or ship-to-shore communications over distances which are within VHF communication range.

For coast station installation of DSB is authorized until January 1, 1972. The following are the effective dates of other new rules:

• Transmission of SSB permissive until January 1, 1972; after January 1, 1972, capability to use full carrier, reduced carrier and suppressed carrier emissions is required.

• International distress and calling frequency 2182 kHz (a) licensee must be able to transmit until January 1, 1972, with DSB or SSB full carrier emission, and after January 1, 1972, with SSB full carrier emission; (b) licensee must be able to receive until Janaury 1, 1977, with DSB and SSB full carrier emission; and after January 1, 1977, SSB full carrier emission.

• After January 1, 1977, 2 MHz will be available only to public coast stations where service is also provided on VHF.

• After January 1, 1977, except for safety communications, SSB shall not be used by a public coast station for communication with a vessel which is within VHF service range of the public coast station.

• After January 1, 1977, except in the Mississippi River and Great Lakes public coast stations serving lakes or rivers will not be authorized to use frequencies in the band 2000-2850 kc/s.

Five new SSB frequencies were made available under the new rules: 2082.5 kHz for intership use on all coasts; 2086.0 kHz for Mississippi River System; 2093.0 kHz for intership commercial fishing vessels; 2096.5 kHz for limited ship and coast stations (see Section 81.361); and 2203.0 kHz for intership use in the Gulf of Mexico. In addition, on a limited basis in areas where interference will not be caused to Canadian assignments, SSB frequencies 2065.0 and 2079.0 kHz may also be assigned.

Various technical standards were also amended, including those for authorized bandwidth, required types of emissions and transmitter power.

Action by the Commission June 10, 1970, by First Report and Order. Commissioners Bartley (Acting Chairman), Robert E. Lee, Cox, H. Rex Lee and Wells, with Commissioner Johnson concurring in the result.

APPENDIX B

COASTAL WARNING DISPLAY STATIONS
(April 1970)

UNITED STATES DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
WEATHER BUREAU EASTERN REGION
Garden City, New York

April 1, 1970

COASTAL WARNING DISPLAY STATIONS WFE422

ATLANTIC COAST

Station	Latitude	Longitude	Type Display
PORTLAND, MAINE - Supervising Office			
Eastport, Maine	44°54.5'	66°59.3'	D&N
Moose Peak STA, Maine (CG)	44°28.5'	67°31.9'	D
Southwest Harbor STA, Maine (CG)	44°16.5'	68°18.8'	D
*Rockland Coast Guard STA, Maine (CG)	44°06.3'	69°06.1'	D
Owls Head LTSTA, Maine (CG)	44°05.5'	69°02.7'	D
Marshall Point LTSTA, Maine (CG)	43°55.0'	69°15.7'	D&N
Boothbay Harbor, Maine	43°51.3'	69°37.7'	D&N
Kennebec River STA, Maine (CG)	43°45.0'	69°46.9'	D
South Portland CG Base, Maine (CG)	43°38.7'	70°15.0'	D&N
Portland LV, Maine (CG)	43°31.5'	70°05.5'	D
*Fletchers Neck STA, Maine (CG)	43°26.0'	70°20.5'	D
BOSTON, MASS. - Supervising Office			
Portsmouth Harbor LTSTA, N. H. (CG)	43°04.3'	70°42.6'	D&N
Merrimac River STA, Mass. (CG)	42°48.9'	70°48.6'	D&N
Newbury, Mass.	42°45.7'	70°50.9'	D&N
Essex, Mass.	42°38.0'	70°46.7'	D
Eastern Point LTSTA, Mass. (CG)	42°34.8'	70°39.9'	D&N

Station	Latitude	Longitude	Type Display
BOSTON, MASS. - Supervising Office (Cont'd.)			
Beverly, Mass.	42°32.4'	70°52.8'	D
Salem, Coast Guard Air Station, Mass. (CG)	42°31.6'	70°52.2'	D
Marblehead, Mass.	42°30.5'	70°50.5'	D&N
*Winthrop, Mass.	42°22.1'	70°59.3'	D
Boston STA, Mass. (CG)	42°22.1'	71°03.1'	D
*Cambridge (Charles River Yacht Club), Mass.	42°21.6'	71°05.1'	D
Boston Herald Traveler Corp., Mass.	42°20.8'	71°03.9'	D&N
Boston LV, Mass. (CG)	42°20.4'	70°45.5'	D
Deer Island LTSTA, Mass. (CG)	42°20.4'	70°57.3'	D
Windmill Point, Mass. (CG)	42°18.2'	70°55.3'	D
*Dorchester (Old Colony Yacht Club), Mass.	42°18.0'	71°02.7'	D
Boston Harbor, MDC Police Patrol Boat, Mass.	42°16.2'	70°51.5'	D
*Hingham Yacht Club, Mass.	42°15.7'	70°53.7'	D
Scituate STA, Mass. (CG)	42°11.9'	70°43.0'	D
*Scituate Fourth Cliff, Mass.	42°09.7'	70°42.5'	D
Green Harbor Marina, Mass.	42°05.1'	70°39.1'	D
Plymouth LTSTA, Mass. (CG)	42°00.2'	70°36.1'	D
Provincetown, Mass.	42°03.1'	70°11.3'	D&N
Wellfleet, Mass.	41°55.8'	70°01.9'	D
*Training Ship (Bay State), Mass.	41°44.5'	70°37.1'	D
Barnstable, Mass.	41°42.5'	70°18.5'	D

Station	Latitude	Longitude	Type Display
BOSTON, MASS. - Supervising Office (Cont'd.)			
Marion, Mass.	41°42.3'	70°45.7'	D
Wings Neck Light (Pocasset), Mass.	41°40.8'	70°39.7'	D&N
*Red Brook Harbor, Mass.	41°40.6'	70°37.0'	D&N
Chatham LTSTA, Mass. (CG)	41°40.3'	69°57.0'	D&N
Fairhaven, Mass.	41°38.2'	70°54.4'	D&N
*South Dartmouth (New Bedford Y.C.), Mass.	41°35.1'	70°56.7'	D&N
Nobska Point LTSTA, Mass. (CG)	41°31.0'	70°39.3'	D&N
Vineyard Haven, Mass.	41°27.2'	70°36.0'	D&N
Buzzards Bay (Entrance) LTSTA, Mass. (CG)	41°23.8'	71°02.0'	D
Gay Head STA, Mass. (CG)	41°21.0'	70°45.9'	D
Nantucket LV, Mass. (CG)	40°33.0'	69°28.0'	D
NANTUCKET, MASS. - Supervising Office			
*Edgartown Yacht Club, Mass.	41°23.3'	70°30.7'	D
Brant Point STA, Mass. (CG)	41°17.4'	70°05.5'	D&N
BLOCK ISLAND, R. I. - Supervising Office			
Block Island STA, R. I.	41°11.7'	71°35.4'	D&N

Station	Latitude	Longitude	Type Display
PROVIDENCE, R.I. - Supervising Office			
Providence (The Providence Journal Co.), R. I.	41°49.5'	71°25.0'	D&N
Edgewood Yacht Club, R. I.	41°46.6'	71°23.5'	D
Bristol, CG Depot, R. I. (CG)	41°40.0'	71°16.7'	D
*Jamestown, R. I.	41°30.0'	71°22.0'	D
*Newport (Ida Lewis Yacht Club), R. I.	41°28.7'	71°19.6'	D
Castle Hill STA, R. I. (CG)	41°27.8'	71°21.7'	D
*South Kingstown (Snug Harbor Marina), R.I.	41°23.2'	71°31.1'	D
Point Judith STA, R. I. (CG)	41°21.7'	71°28.9'	D&N
*Westerly Yacht Club, R. I.	41°20.9'	71°49.7'	D
Watch Hill LTSTA, R. I. (CG)	41°18.2'	71°51.5'	D
BRIDGEPORT, CONN. - Supervising Office			
*Mystic, Conn.	41°20.5'	71°58.4'	D
*Stonington, Conn.	41°20.0'	71°54.5'	D
*Saybrook, Conn.	41°19.1'	72°21.0'	D
New London Ledge LTSTA, (CG)	41°18.3'	72°04.7'	D&N
*Saybrook (Terra Mar Yacht Basin), Conn.	41°17.0'	72°21.0'	D
Guilford, Conn.	41°16.3'	72°39.9'	D
Clinton, Conn.	41°16.2'	72°31.7'	D
Fishers Island STA, N. Y. (CG)	41°15.4'	72°01.9'	D
*Prospect Beach Fish & Game Club, Conn.	41°15.0'	72°58.0'	D
New Haven Lighthouse, Conn.	41°14.9'	72°54.3'	D&N
*Milford Yacht Club, Conn.	41°12.6'	73°03.0'	D&N

Station	Latitude	Longitude	Type Display
BRIDGEPORT, CONN. - Supervising Office (Cont'd)			
*Westport Longshore Marina, Conn.	41°06.5'	73°22.0'	D
*Westport Compo Basin, Conn.	41°06.4'	73°21.3'	D
NEW YORK, N. Y. - Supervising Office			
*Croton Point Park, N. Y.	41°11.2'	73°54.1'	D
Montauk STA, N. Y. (CG)	41°04.3'	71°56.1'	D
Montauk Point LTSTA, N. Y. (CG)	41°04.3'	71°51.4'	D&N
Stratford Shoal LTSTA, Conn. (CG)	41°03.5'	73°06.0'	D
*East Hampton (Three Mile Harbor), N. Y.	41°01.2'	72°10.9'	D
Eatons Neck STA, N. Y. (CG)	40°57.3'	73°23.9'	D&N
*Mamaroneck (Harbor Island Beach), N. Y.	40°56.6'	73°43.9'	D
*Larchmont Yacht Club, N. Y.	40°55.4'	73°44.7'	D
New Rochelle (B. of M., D. and H.), N. Y.	40°54.5'	73°46.2'	D&N
*Northport Yacht Club, N. Y.	40°54.5'	73°21.5'	D
*Centerport Yacht Club, N. Y.	40°54.1'	73°21.7'	D
*Huntington Yacht Club, N. Y.	40°53.8'	73°25.3'	D
*Hempstead Harbour, N. Y.	40°51.4'	73°39.1'	D
Shinnecock STA, N. Y. (CG)	40°51.0'	72°30.2'	D
*N. Hempstead Town Dk., Port Washington, N. Y.	40°49.9'	73°42.2'	D
*Port Washington Knickerbocker Yacht Cb., N. Y.	40°49.7'	73°42.2'	D&N
*Manhasset Bay Yacht Club, N. Y.	40°49.4'	73°42.3'	D
*Port [illegible] Yacht Club, N. Y.	[illegible]°[illegible].3'	73°42.2'	D

Station	Latitude	Longitude	Type Display
NEW YORK, N. Y. - Supervising Office (Cont'd)			
Moriches STA, N. Y. (CG)	40°47.2'	72°45.0'	D
*Patchogue, L. I., N. Y.	40°45.1'	73°01.2'	D&N
Bay Shore Marine Basin, L. I., N. Y.	40°42.9'	73°14.4'	D
New York STA (Battery Park), N. Y. (CG)	40°42.0'	74°00.9'	D
Freeport Yacht Club, Freeport, L. I., N. Y.	40°38.3'	73°34.7'	D&N
Nassau (Marine Bureau), L. I., N. Y.	40°37.7'	73°40.1'	D
Fire Island STA, N. Y. (CG)	40°37.5'	73°15.6'	D
Point Lookout (Hempstead Town Marina), N. Y.	40°35.6'	73°35.2'	D&N
Atlantic Beach STA, N. Y. (CG)	40°35.5'	73°44.4'	D
Short Beach STA, N. Y. (CG)	40°35.4'	73°33.4'	D
Rockaway STA, N. Y. (CG)	40°34.0'	73°53.1'	D
*Great Kills, S. I., N. Y.	40°32.3'	74°08.5'	D
Staten Island, Prince Bay, N. Y.	40°30.6'	74°11.7'	D&N
Sandy Hook STA, N. J. (CG)	40°28.3'	74°00.8'	D&N
Ambrose Light Station (TWR), N. Y. (CG)	40°27.4'	73°49.9'	D&N
Shark River STA, N. J. (CG)	40°11.7'	74°00.6'	D
Manasquan Inlet STA, N. J. (CG)	40°06.4'	74°02.3'	D&N
Barnegat LV, N. J. (CG)	39°45.8'	73°46.0'	D
Five Fathoms Bank LV, N. J. (CG)	38°47.3'	74°34.6'	D
Delaware LV, Del. (CG)	38°27.3'	74°35.1'	D

