Senate Hearings

Before the Committee on Appropriations

Natural Disaster Monitoring, Warning Dissemination, and Community Preparedness

93d CONGRESS, SECOND SESSION

Fiscal Year 1975

SPECIAL HEARING

Natural Disaster Monitoring, Warning Dissemination, and Community Preparedness

A

HEARING

BEFORE THE

SUBCOMMITTEE ON DEPARTMENTS OF STATE, JUSTICE, AND COMMERCE, THE JUDICIARY, AND RELATED AGENCIES

OF THE

COMMITTEE ON APPROPRIATIONS UNITED STATES SENATE

NINETY-THIRD CONGRESS

SECOND SESSION

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DEPARTMENTS OF STATE, JUSTICE, AND COMMERCE, THE JUDICIARY, AND RELATED AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1975

WEDNESDAY, FEBRUARY 20, 1974

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, D.C.

The subcommittee met at 10 a.m., in room 1114, Everett McKinley Dirksen Office Building, Hon. Thomas F. Eagleton, presiding.

Present: Senators Eagleton and Fong.

DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

STATEMENTS OF:
JOHN W. TOWNSEND, JR., ASSOCIATE ADMINISTRATOR
GEORGE P. CRESSMAN, DIRECTOR, NATIONAL WEATHER SERVICE
ACCOMPANIED BY:
DAVID S. NATHAN, DIRECTOR, OFFICE OF BUDGET AND PROGRAM ANALYSIS
GERALD PETERSON, DIRECTOR, METEOROLOGICAL AND HYDROGRAPHIC OFFICE
GEORGE N. BRANCATO, METEOROLOGIST IN CHARGE, ST. LOUIS, MO., OFFICE, NATIONAL WEATHER SERVICE
ROBERT E. BECK, DIRECTOR, OFFICE OF PROGRAMS AND BUDGET
PAUL E. CLEMENTS, BUDGET OFFICER
JOSEPH A. STRAHL, ASSISTANT CHIEF, OPERATIONS AND FIELD SERVICES DIVISION, NATIONAL WEATHER SERVICE

OPENING STATEMENT OF SENATOR EAGLETON

Senator EAGLETON. Good morning, ladies and gentlemen. This morning the Subcommittee for the Departments of State, Justice, and Commerce, the Judiciary and related agencies will hold an oversight hearing on the programs of the National Oceanic and Atmospheric Administration and the facilities of the National Weather Service, with regard to natural disaster monitoring, warning dissemination, and community preparedness.

On the evening of November 24, 1973, two tornadoes struck in the southeast corner of Missouri, the so-called Bootheel area. This natural disaster resulted in two deaths and extensive property damage.

In response to my subsequent inquiry, I was informed by the National Weather Service that there had been a partial breakdown in the warning system serving the Bootheel area.

I also contacted Senator John O. Pastore, chairman of the subcommittee, and requested that the subcommittee hold an oversight hearing on not only what occurred in the Bootheel area and what steps have been taken to prevent a recurrence, but also how the total severe storm warning system is now operating and what needs to be done to maximize the effectiveness of the system.

Senator Pastore was in complete accord with my suggestion and asked me to preside at this hearing.

Our principal witnesses are Dr. John W. Townsend, Associate Administrator of the National Oceanic and Atmospheric Administration; and Dr. George P. Cressman, Director of the National Weather Service.

PREPARED STATEMENT OF SENATOR SYMINGTON

Before these gentlemen proceed, we have a statement and some supporting information from my distinguished colleague, Senator Stuart Symington, that will be made a part of the record at this juncture.

[The information follows:]

On November 24, 1973 a tornado struck the Bootheel area of Southeast Missouri killing two residents of Dunklin County. Three other persons were killed in Shannon County the same day. Through the investigative efforts of the Daily Dunklin Democrat in Kennett, Missouri, it became apparent that these and future tragedies might be avoided through more efficient management of the National Storm Warning System.

The responsibility for observing and reporting storm activity in Southeast Missouri is divided uniquely between three sections of the National Weather Service's internal radar reporting and weather coordination system. Relay centers for the transmission of warnings between those sections are located in St. Louis, Memphis, Tennessee, and Louisville, Kentucky. These stations must rely on radio and television stations in all three states to broadcast storm warnings to the public.

On November 24 some of these broadcast stations were not notified in time to warn citizens of the impending danger. Mechanical delays in the radar warning system and the lack of personnel at the relay centers prevented the dissemination of warnings to some of the stations serving the Bootheel area. At the suggestion of Jack Stapleton, Jr., publisher of the Daily Dunklin Democrat, I asked Dr. George Cressman, Director of the National Weather Service, to explain the cause of the delays in the weather warning system on November 24 and what steps were being taken to remedy this. In his reply, Dr. Cressman stated:

> "Our primary means for distributing weather information to the news media is the NOAA Weather Wire Service (NWWS). Due to tariff regulations and the need to limit circuit traffic, the NWWS is composed of intrastate circuits. Missouri and all of its surrounding states have NWWS.
>
> "The primary relay of warnings between NWWS circuits is accomplished by our internal RAREP (Radar Report) and Warning Coordination (RAWARC) network, figure enclosed, consisting of five circuits. Relays between RAWARC circuits are handled by the computerized RAWARC Automatic Message Switching (RAMS) center located in Washington, D.C. Tornado warnings and other significant weather messages have a top priority at RAMS. These top priority messages are relayed according to the order in which they are received. Depending upon the amount of top priority traffic, the relay of some warning messages could be delayed. A delay of just a few minutes in relaying a tornado warning can, of course, be critical.

"On November 24, 1973, a tornado caused two deaths in the Missouri Bootheel 1 1/2 miles east of Clarkston, Dunklin County, at 10:25 p.m. This tornado was covered by a watch bulletin issued at 5:50 p.m., valid from 6 p.m. to 1 a.m. Sunday. A severe thunderstorm warning was issued by the Weather Service Forecast Office (WSFO) at St. Louis for Dunklin County at 9:15 p.m., followed by a tornado warning at 9:45 p.m. These warnings were relayed to the RAWARC circuits serving Tennessee and Kentucky. The State Relay Center (SRC) at Memphis entered the warnings on the Tennessee NWWS, but the Louisville SRC did not enter these warnings on the Kentucky NWWS as required. In addition to issuing the warnings, WSFO St. Louis notified the Civil Defense of Dunklin County where community emergency procedures were taken, including tracking the tornado by car. The Missouri Bootheel Commission was also notified.

"As well as we can determine, RAMS relayed the 9:45 p.m. tornado warning to the RAWARC circuits serving Kentucky and Tennessee between 10:10 p.m. and 10:15 p.m. Memphis SRC transmitted it on the Tennessee NWWS between 10:11 and 10:17 p.m. Our inability to determine exactly when the warning was received and transmitted at Memphis is due to the lack of time to log all station actions during critical, shortfused weather situations. We were unable to determine what Memphis radio and television stations broadcast these warnings, or when the broadcasts were made. The Paducah television station was unable to broadcast them, because they were not transmitted on the Kentucky NWWS."

In an effort to prevent future breakdowns in communications between state relay centers and the weather service stations, Dr. Cressman has taken several steps to improve warning services for the Bootheel area.

Through the cooperation of the Defense Civil Preparedness Agency, a new interstate direct communication line has been installed between the Weather Service Forecast Office in St. Louis and the State Relay Station in Memphis. We had asked Dr. Cressman about the possibility of establishing such a direct line following a suggestion in the Daily Dunklin Democrat. At the time of the tornados, a direct line already was in operation between St. Louis and the Kentucky intrastate warning system headquarters in Louisville.

Dr. Cressman also noted that the Forecast Office in Louisville has been instructed to transmit on its state wire all warnings which are received through the regional warning system and which cover areas within 100 miles of its state boundaries. He assured us that in fiscal 1974 the National Weather Service would automate and speed up the exchanges between regional circuits. Certainly we would hope that the National Weather

Service will be granted sufficient funding to improve its storm warning system in order to more effectively serve those citizens who may become endangered through weather conditions over which they have no control.

Each season seems to bring with it new hazards. The melting of winter snows followed by spring rains could create a flood potential along the Mississippi River even greater than last year when record flood levels left many Missourians homeless. It is encouraging that the National Weather Service has expanded its National Weather Service Warning System alerts to include flooding as well as tornadcs and other severe storms.

This warning system is the last line of defense against sudden disaster. The safety of our citizens depends upon the speed with which we can transmit the news of impending storms or flooding to those most likely to be affected.

We should therefore make every effort to assure that our warning system is the best available to allow persons in storm areas sufficient time to protect themselves, their families, and their possessions.

As a part of this record I would like to include an article from the November 27, 1973 Daily Dunklin Democrat, our letter of December 4, 1973 to the National Weather Service, and the December 27 reply from Dr. Cressman.

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THE DAILY DUNKLIN DEMOCRAT, KENNETT, MISSOURI

November 27, 1973

Communications Gap Leaves SeMo in Void for Weather Warnings

By DAILY DEMOCRAT
Staff Newsman

Despite an extensive storm warning system that links Civil Defense, police and electronic media, two Dunklin Countians are dead as a result of a tornado Saturday night that went unreported on several Memphis television stations.

A Daily Democrat investigation of the procedures involved in the issuance of severe storm warnings by the National Weather Service reveals a serious communications void exists between the agency's St. Louis and Memphis stations, a void that prevents direct communication between the two units.

The National Weather Service station at Lambert Airport in St. Louis has the direct responsibility for issuing severe storm warnings throughout all of Missouri, and that includes the Bootheel. The Memphis station, The Daily Democrat check shows, has no direct responsibility for issuing storm warnings to the Bootheel, despite the fact that its area does include counties in Northeast Arkansas and western Tennessee. The Bootheel area is a void on the Memphis station's weather map.

"We cannot give storm warnings for Southeast Missouri," was the explanation offered by Jack Cox, assistant director of the Memphis station. Cox didn't mean the station wouldn't give storm warnings for Southeast Missouri, only that his agency's organizational chart places the Bootheel in the area served by the St. Louis weather station.

The Memphis station has direct responsibility for storm warnings in 10 counties in Northeast Arkansas, 21 counties in western Tennessee and five counties in Northwest Mississippi.

The Daily Democrat check of Saturday night's storm warnings by the St. Louis office shows numerous messages were relayed to agencies throughout Southeast Missouri but no direct communication was made with the Memphis office of the National Weather Service, which in turn services the Memphis television stations.

According to William Waldheuser, supervising forecaster of the St. Louis weather bureau, calls were made to Civil Defense units, the Missouri Highway Patrol, a volunteer storm watch service organized by the Bootheel Planning Commission at Malden, and radio stations at Poplar Bluff, Kennett, Malden and Caruthersville. Several of the stations did not answer the Weather Service calls Saturday night, Waldheuser said, probably because they had gone off the air. Calls were an-

swered at KBOA in Kennett and at Poplar Bluff, the St. Louis official said.

By 9:50 p.m. Saturday, the possibility of a tornado in the Bootheel was placed on the Weather Service's teletype, a state communications link called the Missouri Weather Wire.

