THE WARNING SYSTEM
A Social Science Perspective

Benjamin F. McLuckie

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

National Weather Service
Southern Region

March 1973

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FOREWORD

Tornado, flood and hurricane fatalities have decreased in recent years; a result of better meteorological and communication technologies and increased public education concerning storm protection. But more people become vulnerable to natural disasters each year -- encroachment into coastal and river flood plains and proliferation of mobile homes are but two examples -- and the proud record of lowering fatalities can reverse.

Fatalities will skyrocket if an intense storm strikes a populated area where people fail to take protective action. Storm warning is as much a people problem as a weather problem. Social sciences as well as physical sciences are important in the storm warning process.

Dr. B. F. McLuckie, Department of Sociology, University of Delaware, served as Warning Procedure Consultant to National Weather Service Southern Region in July and August 1972. Sociological disaster study is a fairly new field, however Dr. McLuckie is a recognized authority whose experience spans close to a decade and extends westward to Japan and eastward to Italy and Yugoslavia.

Four years ago the Southern Region made its first serious probe into sociological storm warning implications. We contracted the Social Science Research Center of the Mississippi State University to study warning effectiveness during Hurricane Camille. The second probe was an overview of social science literature and how it related to storm warnings during the 1960's. It was authored by J. Riley, Chief, Meteorological Services Division, and published by the Hogg Foundation of The University of Texas.

The third probe, and subject of this report, is Dr. McLuckie's Social Science Perspective. In addition to Southern Region input, this study was guided by a set of specific propositions and questions formulated by Dr. G. P. Cressman, Director of the National Weather Service.

Dr. Ben McLuckie, author of this report, is not only an expert in his chosen field but a warm engaging personality who delves deeply into each interview, the source of much of his information. And, he expresses his analyses and conclusions in clear language. He says "a warning is not a warning unless it causes somebody to do something."

Dr. McLuckie's report reveals important but rarely considered facets of the warning process. I strongly recommend it as "must" reading for all those involved in the broad areas of storm warning.

L. R. Mahar, Director
Southern Region
NOAA, National Weather Service

EXECUTIVE SUMMARY

Introduction

The study "states the problem" of warning for natural disasters from a social science perspective. To do this, a critical review was made of the current NWS warning system based on: warning case histories, pertinent literature, and interviews with NWS personnel. Emphasis was placed on operational procedures during the various stages of the warning process.

A series of Findings and Recommendations is listed which highlight important parts of the overall warning process as viewed through the eyes of social science. The list, however, is not intended as an end product, but a step in the ongoing effort of building a more effective warning system through the added dimension of a social science perspective.

Findings

1. Warning as a process.

   a. It is essential that there be disaster preparedness plans and that these plans meet people where they are. It is easy for personnel who work daily with the possibility of disaster to assume that the public has a similar perspective, but, of course, this is not the case.

   b. There is some lack of clarity as to the definition of warning. Warning is a two step process in which messages are transmitted to individuals, groups or populations to provide them with information about (1) the existence of danger, and (2) what can be done to prevent, avoid or minimize the danger. NWS material tends to concentrate on the first part of the first step, that is, providing information about the existence of a particular disaster agent (e.g., hurricane).

   c. The decision to warn carries a great deal of cost. The cost of overwarning is embarrassment to public officials, expense of preparation and, most important of all, the insensitizing of the population. Information passed on by the Weather Service is sometimes incomplete and tentative because of the limits of prediction. The combination of the high cost of placing an area in a warning posture and the inexactness of forecast information has led to a dangerous hesitancy in deciding to warn by public officials and others in a number of disasters.

d. Disaster is one of the many "sponge" concepts in the English language. It is used with at least four meanings. The term may refer to (1) the disaster agent, (2) the physical impact which the agent has, (3) the evaluation of the physical event, or (4) the social disruption created by the physical event. There is a need to make those warned aware of the dimensions of the agent and the physical impact and the social disruption that may result.

2. Parts of the Warning System.

a. The NWS is most involved in the forecast stage of the warning process. It is less involved, and has less control, in the dissemination and response stages. At the present moment there does not appear to be any agency that is taking responsibility for the entire system.

b. System linkages are major problems in warning. The subsystems, particularly the forecast subsystem, work relatively effectively.

c. The increased demands placed on limited staff in a disaster threat situation creates the danger of failure in intra-organizational and interorganizational communications. The importance of feedback at every stage of the warning process cannot be overemphasized. At present feedback is on an unplanned and ad hoc basis.

d. Issues, findings and suggestions relating to the three stages of the warning process (forecast, dissemination and response) and feedback are detailed in the fourth chapter of the report.

3. Dissemination of Warnings.

a. The mass media organizations are ones with which the NWS works most closely during warning. This relationship is on a voluntary basis, and there is a wide variation in the kinds of working relationships that have been developed.

b. There are a number of "rules of thumb" that have been developed about means of shaping an effective warning message, but there are still a number of unanswered questions concerning the best content, language and format for warning messages in given situations.

c. There is serious doubt as to whether any warning system that is based on mass appeals to people in an attempt to secure individually-motivated self-protective action will successfully achieve its goal. There is a need for system planning that includes organizational and group support.

4. Response to Warnings.

   a. It would appear that warning disseminators too often assume a simple stimulus-response (S-R) type of communication model. A stimulus-actor-response (S-A-R) model seems more appropriate. In developing the warning system a number of personal and social influences affecting those being warned must be considered. Among these are such factors as: past experience, present direct perceptions of the physical environment and perceptions of how others are responding.

   b. People have a tendency to err on the side of normalcy. Conditions are evaluated as all right until proven otherwise. Therefore, the burden of proof is on the warning system.

   c. Communities vary on such dimensions as size, complexity of organization, heterogeneity of population, degree of autonomy, economy and disaster experience. The warning system is influenced by these dimensions. The amount of knowledge about the nature of that influence varies greatly depending on the particular dimension.

Recommendations

1. System Problems. The major problems appear to be in the system linkages. These problems are particularly great in a relatively decentralized and highly differentiated system such as the United States. There is a need, then, for work that will facilitate the establishment of linkages. Three suggested activities that will help bring these linkages about are the following: (1) The responsibilities of the NWS and other disaster relevant organizations need to be clarified. (2) Some organization or organizations of government such as the Office of Emergency Preparedness or the Defense Civil Preparedness Agency need to work on overall coordination of the system. The National Oceanic and Atmospheric Administration may serve as a catalyst in initiating such activities. (3) A number of well organized conferences for personnel from different disaster relevant organizations would provide opportunities for viewing common system problems and for a cross-fertilization of ideas.

2. Training Issues. The formal and informal training of Weather Service personnel emphasizes the physical sciences and understanding of meteorological phenomena. There is a need for systematic on the job training related to other areas such as the understanding of disasters from the perspectives of physical impact and social disruption. Sessions at regional conferences, blocks of time spent with MICs when they are briefed on new assignments and periodic seminars are but a few of the means of education that might be used.

3. Research Recommendations. The reader is referred to Chapter Five for a discussion of needed research, but two recommendations are underscored in this summary: mass communications and community research. Mass communications is a major link between the Weather Service and the public. It is a system whose participation is voluntary, and the NWS has no formal control over it. It is important, then, that the Weather Service understand as much as possible about the mass media. Similar things may be said about communities that are being warned. They are complex entities that vary on a number of important dimensions and there is a need for continuing research concerning them.

INTRODUCTION

The National Weather Service (NWS) has celebrated its centennial. Personnel within the organization have been wrestling with the problems of forecasting and disseminating weather information for more than one hundred years. NWS documents are filled with varied and innovative suggestions about ways of warning people about impending disaster.

Then, why still another discussion of the subject of warning? What does social science have to add to the already sizeable expertise on the subject found within the NWS? What should be the objectives of a further study of warning?

These three questions provide the outline for the introductory section of the report.

Reasons for the Study

The impetus and justification for this study may be classified under three headings. First, there is the impetus for further study brought about by public criticisms of NWS following disasters. Secondly, there is the push for further study of the system brought by those who work within the system and are conscious of its inadequacies. Thirdly, there is the need for continually updating the system in order to take account of contextual change in the organizations and populations that the NWS is called upon to warn.

1. After Hurricane Camille wrought devastation on the Gulf Coast in August of 1969, certain public criticisms were voiced about the warnings that had been issued.[1] These criticisms were similar to those that are made after many major weather-related disasters. Following tornadoes, blizzards, floods, or any other significant weather disturbance, there is a tendency for citizens and political officials to raise questions about the effectiveness and efficiency of severe weather warnings. This is especially true where there has been large-scale property damage, and particularly if there has been loss of life.[2]

The NWS has been quite conscientious about responding to these criticisms through surveys of the operations of the system in various disasters. It has not limited its surveys to a narrow study of data collection, analysis, prediction and dissemination; but has shown some concern about other parts of the system such as advanced preparedness planning and user response.

2. Perhaps the most important impetus to the study of the warning system comes from the conscientious professionals within NWS who are constantly seeking new ways to improve the system. In a number of studies conducted by the NWS, either directly or indirectly, attention is called to problem areas within the warning system. Two examples taken from the literature point out some rather common difficulties.

> There were important communication problems. Although nearly everyone received the message that the storm was coming, there were great variations in the content of the message received and in the amount of pervasiveness with which the messages were delivered... In addition to the confusion of multiple uncoordinated sources working in the area, there was a problem of content even of the official advisories and bulletins....[3]

> A significant number (of people) had indeed heard (the ESSA Weather Bureau warning), but had not wholly understood. Many of them -people who have read ESSA safety literature, have viewed "Tornado!," and have gone through an extremely tornado-conscious school system- did not know the difference between an ESSA Weather Bureau watch and a warning... To them, a warning was a specific command from somebody in authority to take cover.[4]

3. The changing characteristics and situations of the organizations and populations that the NWS is called upon to warn, place ever changing demands on the system. For example, where a hurricane in the past would have passed over desolate sections of Florida and Louisiana, it would today go over the same ground to batter industries and residences in newly developed settlements.[5] Where these increases in population and scale of economy occur, there is not only an increase in potential death and damage, but generally an increased heterogeneity of population that places more complex damands on the warning system.

> The heterogeneity of the urban population may also work against appropriate response to the warning message. Due to the mobility of Americans, there is always present in any major city a large percentage of transients or newcomers to the area who have not previously been exposed to the kind of disaster to which the area is prone. There is also a sizeable segment of the population which, because of language problems, limited education, or different subcultural values, may not be fully capable of comprehending the warning message as officially intended, or of translating it into action. For these the message must be broadcast in their native tongue or stated in terms meaningful to them. Others, while capable of comprehending the message, may be so alienated from society as to have a profound distrust of the authorities who are trying to spur them to action... In general, the more heterogeneous the population, the less likely it is that the warning message will be effective.[6]

The evidence cited here, and much more that could have been, seems to support the conclusion that while the NWS has come a long way in its first one hundred years, the race toward better warning is far from complete. While the work needs to go on in many areas such as the physical sciences, it is a central argument of this report that an important part of the task yet to be done is in the area of improving the system of warning through social science inputs.

Contributions of Social Science

What does social science have to add to a field that has been studied by professionals for more than one hundred years? There are a number of limitations in relation to both the basic theoretical and substantive areas of social science and in the area of application of existing knowledge. There is enough theoretical and substantive knowledge within the social sciences to make some rather meaningful generalizations about the workings of social systems; but, of course, there is always the need for much more knowledge to provide a better base on which to ground generalizations about application. There is relatively little understanding, at present, of how to translate relevant existing knowledge within social science into practical applications. In addition to these other limitations, there have been limited resources placed behind social scientific research and application compared to the emphasis put on the physical sciences and their applications. What, then, does a social scientist have to add to the understanding of the warning system?

The major contribution of this report will most probably be the particular orientation that it brings to the statement of the problem of warning. This includes such matters as defining warning, critiquing the content and format of warning messages and calling attention to relevant community variables to be considered when developing preparedness plans.

Professional meterologists are trained in the physical sciences, and the major part of their work is related to collecting, evaluating, predicting and disseminating meteorological information. Therefore, by training and by workload, the personnel of NWS are inclined to emphasize the physical sciences. However, the collecting and disseminating of the most highly accurate weather information possible is only a part of the process of warning the population of threat. The content and language of the warning messages, the means by which they are disseminated, and the characteristics of the population to which they are sent must be taken into consideration also. These are variables with which the social scientist is trained to work, and they are emphasized in his daily work load. Therefore, his perspective will place emphasis on the social variables that are interacting in the various stages of the warning system. These differences in emphasis are more than academic distinctions. They help determine how we define the warning process and, consequently,

where we will look for the problem areas in the system. These distinctions also make a difference in the setting of priorities and in the recommendations we emphasize and on which we act.

This researcher agrees with the conclusions about the strengths and weaknesses of social scientific knowledge reported on in the summations of the Hurricane Preparedness Conference sponsored by the Office of Emergency Preparedness in May of 1972.

> The general feeling of the panel was that considerable knowledge exists about people's responses to disasters, including hurricanes. Social scientists have conducted a variety of studies of reactions and behaviors before, during, and after hurricanes. While quantitative studies are far fewer than might be desired, the view of the panel is that we are generally beyond the stage of educated guesses, particularly about the questions which were the focus of the panel (this is discussed later). Our panel felt we could make many recommendations on the basis of available research data.
>
> While further general studies continue to be desirable and should be encouraged, the major gaps in knowledge or research data exist elsewhere. We have little understanding, at present, of how to transfer or translate our general knowledge into practical applications. There are some major communication problems between researchers and disaster planners. For example, research has clearly established that people do not automatically respond to warning messages. Yet, some disaster planning continues to assume that if warning messages are official and simple, recipients will respond in the proper ways; i.e., as implied in the message. There is a great need for studies on how to make the existing basic knowledge available to the disaster planner.
>
> Another special research need is in what is sometimes called operations research. Many operational activities in disasters are carried out in an ad hoc fashion. We do not know as well as we should what and how various operational tasks should be carried out.
>
> Finally, there are some specific areas about which we have some ideas, but no systematic knowledge. For example, the concept of "disaster culture," which is frequently applied to hurricane-vulnerable areas, has never really been used in a systematic research effort. In some specific areas, our knowledge does not extend beyond educated guesses.
>
> Thus, in general, the panel took the position that we had enough general knowledge on which to make recommendations about certain things. It recognized, however, that on some matters, as just indicated, more research is needed.[7]

Social scientific knowledge is strongest on the level of general knowledge and weakest, or at least relatively untried, on the applied level. A number of the suggestions for application that a social scientist would make have already been made by professionals with NWS. Meteorologists in Charge (MICs) know intuitively and by practical experience that a number of human relations variables must be taken into account if the warning system is to be effective. Then, where is the benefit of behavioral science input into a study of warning?

