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AMPHIBIOUS SHIPS METEOROLOGICAL SPACES BASELINE STUDY. METEOROL--ETC(U)
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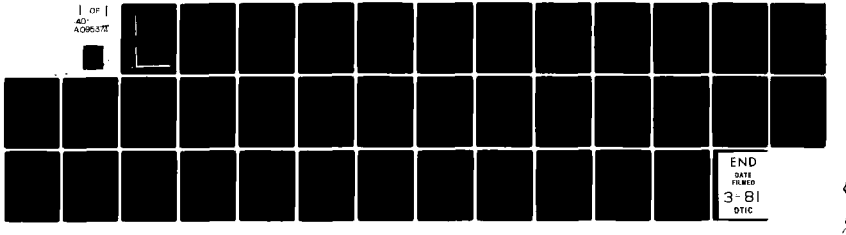
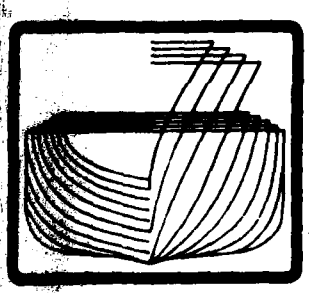


LEVEL II

AD A095374

AMPHIBIOUS SHIPS METEOROLOGICAL SPACES BASELINE STUDY

METEOROLOGICAL SPACES OPERATIONAL REQUIREMENTS



8 APRIL 1975

NAVAL SHIP ENGINEERING CENTER
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AMPHIBIOUS SHIPS METEOROLOGICAL SPACES
BASELINE STUDY.

METEOROLOGICAL SPACES
OPERATIONAL REQUIREMENTS.

D. Isquith

NAVSEC-6179D06

8 April 1975

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Naval Ship Engineering Center
Hyattsville, Maryland

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SECTION I

INTRODUCTION

1.1 General

This study constitutes Phase I of three phases of a comprehensive overall study of the requirements for meteorological spaces in LCC, LPH, and LPD type ships which will include a baseline design for use in backfit and new construction. Phase I involves an overall study of meteorological space requirements utilizing previous studies that have been performed, current deficiencies, relationships with other shipboard facilities, communications and other pertinent information.

1.2 Relationship to Other Current Studies

This study represents a follow-on to an aircraft carrier meteorological spaces baseline study which was reported in references 1 and 2. Some of the data obtained in the course of that study has been utilized in this Amphibious Ships Meteorological Spaces Baseline Study to the extent that the data is relevant.

1.3 Methodology. This study in Phase I:

a. Considers meteorological spaces and equipment as presently provided or authorized

b. Reviews relationships with other shipboard spaces

c. Assesses reported deficiencies

d. Considers the impact of new equipment under development

e. Examines measures required for alleviation of deficiencies

f. States operational requirements in broad terms for further examination, including design rationale, in Phases II and III.

SECTION II

PRESENT METEOROLOGICAL SPACES AND EQUIPMENT

2.1 Prime Requirements for Shipboard Meteorological Facilities

Long established, widely acknowledged, and soundly based concepts of Naval operations require the Navy to maintain a meteorological observation capability to:

a. Obtain the local-area observations essential for meeting the tactical operational needs of the Navy.

b. Meet Navy obligations to respond to global information requirements and report weather data in the regions of Naval operations.

Two fundamental types of information are required to meet the tactical operational needs of the Navy. These are:

a. Direct meteorological observations and measurements.

b. Processed meteorological information (analyses, predictions, edited observations, satellite data) obtained from centralized organizations such as the Fleet Numerical Weather Central (FLENUMWEACEN) and the several Fleet Weather Centrals (FLEWEACEN).

The Naval Weather Service Command (NAVWEASERVCOM) authorizes meteorological equipment allowances, describes for Naval units the environmental services and support available to ships and stations, and consolidates existing requirements for environmental observations and reporting. Current requirements for observations and reports are stipulated in reference 3.

International as well as U.S. national criteria are used in the determination of meteorological parameter measurements to be made and reported. The USA is an active participant in the World Meteorological Organization. Relatively recent studies sponsored by the Naval Air Systems Command have established the details of parameter measurement and prediction requirements. This includes statements of accuracies demanded for those specific parameters directly affecting the conduct of each of the numerous types of Naval operations.* The establishment of parameter accuracy criteria serves to guide the development and selection of meteorological equipment suites for shipboard installation.

*Reference 4, p. A-3

2.2 Approved Plans for Meteorological Facilities for Ships

In reference 5 the Chief of Naval Operations has established approved plans for meteorological facilities for all classes of ships existing at that time. The equipments are identified concisely in reference 5 but such identification was not intended to preclude installation of updated, modernized or replacement items when available. Items addressed in following sections of this report will, if approved, require several substantive changes to reference 5.

2.3 Immediate Purpose of Shipboard Meteorological Facilities

The purpose of the meteorological spaces and equipment aboard ship is to provide the material resources for execution of the general and specific duties required of the shipboard meteorologist under the broad directives of reference 6, which specifies the following:

"a. General Duties. The meteorological officer, when assigned, will be responsible under the operations officer for providing information concerning present and anticipated weather conditions, sonar and radar propagation conditions, and sea and surf conditions as may be required.

b. Specific Duties. The meteorological officer, under the operations officer, will be responsible for:

1. Forecasting weather conditions for surface and air operations.

2. Taking and transmitting unit weather observations as required by current directives.

3. Collecting and evaluating weather reports from other units.

4. Observing and forecasting conditions of sea and surf.

5. Collecting and evaluating strategic weather information.

6. Providing ballistic wind and density data.

7. Providing the information necessary for evaluation of the effects of sea and atmospheric conditions on radar and sonar performance.

8. Maintaining meteorological records in accordance with current directives.

9. Advising the navigator regarding the accuracy and completeness of the weather data required by him in fulfilling his assigned responsibilities."

2.4 Forecasting for Amphibious Units

In amphibious assault operations the criticality of accurate forecasts and observations of sea, swell, and surf conditions is well understood. To ensure forecasts of the highest attainable validity, often involving microanalysis, it is necessary that the amphibious unit meteorologist be able to apply in his analyses all useful synoptic and prognostic information obtainable from within and without own task organization.

Further, it is well to recall that amphibious operations either include, or are supported by, a wide range of types of naval and military operations. Operational decisions concerning these operations frequently may hinge upon environmental conditions as forecast or as observed and reported.

SECTION III

RELATIONSHIP WITH OTHER SHIPBOARD SPACES

3.1 Interactions with Other Functional Areas

Interactions which must occur between the Meteorological Office and other functional areas aboard ship in the execution of the functions required of the embarked meteorological unit can be categorized as:

a. Interactions involving command and control functional areas which receive environmental support and services

b. Interactions involving functional areas which in turn provide support to the Meteorological Office.

The necessary interactions constitute one of the determinants in locating the Meteorological Office, and bear directly upon the selection of the necessary interior communications equipments for the space.

Accordingly, in this study an examination has been made of the interactions which are necessary between the Meteorological Office and the supported command and control functional areas plus certain supporting functional areas, Letters denoting types of interactions in the illustrations in this section have been used in accordance with the table in Figure 3-1. Figures 3-2, 3-3, and 3-4 depict the interactions with meteorological offices in LCC, LPH, and flag LPD type ships respectively.