Station	Latitude	Longitude	Type Display
ATLANTIC CITY, N. J. - Supervising Office			
*Bay Head, N. J.	40°03.9'	74°03.0'	D
Bay Head, Manasquan, N. J.	40°04.2'	74°03.7'	D
*Lanoka Harbor, N. J.	39°52.2'	74°09.2'	D
Barnegat STA, N. J. (CG)	39°45.5'	74°06.3'	D
Beach Haven STA, N. J. (CG)	39°33.2'	74°15.1'	D
*Brigantine, N. J.	39°24.5'	74°22.2'	D
Atlantic City STA, N. J. (CG)	39°22.7'	74°25.4'	D
Great Egg STA, N. J. (CG)	39°17.7'	74°33.8'	D
Townsend Inlet STA, N. J. (CG)	39°07.7'	74°42.6'	D
PHILADELPHIA, PA. - Supervising Office			
*Burlington 2, N. J.	40°04.9'	74°51.0'	D
Bivalve, N. J.	39°14.1'	75°02.1'	D&N
WILMINGTON, DEL. - Supervising Office			
Indian River Inlet STA, Del. (CG)	38°36.6'	75°04.1'	D
WASHINGTON, D. C. Supervising Office			
Arlington Pentagon Lagoon, Va.	38°52.5'	77°03.0'	D
Washington (Corinthian Yacht Club), D. C.	38°51.9'	77°00.9'	D
Alexandria (Old Town Yacht Basin), Va.	38°48.0'	77°02.5'	D

Station	Longitude	Longitude	Type Display
BALTIMORE, MD. - Supervising Office			
*Northeast River (Yacht Club), Md.	39°34.4'	75°57.3'	D
*Elk River, (Herring Island), Md.	39°30.8'	75°52.6'	D
Spesutie Island Boat Club, Md.	39°28.5'	76°06.2'	D
*Gunpowder River (Cove Marina), Md.	39°24.0'	76°21.3'	D
*Georgetown Yacht Basin, Georgetown, Md.	39°21.7'	75°53.0'	D
*Frog Mortar Creek (Md. Marine Mfg. Company), Md.	39°19.3'	76°24.1'	D
*Sue Island (Baltimore Yacht Club), Md.	39°17.3'	76°23.8'	D
*Fairlee Creek, Great Oak, Md.	39°15.9'	76°12.3'	D
*Gratitude Yacht Harbor, (Rock Hall), Md.	39°08.4'	76°15.7'	D
*Gibson Island, Md.	39°05.1'	76°25.4'	D
*Chester (Castle Marina), Md.	38°59.2'	76°17.1'	D
Annapolis (U. S. Naval Academy), Md.	38°58.9'	76°28.8'	D
*South River (Pier 7 Marina), Md.	38°57.0'	76°33.4'	D
*Shady Side (Chesapeake Yacht Club), Md.	38°50.2'	76°31.9'	D
Cambridge Yacht Club, Md.	38°34.6'	76°04.4'	D&N
Ocean City STA, Md. (CG)	38°19.8'	75°05.1'	D
*Solomons Back Creek (Lord Calvert Yacht Club Marina), Md.	38°19.7'	76°27.4'	D
*Fishing Creek, Md.	38°19.3'	76°13.3'	D
Assateague State Park, Md.	38°14.2'	75°08.3'	D
Crisfield (Somers Cove Marina), Md.	37°58.7'	75°51.5'	D

Station	Latitude	Longitude	Type Display
NORFOLK, VA. - Supervising Office			
Chincoteague, Va. (CG)	37°56.0'	75°22.8'	D
Windmill Point, Va.	37°36.9'	76°17.4'	D
Oyster, Va.	37°17.2'	75°55.5'	D
Fort Eustis, Va.	37°10.0'	76°36.5'	D
Fort Monroe, Va.	37°00.1'	76°18.5'	D&N
Newport News, Va.	36°58.3'	76°25.9'	D&N
Norfolk Navy Base, Va.	36°57.1'	76°20.0'	D&N
Cape Henry, Va.	36°55.8'	76°00.5'	D&N
Little Creek, Va.	36°55.0'	76°10.5'	D
Chesapeake LTSTA, Va. (CG)	36°54.3'	75°42.3'	D
Coinjock, N. C.	36°20.7'	75°57.1'	D&N
Elizabeth City, N. C.	36°17.8'	76°13.2'	D&N
Edenton, N. C.	36°03.4'	76°36.8'	D&N
Manteo, N. C.	35°54.6'	75°40.5'	D&N
*Oregon Inlet, N. C.	35°47.5'	75°32.5'	D
Diamond Shoals LTSTA, N. C. (CG)	35°09.2'	75°17.8'	D
Frying Pan Shoal LTSTA, N. C. (CG)	33°29.1'	77°35.4'	D

Station	Latitude	Longitude	Type Display
CAPE HATTERAS, N. C. - Supervising Office			
Hatteras, N. C.	35°13.0'	75°41.0'	D&N
Ocracoke STA, N. C. (CG)	35°06.9'	75°59.2'	D
WILMINGTON, N. C. - Supervising Office			
Washington, N. C.	35°32.2'	77°02.8'	D
Carolina Beach, N. C.	34°02.1'	77°53.6'	D
CHARLESTON, S. C. - Supervising Office			
Little River, S. C.	33°52.1'	78°36.5'	D
Ocean Drive Beach, S. C.	33°49.0'	78°40.4'	D
Briar Cliffe, S. C.	33°48.0'	78°45.0'	D
Garden City Beach, S. C.	33°34.5'	78°59.9'	D
Murrells Inlet, S. C.	33°33.0'	79°02.4'	D
Georgetown, S. C.	33°21.8'	79°16.9'	D&N
McClellanville, S. C.	33°04.8'	79°27.6'	D
Charleston Army Transportation Depot, S.C.	32°54.8'	79°57.4'	D
Charleston Municipal Yacht Basin, S. C.	32°46.7'	79°57.1'	D
Charleston USCG Base, S. C. (CG)	32°46.4'	79°56.6'	D&N
Sullivans Island STA, S. C. (CG)	32°45.5'	79°50.6'	D&N
Edisto Island, S. C.	32°29.5'	80°20.6'	D

COASTAL WARNING DISPLAY STATIONS

GREAT LAKES

Station	Latitude	Longitude	Type Display
SYRACUSE, N. Y. - Supervising Office			
Oswego STA, N. Y. (CG)	43°27.9'	76°30.6'	D&N
ROCHESTER, N. Y. - Supervising Office			
Sodus Point LTSTA, N. Y. (CG)	43°16.2'	76°58.5'	D
Rochester STA, N. Y. (CG)	43°15.4'	77°36.2'	D&N
BUFFALO, N. Y. - Supervising Office			
Niagara STA, N. Y. (CG)	43°15.8'	79°03.9'	D&N
Buffalo STA, N. Y. (CG)	42°52.6'	78°53.2'	D&N
ERIE, PA. - Supervising Office			
Erie Coast Guard, Pa.	42°09.2'	80°04.7'	D
CLEVELAND, OHIO - Supervising Office			
Conneaut, Ohio	41°58.1'	80°33.2'	D
Ashtabula STA, Ohio (CG)	41°54.1'	80°48.1'	D
Fairport STA, Ohio (CG)	41°45.6'	81°16.9'	D
Mentor Harbor Yachting Club, Ohio	41°43.6'	81°21.2'	D
Willoughby (Chagrin Lagoons Yacht Club), Ohio	41°40.6'	81°26.3'	D

Station	Latitude	Longitude	Type Display
CLEVELAND, OHIO - Supervising Office (Cont'd.)			
Put-in-Bay, Ohio	41°39.3'	82°48.9'	D
Kelleys Island, Ohio	41°35.7'	82°43.4'	D
Cleveland (Northeast Yacht Club), Ohio	41°34.4'	81°35.1'	D
Marblehead STA, Ohio (CG)	41°32.6'	82°43.8'	D&N
Port Clinton, Ohio	41°31.9'	82°56.4'	D
Cleveland (Lakeside Yacht Club), Ohio	41°31.6'	81°39.9'	D
Cleveland STA, Ohio (CG)	41°30.2'	81°42.7'	D&N
*Cleveland (Edgewater Marina Boat Club), Ohio	41°29.6'	81°43.7'	D
Rocky River (Cleveland Yacht Club), Ohio	41°29.2'	81°50.1'	D&N
Cedar Point Mariner, Ohio	41°28.8'	82°41.1'	D&N
Lorain STA, Ohio (CG)	41°28.3'	82°10.7'	D&N
Sandusky (Meigs Street), Ohio	41°27.8'	82°42.3'	D
Sandusky (Jackson Street), Ohio	41°27.5'	82°42.9'	D&N
Vermilion, Ohio	41°25.5'	82°21.8'	D
Huron, Ohio (CG)	41°23.8'	82°33.0'	D&N
TOLEDO, OHIO - Supervising Office			
Toledo STA, Ohio (CG)	41°41.6'	83°28.3'	D

COASTAL WARNING DISPLAY STATIONS

MISCELLANEOUS WARNING DISPLAY STATIONS

Station	Latitude	Longitude	Type Display
BURLINGTON, VT. - Supervising Office			
*Burton Island State Park, Vt.	44°46.6'	73°11.9'	D
*Plattsburg, N. Y.	44°41.7'	73°26.6'	D
*Colchester, Vt.	44°33.0'	73°13.3'	D
*Burlington Coast Guard, Vt.	44°28.5'	73°13.3'	D
*Shelburne, Vt.	44°26.1'	73°14.9'	D
*Essex, N. Y.	44°18.4'	73°21.0'	D
*Charlotte, Vt.	44°16.5'	73°17.3'	D
*Westport, N. Y.	44°11.0'	73°26.8'	D
*Port Henry No. 2, N. Y.	44°03.3'	73°27.2'	D
CONCORD, N. H. - Supervising Office			
*Glendale (N. H. Dept. of Safety), N. H.	43°35.0'	71°23.0'	D
SYRACUSE, N. Y. - Supervising Office			
*Brewerton, N. Y.	43°14.4'	76°07.5'	D&N
*Sylvan Beach, N. Y.	43°11.6'	75°44.0'	D
*Onondage Lake Park, N. Y.	43°06.0'	76°12.5'	D
ALBANY, N. Y. - Supervising Office			
Troy Lock & Dam No. 2, N. Y.	42°45.1'	73°41.2'	D&N

Station	Latitude	Longitude	Type Display
COLUMBIA, S. C. - Supervising Office			
Lake Murray Dam, S. C.	34°03.1'	81°13.2'	D
Santee, S. C.	33°30.2'	80°27.6'	D
CHARLESTON, S. C. - Supervising Office			
Wilsons Landing Spillway, S. C.	33°27.0'	80°10.0'	D
Santee Hydro Station, S. C.	33°14.6'	79°59.8'	D

D Day Displays

D&N Day and Night Displays

CG Coast Guard

* Seasonal Displays Only

COASTAL WARNING DISPLAY STATIONS

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STATION	LATITUDE	LONGITUDE	TYPE DISPLAY
SAVANNAH, GA. - Supervising Office			
Isle of Hope, Ga.	31°58.8'	81°03.4'	D
JACKSONVILLE, FLA. - Supervising Office			
Fernandina Beach, Fla.	30°40.3'	81°27.9'	D
Jacksonville Beach, Yacht Basin, Fla.	30°17.2'	81°25.2'	D
St. Augustine, Fla.	29°53.5'	81°18.6'	D
DAYTONA BEACH, FLA. - Supervising Office			
Daytona Beach Halifax River Yacht Club Fla.	29°12.5'	81°00.9'	D
Ponce de Leon Inlet Sta., Fla. (CG)	29°03.9'	80°54.9'	D
WEST PALM BEACH, FLA. - Supervising Office			
West Palm Beach (Marina), Fla.	26°43.0'	80°03.0'	D
Lake Worth Inlet Sta., Fla. (CG)	26°46.2'	80°02.7'	D
MIAMI, FLA. - Supervising Office			
Eau Gallie, Fla.	28°07.5'	80°37.7'	D
Melbourne Marine, Fla.	28°04.7'	80°36.6'	D&N
Vero Beach, Fla.	27°39.2'	80°22.2'	D
Fort Pierce Inlet Sta., Fla. (CG)	27°28.0'	80°17.9'	D
Stuart #2, Fla.	27°11.8'	80°15.4'	D&N
Port Everglades, Fla.	26°05.6'	80°07.5'	D
Port Lauderdale (Bahia Mar), Fla.	26°06.8'	80°06.5'	D&N
Fort Lauderdale (Pier 66), Fla.	26°06.1'	80°07.1'	D&N
Hollywood City Yacht Basin, Fla.	26°00.8'	80°07.1'	D
Miami (Bakers Haulover), Fla.	25°54.2'	80°07.5'	D
Miami Beach Yacht Corporation Slip, Fla.	25°47.7'	80°08.7'	D
Miami Bayfront Park, Fla.	25°47.2'	80°10.8'	D
Miami (Dinner Key), Fla.	25°43.6'	80°14.2'	D&N
Miami (Crandon Park), Fla.	25°43.4'	80°09.4'	D
Fowey Rocks LTSTA, Fla. (CG)	25°35.4'	80°05.8'	D