Asked how Bootheel residents could be assured of receiving severe weather bulletins on Memphis TV stations, Waldheuser suggested the installation of a direct St. Louis-to-Memphis telephone line, linking the two weather stations. Called NAWAS (National Warning System) the line would enable the St. Louis weather station to notify the Memphis station of possible severe storms or tornadoes in the Bootheel. This would enable the Memphis weather station to alert Southeast Missourians through direct broadcasts over Memphis television stations, just as is now done with warnings for Northeast Arkansas and western Tennessee.

Waldheuser said the NAWAS line would be a direct connection, always open for instant communication between the two stations.

Asked how such a line might be installed, he said authority would have to be made by the National Weather Service's overall supervising agency, the U.S. Department of Commerce.

29-545 O - 74 -- 2

December 4, 1973

Dr. George Cressman
National Oceanic and Atmospheric
Administration
Department of Commerce
14th and Constitution
Washington, D.C.

Dear Dr. Cressman:

Two residents of Dunklin County were killed in Tornadoes which struck Southeast Missouri November 24.

Based upon a preliminary investigation by the Daily Dunklin Democrat in Kennett, storm warning information was not directly available to all of the broadcast stations which serve the "bootheel" area of our State.

As a result, persons watching television programs from Memphis, Tennessee or Paducah, Kentucky did not hear advisory warnings which were sent out by the St. Louis office of the National Weather Service.

Suggested in the article is the establishment of a direct St. Louis to Memphis telephone line to link the two weather stations.

Clearly the matter requires urgent attention. We would appreciate your comments and suggestions for a temporary solution to this problem, in the event a storm occurs in the immediate future, and any proposed long-range system which can overcome this communication warning gap.

Sincerely,

Stuart Symington

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Rockville, Md. 20852
Wx2

DEC 27 1973

Honorable Stuart Symington
United States Senate
Washington, D. C. 20510

Dear Senator Symington:

This is in response to your letter of December 4, 1973, concerning the dissemination of storm warnings to broadcast stations serving the Bootheel area of Missouri. We've reviewed this carefully. Our review showed that the warning actions taken by our St. Louis office were timely and the safety authorities in the counties affected took effective actions. A breakdown in part of our distribution procedures, however, prevented dissemination to some of the media stations serving the Bootheel area.

Our primary means for distributing weather information to the news media is the NOAA Weather Wire Service (NWWS). Due to tariff regulations and the need to limit circuit traffic, the NWWS is composed of intrastate circuits. Missouri and all of its surrounding states have NWWS.

The primary relay of warnings between NWWS circuits is accomplished by our internal RAREP (Radar Report) and Warning Coordination (RAWARC) network, figure enclosed, consisting of five circuits. Relays between RAWARC circuits are handled by the computerized RAWARC Automatic Message Switching (RAMS) center located in Washington, D.C. Tornado warnings and other significant weather messages have a top priority at RAMS. These top priority messages are relayed according to the order in which they are received. Depending upon the amount of top priority traffic, the relay of some warning messages could be delayed. A delay of just a few minutes in relaying a tornado warning can, of course, be critical.

On November 24, 1973, a tornado caused two deaths in the Missouri Bootheel 1 1/2 miles east of Clarkston, Dunklin County, at 10:25 p.m. This tornado was covered by a watch bulletin issued at 5:50 p.m., valid from 6 p.m. to 1 a.m. Sunday. A severe thunderstorm warning was issued by the Weather Service Forecast Office (WSFO) at St. Louis for Dunklin County at 9:15 p.m., followed by a tornado warning at 9:45 p.m. These warnings were relayed to the RAWARC circuits serving Tennessee and Kentucky. The State Relay Center (SRC) at Memphis entered the warnings on the Tennessee NWWS, but the Louisville SRC did not

enter these warnings on the Kentucky NWWS as required. In addition to issuing the warnings, WSFO St. Louis notified the Civil Defense of Dunklin County where community emergency procedures were taken, including tracking the tornado by car. The Missouri Bootheel Commission was also notified.

As well as we can determine, RAMS relayed the 9:45 p.m. tornado warning to the RAWARC circuits serving Kentucky and Tennessee between 10:10 and 10:15 p.m. Memphis SRC transmitted it on the Tennessee NWWS between 10:11 and 10:17 p.m. Our inability to determine exactly when the warning was received and transmitted at Memphis is due to the lack of time to log all station actions during critical, short-fused weather situations. We were unable to determine what Memphis radio and television stations broadcast these warnings, or when the broadcasts were made. The Paducah television station was unable to broadcast them, because they were not transmitted on the Kentucky NWWS.

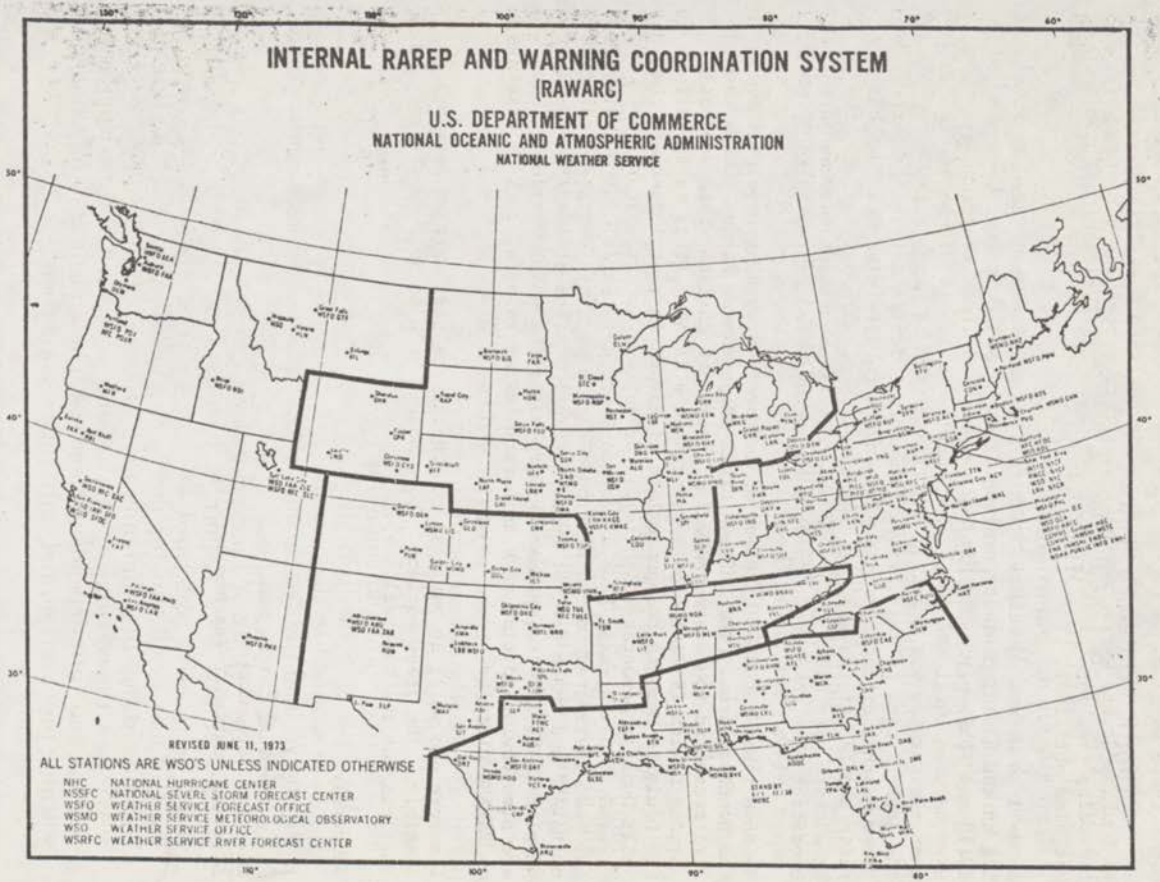
We have taken a number of steps to improve the warning services for the Bootheel area. The Defense Civil Preparedness Agency (DCPA) has been requested to furnish WSFO St. Louis with an interstate National Warning System (NAWAS) drop on Tennessee's NAWAS. (This is the direct St. Louis to Memphis telephone line discussed in your letter and the Daily Dunklin Democrat editorial.) We believe our request will be granted. They already have a drop on Kentucky's NAWAS. WSFO Louisville has been instructed to transmit on NWWS all warnings which are received on RAWARC and which are for areas within 100 miles of its state boundaries. We plan in FY 1974 to automate and speed up the RAWARC circuits. We are also trying to find ways to assure faster relay of tornado warnings on RAWARC circuits.

I assure you we'll do our best to provide the best warning services possible. The steps outlined above should help to improve the warning services for the Bootheel area.

Sincerely,

for George P. Cressman
Director, National Weather Service

Enclosures


INTERNAL RAREP AND WARNING COORDINATION SYSTEM
(RAWARC)
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
REVISED JUNE 11, 1973
ALL STATIONS ARE WSO'S UNLESS INDICATED OTHERWISE
NHC NATIONAL HURRICANE CENTER
NSSFC NATIONAL SEVERE STORM FORECAST CENTER
WSFO WEATHER SERVICE FORECAST OFFICE
WSMO WEATHER SERVICE METEOROLOGICAL OBSERVATORY
WSO WEATHER SERVICE OFFICE
WSRFC WEATHER SERVICE RIVER FORECAST CENTER

INTRODUCTION OF ASSOCIATES

Senator EAGLETON. Dr. Townsend, you may proceed.

Dr. TOWNSEND. I would like to introduce the people accompanying me. At my far left is Mr. Peterson, next to him we have Mr. George Brancato. On my immediate left is Dr. George Cressman, the Director of the National Weather Service. On my immediate right is Mr. Paul Clements, budget officer, and next to him is Mr. Robert Beck, Director, Office of Programs and Budget.

NATURAL DISASTER WARNING AND PREPAREDNESS FUNCTIONS

Mr. Chairman and members of the committee, I am pleased that we have this opportunity to testify today on NOAA programs for natural disaster warning and preparedness. I will give an overview of pertinent NOAA activities, then, with your permission, Dr. George Cressman, Director of the National Weather Service, will discuss the tornadoes which caused two deaths and considerable damage in the adjacent portions of Missouri, Arkansas and Kentucky on November 24, 1973.

Natural disasters continue to plague this Nation. However, a record number of 1,107 tornadoes in 1973 caused only 87 deaths, well below the average of 113. Our warning system and community preparedness programs contributed significantly to this reduced death toll.

The national responsibility for severe storm and flood warnings lies with the National Oceanic and Atmospheric Administration (NOAA). Other agencies of the Federal Government make major contributions to the operation of the system.

NOAA also supports natural disaster preparedness planning in cooperation with the Defense Civil Preparedness Agency and provides assistance to State and community programs.

Our extensive facilities are good and our systems are efficient but they are strained to the breaking point by widespread major disasters which overload the system and by phenomena such as tornadoes which require fast reaction times.

