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Summary Report of Civil Defense Warning Requirements Study

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SUMMARY REPORT OF

CIVIL DEFENSE WARNING REQUIREMENTS STUDY

by

Special Projects Staff

Operations Development Department

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This report has been reviewed in the Office of Civil Defense and approved for publication. This approval does not signify that the contents necessarily reflect the views and policies of the Office of Civil Defense or of the various State and local civil defense organizations.

PREFACE

In February of 1962, the System Development Corporation was awarded contract OCD-OS-62-119 by the Office of Civil Defense to perform a program requirements analysis of the DOD-OCD warning system. The principal objective of this contract was to determine system requirements for an effective warning system to meet present and future needs.

This document is a summary of the work performed and the conclusions arrived at in the study. Full details may be found in two other volumes, TM(L)-900/001/01, "Civil Defense Warning Requirements Study" and TM(L)-900/002/00, "Classified Supplement to Civil Defense Warning Requirements Study (U)."

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W. R. Warren

Special Projects Staff

I. SCOPE OF THE STUDY

In February 1962, under a research contract (OCD-OS-62-119) to the Office of Civil Defense, the System Development Corporation began a program requirements analysis of the Department of Defense - Office of Civil Defense warning system. The objective of this research effort was to determine warning system effectiveness in meeting the present and future needs for warning. Program objectives, as stated in the contract, and the SDC approach to the study are as follows:

A. PROGRAM OBJECTIVES

1. A detailed study of the requirements for warning in the late 60's and early 70's, including an evaluation of the need for outdoor and indoor warning devices and other warning systems which are capable of transmitting identifiable signals to the general population.

2. An analysis and evaluation of the effectiveness of the warning system in meeting the needs for warning of attack and for determining what role the system plays in providing warning of radiological, chemical, and biological hazards.

3. An identification of the cost-effectiveness of feasible warning systems and programs for the present and future, considering strategic needs in the late 60's and early 70's, and the likely performance requirements of the warning system.

4. An identification of training requirments, formulation of an overall training plan, and evaluation of the use of simulation techniques and tactical exercises as training devices.

5. The development of testing procedures which are capable of measuring operational readiness both independently and in conjunction with the training plan.

B. APPROACH TO THE STUDY

There are various approaches to the study of a national warning program. One of these is a fundamental study determining a national philosophy about the need and usefulness of civil defense warning. Questions concerning whether or not there is a need for such a program, what must its goals be, and what will be its effects upon overall national policy must be answered in that type of study. This broad view of the warning program must also consider the relationship between the establishment of an effective warning program and the presently planned shelter program. As capabilities to shelter the population increase, the more stringent time requirements presently imposed upon the system are lessened. Responsibility for warning is another important consideration. What agency is most capable

of performing the warning function? Is warning a basic civil defense function, or a separate function more adequately performed by another agency?

A second approach to performing a warning study is that of specifically defining the overall scope of the warning program, more from a view of what it entails than how it should be administered or how it relates to other programs. What elements are required in the warning itself? Is nuclear attack warning sufficient, or is there a basic responsibility to provide warning of the effects of such an attack and of various natural disasters? Is a single warning system capable of performing all these functions? What are the basic requirements for warning and what are the operational characteristics and performance requirements of the system?

A third approach is that of defining the system itself. This includes the definition of necessary decision points, an appropriate organization, all communication networks, and specifications for hardware design and implementation.

All of these approaches, or levels of investigation, are necessary in the development of an effective warning program. However, they are not all contained within the scope of this study as outlined in the objectives of the contract. The SDC focus, due to contractual guidelines, time, and manpower constraints, has been predominantly at the second level with as much overlap into the other areas as was possible to accomplish.

The Warning Requirements Study is therefore primarily concerned with:

a. Establishing the need for warning.
b. Developing basic requirements for a warning system.
c. Evaluating feasible warning systems.
d. Establishing an implementation program.

Subsequent to this study and dependent upon concurrence with the needs and requirements established, projects should be initiated to evaluate further the specific types of warning systems considered in this project and recommended as being most feasible. These investigations should cover both the operational and technical feasibilities of such systems. Studies of operational feasibility should include the determination of required warning coverages and how they may be attained. This should be accomplished in more detail than this study provides. The technical elements of the warning system (i.e., warning devices, communication networks, etc.) can then be evaluated to ensure an effective operational capability.

Research which concurrently examines operational potential systems is subject to unique constraints. Although the existing system does provide a partial basis for focus and improvement, recommendations for any future system should not be linked arbitrarily to what exists solely for the sake

of providing a continuing operational capability which may be inadequate. In some sense this implies results more compatible with the extant system and can preclude genuine research designed for exhaustive study leading to new conclusions or substantiation of existing opinion. Such recommendations are based on both new and/or differently collated facts derived from the research. SDC has attempted to maintain a research perspective despite the limitation imposed by the scope of study and the fact that warning is simultaneously a complex research problem as well as a controversial public issue.