We come back to where we started by indicating that the contributions of social science are in the following areas: 1) a statement of the problem from a somewhat different perspective with different priorities and emphases; 2) specific recommendations based on substantive social scientific knowledge about disasters; and 3) the designing and implementing of a research design that will provide for a systematic feedback of information so knowledge in the general and applied areas can be corrected, modified and made cumulative.

This report will concentrate on a statement of the problem which will, hopefully, provide a groundwork on which to build a fruitful dialogue with professionals in NWS. It is also hoped that some of the general recommendations will be complemented by the operational expertise of NWS personnel. What is being presented in this report, then, is not a set of new and revolutionary findings; but some fresh insights that may be one further step toward a more sensitive and effective warning system.

Research Objectives

1. The problem of warning is outlined. This determines the perspective, priorities and emphases that will be taken throughout the study. The general bias taken is that of a systems perspective.

2. The NWS organizational literature and operations pertaining to warning will be critically reviewed from a social science perspective.

3. The system of warning will be examined by studying particular stages in the process, some of the subsystems that are active in them and the interrelationships between the subsystems.

4. Certain critical areas about which more information is needed and some means of gathering valid and reliable information about those areas will be suggested.

Outline of the Report

The major divisions of the report are listed below.

I. Introduction

II. The Warning System

III. A Critique of Warning Literature and Operations

IV. An Analysis of the Warning System: Stages, Subsystems and Interrelationships

V. Research Recommendations

VI. Summary and Conclusions

A Warning

A successful warning is one that moves people to protective action. There is much more to effective warning than sending a well worded message. Whether the message is received and acted upon is dependent on, among other things, shared meaning by the sender and recipient and the situational factors present when the message is received.

Applying a similar perspective to this report, we may say that whether the report is received and acted upon will be due, in large part, to the presence of shared meaning by the writer and readers and the situational factors present when the report is received. Some of what social scientists say tends to be treated as generally known common sense information. This writer would plead with the reader to give serious consideration even to those statements he believes he already understands. Only when that knowledge is integrated into our total perspective of the warning system and made one of the bases of action, do we really understand.

CHAPTER II

THE WARNING SYSTEM

Introduction

This chapter lays the groundwork for much of what is discussed in the remainder of the report. It is divided into the following five major parts: 1) warning is defined, 2) the concept of disaster is explored, 3) disaster agent characteristics and their consequences for warning are examined, 4) the warning system is briefly outlined, and 5) some summary statements and implications are suggested.

A Definition of Warning

Warning has been defined as "the transmission to individuals, groups, or populations of messages which provide them with information about (1) the existence of danger, and (2) what can be done to prevent, avoid, or minimize the danger."[1] It clearly follows that any activity that does not include the second component is not warning, according to this definition. In practice, it often seems that only the first part of the definition (advance notification of danger) is emphasized explicitly. The second part of the definition (what can be done to prevent, avoid, or minimize the danger) is often left on the level of an implicit intention of the communicator. A warning, then, is more than the notification of danger; it is a call to action. Beach notes, "if it does not have this function (calling people to action), it might as well not have occurred."[2] The definition used in this report is one that emphasizes the alerting to danger and the call to action.

In order to accomplish the two steps that are a part of the above definition of warning there must be some preparation on the part of the recipients of the message. From a social-psychological perspective, the warning message may be viewed as a symbol. This means that both the sender and the receiver must share a field of common meaning in order for understanding to take place. For example, it is a rather rare situation where the sounding of a siren will elicit the desired behavior on the part of the recipient. The receiver will more likely seek to expand and clarify the full meaning of such a signal by looking at the sky for environmental cues and looking next door to see what his neighbor is doing. It becomes clear then, that the sounding of the siren is not generally a significant symbol or warning in itself, but must be viewed as a part of a broader and more explicit warning. We will return to the question of consensus regarding the meaning of the warning message at different places in the report, but it is noted here in order to call to the attention of the reader some of the social-psychological assumptions to which the sender of a warning must be alert.

In addition to the set of assumptions the sender of a warning message makes on the social-psychological level, there are a number of organizational and situational assumptions that are made on the behavioral level. Is the recipient in a position where it is possible for him to take the desired protective action? For example, if he is told to go to his nearest shelter, is there a shelter within his reach?

One further consideration in the defining of warning is important to clarify. Warning may be equated simply with information about an impending danger; viewed this way it is considered as some sort of discrete message or act. In this report, warning is considered as a process that is the product of a system.

Some of the key characteristics of warning as viewed in this research are that it is a transmission that provides individuals, groups, or populations with information about the existence of danger and what can be done to prevent, avoid, or minimize the danger. In order to accomplish these transmissions successfully it is important to be aware of the social-psychological and situational environments in which the recipients are living. It is also important to be constantly aware that successful warning is the completion of a total process which is dependent on the efficient functioning of a system. The successful completion of one stage of the process by one component of the system is not enough to guarantee the desired results, that is, moving people to protective action.

The Concept of Disaster

Disaster is one of the many "sponge" concepts within the English language. When it is used, it often refers to different things. We can distinguish four different meanings for the term.

1. Disaster often refers to the disaster agent, e.g., a hurricane, an earthquake, a fire.

2. Disaster also refers to the physical impact which the agent has, e.g., the resulting property damage and the loss of life.

3. Disaster can mean the evaluation of the physical event. In other words, evidences of physical damage are evaluated as being disastrous.

4. Finally, disaster can mean social disruption created by the physical event. Social organizations at many different levels - family, neighborhood, or community - may be disrupted.[3]

It is important that we define the concept of disaster because it has a bearing on the warning system. The forecasts of the NWS pertain to the

disaster agent and this is where NWS warnings concentrate. Sometimes the warning message goes beyond this and also discusses the threat of physical impact. These are only some of the threats facing a community or a region and if these are the only threats about which the community is warned then warning would seem to be incomplete. This thought is expressed in an emergency operation plan drawn up for a county and two cities in the state of Texas which says the following, "While it is true that tornadoes present the most likely form of destruction, lack of organization could present the most likely form of disaster."[4] How we define the threat, then, is extremely important for how we view the warning system.

Disaster Agent Characteristics: Consequences for Warning

Since the kind of disaster agent that poses a threat is of crucial importance to warning processes, it is necessary to analyze briefly the dimensions along which disaster agents can differ. Using such characteristics, it is possible to develop a typology of disasters, along key dimensions and thus avoid the necessity of talking about particular kinds of disaster agents, i.e., tornado funnels, flood surges, hurricane clouds and winds, and so on. However, our aim here is much more modest. It is merely to list the key dimensions of disaster agents and to indicate in general terms how they may have a bearing on warning. As has been detailed elsewhere, there are at least nine major characteristics or dimensions along which disaster agents may differ.[5] These are: frequency, physical consequences, speed of onset, length of possible forewarning, duration, scope of impact, destructive potential, gross predictability and gross controllability. We shall discuss each one separately as their implications for warning range from very important to relatively minor.

Frequency

Hundreds of disasters occur every year but disaster agents differ considerably in their probability of frequently hitting a given locale. An earthquake may strike a particular area only once in recorded history, or the region may experience periodic earthquakes such as well-known regions in Italy, Japan, and some places in the western United States. Communities in certain sections of midwest America are often threatened by tornadoes. In fact, at least several dozen American cities have been struck two or more times by a tornado funnel. Certain river communities in the upper midwest have come to expect floods annually at given times of the year. Although irregular, seismic waves are periodically anticipated at particular points around the rim of the Pacific Ocean and the islands therein.

The importance of frequency in relation to warning is that the number of times an area has been impacted, or at least threatened, affects whether people and organizations become sensitive to threat cues, the

warning systems organizations develop, and the general response that might be anticipated to a warning of danger. In general, the frequency with which a disaster agent strikes or threatens a particular community affects the way that community responds. Thus, hurricane-prone cities such as Miami or New Orleans are especially alert to cues of such a potential threat; have elaborate warning procedures to alert their residents; and have developed a complex organizational structure to collect and collate threat cues, to disseminate warning messages, and to evoke public community responses to warnings of hurricane danger.[6]

Physical Consequences

Disaster agents inherently differ as to their physical consequences. The water involved in a flood creates a different kind of task problem than the wind of a tornado. Boats are needed in a flood situation where they would not normally be required in a tornado disaster. An epidemic likewise has different physical consequences than an explosion.

There are some implications for warning in the inherent physical consequences of a disaster agent if warning is thought of as involving an indication of the course of action to be followed. This is particularly true if the physical consequences of the disaster agent are not "self-evident." In an explosion in the atomic plant in San Antonio in 1963 that was studied by DRC, there was lack of clarity as to the consequences of the explosion and, therefore, what warnings were to be issued to the surrounding area.

Sometimes, the physical consequences of even a relatively familiar disaster agent may not be fully understood with unfortunate results. When Hurricane Audrey struck lower Louisiana, over 400 lives were lost. A great number of the dead seem to have been the inhabitants of one parish in the state who thought the rising waters accompanying the hurricane would not reach the ridges on which they were located. That the warning messages issued failed to make absolutely clear that one physical consequence of such a storm would be such very high waters, contributed in part to the heavy loss of life.[7]

Speed of Onset

The onset of disaster agents can vary widely but it is possible and useful to think of three types of onset: rapid, gradual, and repetitive. In the case of rapid onset, the length of time between the pre-impact phase and the beginning of the emergency period is very short because the agent strikes very rapidly (we ignore here those cases where there is no time at all as in the instance of most earthquakes). The flash floods which struck central and south Colorado including Denver in 1965 are examples of this type of onset.[8] Gradual onset refers to those situations

in which the effect of the agent on the populace is very gradual but ever-increasing in intensity until the emergency period is reached. Thus, in contrast with those disaster agents that suddenly and unexpectedly appear, there are others, such as the rising rivers in the upper midwest in 1969 as a result of heavy winter snows, that literally were weeks in appearing. However, there are other types of disaster agents that do not strike with a single impact. They may be repetitive over a period of time, but are not so far apart that one would refer to them as separate disaster agents. For example, a series of seismic waves struck Crescent City, California in 1964 as a result of the shock waves set up by the Alaskan earthquake.

The speed of onset is an extremely important dimension in relation to warning. When the speed of onset is rapid, the warning period is necessarily short, and there is a probability that fewer people will receive the message about the danger. Even for those who do receive the message, there is less time to take protective action. Consequently, some protective actions that might have been possible given a longer period of time, as in situations of gradual onset, are not possible when onset is rapid, e.g., pre-impact evacuation.

However, it should not be assumed that the slower the speed of onset, the more effective will be the warning. Too long a period of forewarning without any immediate danger is more likely to create an apathetic reaction on the part of both individuals and groups, rather than an active response to a warning of threat. In other words, if the speed of onset is too slow, it will diminish the probability of the warning being taken seriously (everything else being equal). While the availability of a time period to give warnings is more desirable than no time at all, too much time in a sense is a mixed blessing.

Length of Possible Forewarning

There is a difference, not always recognized, between the speed of onset and the length of forewarning of a given disaster agent. The two are not necessarily related; it is possible to have either a long period of forewarning or no forewarning associated with each of the three modes of onset we discussed -- rapid, gradual, and repetitive. For example, there was a correct forewarning of almost an hour as to when the first seismic wave was to reach Crescent City, California, yet the impact was very rapid.[9]

The length of forewarning is, of course, important because it allows the opportunity for protective action. The degree of community disorganization may be inversely proportional to the length of forewarning in disasters with rapid onset. Problems of communication and coordinated response are heightened in such situations. This seems to result because

without forewarning and with rapid onset, organizational activities are inhibited and the predominant adaptive response comes from individuals. Isolated individuals tend to operate within their own limited sphere of action. There is a tendency to react to the needs of the immediate situation, with little communication of needs and knowledge to others. Even possible warning messages about the danger may not be passed on.

Duration

Disaster agents may be grossly conceptualized as being of limited duration or of prolonged duration. Limited duration would be illustrated by an explosion such as the Indianapolis Coliseum explosion, where (with no secondary threats) the impact was over almost as soon as it occurred.[10] On the other hand, certain disaster agents, such as floods or forest fires, may extend over several days or weeks, or in something like an epidemic possibly several months.

The duration is related to warning in at least two ways. Warning information about how to protect oneself from a disaster agent of long duration will obviously be different from that concerning preparations necessary for a short duration agent. Some of the difficulties that occurred in New Orleans as a result of Hurricane Betsy were the result of the fact that people had been warned about, prepared for, and responded to a hurricane; however, what they actually were faced with was a disaster agent of a much longer duration -- a flood. In other words, the content of warning messages and the protective actions taken as a result will necessarily be affected by the duration of disaster agents.

In addition, the period of time a disaster agent stays in a community will influence the issuing of warnings, particularly of new threats. In some respects, because of the disruption of community life occasioned by an initial disaster agent, it is sometimes difficult to transmit effective warnings about secondary sources of danger, e.g., about polluted water or food as in the Alaskan earthquake of 1964. In the Fairbanks flood of 1967, the amount of time the waters remained in the city meant that certain areas were not readily accessible to any kind of communication, and it was not easy to disseminate warnings about secondary threats.