The former Office of Emergency Preparedness identified many needs in its January 1972 Report to Congress on Disaster Preparedness which have been reaffirmed by surveys of subsequent disasters. The most urgent needs are for more efficient warning dissemination and better assistance to community preparedness planning.

We view the warning system as being composed of three equally important and interdependent elements. These elements are: observing, warning preparation, and warning dissemination.

GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM (GOES)

The first of these, observing, requires a multiplicity of equipments and networks that detect, measure, and track specific hazardous phenomena.

We continually exploit our expanding technology. For example, the geostationary operational environmental satellite system is expected to be operational later this year. The GOES system offers radically new and improved methods of identifying potential locations of severe weather and tornado-producing thunderstorms.

Satellite data must be supplemented for effective use in warnings on severe local storms. To do this we plan to fill gaps in the present radar network, modernize it, and develop more efficient applications of radar data.

We plan to extend the network of river and rainfall stations to a total of about 10,000 stations, one-half of which should be automated. About 15 percent of the present network of 5,500 stations is now automated.

Aircraft provide another important source of specialized information. Planned improvements to the NOAA aircraft fleet are vital to Project STORMFURY which has shown potential in decreasing the maximum wind speeds in hurricanes. The NOAA aircraft can also collect data for studies of severe local storms and tornadoes.

GOES SYSTEM

Senator EAGLETON. May I break in there? Let's backtrack a bit to where you were talking about GOES, which is the new satellite you expect to have on line later this year. Is that the one that will coordinate 10,000 rainfall and river stations?

Dr. TOWNSEND. No; the GOES system is used primarily for producing pictures of the full disc of the Earth with a resolution of about 1 mile. This is considerably better than the pictures you see on TV, which come from a research satellite called ATS.

The reason I hesitated initially was that the GOES satellite does have the ability to automatically relay remote station data back to a central location.

The central location can interrogate out or the remote station can continuously provide information through the satellite. In that sense, GOES is useful in the collection of data from river and rainfall stations.

We do plan to automate a number of those systems through GOES, but only where they cannot be connected up to local power or telephone lines.

Senator EAGLETON. Then what you plan to have is 10,000 rainfall and river stations as an optimum. You don't have that now. You only have 5,500; is that correct?

Dr. TOWNSEND. That is correct.

Senator EAGLETON. You want to have them automated and now only 15 percent are automated, is that right?

Dr. TOWNSEND. Right.

WARNING PREPARATION

The second element of the warning system, warning preparation, depends on rapid centralized analysis and computer processing of data. A more powerful fourth-generation computer system being installed at Suitland, Md., will permit improved operational forecasts as well as expanded research and development.

The President's fiscal year 1975 budget includes funds for implementation of the first operational phase of the automation of field operations and services (AFOS) which will provide for minicomputers and TV-type displays at key forecast offices and river forecast centers.

The automated features of AFOS will improve the accuracy and timeliness of warning messages and greatly expand the capacity of the warning system to efficiently handle the excessive workloads generated by widespread major disasters.

DISSEMINATION

Dissemination is the third element in the warning system. None of the special purpose dissemination systems now in use is sufficient in itself. They supplement one another to reach the greatest number of people.

NOAA's radar report and warning coordination circuit, and the national warning system network of the Defense Civil Preparedness Agency are used for internal office-to-office communications.

The NOAA Weather Wire Service, the national warning system, and local public service teletypewriter circuits are used to provide information to the mass news media and Government officials.

The primary means of direct public contact is the broadcast by commercial radio and TV stations of warnings prepared by NOAA. However, NOAA also transmits warnings directly to the public by VHF/FM continuous weather radio transmissions, multiple access recorded telephone announcement systems and a few local civil defense siren systems. The VHF/FM radio and telephone warning dissemination systems are planned for expansion and improvement.

Warnings must be accurate and timely, but public response depends on adequate community preparedness. This is the final link in the chain of Federal-State community programs to mitigate the impact of natural disasters.

NOAA provides risk assessment information on atmospheric phenomena that cause disasters and has a continuing program for the preparation of storm evacuation charts for the Gulf of Mexico and Atlantic coastlines. NOAA's preparedness assistance programs are carried out in coordination with the Defense Civil Preparedness Agency.

FEDERAL PLAN FOR NATURAL DISASTER WARNING AND PREPAREDNESS

In June 1973, NOAA published a "Federal Plan for Natural Disaster Warning and Preparedness" which was prepared with the assistance of several other agencies. The plan presents a coordinated response to the needs that are known to exist in our programs to detect, predict, warn, and prepare for natural disasters.

I have copies of the plan if members of this committee desire them. We are now preparing a supplement to the plan to reflect the President's fiscal year 1975 budget, which continues to recognize the importance of disaster warning and preparedness programs.

NOAA BUDGET AMOUNTS FOR NEEDED DISASTER WARNING

I have made references to past budget increases of NOAA that were directed to improving our natural disaster warning system and community preparedness efforts. I have also described planned improvements in many elements of our systems which will require further budget increases. The total amounts are summarized as follows:

Fiscal year:	*Millions*
1972—Appropriated	$145,089
1973—Appropriated	170,157
1974—Appropriated	202,619
1975—Requested	226,263

Recent budget increases show a 50 percent increase.

CONCLUSION

In conclusion, I would like briefly to summarize my testimony by making the following points.

First, the United States has an extensive and efficient natural disaster warning and preparedness system, but identified needs have yet to be fully satisfied. Each year disasters continue to take a toll in lives and property damage that is of deep concern to us all.

Second, advances in technology and continuing operations require a continuing investment to maintain and extend the capabilities of the system.

Last, we have developed balanced programs to satisfy demands on NOAA warning systems and services. These functions have been given highest priority in recent Presidential budgets and favorable consideration by the Congress. We hope this trend will continue so long as we can identify worthwhile means of improving our performance.

Mr. Chairman, that completes my verbal testimony. I have a more detailed statement I would like to submit for the record. I will be glad to answer any questions now, or after Dr. Cressman presents his testimony.

PREPARED STATEMENT AND COPY OF "FEDERAL PLAN"

Senator EAGLETON. Doctor, we would be pleased to have a copy of your "Federal Plan for Natural Disaster Warning and Preparedness." It will be made a part of the record. We will also include your full statement in the record.

[The statement follows:]

[A copy of "A Federal Plan for National Disaster Warning and Preparedness" has been forwarded to Senator Eagleton and is available in the committee files.]

29-545 O - 74 -- 3

Mr. Chairman and Members of the subcommittee, I am pleased that we have this opportunity to testify today on NOAA programs for natural disaster warning and preparedness. Our testimony will be in two parts--first, I will give an overview of NOAA activities covering the broad areas of disaster monitoring, warning preparation, warning dissemination, and community preparedness; then, with your permission, Dr. George Cressman, Director of the National Weather Service, will discuss the situation of November 24, 1973, in which tornadoes caused two deaths and considerable damage in portions of Missouri, Tennessee, and Kentucky.

Natural disasters continue to plague this nation. For example, 1972 produced record floods and 1973 produced a record-setting total of 1,107 tornadoes. This is considerably higher than the annual average of 681 and the previous one-year record of 929 which occurred in 1967. I think it is highly significant that although there was a record number of tornadoes in 1973, they caused only 87 deaths, well below the average of 113. Our warning system and community preparedness programs made a significant contribution to this reduced death toll. The year 1973 also saw prolonged floods of record on the Mississippi River. Here again the system worked very well.

As you know, the national responsibility for severe storm and flood warnings lies with the National Oceanic and Atmospheric Administration (NOAA). The national natural disaster warning system is operated by NOAA's National Weather Service, but other parts of NOAA and other agencies of the Federal Government provide key facilities and make major contributions to the system. The Departments of Commerce, Interior, Agriculture, Defense, Housing and Urban Development, and Transportation, as well as NASA and the National Science Foundation are integral to this fully coordinated national system. NOAA also supports natural disaster preparedness planning in cooperation with the Defense Civil Preparedness Agency and provides assistance to state and local programs.

To carry out natural disaster warning responsibilities, NOAA operates extensive facilities and systems. Our facilities are good and our systems are efficient but they are strained to the breaking point in two types of situations. First, widespread major disasters simply overload and overwhelm the capacity of the system. This was the case in some areas in the devastating floods following Hurricane Agnes in 1972. The second situation involves highly destructive phenomena such as tornadoes which occur rapidly and on a very small scale placing enormous demands upon the reaction time of our system.

The former Office of Emergency Preparedness identified many needs in its January 1972 "Report to Congress on Disaster Preparedness." The findings of that landmark report have been reaffirmed by post-disaster surveys of subsequent disasters such as the floods of Rapid City and Hurricane Agnes. We learned long ago that experience is a great proving ground and teacher so each major disaster is surveyed to evaluate the effectiveness of all elements of our systems involved in detection, prediction, and warning dissemination. Particular attention is given to determining if system elements functioned adequately, and if they did not, why, and what is needed to prevent recurrence of the deficiency. Requirements identified by these surveys are frequently beyond the existing capability and resources of NOAA and therefore evolve into requests for budget increases. As I review for you the NOAA programs directed toward our major objective to reduce the economic and social disruption of natural disasters, I shall also describe the considerable success we have achieved in recent years in our budget requests needed to attain this objective. Even with this success, many improvements remain to be made. The most urgent of these needs are to achieve more efficient warning dissemination and to provide better assistance to community preparedness planning.

We view the warning system as being composed of three equally important and interdependent elements. These elements are:

- o Observing
- o Warning preparation, and
- o Warning dissemination

The first of these, observing, must detect, measure, and track specific hazardous phenomena and, at the same time, it must provide data to support both forecasts and vulnerability assessments of these phenomena. Observing requires a multiplicity of equipment and networks that complement one another, some of which provide highly specialized information.

We continually develop improved ways to exploit our expanding technology. For example, our planned improvements include one of the more outstanding technological developments in recent years, the Geostationary Operational Environmental Satellite (GOES). NASA will soon launch the first operational prototype satellite and a two spacecraft system is expected to be operational later this year. The GOES system offers radically new and improved methods of forecasting both hurricanes and severe local storms because we can observe their development almost continuously. For example, NOAA scientists, working with data from NASA's Advanced Technology Satellite, have learned that certain unique cloud formations seen in the satellite pictures permit identification of potential locations of severe weather. NOAA and NASA scientists working together have determined the detailed characteristic features of certain tornado-producing thunderstorms, which the operational geostationary satellites will enable us to observe routinely. Other studies have contributed to improved forecasts of hurricane winds and rainfall, fog, clear-air turbulence, blizzards, coastal gales, and flash floods.

The relatively broad-scale satellite data must be supplemented to provide the details required for effective warnings on severe local storms. To do this we are following a carefully considered plan to fill gaps in the present radar network, modernize it by replacing worn

out and obsolete equipment, and continue to develop more efficient applications of radar data such as integration with the information from satellites and the network of river and rainfall stations. We plan to improve reliability of river and rainfall stations through automation and by increasing the number of stations until the network is complete. A total of about 10,000 stations is needed, one-half of which should be automated. Approximately 15 percent of the present network of 5,500 stations is now automated.