II. NEED FOR WARNING

It has been said that warning of a nuclear attack will be of little value for those who are in the ground zero area and the immediately adjacent areas. Other than on moral grounds, it is difficult to argue with this concept. It is equally difficult, however, to describe with any degree of accuracy and dependability what will be the strategies of the attacker, the scope of the attack, and the specific ground zero points (for which warning will be of no value). It is obvious, then, that to those millions outside of the immediate ground zero area, and to those well away from the target area itself, provision of warning is justifiable. Not being able to define specifically to whom warning should be provided dictates the requirement that warning should be provided to all who might derive some benefit from receiving it.

In addition to the moral obligation to the people, there is the practical consideration of enhancing the survivability of our nation. Studies indicate that an adequate set of protective measures, combined with sufficient warning to permit the populace to take advantage of them, can save the lives of large segments of the population. These lives represent the skills and experience that mean the difference between economic and social viability and total destruction of our nation and way of life. This aspect of the need for warning becomes increasingly important as the shelter program continues to provide additional protective means to be taken in the event of an attack.

Any elaborate analysis of population as a resource should include the structure of urban, rural and transient elements and the analysis of human skills by priority. However, such an analysis appears basically inimical to the warning program and could lead to the same type of invidious comparisons engendered by the question asked as to whether it is moral and/or legal to protect your fall-out shelter with a gun. Further, and more importantly, warning information assists planners and populace in definition of the situation which, in turn, facilitates protection of people, protection and recovery of property, and resource management.

Providing warning, then, of a forthcoming direct nuclear attack is justifiable. Of equal importance is the necessity of providing effective warning and information about the after effects of an attack. The requirement to provide the populace warning of these effects is no less stringent than the requirement for

providing attack warning itself, since attack effects may impair or kill many more millions than the attack itself. The position of the Federal government on the need for warning appears to be clear. That position has been stated in the Federal Civil Defense Act of 1950, the Reorganization Plan of 1958, and the National Plan for Civil and Defense Mobilization. More recently, the obligations and responsibility of the Federal government for provision of warning were reaffirmed through Presidential Executive Order 10952. This EO, in assigning former OCDM tasks to the Department of Defense, states that the DOD functions shall include all functions contained in the Federal Civil Defense Act of 1950. These functions included the development of:

1. A fallout shelter program.

2. A chemical, biological, and radiological warfare defense program.

3. All steps necessary to warn or alert Federal military and civilian authorities, state officials and the civilian population.

III. DEFINITIONS AND ASSUMPTIONS

As a preface to this study, it was necessary to formulate and state certain definitions and assumptions upon which work could be based and warning requirements developed. As the study progressed, it became imperative that terms be clarified. A list of terms used in the study is given in TM(L)-900/001/01. However, a few whose exact meaning is crucial to the understanding of this report are defined here:

Alert - An attention getting signal or alarm used to arouse the intended recipient to a state of action. As opposed to warning, alert or the process of alerting provides only an initial awareness of a threatening situation, and does not in itself define what the situation is, where it is, or when it will happen.

Warning - The advance notification of a nuclear threat, the effects of an attack, or impending natural disasters. Notification includes the provision of information about the nature of the threat, its extent or scope, and its imminence. Warning is completed when the recipient has received and interpreted data presented to him and decided to act.

Local Warning Center - A facility capable of 24 hour operation found normally at the city or county level. The local warning center must be capable of performing all functions required to provide warning to the inhabitants within its jurisdiction.

Intermediate Centers - An organizational level in the warning system between the national and local levels. Intermediate centers will normally be at state or regional levels, and will have functions which will require interactions with both Federal, state, and even local civil defense organizations.

The assumptions upon which this study was predicated were based on information contained in various portions of the National Plan or were formulated as a result of recent changes in the civil defense program. The assumptions are divided into three categories: those which are concerned with the nature and scope of the hazard; those pertaining to the process of warning; and those related to a program of protective measures.

A. NATURE AND SCOPE OF THE HAZARD

The DOD-OCD warning program must provide warning to the people of the United States of (a) impending nuclear attack, (b) hazards which result from such an attack, and as applicable (c) impending natural disasters and their after effects.

The threats and hazards defined above if allowed to pursue their courses unhindered or unprotected against, will result in injury and death to many people or damage and destruction to property. The overt aggressive acts of foreign powers toward this country are of the greatest concern to the DOD-OCD warning system, as nuclear detonations and their effects could harm millions of people. Biological and chemical hazards as the result of a hostile attack can also decimate large segments of the population. The attack strategy employed by the enemy may have significantly different effects on different portions of the populace. Likewise, natural disasters such as earthquakes and hurricanes can have catastrophic effects. Therefore, civil defense must plan for a variety of contingencies to achieve the maximum amount of protection attainable.