Scope of Impact

The area that a disaster agent strikes may be localized or diffuse. A disaster whose scope is more diffuse throughout the total community tends to be more serious than one which is localized within the community. A localized disaster may leave the rest of the area around a neighborhood or segment of a community almost totally unaffected. When there was a gas main explosion in Jamaica, New York in 1967 only a few blocks were

affected; the rest of the metropolitan area was totally uninvolved. A diffuse disaster would tend to be more disruptive. When Hurricane Beulah hit southern Texas in late 1967 it affected thousands of square miles and hundreds of communities in varying degrees.

Here again there are some possible consequences for warning, especially of secondary threats. In a localized disaster, communication equipment and manpower might be almost all intact, and since relatively few persons might be directly involved, additional warnings might be easy to disseminate. In contrast, in the Easter Sunday tornadoes that cut across Illinois, Indiana, Michigan, and Ohio, the diffuseness of the impacted area (among other reasons) made it difficult for the earlier struck localities in the west to warn the eastern areas hit later.

Destructive Potential

Disaster agents differ as to their destructive potential, an obvious fact that is often forgotten by many within and outside the impacted area. This potential has two aspects to it. One, there is no necessary correlation between personal loss and property damage. A disaster agent may have tremendous potential for killing or incapacitating people, but it may have no consequences for damaging or destroying property. An epidemic is an obvious example of this, but a nerve gas "fall-out" accident as recently happened in Utah also illustrates the point. The converse of course can also be true -- that is, there may be considerable property damage and yet the disaster agent may have little direct consequence for persons, as in the instance of crop diseases or sudden freezing spells in Florida or California citrus fruit areas.

In addition, of course, disaster agents will differ in the extent of the destructiveness they may cause. When the Vaiont Dam overflowed in Italy as a result of a mountain top sliding into it, there was almost total obliteration of the people and property in its path. From a maximum of total personal and material losses in such situations, disaster agents diminish in their destructive capability.

The destructive potential of a disaster agent is important to warning in several ways. Prior to impact, it is not always easy to gauge the potential impact of a disaster agent and thus to evaluate the kind of warning that should be issued. Many factors may affect the potential destructiveness of a tornado or hurricane, for example, even if they do hit a particular locality. In part, because of the particular way Hurricane Betsy hit New Orleans, it was far more destructive than otherwise would have been the case. In some kinds of natural disasters such as hurricanes, the nature of the secondary threats that may be associated with it, such as the lines of tornadoes that are frequently spawned, are all but impossible to ascertain prior to impact.

After impact, the consequences of great intensity or great destructiveness, have many of the same implications for warning as a diffuse disaster agent. Greater damage and loss of life and general community disruptions may make it difficult to learn about and inform communities of secondary threats. The Alaskan coastal villages in the 1964 earthquake were in poor positions to be informed about and to respond to the seismic wave warnings that were issued in connection with the quake.

Gross Predictability

Disaster agents differ considerably in their predictability. Some disaster agents, such as those involved in explosions and earthquakes, are outside any current forecasting methodology. Some others, such as floods, hurricanes, and tornadoes can be predicted within a certain range. That is, gross predictions can be made of the probability of their appearance or nonappearance, the general paths the disaster agents are likely to take, and some estimates of their possible intensity. More specific details are currently unpredictable although recent advances in meteorology have considerably narrowed the area of the unknown.

Obviously the predictability of a disaster agent as a threat determines, to a considerable extent, the length and kind of warning possible. This, in turn, has consequences for the whole process of disaster response. The accuracy with which a disaster agent may be anticipated also has important consequences for response. In general, the more accurate the prediction as to the location of the threat, the more effective the response may be by the population affected.

Perhaps the most classic case of accurate prediction and effective response on a large scale, in a natural disaster occurred in connection with Hurricane Carla in September 1961. This hurricane of considerable magnitude, was spotted about a week before it reached the Texas-Louisiana coastline. Tracked by the weather bureau, it was possible to give rather extensive warnings. As a consequence, it is estimated that somewhat over half a million residents of coastal Louisiana and Texas evacuated their homes, with perhaps 200,000 of them spending at least part of their time at one of the more than 650 inland shelters that had been set up.[11]

Gross Controllability

Although the range is not as wide as in the case of predictability, disaster agents also differ somewhat in their controllability. Some kinds of disaster agents lend themselves to control, e.g., floods or forest fires. At least in the long run if not the short run it is possible to take actions which will neutralize the disaster agents involved. In the case of floods, dams can be built over the long run and spill-off

procedures and raising of levees can be undertaken over a shorter period of time. In the instance of forest fires or mud slides, engineering activities can be undertaken that will prevent such events from occurring or at least will confine them to a very narrow area if they do occur. Other disaster agents, of course, are much less controllable, e.g., tornadoes, severe storms, and earthquakes. Even some of these agents, through such procedures as cloud seeding, might eventually be brought under some degree of gross control although at present that is outside of the limits of man's current knowledge and technology.

The degree of gross controllability that is visualized will have some effect on the warning that is possible and probable. For example, if it is thought that the disaster agent is potentially controllable in a given situation, there may be a reluctance to warn and alarm people. In some flood cases studied by DRC an element of this probability seems to have been operative and affected warning that was issued. In other instances, it is the matter of the possibility of control rather than probability that influences what occurs. If no control is thought possible, then it is very likely that warning messages will be issued or residents of an area will pick up threat cues on their own and act accordingly. Thus, when the largest dam in the area was thought to have broken, about a quarter of the city residents of Port Jervis, New York went to high ground.[12]

In a highly truncated fashion we have tried to indicate what dimensions of disaster agents are likely to be most salient in warning. We have treated each of the characteristics of disaster agents separately and individually. However, it is necessary to note that they may have different effects when taken cumulatively or in conjunction with one another. Insofar as warning is concerned, certain aspects may be magnified when they occur together, or in some cases they may actually neutralize one another. For example, it might be hypothesized for reasons implied in the last few pages that warning would be most difficult and ineffective if the disaster agent were infrequent, had non-obvious physical consequences, was rapid in onset, involved a short period of forewarning, was of lengthy duration, had very wide scope of impact, extremely high destructive potential, and both little gross predictability and gross controllability.

The Warning System

The framework in which warning is conceptualized in this work is that of a systems approach. Warning is viewed as a process that is the product of a system. The process has certain stages, for example, detection, prediction and dissemination. The system has certain components, for example, police departments and civil defense organizations. These stages and components are singled out for analysis, but it should be kept in mind that we are discussing ongoing processes rather than accomplished acts and interrelated parts of a system rather than discrete entities.

Disaster warning conceived in such a manner helps to explain the interdependence of various activities which comprise it. Thus, we become aware of the possiblity that an inadequacy, or breakdown, in a certain part of the disaster warning process may result in the failure of the system as a whole. Similarly, a modification in one aspect of a warning system may result in change in another part of it.

The desired consequence of a warning system is, of course, a successful public response -- a response which, given the maximum preparatory, protective behavior on the part of those who reside in the target area, may limit the devastating effect of the agent. Such a response occurs only to the degree that each of the parts of a warning system makes an adequate contribution to the process.

In order that "problem" areas may be identified, some of the more important aspects of the warning system are presented here in outline form. There are a number of references in the literature that treat this subject rather thoroughly.[13] Therefore, we will use only enough detail to give the reader some sense of the systems' approach.

In its simplest form, the warning process may be conceptualized as consisting of three parts: (1) forecast, (2) dissemination and (3) response. Figure 1 presents a diagram of the warning system.[14]

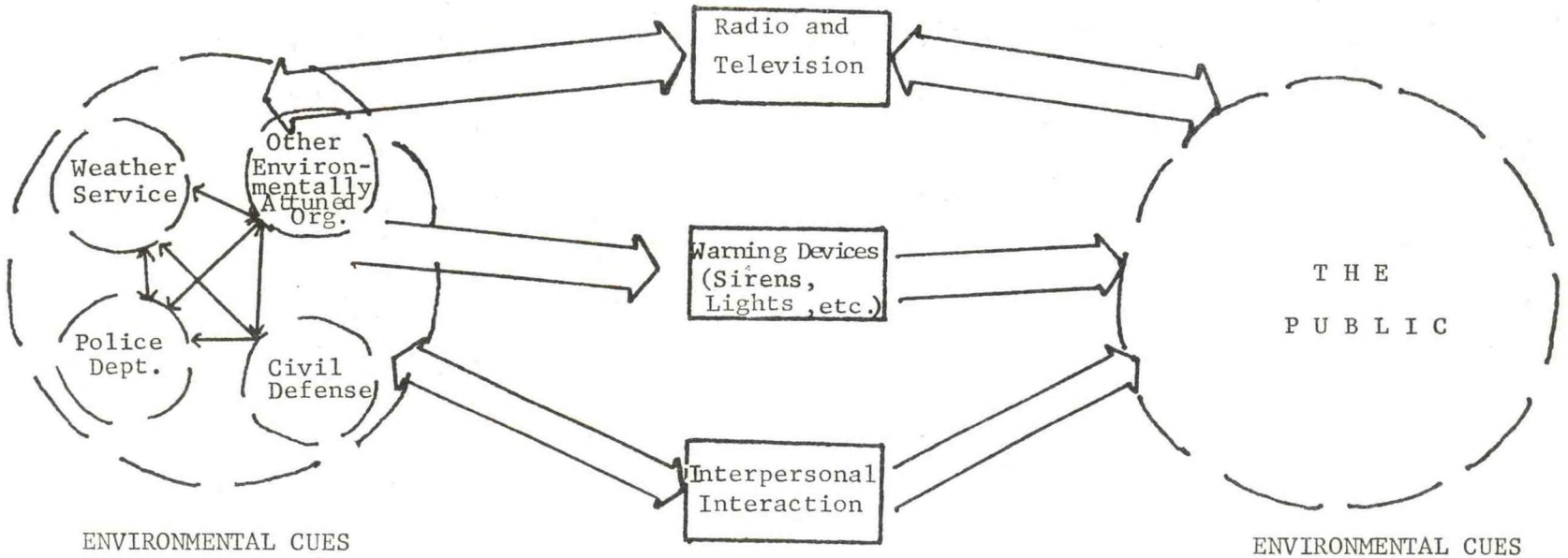
The forecast stage of warning is that stage in which "environmentally attuned" organizations are involved in the collection, collation and evaluation of threat data. The input at this stage may be from the local organization or from some external organization, for example, the Weather Service Office (WSO) may receive word from Severe Local Storms (SELS) or from National Hurricane Center (NHC), depending on the type of disaster agent. The output is a warning message sent to disseminating agents, for example, mass media, warning devices, schools, etc.

The dissemination stage warning involves the passing of warning on to those individuals and groups who need to be informed. Of the many aspects involved in this stage, the following three appear to be particularly salient: the decision to warn, the dissemination of warning and the warning message.

The response stage of warning includes such phases as reception, interpretation or evaluation, reinforcement, action and feedback. Those receiving the message may be thought of in community, group or individual contexts.

Figure 1 presents a diagram of the warning system. Subsystem "A" includes those organizations that as a part of their day-to-day functioning are "environmentally attuned" and are usually involved in forecasting and deciding to disseminate warning messages. These organizations form an "open system," are interrelated both through reciprocal functions and

FIGURE 1



THE WARNING SYSTEM

communication channels, and have external ties outside of the community to state, regional and national organizations. Initial warning cues often enter the warning system as inputs at this point. These inputs come from (1) information received by these organizations from external community organizations (e.g., SELS and local weather bureau) or (2) from directly perceived environmental cues. The channels along which the warning message is communicated from "A" to the public "C" is labeled "B." These channels of dissemination are (1) radio and television, (2) warning devices and (3) interpersonal interaction. It should be noted that the public, "C," also may receive warning cues directly from the environment by direct observation. The three main warning stages of forecast, dissemination and response roughly correspond to the system elements "A," "B" and "C."

The forecast, dissemination and response stages may each be thought of as subsystems of the larger warning system. Each has its inputs, outputs, controls, filters, etc. Because of law, history, appropriations and expertise, organizations hold responsibility and become involved in particular parts of the system. For example, the NWS is involved to a greater extent with forecast than response, and Office of Civil Defense (OCD) and Office of Emergency Preparedness (OEP) are involved with response rather than forecast. It should become clear, then, that one of the central problem areas in warning is that of linkages, or interfacing, between the organizations specializing in particular subsystems. In other words, one of the central problems in warning is making a total system from a number of subsystems. There are legal, traditional, appropriational, expertise, personality and contextual (environmental) concerns to be considered in bringing these subsystems into an efficient warning system.

Summary and Implications

Much of what has been discussed in this chapter will be referred to at various points throughout the report. At this time, however, a few summary statements and implications may be helpful.

The terms, warning, disaster and system are used often and the general assumption seems to be that we know their meanings. In order to discuss these terms most effectively throughout the report it has been necessary to spend some time defining and clarifying the concepts. The purpose of doing this is for more than an academic pursuit at conceptual clarity. The more basic reason is that lack of clarity about such matters as what warning and disaster mean has hindered effectiveness of warning in many disasters. Clarification of these concepts is a necessary condition for the building of a more efficient and effective warning system.

It is necessary for the NWS to appreciate the fact that warning means alerting people to danger and giving them some information about possible alternative protective actions. There is a tendency for professional

meteorologists to concentrate on the dimensions of the disaster agent and less on the second part of warning, that is, protective action. In addition MICs should be trained to understand the social-psychological and situational variables that can effect response to warning.

Another necessary condition for effective warning is that NWS personnel realize what they are warning people about. Meterologists and hydrologists work most closely with the disaster agent, but the concept of disaster means much more than that. The physical impact and social disruption created by the physical event are just as important. For example, it is helpful for the recipient to know that a certain velocity of wind will cause a particular heighth of wave action on top of a certain tide level and that all of this offers a physical threat to given areas. All of these things in combination may cause social disruption, but there are a variety of protective actions that individuals, groups and populations may take to lessen the chances of that social disruption. If all of these aspects of disaster are not considered, the warning will be less successful because it will be incomplete.