Flash floods present a special problem in both forecasting and detection in that they develop over very small areas in extremely short periods of time. Relatively new and effective automatic flash flood alarm devices are being tested in a number of locations.

Aircraft provide another important source of specialized information. Aerial reconnaissance by DOD aircraft is used extensively to collect detailed data, such as wind force and central pressure, on severe winter storms and tropical disturbances. NOAA aircraft are used primarily in weather modification research. Planned improvements include modernization of the NOAA aircraft fleet by phased replacement of obsolete aircraft and improved instrumentation. These improvements are vital to Project STORMFURY which has shown potential in decreasing the maximum wind speeds in hurricanes. Research to better understand severe local storms is now under study and we plan to increase the NOAA efforts in future years. Eventually, NOAA aircraft will assist in this study in a manner similar to that which has been so effective in the Florida experiments on increased rainfall. The knowledge gained will also assist us to better understand severe local storms and should contribute to more accurate forecasts and warnings of tornadoes.

The second element of the warning system, warning preparation, must depend on centralized analysis and processing of huge volumes of powerful fourth-generation computer system is nearing completion at Suitland, Maryland, for joint use by the National Meteorological

Center and the National Environmental Satellite Service. This increased capability will permit improved operational forecasts as well as expanded research and development.

Improvements in techniques and facilities of our field forecast offices have not kept pace with emerging technology as have our national analysis and forecasting centers. However, we have a program to correct this. The Automation of Field Operations and Services (AFOS) System is now in prototype development stage. The President's FY75 budget includes funds for implementation of the first operational phase of AFOS which will provide for mini-computers and TV-type displays at key forecast offices and river forecast centers in the field. These are to be interconnected with each other, with national centers and with field service offices by high speed communications links. The automated features of AFOS will improve the accuracy and timeliness of warning messages and greatly expand the capabity of the warning system to efficiently handle the excessive workloads generated by widespread major disasters.

Dissemination is the third element in the warning system. For maximum effectiveness, accurate warnings of all types of potential natural disasters must reach all who need the information with adequate lead time for making decisions and taking protective actions. Multiple warning dissemination systems currently in use also serve as a means to disseminate general weather information and forecasts. None of the special purpose systems now in use is sufficient in itself. They supplement one another to make warnings available to the greatest number of people we can reach. Teletypewriter networks, such as NOAA's Radar Report and Warning Coordination Circuit, and the National Warning System telephone party-line network of the Defense Civil Preparedness Agency are used for internal office to office communications. The NOAA Weather Wire Service, the National Warning System and local public service teletypewriter circuits are used to provide information to the mass news media and government officials. The National Warning System is also

especially useful for obtaining feedback from volunteer observer spotter networks and from police and other local authorities in areas warned.

The primary means of direct public contact is the broadcast by commercial radio and TV stations of warnings prepared by NOAA. However, NOAA also transmits warnings directly to the public by VHF/FM continuous weather radio transmissions, multiple access recorded telephone announcement systems and a few local civil defense siren systems. The VHF/FM radio and telephone warning dissemination systems are planned for expansion and improvement.

Another system, the Decision Information Distribution System, is being tested by the Defense Civil Preparedness Agency. If feasible, it will be used for both attack warnings and for warnings of natural disasters. In the long term, NOAA in conjunction with NASA is studying the feasibility of a Disaster Warning Satellite System that might be available by the 1980's for both the dissemination of natural disaster warnings and the collection of data and feedback information before and during natural disasters.

Warnings must be accurate and timely, but public response depends on adequate community preparedness. This is the final link in the chain of Federal-State-community programs to mitigate the impact of natural disasters.

NOAA routinely provides risk assessment information on the frequency of occurrences and intensity of atmospheric phenomena that cause disasters. In addition, the NOAA National Ocean Survey has a continuing program for the preparation of storm evacuation charts for the Gulf of Mexico and Atlantic coastlines. NOAA's preparedness assistance programs are carried out primarily through the field offices of the National Weather Service. A recent joint agreement between the Defense Civil Preparedness Agency and NOAA provides for full coordination of preparedness planning assistance to communities. The program is given emphasis seasonally for different types of storms in areas where they most frequently occur

using appropriate pamphlets and verbal presentations. Hurricane preparedness specialists have been assigned to Hurricane Warning Offices to assist communities in organizing their preparedness efforts. We plan to assign additional community preparedness specialists to Weather Service Forecast Offices in the future to perform several tasks, including:

- o improving flash flood warning systems;
- o developing tornado and severe storm spotter networks; and
- o community preparedness planning assistance.

The President's FY 1973 and 1974 budgets recognized the need for interagency action and coordination of programs concerned with disaster warnings and community preparedness. In consonance with that guidance, NOAA published in June 1973, a Federal Plan for Natural Disaster Warning and Preparedness which was prepared with the assistance of several other agencies. The Plan was conceived as a joint effort of the agencies involved to present a coordinated response to the needs that are known to exist in our programs to detect, predict, warn, and prepare for natural disasters. Copies of the Plan are available for members of this subcommittee and have been furnished to a number of other Members of Congress. The President's FY 75 budget continues to recognize the importance of disaster warning and preparedness programs. We are now preparing a supplement to the Plan to reflect recent actions.

I have made references to past budget increases of NOAA that were directed to improving our natural disaster warning system and community preparedness efforts. I have also described planned improvements in many elements of our systems which will require further budget increases. The total amounts, past and planned, which we refer to as the "Disaster Package" are summarized as follows

FY 1972 - Appropriated	$145,089,000
FY 1973 - Appropriated	170,157,000
FY 1974 - Appropriated	202,619,000
FY 1975 - Requested	226,263,000

In conclusion I would like to briefly summarize my testimony by making the following points:

First, The United States has an extensive and efficient natural disaster warning and preparedness system, but identified needs have yet to be fully satisfied. Each year disasters continue to take a toll in lives and property damage that is of deep concern to us all.

Second, Advances in technology and continuing operations render many of the elements of the warning system--observing, warning preparation, and warning dissemination--obsolete from time to time and necessitate replacement. Continuing investment is necessary to maintain and extend the capabilities of the system.

Last, We have developed balanced, time-phased programs to satisfy unmet demands on NOAA systems and services. These give appropriate attention to our most urgent needs for more efficient warning dissemination and to provide better assistance to community preparedness planning. The environmental monitoring, prediction, and warning functions have been given highest priority in recent Presidential budgets and favorable consideration by the Congress. This is evidenced by the increase of $67,298,000 approved by the Congress for 1972, 1973, and 1974 for this program and by the increase of $23,644,000 requested by the President for 1975. We expect this trend to continue so long as we can identify worthwhile means of improving our performance.

Mr. Chairman, that completes my portion of the NOAA testimony. I will be glad to answer any questions now, or after Dr. Cressman presents his testimony.

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KEY ELEMENTS OF WARNING SYSTEM

Senator EAGLETON. Before going to Dr. Cressman; in your prepared statement, Dr. Townsend, you mentioned the three key elements in the warning system: One, observing; two, warning preparation, and three, warning dissemination.

WEAKEST LINK IN WARNING SYSTEM

Of those three interconnected links in the chain, is any one of the three the weakest?

Dr. TOWNSEND. Yes, sir. I would say warning dissemination is the weakest by the very nature of the problem. Reaching all of the people at any hour of the day or night in all parts of the country is a formidable problem.

In my statement, I said quite apart from NOAA's technical job, each community can play a vital role for itself in preparing for natural disasters. I would say that kind of work is probably even weaker than the dissemination system. It depends on where you are in the country.

If you are out in the so-called tornado alley, you find the communities are quite prepared. They are used to the threat of tornadoes and they work hard at getting ready. Likewise, along the gulf coast, where hurricanes are relatively common, you find the cities and communities relatively well prepared.

Unfortunately, where severe weather is less of a threat, you find less community interest.

To summarize, I would say the weakest link is community preparedness. The weakest technical problem is dissemination.

VHF/FM TRANSMISSIONS

Senator EAGLETON. In your statement you mentioned VHF and FM continuous transmissions. As a practical matter, do you rely mostly on commercial broadcasting to alert the citizenry?

Dr. TOWNSEND. Yes, sir.

Senator EAGLETON. The key question is, then, to observe the phenomena, and as quickly as possible disseminate that information as expeditiously as possible through commercial networks?

Dr. TOWNSEND. Yes, sir, the commercial networks give you the highest probability of contacting the majority of the people.

Senator EAGLETON. With respect to the tornado in Missouri in November of 1973, what problems did NOAA come up against with dissemination of that information?

Dr. TOWNSEND. The preparedness system in the State of Missouri worked quite well. The problem was a number of the people in the Bootheel apparently listened to a distant TV station. Our problem was getting to this TV station. Dr. Cressman will discuss it at this point.

Senator EAGLETON. I will yield at this time. We welcome Senator Fong.

SEVERE STORM MODIFICATION

Senator FONG. What has NOAA done to ameliorate the force of tornadoes?

Dr. TOWNSEND. We have no plans to moderate tornadoes at the present time. We have research programs involving the severe convective process, the thunderstorm—which, in some cases, when it is large and violent, produces a tornado. We are trying to understand that convective problem, but we have no programs to modify a tornado as yet. We have attempted to modify hurricanes and have been successful in reducing the wind fields on two or three occasions.

I say apparently successful because we have a physical model that leads us to believe that we can understand the storm and we can simulate a storm seeding in that model. We went out and tried it experimentally, and about what we expected occurred. We are optimistic there.

In terms of the tornado, my guess would be that we are well away from any ability to modify or change the tornado-producing thunderstorm.

Senator FONG. Is NOAA working on a process?

Dr. TOWNSEND. Sir, within the Federal Government, there are programs addressed at modifying severe storms to some extent. For example, the National Science Foundation, with the cooperation of a number of agencies, has a program that is being run in northwest Colorado to attempt to modify hail from severe thunderstorms.

Again, the manner in which this is done and the physical model for it do not indicate, at least to me, that one could change a tornado in that kind of a fashion.

Senator FONG. Would the responsibility lie in NOAA or the National Science Foundation or somewhere else?

Dr. TOWNSEND. The responsibility is shared. The Science Foundation and NOAA play the main role.

Senator FONG. Thank you.

Senator EAGLETON. Thank you, Senator Fong.

Dr. Cressman?

STATEMENT OF DR. CRESSMAN

Dr. CRESSMAN. Mr. Chairman and members of the committee, I am here today to testify concerning the tornadoes which struck the Bootheel area of Missouri on the 24th of November 1973.

Between 10:25 and 10:30 p.m. November 24, two tornadoes struck in the Bootheel area of Missouri. Although the warnings issued were timely and accurate, two lives were lost. We are not sure everyone got the word. A serious problem in making a warning system 100 percent effective is to reach all citizens in the area regardless of what they may be doing. In particular, people may be asleep in bed or listening to radio or television stations a hundred or more miles away. This problem has arisen in other instances in different States during the last year.

