MARINE WEATHER DISSEMINATION SYSTEMS STUDY

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16. Abstract

Work performed during a study of Marine Weather Dissemination Systems is summarized. The study examined existing and planned systems for disseminating weather and other environmental information to marine users, and made objective, comparative measurements of the effectiveness of each of the systems. Based on these analyses, recommendations were made for changes which would improve the service to the marine user. The recommendations were addressed to the policies, facilities and procedures of the Coast Guard and other government and non-government agencies. Finally, guidelines were generated for future Coast Guard research and development efforts on advanced alerting and dissemination systems to serve recreational boatmen.

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FOREWORD

This document summarizes work performed 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-00,579A, which was awarded to CSC on August 31, 1970; completed August 16, 1971. The results of the study are presented in five volumes as follows:

- Volume 1 - Summary document describing the organization of the report and briefs of Volumes 2 through 5. Includes an extract of all recommendations, a U. S. Coast Guard Policy Statement, a National Weather Service Statement, and the initial distribution of the Study.
- Volume 2 - Establishment of a data base describing existing marine weather dissemination systems, and the characterization of these systems in terms of their facilities, policies and procedures.
- Volume 3 - Measurement of effectiveness of existing and planned weather dissemination systems, following the development of standards and criteria against which to measure this effectiveness.

- Volume 4 - 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.
- Volume 5 - 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. CSC would also like to take this opportunity to thank Mr. Max Mull, Mr. William J. McKee Jr., and Mr. Warren Hight of the National Weather Service, NOAA, for their valuable assistance.

It should be noted that the conclusions presented in these reports are solely those of CSC and do not necessarily reflect the views of the Coast Guard or the National Weather Service. See both the U. S. Coast Guard and National Weather Service policy statements appended to this Executive Summary.

INTRODUCTION

The rapid growth of the recreational boating community in recent years has led to the presence of a growing number of casual, inexperienced operators on waters under Coast Guard jurisdiction.

Unlike the more serious yachtsman, whose interest in sailing is an end in itself and who seeks skills in seamanship, the casual boatman frequently uses his vessel as a means to enjoy interests such as fishing, water skiing, or skindiving.

By his very nature he is the least experienced, the most poorly equipped, and the most vulnerable member of the boating community. He represents by far the most numerous type among the estimated 8.5 million boatmen in the United States.

The Coast Guard has done much to ensure safety by requiring that boats be equipped with life-saving devices, fire extinguishers, lights and horns. However, the boatman often remains unaware of the dangers of the weather, and in many cases he lacks adequate means of communication with weather disseminating organizations.

The problem is not confined to the lack of equipment and experience on the part of the user. Weather dissemination systems and techniques have historically served the less vulnerable and better equipped users and are not geared to the needs of the small user. In addition, crowding of the airwaves and the policy changes by the Federal Communica-

tions Commission (FCC) to relieve this congestion make a reexamination of current practices essential before any serious reorganization can be implemented. The diversity of broadcast frequencies and modulation techniques, the use of both transceivers and monitors, the wide variations in broadcast schedules, and the immense range in user requirements render a simple decision on such reorganization impossible.

Recognizing these factors, CSC developed a study tailored to the specific problems involved and using methodologies developed expressly for this purpose. The results of this study are contained in the five volumes of this report.

ORGANIZATION OF THE REPORT

The report is presented in five volumes:

VOLUME 1 - Executive Summary

VOLUME 2 - Systems Characterization

VOLUME 3 - Systems Effectiveness Measurement

VOLUME 4 - Recommendations for Change

VOLUME 5 - Guidelines for Future Coast Guard Research and Development

The contents of Volumes 2 through 5 are summarized in the following sections:

VOLUME 2 - SYSTEMS CHARACTERIZATION

Work conducted under the first task of the study is presented in this volume. The objectives of the task were to familiarize the study team with existing Coast Guard and National Weather Service operations, to

assemble the data base for Task 2 of the study, and to develop a characterization of the existing weather dissemination systems in terms of their policies, facilities and procedures.

The report examines the environment within which the systems operate, and describes in detail the systems serving the Coastal, Off-Shore and High Seas areas. Each broadcast (or display) facility is indentified by name, location, transmitting frequency and power (or display type) and antenna height. Policies and operating procedures are described and samples of charts transmitted by radio facsimile are given. Background documentation includes appropriate policy statements of the Coast Guard, FCC and World Meteorological Organization.