COASTAL WARNING DISPLAY STATIONS

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ATLANTIC COAST — WFS422

STATION	LATITUDE	LONGITUDE	TYPE DISPLAY
MIAMI, FLA. - Supervising Office (Cont.)			
Homestead Bayfront Park, Fla	25°27.7'	80°20.3'	D
Jewfish Creek, Fla.	25°10.9'	80°23.4'	D
Tavernier, Fla.	25°00.5'	80°31.1'	D&N
Windley Key, Fla.	24°56.5'	80°36.4'	D
Islamorada, Fla.	24°55.0'	80°38.2'	D
KEY WEST, FLA. - Supervising Office			
Long Key, Fla.	24°49.6'	80°48.8'	D
Grassy Key (Bonefish Harbor), Fla.	24°46.0'	80°56.7'	D
Marathon (Nicks Sporting Goods Store) Fla.	24°43.8'	81°01.8'	D
Marathon (Miller's Tackleshop), Fla.	24°42.5'	81°06.4'	D
Key West Lisner Yacht Basin, Fla.	24°33.5'	81°47.3'	D
Key West WBFO, Fla.	24°33.1'	81°45.4'	D&N
Key West Navy Station, Fla.	24°33.4'	81°48.5'	D
Key West (Lumley&Roberts Hardware Co) Fla.	24°33.6'	81°48.1'	D&N
SAN JUAN, P. R. - Supervising Office			
Puerto Rico			
Isleta Marina, P. R.	18°20.7'	65°37.2'	D
Point Borinquen LSTA, P.R. (Punta Borinquen) (CG)	18°30.0'	67°09.0'	D
San Juan CG Base, P. R. (CG)	18°27.7'	66°07.0'	D
Fort San Cristobal, P. R.	18°28.2'	66°06.7'	D
Club Nautico, P. R.	18°27.7'	66°05.3'	D
Cangrejos Yacht Club, P. R.	18°27.5'	65°59.5'	D
Cape San Juan LISTA, P. R. (Cabo San Juan) (CG)	18°23.0'	65°37.1'	D
Playa de Fajardo, PR	18°20.2'	65°37.9'	D
Point Tuna LISTA, P. R. (Punta Tuna) (CG)	17°59.4'	65°53.1'	D
Ponce Yacht and Fishing Club, P.R.	17°58.0'	66°37.1'	D
Playa de Ponce, P. R.	17°58.9'	66°37.2'	D
Playa de Guayanilla, P. R.	18°00.5'	66°46.0'	D
Guanica, P. R.	17°58.0'	66°54.5'	D
Mayaguez 2, P. R.	18°12.5'	67°09.0'	D
Aguadilla City, P. R.	18°26.0'	67°09.3'	D

COASTAL WARNING DISPLAY STATIONS

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ATLANTIC COAST — WFS422

STATION	LATITUDE	LONGITUDE	TYPE DISPLAY
SAN JUAN, P. R. - Supervising Office (Cont.)			
St. Thomas Island			
Blue Beards Castle, V. I.	18°20.5'	64°55.5'	D
Charlotte Amalie, V. I.	18°20.5'	64°55.8'	D
Hassel Island, V. I.	18°19.6'	64°56.0'	D
St. Johns Island			
Cruz Bay, V. I.	18°20.0'	64°47.9'	D
Coral Bay, V. I.	18°21.0'	64°43.0'	D
John's Folly, V. I.	18°19.2'	64°42.2'	D
St. Croix Island			
Ham Bluff LTSTA, V. I. (CG)	17°46.3'	64°52.5'	D
Fort Frederik, V. I.	17°43.0'	64°53.0'	D
Frederiksted, V. I.	17°43.0'	64°53.1'	D
Fort Christiansted, V. I.	17°44.9'	64°42.1'	D
Christiansted, V. I.	17°44.9'	64°42.2'	D
Mona Island			
Mona Island LTSTA, P. R. (CG)	18°05.3'	67°50.8'	D
St. Maarten Island			
Phillipsburg, N. A.	18°01.0'	63°03.0'	D

Stations listed in accordance to location from north to south along the Atlantic Coast except for Puerto Rico and the Virgin Islands where stations are listed clockwise around island

D	Day Displays	N	Night Displays
D&N	Day and Night Displays	(CG)	Coast Guard
PW	Post Warnings		

SOUTHERN REGION April 1, 1970

GULF COAST

WFS422

STATION	LATITUDE	LONGITUDE	TYPE DISPLAY
MIAMI, FLA. - Supervising Office			
Flamingo Ranger Station, Fla	25°08.5'	80°55.5'	D
Everglades, Fla.	25°50.8'	81°23.3'	D
Naples (12 Ave. & 8th St.), Fla.			
FORT MYERS, FLA. - Supervising Office			
Fort Myers Beach, Fla.	26°27.4'	81°57.3'	D
Fort Myers, Fla.	26°38.8'	81°52.3'	D
Punta Rassa, Fla.	26°29.2'	82°00.8'	D
Port Boca Grande, Fla.	26°43.2'	82°15.6'	D
TAMPA, FLA. - Supervising Office			
Venice (Jetty), Fla.	27°06.7'	82°27.9'	D&N
Sarasota #2, Fla.	27°20.0'	82°32.7'	D
Cortez, Fla.	27°28.1'	82°41.3'	D
Bradenton, Fla.	27°29.9'	82°34.4'	D
St. Petersburg Beach, Fla.	27°41.1'	82°44.2'	D
O'Neill's Boat Marina, St. Petersburg, Fla.	27°42.4'	82°40.9'	D&N
Gulfport, Fla.	27°44.3'	82°41.7'	D
St. Petersburg 2, Fla.	27°46.3'	82°37.6'	D&N
South Pasadena Marina, St. Petersburg, Fla.	27°45.3'	82°44.2'	D&N
John's Pass, Fla.	27°47.6'	82°47.8'	D
Clearwater Pass, Fla.	27°57.8'	82°49.5'	D
Clearwater Beach Marina, Fla.	27°58.6'	82°49.5'	D
Dunedin Marina, Fla.	28°00.7'	82°47.6'	D&N
Tarpon Springs, Fla.	28°09.3'	82°45.7'	D&N
Port Richey, Fla.	28°16.3'	82°43.5'	D
TALLAHASSEE, FLA. - Supervising Office			
Alligator Point, Fla.	29°54.3'	84°25.2'	D&N
APALACHICOLA, FLA. - Supervising Office			
Carrabelle, Fla.	29°50.9'	84°39.8'	D&N
Apalachicola, Fla.	29°43.6'	84°59.0'	D
PENSACOLA, FLA. - Supervising Office			
Valparaiso, Fla.	30°30.3'	86°29.4'	D
Pensacola (Fla. Hwy. Patrol), Fla.	30°25.1'	87°11.6'	D
Pensacola Yacht Club, Fla.	30°23.8'	87°14.4'	D
Pensacola, Fla.	30°24.1'	87°12.7'	D&N
Fort Pickens State Park, Fla.	30°19.8'	87°17.9'	D

COAST GUARD DISTRICT 11 - California, south of latitude 34°58'N
Heartwell Building
19 Pine Avenue
Long Beach, Calif. 90802

Station	Latitude	Longitude	Type Display
Los Angeles - Supervising Station			
Santa Barbara, California	34°24.2'	119°41.5'	D&N
Ventura Marina, California	34°15.1'	119°15.9'	D&N
Oxnard (Channel Islands Harbor), Calif.	34°09.6'	119°13.3'	D&N
Port Hueneme, California	34°08.8'	119°12.7'	D&N
Santa Monica Pier, California	34°00.4'	118°29.9'	D&N
Marina Del Rey, California	33°58.2'	118°26.8'	D&N
Redondo Beach, California	33°50.8'	118°23.9'	D&N
Wilmington, California	33°46.0'	118°15.0'	D
Long Beach Marina, California	33°45.0'	118°06.8'	D&N
Long Beach, California	33°44.9'	118°12.9'	D&N
Terminal Island, California	33°43.9'	118°15.8'	D
Los Angeles LTSTA, California (CG)	33°42.5'	118°15.0	D&N
Newport Beach Harbor, California	33°36.2'	117°53.0'	D&N
Avalon Pleasure Pier, California	33°20.6	118°19.5'	D&N
San Diego - Supervising Station			
Oceanside Yacht Harbor, California	33°12.5'	117°23.7'	D&N
Mission Beach, California	32°45.7'	117°14.4'	D&N
San Diego Municipal Pier No.2, Calif.	32°43.0'	117°10.5'	D&N
San Diego (Shelter Island), Calif.	32°42.5'	117°14.0'	D&N
Coronado Yacht Club, California	32°40.8'	117°10.5'	D
Cabrillo National Monument, Calif.	32°40.4'	117°14.3'	D

COASTAL WARNING DISPLAY STATIONS

SOUTHERN REGION — April 1, 1970

GULF COAST

STATION	LATITUDE	LONGITUDE	WFS422 TYPE DISPLAY
MOBILE, ALA. - Supervising Office			
Gulf Shores, Ala.	30°16.7'	87°41.0'	D&N
Mobile Point Range Rear LTSTA, Ala. (CG)	30°13.7'	88°01.5'	D
Bayou La Batre, Ala.	30°23.5'	88°16.0'	D
Biloxi (Display), Miss.	30°23.5'	88°53.1'	D&N
Gulfport, Miss.	30°21.5'	89°05.8'	D&N
NEW ORLEANS, LA. - Supervising Office			
New Canal LGT Sta., La. (CG)	30°01.6'	90°06.7'	D
New Orleans Inner H. Navig. C. Locks, La.	29°56.0'	90°01.6'	D&N
Grand Isle Sta., La. (CG)	29°16.0'	89°57.4'	D
LAKE CHARLES, LA. - Supervising Office			
Cameron, La.	29°46.7'	93°20.5'	D
GALVESTON, TEXAS - Supervising Office			
Galveston CG Base, Texas (CG)	29°20.0'	94°46.3'	D&N
Freeport Sta., Texas (CG)	28°56.5'	95°16.1'	D
Port O'Connor Sta., Texas (CG)	28°26.0'	96°25.6'	D
CORPUS CHRISTI, TEXAS - Supervising Office			
Rockport, Texas	28°01.2'	97°03.0'	D
Aransas Pass, Texas	27°53.9'	97°08.4'	D
Port Aransas Sta., Texas (CG)	27°50.3'	97°03.5'	D
Corpus Christi (T Head), Texas	27°47.7'	97°23.3	D
Corpus Christi (Padre Island Causeway), Tex	27°36.1'	97°14.4'	D
Padre Island National Seashore	27°27.2'	97°17.2'	D
BROWNSVILLE, TEXAS - Supervising Office			
Port Mansfield, Texas	26°33.4'	97°25.6'	D
Port Isabel CG Sta., Texas	26°4.4'	97° 9.8'	D

Stations listed in accordance to location from east to west following the Gulf Coastline.

D	Day Displays	PW	Post Warnings
D&N	Day and Night Displays	(CG)	Coast Guard

COAST GUARD DISTRICT 12 - California, north of latitude 34°58'N
Appraisers Building
630 Sansome St.
San Francisco, Calif. 94126

Station	Latitude	Longitude	Type Display
Eureka - Supervising Station			
Crescent City, California	41°44.6'	124°10.8'	D
EEreka, California	40°48.3'	124°10.3'	D
Humboldt Bay LBCTA, Calif. (CG)	40°46.0'	124°13.1'	D&N
San Francisco - Supervising Station			
Blunts Reed LV, California (CG)	40°26.4'	124°30.2'	D
Sausalito, California	37°52.2'	122°30.2'	D
Berkeley Yacht Harbor, California	37°52.0'	122°19.0'	D
San Francisco (Pier 45D), California	37°48.7'	122°25.2'	D
San Francisco (Telephone Bldg.), Calif.	37°47.2'	122°24.0'	D&N
San Francisco LV, California (CG)	37°45.0'	122°41.5'	D
Monterey CTA, California (CG)	36°36.5'	121°53.7'	D&N
Morro Bay, California	35°21.9'	120°51.1'	D
Port San Luis, California	35°10.7'	120°44.0'	D
Sacramento, California - Supervising Station			
Antioch, California	38°01.2'	121°45.2'	D
Bethel Island, Calif.	38°00.8'	121°38.4'	D

COAST GUARD DISTRICT 13

Station	Latitude	Longitude	Type Display
Astoria - Supervising Station			
*Ilwaco, Washington	46°18.4'	124°02.2'	D
Pt. Adams, Oregon (CG)	46°12.0'	123°56.7'	D&N
Cape Disappointment	46°16.4'	124°02.5'	D
Portland - Supervising Station			
Columbia River LV, Oregon (CG)	46°11.0'	124°11.0'	D
*Nehalem River STA (CG)	45°39.6'	123°55.7'	D
*Tillamook Bay Lookout, Oregon (CG)	45°34.2'	123°57.3'	D
Tillamook Bay STA, Oregon (CG)	45°33.2'	123°54.8'	D
Depoe Bay STA, Oregon (CG)	44°48.6'	124°03.5'	D&N
Yaquina Bay STA, Oregon (CG)	44°37.6'	124°03.7'	D&N
Yaquina Bay Lookout, Oregon (CG)	44°37.4'	124°03.7'	D&N
Florence, Oregon	43°58.0'	124°06.4'	D
*Winchester Bay STA, Oregon	43°40.7'	124°10.4'	D
Umpqua River STA, Oregon (CG)	43°40.0	124°12.0'	D&N
Coos Head Lookout, Oregon	43°21.1'	124°20.1'	D&N
Coos Bay STA, Oregon (CG)	43°20.8'	124°19.4'	D&N
Coquille River STA (Bandon), Oregon (CG)	43°07.2'	124°25.0'	D
Port Orford, Oregon	42°44.4'	124°29.9'	D
Wedderburn, Oregon (CG)	42°25.6'	124°25.3'	D
Chetco River STA, Oregon	42°02.7'	124°16.1'	D

* Seasonal displays only.