3.2 Location of Meteorological Office

Two primary factors bearing on the optimum location of the Meteorological Office in ships in general are: the extent of requirement for proximity to those command and control functional areas which derive direct support from the Meteorological Office, and the extent of requirement for visual observation from the Meteorological Office. Both factors have validity, but can conflict in application.

A direct view of a portion of the environment external to the ship is considered by many meteorological officers and aerographer's mates to be of definite value in analysis processes, and to be useful in alerting observers to the need for special observations, official or otherwise. A capability to move directly from the Meteorological Office to a weather deck or platform similarly has been considered important as a means of facilitating observations.

Requirements for proximity to command and control spaces are conditioned in part by the extent to which face-to-face contact and hand-carrying of hard copy materials may be supplanted by electronic methods of dissemination within the ship. It is not expected that the

entire requirement for face-to-face contact for consultation and briefing situations would be lifted by improvements in interior communications. However, there are indications that manpower utilization could be improved by interior communications improvements which also would increase the quality of environmental support.

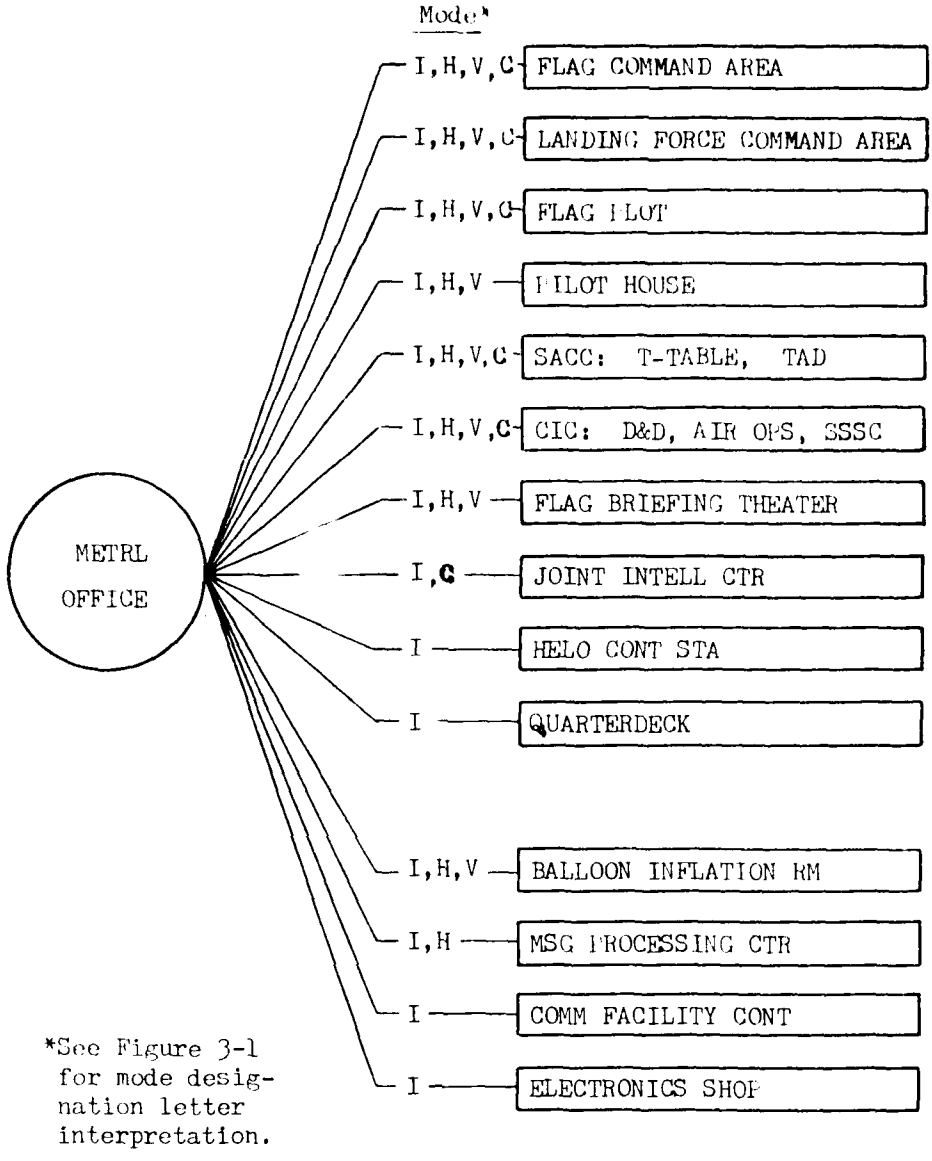
To aid the feasibility of locating the Meteorological Office where best capable of executing its functions, all reasonable effort should continue to be directed toward minimizing space required for those functions.

3.3 Balloon Inflation Room Interrelationships

For balloon inflation rooms as presently organized and equipped the primary interactions have been with the Meteorological Office, Pilot House, and CIC in both LCC and LPH type ships; and with Fly Control in the LPH type. Any of several interior voice circuits have the potential for providing a satisfactory mode of interaction for most purposes. Location considerations primarily involve adequacy for exit with inflated balloons and equipment trains to areas favoring successful balloon release. Other factors involving balloon inflation rooms are cited in paragraph 4.3.