VOLUME 3 - SYSTEMS EFFECTIVENESS MEASUREMENT

The analytic techniques used in this phase of the study are applied to six, carefully selected scenarios, representative of the total area of interest but sufficiently limited to permit thorough analysis. The scenarios cover the following areas:

1. New Jersey coast from Sandy Hook to Cape May.
2. Chesapeake Bay.
3. Southern Florida coast from Jupiter Inlet to Bayport.
4. Gulf coast from Galveston to Brownsville.
5. Pacific Northwest coast from Grays Harbor, Washington to Coos Bay, Oregon.
6. Great Lakes region including Lakes Michigan, Erie and half of Huron.

The study begins with an examination of the systems serving coastal waters and proceeds to a definition of effectiveness as applied to these systems.

Recognizing several levels of effectiveness, a methodology is developed that defines the first of these levels as "accessibility" and measures it as a function of coverage, audience and schedule. A second level is examined in terms of characteristic weather phenomena and user habits and is termed "timeliness". The development and application of these techniques is described in Section 1, Study Rationale and Methodology. Elements of the analysis are described in detail in Sections 2 through 5, Coverage, Audience, Schedule, and Timeliness.

Nonbroadcast systems serving the user in a pre-excursion mode are examined separately in Section 6, Nonbroadcast Systems. Section 7, Offshore and High Seas Systems, discusses service to users in these areas.

Analysis of the broadcast-mode coastal systems yields quantitative measurements of their effectiveness on a comparative basis. Because of the importance of each of the elements of level 1 effectiveness (coverage, audience, and schedule) the results for each of these stages of the analysis are presented separately in Section 8. The performance of the nonbroadcast coastal systems is also discussed in this section.

The analysis performed during this phase of the study indicate that none of the systems examined is adequate to serve the needs of the majority of recreational boatmen.

The greatest effectiveness in terms of coverage and audience is exhibited by the commercial broadcast system. Other systems are limited either by poor coverage or by the size of the audience equipped to receive their broadcasts. When system schedule is taken into account, all systems are shown to have extremely low effectiveness.

VOLUME 4 - RECOMMENDATIONS FOR CHANGE

This volume describes work performed under Task 3 of the study and includes recommendations for change aimed at improving weather dissemination services to marine users.

The analysis leading to the recommendations were based primarily on the results of the systems characterizations made under Task 1 and the systems effectiveness measurements of Task 2 of this study. Existing systems were examined to determine their potential performance based on realistic improvements in the next 5 to 6 years. Comparing the potential of these systems to the projected requirements of the user, deficiencies in service were identified and solutions sought. By considering multiple-use solutions and avoiding duplication of effort, an overall systems rationale was developed to serve the total marine community. The implications for each agency in meeting the requirements of this service were then examined individually to evaluate their technical, economic and political feasibility. Where the proposed changes were shown to be impractical, alternate proposals were examined for the role of that agency and the impact of the revision on the total system was determined. The requirements for implementing this system led to the 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.

To ensure that the marine user, and in particular the susceptible recreational boatman, is provided with essential weather information services, CSC recommends that the Coast Guard institute within its ranks a body of persons concerned solely with the provision and coordination of such services. This body should monitor the availability of services in each District and recommend and initiate corrective action where needed. It should also maintain an awareness of changing user requirements and suggest appropriate modification of service to the sponsoring agency or organization.

It is not within the scope of this study to determine the exact organizational make-up of this body, nor to specify the staffing level required. The recommendation is made on the basis that this proposal will lead to an improvement in weather dissemination significantly greater than that which could be attained through an equivalent expenditure in funds in support of Coast Guard operated dissemination programs.

It is further recommended that this body establish intimate working liaison with representatives of the marine services division of the National Weather Service. This liaison might best take the form of a specially convened, permanent committee on marine weather dissemination. Other organizations having as their concern the welfare of the recreational boatman should also be actively involved in the business of this committee.

The first business of this committee should be the implementation of a network of commercial radio stations making frequent broadcasts of marine weather information.

The report examines service to the coastal areas (predominantly recreational boatmen) as well as off-shore and high seas dissemination services. The recommendations resulting from these analyses are reprinted in this Executive Summary.