B. THE WARNING PROCESS

The warning process must provide for the dissemination of alert and warning to the civil defense organization and to the general public.

The primary source of tactical warning is, and will continue to be, the North American Aerospace Defense Command (NORAD). In addition to NORAD messages providing strategic warnings may be received from the President or his delegates, DOD or other intelligence agencies, and from civil defense headquarters. Detection and evaluation of attack effects such as radiological fallout and contamination, and biological and chemical hazards must be performed by the civil defense organization and allied agencies (data sources) at local levels.

To disseminate warning of natural disaster the warning system must be sensitive to a great many sources of information. Means of developing sensitivity to all such sources is beyond the scope of this study.

C. PROTECTIVE MEASURES PROGRAM

The final effectiveness of the total national warning program will be dependent upon the development and availability of a suitable program of protective measures.

The goal of the protective measures program is the provision of both specified and suitable levels of protection, including improvised, fallout, and blast shelters and tactical and strategic evacuation or dispersal. It is assumed that a national program of fallout shelters suitable and proximate for the majority of the population in urban industrial and target areas will be developed and implemented.

IV. STUDY METHODOLOGY

This section describes the general approach taken to determine the present and future requirements for a civil defense warning system.

A. ACQUISITION OF INFORMATION

In the systematic and comprehensive collection of data concerning the civil defense warning system, emphasis was placed upon contact with knowledgeable persons associated with the system, and upon extensive coverage of available documentation. Personnel were contacted at all levels of the existing civil defense Attack Warning System. Discussions were held with many Department of Defense agencies associated with both civil and air defense systems, and with many persons associated with research efforts or knowledgeable about possible alternative warning systems.

Publications reviewed included research reports, Department of Defense and other government or military studies, as well as the National Plan for Civil Defense and Defense Mobilization. Existing procedural manuals and NORAD intelligence estimates were used in the evaluation of the probable attack hazards from the present until 1970.

Further, the study team drew upon SDC's own extensive experience and investigations in the air defense field for further analysis of the attack hazard and performance requirements for a warning system.

B. SYSTEM DESCRIPTION

The study team first defined the operations of the warning system. This, plus careful delineation of the associated civil defense organization and an analysis of the hazards and protective measures in terms of available warning time, provided the basis for determining the requirements and operational characteristics of the warning system.

C. SYSTEM ANALYSIS

After organizing the information obtained and relating it to the warning process, delimiting assumptions were made about the system and the hazards and protective measures that exist. From these it was possible to derive the operational requirements and functions that should exist for the system. Performance requirements and criteria were also determined and organizational needs examined.

D. COMPARATIVE EVALUATION OF FEASIBLE SYSTEMS

Many different alerting and warning methods and devices were examined in light of the operational and performance requirements that were established. Three major systems (power line, wire line, and electromagnetic) were considered as being those which could come closest to satisfying requirements developed for an alerting and warning system. The degrees of satisfaction offered by these systems to meet various requirements were investigated. Operational, installation, and maintenance problems were also considered and discussed. The difficulties and problems associated with system and component testing and training (including the education of the public) were considered for each system individually and in various combinations. The cost of procuring, installing, and maintaining each system in relation to its effectiveness in meeting the requirements was also assessed.

E. ANALYZE CURRENT WARNING SYSTEM OPERATIONS

Using data obtained primarily from observation of system operation during visits to facilities, through discussions with experienced personnel, and through initial analyses of data obtained through various exercise programs, the study group considered the present attack warning system and assessed its system capabilities in light of performance requirements developed. The analysis defines the capabilities of the system and indicates where inadequacies or deficiencies exist.

F. IMPLEMENTATION

On the basis of the above analyses certain recommendations are made concerning the establishment of a long range plan for civil defense warning system development, and for the implementation of certain immediate improvements in the present system. These recommendations delineate a minimum set of actions that must be taken if the nation is to possess a warning system capable of meeting requirements for warning in an era of thermonuclear threat.

G. TESTING AND TRAINING

The exercising of the system to provide practice in its operation and to evaluate the performance of the system are delineated as essential aspects of system operation. Modification and improvement of the system are considered continuous tasks requiring each change to be tested to determine its effect upon system performance.

H. FURTHER RESEARCH

In the course of the warning requirements study, the group found certain areas which required further research. However, because of time and manpower constraints and the focus imposed by the contract objectives, they were precluded in this effort. Areas needing further research include both technical studies required prior to a system selection and studies of a more general nature dealing with operational and organizational functions of the warning system.

V. CONCLUSIONS

Significant conclusions emerging from the research efforts applied in this warning requirements study are as follows:

A. ALERT AND WARNING

It is necessary to distinguish between alert and warning. Alert is an attention getting signal that is used to call the intended recipient to a state of action. Warning, on the other hand, means the advance notification and the provision of meaningful data about the nature, extent, and imminence of a nuclear threat, the chemical, biological, and radiological effects of an attack and, as appropriate, the advance notification of certain natural disasters.