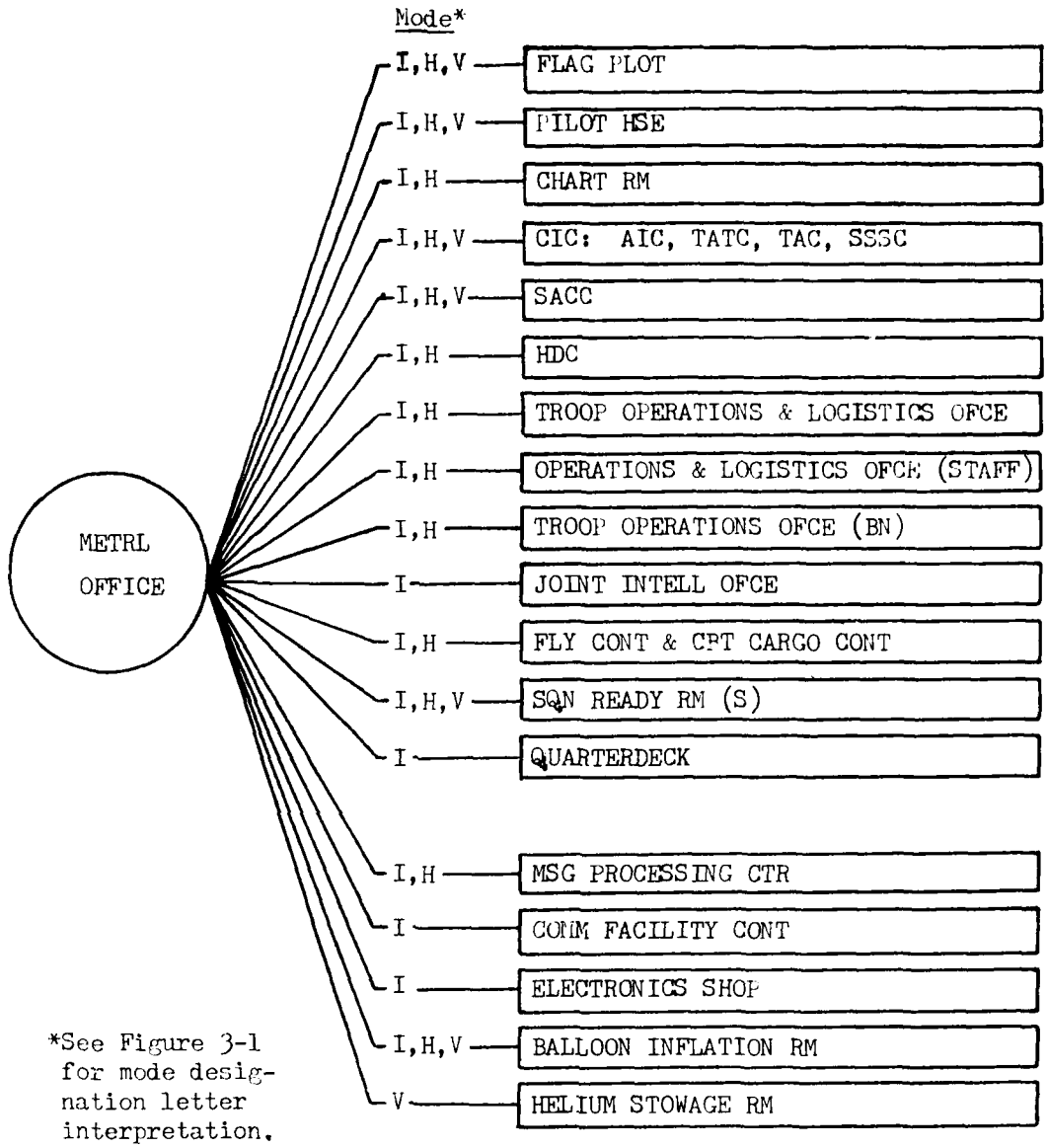
MODE OF INTERACTION		PHYSICAL CLOSENESS	
O	ORAL-PERSON TO PERSON OPERATE-TOUCH	A	ABSOLUTELY CLOSE (6FT MAX) SPEAK PERSON-TO-PERSON TOUCH-OPERATE
V	VISUAL VISIT-WALK INTO SPACE	N	NECESSARILY CLOSE (20 FT MAX) VISUAL/LISTEN DIRECT PHYSICAL ADJACENCY
		P	WITHIN IMMEDIATE PROXIMITY
I	ICS-INTERPHONE	I	ICS ELECTRICAL TRANSMISSION OF VOICE OR VISUAL
C	CCTV		
D	DIGITAL; DATA LINK	D	DIGITAL; DATA LINK
H	HARD COPY TTY/HI SPEED PRINTER/ RECORD TRAFFIC (ANY PIECE OF PAPER)	U	PHYSICAL CLOSENESS UNIMPORTANT
M	MAIL		
R	VOICE RADIO		
X	NO DIRECT INTERACTION		

Figure 3-1. Modes of Interaction and Physical Closeness Requirements



*See Figure 3-1 for mode designation letter interpretation.

Figure 3-2. LCC Meteorological Office Primary Direct Interactions



*See Figure 3-1 for mode designation letter interpretation.

Figure 3-3. LPH Meteorological Office Primary Direct Interactions

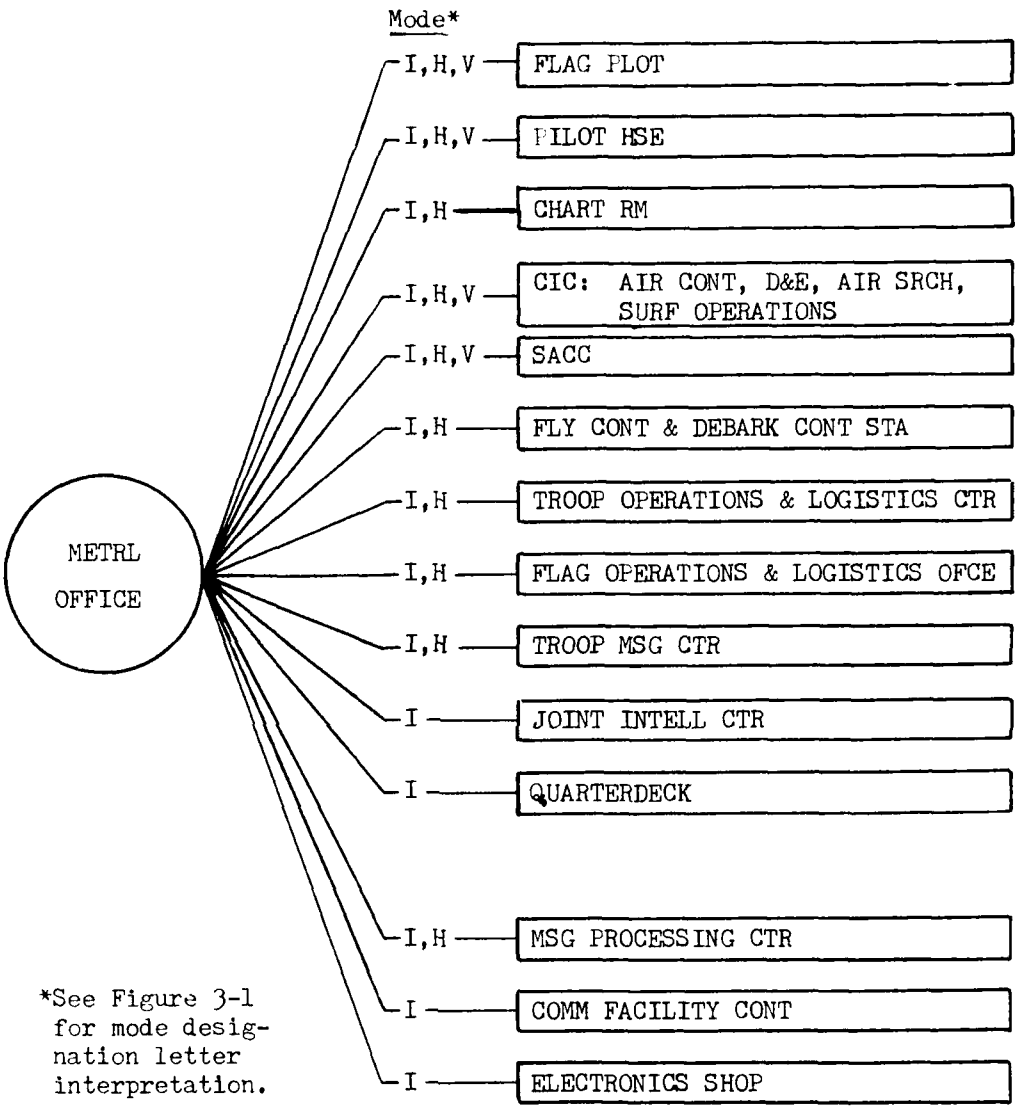


Figure 3-4. Flag LPD Meteorological Office Primary Direct Interactions

SECTION IV

REPORTED DEFICIENCIES IN METEOROLOGICAL FACILITIES

4.1 Nature of Deficiencies

This section reports deficiencies in shipboard meteorological facilities as reported by meteorological personnel currently in, or recently in, shipboard Naval Weather Service Meteorological Units during meetings and interviews scheduled during this series of studies. The reported deficiencies have been discussed with personnel of the Naval Weather Service Command and/or with personnel of the Naval Air Systems Command having cognizance or other background knowledge of the items reported. Experienced personnel will recognize that some of the reported deficiencies are well known items for which remedial programs are underway. These items are included nonetheless in order to engender continuity of action.