As we review the events of November 24, we will go over the particular aspects of the difficulty as it affected the warnings for Bootheel.

INTERNAL AND EXTERNAL SYSTEMS

To fully appreciate the events of that evening, it is necessary to have some background of the communication facilities used by the National Weather Service to handle warning messages. They are essentially of

two kinds: internal systems to transmit messages to other NWS offices, and external systems to disseminate the warnings to the public via radio and TV and to law enforcement and civil defense authorities who in turn can activate their own alert systems.

[See figure 1, page 27.]

RADAR REPORT AND WARNING COORDINATION TELETYPEWRITER NETWORK (RAWARC)

Dr. CRESSMAN. The Radar Report and Warning Coordination Teletypewriter Network (RAWARC) is an internal system, and is shown on the first chart. It is a landline teletypewriter network consisting of five circuits which terminates at both Kansas City and Suitland, Md. The Communications Center at the National Severe Storms Forecast Center (NSSFC) at Kansas City is the monitor station. Suitland performs the computer relay functions between RAWARC circuits. The traffic on RAWARC is basically unscheduled and is handled according to a priority system. The only regularly scheduled operation on RAWARC is an hourly collection of radar reports which are relayed by Suitland as required.

The priority system has two categories—severe weather information (watches, tornado warnings, and so forth) and routine weather (zone, State forecasts, and temperature bulletins). The RAWARC consists of a combination of 75 and 100 wpm circuits. Kentucky, Tennessee, and Missouri are each on different circuits.

[See figure 2, page 28.]

NOAA WEATHER WIRE SERVICE (NWWS)

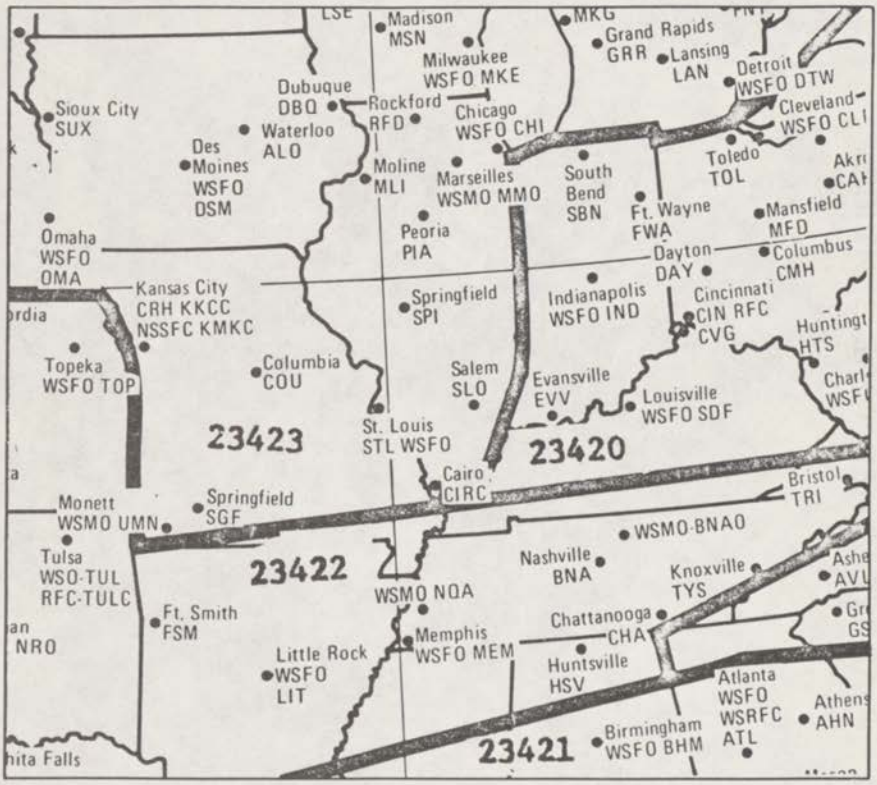
Dr. CRESSMAN. NOAA Weather Wire Service (NWWS) is an external system. This is the teletypewriter system operated by the NWS which makes around-the-clock weather service available to mass news dissemination media and other subscribers. NWWS currently covers 30 States, either wholly or partially. Plans call for completely covering the contiguous United States as funds become available. The NWS pays for the line charges to a central location in a user area and the user pays for the equipment and line charge from the central location.

Due to tariff restrictions and the need to limit and select the material transmitted, the circuits are operated on a State-by-State basis. Information can be relayed between circuits as required by means of an overlay circuit. Each Weather Service office (WSO) can enter material on the circuit and one office, usually the Weather Service forecast office for the State, serves as a State relay center (SRC).

[See figure 3, page 29.]

Fig. 1

INTERNAL RAREP AND WARNING COORDINATION SYSTEM



ALL STATIONS ARE WSO'S UNLESS INDICATED OTHERWISE

NHC	NATIONAL HURRICANE CENTER
NSSFC	NATIONAL SEVERE STORM FORECAST CENTER
WSFO	WEATHER SERVICE FORECAST OFFICE
WSMO	WEATHER SERVICE METEOROLOGICAL OBSERVATORY
WSO	WEATHER SERVICE OFFICE
WSRFC	WEATHER SERVICE RIVER FORECAST CENTER

NOAA WEATHER IRE SERVICE

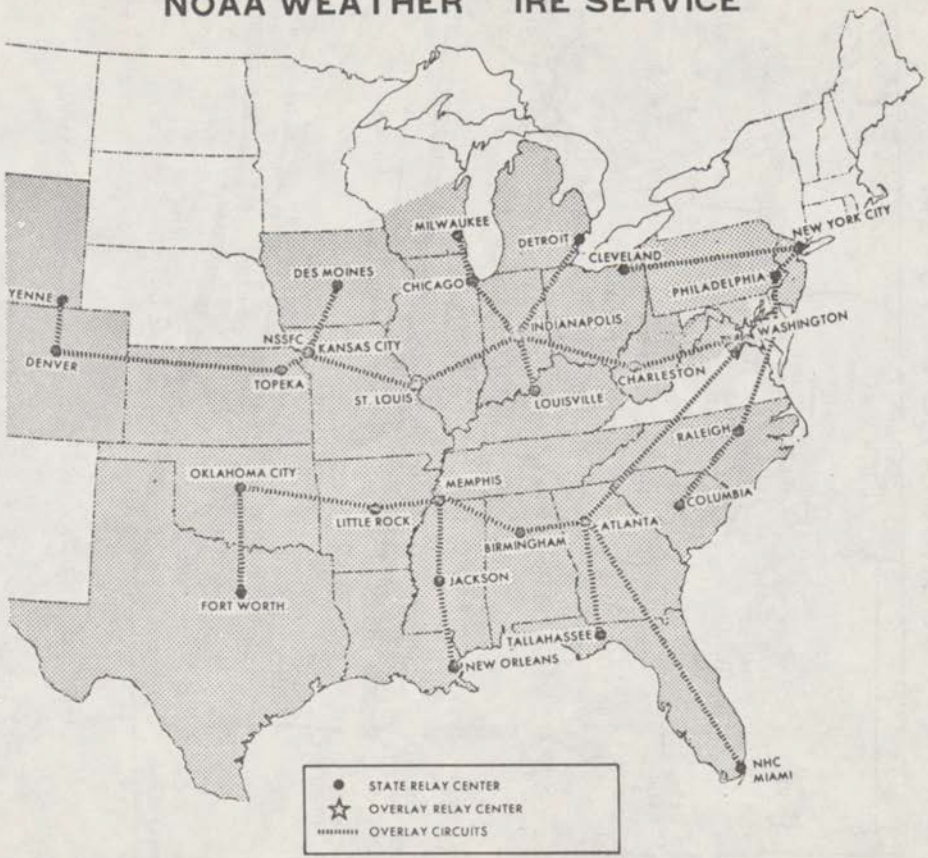
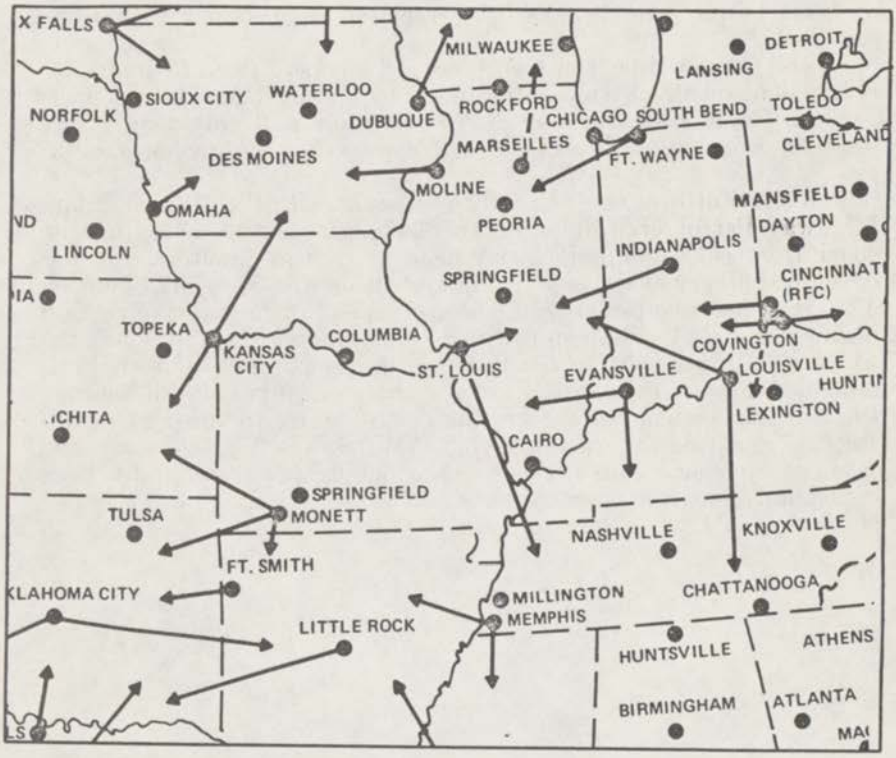


Fig. 2

Fig. 3

NATIONAL WEATHER SERVICE
NATIONAL WARNING SYSTEM LOCATIONS



LEGEND:
- ● INTRASTATE LOCATION
- ●→ INTERSTATE CONNECTION - ARROW TERMINATES IN THE STATE ON WHOSE NAWAS CIRCUIT THE OFFICE LOCATED AT THE ARROWS ORIGIN IS CONNECTED.

NATIONAL WARNING SYSTEM (NAWAS)

Dr. CRESSMAN. National Warning System—NAWAS—is an external system. This is the Defense Civil Preparedness Agency—DCPA—operated hotline interstate telephone system which connects DCPA warning points within each State and between States. Most WSO's are connected with this system. Such circuits are operated on a State-by-State basis. Some WSO's have interstate connections with adjacent States.

At the present time, the NWS has 218 intrastate and 67 interstate connections on this system, all funded by the DCPA. The system is very useful in disseminating NWS warnings and collecting severe weather information from Civil Defense and law enforcement agencies.