B. WARNING SYSTEM MISSION

The mission of the warning system is to enable the population to achieve specified levels of protection upon detection of a threat or threats within a defined range.

C. THE WARNING PROCESS

The process of warning consists of ordered and interrelated phases which are set into action by the perception of a defined threat or hazard. The phases are: the evaluation of the detected threat; the making of the decision to warn; the dissemination of the alert and the warning information; and the receipt, interpretation, and decision to act on the part of the recipient. The decision by the recipient to take action concludes the warning process.

D. WARNING TIME CATEGORIES

General ranges of warning time may be established by an analysis of threats and hazards. These ranges relate to the anticipated time between detection of the threat and the moment of occurrence of the threatened event. They provide increments of time from which warning system parameters may be derived and within which ranges of protective actions may be taken. The categories derived from the analysis and utilized in this study are as follows:

Critically Short Warning Time	0 - 15 minutes
Short Warning Time	15 - 45 minutes
Moderate Warning Time	45 minutes - 3 hours
Long Warning Time	3 - 5 hours
Extended Warning Time	5 hours and greater

E. PROTECTIVE MEASURES

Protective measures feasible for use within the warning time categories are shelter and evacuation. Duck and cover measures (including improvisation), fallout and blast are types of shelter which may be obtained. Evacuation measures can be considered as either tactical (dispersal) or strategic.

F. BASIC WARNING REQUIREMENTS

Basic warning requirements have been divided into two sets: those which are applicable to nuclear attack warning and those which are imposed by radiological, chemical, and biological hazards and natural disasters. The basic requirements for warning of nuclear attack are as follows:

- The public must be conditioned through training and education to respond to alerting and warning in such a way that available levels of protection can be achieved.

  Where warning time is extremely short, any hesitancy in response can be disastrous. Failure to heed instructions or consider information provided in a warning message will lead to less than optimal utilization of available protection. The public must be adequately conditioned to recognize, understand, and react appropriately to the message.

- The warning must contain all information necessary to permit carrying out prescribed activities.

  While an alerting signal alone might be sufficient to elicit an appropriate response under wartime conditions, it does not convey enough information nor is it sufficiently convincing under peacetime conditions

to elicit the most appropriate response. Since different areas may have different amounts of warning time to seek the maximum protection available, information on the kind of hazard (missile or flood), the imminence of the hazard, and suggested action should be presented as well as an attention getting alert signal.

- The alerting and warning messages must be clearly recognizable, distinctive, and unambiguous.

  As a precursor to the warning message, the alerting signal must force attention and not be confused with other signals. The warning message should follow the alert as soon as possible, and be short and to the point. The message should clearly state the danger, the time available, and what should be done.

- Confidence in the validity of the warning must exist.

  Much of what has been termed public apathy to civil defense alerts may be in fact confusion and uncertainty over the meaning of the signal, reinforced by frequent tests of the alerting signal without any follow-on explanation. The warning should provide within itself the authenticating information to instill confidence in its validity.

- The warning system must operate reliably and its capability to perform should not be subject to degradation due to malfunction, sabotage, or false triggering.

  Although there is a very low probability during any period of time that the system will be used, it is essential that it work if it is needed. Public confidence in the system should not be destroyed by failures to operate during test runs nor by any false alert. Again, authenticating information provides the recipient with knowledge that a false alert has occurred and precludes a cry wolf conditioning.

- The warning system must be designed to provide warning to the vast majority of the population.

  Although some segments of the population are in more hazardous positions than others, complete coverage is due to all even though warning is slower to sparsely settled areas. Persons in transit are a special problem in this respect.

- Destruction of one geographic segment of the warning network should not impair the capability of the warning to reach surviving segments.

  A nuclear detonation in an area may be the first warning that is received. Its occurrence should not deny additional warning to adjacent areas. In general, no significantly large area should be severed from the warning system due to damage in another area.

. The warning system must be a full period system, in a state of constant readiness.

An attack or disaster might occur at any time. Immediate capability to sound an alert and select and transmit an appropriate warning message is the minimal level of readiness that will satisfy this requirement.

. Within the capabilities of detection facilities, public warning must be disseminated in sufficient time to permit the designed levels of protection to be achieved.

Speed is essential in warning the populace. The sooner the people are warned the more adequate protective measures they may take. On the other hand, speed should not result in undue false triggering, nor should it cause degradation of warning content. Once the decision to warn is made, however, there should be as little interference or intervention in the passage of the message as possible. Assuring that the time available allows people to attain protective measures and not be enroute when subsequent or shorter warnings are received, is a special problem requiring further investigation.