Not discussed in this section are new equipment developments, some of which relate to deficiencies cited. These are discussed in Section V. Section V treats new developments presently programmed or anticipated to be implemented in response to new requirements and which are expected to impact a shipboard meteorological equipment suite in or before FY 1980.

4.2 Noise

Disruptive acoustic noise from teletype equipment in the main working areas of meteorological offices has long been cited as a factor which detracts from the abilities of meteorological personnel to concentrate efficiently on detailed tasks within the space. Operators continue to comment on teletype noise. Few, however, comment on disruptive noise originating outside the spaces, as from aircraft. This may indicate that personnel are more affected by noises which they believe could be reduced or eliminated by the application of available techniques. Available techniques to be considered for application include:

a. Environmental cabinets for suppressing acoustic noise;

b. Separation of teleprinters from main working areas by sound attenuating partial panels;

c. Elimination of noise at the source by selection of quiet equipment, when feasible.

4.3 Vibration

Hull-transmitted propulsion system vibrations have resulted in reports of equipment failures due to vibration in LPH type ships having meteorological spaces located aft. Vibration has been cited as interfering with proper operation of radiosonde receptors in balloon inflation

rooms located aft; these receptors utilized ink pen recording equipment. Although the more significant vibration problems can probably be expected in single-screw ships, vibration problems occur in ships generally and particularly toward the stern.

Accordingly, the selection of meteorological equipment capable of sustaining prolonged vibration and utilizing recording techniques least susceptible to vibration appears warranted to the extent feasible. In the case of radiosonde receptors which may be affected by vibration during recording, consideration is warranted of placement of receptors in the meteorological room, rather than in the balloon inflation room, when the meteorological room is significantly forward of the balloon inflation room.

4.4 Space Utilization

In the LCC-19 class ships the equipment density within the Meteorological Office remains light at present. Contributing to this light density is the fact that several large equipment items, for which space and weight allowance only was made during ship construction, remain uninstalled. Two of the three originally-planned meteorological light tables are in this category. The same is true of the closed circuit TV equipment. Consequently, modifications to the existing equipment arrangement which might involve equipment additions could be sponsored with relatively minor concern for crowding the space so long as some of the larger space and weight items were dropped. Light tables may be in this category; the initial assessment based on inputs from LCC-experienced meteorologists is that the single light table is adequate.

Meteorological offices in LPH-2 class ships show the effects of the addition of equipments such as the Meteorological Data Receiver Recorder Set AN/SMQ-6(V). One effect is creation of a distinct limit in space for meteorological personnel to function when the pace of operations demands greater activity than normal. Another effect of crowding is the reduction in vertical surfaces usable for static display of maps, other graphic material, and tabular information in the processes of analyzing, correlating, interpreting, and locally disseminating environmental data.

In meteorological offices of flag-configured LPD type ships the equipment density is high. That is, installed equipment occupies a relatively high percentage of deck and bulkhead space. The small total area of the space and the high equipment density limit operator working positions to two, and the amount of surface available at present for static displays of all types is extremely limited. The amount of space available for ready access stowage of meteorological forms and publications, technical manuals, and maps is marginal at best.

4.5 Equipment Arrangements

As a general observation reported during this study the existing equipment arrangements have not afforded shipboard meteorological personnel the means of utilizing "the tools of the trade" as effectively as

should be expected. By "tools" in this sense is meant portable equipment, plotters, forms, and reference publications for which the shipboard allowances are established in reference 7 plus environmental data received via existing communications terminal equipment.

Reference 7 includes allowances for precision aneroid barometers, marine barographs, and certain other equipments which occupy a fixed location. Arrangement drawings for meteorological spaces have not consistently indicated the planned locations for these equipments. The result has been that ultimate locations of these equipments have not been in the best operational relationships to other equipment. Further, static vent lines leading to static vent fittings located at selected locations on the exterior of the ship, as required for barometers and barographs, have not been provided in many instances.

In addition to technical manuals for equipment within meteorological spaces, sets of climatic reference publications are required aboard ship. In order to enhance capabilities for providing environmental support to naval operations over any of various widely scattered potential operating areas without delay, fleet policies have demanded that full sets of climatic reference publications be maintained aboard. The total bulk of reference publications required has created storage problems. A remedy for these problems is required. Fuller utilization of microfiche equipment as referred to in later sections of this document may afford a solution. Furniture and equipment arrangements should reflect this use of microfiche.

Some excellent arrangements of communications terminal equipments to serve meteorological purposes have been noted. However, the space for utilization of the outputs of the communications equipment for interpretation and analysis within the shipboard meteorological office, and for dissemination to command and control stations which require environmental support has not been uniformly adequate. In LPH-2 class ships and in flag-configured LPD type ships in particular, static display space is severely limited. The general opinion expressed by shipboard meteorological personnel in the course of this study has been that ships should be afforded as much flexibility as possible as to what and how graphic and narrative data should be displayed. A pegboard type of display facility within the meteorological office is viewed as having high potential for affording this flexibility. Full utilization of the output of communications equipment should not be expected without adequate arrangements for display of same. Since perishable data is involved the utilization should be as efficient as feasible.

Arrangements within meteorological spaces of flag-configured LPD type ships are severely space-constrained. Communications terminal equipment presently occupies a preponderance of the space. If feasible, a reduction in space required for communications terminal equipment in

LPD type ships should be accomplished in order to improve capabilities for total environmental support of embarked amphibious unit commanders.

4.6 Radio Communications Equipment

4.6.1 Radio Receivers

Standard radio equipment suites in LCC, LPH, and flag LPD Meteorological Offices have continued to include two Radio Receivers AN/WRR-3( ). These low frequency receivers (14 KHz to 600 KHz) see virtually no usage according to shipboard meteorological personnel polled during this series of studies. Perusal of worldwide schedules for unprotected RATT and facsimile broadcasts indicates that these receivers have only an extremely low potential usefulness for meteorological purposes. On rare occasions when reception might be desired for a broadcast within the AN/WRR-3( ) capability it is expected that a receiver may be patched through main communications. Both Commander Amphibious Force Atlantic and Commander Amphibious Force Pacific concurred in November 1974 in a statement of no requirement for the Radio Receiver AN/WRR-3 in shipboard meteorological spaces.*

Removal of all Radio Receivers AN/WRR-3( ) and associated antenna couplers, antenna controls, and low pass filters from the meteorological office will eliminate an unnecessary expenditure of resources for maintenance. The removal will also facilitate a consolidation of radio communications equipment which may permit more efficient utilization of space.

Two Radio Receivers R-390A/URR remain installed in LCC and LPH meteorological rooms. Increasing difficulties are anticipated in logistically supporting these receivers. The present standard LCC and LPH installations also include two Radio Receivers R-1051( )/URR. Some shipboard meteorological personnel have favored replacement of R-390 equipment with R-1051( )/URR equipment to attain improved reliability. This increase from two to four R-1051( )/URR receivers would provide superior total capability and reliability for frequencies from 2 MHz to 30 MHz. Reception below 2 MHz would require receiver patching from main communications switchboards. The initial assessment is that this requirement for patching would be an unusual event, not of high importance, and that four Radio Receivers R-1051( )/URR would constitute the minimum requirement for radio receivers.