Knowing the most important characteristics of disaster agents should allow the NWS to build alternative and flexible warning systems. And placing all of these within a total system perspective should alert MICs and others to the importance of working effectively with other organizations and groups. The NWS can not be responsible for the entire system, but it must be aware and act as a catalyst. If this is not done, all the internal efficiency imaginable will not lead to a successful warning.

CHAPTER III

A GENERAL CRITIQUE OF WARNING LITERATURE AND OPERATIONS

Introduction

> Warnings convince those in danger, and thus are successful, because communication takes place among organizations, groups and individuals. No mechanical system--no matter how sophisticated--appears at the present time capable of replacing the human in this process.[1]

> You just can't get to people when they aren't listening.[2]

The two quotes cited above, the first from a social scientific study of a warning system and the second from a NWS survey report, point to a common theme in the literature on disasters. That is, there is much more to effective warning-- that which moves people to protective action--than simply sending a well worded message. Indeed, it is a cliche in disaster literature that a warning sent is not necessarily a warning received, and we may go on to say that a warning received is not necessarily a warning acted upon. Seemingly, many of the problems involved here are not mechanical but human.

The emphasis of this section of the report will be on the human aspects of the system. The critique will remain on a very general level and the discussion is from the perspective of the NWS role in the warning process.

The first three general observations have to do with the nature of the population receiving the warning and the last four are concerned with the organizations that are responsible for issuing warnings.

General Observations

A number of general statements about key variables to be considered in the warning system are discussed in the remainder of this chapter. For the most part, these generalizations have applicability to a number of stages in the warning process, i.e., forecast, dissemination and response. They also have applicability to a number of subsystems within each stage, i.e., intraorganizational, interorganizational and public.

1. Communication Models

It would appear that "warning disseminators too often assume a simple stimulus-response (S-R) type of communication to be adequate."[3] A more

satisfactory communications model is a stimulus-actor-response (S-A-R) model. In this model, a stimulus (for example, a radio broadcast) is sent to and received by an actor who brings his present situation and past experiences to bear in deciding whether danger exists and the proper response to take.

The S-A-R model has greater utility than the S-R model, but it is also more difficult to apply. Charles Fritz outlines the kinds of considerations used by an actor in deciding whether danger exists and the proper response to it.

> Many of the difficulties in obtaining the desired response to warning stem from an oversimplified conception held by persons issuing warning information. They often conceive of warning as a direct stimulus-response type of communication, in which the person issuing the warning gives the signal "danger" and people automatically respond as though danger were imminent. This view ignores the many social and personal influences that enter into people's interpretation of danger and their response to it. In deciding whether danger exists, people use their past experience ("the tide never got higher than that before"); their present direct perceptions of the physical environment ("it looks like just another bad storm"); their perceptions of how others are responding ("Nobody else seems to be doing anything about it"); and their comparison of their own information and perceptions with people who are significant to them in their daily lives ("Tom says he thinks we had better pack up and leave right now").
>
> In deciding how to respond to a danger signal or warning message, people also take into account the nature and strength of the threat (Will it strike here or elsewhere? Is our life in danger or just our property?); the time before onset (How long do we have before it strikes?); the effectiveness of available countermeasures (What can we do to protect ourselves and how much good will it do in reducing or preventing our losses?"); and the cost ("How much will it cost--in time, effort, personal sacrifice, or money--to take the available countermeasures?"). In an inexperienced or untrained population, the outcome of this complex process may or may not result in the public responses intended by the warning agent.[4]

The considerations listed above represent only a partial list of the kinds of questions the sender of the message must consider. Their relevance has been shown time and again, and there is evidence to support the claim that warnings have been made less effective because they were not given adequate consideration. This, then, raises the issue of whose responsibility it is to address these kinds of questions.

Obviously, a list of questions such as those cited above cannot be answered on the spur of the moment. Such a list is difficult to address

during normal time operations, and nearly impossible with the increased workload that a disaster threat brings. There is, then, the need for prior planning so that these important considerations will not be on an ad hoc basis. In that planning, an S-A-R model of communication would seem to be far more satsifactory than an S-R model.

2. Normalcy Bias

Among the many considerations, the disaster planner and disseminator of warnings must take account of is what we have termed the "normalcy bias." By normalcy bias we mean the tendency of people to err on the side of normalcy. People interpret signals of warning within a framework that suggests conditions are all right until proven otherwise. Williams says that "the burden of proof seems tobe on the warning system."[5] Fritz says: "Even where the existence, nature, and time of the danger can be adequately forecast, it is difficult to secure public acceptance of warning messages. People tend to seize on any vagueness, ambiguity or incompatibility in the warning message that enables them to interpret the situation optimistically. They search for more information that will confirm, deny, or clarify the warning message, and often they continue to interpret signs of danger as familiar, normal events until it is too late to take effective precautions. In brief, most people would rather believe they are safe than in danger; and the burden of proof that danger is imminent rests on the people, agencies, or systems that disseminate the warning."[6]

Even when the warning message is as free of ambiguity as possible, there are difficulties presented by the normalcy bias. The recipients will seek further confirmation of the credibility and urgency of the message. This is done in a number of ways, only one of which is the issuance of further messages. People who are at home will often check to see what action their neighbors are taking, and people who are in a work or school setting will generally wait for some cues from the organization. In the absence of these cues the tendency is to interpret the situation as normal.

3. Group Orientation and Individual Orientation

A third general concern is the question of the kind of audience to be reached by those concerned with warning. Should appeals be addressed via mass media asking for individual action or should there be greater effort at group actions.

Charles Fritz[7] suggests at least two basic reasons for "non-compliance to hurricane warnings and advisories." First, there is non-compliance because "the information, perspectives, value systems and definitions of the situation of the intended recipients of the warning messages differ from those possessed by the persons responsible for detecting the danger

and disseminating the warning."[8] This, of course, is a large part of what this overall report is all about, that is, calling to the attention of people responsible for warning some of the key social variables to be considered in warning. Some attention has been called to these variables earlier in the report and they will be referred to in later sections.

The second reason for non-compliance "is the error of assuming that disaster preparedness and warning programs should be based on appeals to people in the mass to undertake self-protective actions."[9] It is this second reason that is discussed in the next few paragraphs.

> Programs designed to prepare people for uncertain future threat must compete in the market place of immediate and pressing human concerns--the day-to-day problems of earning a livelihood, protecting oneself and family members from the daily dangers to life and health, and securing recognition, response, and status in relations with members of one's personal community. This competition is adherently unfavorable to communications that are oriented to the future rather than the present. This is especially true when the future conditions referred to are unpleasant or painful to contemplate, when there are no present societal rewards for the personal costs and sacrifices involved in making preparations, when there is no way of realistically testing whether preparedness measures are effective, when there seems to be additional time before one has to make a decision, and when there is no apparent way to come to grips with the problem in terms of present resources or manageable units of activity.
>
> Both the studies of natural disaster and the public opinion surveys on civil defense readiness have consistently shown that less than ten percent of the population will build shelters or take other realistic preparatory measures for future disasters when the program of preparation rests primarily on individual initiative. Follow-up studies of both public and industrial accident-prevention programs have produced similar results.[10]

If Fritz and others are correct, and the evidence seems to indicate that they are, there are a number of implications that may be drawn from their position. Any amount of warning that relies too heavily on mass appeal in an attempt to secure individually-motivated self-protective action is bound to fall far short of its goal. That is <u>not</u> to say that the individual has no responsibility, nor does it imply that there is no effective action an individual or family can take to protect itself. It does speak, however, to the ordering of priorities. More attention needs to be paid to a number of means of communication in addition to mass media. It suggests also the importance of developing community plans and organizational support. And it brings us back, once again, to the importance of system planning. It may not be the responsibility of the NWS to make the whole system go, but it is most important that some agency, or consortium of agencies, prepare in this direction.

4. Limited Perspective

Ernie Pyle once commented that war was that which was five feet on one side of you and five feet on the other. This same type of perspective problem often takes place in disasters. For example, one of the communications problems encountered in disasters is that messages may not be sent because the increased demands within organizations put strains on personnel so that they have little time left for thinking beyond their own duties. This may occur within organizations, e.g., one division does not let another division know about the emergency, or between organizations, e.g., the ambulance service personnel are so busy preparing for possible calls that they do not think to notify hospitals in the area or assume they have been warned by other organizations.

There is increased workload within the organization in times of emergency. Added to this are the convergence of outside inquiries and calls following the issuance of the initial watch or warning message. This is particularly true in the case of disaster agents that allow for a lengthy warning period, e.g., hurricanes. Extra demands put a strain on essential duties such as interorganizational liaison, and the maintenance of a broad perspective that includes more than the most immediate tasks to be performed. A special effort must be made to maintain an appreciation for the total system and the kinds of duties that are performed there.

An example of a program addition that met the kind of problem discussed in this section is one describing the public information and operations during Hurricanes Fern and Edith in 1971.

> During the two recent hurricanes, Fern and Edith, a very effective link was added. Mr. Bice, Regional Preparedness Meterologist came down to assist us. We found the ideal place for him was in the civil defense headquarters. He remained throughout most of the storm intervals at the headquarters. He was continuously and immediately available to respond to questions regarding meterological questions and of course stayed in close touch with us regarding locally unique problems utilizing the civil defense communications. He appeared on television in innumerable two or three minute spots, sometimes there were several in an hour. Often he appeared with the civil defense director or with some other official.
>
> The entire area response was one of appreciation to the NWS for this man's services. We have always had additional help from the Southern Regional Headquarters when we needed it, but this is the first time the people were aware of it. Public officials, the news media, industry and the general public were impressed by this direct and continuous availability.

> On the basis of this recent experience, especially, I would recommend a similar public information help from the Southern Region Headquarters. The fact that a station has a small staff does not necessarily indicate that a small population or few news media need service. The effectiveness of a continuously functioning public information officer that could be free to serve as Mr. Bice did cannot be minimized. There are some problems because the "imported" man may not be aware of local problems and people. However, by getting briefed first and often by the local staff, and by using the kind of judgment exercised by Mr. Bice, the end result is a great gain in public relations and a more effective warning system.[11]

The use of outside personnel, the use of noncritical personnel within the organization, or similar type planning may help meet this common communications problem. Specific ways of handling these difficulties may vary with the structure and staffing of the particular weather office and the type of emergency, e.g., tornadoes and hurricanes, but the principle is the same. In order to assure proper intraorganizational, interorganizational and public communications and program linkages, it is good to have particular personnel, free from other duties, concentrating on this aspect of warning.

5. From Plans to People

We have been discussing models of communication and a few of the obstacles that sometimes hindered effective warning. In each section there has been an explicit or implicit conclusion that planning is essential for successful warning. This section discusses the importance of disaster plans.

E. L. Quarantelli, in summarizing the discussions at the Hurricane Preparedness Conference, writes "Most panel members felt that the most general and basic answer to the question of why there is public noncompliance to hurricane advisories and warnings is a simple one: erroneously conceived and inadequate disaster preparedness plans and organization."[12] The same report makes a number of recommendations that explicitly or implicitly refer to the importance of planning. A selected number of these recomendations are included in the following list:

(1) Prototype plans, messages, and programs for alerting the public to messages, and programs for alerting the public to the potential effects of hurricanes and what protective actions ought to be taken should be developed and tested in a joint government and mass media effort.

(2) Such organizations as the Council of State Governments, the National League of Cities, the U. S. Conference of Mayors, and similar organizations should be encouraged to conduct special symposia and seminars on the causes of hurricanes (and other disasters), with special emphasis on the human and social problems involved in warnings about such potential threats.

(3) Emergency organizations should encourage, by whatever means possible, officials at all levels of government to take leadership in disaster planning.[13]

The importance of plans is recognized by professionals responsible for warning within the NWS. The following "Suggestions for Strengthening your Hurricane Preparedness Program" were among those sent to "All Coastal Offices" in the Southern Region of the NWS.

(1) Encourage local officials to develop adequate preparedness plans where this has not already been done.

(2) Emphasize the importance of authoritative leadership for effective execution of plans during emergencies.

(3) Encourage local government to provide an emergency operations office during hurricane emergencies.[14]

Authorities who have written on disasters both from within particular organizations and those writing from a more detached academic perspective have suggested the importance of plans and planning. Each of the previous sections of this report in discussing such subjects as Groups versus Individuals, Normalcy Bias, and Communication Models has reinforced the idea of the importance of planning as a necessary condition for effective warning. These plans are for the purpose of bringing the people to the place where they will respond to a possible threat in the most effective manner possible. This is the goal and, of course, it can only be approximated. Nevertheless, it seems that the best way to approach the goal of adequate response is to develop plans that will adjust to people, that will be flexible enough to meet the situation and to be sure that these plans are updated, rehearsed, and known by those who are responsible for carrying them out. A few generalizations may be made about the importance of planning and some general principles that apply to plans and planning. Some of these are listed below.

(1) Plans should be adjusted to people rather than people being expected to adjust to plans. This is much more than an academic distinction. Among the difficulties encountered in actual disaster situations have been those where plans were written by authorities who had unrealistic expectations about the public. It is much more realistic and, frankly, just much easier to adjust the plans to fit the population as it is than to try and do things the other way around.

(2) Plans should be kept as general as possible and as flexible as possible. The matter of generality is one that might bring some debate, but the principle suggested here is that a community can develop a set of plans for a particular type of disaster that has enough generality that it can be applied to other types of disasters. This is particularly important for communities that are subject to more than one type of natural disaster threat. To coordinate one plan well is a major task, and to have too many and too elaborate plans can become dysfunctional. Flexibility should also be kept in the plans in that it is an almost certain thing that every disaster will bring unanticipated tasks and relationships and there will need to be some room for flexibility.