COAST GUARD DISTRICT 13 - Oregon, Washington and Idaho
Alaska Building
618 Second Avenue
Seattle, Wash. 98104

Station	Latitude	Longitude	Type Display
Seattle - Supervising Station			
Blaine, Washington	48°59.8'	122°45.1'	D&N
Bellingham, Washington	48°45.4'	122°30.2'	D&N
Neah Bay Sta., Washington (CG)	48°22.3'	124°35.8'	D&N
New Dungeness LTSTS, Wash. (CG)	48°10.9'	123°06.6'	D
Umatilla Reef LV, Wash. (CG)	48°10.0'	124°50.4'	D
Port Angeles, Washington	48°07.2'	123°26.5'	D&N
Port Townsend, Washington	48°07.1'	122°45.3'	D&N
Everett City Dock, Washington	47°58.8'	122°13.2'	D&N
Quillayute River Sta., Wash. (CG)	47°54.4'	124°38.0'	D
Shilshole Bay Marina, Washington	47°40.8'	122°24.3'	D
Seattle (U.S. Govt Locks), Wash.	47°40.0'	122°23.7'	D
Seattle Yacht Club, Washington	47°38.7'	122°18.4'	D&N
Seattle (Lake Union), Washington	47°38.9'	122°20.1'	D
Redondo, Washington	47°20.9'	122°19.4'	D
Tacoma (Point Defiance), Washington	47°18.4'	122°31.0'	D
Tacoma (Port of Tacoma), Washington	47°16.6'	122°24.7'	D
Tacoma (Narrows Marina), Washington	47°14.7'	122°33.4'	D
Ocean Shores Marina, Washington	46°58.4'	124°08.4'	D
Westport (Grays Harbor Sta.), Wash. (CG)	46°54.3'	124°07.2'	D&N
Willapa Bay Sta., Washington	46°42.3'	123°58.0'	D&N
South Bend, Washington	46°40.4'	123°46.7	D&N
Nahcotta, Washington	46°29.9'	124°01.9'	D

U.S. DEPARTMENT OF COMMERCE
Environmental Science Services Administration
WEATHER BUREAU CENTRAL REGION
601 East 12th Street
Kansas City, Missouri 64106

April 1, 1970

COASTAL WARNING DISPLAY STATIONS — GREAT LAKES.

Station	Latitude	Longitude	Type Display*	Dates
DETROIT, MICH. - Supervising Office				
Monroe, Mich. (Bolles Harbor)	41°52.3'	83°23.0'	D	About 4/15-10/15
Gibraltar, Mich. (Police Dock)	42°05.6'	83°11.2'	D	
Detroit, Mich. (Detroit Boat Club)	42°20.4'	82°59.6'	D	About 4/15-10/15
Detroit, Mich. (Memorial Park Marina)	42°21.1'	82°59.1'	D	About 4/15-10/15
Detroit, Mich. (Belle Isle CG)	42°20.4'	82°57.7'	D	4/15-10/31
Grosse Pte. Farms, Mich. (Crescent Sail Y. C.)	42°24.1'	82°53.1'	D	About 4/14-10/15
Grosse Pte. Farms, Mich. (Municipal Pier)	42°24.3'	82°53.1'	D	About 4/15-10/15
St. Clair Shores, Mich. (Jefferson Beach Marina)	42°28.1'	82°52.7'	D	About 4/14-10/15
Mt. Clemens, Mich. (Gasow Marine)	42°35.6'	82°46.8'	D	About 4/15-10/15
Mt. Clemens, Mich. (Selfridge AFB)	42°36.6'	82°48.7'	D	
New Baltimore, Mich. (Salt Creek Marina)	42°39.5'	82°46.7'	D	About 4/15-10/15
Port Huron, Mich. (CG)	43°00.3'	82°25.4'	D	4/15-10/31
Port Sanilac, Mich. (Municipal Dock)	43°25.9'	82°32.4'	D	About 4/15-10/15
Harbor Beach, Mich. (CG)	43°51.0'	82°38.6'	D	4/15-10/31
Essexville, Mich. (Consumers Power Co.)	43°38.5'	83°50.8'	D	
ALPENA, MICH. - Supervising Office				
Tawas STA. Mich. (CG)	44°15.0'	83°26.2'	D&N	4/15-10/31
Oscoda, Mich.	44°24.4'	83°19.4'	D	5/15-9/15
Harrisville Dock, Mich.	44°39.6'	83°17.4'	D	6/1-9/30
Rogers City Yacht Harbor, Mich.	45°25.4'	83°48.8'	D	6/1-10/1
Thunder Bay Island LTSTA, Mich. (CG)	45°02.2'	83°11.7'	N	4/15-10/31
Alpena (City), Mich.	45°03.8'	83°25.8'	D	5/30-9/15
SAULT STE. MARIE, MICH. - Supervising Office				
DeTour, Mich. (CG)	45°57.0'	83°54.2'	D	4/15-10/31
Beaver Island STA, Mich. (CG)	45°44.6'	85°30.5'	D	4/1-10/31
Harbor Springs, Mich.	45°25.7'	84°59.3'	D	
Charlevoix STA, Mich. (CG)	45°19.1'	85°16.7'	D	4/1-10/31
Grand Marais STA, Mich. (CG)	46°40.6'	85°58.5'	D	4/15-10/31

* D - Day Display
N - Night Display
D&N - Day and Night Display

COASTAL WARNING DISPLAY STATIONS — GREAT LAKES

Station	Latitude	Longitude	Type Display*	Dates
MUSKEGON, MICH. - Supervising Office				
Northport, Mich.	45°07.9'	85°36.8'	D&N	
Leland, Mich.	45°01.4'	85°45.7'	D	
Frankfort STA, Mich. (CG)	44°37.8'	86°14.6'	D&N	4/1-10/31
Manistee STA, Mich. (CG)	44°15.0'	86°20.4'	D	4/1-10/31
Ludington STA, Mich. (CG)	43°57.2'	86°27.6'	D&N	4/1-10/31
Muskegon STA, Mich. (CG)	43°13.7'	86°20.4'	D	4/1-10/31
Grand Haven STA, Mich. (CG)	43°03.6'	86°14.9'	D&N	4/1-10/31
Bay Haven Marina, Holland, Mich.	42°47.4'	86°11.2'	D	
Holland State Park, Holland, Mich.	42°46.4'	86°12.5'	D	
Pointe Betsie, Frankfort, Mich. (CG)	44°41.5'	86°15.3'	D	
Pentwater, Mich.	43°46.9'	86°26.5'	D	
Saugatuck, Mich.	42°39.2'	86°12.3'	D	Memorial day to Labor day.
CHICAGO, ILL. - Supervising Office				
South Haven STA, Mich. (CG)	42°24.0'	86°17.0'	D	4/1-10/31
St. Joseph STA, Mich. (CG)	42°06.8'	86°29.1'	D	4/1-10/31
Michigan City STA, Ind. (CG)	41°43.4'	86°54.4'	D	4/1-10/31
Gary (Miller), Ind.	41°37.2'	87°15.9'	D	5/1-10/1
Gary Steel Works, Ind.	41°37.4'	87°19.6'	D	5/1-10/1
Gary Buffington Harbor, Ind.	41°38.7'	87°24.7'	D	5/1-10/1
Calumet Harbor STA, Ill. (CG)	41°43.1'	87°31.5'	D	4/1-10/31
Chicago Yacht Club (Monroe Street), Ill.	41°52.9'	87°36.9'	D	5/15-10/31
Chicago Yacht Club (Belmont Harbor), Ill.	41°55.4'	87°38.2'	D	5/15-10/31
Wilmette Harbor STA, Ill. (CG)	42°04.7'	87°41.0'	D	5/1-10/31
Waukegan, Ill.	42°21.7'	87°49.2'	D&N	
Great Lakes Naval Training Station, Great Lakes, Ill.	42°18.6'	87°49.8	D	5/1-10/31
MILWAUKEE, WIS. - Supervising Office				
Racine STA, Wis. (CG)	42°44.1'	87°46.2'	D&N	4/1-10/31
Milwaukee, Wis. (CG)	43°03.0'	87°53.0'	D	4/1-10/31
Sheboygan STA, Wis. (CG)	43°45.0'	87°42.2'	D	4/1-10/31
GREEN BAY, WIS. - Supervising Office				
Two Rivers, Wis.	44°08.5'	87°34.2'	D	4/1-10/31
Sturgeon Bay, Wis.	44°47.7'	87°18.8'	D	4/1-10/31

* D - Day Display
N - Night Display
D&N - Day and Night Display

COASTAL WARNING DISPLAY STATIONS — GREAT LAKES

Stations	Latitude	Longitude	Type Display*	Dates
MARQUETTE, MICH. - Supervising Office				
Marquette STA, Mich. (CG)	46°32.8'	87°22.5'	D	4/15-10/31
DULUTH, MINN. - Supervising Office				
Ashland, Wis.	46°35.5'	90°53.1'	D&N	
Duluth Lakehead Boat Basin, Minn.	46°46.5'	92°05.5'	D&N	
North Superior LBSTA, Minn. (CG)	47°44.8'	90°20.1'	D&N	4/15-10/31

Stations listed in accordance to location from east to west following the Great Lakes Coastline.

Unless otherwise indicated, for Great Lakes Stations, displays are made during the Great Lakes Navigation Season.

WARNING DISPLAY STATIONS

DUBUQUE, IOWA - Supervising Office				
Guttenberg Lock and Dam No. 10, Iowa	42°47.0'	91°06.0'	D	4/1-10/31
Dubuque Lock and Dam No. 11, Iowa	42°32.0'	90°39.0'	D	4/1-10/31
Bellvue, Iowa	42°16.0'	90°25.2'	D	4/1-10/31

* D - Day Display
N - Night Display
D&N - Day and Night Display

U.S. DEPARTMENT OF COMMERCE
Environmental Science Services Administration
WEATHER BUREAU CENTRAL REGION
601 East 12th Street
Kansas City, Missouri 64106

April 1, 1970

WARNING DISPLAY STATIONS

Stations	Latitude	Longitude	Type Display*	Dates
DUBUQUE, IOWA - Supervising Office				
Guttenberg Lock and Dam No. 10, Iowa	42°47.0'	91°06.0'	D	4/1-10/31
Dubuque Lock and Dam No. 11, Iowa	42°32.0'	90°39.0'	D	4/1-10/31
Bellvue, Iowa	42°16.0'	90°25.2'	D	4/1-10/31

* D - Day Display
N - Night Display
D&N - Day and Night Display

Environmental Science Services Administration
[illegible] Pacific Region

MAR 19 1970

Reply to
Attn of: WFP421x2 (File: 535)

Commander
Attention: Aids to Navigation
Fourteenth Coast Guard District
677 Ala Moana Blvd.
Honolulu, Hawaii 96813

Dear Sir:

The following is the updated annual list of Coastal Warning Display Stations for the Pacific Region. Please publish this list in the Local Notice to Mariners.