These dedicated receivers, located in the Meteorological Office, continue to be required for reception of worldwide unprotected facsimile broadcasts and frequency diversity reception of worldwide RATT broadcasts.

* References 3 and 9.

It continues to be necessary to provide these receiving capabilities to enable the shipboard meteorological officer to obtain all reasonable benefit from broadcasts available, and of significance, in any given potential operating area. Location within the Meteorological Office permits tuning and adjustments of receivers and related terminal equipment, to accomodate changing schedules and propagation conditions, without involvement of additional personnel at another communications space.

The effect on communications requirements of the Shipboard Naval Environmental Display Station, NEDS-2, is mentioned in Section V. As a minimum, it is expected that the Fleet Facsimile Broadcast will continue to be transmitted until all planned NEDS-2 equipment installations have been completed in operating ships. Prudence indicates that a given ship should continue to maintain a capability for receiving the Fleet Facsimile Broadcast after that ship's NEDS-2 installation is completed for as long as the Fleet Facsimile Broadcast is transmitted. Additional equipment apparently will not be required for the maintenance of this capability. Equipment provided for reception and recording of worldwide facsimile broadcasts is expected to suffice for this purpose.

Equipment should be provided for monitoring weather broadcasts which are transmitted through aviation navigational aids ashore. These broadcasts are often particularly useful to ships operating aircraft in coastal areas.* At present, meteorological spaces are not equipped with either receivers or remote voice radio terminal equipment for monitoring these broadcasts. Reception of AM voice transmissions on UHF frequencies is required. The installation of a standard audio amplifier plus a radio loudspeaker and radio jackbox patchable to non-dedicated receivers located in communications spaces may provide an acceptable means of monitoring these broadcasts.

4.6.2 Facsimile Equipment

A facsimile transmission capability in meteorological spaces of LCC and LPH type ships has been required by previous OPNAV direction. The equipments installed for attaining this capability are the Facsimile Transceiver TT-321/UX and the associated Modulator MD-168/UX. A review of the validity of the requirement for maintaining a shipboard capability for facsimile transmission for meteorological purposes was made in connection with the recent Carrier Meteorological Spaces Baseline Study.

In this review the experienced meteorological personnel who were queried found it difficult to cite situations in which the facsimile transmission capability would be used. A primary point considered was that

* Reference 3 , p. 2-3.

any ship capable of receiving a ship-to-ship facsimile transmission would also be capable of receiving weather facsimile from the Fleet Facsimile Broadcast and other broadcasts. Only a single, probably rather tenuous, hypothetical situation was described in which weather facsimile transmissions from an amphibious force ship might be useful. This hypothetical situation was one in which a flag officer might be embarked in a flag LPD with aerographers mates but no meteorological officer aboard and an LPH might be in the same task organization. In that situation a supposition could be made that the LPH, having a meteorological officer aboard, might produce maps or other graphics which provide useful environmental support to the flag officer aboard the LPD if transmitted.

It is considered that the frequency of occurrence of this, or a similar, situation would be extremely low. A long-term trend of decreased production of prognostic materials aboard ship and increased use of centrally produced prognostics is noted as a factor. As a practical matter it is recommended that facsimile transmission equipment be removed from meteorological spaces of amphibious force ships and that the related space, weight, and maintenance resources be utilized otherwise.

Commander Amphibious Force Atlantic and Commander Amphibious Force Pacific reported in November 1974 that the Facsimile Transceiver TT-321/UX and Modulator MD-168/UX were no longer required for meteorological purposes aboard ship. *

After 1980 a facsimile transmission capability procured for other operational requirements may be available elsewhere in the ship. This is a new tactical facsimile equipment under a tri-Service development program to meet SOR 32-A6.

Facsimile recorders are provided for the Fleet Facsimile Broadcast and other worldwide facsimile broadcasts. Standard installations in meteorological spaces of LCC, LPH, and flag LPD ship classes provide two Facsimile Recorders AN/UXH-2( ) plus the recording capabilities of the Facsimile Transceiver TT-321/UX aboard LPH type ships. The latter equipment is a space and weight allowance item for LCC type ships.

Due to low maintainability and low reliability experienced with the AN/UXH-2 equipment, COMNAVWEASERV has been providing leased commercial facsimile recorders to ships in order to copy facsimile reliably. These are Alden 519 recorders. In responses to a ship survey initiated by COMNAVWEASERV in November 1974 the amphibious and aviation type commanders reported favoring removal of AN/UXH-2 equipment from meteorological spaces except for, in some instances, the retention of one as backup for the Alden equipment.

* References 8 and 9.

The installation of Shipboard Naval Environmental Display Station (NEDS-2) equipment, as mentioned in Section V, will reduce the importance of maintaining a conventional facsimile recording capability since the contents of the Fleet Facsimile Broadcast will be recorded through NEDS-2 equipment. A requirement for recording other worldwide facsimile broadcasts will remain. A single recorder with reliability as high as that of the Alden 519 may meet this requirement adequately.

The most acceptable solution to the problem of low reliability of the Facsimile Recorder AN/UXH-2( ) appears to be as follows:

a. LPH and LCC - Pending installation of NEDS-2 equipment provide one commercial-type facsimile recorder plus one AN/UXH-2( ) equipment as backup. Replace AN/UXH-2( ) with NEDS-2.

b. LPD - Provide one commercial-type facsimile recorder and one AN/UXH-2( ) equipment. Replace AN/UXH-2 with commercial-type facsimile recorder as additional commercial type equipment can be made available.

The frequency shift converters in general use with the Facsimile Transceiver TT-321/UX, Facsimile Recorder AN/UXH-2( ), and Alden 519 Facsimile Recorder are types CV-1066 and CV-172A. A new converter of higher reliability, type CV-2979/UX, has been made available to a limited number of ships. The program for replacement of the older converters by the Frequency Shift Converter CV-2979/UX should be continued to completion with the possible exception of converters allocated for use with TT-321/UX equipment.

4.7 Ceilometers

A capability for display of accurate and current information on present ceiling and visibility at own ship at any time is generally understood as a requirement aboard CVA, CVAN, and CV type ships in connection with aircraft launch and recovery decisions. For LPH type ships, for as long as required to launch and recover only helicopters, the accuracy and currency of ceiling and visibility information will remain less critical due to lower weather minima and greater fuel reserves of helicopters. However, in consideration of potential requirements of the 1980's for frequent operation of VSTOL aircraft from the LPH, a need is seen for more accurate and more current measurement and display of ceiling and visibility in that time frame.

The estimation of surface visibility and possible occasional measurement of cloud height by use of present shipboard light projectors and manual clinometers may not be a realistic method of providing the data needed for launch/land decisions involving VSTOL aircraft aboard the LPH. Decisions

concerning deck alert VSTOL aircraft may be of particular concern. In any rearrangement of equipment in meteorological spaces of LPH type ships consideration should be given to an eventual installation of equipment to provide automatic direct readout of ceiling and visibility.

4.8 Bathythermograph Observations

The LPH has an unexploited potential for playing a useful role as a participant in the Mobile Oceanographic Net. As a general rule any increase in the number of ships possessing a capability for bathythermograph (BT) observations increases the data base for the Antisubmarine Warfare Environmental Prediction Service (ASWEPS) and improves the effectiveness of that service. Since development of the expendable bathythermograph a capability for BT observations has required only a very modest equipment installation and obtaining observations has not imposed manueuvering restrictions at speeds below 30 knots. Manpower for employment of an expendable BT capability is latent in the LPH meteorological unit. Little impact on overall workload should be expected since obtaining and processing BT data with present equipment involves little effort.