(3) Disaster plans should be built around as realistic a picture as possible of what actually happens in a disaster situation. Disasters frequently create new tasks of undeniable immediacy which must be accomplished if the community is to continue to exist and function as a viable entity. This is true of all stages of the disaster including the warning stage. There has been enough research done on disasters that a number of empirical generalizations about disaster behavior may be anticipated and taken into account when drawing up plans. For example, it would appear from the present evidence that there is little fear of panic of the population when they are warned of impending disaster, therefore, authorities in preparing for the warning stage would do well to know this and not be overly concerned about it. Similar things could be said about other aspects or parts of disaster planning. In order to have an understood and agreed upon division of labor among different groups and organizations in disaster, disaster plans should take into account and assign the tasks that commonly occur in community crises. These assignments of tasks should be brought as close to meeting what available evidence would indicate are the possibilities in a disaster situation as is possible.

(4) Disaster plans must be more than paper plans, that is, they must be constantly revised and they must be regularly rehearsed. To be effective, disaster plans must be subjected to regular review and revision. All plans have to be up-to-date to be of optimum use and value in coping with crisis. It is not unusual for disaster plans to be of limited value during a crisis because they have not been given any attention since the time they were first formulated. Disaster plans frequently remain unrehearsed in similation exercises. Through lack of practice, gaps in the plans and ineffective aspects in disaster preparation remain undetected. These quickly appear in the time of disaster and crucial time must be taken to make compensation for inadequate arrangements. Regular rehearsal does appear to have some success in familiarizing communities with the nature of the plan and the possibility of disaster. In

Topeka, for example, yearly disaster similations are held to coincide with the beginning of the tornado season, and in this community the disaster plans were very effective during the tornado crisis of 1966.

(5) Some disaster plans stress the physical aspects of disasters and pay insufficient attention to the social-organizational aspects of disaster response. For example, in one western city, sand bags had been stored in accessible locations and plywood barriers had been errected throughout the community, but the disaster plan did not include arrangements for coordinating the arranging of these supplies in their proper place. The scope of disaster plans should be sufficiently broad to encompass the social-organizational as well as the physical contingencies of disasters.

6. Community Structure

A number of conditions are necessary in order for a community to function effectively. Certain equipment, such as radios and radar, are necessary for the gathering of data and there must be well trained and efficient personnel filling the roles within the community. Another condition is that a well thought out and worked out structure be set for the governing of these personnel and the use of the equipment. A number of suggestions may be made to help this structure become more effective.

(1) Successful communications during disasters are more probable when they are a continuation of normal time patterns. This means that contacts that are to be relied upon in disaster periods ought to be contacts that have been established in normal time operations. To establish new patterns consumes critical time and energy that is needed elsewhere. Parr[15] suggests the immediate problem in a disaster situation is neither uncontrolled behavior such as looting nor intense emotional reaction such as panic, but deficiencies of inter-organizational coordination. This same principle applies to the warning stage prior to impact of the disaster agent, that is, there is a need for many rapid interorganizational contacts and decisionsto be made. These are made much easier and more efficiently when they are between personnel who have had prior contact in normal times.

(2) A second structural matter about which some attention should be paid is that of authority structure. There are decisions to be made throughout the warning process. Who is to be warned? What means of warning are to be used? What information should be passed along? These questions and a number of others must be asked at each stage and it should be clearly understood who has authority to answer them. Linkages between subsystems have

presented a number of problems where they were not clearly defined. The community authority structure should be clearly understood by all those involved.

(3) High turnover of personnel in the positions within the warning system creates a problem in the development of an effective warning network. This underlines the importance of constantly revising and updating plans and parts of plans, such as calling lists. It also underlines the importance of a training system for people coming into new roles. New people need to establish working relationships with others in the plan so that they will be able to function efficiently in time of stress.

(4) Bureaucracy tends to become routinized and rigid, whereas, emergencies call for flexibility. Part of the nature of the bureaucratic system is that the authority of various offices is limited by rules. There must be care that the structure of the system is given special flexibility in time of emergency, so that parts of the system may be free to improvise to meet new situations as they arise. For example, in any number of disasters radio stations have gone off the air because of Federal Communications Commission regulations. It would have helped for these stations to be made aware of the special conditions under which the FCC allows stations to stay on the air after their regular hours.

7. Jurisdiction

One of the problems that this general discussion keeps coming back to is the area of responsibility of the NWS. It is obvious that the NWS cannot be responsible for the entire system, but by default it has stretched its area of responsibility and taken some obligations upon itself to establish effective warning systems. This then raises the questions of the historical and legal role, the present functioning, and the future directions of the NWS. If the sub-systems that are a part of the total warning system are to increase in their effectiveness then a number of these jurisdictional problems pertaining to linkages must be studied and suggestions made concerning them.

Summary and Implications

A number of general observations have been made in this chapter. They have been culled from the social scientific literature, from NWS published reports, from intraorganizational communications, and from conversations with NWS and other disaster relevant organizations.

The first three generalizations have to do with the nature of the recipients and the situational contexts in which warning is received. These are, in one sense, the givens which set parameters within which the NWS and other disaster related organizations must work. It is highly questionable whether they can be changed to any great extent. It would seem to be a more useful approach, then, to adjust the plans and organizations working with the warning system to the existing situations.

The last four generalizations address themselves to the question of adjustments that are essential to bring disaster plans and organizations into the most effective posture for working within the given parameters.

It is clear from what has been said in relation to the first three generalizations that those responsible for warning cannot assume that a clearly worded and properly issued warning message will result in protective action by the population. There must be constant attention paid to the different audiences and actors through which the warnings must be filtered. It is also necessary to be aware of the normalcy bias, and the problems of attempting to move people to action by mass appeals to individuals. All of these difficulties point to the importance of providing for confirmation of the warning and the availability of ready assistance for those who need help in taking protective action. For example, emergency organizations such as public safety departments should inform people by sirens and neighborhood canvassing where possible. Organizations such as schools, factories, retail stores and offices should have plans for warning employees and customers and providing for their safety. These are but a few of the supports available to reinforce the warning message.

The most feasible way of handling the difficulties suggested in the first three generalizations is through planning. The development of realistic preparedness programs (including the development of an effective warning system) must start with the recognition that adequate disaster preparation resides in system planning and management. In the building of an effective system it becomes clear that it is far more reasonable to adjust plans to suit the characteristics of the population and to mold disaster relevant organizations around people as they are than to try and make the population fit an inflexible plan. The proper question to be asked in this connection is not, "Why didn't people respond to our plans, but where did our plans fail to mesh with the population?"

The implementation of disaster planning is a difficult and time consuming task. Whose job is it to encourage the development of warning plans and the implementation of these plans? The NWS has always been instrumental in encouraging local communities to develop warning systems. MICs and members of their staffs have spent long hours working with community groups in an effort to encourage them to develop programs for disaster threats. In order to continue and strengthen these kinds of actions there should be intraorganizational and extraorganizational

supports made available. For example, intraorganizational supports may include such matters as time credits for staff members working with outside groups and organizational rewards for the development and maintenance of efficient plans. If there is evidence that the NWS places enough importance on these activities to build them into its reward structure, this should certainly contribute to keeping planning a high priority among staff members.

In addition to the intraorganizational supports that may be used to encourage programs, there are some extraorganizational helps available. These resources should be recognized and advantage taken of them. For example, Public Law 91-606 and the strengthening of the Office of Emergency Preparedness under the Executive Office of the President add legislative and executive weight to the importance of disaster planning. Part of this Law includes matching funds for states that would develop plans and update plans. Part of the role of OEP is to lend support in the form of personnel to the drawing up of plans. It seems that while this Law refers to disaster planning in its total that warning is a part of that and that this might make a good resource for the NWS to tap into and use in getting community support for its warning programs. These laws and these executive decisions ought to be pursued in that they hold a great deal of promise, and this is exactly where many of the needs of the warning system exist, that is, in the organizational and legislative vacuums between parts of the system.

This chapter has dealt with some very general observations about warning. In the next chapter we will look at the system in terms of its various stages, that is, forecast, dissemination, response and feedback.

CHAPTER IV

AN ANALYSIS OF THE WARNING SYSTEM: STAGES, SUBSYSTEMS AND INTERRELATIONSHIPS

Introduction

A detailed elaboration of the warning system could fill volumes. What will be attempted in this part of the report is the highlighting of a number of particularly important aspects of the total system. Warning is divided into three major subprocesses: forecast, dissemination and response. Each of these stages has a feedback loop. The issue of feedback is so crucial, however, that there is a separate section in which the subject is discussed. A further implicit subclassification of the system is into intraorganizational, interorganizational and public subsystems. While there are separate sections in which the major divisions into forecast, dissemination, response and feedback are examined, discussion of the subclassifications of intraorganizational, interorganizational and public subsystems is not explicitly discussed. This chapter, then, is divided into sections on forecast, dissemination, response, feedbacks, and summary and implications. Figure 2 outlines the major divisions of the chapter diagrammatically.

Figure 2

	Forecast	Dissemination	Response	Feedback
Intraorganizational				
Interorganizational				
Public				

THE WARNING SYSTEM

Forecast

The forecast stage of warning is that stage at which "environmentally attuned" organizations are involved in the collection, collation and evaluation of threat data. The input to this stage may be from the local organizations or from some external organization, for example, the Weather Service Office (WSO) may receive word from Severe Local Storms (SELS) or from the National Hurricane Center (NHC), depending upon the type of disaster agent. The output is a warning message sent to disseminating agents, for example, mass media, warning devices, and schools. This is the part of the warning system with which the NWS becomes most involved. It is also the part of the system that a number of reports, both those written by NWS personnel and those written by independent research organizations, suggests is the most efficient part of the total system.

We begin this section accepting the fact that there are given parameters of accuracy of weather prediction. There does not seem to be any promise of spectacular breakthroughs in prediction accuracy in the near future. Cooley and Derouin[1] suggest that during the past two or three decades there has been progress, though sometimes slow, in forecasting accuracy. Simpson[2] suggests a similar evaluation of the specific area of hurricane forecasting. There appears to be some concensus that progress in the next several years will continue to follow a similar pattern of steady but slow progress. We begin, then, with certain limits placed on information inputs at this first stage of the warning system. This presents a problem for the system, but it is only one of a number of problems. Some of the key concerns related to the forecast stage of warning are discussed in the following paragraphs.

1. Balanced Forecasting

The constant goal of the forecaster is to reach the place where he neither overwarns nor underwarns. Of course this is a goal that can only be approximated. There are penalties to be paid for erring in either direction. The penalty for overwarning is the insensitizing of the population. The consequences of underwarning are loss of life and property. There are, then, consequences for erring in either direction, but the more serious of these would seem to be the consequences of underwarning.

2. The Message

No amount of work on refining the message will guarantee an effective warning. That does not mean that the message is not a very important aspect of warning. Our critique of forecast message will be centered around three themes: content, medium and source.

(a) Content

The content of a message is something that needs continual work. There is a constant danger of assuming too much knowledge on the listener's part. The content should be as specific and complete as possible. For example, following Hurricane Camille, the criticism was made on the Gulf coast that many of the listeners did not comprehend what wind velocity and tide levels in combination can do. It was suggested, after the fact, that it would have been helpful if the general public had been made to understand that the predicted tide level, in combination with the high velocity winds, would produce waves of a higher and more destructive magnitude than any storm ever experienced by the present population. To those familiar with the subject it was obvious what this combination could do, but to the layman it was not so obvious a fact. It may not be possible for the NWS to write the content of forecast messages to fit every possible audience, but personnel should be sensitive to the needs of those receiving the forecast.

There should be the use of layman's language. In some reports on warning, particularly in the case of tornadoes, there has been some questioning of the number of terms used in the overall warning process. For example, there is some evidence to indicate that the distinction between tornado WATCH and tornado WARNING is not understood by the majority of the population. In more than one report it has been suggested that still another category is needed to convey a sense of urgency about the potential threat. The essential point being made here is not whether these specific examples are to be answered one way or another, but that language must be kept clear and nontechnical.

Other concerns relating to the message include the matter of consistency. The information should be consistent and free from ambiguity and contradiction.

Where possible, an effort should be made to tie the message to known landmarks, phenomena and experiences of the population being warned. For example, rather than giving abstract heights of tides and wave action, it might be helpful to tie these into specific landmarks. The people living in a specific community may be told that water may reach the second story of the downtown post office. It was suggested in a panel at the Hurricane Preparedness Conference in Miami in 1972 "that if a hurricane threatens to exceed in violence previous storms experienced in the past in the same area, this fact should be emphasized in all public advisories."[3]

(b) Medium

The NWS has made great strides in automating the transmission of forecasts. Teletypewriters and VHF beam weather information almost instantaneously. There are automatic transmission systems that have the advantage of being continuous, rapid and immediate. These systems seem to have the disadvantage of giving a certain unwarranted sense of security about forecasts being received and acted upon. There is evidence that forecast warnings have run from teletypewriters into wastebaskets unheeded by radio and television personnel. This is a particular danger where small stations are working with limited personnel. Automatic systems can only be as effective as the personnel who use them.

The speed with which the forecast is gathered and sent is of great importance. At every stage of the warning process there are decisions to be made. These decisions must be made in time to give the population the ability to prepare. Delays at the forecast end may be compounded by delays at the dissemination and response stages until effective preparation is no longer possible. This appears to be self-evident, but it needs to be emphasized in that in a number of disasters proper preparation was hindered by delays in sending warning messages.

The format with which the message is sent is also of great importance. In some cases the format is seemingly more important than the actual content of the message. For example, in one study of a series of tornadoes it was found that a number of stations made spot announcements of warnings and then went back to their regular broadcast format. Stations that broadcast warnings and also went to special broadcast format reinforced the importance and urgency of those warnings. A normal time format of broadcasting would seem to deny the urgency of the situation.

(c) Source

The source of information should be official and authoritative. Appropriate steps are needed to increase cooperation between media personnel and weather forecasters. It appears to be helpful to have broadcast media establish direct feeds from Weather Service Offices (WSOs) and/or other official sources of emergency information within the relevant areas or communities.