COASTAL WARNING DISPLAY STATIONS

PACIFIC

Station	Latitude	Longitude	Type Display
HONOLULU, OAHU, HAWAII - Supervising Office			
Haeia, Honolulu, Hawaii	21°26.8'	157°48.7'	D
Kaneohe MCAS (Mokapu Peninsula), Oahu, Hawaii	21°26.5'	157°46.0'	D
Kaneohe Yacht Club, Honolulu, Oahu, Hawaii	21°25.1'	157°46.3'	D
Honolulu (Ala Wai Yacht Harbor), Oahu, Hawaii	21°17.4'	157°50.6'	D
Honolulu (Kewalo Basin), Oahu, Hawaii	21°17.7'	157°51.4'	D
Honolulu (Aloha Tower), Oahu, Hawaii	21°18.6'	157°52.1'	D
Keehi Marina, Oahu, Hawaii	21°19.2'	157°53.6'	D&N
KAHULUI, MAUI, HAWAII - Supervising Office			
Kaunakakai, Molokai, Hawaii	21°05.0'	157°01.9'	D
Kahului Harbor, Maui, Hawaii	20°53.9'	156°28.3'	D
Hana, Maui, Hawaii	20°45.6'	155°59.1'	D
Maalaea Harbor, Maui, Hawaii	20°47.7'	156°30.8'	D
Lahaina, Maui, Hawaii	20°52.5'	156°40.9'	D
Kaumalapau Harbor, Lanai, Hawaii	20°47.3'	156°59.5'	D

MAR 19 1979

2
Commander, 14th Coast Guard District

Station	Latitude	Longitude	Type Display
HILO, HAWAII - Supervising Office			
Kailua-Kona (Kona Pier), Hawaii, Hawaii	19°38.6'	156°00.0'	D
Mahukona, Hawaii, Hawaii	20°11.3'	155°54.3'	D
LIHUE, KAUAI, HAWAII - Supervising Office			
KWAJALEIN, MARSHALL ISLANDS - Supervising Office			
Kwajalein, Marshall Islands	08°44.0'	167°44.3'	D

D - Day Displays
D&N - Day and Night Displays

(CG) - Coast Guard

Sincerely,

F. H. Kutschenreuter
Director, Pacific Region

cc:
11151
CGGS (G323)

APPENDIX C

COMMANDANT INSTRUCTION 3140.2

Coast Guard Weather Information Reporting
And Dissemination Policy

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to
COMMANDANT (OMS-1
U.S COAST GUARD
WASHINGTON, D.C.
20591

COMDTINST 3140.2

COMMANDANT INSTRUCTION 3140.2

27 AUG 1969

Subj: Reporting and Dissemination of Weather Information

1. Purpose. This Instruction sets forth policy for reporting and dissemination of weather information, directs close coordination and cooperation with the U. S. Weather Bureau in these activities, and requires submission of planning information.

2. Program Objectives.

a. To assist the U. S. Weather Bureau in its weather reporting and dissemination program.

b. To establish future requirements for marine weather information.

3. Discussion.

a. The U. S. Weather Bureau has statutory responsibility for providing weather information to the public. Under the authority of 14 USC 147, the Commandant has cooperated with the Weather Bureau by providing weather and sea data, and by disseminating weather information through visual displays and radio broadcasts.

b. A number of recent Coast Guard actions emphasize the need to determine the future direction and policies of this important program. For example, pilot projects have been undertaken to transmit marine information on VHF-FM to boatmen. Similarly, up-to-date weather information is being broadcast at frequent intervals during the day on 2670 kHz in several areas with large concentrations of recreational boats.

c. The Weather Bureau has recently authorized specified Coast Guard units to originate visual warning displays under the conditions noted in enclosure (1).

A Weather Bureau request for an expanded Coast Guard role in high seas weather broadcasts is now being evaluated. Thus, increasing demands are being placed on our resources and planning information is needed.

d. Increasing Federal involvement in Coastal Zone planning, potential future exploitation of the Continental Shelf, and greater emphasis on ports and waterways development all lend a sense of urgency to the development of a long-range plan for weather reporting and dissemination by the Coast Guard.

4. Policy.

a. Coordination. In order to provide part of the basis for an effective marine safety information program, close coordination and cooperation is desired with the regional directors, U. S. Weather Bureau. Weather Bureau manuals and directives are the basis for detailed weather reporting and dissemination requirements.

b. Weather Reporting.

(1) Weather reports shall be made by all Coast Guard Cutters that have a radioman on board and a capability for either radio telegraph or radio teletypewriter, when at sea more than 25 miles distant from the nearest known regularly reporting weather station, unless radio silence has been imposed. District Commanders may designate cutters with only a voice capability to make reports if the Weather Bureau has need for such reports in areas without sufficient reporting stations.

(2) Lightships and manned offshore light stations are also designated as weather reporting stations. District Commanders may designate other shore units as reporting stations after coordinating requirements with the regional director.

(3) Use of the Coast Guard Auxiliary to report on-scene weather is encouraged. Plans to rebroadcast from either Coast Guard or local commercial stations should be coordinated with the local Weather Bureau office.

(4) Timely reporting of data is important and delivery of the data collected shall be made by the most efficient means available that is mutually agreeable to the cognizant district commander and regional director of the Weather Bureau. Programs for reporting units shall include, but are not limited to, taking and reporting synoptic observations at 0000, 0600, 1200, and 1800 GMT daily.

(5) Coast Guard radio stations shall accept weather reports from any authorized reporting unit (government or nongovernment).

c. Weather Dissemination.

(1) Visual Dissemination. District Commanders, in liaison with the regional directors of the U. S. Weather Bureau, will designate those Coast Guard shore units, lightships, and light towers required to display coastal warning signals. To provide for a more prompt reaction to hazardous conditions that are officially observed but not yet forecast, selected display stations have been authorized by the Weather Bureau (WB Operations Letter 68-23 of 19 June 1968, enclosed) to initiate visual small craft warnings.

(2) Radio Dissemination. The Commandant supports a broadcast program which provides timely information tailored to the local area. Weather and other environmental information in areas of high danger and/or high boating concentration are particularly important. Scheduled weather broadcasts will be provided as directed in CG-233-1 and may include other marine information. Weather warnings -- small craft, gale, storm -- will be broadcast when received from the Weather Bureau. Stations authorized to initiate visual small craft warnings based upon local observations shall also make unscheduled radio broadcasts as prescribed in enclosure (2). For the present, VHF-FM frequency use will be limited (except in the Great Lakes) to warning messages on 156.8 MHz. The frequency of 156.750 MHz has recently been designated for the broadcast of environmental information and the role of this frequency is now under evaluation by the Federal Communications Commission, Coast Guard, and ESSA.

(3) Forecasts. A unit may supply information to the public regarding existing weather, bar, sea, or surf conditions and Weather Bureau forecasts upon request. No predictions of future conditions shall be made except that forecasts of weather and sea conditions prepared by Coast Guard units with a qualified forecaster may be released to search and rescue participants in cases under Coast Guard control in which commercial or other government ships or aircraft are actively involved if it will contribute to the success of search and rescue operations.

5. Action.

a. District Commanders shall:

(1) In coordination with the Weather Bureau, develop a weather reporting and dissemination plan, taking into consideration the requirements of both commercial and recreational marine users. The Federal Plan for Marine Meteorological Services which is being distributed separately to district commanders will be useful in preparation of this plan.

(2) Provide the Commandant (O) by 1 March 1970 with resource requirements in excess of present capability to carry out the plan so that appropriate support by the Commandant can be programmed.

(3) Implement the above policy to the extent that present resources permit.

(4) Forward to Commandant (OMS) a list of reporting and display stations designated in accordance with this Instruction, with annotation to indicate the type and frequency of reports and the type of display (day, day/night, etc.), and keep Commandant (OMS) advised of changes to this list.

b. Commanding officers and officers-in-charge of reporting and display stations shall comply with the applicable portions of the enclosure to this Instruction.

R. W. GOEHRING
Chief, Office of Operations

Encl: (1) Instructions for Visual Display
(2) Instructions for Broadcasts
(3) Information on Observing and Reporting

Dist: (SDL No. 89)
A: abcdew(3); fghmntv(2); remainder(1)
B: b(3); c(20); f(15); g(11); e(10); h(6); n(5); m(3); dj(2); nq(1)
C: a(5); bdn(3); gijo(2); remainder(1)
D: ad(2); blmqsu(1)
E: None
F: None

INSTRUCTIONS FOR VISUAL COASTAL WARNING DISPLAY PROGRAM

1. Weather Bureau Operations Manual Letter 68-23, which is attached, prescribes Weather Bureau policy on coastal warning display stations and delegation of authority to the Coast Guard under certain specified conditions, to initiate small craft displays. The following additional information is furnished to amplify Weather Bureau instructions:

a. Coastal warning signals shall be hoisted, changed, and taken in only upon receipt of Weather Bureau information from the district commander or the U. S. Weather Bureau except at those units specifically authorized to initiate small craft displays. They shall be hoisted, changed, and taken in promptly at the time indicated in the messages. They are not to be taken in automatically at the end of a 24 hour period.

b. The time of receipt of coastal warning information and the time of displaying, changing, and taking in storm warnings shall be logged.

c. Any interference with the unit's capability to display coastal warning signals shall be reported promptly to the supervising Weather Bureau Office and to the district commander.

d. Night coastal warning signals shall not be displayed by any Coast Guard vessel.

e. Display stations will be guided by current Weather Bureau directives.

f. Units not specifically designated as display stations shall not display coastal warning signals.

2. When information is received by a district commander from the supervising Weather Bureau Office or from a designated coastal warning signal display station, either Coast Guard or civilian, that a station is established, moved to a new location, changed from day to both day and night displays or vice versa, permanently discontinued, temporarily unable to make the required display, resuming display after being inoperative, or changing its name, the district commander shall issue an appropriate notice to mariners and take such other action as may be indicated.

3. The Weather Bureau will furnish the Coast Guard, once yearly, a list of marine visual display stations. Upon receipt, each district commander will arrange for a list of stations within his district to be published in the local Notices to Mariners.

Enclosure (2) to COMDTINST 3140.2

U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

WEATHER BUREAU
SILVER SPRING, MARYLAND 20910

Operations Manual Letter 68-23

Date of Issue: June 6, 1968 | Effective Date: June 19, 1968

In Reply Refer To: W1121 | File With: D-50

Subject: Coastal Warning Display Stations

A. Establishment of new coastal warning display stations.

With the increasing availability of warnings on commercial radio and television, the increased dissemination over Coast Guard radio channels, and the advent of our own VHF-FM continuous weather broadcasts, there is less dependence on visual displays to warn of approaching storms and other weather and wave hazards. As a long-range trend, the need for visual displays is expected to diminish. However, for the next few years the user requirements for visual displays are expected to remain strong because of the increasing number of small boats, many of which are not yet equipped with radio. The visual display program will therefore be continued.

New coastal warning display stations may be authorized by the Region where strong interest exists and where a dependable cooperator is available. There will be no change in the funding for existing stations. For new stations the cost of flags may be borne by the Weather Bureau, but all other expenses, including the provision of poles and halyards and their maintenance, will be borne by the cooperator. The workload of the Weather Office responsible for issuance of warnings must be considered in arranging for a new display. In any event the cooperator must agree to accept warning messages via collect telephone or telegraph, should the Bureau deem it necessary to use such means of communication. New display stations will be reported immediately to Weather Bureau Headquarters, W1422, on WB Form 530-5 for post review and documentation. All other instructions relating to the display program remain in effect.

B. Delegation of authority to Coast Guard to initiate small craft displays.

The responsibility for warnings of expected hazardous weather and wave conditions lies with the Weather Bureau. The basis for these warnings, particularly for warnings to small craft near shore, includes official observations from Coast Guard ships and stations. Without compromising the Weather Bureau's responsibility for issuing small craft warnings, and in order

to provide for a more prompt reaction to hazardous conditions that are officially observed but not yet forecast, the Regional Director may make arrangements with the Coast Guard District Office for Coast Guard personnel making official weather and sea condition observations at selected stations or patrol craft to initiate small craft displays at such specified Coast Guard stations when existing wind or wave conditions reach the criteria established for small craft warnings, subject to the conditions listed below. Any such arrangement should be reported to Weather Bureau Headquarters, Attention W11.

Conditions for granting this authority will include the following:

1. The Coast Guard station will be an official observation and display station with a satisfactory view of the waterway.

2. The appropriate Weather Bureau Office must be immediately notified, by teletypewriter circuit or telephone, of the display and of the existing wind and wave conditions.

3. Upon receipt of the observation and the information that a display was initiated, the Weather Bureau Office with warning responsibility will promptly issue a small craft warning or revise the existing warning so as to reflect these reported conditions, using the time the display was initiated, and indicating the time of discontinuance of the warning and display.

4. Criteria for displaying the small craft pennant will be the same as that established for issuance of a small craft warning.

George P. Cressman

George P. Cressman
Director, Weather Bureau

INSTRUCTIONS FOR WEATHER BROADCAST DISSEMINATION PROGRAM

1. Weather information supplied by the Weather Bureau shall be included in the Weather and Marine Information Broadcasts from Coast Guard stations on frequencies designated by the Commandant for this purpose. Warnings affecting small boats shall be given the widest dissemination and need not be confined to those stations designated to make regular broadcasts. The district commander is authorized to take such additional action as he deems necessary to insure widest dissemination of information during severe weather conditions, particularly by designating additional broadcasts on VHF-FM, which has a limited range. Weather forecasts, advisories, and warnings included in the broadcasts shall be limited to official information furnished by the Weather Bureau and shall identify the source (i.e. Weather Bureau) of the information. On-scene weather conditions observed at Coast Guard stations may be included in regular scheduled broadcasts.

2. Stations authorized to initiate small craft visual warning displays based upon locally observed weather shall also make unscheduled radio broadcasts on 2182 kHz and 156.8 MHz at such times as they initiate small craft warnings. The broadcast shall state that small craft warnings are in effect for the local area based upon observed weather conditions. Wind and sea conditions observed shall be included in the broadcast.

3. The Coast Guard and Weather Bureau have agreed that all weather and warning messages originated by the Weather Bureau for further dissemination by the Coast Guard shall contain brief instructions as to the action required. These instructions shall be incorporated in the heading by the originating Weather Bureau Office. Arrangements for obtaining the weather information to be broadcast shall be made locally between the district commander and the cognizant Weather Bureau Region.