For warning of attack effects and natural disasters, the basic requirements are the following:

. Detection, monitoring, and assessing capabilities must be provided at the local level and assessing capabilities provided at successively higher organizational levels.

. A two-way communications capability between civil defense organizational elements at local, intermediate, and national levels must be provided with extensions to government elements responsible for public protection and welfare.

. The capability must exist to alert and disseminate information and instructions to the general public.

G. PERFORMANCE CHARACTERISTICS

Based on the above requirements for warning, the performance characteristics were determined to be as follows:

1. The attack warning to the general public shall be capable of being disseminated in two forms: an alerting signal plus a voice warning message, and a voice warning message only.

2. The warning system must provide the capability to:

a. Simultaneously transmit warning both to the general population and civil defense organizational elements from a National Warning

Center without interruption or intervention at any lower organizational level.

b. Transmit warning to relevant civil defense organizational elements only.

c. Initiate warning at the local level for dissemination to that segment of the population that is within the jurisdiction of the local warning center.

d. Disseminate a warning message either generally or selectively to the population from the major political levels above the local level (i.e., state and Federal).

e. Maintain the capability to disseminate a voice message to the general public, even when sheltered, in any area subjected to damage short of total destruction.

3. Any public alerting signal must be capable of commanding the attention of the public and indicating that an extremely hazardous condition exists or is imminent. The alerting signal must be immediately followed by a warning message which will contain all necessary information.

4. The alerting signal must not have been or be compromised by resemblance to other signaling devices in common use or by testing in a manner which will result in doubt whether the alert heralds a test or a hazardous condition.

5. All devices employed for alerting the general population and civil defense organizational elements shall be capable of activation by a common alert activation signal.

6. The warning system shall provide basic attack data in coded form from a National Warning Center which will result in automatic selection of several locally determined prerecorded messages and dissemination of these messages within the area of local jurisdiction. Basic attack data must also be provided in printed form from the National Warning Center to all civil defense organizational elements.

7. Inherent to the warning system must be the capability to disseminate a voice message from the principal governmental levels (i.e., city/county, state, and Federal) to the general population within their respective areas of jurisdiction.

8. The warning system shall provide complete and immediate coverage in those areas having relatively high population densities and/or presumed to be "target" areas (including people indoors, outdoors,

and in transit) and coverage to the greatest degree possible within the limits of practicability to the sparsely populated areas of the country.

9. The transmission of warning should be via a highly survivable network so that destruction of any single link would not cause isolation of any part of the system.

10. The warning system shall be capable of detecting the failure or malfunction of any element of the network and restoring the path or substituting an alternate facility in order to ensure and maintain continuous and reliable operation of the system.

11. The warning system must be virtually immune to false triggering due to accident, sabotage, or malfunction; rigid design standards of the system must be imposed.

12. The warning system must be continuously in a state of readiness.

H. OPERATIONAL REQUIREMENTS

The operational requirements of the warning system indicate that:

1. Three organizational levels are required in the warning system, namely, national, intermediate, and local.

2. Two specific decision making levels are required within the system organization. One of these is at the national level, where the National Warning Center is the focal point for the dissemination of the nuclear attack warning. The second is at the local warning center, wherein attack effects and natural disaster warning will be disseminated to the general public. The intermediate level normally has no critical decision making functions as pertains to the issuance of warning messages.

3. Three interconnected and related communication networks are required in the warning system. One of these is a survivable distributed network interconnecting the National Center with intermediate centers. The second network interconnects intermediate levels with local warning centers. The third network connects local warning centers with the public warning distribution services.

I. COMPARATIVE EVALUATION OF PROPOSED WARNING SYSTEMS

The results of a comparative evaluation of proposed warning systems are presented in matrix form in the following figure.

Seven basic conclusions may be derived from the evaluations considered within the report and summarized in Figure 1. These conclusions are:

1. All systems analyzed could be made capable of reaching the indoor and outdoor populace. However, the radio system is the most feasible for reaching the 10 to 25% transient population.

2. Current power line systems (e.g., NEAR) are incapable of transmitting a voice message requiring validation of the warning by other means, and incapable of being tested without compromise.

3. The radio and telephone systems have the greatest possibility of fast, unified alert and warning.

4. The radio, telephone, and power line systems are decreasingly survivable in that order. Power line systems are less survivable because they are dependent on 60 cycle power both at the signal generator and at the receiver.

5. The radio system is the only system not requiring change or expansion to meet population changes or growth.

6. The legal and implementation problems of a power line system and the system using existing telephone lines and instruments are greater than those of the private wire telephone system and the radio system.

7. Analysis indicates that ten year costs of utilizing individual or private wire systems are prohibitively expensive. Power line systems, radio systems and systems using existing telephone lines and instruments are progressively less costly in that order.