The NWS utilizes these circuits and works with the Missouri State Highway Patrol, civil defense, other law enforcement agencies, Missouri Bootheel Commission, and mass news disseminators, and has developed a very effective warning system for the Missouri Bootheel. The Missouri Bootheel Commission is an organization of civic and business leaders residing in the area whose purpose is to promote the welfare and prosperity of the Bootheel in any possible manner. Periodic meetings are held with all of the above organizations to improve the warning system for the Bootheel. Procedures in this system call for disseminating the warnings via NAWAS, NWWS, telephone, and law enforcement radio networks. Various agencies and individuals continually monitor these systems.

[See figure 4, page 31.]

FLOW DIAGRAM FOR T[illegible]'O WARNINGS
November /3

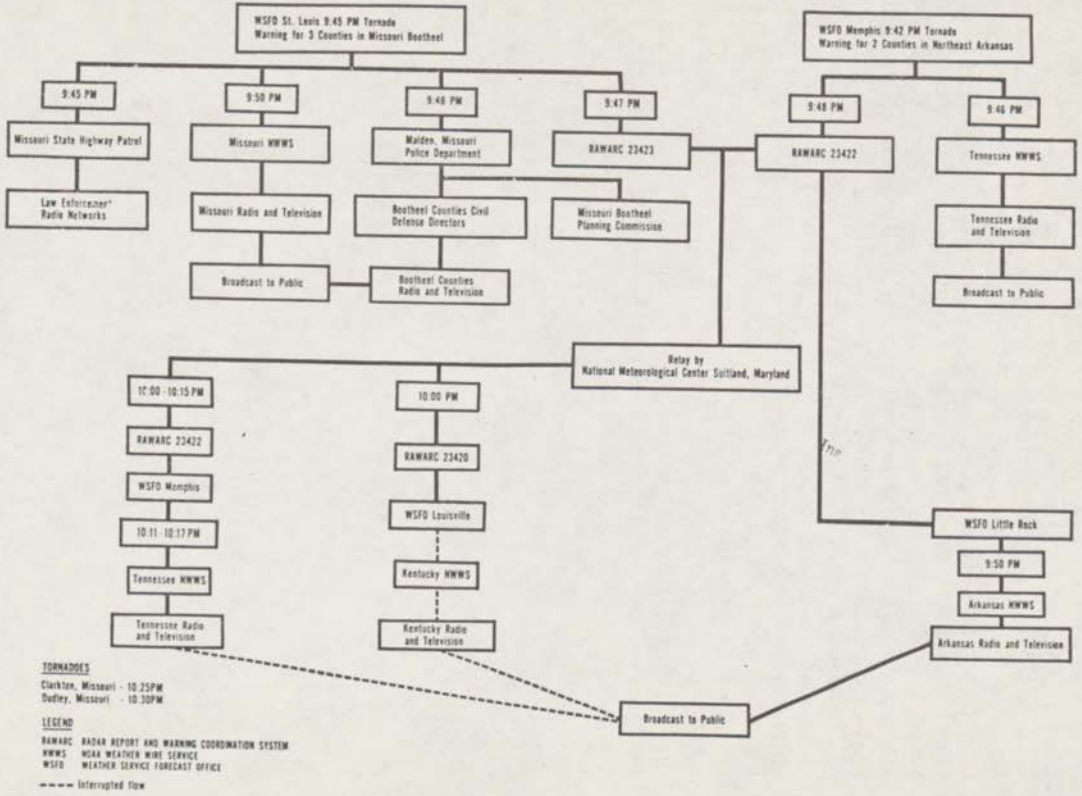


FIG. 4

WARNINGS ISSUED TO BOOTHEEL AREA—TORNADO WATCH

Dr. CRESSMAN. On November 24, 1973, the residents of the Bootheel were alerted to the approach of severe storms by a series of messages. The National Severe Storms Forecast Center in Kansas City, Mo., issued a tornado watch for the Bootheel and surrounding areas at 5:50 p.m., valid from 6 p.m. November 24 to 1 a.m. November 25. This watch was distributed by all affected State relay centers on the appropriate circuits, together with the redefining statement. The redefining statement names the affected counties. All of the counties later affected by the tornadoes were named in this redefining statement.

The watch alerted all concerned NWS offices to continuously monitor the situation. Based on radar data, WSFO St. Louis issued a severe thunderstorm warning for Dunklin, Pemiscot, and New Madrid Counties at 9:15 p.m. This warning, valid from 9:15 p.m. to 11 p.m., was given distribution in the Missouri Bootheel on all appropriate circuits.

[See figure 5, page 33.]

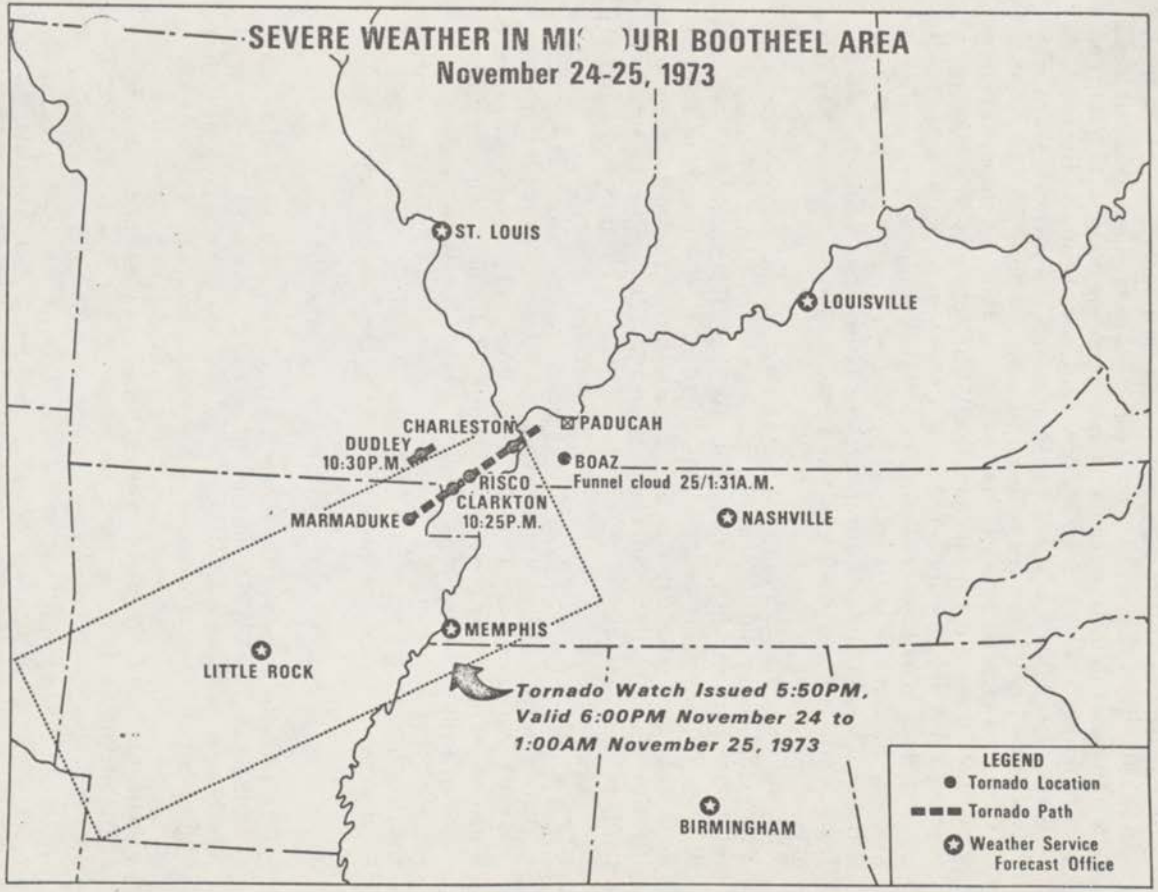

SEVERE WEATHER IN MI URI BOOTHEEL AREA
November 24-25, 1973
ST. LOUIS
LOUISVILLE
CHARLESTON
PADUCAH
DUDLEY
10:30P.M.
BOAZ
Funnel cloud 25/1:31A.M.
RISCO
CLARKTON
10:25P.M.
MARMADUKE
NASHVILLE
MEMPHIS
LITTLE ROCK
Tornado Watch Issued 5:50PM,
Valid 6:00PM November 24 to
1:00AM November 25, 1973
BIRMINGHAM
LEGEND
Tornado Location
Tornado Path
Weather Service
Forecast Office

Fig. 5

TORNADO WARNING FOR BOOTHEEL AREA

Dr. CRESSMAN. At 9:45 p.m., St. Louis, after receiving a report from WSFO Memphis that a radar hook echo was located near Marmaduke, Ark. (Greene County), issued a tornado warning, valid 9:45 to 11 p.m. for Dunklin, Pemiscot and New Madrid Counties in the Bootheel. A hook echo looks like a figure 6, and is one radar indication of a tornado. At the same time, Memphis issued a tornado warning for the counties of Clay and Greene in northeast Arkansas. Both of these warnings were entered on the appropriate RAWARC circuits so the relay to other RAWARC circuits could be initiated. St. Louis and Memphis entered their warnings on their State NWWS and other circuits. I understand that the radio stations at Kennett and Poplar Bluff, Mo., and the TV and radio station at Cape Girardeau broadcast the St. Louis warning shortly after it was received via the Missouri NWWS around 9:50 p.m.

In addition, the St. Louis WSFO called the police department at Malden, Mo. (Dunklin County), via commercial telephone. In turn the police department contacted Mr. Wilbur Thornton, civil defense director of Dunklin County. According to the warning plan for the Bootheel, contacting Mr. Thornton fulfills the requirement for contacting the Missouri Bootheel Commission. Mr. Thornton in turn distributed the warning via citizens band radio to other counties in the Bootheel.

The Civil Defense of Dunklin County, on receiving this warning, were able to follow the tornado by automobile. St. Louis contacted the Missouri State Highway Patrol via NAWAS and gave them the warning. The patrol also subscribes to NWWS, and fans out the warning to other Missouri patrol divisions and other county law enforcement agencies. By 9:55 p.m., St. Louis had entered the 9:45 p.m. tornado warning on all teletypewriter circuits as well as the NAWAS and commercial telephone contacts required by the Bootheel warning plan.

RAWARC CIRCUIT RELAY OF MESSAGES

The relay of messages from one RAWARC circuit to another is accomplished at the NWS Communication Center located at the National Meteorological Center (NMC) at Suitland, Md. This relay function is automated and is performed in a computer which also handles a large number of other circuits which carry national and international environmental data. Our best information shows that the tornado warning issued by St. Louis at 9:45 p.m. was relayed to the RAWARC circuit which serves Kentucky at approximately 10 p.m. It was also relayed to the RAWARC circuit which serves Arkansas and Tennessee, a slower speed circuit, between 10:10 and 10:15 p.m. The delay in the relay of messages between circuits, although it was apparently not a significant factor in this instance, is a cause for some concern and will be addressed a little later.