4. All information disseminated by radiotelephone, radiotelegraph, radioteletype, or facsimile shall be broadcast in accordance with the requirements of the Coast Guard Communications Manual (CG-233) and additional local instructions promulgated by the district commander.

INFORMATION ON WEATHER OBSERVATION AND REPORTING PROGRAM

1. Coast Guard reporting units shall be guided by Weather Bureau manuals and shall use Weather Bureau forms prescribed by the Regional Director of the Weather Bureau. Required publications, manuals, forms, and corrections thereto, will be furnished by the Weather Bureau direct to the reporting unit. In addition, the Weather Bureau has agreed to visit each Coast Guard reporting unit on a mutually agreeable scheduled basis to provide instrument calibration and technical guidance. If a unit is not visited by Weather Bureau personnel within any 12-month period, the commanding officer or officer-in-charge of the unit concerned shall inform the district commander.

2. Weather Bureau Marine Centers and Port Meteorologists that will assist Coast Guard units are listed below:

Atlantic Area

Weather Bureau Office
30 Rockefeller Plaza
New York, New York 10020
971-5561

Weather Bureau Office
U. S. Coast Guard Base
427 Commercial Street
Boston, Mass. 02109
CA. 7-8139

Weather Bureau Office
U. S. Customhouse
Room G-6
101 E. Main Street
Norfolk, Va. 23510
MA. 2-5705

Gulf Area

Weather Bureau Office*
701 Loyola Avenue
New Orleans, La. 70113
525-4046

Weather Bureau Office
516 U.S. Court & Custom Bldg.
Mobile, Alabama 36602
433-3241

Weather Bureau Office
1002 Federal Office Bldg.
Houston, Texas 77014
228-4265

Great Lakes Area

Port Meteorological Officer
Marine Services Unit
Weather Bureau Airport Station
Cleveland Hopkins International Airport
Cleveland, Ohio 44135
267-3900

Pacific Area

Weather Bureau Office
2544 Custom House
300 South Ferry Street
Terminal Island
San Pedro, Calif. 90731
831-9281 Ext. 239

Weather Bureau Airport Station
Lindbergh Municipal Airport
San Diego, Calif. 92101
293-5609

Weather Bureau Office
703 Federal Building
Seattle, Wash. 98104
583-5447

Weather Bureau Office*
Room 219A, Custom House
San Francisco, Calif. 94111
556-2490

Weather Bureau Office
Box 3650, Pier 2
Honolulu, Hawaii 96811
588-869

*Marine Centers

APPENDIX D

WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR MARITIME METEOROLOGY

WORKING GROUP ON REQUIREMENTS FOR MARINE METEOROLOGICAL SERVICES

FINAL REPORT OF THE FIRST SESSION

GENEVA, 16-20 NOVEMBER 1970

1. OPENING OF THE SESSION (Agenda item 1)

1.1 The first session of the CMM Working Group on Requirements for Marine Meteorological Services was opened in the WMO Secretariat at 10.05 a.m. on 16 November 1970. Nine members of the group were present and Mr. Jens Smed of the International Council for the Exploration of the Sea (ICES) was invited to attend as an observer. A list of participants is given in Annex I of the report.

1.2 Dr. K. Langlo, Director of the Scientific and Technical Department of the Secretariat, welcomed the participants on behalf of the Secretary-General. He particularly welcomed the representatives of the other international organizations present, as requirements of marine activities for marine meteorological information and services cannot be established without full co-operation of all user groups. The fifth session of CMM noted that the expansion of marine activities made it desirable to make a close study of present and future requirements of marine activities and, therefore, established the present CMM Working Group on Requirements for Marine Meteorological Services. The recent meetings of the Executive Committee Panel on Meteorological Aspects of Ocean Affairs and the Intergovernmental Oceanographic Commission (IOC) Working Committee for the Integrated Global Ocean Station System (IGOSS) have both stressed the need for more information on marine user requirements. Dr. Langlo concluded by extending his best wishes to the group for success in their endeavours in carrying out the task of tremendous importance which lay before them.

1.3 The representatives of the Intergovernmental Maritime Consultative Organization (IMCO) and of the International Chamber of Shipping (ICS) expressed their concern regarding the recent decision of EC-XXII regarding the possible dissolution of CMM. They wished to underline the importance of CMM and feared that an expanded and more sophisticated commission might well deviate from the already well-established aims of the present commission to cater specifically for the day-to-day needs of mariners.

1.4 The representative of the Food and Agriculture Organization of the United Nations (FAO) pointed out the overlap of the work of the group and that being done by IOC. He hoped that there would be close collaboration with IOC.

1.5 The observer for ICES stressed the interest which his organization took in the work of the group. This work will be of the greatest importance to all users of marine meteorological services, including not only fisheries, but also fisheries research and oceanography. Therefore, ICES greatly appreciated the invitation from WMO to be represented at this first meeting of the group.

2. APPROVAL OF THE AGENDA (Agenda item 2)

The agenda, as approved, is produced in Annex II of the report.

3. IDENTIFICATION OF THE REQUIREMENTS OF VARIOUS MARINE USER GROUPS FOR MARINE METEOROLOGICAL AND SUB-SURFACE INFORMATION (Agenda item 3)

General

Under this item, the session reviewed the statements on marine environmental parameters of operational significance submitted by members of the group and international organizations concerned. A brief summary of the discussions on requirements of particular interest to different user groups is given in the following paragraphs. It was agreed that the requirements for merchant shipping and fisheries were, to a large extent, very similar in nature and the two items were considered together. The detailed summary of requirements with respect to parameters and forecast products together with explanatory notes are contained in Annexes III and IV respectively of this report. The requirements set out in this report have been formulated without taking into account the organizational division of responsibility for their co-ordination.

Synoptic and real time information

3.1 Shipping

The requirements for warnings of hazardous environmental conditions as described in the Convention on Safety of Life at Sea, and also in the Technical Regulations, were reviewed and found to adequately reflect the current requirements with respect to safety of shipping. Lesser values of wind and waves as well as restricted visibility, ice accretion and sea ice, affect the safety, efficiency, economy or comfort of voyages.

3.2 Fisheries

Since fishing vessels in transit are affected by environmental conditions in the same way as any small merchant vessel, the requirements for both are identical. However, when actually engaged in fishing operations, these vessels are more susceptible to certain weather hazards, e.g., ice accretion, gales, etc. In connexion with fish catch, parameters such as sea surface temperature and mixed layer depth may be important. The group discussed other special requirements for fisheries such as bottom temperature, salinity and the intensity of the thermocline.

3.3 Coastal and off-shore activities

These activities generally require highly specialized information tailored to a particular geographical point and to the kind of operation involved. Critical values of wind and waves and other environmental parameters vary with the specific type of operation.

3.4 Recreational boating

The so-called "small craft" used in recreational boating come in many types and sizes and, in many cases, are manned by people relatively unfamiliar with the dangers inherent in these operations. These craft are particularly vulnerable to instability phenomena, such as sudden winds associated with thenderstorms or squalls. The warning criteria are considerably lower than with an ocean-going vessel.

3.5 Marine Pollution

In combatting an oil spill or the spill of some other harmful substance into coastal waters, information concerning wind and water movement in the vicinity of the pollutant is required, to help determine its spread. In addition, information concerning other environment parameters is necessary to assist the on-scene commander in deploying equipment.

Climatological information

3.6 The working group was informed of the two projects in the field of marine climatology sponsored by WMO, namely the Marine Climatological Summaries Project and the Historical Sea Surface Temperature Data Project; the former covers the period from 1961 onward and the latter from 1860 to 1960. While the group considered that the statistical information to be provided through these projects will be of great value to various fields of marine activities, it expressed the hope that some additional statistical parameters might be added to satisfy certain types of marine user requirements. A strong requirement was expressed for extreme values for each month and for information concerning historical ("all-time") extremes. The detailed requirements for marine climatological information are given in Appendix B to Annex III of the report. The working group invited the president of CMM to bring these requirements to the attention of the CMM Working Group on Marine Climatology for consideration.

3.7 The working group expressed concern regarding the delay in the publication of the Marine Climatological Summaries. Although it was realized that the delay is unavoidable in this type of project, hope was expressed that the issue of the summaries might be accelerated. In this relation, the group was informed that appropriate action is being taken to further this end.

3.8 The representative of ICES questioned the possibility of access to raw data collected and processed by the Members responsible for the preparation of marine climatological summaries. It was agreed that this possibility might be explored with the individual Members on a bilateral basis.

3.9 With regard to statistical information concerning ice accretion, the working group was informed of a comprehensive study in this field presently undertaken by IMCO. It is hoped that this study will reveal many hitherto unknown scientific aspects of the problem. The IMCO representative stated that the outcome of the investigation, when completed, can be made available to WMO for information.

4. ANALYSIS OF THE PRESENT STATE OF THE PROVISION OF INFORMATION TO MARINE USER GROUPS (Agenda item 4)

4.1 Marine meteorological and sub-surface information

In the general discussion on this item, the point which emerged strongly was that some mariners are not sufficiently aware of the marine meteorological information available to them and may not understand how it can be usefully applied to their activities. CMM has prepared a number of guides and, in a number of

countries publications have been produced to inform the mariner regarding information available and to assist in interpreting this information. Many of these publications are directed to the needs of specific user groups. Some provide information on symbols used on facsimile charts, others help the mariner to select the specific charts he requires. The group agreed that special efforts should be made to inform and assist the mariners. It was proposed that simplified guidance material be prepared, that meteorological or other informed personnel make voyages on ships in an advisory capacity, that appropriate training courses or instruction be provided on shore, and that the possibility be considered of sending a WMO expert to survey the conditions and needs in this regard in the less developed countries, provide appropriate guidance and report on action which could be taken to improve the situation.

4.2 The group reviewed the documents presenting the existing services to marine users furnished by certain maritime nations and felt that, in the light of expanding activities in marine areas and the changing technology as related to marine environmental sciences, a new approach is required to ensure an optimum service to marine user groups. As a result of discussions under agendo item 3, additional parameters of operational significance were identified.

4.3 The problem of ships carrying only one radio officer was raised and it was recognized that warning bulletins might well be missed. It was also pointed out that the Technical Regulations make provision that, in fixing the time of issue of weather bulletins for shipping, a Member should take into consideration the time of watch-keeping of the radio officers in all the areas to which such bulletins apply. In the absence of a better procedure, it was agreed that, for the present, warning bulletins should be broadcast at least at six-hour intervals with additional broadcasts as necessary.

4.4 The units to be used in relation to the services provided to marine octivities were discussed in depth. With regard to the decision of WMO to use metric units in the international exchange of data, some Members strongly advocated the advantage of retaining the units familiar to mariners such as knots and the Beaufort wind scale in information addressed to marine users. However, information made available by other members of the group indicated the preference of certain user groups for the uniform use of metric units for marine purposes.

5. ESTABLISHMENT OF GUIDING PRINCIPLES FOR DEVELOPING WMO PLANS FOR IMPROVED SERVICES TO MARINE ACTIVITIES (Agenda item 5)

5.1 The working group noted the decision of the Executive Committee that it was most important to strengthen the role of CMM in the field of marine sciences and services. It noted the proposal of the Executive Committee to Sixth Congress to establish a broadened Commission for Maritime Meteorology, namely, the Commission for the Marine Environment. The working group hoped that this new commission would continue to give the necessary consideration, as in the past, to the matter of providing marine meteorological services to a variety of marine user groups, including shipping and fisheries.

5.2 The working group took note of the United Nations General Assembly Resolution 2580 (XXIV) - Co-ordination of Marine Activities - which calls on the Secretary-General of the United Nations to prepare, in consultation with Member organizations of the United Nations and appropriate non-governmental scientific bodies, a review on:

(a) The trends in traditional uses of the ocean;
(b) The foreseeable new uses; and
(c) The effects of those uses on the marine environment.

5.3 The working group also noted the decision of the Executive Committee that it would be helpful to provide the Secretary-General of the United Nations with a memorandum describing the manner in which meteorology either separately or in combination with physical oceanography:

(i) supports present ocean-based or ocean-dependent activities;
(ii) should develop its capabilities and services to support foreseeable new forms of ocean uses and improve further its support to present uses.

This decision of the Executive Committee further suggests that the appropriate body to prepare the memorandum covering the above points would be the CMM Working Group on Requirements for Marine Meteorological Services. However, in view of the short time available, the Committee agreed that the initial draft should be prepared by an expert who could be expected to complete the work within two or three months. This initial draft would then be submitted to the CMM Working Group on Requirements for Marine Meteorological Services for consideration and approval, possibly as an "International Guide". Throughout the consideration of matters relevant to the terms of reference of the working group, the working group kept in mind the Executive Committee decision. It is hoped that the requirements set forth by the working group in the present report will constitute the basis for the envisaged "International Guide".

6. REVIEW OF THE CONTENT, FORMAT AND SCHEDULE OF INFORMATION PROVIDED BY VARIOUS MEDIA (Agenda item 6)

General

The discussions under this item highlighted the advantages, disadvantages and deficiencies in the various media used to provide marine meteorological services.