J. ANALYSIS OF THE PRESENT ATTACK WARNING SYSTEM

Based upon the requirements summarized in this document, the analysis of the present system indicates that:

1. The Attack Warning System lacks a cohesive, coordinated organization. There is a lack of appropriate and adequate procedures at all levels of the system. The system is not well trained nor adequately supported to provide more than a minimum degree of capability and effectivenss.

2. The three subsystems in the Attack Warning System are controlled and administered by the political subdivision within which each falls. Consequently, they tend to isolate themselves, allowing only a minimum of interaction and coordination.

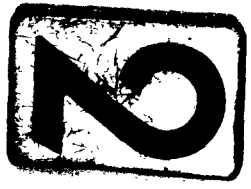
REQUIREMENTS AND COSTS *	TYPES OF WARNING SYSTEMS			
	POWER LINE SYSTEM, e.g. , NEAR	TELEPHONE SYSTEM USING EXISTING LINES AND INSTRUMENTS	PRIVATE WIRE TELEPHONE SYSTEM USING SPECIAL PURPOSE RECEIVER BY SUBSCRIPTION e.g. , TELEGLOBE	RADIO SYSTEM
POPULATION COVERAGE				
INDOOR	VERY GOOD	GOOD	VERY GOOD	VERY GOOD
OUTDOOR (WITH APPROPRIATE AUXILIARIES)	GOOD	GOOD	GOOD	GOOD
TRANSIENT (IN VEHICLES)	NONE	NONE	NONE	GOOD
RELIABILITY	SATISFACTORY	SATISFACTORY	SATISFACTORY	SATISFACTORY
SURVIVABILITY	FAIR	GOOD	GOOD	GOOD
SABOTAGE	NOT CONSIDERED A UNIQUE PROBLEM			
FALSE ALARM PROBABILITY	LOW	LOW	LOW	LOW
QUALITY OF WARNING				
UNIQUENESS OF SIGNAL	GOOD	FAIR	VERY GOOD	EXCELLENT
ABILITY TO DISSEMINATE VOICE MESSAGE	NONE	GOOD	VERY GOOD	EXCELLENT
VALIDITY OF WARNING	REQUIRES VALIDATION	SELF VALIDATING	SELF VALIDATING	SELF VALIDATING
ABILITY TO TEST WITHOUT COMPROMISE	POOR	VERY GOOD	GOOD	GOOD
GROWTH POTENTIAL	GENERATOR SYSTEM REQUIRES CHANGE WITH GROWTH OF POWER SYSTEM AND POPULATION	PLANT MUST EXPAND WITH POPULATION	PLANT MUST EXPAND WITH POPULATION	TRANSMITTER SYSTEM PRACTICALLY INDEPENDENT OF POPULATION GROWTH
IMPLEMENTATION PROBLEMS				
LEGAL	MANY	SOME	NONE DISCERNIBLE	NONE DISCERNIBLE
RATE CHARGES	UNRESOLVED	UNRESOLVED	NONE	NONE
RECEIVER DISTRIBUTION & INSTALLATION	UNRESOLVED	NONE	UNRESOLVED	UNRESOLVED
PUBLIC ACCEPTANCE OF RECEIVER	UNKNOWN	EXCELLENT	UNKNOWN	UNKNOWN
COST: INITIAL & RECURRENT				
NUMBER OF RECEIVERS, BEGINNING AND END OF PERIOD	60-70 MILLION	50-60 MILLION[1]	60-70 MILLION	60-70 MILLION
SIGNAL GENERATORS	$4/METER $240 MILLION	$20/SUBSCRIBER 1.0 BILLION	INCLUDED IN[2] SUBSCRIPTION COST	$2 MILLION
SIGNAL DISTRIBUTION FACILITIES	EXISTING POWER LINE	EXISTING TELEPHONE LINES	LEASE FROM COMMON CARRIER	FREE SPACE
SYSTEM ENGINEERING	$3.0 MILLION/YR	INSIGNIFICANT	INCLUDED IN	INSIGNIFICANT