VOLUME 5 - GUIDELINES FOR FUTURE COAST GUARD RESEARCH AND DEVELOPMENT

The final volume examines the system requirements and operational constraints of an advanced environmental information dissemination and alerting system to serve the recreational boatman. The format of the report is a baseline study document for possible future Coast Guard research and development in this field.

The first section of the report establishes a set of system objectives to guide any future initial design efforts. The objectives are developed through an in-depth examination of the operation of the system in its two basic modes - information dissemination and hazard alerting - and the discussion draws heavily on information gained during the initial phases of the study. The set of objectives is stated in Volume 5.

Section 2 addresses areas in which specific data are required in order to perform system parametric and trade-off analyses. Data is presented on the cost of user reception equipment, radio frequency availability, radio propagation phenomena and potential audience size. Areas in which data is unavailable or in which further analysis is required are identified and possible techniques for satisfying the requirements are suggested.

SUMMARY OF RECOMMENDATIONS

The recommendations for change resulting from this study have been presented and discussed in detail in Volume IV. For the convenience of the reader, and for reference purposes, the recommendations for both Coastal and Off-Shore/High Seas services are summarized briefly in the following paragraphs. The reader should note that the reasoning behind each of the recommendations, its relationship to overall systems service, and the justification for each individual proposal may be found in the appropriate section of Volume IV.

RECOMMENDATIONS FOR CHANGES IN COAST GUARD POLICY, FACILITIES, AND PROCEDURES

CSC recommends that the Coast Guard

1. Institute within the Coast Guard a body concerned solely with the provision and coordination of marine weather services by the Coast Guard, National Weather Service, commercial broadcast stations, and other organizations.

2. Initiate as rapidly as possible a program of regularly scheduled broadcasts of marine weather information via commercial broadcast stations.

3. Increase its efforts in the fields of boating education and public information to promote and advertise the availability and nature of existing and proposed services to the marine user, particularly through the mass media.

4. Extend the coverage of Coast Guard facilities at VHF frequencies in the interests of safety in accordance with the currently planned expansion.

5. Continue current procedures for broadcasts, at 156.8 MHz, of urgency signals and messages and announcements of special broadcasts.

6. Remove from consideration an extensive program of frequent, scheduled Coast Guard broadcasts of marine information at VHF frequencies at this time.

7. Remove from consideration use of the Environmental Channel No. 15 (156.75 MHz) in view of limited service capability and potential interference with monitor operations on the National Distress, Safety, and Calling Channel No. 16 (156.8 MHz).

8. Procure and install VHF monitor receivers with a tone-operated alerting feature at Rescue Coordination Centers (RCC) and subordinate commands located within the service area of NWS VHF broadcast stations.

9. Continue scheduled broadcasts of marine information on 2670 kHz, changing the number of broadcasts and content as necessary to reflect the changing needs of the user.

10. Install broadcast tape-recording equipment at radio stations to facilitate voice broadcasts in the 2 MHz band.

11. Establish a policy of referral to NWS services for the dissemination of marine weather forecasts by landline telephone, but give careful consideration to its own role in the dissemination of one-scene observations.

12. Continue with plans to implement a full HF broadcast service to high seas areas from new long-range radio stations.

13. Establish targets for receipt of dissemination products by both Coast Guard and commercial disseminators, and review the attainment of these targets on a continuing basis.

14. Establish a continuing, close, cooperative role with major organizations operating coastal stations, and seek means to demonstrate mutual interests. The commercial radio disseminator makes a significant cost-free contribution to the weather dissemination program (and to Coast Guard Operations), and should be made to feel a team member.

15. Continue to evaluate coverage, transmission modes, and presentation techniques to off-shore and high seas users through pilot programs similar to those in operation at Radio Station Boston.

16. Formulate hardware development objectives for future shipboard communications equipment, incorporating industry views and encouraging standardization programs.

17. Continue technical support programs addressing coverage, propagation prediction, frequency selection, and site engineering, expanding these programs, if possible, to include computer prediction techniques and the definition of required signal levels for different transmission modes (telephone, facsimile, teleprinter, and manual CW telegraph).

18. Investigate means of transmission to the off-shore and high seas user while in transit of coastal and port approaches.

19. Integrate existing managerial procedures for service evaluation and user feedback to effect control and improvement of off-shore and high seas weather dissemination.