6.1 Radio telegraph

For practical reasons, transmissions of marine meteorological information are generally restricted to about thirty-minute periods. This restriction and the speed of transmission greatly limit the contents of a given broadcast. It was stressed that broadcasts should conform to the standard communication procedures.

6.2 Radio facsimile

6.2.1 Provision of marine meteorological services by facsimile is the most effective means of transmitting a large amount of information and it was noted that the use of this media is increasing. The value of facsimile is greatly enhanced by the capability of using this media for the transmission of other than meteorological information. The problem arising from the different speeds of transmission was stressed. The group invited the attention of the Working Group on Observation Network at Sea and on Maritime Telecommunications to the lack of standardization of transmission speeds.

6.2.2 The problem of presentation of analyses and forecasts was discussed. The group felt that this information should be provided in such a way that, on receipt, no further analysing would be required for either navigation or safety purposes. Although some ship personnel are capable of interpreting complex meteorological information, consideration should be given to the establishment of a separate service intended for mariners. It was felt that there was a need for standard symbols for use on facsimile charts which can be easily interpreted by mariners. The group was informed that an up-dated version of the Guide to the Preparation of Synoptic Weather Charts and Diagrams has been completed and will appear as Volume II of the Guide for the Global Data Processing System. The working group, however, felt that this guide was designed for meteorologists and that this guide should be suitably amended to include material on the preparation of charts intended for exclusive use by mariners. Special symbols may be required for marine facsimile charts. The group also took note that, at its first session (Geneva, May 1970), the CMM Working Group on Observation Network at Sea and Maritime Telecommunications recognized this problem and requested the CMM Working Group on Requirements for Marine Meteorological Services to carry out initial studies of symbols and abbreviations used on facsimile charts. The group accepted with appreciation the offer of Mr. McGlening (Canada) to lead the study of this problem, and the members agreed to assist him with the task, as necessary.

6.2.3 The language used on facsimile charts intended for international marine use was also discussed and the group felt that, when possible, printed information should be in English as well as the language of the country in which the chart originated.

6.3 Radiotelephony

It was pointed out that the use of radiotelephony was increasing and thot there was a great need for a standard voice code. The working group was informed that the president of CMM had appointed Mr. Crawford (South Africa) as Rapporteur on an International Marine Voice Code. The need for a standard condensed meteorological vocabulary was stressed. The group also stressed the value of continuous and/or scheduled VHF weather broadcasts to ships in coastal areas and harbours and to fishermen who are frequently incapable of receiving information by other means. The IMCO representative informed the group that mother ships of fishing fleets have made a practice of transmitting weather information to the smaller ships by voice. The group felt that it would be extremely helpful to other fishing vessels to have all such voice broadcasts given in English also.

6.4 Visual displays

The discussion brought to light that the use of visual signals for weather information is far from universal. Some countries have discontinued the use of visual signals, but others still maintain a visual signal system to provide information to small craft and vessels operating in harbours and coastal waters. It was also noted that there are many variations in the use of the International System of Visual Storm Warnings Signals (WMO Volume D, Part D).

6.5 Languages

The attention of the group was drawn to the fact that storm warnings, synopses of meteorological conditions and forecasts (Parts I, II and III) are not always transmitted in accordance with the provisions of the Technical Regulations, i.e., in the language of the issuing Member and in English. The group therefore agreed that maritime Members of WMO should be reminded of the necessity for strict adherence to these provisions. The group also recommended that IMCO be invited to undertake similar steps.

7. OTHER BUSINESS (Agenda item 7)

Under this agenda item, the group discussed their future work. It was felt that at this meeting they had not been able to go into enough detail with regard to marine meteorological products, but at least a basis for product requirements had been established. The group agreed that work should continue by correspondence.

7.1 It was felt that insufficient time had been spent in considering the problem of weather routeing of ships. The representative of IMCO considered it desirable to have a meeting at an international level to establish all the data requirements for ship routeing, including environmental information. This suggestion received support from the group and it felt it would be desirable to bring this matter to the attention of the Executive Heads of WMO and IMCO.

7.2 It was pointed out that the Commission for Maritime Meteorology, at its fifth session, had recognized the need to amend Parts II and III of the Weather Bulletins for Shipping contained in the Technical Regulations. The group felt that more definite information had now been formulated to meet the needs of all marine user groups. The group therefore agreed to invite the president of CMM to take appropriate measures to ensure that the conclusions of the working group are considered when future changes in the Technical Regulations are envisaged.

8. CLOSURE OF THE SESSION (Agenda item 8)

The session closed at 3.35 p.m., 20 November 1970.

LIST OF PARTICIPANTS

M. W. Mull (chairman)	U.S.A.
D. Deacon	International Chamber of Shipping
P. Lenoir de la Cochetière	France
L. K. McGlening	Canada
B. Repkin	Intergovernmental Maritime Consultative Organization
A. C. da Silva	Brazil
J. Smed	International Council for the Exploration of the Sea
G. Tomczak	Food and Agriculture Organization of the United Nations
K. Vasiljev	U.S.S.R.
H. K. Wölcken	Argentina

K. T. McLeod	Invited expert

Secretariat

M. Eaton

S. Mizuno

I. Carter (Miss)

AGENDA

1. OPENING OF THE SESSION

2. APPROVAL OF THE AGENDA

3. IDENTIFICATION OF THE REQUIREMENTS OF VARIOUS MARINE USER GROUPS FOR MARINE METEOROLOGICAL AND SUB-SURFACE INFORMATION·

   3.1 Shipping
   3.2 Fisheries
   3.3 Coastal and off-shore activities
   3.4 Recreational boating
   3.5 Marine pollution

4. ANALYSIS OF THE PRESDNT STATE OF THE PROVISION OF INFORMATION TO MARINE USER GROUPS

   Marine meteorological and sub-surface information

5. ESTABLISHMENT OF GUIDING PRINCIPLES FOR DEVELOPING WMO PLANS FOR IMPROVED SERVICES TO MARINE ACTIVITIES

6. REVIEW OF THE CONTENT, FORMAT AND SCHEDULE OF INFORMATION PROVIDED BY VARIOUS MEDIA

7. OTHER BUSINESS

8. CLOSURE OF SESSION

PARAMETERS INCLUDED IN REQUIREMENTS OF MARINE USER GROUPS FOR MARINE METEOROLOGICAL AND SUB-SURFACE INFORMATION

Parameters	Shipping		Fisheries		Coastal and off-shore activities		Recreational boating		Marine pollution	
	Synop.	Climat.	Synop.	Climat.	Synop.	Climat.	Synop.	Climat.	Synop.	Climat.
1. Surface winds	X	X	X	X	X	X	X	X	X	X
2. Sea and swell	X	X	X	X	X	X	X	X	X	X
3. Surface visibility	X	X	X	X	X	X	X		X	
4. Ice accretion	X	X	X	X	X	X				
5. Sea ice	X	X	X	X	X	X				
6. Icebergs	X	X	X	X						
7. Precipitation and cloud cover	X	X	X	X			X			
8. Air temperature	X	X	X	X			X			
9. Humidity	X	X	X	X						
10. Sea surface temperature	X	X	X	X			X		X	
11. Ocean currents	X	X	X	X					X	
12. Surface weather analysis	X		X						X	
13. Mixed layer depth			X	X						
14. Areas of upwelling			X	X						
15. Tsunami	X		X							
16. Water-level anomalies	X	X	X	X	X	X			X	X
17. Tidal current deviations	X	X	X		X				X	X
18. Harbour seiche	X	X								
19. Bar conditions	X	X	X				X			
20. Sand waves	X									
21. Surf and breakers					X	X	X			
22. Storm surge	X	X	X	X	X	X	X		X	X

Note: The CMM Working Group on Sea Ice is also responsible for considering user requirements for sea ice data, both for operational and research purposes.

EXPLANATORY NOTES RELATING TO THE PARAMETERS INCLUDED IN REQUIREMENTS

(Synoptic and real-time information)

1. SHIPPING

1.1 Surface winds

1.1.1 The present warning criteria for wind as specified in the WMO Technical Regulations and as amplified in Volume D are considered adequate regardless of the type of disturbance. Warnings are also required of severe local winds, e.g. the bora, levante, sirocco, etc., applying the same criteria. A minimum of 6 to 12 hours is necessary to prepare the ship for extreme conditions, and a warning of 24 hours or longer may be required to enable the captain to take effective evasive measures. The state of the science is such that a forecast beyond 24 to 36 hours becomes increasingly uncertain. Generally, the longer period forecasts are treated as outlooks or stated as a probable trend.

1.1.2 Within a harbour area, wind is an important factor in the handling of cargo, scheduling manpower and for ships' safety. Generally, at least 12 to 24 hours advance notice is required for these purposes. Shorter notice may be valuable for some harbour operations to be conducted in safety.

1.2 Sea and swell

The combined effect of wind and waves creates hazards to ships. A forewarning of waves 3 metres or higher should be provided in connexion with vessel safety. Warning times are the same as for wind. For use in navigation and for certain shipboard operations, it would be useful to have available on the ship patterns of wave heights at one-metre increments for observation time, and for twelve-hour intervals in the future. The parameter of most interest is the significant height of the combined sea and swell. (Significant height is, statistically, the average of the 1/3 highest waves. It is also the value of the mariner's visual estimate of wave height). The height, period and direction of each principal wave system are also of use in many operations.

1.3 Surface visibility

1.3.1 Restricted visibility is a major hazard to ocean-going vessels, particularly near coasts and in areas of high traffic density. Services should include information on present and predicted areas of visibility of half a mile (fog), one mile, and two miles. Phenomena restricting visibility, such as sea smoke, fog and precipitation should be identified. Information concerning visibility in all categories is also needed.

1.3.2 IMCO has stated that "It is considered, in the ordinary practice of seamen, that certain anti-collision measures and precautions required by the Regulations for Preventing Collisions at Sea (reinforcement of look-out, reduction of speed, giving sound signals, using radar, etc.) should be imposed when the visibility range has

dropped to two miles or less". Information concerning visibility restriction is required at least six hours before the occurrence of restricted visibility at the ship. Within harbours, restricted visibility affects cargo handling and ship movements.

1.4 Ice accretion (freezing rain or sea spray)

The accumulation of ice on the superstructure of a vessel, even a large one, may seriously affect safety and operations on board. Such icing presents a greater hazard to smaller vessels, particularly those below 1,000 tons gross tonnage. A warning is required when conditions are such (high winds, low temperatures and precipitation) that freezing rain or spray is probable. The warning should include the expected rate of ice accretion.

1.5 Sea ice

Depending on the area and time of the year, advice on the distribution, character and movement of the ice are required with as much advance notice as possible.

1.6 Icebergs

The position of icebergs at specified times, with estimated size, speed in knots and direction of movement to eight points of the compass are required.

1.7 Precipitation and cloud cover

Information concerning precipitation (character, time of day, duration) of thunder showers and of cloud cover is useful for advanced planning of position fixing by astronomical methods and for some other shipboard operations including those for proper care of cargo. The beginning, intensity, type and ending of precipitation are of importance in cargo handling in port areas.

1.8 Air temperature

Because of its relation to ice accretion, air temperature when below freezing may affect the safety of the ship. A high accuracy in air temperature is required for proper care of cargo with special emphasis on sudden changes in temperature.

1.9 Humidity

Information concerning humidity is required for cargo care. In this relation, reference is made to WMO Technical Note No. 17 - Notes on the problems of cargo ventilation.

1.10 Sea-surface temperature

Information concerning sea-surface temperature is of interest in connexion with the possibility of fog formation and also for proper care of cargo.

1.11 Ocean currents

A knowledge of the stream core and the direction and speed of the current is of use in navigation.

1.12 Surface weather analysis

A surface analysis indicating centres of high and low pressure, isobars, and major fronts has been a part of the services to mariners for many years. IMCO states that such an analysis is useful if it does not require further analysis on board.

1.13 Mixed layer depth

No requirement for this parameter was expressed.

1.14 Areas of upwelling

No requirement for this parameter was expressed.

1.15 Tsunami

Near the shore and in harbour areas the tsunami has the potential for causing loss of life and endangering ships. The computed time of arrival at specified coastal and island points is needed within minutes if precautions are to be taken. Although an estimate of the height of the wave as it reaches the shore would be highly useful, at present it may be possible to give only a very qualitative assessment of probable height within the present state of the science.

1.16 Water-level anomalies

In harbour areas and at other critical points, the height of the water level is needed in decimetres at intervals of two hours. In addition to the calculated astronomical tidal height, the added height anomaly due to meteorological conditions of wind stress and atmospheric pressure is required at least eight to twelve hours in advance.

1.17 Tidal current deviations

Forecasts of deviations from normal tidal currents are required for critical points at two-hour intervals, with direction specified to sixteen points of the compass and speed in tenths of a knot.

1.18 Harbour seiche

Long swell waves and certain wind and pressure conditions may set up sympathetic oscillations within a harbour area sufficient to damage ships, piers and certain equipment.