Figure 1. Comparative Evaluation of Warning Systems

& INSTALLATION	UNRESOLVED	NONE	UNRESOLVED	UNRESOLVED
PUBLIC ACCEPTANCE OF RECEIVER	UNKNOWN	EXCELLENT	UNKNOWN	UNKNOWN
COST: INITIAL & RECURRENT				
NUMBER OF RECEIVERS, BEGINNING AND END OF PERIOD	60-70 MILLION	50-60 MILLION[1]	60-70 MILLION	60-70 MILLION
SIGNAL GENERATORS	$4/METER $240 MILLION	$20/SUBSCRIBER 1.0 BILLION	INCLUDED IN[2] SUBSCRIPTION COST	$2 MILLION
SIGNAL DISTRIBUTION FACILITIES	EXISTING POWER LINE	EXISTING TELEPHONE LINES	LEASE FROM COMMON CARRIER	FREE SPACE
SYSTEM ENGINEERING	$3.0 MILLION/YR	INSIGNIFICANT	INCLUDED IN SUBSCRIPTION COST	INSIGNIFICANT
SYSTEM MAINTENANCE	$2.4 MILLION/YR	$10 MILLION/YR	INCLUDED IN SUBSCRIPTION COST	INSIGNIFICANT
RECEIVER COST (MANUFACTURE & DISTRIBUTION)	$15 EACH $900 MILLION	NO ADDITIONAL CHARGE	INCLUDED IN SUBSCRIPTION COST	$20 EACH 1.2 BILLION
RECEIVER INSTALLATION	$210 MILLION	NONE REQUIRED	INCLUDED IN[3] SUBSCRIPTION COST	$210 MILLION
RECEIVER MAINTENANCE	$1.7 MILLION YR	NO ADDITIONAL CHARGE	INCLUDED IN SUBSCRIPTION COST	$1.7 MILLION/YR
ADMINISTRATION	UNRESOLVED	UNRESOLVED	INCLUDED IN SUBSCRIPTION COST	INSIGNIFICANT
OTHER COSTS	NONE	NONE	NONE	$2.0 MILLION/YR (NIGHT OPERATORS)
10 YEAR COST[4]	$1.[illegible] BILLION[5]	$1.[illegible]1 BILLION	$2.[illegible]4 BILLION[6]	$1.6[illegible] Billion

1. BASED ON ESTIMATED NUMBER OF TELEPHONE SUBSCRIBERS
2. $30 MILLION
3. $210 MILLION
4. SEE APPENDIX D FOR DERIVATION OF 10 YEAR COST
5. IN ADDITION TO THE LISTED CHARGES, THE NEAR SYSTEM MUST ALSO SUPPORT AN ADDITIONAL VOICE NETWORK TO TRANSMIT THE WARNING MESSAGE FROM LOCAL WARNING CENTERS TO ONE OR MORE LOCAL RADIO STATIONS
6. COST BASED ON $36/YR SUBSCRIBER CHARGE

* TESTING AND TRAINING ISSUES ARE CONSIDERED GENERICALLY RATHER THAN FOR SPECIFIC SYSTEMS.



3. At state and local levels, misconceptions often exist as to potential threats and hazards, and local circumstances often dictate the means and methods for the warning dissemination more than do operational requirements.

4. The elements of the existing Attack Warning System are vulnerable to sabotage and attack damage and do not comprise a distributed network.

5. Local alerting and signaling systems are subject to false alarms and do not supply either the necessary quantity of information or validation of their specific intent.

6. Activation of local alerting devices is often dependent entirely upon the approval of a local authority.

7. The Federal portion of the Attack Warning System (NAWAS) fulfills some of the basic requirements for a warning system. It has an organization, basic procedures, is a full period system, and utilizes voice messages in its operation. Unfortunately, these voice warning messages stop at the warning point and are not disseminated to the general public.

K. GENERAL IMPLEMENTATION

Practical system development is evolutionary in nature. An implementation plan should provide a means for progressing from the existing system to the desired system without impairing a minimum operational capability in the process. Two considerations upon which an implementation plan must be based are the annual budget level available for this purpose and the results of present and future research studies. These considerations will determine all aspects of the implementation program and lead to the development of a long range program and appropriate public conditioning.

1. Long Range Program

The warning program must be established firmly in fact. It must be long-term and well-defined. It must be coupled to the shelter program because the two programs are complementary. The existence of one does little good without the other. The absence of one, however, does not negate the need for the other.

2. Public Conditioning

Education, training, and a comprehensive conditioning of the public to the necessity and benefits of an effective warning program is of paramount importance.

3. Phase 1 - Immediate Modifications and Improvements

Modifications of a more immediate nature to the present Attack Warning System would serve to strengthen and improve the existing capabilities of the system. In some instances these modifications are necessary to provide the system a minimum essential capability to provide warning. In others, they extend existing capabilities and improve overall system effectiveness. A summary of these modifications, which are detailed in Chapter Ten, follows:

- Establish a cohesive and unitary organizational structure which may be regularly modified in a coordinated fashion to meet new developments.
- Implement appropriate organizational manning to insure both immediate and long range operational capability.
- Review and revise warning system operational procedures in light of the current threat and specify all duties and responsibilities of the warning system personnel.
- Establish alert conditions appropriate for all levels of civil defense to provide graduated levels of readiness in case of emergencies.
- Maintain civilian control of the attack warning system until further research is concluded, in order to provide an organization whose primary role is warning, and whose mission is not likely to be secondary to the alerting and control of military forces.
- Consolidate warning system operational functions at OCD regions and attack warning centers to promote greater efficiency and effectiveness.
- Utilize commercial radio broadcast facilities as warning points on the NAWAS net, integrate useful CONELRAD procedures, and allow voice warning to be disseminated directly to the public.
- Establish uniform meaning for signals and provide both an alerting signal and a warning message to the general public.
- Establish a non-alert testing capability that will not compromise or degrade the meaning of the signal for the public.
- Modify the interconnections of the warning circuit to provide the capability of immediate operation and system control to the National Warning Center.