3. The Decision to Warn

At several stages in the warning process there is a decision to pass the warning along to others. During this stage, the decision to warn

means forecasters must pass along information that may not be unambiguous, consistent or complete. Given the present development of the science, it becomes necessary to pass warning along before the NWS can be certain about all the dimensions of the disaster agent or its possible effects. This has a number of consequences for those involved in later stages of the warning system. Some of those consequences will be discussed in the section of the report dealing with dissemination.

4. Feedback

The importance of feedback at each stage in the warning process cannot be overemphasized. Feedback may be thought of as short term and long term.

Short term feedback is that which comes back from the field immediately prior to disaster impact, and gives information about the interpretations and actions of the recipients. This is the basis on which new warnings, corrected in terms of responses to the first warning messages, may be issued. This is easier to do in certain types of disasters than in others. For example, feedback prior to a hurricane threat would be easier to establish than feedback prior to a tornado threat.

Long term feedback provides similar kinds of information about the interpretations and responses given to forecasts by the recipients. In this case, however, it is used for long term evaluation and planning for the future.

While this is an important function, it often appears to be on an unplanned and ad hoc basis. It would be helpful to have a planned program for feedback on both the short term and long term basis. Some of the groups that might be included in this are news media, public safety agencies, departments of public works, and the general public. It is only through planned and reliable feedback that one can evaluate the warning system in order to make it more efficient.

5. The Ranking of Disaster Agents

There has been some tentative exploration of the feasibility of ranking disasters. One of the problems that appear in the literature is that of deciding on the seriousness of a disaster threat. The ranking of hurricane threats in forecasts to the mass media is currently being tried on an experimental basis. The intent is to see if a ranking system will help mass media recipients separate the really important warnings from the less important ones. There are a number of possible difficulties with this system, but it may prove to be of benefit. The

possibility of applying a similar approach to the public at some future time should not be ruled out.

6. Summary

Forecasting is the process in which the NWS is most heavily involved and, yet, it is not discussed at great length in this report. There are a number of reasons for this: (1) it is one of the more efficiently functioning processes within warning, (2) to examine the intricacies of the process would demand much more research than the time allotted for this report would permit, and (3) the emphasis of the report remains on the total system. The relative brevity of the discussion does not mean that the forecast stage is not viewed as essential. It is the foundation on which the system rests.

Dissemination

The dissemination stage of warning involves the passing of warning on to those individuals and groups who need to be informed. Among the many objects involved in this stage, the following appear to be among the more salient: the decision to warn, the warning messages and the dissemination of warning. The discussion of dissemination will be divided into sections on 1) the decision to warn, 2) the warning message, 3) the dissemination of warning, 4) problems of dissemination and 5) suggestions.

1. The Decision to Warn

At each stage in the warning process there is the decision to pass information along to the next stage. Nowhere is this more crucial than in the dissemination stage. This is where the information moves from the forecast unit to other units within the organization and to the public.

As discussed in an earlier section of this report, there is a danger in overwarning and underwarning. If responsible officials, after receiving information concerning an emergency, however ambiguous it may be, fail to call for evacuation, they may be held publicly responsible for loss of life and property. If, on the other hand, they call for evacuation too frequently, and there is a long period when disasters fail to materialize, they may be held up to public criticism and ridicule with a resultant loss of effectiveness. Such a problem is well documented in the literature; Fritz's comment is typical:

> When people have had no recent experience with disaster or cannot actually perceive the danger in their immediate surroundings, successful public warning is much more difficult. The difficulties

> often start with the persons or agencies who are responsible for detecting the danger and issuing the warnings. These agents are usually reluctant to issue a specific warning until they are reasonably certain that the danger will actually materialize. In many cases, waiting for this degree of urgency only delays the warning until it is too late.[4]

Nowhere in the warning process is the problem of error in forecast information more crucial than at this juncture. The fact is that those responsible for passing information along must work with information that is of a probablistic nature. The place a disaster agent will strike, the exact time it will strike and the force with which it will impact must all be stated in probablistic language. This means that local officials, those ultimately responsible for warning the public, often must operate with information that is incomplete, when time is of the essence, and when their decisions may have life or death consequences. It is no wonder, then, that local officials sometimes hesitate, and that hesitation may make the difference between a successful and an unsuccessful response to disaster threat.

A number of considerations affect whether local officials will decide to alert the general public and call for protective action; among them are: 1) the nature of the information received from sources outside the community, e.g. the NWS, 2) changes in the community's environment that can be observed locally and can indicate impending disaster, e.g., increasingly high winds and water levels, 3) the past experience of officials, and 4) the anticipated reaction of the public, particularly in the event of a false alarm.

One of the latent functions of community education programs concerning disasters may be that they make the public more aware of the importance of warning and, therefore, more understanding of miscues by officials. While a number of studies have shown that education programs do not have the effect that officials would wish,[5] it certainly seems plausible that they would at least create a certain preconditioning for the possibility of disaster. Thus, they should make the decision to warn somewhat easier.

2. The Warning Message

A number of points arise in reviewing the literature pertaining to the warning message. These points, some of them touched upon in the forecast section of the report, will be summarized in the few pages that follow.

(a) Speed. The speed with which the message is sent is a critical factor. Messages received too late, even though they may meet all the other criteria of a good message, do not allow time for necessary decisions and preparations

by community leaders. Therefore, it is often necessary for the message to be sent even though it does not rank well on the suggested criteria that follow.

(b) Clarity. The message must be as clear and unambiguous as possible. This is particularly true in light of what has been said earlier about the "normalcy bias", that is, people will interpret ambiguous information in the best possible light, thus, tending to take less protective action than recommended.

(c) Completeness. The message should be as complete as possible. The warning should include information about the kind of agent and its characteristics, its estimated time and place of impact, the physical and social damages that are possible and the kind of protective actions that are possible.

(d) Source. The source of the message should be official and well known to the community. Well known newsmen, public officials and NWS personnel have all served in this capacity. There have been difficulties develop in putting NWS personnel on direct broadcasts, but it appears to have merit nevertheless. These kinds of programs have the benefit of reinforcing the message that the situation is serious and urgent.

(e) Consistency. There are a number of messages that go out during a warning. These messages sometime seem contradictory, or at least inconsistent. The series of messages should be consistent so that they add to each other and reinforce each other. They are all a part of one total and, hopefully, consistent warning message.

(f) Balanced. The message should be neither exaggerated nor underplayed. There is a cost for going in either direction.

(g) Broad Based. The message should be written in language that is understandable to a wide range of the population. The audience to which the warning is addressed is quite probably a very heterogeneous population. People vary as to demographic characteristics, language, knowledge and understanding of the threat and situational factors. It is a challenge for any disseminator to word a message that will reach all people that differ on the characteristics just discussed, indeed, it probably cannot be done. For example, there may be a need for foreign language broadcasts and there may be a need for special messages for groups that are socially or geographically isolated.

(h) Explicit and Specific. Messages should be as specific as possible. When talking about tide levels, for example, it may be helpful to refer to the possibility of floods reaching certain well known landmarks rather than talking about flooding in general. A number of the survivors of Hurricane Camille said they had no real comprehension of what the scope and intensity of such a hurricane really meant when translated into concrete occurrences.

3. The Dissemination of Warning

(a) Those responsible for disseminating warning have been criticized in the literature for placing too much emphasis on the technical and mechanical aspects of the system. The criticisms do not appear to be against the use of the most up-to-date engineering practices, but rather they are concerned about an overdependency on mechanical systems. The best of equipment is only effective when it is handled by efficient personnel. Excellent engineering may help to take up some of the slack of an inefficient organization and an excellent human organization may make-up for shortcomings in the mechanical system, but the studies of warnings in disasters indicate that it is a rare instance when either the mechanical system or the human system can do it alone. Each system is a necessary condition for effective warning, but neither is a sufficient condition for effective warning.

(b) There should be more than one medium of dissemination. Not everyone, for example, watches television and relatively few are watching after certain hours of the evening. Sirens, bells, and door-to-door canvassing are additional means that have been used.

(c) It has been emphasized in other sections of this report that it is unwise to assume that a mass appeal stimulus will result in the desired response. In order to increase the chances of the desired response occurring it is important that a number of supporting organizations be a part of the warning system.

(d) The single category of organizations that is most central to warning is the mass media. There are a number of "unknowns" concerning the best means of working with the mass media, but there are also a number of clues to effective use of this medium that may be culled from the existing literature.

(1) The mass media is an intermediary organization, that is, the disseminator of information that is given to it.

Thus, the upgrading of the end product, organizational and public understanding and compliance to warning, is a cooperative venture. This section emphasizes the improvements that may help the mass media perform its task more effectively. Among these inputs are the following:

(a) Commercially produced radio and TV spot announcements depicting the threat and recommended protective actions, to be aired both on a year around basis and at the time of impending disaster;

(b) Topographical maps showing areas vulnerable to various storm-surge levels;

(c) Kits of coded, standby messages from civil defense, police, and voluntary agencies, pre-positioned in radio and TV stations for selective use when the official source gives the "go" signal;

(d) NWS meteorological teams trained in broadcasting techniques -- and freed from operational responsibilities -- who can go on the air when requested to do so by the broadcast media; and

(e) Arrangements for broadcasters and the press to operate out of National Weather Service facilities when the situation becomes critical. Many of these actions are being taken presently, particularly in hurricane prone areas. Perhaps these actions can be expanded.[6]

(2) The effectiveness of the media as a disseminator may be helped by certain actions being taken by the media itself. Among these actions are the following:

(a) The capability to broadcast warning messages in languages other than English if the local population contains a large non-English speaking minority;

(b) The publication, both at the start of the annual hurricane season and at the time a definite threat is perceived, of special newspaper sections devoted to the threat and recommended protective actions;

(c) Balancing information to the public to avoid crying "wolf" while insuring that if a hurricane threatens to exceed in violence previous storms experienced

in the past in the same area, this fact will be emphasized in all public advisories; and

(d) Recognizing that there are -- particularly in metropolitan areas -- transients and newcomers to the community who need special attention because they may not have previously lived in a hurricane-prone area and cannot, therefore, be expected to have even the most basic knowledge of hurricane effects or how to protect against them.[7]

(e) Other matters that may be considered from the perspective of mass media disseminators themselves are such things as the ability to change their broadcasting format. It has been suggested in other sections of the report that change in format emphasizes the importance of a particular warning as much or more than the content of the warning itself. If the threat is important enough to go to special format, then, it is certainly an emergency. Where possible broadcast media ought to take this into consideration. Past experience has shown that it is much easier for a radio station to be flexible in changing format than for a television station, but a number of television stations have also made provision for this change of format, e.g., broadcasting directly from NWS headquarters.

(f) The use of authorities may reinforce the importance of warning. For example, popular television personalities might explain how they have interpreted the warning and what protective action they are taking. People such as government officials or National Weather Service personnel might be brought on to the air to add credibility to the message.

(g) A final matter that might be considered is the question of developing an extra category beyond that of warning. This is stated as more of a research question than a recommendation, but the issue has been raised in the literature and in the Hurricane Preparedness Conference in Miami 1972. There seems to be the necessity of a category of warning that calls to the attention of both the disseminator and the general public the unusualness of this particular warning.

(3) In order to <u>facilitate</u> the kinds of actions discussed in sections (1) and (2) above, there needs to be some reinforcement through public interest and legislative action.

At the present moment mass media participation is completely on a voluntary basis, and the mass media have been quite cooperative about their voluntary participation; but it might be of some help to have legislation that would bring some clarification and standardization to the role of the mass media. For example, legislation similar to that applied to the use of public service time might be used for preparation for disasters.

4. Problems of Dissemination

(a) The effectiveness of the dissemination process can only be determined through an effective system of feedback.

(b) Interorganizational linkages are important as forecast leads to response through disseminating organizations. Some of the systems that appear to work most effectively are those where personnel have had long years of experience in working together. In these kinds of situations smooth working relationships have been developed.

(c) There is not always a consistent set of shared boundaries between WSOs and WSFOs and the mass media. It may be, too, that citizens in a particular threatened area may be listening to broadcasts from a city outside the threat area. In the case of Hurricane Camille, for example, a number of people along the Gulf Coast were listening to a popular New Orleans station. This station was far enough away from the threatening eye of the hurricane that it did not handle some of the emergency warning with the same urgency that the stations located farther east did. Attention should be paid to this kind of difficulty in planning the warning system.

(d) Listening publics and the staffing of mass media organizations vary according to the season of the year and the time of the day. It is rather easy for NWS personnel, who work on an all day and every day schedule, to assume that other organizations do the same. There have been instances when teletyped warnings were not read until after the disaster agent struck because the one or two personnel working on late night shifts for a broadcast station were busy with other tasks.

(e) There are certain aspects of rural/urban differences that are relevant for planning for the disseminating of warning. The differences listed here are in terms of generalities; there may be idiosyncratic situations in particular communities. Difficulties encountered in rural areas are that there are greater

distances between people and this may make for some difficulties in warning. Mass media access is not always as good in these areas particularly television access, although cable television and other mechanical improvements are cutting down this difference. The number of organizations in some rural areas is not great and so there is a greater dependency on one or two organizations. If these organizations do not function, warnings may not go out. For example, if there is one rural sheriff that is responsible for warning and he does not do his job, or cannot be contacted, then the whole warning system may fail to function efficiently.

There are also particular difficulties that tend to arise in urban areas. The greater differentiation in the organizational structure of a community means that there are more organizations that need to respond in concert. This makes for greater problems of coordination and cooperation. There is generally speaking a greater heterogeneity of population and this means that there are differences in population sub-groups that need to be given some attention. For example, there may be foreign language groups, and there may be minorities that are alienated from the more traditional authority structure of the community. There may also be a dulled sense perception in that urban populations receive a number of stimuli daily. And finally, there is the question of sheer population size and the problems that it causes for such things as evacuation. There may need to be more alternatives made available to the public.

5. Suggestions

(a) The potentials of cable television for disseminating information and warnings about natural disasters should be studied to determine the feasibility of allocating a channel for emergency communications.