Our Memphis office received the 9:45 p.m. St. Louis warning via RAWARC between 10:10 and 10:15 pm, and relayed it to the Tennessee NWWS between 10:11 and 10:17 pm. We are not able to say exactly when Memphis received and transmitted this warning, since no time entries are made on the teletypewriter networks. Although all

warnings were probably not disseminated by radio or television stations in Memphis, the 9:45 p.m. tornado warning for the two northeast Arkansas counties was broadcast at least once by some of the Memphis stations.

BREAKDOWN IN WARNING DISSEMINATION PROCEDURES

A breakdown in the warning dissemination procedures occurred at our Louisville, Ky., forecast office. The tornado warning issued by St. Louis, and relayed about 10 p.m. to the RAWARC circuit serving Kentucky, should have been relayed manually to the Kentucky NOAA weather wire service, but wasn't. The purpose of the desired relay was to enable Bootheel residents listening to distant stations in Kentucky to hear the warnings. However, this relay wasn't made, and the Paducah, Ky., television station didn't receive the warning. At Louisville there were two men on duty, the forecaster and the weather observer. Each was in a separate room working on his assigned duties. The teletypewriter machines are in a third room, located between the forecasting and observing rooms; the men on duty failed to hear the bells which signal that an important warning message is coming in on the teletypewriter. In retrospect we can see that it is not always practical to expect a busy man to hear a small bell in another room. The remedy is relatively inexpensive—a remote bell or light at the forecaster's desk, and has been ordered.

[See Chart 4, page 31.]

TORNADO DAMAGE AND LOSS OF LIFE

Dr. CRESSMAN. The tornado associated with the radar hook echo moved out of Arkansas and skipped intermittently across much of the Bootheel. There were several damage areas along a line from Marmaduke, Ark., to Clarkton, Mo., across Risco, Mo, to near Charleston, Mo. in Mississippi County, then into Kentucky. No damage was reported from Kentucky. Two persons, a man and his wife, were killed near Clarkton, Mo., as the tornado moved across the area at 10:25 p.m. Six people were injured along the tornado's path. Damage was estimated at $150,000 to $200,000.

One home was destroyed near Gideon, Mo., but the family was in the cellar and escaped injury. Apparently they had heard the tornado warning broadcast by the radio and television stations in the Bootheel and had taken the necessary safety precautions. Another small tornado struck Dudley in Stoddard County at 10:30 p.m. causing no deaths or injuries and only minor property damage. Stoddard County was not included in the warned area, though the county was named in the watch area about 4½ hours earlier.

From what we have been able to find out, radio and TV broadcast coverage of the warning for the Bootheel area was quite good. One radio station and the TV station at Cape Girardeau covered it. So did a Kennett, Mo., radio station before 10 p.m. A Popular Bluff, Mo., radio station also carried the warnings. The staff at the Sikeston radio station could not recall whether they broadcast the warning.

We in the National Weather Service continuously try to improve our service within our capabilities. This is especially true after natural disasters.

[See Chart 5, page 33.]

IMPROVEMENTS TO WARNING SYSTEM

Dr. CRESSMAN. We ask ourselves how we could have improved our service. Since the November 24, 1973, tornadoes in the Bootheel, we have done the following:

1. At Louisville we have reissued the warning relay instructions to each employee. The main point here is the immediate relay onto the NOAA weather wire of any warnings for the seven neighboring States.

2. We have ordered a speedup to 100 words per minute of the remaining three RAWARC circuits, where the speed is now 75 words per minute. These serve the Midwest and the West. This should be done by April 1, 1974, and will provide increased capacity and faster dissemination.

3. We have requested DCPA to install telephone connections on the Tennessee NAWAS system at our St. Louis office and the Memphis radar site. That is at Millington, Tenn. This will permit the radar man to talk directly to St. Louis.

Now let's discuss what we plan to do.

(*a*) We have ordered remote alerting devices to be attached to RAWARC teleprinters in offices where the communication facilities are not in the forecaster's area. The alerting devices will provide a visible or audible indication at the forecaster's desk that a warning message is being transmitted on RAWARC. The first of these remote alerting devices has been ordered for Louisville. The cost for the first year will be approximately $300 per station.

(*b*) The automatic relay of warning information between RAWARC circuits takes too long. We are going to rewrite the computer program that does the relay to exercise a better priority scheme so tornado warnings will be relayed faster. Together with the speedup of RAWARC circuits this will do the job.

FISCAL YEAR 1975 BUDGET REQUESTS

(c) The NOAA Weather Wire Service will be expanded to additional States as funds become available. As a result of our fiscal year 1974 budget request, the following States will be provided service: Arizona, Montana, Nebraska, New Hampshire, New York, Vermont, Virginia, and the northern parts of Michigan and Wisconsin. In fiscal year 1975 we have requested funds to expand the NWWS to the following States: California, Connecticut, Northern Idaho, Maine, Massachusetts, Minnesota, North Dakota, Rhode Island, South Dakota, and Washington.

Senator EAGLETON. I take it the NOAA Weather Wire Service is operable in all parts of Missouri?

Dr. CRESSMAN. Yes, sir.

COMMUNITY PREPAREDNESS PROGRAM

(d) We will shortly establish a separate staff in the National Weather Service to concentrate on our Community Preparedness Program. These people, working with others at our forecast offices, will work with civil groups to establish or improve emergency warning plans.

Dr. Townsend mentioned one of our major efforts toward improving our service during the next few years: the Automation of Field Operations and Services (AFOS). This will provide, among other improvements, high-speed automatic relay and distribution of warnings both internally and to radio, TV and press interests via the NOAA Weather Wire circuits.

The President's fiscal year 1975 budget requests additional funds to support the warning service. In particular I draw to your attention the following items:

1. AFOS, which Dr. Townsend and I have both mentioned.

2. Radar, which will provide local use radars at 25 locations around the country plus filling a gap in our primary weather radar network over southern New York.

3. Community Preparedness, which will provide some additional staff at forecast offices to work with civil groups to establish emergency warning plans for various communities.

4. NOAA Weather Wire, which will provide coverage for nine and a half States: Maine, Massachusetts, Connecticut, Rhode Island, Minnesota, North and South Dakota, Washington, California, and northern Idaho.

STATES INCLUDED IN WEATHER WIRE SERVICE

Senator EAGLETON. You read off the States that will be brought into the system in fiscal 1974 and another group of States in 1975. Would the group of States on paragraph four, page 10, be all of them?

Dr. CRESSMAN. No, sir. It is the same as the list for fiscal 1975.

Senator EAGLETON. After that is done, will there still be several States not covered?

Dr. CRESSMAN. I hope to clean them up in 1976.

Senator EAGLETON. Then it is clearly a matter of dollars. If you had more money, you could bring more States into the system?

Dr. CRESSMAN. We have to have people and dollars. They go hand in hand.

At the present time, the manual operations of the NOAA Weather Wire Service require a good number of people. Our minimum is three people for each relay station. That requires time.

STATE PRIORITY FOR NOAA WEATHER WIRE SERVICE

Senator EAGLETON. What determines the priority by which States are brought into the system?

Dr. CRESSMAN. Wherever a State is subject to bad weather, we have given it a high priority for the NOAA Weather Wire Service.

As you can see on the chart with the 1975 budget, we will have the vast tornado areas of the United States covered by the NOAA system.

It so happens that the Gulf Coast and Southeast States are also included in this group of States.

5. Satellite, which will provide equipment for displaying information from the GOES satellite at some 24 forecast offices that don't have this equipment.

6. Flash Flood Warning program to provide some people and equipment to expand our flood warning program.

In the meantime, we will pursue the near time improvements, including the reprograming of about $15,000 to install warning message alerting devices at the forecaster's desks.

This concludes my statement. I will be glad to answer questions.

FLASH FLOOD WARNING PROGRAM

Senator EAGLETON. Let's take up item 6, the Flash Flood Warning program. It is my understanding that record floods are projected for the Nation this year; is that correct?

Dr. CRESSMAN. That is a little premature, Senator. If I may give you a little summary of this situation, I will be glad to do so now.

Senator EAGLETON. Please proceed.

LOWER MISSOURI AND CENTRAL AND LOWER MISSISSIPPI FLOODS

Dr. CRESSMAN. The flood situation along the lower Missouri, and the central and lower Mississippi River has improved during the past few weeks.

Senator EAGLETON. You say it has improved in the last 2 weeks?

Dr. CRESSMAN. Yes, the situation has improved very rapidly during the past 2 weeks. Only scattered light rain has fallen since early February on the lower Missouri and Mississippi Rivers southward to Vicksburg.

We predict slowly falling water levels from Vicksburg to New Orleans.

Senator EAGLETON. You say stages have fallen on the lower Missouri first?

Dr. CRESSMAN. Yes.

Senator EAGLETON. What would be the parameters of what you describe to be the lower Missouri?

Dr. CRESSMAN. I have here information concerning the Missouri River from Kansas City to St. Charles, which is near St. Louis.

Senator EAGLETON. That is part of the lower Missouri?

Dr. CRESSMAN. Yes, sir.

Senator EAGLETON. The stages are now below flood level?

Dr. CRESSMAN. Yes, they are. They are also 4 or 5 feet below the levels at this time last year.

Senator EAGLETON. They are below the stages at this time last year?

Dr. CRESSMAN. Yes, sir. They are well below flood stage.

MIDDLE MISSISSIPPI FLOODS

Senator EAGLETON. Now let us take up the situation in the Middle Mississippi River. First, describe that area for us.

Dr. CRESSMAN. Going from New Madrid. The present levels are at or below the stages at this time last year. From Quincy, Ill., to New Madrid, the stages are running again as much as 5 feet below the stages at this time last year. They are well below flood stages. The recent crest has passed through that area.

Senator EAGLETON. From Quincy, Ill., through New Madrid, Mo., which is the southern extremity of Missouri, the stages are well below flood level?

Dr. CRESSMAN. Yes, sir. The only exception is the area from Burlington, Iowa, to Quincy, Ill., which is still below flood level.

If we then go down the Mississippi, say from Memphis, Tenn., to New Orleans, we are now dealing with high stages in the area from Vicksburg, Miss., to New Orleans.

Senator EAGLETON. Would the high stages be higher than this time last year?

Dr. CRESSMAN. Yes, sir. They are 5 to 7 feet higher than they were last year. The stage now is at about its maximum around Baton Rouge, but farther up the Mississippi, the river has fallen, so it is a couple of feet below its stage at this time last year and about 8 feet below flood stage.

The water has moved down the Mississippi and is now down to about the mouth of the Mississippi and is moving out.

CAUSES OF VARIATIONS IN RIVER LEVELS

Senator EAGLETON. Since I am not a weather forecaster or an expert, can you explain to me as a layman, what phenomena has occurred that causes, for instance, the river level from Burlington to Quincy to be equivalent to what it was a year ago at this time, yet from Quincy to New Madrid, it is 5 feet below what it was?

Dr. CRESSMAN. I think, I would describe that easiest by saying it was not high at this time last year.