RECOMMENDATIONS ADDRESSED TO THE NATIONAL WEATHER SERVICE

CSC recommends that the National Weather Service

1. Continue its excellent cooperation with the Coast Guard in the provision and dissemination of marine information products.

2. Cooperate in particular in the establishment of a marine weather dissemination service via commercial broadcast stations, lending its considerable influence to encourage the participation of suitably located stations, and providing the required dissemination products and information on how they may be obtained.

3. Give careful consideration to the content of its products with reference to the needs of the recreational boatman, placing greater emphasis on the inclusion of existing conditions and surface phenomena.

4. Update marine information transcripts frequently in comparison with the rate of change of local weather phenomena, and include the time of the most recent update even though the message content may not have changed.

5. Reexamine the criteria for the establishment of weather information services noting that marine users generally, have a higher priority need for these services than the general public.

6. Consider the implementation of subsidiary VHF transmitting sites at existing Coast Guard facilities in areas of significant marine activity which will not be covered by the fully-implemented VHF Weather Radio Service, evaluated under realistic transmission range assumptions.

7. Carefully examine the recently initiated weather broadcast and alerting service via time station WWV to ensure that the scheduled

broadcast time (15 to 17 minutes after each hour) does not distract the attention of radio operators during the international silent period on 500 kHz in the time interval 15 to 18 minutes after the hour.

8. Continue the excellent cooperative pilot programs such as the facsimile transmission via CG Radio Station Boston, and seek to include the evaluation of user feedback from such services into adaptive improvement procedures.

9. Examine the particular needs of off-shore and high seas users during transit of coastal and port approaches, and consider the provision of specialized services such as VHF transmitted facsimile information.

10. Re-examine the correlation between off-shore and high seas forecasts areas in relation to traffic distribution and user needs as well as weather phenomena.

RECOMMENDATIONS ADDRESSED TO COMMERCIAL RADIO OPERATIONS

CSC suggests that commercial radio concerns give careful consideration to the unique capability which they possess by virtue of their universal audience to contribute significantly to the safety of more than 8 million recreational boatmen on U. S. waters.

CSC recommends that stations located within range of significant boating activity familiarize themselves with the essential conclusions of this study and recognize the important role they can play. It is further recommended that such stations examine the market potential and commercial gains associated with the dissemination of valuable marine weather and environmental information in areas of significant boating activity.

Interested operators are encouraged to seek further information from their local Coast Guard and National Weather Service offices as to the part which they can play in this essentially public service oriented, but potentially profitable, role.

RECOMMENDATIONS DIRECTED TO PUBLIC COAST AND LIMITED COAST STATIONS

CSC recommends that commercial marine radio telephone operators equip with effective means for receiving up-to-date marine weather information (such as the Weather Wire or VHF Weather Radio Services of the National Weather Service); that the availability of such information is made known to its subscribers so that they may seek self-protective information on request at normal tariff rates; and that such information is used to alert all suitably equipped users within range in the event of an emergency, according to accepted practice.

U. S. COAST GUARD STATEMENT OF POLICY

The recommendations addressed to the U. S. Coast Guard and contained in Volume IV of the study and extracted in the Executive Summary have been reviewed and approved in principle. Each recommendation that requires specific action will be implemented as funding is available.

Although this study was confined to the dissemination of weather to Marine Interests, the Coast Guard intends to continue broadcasting other marine information and to encourage other disseminators of weather information to include selected inputs of important marine information in their broadcasts. Copies of this study have been officially forwarded to the National Oceanic and Atmospheric Administration (NOAA), the Federal Communications Commission (FCC) and other interested agencies for their final review.

All volumes of this report have been approved for public release with unlimited distribution. Copies may be obtained through the National Technical Information Service (NTIS) clearing house, Springfield, Va. 22151.

Inquiries with regard to the Coast Guard concerning this study may be addressed to:

Commandant (OC)
U. S. Coast Guard
400 7th St. S.W.
Washington, D. C. 20591

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NATIONAL WEATHER SERVICE STATEMENT

The Marine Weather Dissemination Systems Study prepared for the United States Coast Guard includes a good review of the present national programs for disseminating marine weather, and offers a number of considered recommendations for improving the present system. The National Weather Service will work with the Coast Guard, as it has in the past, in looking into the problem areas highlighted by the Study, with the view of making improvements in the marine service program to the extent that resources permit.

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