It is expected that the BT observations would be made by the LPH when surface ASW ships were not in proximity. In situations when the LPH would be operating or controlling ASW helicopters for close ASW operations the BT data obtained on board would be valuable for direct tactical application in planning sonobuoy fields and for related ASW purposes.

4.9 Meteorological Satellite Reception

Problems in direct reception of signals at the Meteorological Data Receiver Recorder AN/SMQ-6(V) as a result of antenna locations which do not permit satisfactory reception on all bearings have been reported by shipboard meteorological personnel. Aboard some LPH type ships the reception of signals from starboard has been poor. Changing ship's course to permit reception often has not been acceptable tactically.

4.10 Meteorological Office Access and Interior Communications

In practice, the modes of interaction between meteorological offices and the command and control locations which receive primary environmental support have resulted in necessary personnel movement between the meteorological office and the location being supported. This movement has been necessary for distribution of hard copy materials, briefings, and consultations.

Aboard those LPH type ships in which the Meteorological Office is located far aft on the 02 deck the amount of time utilized by meteorological personnel in traversing to and from supported spaces is a matter meriting concern. Routes utilized frequently are through darkened troop berthing spaces. Improvements in interior communications systems for dissemination of environmental data within the ship, and for queries from supported locations, may afford potential for reducing personnel movement and improving manpower utilization.

SECTION V

IMPACT OF NEW EQUIPMENT DEVELOPMENT

5.1 General

In this section, consideration is given to the impact upon shipboard meteorological requirements of larger scale programs such as the Naval Modular Automated Communications System (NAVMACS), and of smaller scale equipment programs which are directed specifically toward meteorological problems.

5.2 Radiosondes

New light weight radiosondes under development at the Naval Air Development Center, Warminster, are expected to replace for Navy use afloat the radiosondes now in use. This development program is keyed to important requirements for efficient derivation of atmospheric refractive indices. It is expected that these new radiosondes will provide all upper air measurements required aboard ship, and that they will constitute the standard shipboard radiosonde. Small balloons, not larger than present pilot balloons, are to be used with these radiosondes. The small balloons will decrease expenditures of helium, allow reduction in requirements for shipboard storage of helium, and reduce the space and weight required for balloon inflation rooms afloat. The first delivery of the new radiosondes is scheduled for FY 76A, and TechEval is expected in FY 77.

Except for refractive index measurements, upper air soundings by Navy ships at present are considered to play a less important role in onboard predictions and in contributions to global weather data than in years past. This is due in part to increased information available from satellites. LFH installations include the Weather Satellite Receiving System AN/SMQ-6. This equipment provides direct reception, recording, and reproduction of satellite automatic picture transmission (APT) modes. It also provides a mode for IR measurement of radiation temperatures of cloud tops and terrain features at night.

Navy ships are no longer routinely required to make and report upper air soundings on a regular schedule. A previous standing requirement for soundings is no longer specified in reference 3. However, the retention of shipboard capabilities for radiosonde and radar wind observations as elements of a complete meteorological measuring system is considered important.

The capability should be maintained for conducting upper air soundings to supply missing information, and to provide the fine-grained

information needed for naval operations, particularly for refractive conditions, propagation conditions, and range forecasting.

Other new upper air sounding equipment may become available as a result of the Next Generation Upper Air System (NEXAIR) of the National Weather Service. Present descriptions of the candidate upper air sounding equipment under NEXAIR indicate payload and resultant balloon size significantly larger than the light weight radiosonde mentioned above. For that reason, the light weight radiosonde remains more attractive for meeting the requirements of amphibious force ships.

5.3 Laser Transmissometer/Ceilometer

For U.S. Marine Corps expeditionary use a system is under development to provide direct readout of ceiling and visibility by use of a laser backscatter technique. The first procurement of the system is scheduled for FY 76. Further procurement is expected in FY 77, 78, and 79 with the FY 77 equipment going to shore stations. It is expected that some equipments under the FY 78 and 79 procurement will be installed aboard ships.

Present ceiling measurement equipment in shipboard allowances consists of ceiling light projectors and manually operated clinometers.

The new laser equipment affords potential for meeting the needs of aircraft control operators for accurate current data without expenditure of significant manpower. The advantages of this equipment to the meteorological unit in connection with local observations is apparent. A recommendation concerning this equipment and LPH type ships was provided in paragraph 4.7.

5.4 Shipboard Automatic Weather Sensing

Systems for automatic sensing and transmission of surface weather parameters for direct remote display show promise for savings in operator manpower. This applies not only in meteorological spaces but also in other operational stations which require the sensed data, but must receive it only by hand in hard copy or by voice, and then transcribe the data for display.

Extensive programs for automatic sensing and display of surface weather parameters have been funded in recent years. Programs sponsored by the FAA for these purposes can be noted with particular interest. This is because of various parallels that can be shown between the needs of FAA controllers for weather data and the needs of shipboard operators. To the extent that similarities in equipment requirements may exist in the Navy and in the FAA, costs of equipment development and procurement by the Navy may be lower.

The primary Navy candidate system for automatic sensing of several parameters in shipboard installations is the Shipboard Automatic Weather

Station AN/SMQ-7(XAN-2). This equipment has been through operational assist testing aboard an LPH, and is expected to be ready for TechEval/OpEval in 4th Quarter FY 75. The equipment is designed to provide continuous measurement and remote direct digital LED readouts of barometric pressure, ambient temperature, water temperature, and dew point. The equipment may become operational as early as the latter portion of FY 76.

The AN/SMQ-7 equipment is considered adaptable to driving remote displays at several locations. With the primary display in the meteorological office all display data could be monitored by meteorological personnel in line with responsibilities for the collection, evaluation, and dissemination of environmental data. For remote displays at operational user stations the data would be converted automatically to the desired units (millibars to inches of mercury, etc.) without introducing possibilities of human error in conversion or transcription.

5.5 Interior Dissemination and Display

The previous paragraph illustrates realistic involvement by meteorological personnel in dissemination of real time environmental data within the ship. As an example of implementation aboard LPH type ships of automatic dissemination of real time data the requirements of the Fly Control should be considered. The following would be displayed if fully implemented:

Ceiling
Horizontal surface visibility
Flight deck temperature (air)
Seawater temperature
Altimeter setting (inches Hg)
Density altitude
Apparent surface wind direction and speed

Essentially all other environmental data required by the supported operational stations comprises non-real time data. Improvements in the conventional methods of dissemination by hard copy materials, intercom, dial telephone, and person-to-person contact are particularly desirable in LCC type ships in order to provide the scope of information which is necessary at this flagship level without penalty to the time and effort which meteorological personnel must devote to procurement and analysis of environmental data.

Storage and retrieval of appropriate environmental data as a function accomplished through the Amphibious Flagship Data System should be considered.

Character generator equipment for closed circuit TV systems as

designed for USS Nimitz (CVAN-68) allows for insertion of a limited amount of alphanumeric information into briefing TV circuits through a keyboard in the meteorological office. The Meteorological Office is seen as the optimum point of entry of this type of data into any dissemination system due to the availability at that point of more abundant and more current data than at other locations. In order to permit the dissemination of graphic as well as more extensive alphanumeric information to other stations, the closed circuit TV camera equipment which was originally planned for LCC meteorological offices should be installed. Updated camera equipment compatible with existing equipment on Circuit 4TV should be utilized.