1.19 Bar conditions

Long swell waves from storms which may be distant from the area may cause breakers over the bar at a river entrance or other locations, sufficient to close the entrance to traffic, or to create a hazard to ships and boats attempting to enter.

1.20 Sand waves

The reduction in depth of water from this cause may well be a critical factor in some ship operations. The identification of areas in which this phenomena occurs is an urgent requirement and studies are needed to determine the rate of movement and amplitude of sand waves. At the present time, reports show that this phenomena occurs in the southern part of the North Sea and in the Malacca Strait.

1.21 Surf and breakers

No requirements were expressed for this parameter except as noted in paragraph 1.19 above.

1.22 Storm surge

Notice of significant anomalous heights are required eight to twelve hours in advance.

2. FISHERIES

2.1 Surface wind

Whilst en route to the fishing grounds, the requirements of fishing vessels for wind warnings are the same as for shipping. Whilst on the fishing grounds a minimum of six hours warning may be required to secure the vessel and fishing equipment. For use in fishing operations, forecasts of wind speeds and directions for the next 24 hours, at 5-knot intervals and to 8 compass points, are useful when the wind is 15 knots or more.

2.2 Sea and swell

General requirements are the same as those for shipping.

2.3 Surface visibility

Requirements are similar to those used for shipping.

2.4 Ice accretion (freezing rain or sea spray)

Requirements are similar to those used for shipping.

2.5 Sea ice

Requirements are similar to those used for shipping. Information regarding areas of open water is of importance to fishing operations. As much advance notice as possible is required regarding ice coverage at harbours as well as at fishing grounds.

2.6 Icebergs

Requirements are the same as those for shipping.

2.7 Precipitation and cloud cover

General requirements are the same as those for shipping.

2.8 Air temperature

Requirements are the same as those for shipping.

2.9 Humidity

Requirements are the same as those for shipping.

2.10 Sea-surface temperature

Fish catch can be related to surface temperature, particularly to significant horizontal temperature gradients. Near the temperature critical for the fish catch, temperature should be defined to 0.5°C. Sea-surface temperature is also the best criteria for determining areas of upwelling.

2.11 Ocean currents

For navigation, requirements are the same as those for shipping. For fishing operations, information concerning the boundaries of the currents and the horizontal temperature distribution is an aid.

2.12 Surface weather analysis

Requirements are the same as those for shipping.

2.13 Mixed layer depth

The depth of the mixed layer is a factor in the catch of some fish. Additional information concerning the underwater thermal structure may be useful to fisheries operations as, for example, the vertical temperature gradient within the thermocline.

2.14 Areas of upwelling

A knowledge of areas of upwelling would be of value to fisheries operations. Increased capabilities for ocean monitoring would make possible the addition of this information to the services furnished to fisheries.

2.15 Tsunami

Requirements are the same as those for shipping.

2.16 Water-level anomalies

Requirements are the same as those for shipping.

2.17 Tidal current deviations

Requirements are the same as those for shipping.

2.18 Harbour seiche

No requirement for this parameter was expressed.

2.19 Bar conditions

Waves breaking over the bars at entrances to streams and rivers frequented by fishing vessels constitute a hazard to a vessel transiting the bar, and also have a significant economic effect in delaying the departure of a vessel or in preventing a vessel returning from the fishing grounds from delivering the fish catch. Current conditions and predictions for 24 hours of bar conditions are needed.

2.20 Sand waves

No requirement was expressed for this parameter.

2.21 Surf and breakers

No requirements were expressed for these parameters.

2.22 Storm surge

Requirements are the same as those for shipping.

3. COASTAL AND OFF-SHORE ACTIVITIES

3.1 Surface wind

Although high winds constitute a hazard to coastal and off-shore activities, the criteria varies with the specific operation involved. In some instances relatively low values can disrupt a particular operation. Drilling and other operations off-shore require highly specialized information, tailored to a particular geographical point and to the kind of operation involved. The environmental specialist must work closely with the operation manager.

3.2 Sea and swell

3.2.1 Movement and placement of oil-rigs

Some equipment is particularly vulnerable while being moved to the drilling site. At least two hours warning of critical wave height (2-3 metres) is essential. However, 12 to 24 hours warning time is generally required for planning the relocation of equipment.

3.2.2 Drilling operations

The tolerance for side-to-side movement of drilling equipment resulting from pitch and roll of the rig or drilling ship is very small. Waves with a period at or near the natural period of the drill ship can lead to hazardous pitch and roll. The required information includes the height of significant and maximum waves in 0.5 metre increments and the direction and period of the principal wave systems.

3.3 Surface visibility, ice accretion and sea ice where applicable

Critical values of these parameters vary with the equipment.

3.4 Water levels and currents

Information concerning water levels and currents is needed for coastal operations.

3.5 Surf and breakers

Information concerning surf and breakers is needed for some coastal operations.

3.6 Storm surge

Requirements are the same as those for shipping.

4. RECREATIONAL BOATING

4.1 Surface wind

The so-called "small craft" used in recreational boating are of many types and sizes and are manned, in many cases, by people relatively unfamiliar with the dangers inherent in boat operations, These craft are particularly vulnerable to winds associated with meso-scale systems, e.g., thunderstorms and squalls which, in general, cannot be predicted more than one to six hours in advance, or may not be evident until detected by a weather radar station. In addition, there are the problems inherent in the sea-land interface, particularly where the coastline is rugged and strongly influences the wind patterns. Adequate means of dissemination of forecasts to pleasure craft is essential for safety.

4.2 Sea and swell

The warning criteria may vary locally, depending to some extent on the kind of boats operating in an area. Short-period waves as low as one metre present a hazard to smaller boats with inexperienced operators.

4.3 Surface visibility

Requirements are the same as those for shipping.

4.4 Precipitation

Thundershowers and squalls are instability-type phenomena which present an extreme hazard because of their rapidity of development and movement over the boating area. A formal issuance of a small-craft advisory, accompanied by visual displays, is often not practicable due to lack of time remaining before the hazard strikes.

4.5 Air temperature

In common with other recreational activities, air temperature is of interest. Particularly of interest is any sudden change in temperature.

4.6 Water temperature

Water temperature is important for recreational purposes.

4.7 Bar conditions

Requirements are the same as those for shipping.

4.8 Surf and breakers

Increasingly large numbers of people frequent beaches for sunning, swimming and surfing. In some areas, recreational beaches have become a sizable economic addition to the community. A prediction is needed a day ahead for significant and maximum breaker heights, breaker period and direction from which the breakers arrive, for example, breakers of 1.5 metres or more may require additional manning of lifeguard stations. Strong littoral currents of 2 knots or more greatly increase the surf hazard for inexperienced swimmers and also create erosion problems.

4.9 Storm surge

Requirements are the same as those for shipping.

5. MARINE POLLUTION

In combatting an oil spill, or the spill of some other harmful substance into coastal waters, the environmental specialist can help by providing information on the following parameters: surface winds, sea and swell, surface visibility, sea surface temperature, ocean currents, weather analyses, water-level heights, tidal current deviations and storm surges. In general, analyses and forecasts of parameters at the air-sea interface are needed for two reasons. First, the operations to contain or remove the pollutant are affected by winds and waves, restricted visibility and other parameters that affect marine operations. Second, the predictions of the air and water movements help determine the movement of the pollutant.

EXPLANATORY NOTES RELATING TO THE PARAMETERS INCLUDED IN REQUIREMENTS

(Climatological information)

1. Surface wind

For design and planning purposes, including weather-routeing, wind climatology is needed. This includes the percentage frequency of 34-knot or greater winds. Also needed are wind roses which show the percentage frequency by speed and 8-point direction categories and which include mean vector and scalar winds. This might be useful for coastal engineering and for towing operations.

2. Sea and swell

The most useful information is the percentage frequency of waves greater than four metres. Also, wave roses similar to those for wind are needed which show direction versus height by categories, and period versus height. Other relevant wave characteristics are also needed. These products are for planning and design purposes.

3. Surface visibility

For planning purposes, climatological information concerning fog-prone areas is useful. The percentage frequency of visibility less than two miles is particularly desired. Statistics relating to synoptic situations which cause visibility restrictions are also required.

4. Ice accretion

Climatological information concerning the frequency of occurrence of ice accretion, its major causes and intensity by category, would be very useful.

5. Sea ice

Climatological information giving ice characteristics, concentration and extreme geographical limits for each month, or in shorter periods where appropriate, is required for planning purposes.

6. Icebergs

For planning purposes, climatological information by month or season of the year is required concerning major icebergs that have been identified along with iceberg limits.

7. Precipitation and cloud cover

For planning purposes, climatological information concerning cloud cover and precipitation is needed.

8. Air temperature

For planning purposes, climatological information of temperature along the route and in coastal areas is needed.

9. Humidity

For planning purposes, information concerning humidity is required for cargo care.

10. Sea-surface temperature

Expectancies of sea-surface and air temperature, as well as the air-sea temperature differences, are all needed for planning purposes for care of cargo, passenger comfort, etc.

11. Ocean currents

Climatological products indicating the speed and direction as well as the persistency of ocean currents is needed for route planning.

12. Water-level anomalies

Extra long-term (up to twenty years) predictions of sea-level fluctuations are required for the planning and implementation of coastal construction.

13. Harbour seiche and bar conditions

Statistical information is required for the safety of navigation.

14. Statistical information on mixed layer depth, areas of upwelling, tidal current deviations, surf and breakers and storm surge would be of great value for some marine operations and fisheries.

REQUIREMENTS FOR FORECAST PRODUCTS

I. WARNINGS

(Gales, storms, hurricanes (typhoons) including local hazardous phenomena such as bora, mistral and the tehunatepecer)

Minimum of six hours prior to on-set of phenomena; period covered by warning - 24 hours; information at 6-hour intervals with more frequent information when significant changes occur.

Wind:	Wind direction (8 compass points), wind speed (kts, m/s, Beaufort) equal to or greater than 34 knots (gales, storms and hurricanes).
Pressure systems:	When applicable the movement of storm centres in knots and eight compass points except tropical storms/hurricanes, direction of movement in tens of degrees or conic sectors.
Seas:	Significant heights of combined wind waves and swell three metres or greater.
Storm surge:	Notice of significant anomalous heights 8 to 12 hours in advance.
Tsunamis:	Time and place of seismic disturbance, time of arrival and of estimated heights of waves at coastal and island points.
Visibility:	Visibility 2 miles or less and phenomena which causes restriction to visibility, e.g. fog, mist, sea smog, precipitation, etc.
Ice accretion:	Ice accretion with rate of accumulation when possible.

Severe instability phenomena: Squalls, thunderstorms, etc.

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II. FORECASTS (General)

Wind:	General distribution of wind direction (8 compass points) and speed (kts, m/s, Beaufort) with emphasis on areas with 15 knots or greater.
Waves:	Significant heights of combined wind waves and swell 3 metres or greater. When mode of transmission permits significant heights (metres) period (sec) and direction (8 compass points) of the waves for each major wave system.
Visibility:	Visibility, and any phenomena causing restrictions.
Precipitation:	Type and intensity of precipitation.
Cloud cover:	Cloud coverage.
Air temperature:	Air temperature with emphasis on sudden changes.
Sea-surface temperature:	Sea-surface temperature (degrees Celsius).
Ice accretion:	Conditions which can produce ice accretion with emphasis on the severity (light, moderate or heavy).

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III. FORECASTS (Special)

Speciol forecasts include information for special user groups and in general require more detail of the parameters thon in a general forecast. The requirements listed below are a general summary of special user requirements:

Wind:	General wind distribution (direction - 8 compass points and speed - knots) in required areas. Special user groups may require wind information at specified points or in finer distribution.
Sea:	Significant height (metres) period (sec) and direction (16 compass points) of waves for each major wave system.
Visibility:	Visibility and ony phenomena causing restrictions.
Precipitation:	Type and intensity of precipitation.
Cloud cover:	Type and extent of coverage.
Air temperoture:	Air temperature with emphasis on sudden changes.
Sea-surface temperature:	Sea-surface temperature with emphasis on sighificant horizontal grodients. For certain fishing operations, temperature within 0,5°C.
Ice accretion:	Reports of conditions which can produce ice accretion, including emphasis on severity (light, moderate or heavy).
Water-level anomalies:	Height (metres) of onomalous water levels.
Tidal current deviations:	Deviations in tidal currents for critical points.
Icebergs:	Location, estimated size (category), direction of movement (8 compass points) speed of movement (kts) for each significant iceberg.
Sea ice:	Distribution, character and movement.
Harbour seiche:	Height (centimetres).
Bar conditions:	Breaking waves at entrances to rivers and bays.
Ocean currents:	Anomalies in major ocean currents, e.g., Gulf Stream, Kuroshio and others.
Mixed layer depth:	Depth (metres) of mixed layer. Thermol gradient in the thermocline.

Humidity:	Relative humidity or other humidity parameters as needed.
Weather routeing:	Meteorological information required in routeing of ships, e.g., storm tracks, extended period forecasts, etc.

APPENDIX E

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