(b) Information programs, documentaries, and warning messages used in other highly disaster-variable societies ought to be studied to see what applicability they might have to the American scene.

(c) Seminars and planning meetings with government agencies, schools, voluntary associations, and mass media ought to be planned regularly in various regions in order to plan more effectively and develop information input from varied sources.

(d) The relevant warning agencies should develop mechanisms to ascertain whether their messages have been received and how they have been relayed by mass media.

(e) Appropriate steps should be taken to increase cooperation between media personnel and weather forecasters and among media to insure that a coordinated and consistent picture is presented to the public.

(f) Broadcast media, prior to the landfall of a hurricane or the striking of another type of disaster, should establish direct feeds from forecasters or other official sources of emergency information within the relevant areas or communities.

(g) Long-range educational program on disaster preparedness and emergency announcements must recognize and be tailored to the understanding of different classes, deviant sub-groups, ethnic groupings, non-English speaking enclaves, and other different social groups found in most metropolitan area.

(h) Attention in disaster plans and advice should be given to specifying protective actions other than evacuation that ought to be undertaken upon the approach of a disaster.

Response

This section of the report reviews the literature on response to warning. There are a number of references that deal with the subject so that only a few highlights will be discussed at this point. The subject is divided into segments dealing with 1) the desired response, 2) possible hindrances to response and 3) suggestions for improving response.

1. The Desired Response

The desired public response may be broken down into two major headings:

a. accurately understanding the existence of danger;
b. responding in a manner that will prevent, avoid or minimize the danger

On occasion it is not clear what is the desired public response. In a number of situations there may be more than one possible response to disaster threats. Evacuation, and/or seeking immediate shelter, and/or cutting down the impact of the disaster agent (e.g., building dikes) may be desired responses. These responses and the means of making them possible for the general public should be worked out with key organizations and the general public. In any number of disasters alternative responses have not been planned and the individual citizen has had to fend for himself.

2. Hindrances to Response

a. Fritz's[8] generalization that programs that are dependent on individual response fall far short of their goals is well taken. It appears that recommended protective measures are not always matched with the available social settings, e.g., "go to a nearby shelter" assumes the existence of such a facility.

b. It seems rather clear that one of the major difficulties in warning is the lack of coordination between subsystems that comprise the total system. In many instances particular units and individuals have performed their particular tasks extraordinarily well only to have their efforts frustrated by non-coordination with other parts of the system.

c. The matter of legal authority arises in some disasters. In a number of cases officials reported difficulty in convincing people to evacuate. In at least two disaster situations, authorities resorted to ruses to evacuate people. In most areas public safety officials do not have the legal authority to order people to evacuate.

d. There are other general factors that stand in the way of adequate response. These are discussed in the references cited earlier,[9] but they are listed here to give the reader some understanding of the kinds of hindrances being discussed.

(1) Sociocultural factors are those which develop over time and are "peculiar" to a specific group, organization, community or society. They include such dimensions as past experience with disasters, social class, ethnicity, and religion.

(2) The historical setting is another general factor because disaster agents occur in time. Just such matters as time of the day and day of the week can have profound influence on warning. What is an acceptable warning medium in the early evening may be much less effective late at night, e.g., television. A weekend disaster threat would find large numbers of people in the family setting and many organizations reduced in personnel.

(3) The social situations in which people find themselves during warning vary greatly. For example, an employee at work may need little understanding of the threat if his company has an effective plan for preventive action. He may be instructed to take shelter and do so without fully comprehending why. The same employee, when by himself outside the work situation may be in grave danger because of his lack of understanding.

3. Suggestions for Improving Response

a. The use of existing organizations in planning should be given one of the top priorities. For example, businesses, hotels, and churches are accustomed to dealing with groups on a day-to-day basis. These organizations have functioning authority structures, they interact with other organizations on a daily basis, and they are experienced with dealing with the public. It may be good to co-opt such groups into the business of disaster warning. In a similar manner to that in which airlines make safety announcements before each flight, hotels might hand out safety brochures or inform their clientele in some other way about safety factors. This goes counter to the image that some communities are trying to create as havens for sun and sea and undisturbed rest, but these difficulties may not be insurmountable.

b. The response stage of disaster warning needs both short term feedback and long term feedback. Short term feedback should be able to answer such questions as how well organizations are performing and how well the general public is responding. Long term feedback concentrates on general evaluation of the community response. Such matters as interorganizational cooperation, coordination of efforts and the general public response should be evaluated. Recommendations should be developed from long term feedback for the improving of future community response. A good time for change and improvement in community structures is after the appearance of a disaster. At this time the community is sensitive to the need and outside authorities may be brought in to reinforce and build upon that sensitivity. At a point like this these demands seem immediate and communities are generally more willing to expend the energy and cost involved in adequate preparation. An example of this kind of community improvement is the case of Hilo in Hawaii where following one tidal surge the community made improvements in its warning system that were very effective when a second tidal surge struck. These improvements included the following:

(1) improvements of the civil defense emergency communication system
(2) added staff provided for civil defense
(3) improvement in radio broadcasting was made
(4) remote control tidal gauges were set up
(5) delineation of areas or zones to be evacuated were drawn on charts for public dissemination
(6) there was designation of additional shelters for time of emergency
(7) there was the publication of warning and evacuation plans on a regular basis so that the community would be aware of these[10]

Feedback

The subject of feedback has been included in each of the previous sections of this chapter. A few key general issues related to feedback are discussed in this segment. The impression this writer gets from an examination of materials on disasters is that so much energy is placed on the process of forecast, dissemination and response that relatively little planning and few resources are given over to feedback.

Feedback may be of an immediate nature or a long term nature. The increased tasks placed on warning agencies appears to be among the chief obstacles to immediate feedback. People are preoccupied with other duties. There is also a lack of appreciation for the model of warning that views the process as one that has constant feedback loops. The tendency is to view the total process as a chain of events that develops in a straight line fashion from beginning to end.

One of the major difficulties with long term feedback is that it takes on the characteristics of evaluation. Indeed, this is a large part of what it is. Evaluation can be threatening to personnel of an organization. It can even threaten self confidence to the point where individuals are fearful of taking too much responsibility under pressure. That willingness to remain flexible during disaster threats is crucial to effective warning.

Some specific areas for long term evaluation feedback might include the following:

(1) evaluation of VHF radio warning network;
(2) evaluation of NWS teletypewriter usage by mass media and other sources;
(3) questionnaires to OIC's and MIC's about time commitments, priorities, and special problems occurring under emergency conditions;
(4) evaluation of how much general information concerning behavior in disasters is known by personnel within the NWS;
(5) questionnaires to news media personnel about how they use NWS information and what suggestions they would have for improvement of that information input into their organizations;
(6) a look at material from other societies for comparison with that in the United States;
(7) a look at some particularly successful warning systems to see not only what went wrong, which seems to be emphasized in a great deal of the literature, but to see what went right and what positive things contribute to effective warning.

Conclusion

We have reviewed the materials pertaining to disasters under the headings of forecast, dissemination, response and feedback. A few suggestions have been made in the course of the materials presented, but these have been kept to a minimum because the report emphasizes the examination of the system rather than the making of many recommendations. The overall perception is that the units within the system are functioning relatively efficiently, but there are many difficulties with linkages between the subsystems.

CHAPTER V

RESEARCH RECOMMENDATIONS

Introduction

The material presented in this report has been culled from the examination of disaster literature and organizational documents, and from numerous conversations and interviews with NWS personnel, social scientists and personnel from dozens of disaster relevant organizations. The observations made throughout the study have been of an illustrative, antecedotal and qualitative research nature. This researcher has marvelled at how well the generalizations from social science fit the empirical situations as described in material from other sources, e.g., NOAA Survey Reports and intraorganizational critiques of warning. One may allow for a certain degree of circularity in that the generalizations develop, in part, from NWS materials. After allowing for such influences, however, the generalizations remain quite valid and reliable. The major areas of research need appear to be applied research and quantitative empirical research.

It is a temptation in a chapter such as this one to list area after area for research. The tack that will be taken is to concentrate on a few areas in which research appears to be of a high priority.

System Linkages

It becomes clear in a number of areas that system linkage is a major problem in warning. There is need for systematic research into this area. Whether the focus of analysis is intraorganizational, interorganizational, community or society, there is a need for more information about the subject. Such questions as the following need researched:

1. Who are the boundary personnel in each unit? Are there patterns that develop? Are they the same people the disaster plans suggest? Are they the same for different kinds of threat situations? Are some positions more effective than others? Under what conditions?

2. What is the role of NWS in overall disaster planning? In what areas does NWS accept sole responsibility for warning? In what areas is partial responsibility accepted? What are the legislative and appropriational supports for these areas of complete and partial responsibility? What extra organizational supports are available to the NWS?

At present it appears that the NWS has stretched its jurisdiction in order to establish a number of important interorganizational and community linkages in the warning system. MICs have done this in their regions of responsibility partially because no one else was doing it. At present

there is no organization which is responsible for coordinating the total system (OCD and OEP come as close to this responsibility as any groups.) There is a need for a clarification of the rights, responsibilities and boundaries of the NWS and other organizations. It is at these points, i.e., the linkages in the system, that there are often breakdowns in the system. The clarification of responsibilities for linking systems should prove helpful in developing an effective total system.

Warning Messages

The data seem to indicate that the warning message is only one variable in the multidimensional reasons for peoples' response to disaster threat, and it may not be the most important variable. Nevertheless, it is a contributing factor and one for which the NWS has a large responsibility. There is a need for research that studies effective message content and format.

At present the NWS appears to be stronger in its ability to describe the disaster agent than it is in its ability to describe the possible consequences of the disaster agent and the kinds of protective action that will reduce the danger. The reasons for these strengths and weaknesses may be grouped under the two general headings of (1) training and expertise and (2) unanswered questions concerning message content and format.

The training and expertise of NWS personnel is generally in the areas associated with meteorology. The daily tasks handled by these professionals has to do with data concerning weather. A number of employees of the NWS have experienced natural disasters and others have been associated with disasters through planning for emergencies and evaluation of disaster reactions.

A number of questions arise at this point. While this researcher has not checked comparative statistics, it is his impression that NWS personnel have relatively long years of service when compared to most non-governmental organizations and a number of governmental organizations. Some of these long term employees have personally experienced natural disaster situations. There is relatively little formal training in the education of a meteorologist, however, that teaches him about natural disasters. The concentration tends to be on areas more directly related to the nature of the disaster agent.

Warning is related not only to information about the agent, but to the possible physical and social consequences of the agent and the actions that should be taken to protect life and property. It seems fair, then, to suggest that the formal education and on-the-job training of NWS personnel is lacking in information concerning the physical and social consequences of a disaster agent and the possible protective actions that

may be taken. This may become an ever more critical factor in the future than at present as the present cohort of long term professionals moves to retirement age and is replaced by a younger cohort. This second group may not receive formal training nor have the practical knowledge that comes from actually experiencing a disaster. It becomes extremely difficult for personnel to draft a complete warning message when they are tending to concentrate on one aspect of warning, i.e., the disaster agent.

All of this has implications for the formal education and on-the-job training of NWS personnel. These implications will be discussed in the next chapter of this report. The remainder of this section concerning warning messages will discuss some research implications that are especially related to the content and format of those messages.

The content and format of the warning message is a subject that needs further research. There are a number "rules of thumb" that emerge from the literature and they are listed in Chapter Four of this report. There are still a number of questions that need systematic empirical research, however. Such questions as the following need further study:

How can "official" messages be made personal and persuasive?

How can the somewhat technical language of forecasting be made more understandable to the layman?

What is the optimum point of effectiveness in educating the public to technical weather language and translating technical language to lay language?

What language is most effective with which subgroups within the population?

How can warning concerning the possibility of a disaster threat which may strike a particular community only once in ten years be made a solvent, high priority and credible concern?

How can warnings be made locality relevant and specific?

What is the ideal balance of content related to the disaster agent, possible physical and social consequences and preventive and protective actions to be taken?

What are the best content and format of messages for different media, e.g., radio, television and newspapers?

Are there workable mechanisms for feedback that will provide information for corrected warnings?

A number of opinions about the answers to these questions have been expressed in the literature, but there is the need for systematic research concerning them. There are a number of difficulties associated with this type of research, but none of them are insurmountable. For example, there is the difficulty of relating expressed attitudes toward warning with behavior. There is also the exacerbation of difficulties in sampling a population that has been displaced by a disaster. None of these "problems" makes systematic research impossible and it should be developed as a regular part of the ungoing tasks of the NWS.

Mass Media

When the message is being developed in the forecast stage it tends to stay within the NWS organization. In order to get that message to the general public, however, it is necessary to depend on other organizations. Along with this, dependency on other organizations causes loss of control and changes in procedure.

At time there is a tendency to treat the intermediate link as if it were but a mechanical bridge or mechanism for transmitting messages. The mass communications system consists of a web of groups and organizations. Some of these groups are very complex and have their own sets of values and norms about the nature of their responsibilities and operations. For example, the mass communication system is not a single homogeneous entity, but rather different communication outlets that vary considerably in the degree to which they see themselves obligated to seek information. Many messages enter into the different components of the system and weather messages are only one variety. These inputs are perceived and handled with varying priority.

There are different values and norms affecting what will or will not be transmitted by the different components of the mass communication system. For example, rules or norms governing interruption of regular programs are rather different for radio and television. Frequency and kinds of messages disseminated are also dependent upon a variety of factors ranging from the bureaucratic nature of the communication outlet to the work shift schedules which are operative. In general, output of information falls short of the information input into the mass communication system.

There is need for research in actual disasters to see the process that takes place between the receipt of warning by mass media and the receiving of feedback and sending of revised messages. Such topical areas as the following need to be researched: the content of the message, the mode of sending it, the time the message was received, who received it, the decision of whether to transmit, how to transmit it, the format to use, the kind of message actually sent (changed or similar) and the formal and informal feedback mechanisms employed.