5.6 Naval Environmental Display Station

The principal information source for naval units is expected to continue to be centrally prepared analyses and predictions. Shipboard electronic equipment for storing and displaying this information to maximum advantage for analysis is expected to be in use by 1980 aboard selected ships. Naval Environmental Display Station NEDS-1 (Fleet Weather Central version of NEDS) is scheduled for TechEval and OpEval in FY 75. NEDS-2 equipment (shipboard version of NEDS) will provide within the meteorological office the capability for storage, retrieval, and display of modest amounts of environmental data in both graphic and alphanumeric form. NEDS-2 equipment is expected to undergo TechEval and OpEval in the FY 76-77 timeframe.

This equipment is expected to reduce the facility requirements for manually prepared prognostic materials. Graphic material utilized in the NEDS-2 will supplant that presently recorded by conventional facsimile equipment from the Fleet Facsimile Broadcast insofar as ships with NEDS-2 installations are concerned.

It is understood that 12 NEDS-2 equipments are planned in the initial production procurement action, and that 25 total are planned.

5.7 Meteorological Data Receiver-Recorder Sets

The Meteorological Data Receiver-Recorder Set AN/SMQ-6(V) is expected to remain the primary shipboard equipment for major amphibious force ships for receiving, recording, and displaying APT and IR information from satellites. Modifications involving new antennas and improved capabilities for use with Geostationary Observation Environmental Satellites are expected to increase the importance of this equipment.

The greater capabilities of the Meteorological Data Receiver-Recorder Set AN/SMQ-10 would be highly desirable aboard LCC-19 class ships. However, the significantly greater space, weight, and manpower required for an AN/SMQ-10 installation are unlikely to be acceptable.

5.8 Radio Communications

Terminal equipment utilized for U.S. Navy communications in the meteorological office must be compatible with the Naval Modular Automated Communications System (NAVMACS) as implemented. By 1980 the NAVMACS System "E" is expected to be installed in LCC and LHA type ships, and System "D" in flag LPD's. The NAVMACS automated message processing equipment will interface internal to the ship with shipboard remote narrative terminals. The NAVMACS System "E" will also interface internally with shipboard remote data terminals.*

External to the ship NAVMACS will interface with the Naval Communications Processing and Routing System (NAVCOMPARS) by means of the Fleet Multichannel Broadcast via satellite, and with the Common User Digital Information Exchange System (CUDIXS) by means of a Half Duplex High Data Rate (Ship/Shore) path also via satellite. NAVMACS will be utilized with a shipboard switching which also provides for a full manual backup capability and use of convential HF paths.

The remote narrative terminals utilized for message processing and distribution at various shipboard locations under NAVMACS will by no means afford the capabilities of the Naval Environmental Display Station NEDS-2. NEDS-2 equipment is expected to handle data through or in combination with NAVMACS. In ships equipped with NEDS-2, that equipment will constitute the primary terminal equipment serving the meteorological unit for both narrative and graphic environmental communications.

The major portion of record communications utilized by the meteorological unit is comprised of traffic not of direct consequence to other shipboard operational stations. Consequently, it is not expected that a NAVMACS remote transmit-receive user terminal of the type utilized elsewhere in the ship can be justified for installation in the meteorological office provided that NEDS-2 equipment is installed. A terminal located elsewhere in the ship can be expected to serve the requirements of the meteorological unit adequately.

As a backup item, for use either in event of a casualty to NEDS-2 equipment or upon reversion to NAVMACS manual mode following a casualty to NAVMACS, a standard teleprinter with weather symbols should be installed in the meteorological office. This equipment should provide the capability of copying the equivalent of the present weather channel of the Fleet Multichannel Broadcast. It should be in addition to teleprinters utilized routinely for unprotected worldwide weather RATT broadcasts.

*Reference 10.

5.9 Microfiche Equipment Program

It is expected that standardized equipment for viewing and printing microfiche soon will be in common use aboard ship. Procurement is underway for equipping all ships with an initial allowance of readers and printers for COMTAC and intelligence microfiche by 1 August 1975. Further, shipboard equipment allowances for NAVMAT technical publications microfiche are being established concurrently.*

In keeping with this trend toward increased use of microfiche, it is expected that the environmental reference publications which are not already available in microfiche form will be on microfiche soon. Informal expressions by shipboard meteorological personnel have indicated high acceptability for use of climatic publications in microfiche form.

The prospect of effecting large reductions in overall bulk of sets of reference publications without necessarily reducing the actual amount of data on board ship has obvious merit. A recent preference sample indicated that minimum requirements in a shipboard meteorological office would be met by an appropriate viewer (without printer) provided that a viewer-printer was available elsewhere on board for printout of selected microimages.

Some new techniques for the production of microfiche may result in the maintenance of more current environmental reference files in microfiche than in bound publications due to lower costs of revising documents. Among these is a technique for production of microfiche directly from computer magnetic tapes.**

*Reference 11.

**Reference 12, p.1.

SECTION VI

SUMMARY OF OPERATIONAL REQUIREMENTS

6.1 Purpose of Summary

Summarized in this section are operational requirements for correction of deficiencies in meteorological equipment and spaces, and to meet other requirements addressed in Sections III, IV, and V. Requirements are stated in broad terms for further examination and amplification to include design rationale in a later phase of this study.

6.2 Meteorological Office Location

In LCC and LPH type ships, the Meteorological Office should be located in the island structure if feasible. If not, it should be located on the gallery deck in proximity to primary command and control spaces. In flag LPD type ships, the location should be in the superstructure adjacent to flag spaces.

6.3 Balloon Inflation Room

A balloon inflation room is required for a full capability shipboard meteorological installation, and should continue to be provided in LCC and LPH type ships. The size of the balloon inflation room may be limited to that required for handling balloons of the size required for light weight radiosondes. The location should provide for a balloon access door facing aft, where practicable, abaft the island or superstructure. The door should give access to an area of weather deck sufficiently free of encumbrances for release of balloons.

6.4 Radio Receivers and Related Terminal Equipment

The following are required to be installed in the Meteorological Office:

a. 4 Radio Receivers 2-30 MHz, A3a, A3b, F1, F4

b. 1 Send-Receive Teletype Set (LCC, LPH only)

c. 2 (minimum) Teletype Page Printers with weather characters

d. Receiver switchboard, comparator-converter groups, TTY patch panel, antenna filters and patch panel, and other controls/indicators to enable fullest flexibility in employment of receivers on unprotected RATT and facsimile broadcasts and teletypes on unprotected RATT or on a channel of the Fleet Multichannel Broadcast

e. Noise suppressing cabinets or other effective means for attenuating or preventing acoustic noise from teletypes within the Meteorological Office.

6.5 Facsimile Equipment

Two facsimile recorders should be provided. Facsimile transmitting equipment is not required. At least one facsimile recorder should be a commercial, or commercial equivalent, type of demonstrated reliability. Upon installation of a Naval Environmental Display Station NEDS-2, consideration should be given to reducing the number of facsimile recorders to one.

6.6 Automatic Measurement and Display of Environmental Parameters

Automatic measurement and remote automated display of surface environmental parameters should be provided in the Meteorological Office subject to the availability of equipment of proven reliability. For LPH type ships, consideration should be given to automatic measurement and display of ceiling and visibility.