- Expand back-up radio communication capability in case NAWAS links are destroyed or disrupted.
- Augment the NAWAS extensions program to provide voice warnings below the warning points to local warning points.
- Provide necessary equipments, authorities and procedures for local warning points to activate alerting devices immediately and without local approval upon receipt of warning from higher levels.
- Provide warning system teletype capability to obviate delays caused by hand recording of information.

4. Phase 2 - Interim System Modifications

Interim modifications to the warning system take on more of the aspect of the final system configuration. In some cases, they are extensions of work accomplished in Phase 1. In other cases, they involve greater capital outlay and must be undertaken only after some additional research has been completed. A listing follows:

a. Establish and integrate additional local warning centers to provide adequate warning coverage and data collection capability.

b. Program and locate the desired number of intermediate centers necessary to provide support to lower echelons.

c. Relocate state warning centers away from prime target areas where necessary.

d. Expand or modify existing circuits between warning centers to provide adequate survivability.

e. Extend the hard copy teletype warning message capability to local warning centers.

f. Provide tie lines between local warning centers and selected radio stations and arrange for 24 hour standby capability where necessary.

g. Provide emergency power and fallout protection for all radio stations required for the dissemination of voice warning messages and other communications.

h. Equip sirens having separate air compressors with modulated air stream loudspeakers to provide outdoor warning messages.

i. Establish public address warning dissemination capability in urban and industrial areas.

5. Phase 3 - Achieving Full System Capability

Prior to the initiation of Phase 3, the results of additional research will be known, development of a suitable warning receiver will have been completed, and necessary funding accomplished. The interim capability and the integration of final improvements must be planned and coordinated to achieve optimum system effectiveness at all times. In view of the size of the task (e.g., 70 million receivers required) it is unlikely that full system capability will be attained before 1970. Long range activities calculated to lead to an adequate system should be undertaken to determine and implement the required improvements.

a. Install an automatic warning system developed through studies aimed at developing plans and specifications for this system.

b. Integrate the warning and attack effects activities into a single homogeneous working organization.

c. Plan and provide necessary communication links with appropriate military installations, and develop the procedures necessary for close cooperation with these agencies.

d. Implement the most feasible indoor warning system as determined by further study and research.

L. SYSTEM TRAINING

Training requirements derived from this study lead to two general conclusions:

1. Development of a System Training Program with simulation exercises is essential to establishing, maintaining, and testing operational readiness of the warning system. These should be capable of involving civil defense officials generally, NAWAS personnel specifically, and sections of the populace when appropriate.

2. Training and testing programs should be designed for appropriate system and subsystem elements to facilitate integration of new equipment procedures or personnel without sacrificing operational readiness.

M. TESTING PROGRAM

1. The warning system must ensure its operational readiness capability. To accomplish this requires that elaborate subsystem testing be a routine and periodic activity.

2. Component testing may be determined by:

a. The failure rate of each component of the subsystem under standby conditions.

b. The required probability of operation.

c. The statistical probability distribution function that describes the reliability behavior of the component.

3. Appropriate testing of an alert signal coupled with proper information and education can instill awareness of the system and enhance its effectiveness.

VI. RECOMMENDATIONS FOR FURTHER RESEARCH

Constraints of manpower and time, coupled with the required focus imposed by contract objectives, have limited the warning requirements study to establishment of basic requirements, establishment of performance characteristics, and a general survey of feasible warning systems. These constraints have, however, served to point up areas in which SDC feels additional research is required.

These areas include both technical studies required prior to warning system selection and studies of a more general nature dealing with operational and organizational functions. The areas of concern for further research are outlined below. (Additional areas of investigation are included in the discussion of implementation in TM(L)-900/001/01.)

1. Determine specific feasibility and cost of a radio-based civil defense warning system. Accomplish radio coverage studies and develop and field test a civil defense warning receiver.

2. Perform studies to indicate cost and competitiveness of telephone systems for warning.

3. Formulate plans and specifications for specific circuits and equipments required to implement an Automatic Warning System.

4. Determine through research the potential use of components of the military services for maintenance and/or operation of the system.

5. Determine the operational interfaces between OCD and military command and control structure and analyze and determine the factors that influence the making of the national decision to warn.

6. Establish a schedule of applicable alerting conditions and standardize these for all levels of civil defense.

7. Analyze various operational facilities at Federal, state and local levels to determine the need for information processing in the operation of the system.

8. Determine appropriate formats and contents of warning messages in light of information needs and requirements of officials and the general public.