The control of the NWS lessens as the message leaves the forecast stage and moves into the dissemination stage. The question of responsibility becomes a real issue in these later stages. It does seem appropriate, however, for the NWS to understand as fully as possible the dynamics at work within and between the organizations that are more heavily involved in these later stages of warning, particularly the mass media. Research in this area should yield information that will allow the development of more effective input to the mass media.

The Community

A final area for research is that of the community. An efficiently functioning system, with seemingly satisfactory forecasts and disseminations may not evoke the desired response from area organizations and the public. The social science literature reflects a wide range of responses to disaster threat, and not all of these differences can be accounted for by variables within the forecast and dissemination stages of warning. The same forecast and dissemination patterns may lead to differential response from one community to the next. An important part of the answer to why this is so, may be found in the structural and functional aspects of the communities receiving the warnings.

Evidence supports the thesis that communities in highly vulnerable areas develop characteristics that enable them to cope more effectively with threats from disaster agents. There is a need for comparative community studies that build upon the work already done in this area. It is possible to build a research design that would enable a mixture of the case study approach with the comparative approach. This would enable the researchers to move in the direction of isolating unambiguously some key variables and yet seek the rich suggestiveness of intensive case studies. It would, hopefully, move the research toward an optimum blend of homogeneity and heterogeneity, i.e., enough similarity for control and enough difference for comparison. In addition it would allow for the in-depth understanding that comes from a thorough case study. For example, communities could be matched and contrasted on such structural and functional variables as size, complexity of organization, heterogeneity of population, degree of autonomy, and type of economy. They could be matched and contrasted on such situational variables as types and frequency of disaster threats, types and frequency of actual disasters and degree of success in coping with disaster threats.

This kind of research is needed in order to build a body of empirically supported substantive knowledge on which to plan effective warning.

Summary

It is interesting to this research that the four areas singled out for research fall naturally into the major divisions used in conceptualizing the warning system, i.e., the overall system (linkages), forecast (warning message), dissemination (mass media) and response (community). While the statement of the problem used in this report has remained on a rudimentary level, this writer would argue that the evidence supports the usefulness of the systems approach as a conceptual framework. What is needed now is to move from what appears to be a rather sound, if qualitative, research base to more detailed quantitative empirical research and operations research.

CHAPTER VI.

CONCLUSIONS AND RECOMMENDATIONS

Introduction

Applied research may be conceptualized in terms of two major approaches. The first approach focuses on evaluation of performance. It may examine the performance of an organization in light of its goals and ideals. This kind of research will always find some gap between the ideal and reality. The real issue, then, is the relative size of that gap. Is it tolerable? The second approach is "needs" oriented. What are the areas of greatest need in this organization? What is needed to make it function more efficiently? The emphasis of this study is on the second type of research. The writer has concentrated on a statement of the problem so that areas of need may be clarified. In carrying this out there is some implied evaluation, but that is not the major focus.

This chapter discusses a few issues that appear to be central to the statement of the problem. The conclusions and recommendations are divided into three major headings as follow: (1) system problems, (2) training issues and (3) research recommendations.

System Problems

The National Weather Service is an impressive organization. Like all organizations it sometimes runs into intraorganizational communication problems and the performance of the various field units is not all on the same level. Nevertheless, the NWS is probably the most efficient subsystem in the total warning system.

The major problems appear to be in the linkages in the total system. The NWS is one part of a total system and most of the NWS work falls in the forecast stage of the warning process. The further one moves from the forecast stage, the less control the NWS has over the system. In an effort to improve the total system the NWS has moved beyond its area of forecast into broader concerns, but there are limits to how much responsibility for the total system the Weather Service can or should bear.

These problems are particularly great in a relatively decentralized and highly differentiated system such as the United States. Different levels of government hold responsibility for the varying regional areas of the nation and these levels of government are not always linked in an efficient manner. For example, a hurricane that comes into the Gulf of Mexico may strike two or three states and dozens of communities. Who is responsible for coordinating the overall effort of preparedness? The United States is also a highly developed and structurally differentiated

society. A large number of organizations are involved in keeping the system functioning. Power companies, telephone companies, water companies and numerous others are necessary to keep the technology working. This, added to a decentralized system of government, multiplies the number of points of linkage and the importance of overall coordination.

There is a need, then, for work that will help establish better linkages. Three suggested activities that should help facilitate such linkages are the following: (1) the responsibilities of the National Weather Service and other disaster relevant organizations need to be clarified. The need for research in this area is discussed in Chapter Five. (2) Some organization or organizations of government such as the Office of Emergency Preparedness or the Defense Civil Preparedness Agency need to work on overall coordination of the system. The National Oceanic and Atmospheric Administration may serve as a catalyst in initiating such activities. (3) There would seem to be great benefit in a number of well organized conferences such as the Hurricane Preparedness Conferences held by the OEP. These conferences provide for cross-fertilization of ideas and the opportunity for people from different units within the system to establish contacts and work together on common problems.

Training Issues

In the second chapter of this report there was a discussion of the definition of warning, the concept of disaster, the disaster agent characteristics and the warning system. It is essential that these concepts be made clear to those involved in warning. The emphasis in this section is to suggest implications of these concepts for the personnel of the NWS.

An examination of the content of warning messages suggests that the emphasis is placed on warning people of the existence of a disaster agent, e.g., hurricane, that threatens danger. This is only a small part of warning. The data supports the need for giving information about the disaster agent and its possible consequences in connection with the physical and social context of the area it threatens. In addition to this first step in warning there needs to be information given about what can be done to prevent, avoid or minimize the danger. The concentration of the NWS is on the first part of the first step of warning, i.e., information about the disaster agent. This definition needs to be broadened. Similar arguments may be made about understanding the concept of disaster, the disaster agent characteristics that have consequences for warning and a broad perspective on the warning system.

The training of Weather Service personnel concentrates on the physical sciences and understanding of meteorological phenomena. There

is a need for systematic training related to other areas such as the understanding of disasters from the perspectives of disaster as physical impact and social disruption. Considerable knowledge exists about these areas and it should be incorporated into the knowledge base of NWS personnel. At the present moment a large number of personnel are in the position of developing warning messages about danger threats they only partially understand. There do not seem to be any insurmountable obstacles to incorporating such knowledge into the training process. Indeed, a number of the professionals with whom this writer has had conversations appear to be eager for such information.

Sessions at regional conferences, blocks of time spent with MICs when they are briefed on new assignments and periodic seminars are but a few of the means of education that might be used. Substantive material could be packaged in film strips, information kits, and possible laboratory simulations. Such programs do not offer a panacea, but they do offer means of upgrading information and keeping the importance of the total perspective on warning salient concerns for Weather Service personnel.

Warning is a complex and difficult process. It should prove helpful to take every opportunity available to assure that the personnel responsible for initiating that process are clear about the definition of warning and disaster and the dynamics involved in the process.

Research Recommendations

The reader is referred to Chapter Five for a discussion of areas of needed research, but two recommendations are underscored in this section. Both general and applied research studies are needed. The particular areas that stand out are mass communications and community.

Mass communications is a major link between the Weather Service and the public. It is a system whose participation in warning is voluntary. While the mass media has generally cooperated well with the NWS, there is a critical need for better understanding the rules by which mass communications organizations operate. There is also a need for liaison between the Weather Service and the mass media so that applied research can be developed that addresses such questions as mutually acceptable warning language and the most effective formats. It has become very clear that communities are complex entities that vary from region to region. Further research in this area is essential.

The NWS is not in the business of doing social scientific research. It does have certain characteristics, however, that should be quite helpful in lending assistance to such research. Among these characteristics are the presence of offices in hundreds of communities throughout the United States and thousands of contacts with disaster relevant organizations. These characteristics should be helpful in developing systematic research with a minimum of cost.

Summary

Conclusions and recommendations have been made at various points throughout this study. The three areas cited in this chapter are those that appear to be most salient.

FOOTNOTES

PREFACE

1. Kenneth Wilkinson and Peggy Ross, Citizen Response to Warnings of Hurricane Camille (Jackson, Mississippi: Mississippi State University, Social Science Research Center, Report No. 35, 1970).

2. J. A. Riley, Disaster-Storm Ahead (Austin: The Hogg Foundation for Mental Health, The University of Texas, 1971).

CHAPTER I. INTRODUCTION

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3. Wilkinson, op cit., pp. 44-45.

4. Environmental Science Services Administration Survey Team, The Lubbock, Texas, Tornado, May 11, 1970 (Washington, D.C.: Natural Disaster Survey Report 70-1, U.S. Department of Commerce, ESSA, July 1, 1970), p. 16.

5. These comments were made to the author by Dr. E. L. Quarantelli, Disaster Research Center, Department of Sociology, The Ohio State University, in personal conversation and in unpublished notes.

6. E. L. Quarantelli, "Report of the Panel on Public Response to Hurricanes (Panel IV)", (Unpublished Notes), (Hurricane Preparedness Conference, Miami, Florida, May 9-11, 1972), pp. 10-11.

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8. References that take a process and/or systems approach include Raymond W. Mack and George W. Baker, The Occasion Instant: The Structure of Social Response to Unanticipated Air Raid Warnings, Publication 945 (Washington: National Academy of Sciences, National Research Council, 1961); Harry Estill Moore, et al, Before the Wind: A Study of Response to Hurricane Carla, Publication 1095 (Washington:

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9. Figure 1 is adapted from Dennis E. Wenger and Arnold R. Parr, Community Function Under Disaster Conditions, Report Series Number 4 (Columbus, Ohio: The Ohio State University, Disaster Research Center, 1969), p. 32.

CHAPTER II. THE WARNING SYSTEM

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2. Horace D. Beach, Management of Human Behavior in Disaster (Ohawa, Canada: Department of National Health and Welfare, 1967).

3. This classification of disaster meanings is a summary of that given by E. L. Quarantelli and Russell R. Dynes in the "Editor's Introduction" in the American Behavioral Scientist, Volume 13, Number 3 (January-February 1970), p. 328.

4. County of Pecos, Cities of Fort Stockton and Iraan, Joint Emergency Operations Plan for Tornado, p. 1.

5. For more detailed discussion of some of these dimensions see Russell R. Dynes, Organized Behavior in Disaster: Analysis and Conceptualization, Disaster Research Center Monograph Series (Columbus: Disaster Research Center, The Ohio State University, 1969).

6. This will be detailed in a forthcoming DRC monograph on the impact of Hurricane Betsy in New Orleans.

7. For description of the Colorado floods see Thomas E. Drabek, "Social Processes in Disaster: Family Evacuation," Social Problems 16 (Winter 1969): 336-349, and Drabek and Keith Boggs, "Families in Disaster: Reactions and Relatives," Journal of Marriage and the Family 30 (1968): 443-451.

8. F. L. Bates et al., The Social and Psychological Consequences of a Natural Disaster: A Longitudinal Study of Hurricane Audrey (Washington: National Academy of Sciences - National Research Council, 1963), p. 13.

9. William A. Anderson, "Disaster Warning and Communication Processes in Two Communities," Journal of Communication 19 (June 1969): 92-104.

10. Thomas E. Drabek, Disaster in Aisle 13: A Case Study of the Coliseum Explosion at the Indiana State Fairgrounds, October 31, 1963, Disaster Research Center Monograph Series (Columbus: College of Administrative Science, The Ohio State University, 1968).

11. Harry E. Moore et al., Before the Wind: A Study of the Response to Hurricane Carla (Washington: National Academy of Sciences - National Research Council, 1963).

12. Elliot Danzig, Paul Thayer, and Lila Galanter, The Effects of a Threatening Rumor on a Disaster Stricken Community (Washington: National Academy of Sciences - National Research Council, 1958).

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14. Figure 1 and the accompanying discriptive paragraph is adapted from Dennis E. Wenger and Arnold R. Parr, Community Functions Under Disaster Conditions, Report Series Number 4 (Columbus: The Ohio State University, Disaster Research Center, 1969).

CHAPTER III. A GENERAL CRITIQUE OF WARNING LITERATURE AND OPERATIONS

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2. Environmental Science Services Administration, The Lubbock, Texas Tornado, May 11, 1970, A Report to the Administrators, National Disaster Survey Report 70-1 (Rockville, Maryland: ESSA, NDSR 70-1, July, 1970), p. 16. This was a quote from Judge Robert H. Bean used by the survey team to illustrate some of the human problems in warning.

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6. Fritz, op cit., p. 665.

7. Charles Fritz, "What are the Major Responses for Non-Compliance?" A background paper delivered to Panel 4: Public Response to Hurricanes at the Hurricane Preparedness Conference (Miami, Florida, May 10, 1972).

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9. Fritz, "What are the Major Responses for Non-Compliance?" op cit.

10. Fritz, "Comments..." op cit.

11. Quoted from a letter by the Meteorologist in charge of the Weather Service Office, Port Arthur, Texas to the Director of the Southern Region of the National Weather Service, September 29, 1971.

12. E. L. Quarantelli, "Report of the Panel on Public Response to Hurricanes (Panel IV)," Hurricane Preparedness Conference (Miami, Florida, May 9-11, 1972), p. 7.

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14. Quoted from a letter by Robert E. Helbush, Chief of Operations Division, Southern Region Headquarters, NWS, to "All Coastal Offices" on the subject of "Preparation for the 1972 Hurricane Season," March 27, 1972.

CHAPTER IV. AN ANALYSIS OF THE WARNING SYSTEM: STAGES, SUBSYSTEMS AND INTERRELATIONSHIPS

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5. Examples of such findings may be seen in studies by David Adams, "The Minneapolis Tornadoes," May 6, 1965; "Notes on the Warning Process", (Columbus: Disaster Research Center, The Ohio State University, Research Report Number 16, September, 1965), John Brouillette, "A Tornado Warning System: Its Functioning on Palm Sunday in Indiana," (Disaster Research Center, Columbus, Ohio, 1966); and Environmental Science Services Administration Survey Team, "The Lubbock, Texas Tornado, May 11, 1970," National Disaster Survey Report 70-1 (Washington, D.C.: U.S. Department of Commerce, ESSA, July, 1970).

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