6.7 Instrumentation

For barometers and barographs installed in enclosed ship's spaces, a static pressure head fitting at a favorable exterior location should be provided and connected to barometers and barographs in accordance with the recommendations of reference 13.

In design and selection of shipboard equipments for recording measurements of environmental parameters, the fullest consideration should be given to recording techniques least susceptible to error or disruption from hull or superstructure vibration.

6.8 Interior Dissemination

Reductions in required manpower and increases in operational efficiency should be sought through improvements in transmission and display of environmental data within the ship.

In meeting requirements at operational stations for locally measured environmental data, full consideration should be given to direct digital displays, in or near consoles, utilizing data monitored at the meteorological office.

In LCC type ships which utilize the Amphibious Flagship Tactical Data System, consideration should be given to inclusion of selected environmental data in the data system to enable retrieval by users when needed.

A closed circuit TV camera station should be provided in LCC meteorological offices.

6.9 Satellite Meteorological Data Receivers

For LCC and LPH type ships a requirement continues for reception, recording, and reproduction of televised data from weather satellites as available through the Meteorological Data Receiver Recorder Set AN/SMQ-6(V).

6.10 Naval Environmental Display Station

Shipboard equipment for electronic storage, display, and analysis of environmental data in both graphic and alphanumeric form is required. NEDS-2 equipment shows promise of meeting this requirement.

6.11 Expendable Bathythermograph

A capability for making BT observations should be provided in LPH type ships through use of expendable probes and equipment such as the Bathythermograph Set AN/SSQ-61 or Bathythermograph Set AN/SSQ-56A.

6.12 Hard Copy Displays

Display areas are required in the Meteorological Office for maps, other graphic material, and tabular information used by meteorological personnel in interpreting and analyzing environmental data. In addition to any meteorological display board cabinets which may be provided, a peg-board type of vertical display area is required.

6.13 Meteorological Light Tables

At least one meteorological light table shall be installed in LCC, LPH, and flag LPD type ships.

6.14 Radar Repeaters

One radar display unit, such as the Azimuth-Range Indicator AN/SPA-25B or an equivalent ship's standard display unit, should be provided in LCC meteorological offices. A radar display unit should be considered for installation in LPH meteorological offices when not in proximity to other spaces with suitable radar display units.

6.15 Standard Interior Communications Equipment

The following are required:

a. Intercommunications unit

b. Dial telephone set

c. Sound powered telephone jackboxes

d. Ship's course indicator

e. Ship's speed indicator

f. Wind direction and speed indicator

g. Wind direction and speed recorder

h. General announcing system speaker.

6.16 Clocks

A twenty-four hour mechanical clock is required. In ships which utilize large size electric clocks in other operational spaces a large electric clock also should be provided.

6.17 Microfiche Equipment

One microfiche viewer should be provided. The viewer should be of a standard shipboard type, and shall be sufficiently portable to facilitate use at any one of several stations in the space and to enable stowage when not in use.

6.18 Other Meteorological Equipment

The following are required:

a. Precision aneroid barometer and mounting base

b. Marine barograph

c. Radiosonde receptor

d. Other portable sensor equipment and minor other meteorological equipment of types normally provided in accordance with NAVAIR Allowance List Section L (NAVAIR 00-35QL-22).

6.19 Emergency Equipment

a. Stowage racks for Survival Support Devices (SSD)

b. Fire extinguisher

c. First aid box

d. Battle lanterns.

6.20 Furniture

Office-type furniture should be provided and installed as determined by requirements based on design work study techniques and subsequent arrangement plans. Furniture to be considered shall include, but is not limited to:

a.	Form cabinets	h.	Flat top desks
b.	Lock file cabinets	i.	Book racks
c.	File cabinets	j.	Safe lockers
d.	Stationery cabinets	k.	Work tables
e.	Stools	l.	Log desks
f.	Chairs	m.	Tape storage cabinets
g.	Typewriter desks	n.	Map stowage facilities.

6.21 Drawings

Drawings for ship alterations and new construction, when including meteorological spaces, should indicate locations of those NAVAIR Allowance List Section L items which are to constitute installed equipments. These drawings should be made available to NAVWEASERVCOM for comment and approval prior to issuance in final form.

APPENDIX A

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AIC	Air Intercept Controller
APT	Automatic Picture Transmission
ASW	Antisubmarine Warfare
ASWEPS	Antisubmarine Warfare Environmental Prediction Service
BT	Bathythermograph
CBT	Combat
COMTAC	Communications and tactical (publication)
CCTV	Closed-circuit television
CIC	Combat Information Center
D&E	Display and Evaluation
FLENUMWEACEN	Fleet Numerical Weather Central
FLEWEACEN	Fleet Weather Central
GOES	Geostationary Observation Environmental Satellite
HDC	Helicopter Direction Center
IR	Infrared
LCC	Amphibious Command Ship
LED	Light-emitting diode
LPD	Amphibious Transport Dock
LPH	Amphibious Assault Ship
METRL	Meteorological
NAVMACS	Naval Modular Automated Communications System
NAVMAT	Naval Material Command
NAVWEASERVCOM	Naval Weather Service Command
NEDS	Naval Environmental Display Station

NEXAIR	Next Generation Upper Air System
NOS	NEDS Operating System
OpEval	Operational Evaluation
RATT	Radio Teletype
SACC	Supporting Arms Coordination Center
SOR	Specific Operational Requirement
SSES	Ship Signals Exploitation Space
SSSC	Surface/Subsurface Coordinator
TAC	Tactical Air Controller
TAD	Tactical Air Director
TATC	Tactical Air Traffic Controller
TechEval	Technical Evaluation
TTY	Teletypewriter
XBT	Expendable bathythermograph

APPENDIX R

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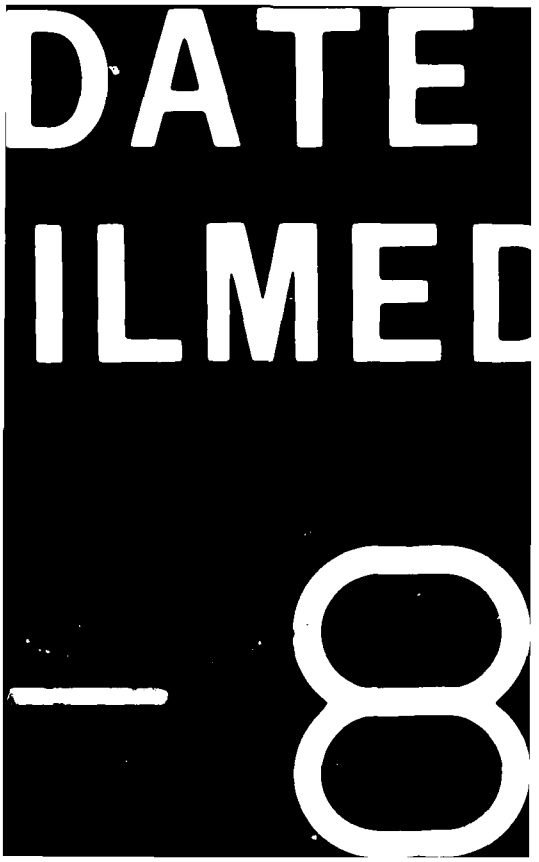
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