You will recall we had extensive rainfall up until the beginning of February. Since that time, it has almost stopped raining. As a result, the river has an opportunity to let the water go down.

Senator EAGLETON. Yet, the stages down near Vicksburg are quite high; are they not?

Dr. CRESSMAN. Yes, sir. That is the water which was rainfall much earlier and is now on its way out the river.

We have also looked at the snow situation because the melting snow cover in the upper reaches of these rivers could contribute to flooding at a later time.

So far, the snow cover in the upper areas of the Mississippi and Missouri is about normal. We would have to have large rainfall to cause serious flooding.

We are expecting more in that area, say in the Mississippi Basin, in the next day or so. However, it will require more than 1 or 2 days to give us a flood level.

LONG-RANGE WEATHER FORECASTS

Senator EAGLETON. Can you give us your long-range forecast? Based on what you have told us so far, rainfall has been almost nonexistent since the first part of February. The snow cover is average, and thus, I take it, not overly worrisome. What do you project for us into the spring?

Dr. CRESSMAN. Our skill at long-range forecasting is not really useful in that respect. However, I will say that in order to produce floods like we had last year, we would need much above normal rainfall. But that is an improvement from the situation at the beginning

of February 1974 when, at that time, it looked as though normal rains would produce flooding.

Senator EAGLETON. Had we had this hearing a month ago, your general projection at that time, based on what had occurred up until a month ago would have been that we were headed for some serious floods, equivalent to or even greater than those we had last year?

Dr. CRESSMAN. Yes, sir.

Senator EAGLETON. Then, because of the sharp decline in rainfall since February 1, it is your opinion that if we experience normal rains from here on out we will be without any amount of flooding?

Dr. CRESSMAN. It depends how the rains fall, of course, but we would have no big troubles. The picture is much better now than it was a few weeks ago.

ACCURACY IN FORECASTS OF RAINFALL

Senator EAGLETON. You say long-range forecasting is a vague art. How far in advance can you predict rainfall with some degree of rational accuracy?

Dr. CRESSMAN. I think the best way I could put this is to say that we can forecast rainfall up until 4 to 5 days in advance. After that, we have very little skill in forecasting rainfall. Our skill at forecasting temperature extends farther into the future, but rainfall is more difficult.

Senator EAGLETON. To summarize further—you said the accumulation of snow up north does not trouble you because it is within normal ranges?

Dr. CRESSMAN. That is right. With one possible exception; that is, the Red River of the north. We have an accumulation of 2 to 4 inches. We are going to have to watch it closely. It is not a sign of trouble, yet, but it is something for us to watch.

Senator EAGLETON. With that one exception then, if the rainfall is normal, we will get through the spring without significant flooding.

Dr. CRESSMAN. Yes, sir.

Senator EAGLETON. If the rainfall is abnormally high, will we have problems?

Dr. CRESSMAN. Yes, sir.

Senator EAGLETON. If we have abnormally high rainfall, where will the flood warning devices be placed, what are the costs involved, and how many will be needed?

Dr. CRESSMAN. I think it would be wise if I distinguished between flash floods and a slow rising flood. A flash flood is a flood that occurs over a limited area over a short period of time where the water level comes up very rapidly, within a few hours. The water comes out of the streams and does damage to houses and roads. That is a flash flood.

When we discuss the Missouri and Mississippi Rivers, we are dealing with the long-range, slow rising floods.

FLASH FLOOD WARNING SYSTEM

Senator EAGLETON. Isn't there occasional flash flooding in the tributaries leading to the Mississippi?

Dr. CRESSMAN. Yes, sir. You can have that happen within 12 hours or 24 hours. We are seldom, if ever, free from that in the Missouri area.

Senator EAGLETON. What warning mechanisms do we utilize to alert us to flash flooding?

Dr. CRESSMAN. We have a variety of ways of getting at that. First of all, we start out with the central forecasts which originate from the National Meteorological Center in Suitland, Md., which are made for the entire country. One of these forecasts is a forecast of how much precipitation will fall within a certain amount of time.

At the same time, we have available from our river forecast system, a system describing how much rainfall is needed within specific periods to produce flooding.

In our weather centers, they take the information telling how much rainfall is needed for flooding together with the evidence from the National Meteorological Center as to how much precipitation is expected, and this allows them to evaluate the danger of flash flooding.

Closer into the event, a valuable tool is radar. It gives very good information on how much rain falls. It also shows whether or not rainfall will stay in one area or move across an area.

In addition to that, we have reports, actual rain gages from our own personnel, the FAA, and ordinary citizens who cooperate in taking these measurements and telephoning them into our offices.

Based upon the rainfall reports from all these sources, our forecast offices then issue flash flood warnings as appropriate.

FLASH FLOOD ALARM SYSTEM

Another device I should mention is the flash flood alarm system. The flash flood alarm system is a simple device which consists of a float which is placed, say, in a stream or creek or river subject to flash flooding. When the river rises the float reaches a preset point, and reaches contact, this causes a loud, disagreeable noise in the office where the gage is connected, indicating that the creek or river has reached the danger stage.

These flash flood alarms have been secured in small volume up to now. We have installed them in a few places in the Appalachians, mainly. The experience with these has been very good.

Senator EAGLETON. Are flash flood warnings disseminated in about the same manner as tornado warnings, both by your own wire service and by commercial communication?

Dr. CRESSMAN. Exactly, yes.

Senator EAGLETON. I have one final question on the possibility of flooding this year. Today is February 20. What is the date after which we can stop worrying about spring flooding?

Dr. CRESSMAN. We are going to worry about it until the snow is gone. Up in the Dakotas, I think we have to worry about it until the first part of April.

Senator EAGLETON. If we have average rainfall between now and the first part of April, we will get by?

Dr. CRESSMAN. Yes, sir.

TORNADO WARNINGS TO NEIGHBORING STATES

Senator EAGLETON. Dr. Cressman, in connection with the Bootheel, you indicated that the Louisville forecast office has been instructed to immediately relay any warnings for the neighboring States in order to

preclude the events of last November from happening again. Have similar instructions been given to other weather service offices servicing multistate areas?

Dr. CRESSMAN. Yes, sir. We have reiterated them in the case of Louisville. It is one thing to make instructions and another to get them followed. That is why we have asked that the remote warning device be placed at the forecaster's desk, so there is no possibility of overlooking an event such as this.

DISSEMINATION OF WARNINGS ON RADIO AND TV

Senator EAGLETON. Your letter, in response to a previous inquiry of mine, and your testimony state that a breakdown in part of your distribution centers prevented dissemination of the tornado warning to the Bootheel area.

Does that include the two men who were in adjacent rooms and did not hear the buzzer?

Dr. CRESSMAN. That is correct. If that had worked, we would have been able to get that warning to the Paducah TV station.

Senator EAGLETON. Then the major breakdown occurred when the Paducah station, which is widely heard, did not get the warning and hence, did not broadcast it?

Dr. CRESSMAN. That is correct.

Senator EAGLETON. Do you constantly try to update your information so as to know what commercial radio and TV stations are tuned in a certain area?

Dr. CRESSMAN. We have personnel who have a great deal of knowledge in this area. We do try to keep up to date on who is watching what. It is not easy. In some States, for example, some of the citizens at night are listening to radio stations some ways away.

WARNINGS ON CABLE TV

Senator EAGLETON. What about the expansion of cable television? I was in Jefferson City, Mo., recently and a TV watcher told me that most people in Jefferson City watch cable TV rather than either the local TV station or the adjacent one in Columbia. If that practice is widespread, how do we disseminate disaster warnings to cable TV viewers?

Dr. CRESSMAN. We have one method which is in fairly wide use at the present time. We have a new device which is connected to the NOAA weather watch device.

We will display them on the cable TV. There have been a large number of these bought. I am not sure how many. I believe it is in the order of 100.

Senator EAGLETON. Therefore, if I am in Jefferson City and I happen to be watching a St. Louis station via cable something will flash on the screen telling about the tornado?

Dr. CRESSMAN. This is generally directed to a weather channel. If you don't tune to the weather channel, you won't see that. We are also experimenting with cable television in another sense. We have run an experiment where we have a device called a carousel which relays maps and forecasts to the various TV stations. We have learned a great deal from this and we have learned where we can serve such an area.

The cable TV systems are beginning very well. This is a good possibility for the future. As long as the cable TV is watched by the citizens. When they start to connect, then this offers a good opportunity to us. We are watching that very carefully.

FATALITIES IN CLARKTON

Senator EAGLETON. Regarding the two people that were killed in Clarkton, am I correct that they were victims of a direct hit?

Dr. CRESSMAN. Yes, sir. I wouldn't want to see a more direct hit. I understand that not even any lumber from the house was even in the vicinity of the house.

Senator EAGLETON. So even if that family had been watching a TV station which carried the warning and gone to the basement, the chances of their survival were meager.

Dr. CRESSMAN. I have a problem here, sir, in that I am not sure that house had a basement. The report I had seen from Mr. Thornton, who is head of Civil Defense, said the area was stripped down to the foundation of the house. I don't know if this means there was a basement or not.

Senator EAGLETON. I should know but I don't. Assuming it had a basement, if they had gotten to it, would they have had a chance to survive?

Dr. CRESSMAN. That is problematic. If the debris was removed, they might have had a better chance than if the debris had fallen in. A regular tornado cellar, of course, would be the only way you could guarantee survival in a situation like that.

This is generally a small underground structure that is lined or some other strong structure separate from the house so it wouldn't be subject to debris from the house. I don't think you could give those poor people much chance.

WARNING DISSEMINATION IN KANSAS CITY TORNADO BELT

Senator EAGLETON. Over the past several years our office received some complaints about the adequacy of warning dissemination in the Kansas City tornado belt. I think you are aware of some of those complaints.

Has anything been done to correct those deficiencies?

Dr. CRESSMAN. We have placed an order now for the Nebraska weather wire system, which should help. One problem we had in Kansas was residents of Kansas listening to stations in Nebraska. We don't have, as yet, in Nebraska a weather wire system. They listen to stations in Nebraska and there is no way for those stations to get word out.

Senator EAGLETON. Is a weather wire for Nebraska on one of your priority lists for fiscal 1974, or fiscal 1975?

Dr. CRESSMAN. I think it is due this year, fiscal 1974.

Senator EAGLETON. You say Nebraska is?

Dr. CRESSMAN. It is due this year, and I believe the order has already been placed. I am not positive of that, but it should be by now.

TORNADO WARNING IN SALINA, KANS.

That particular tornado situation was one in which the warnings were extremely effective in Kansas, and we are convinced that a large number of lives were saved by the warning service there. This was a warning of tornadoes that struck Salina and other nearby towns. This was a situation where we got some complaints that there was no warning of the Nebraska stations.

Senator EAGLETON. Maybe you could point out on the map where Salina, Kans., is. Is it north of Topeka?

Dr. CRESSMAN. It is west of Topeka, approximately 90–100 miles.

Senator EAGLETON. So the warning was adequate there for those who listen to Kansas broadcasts but some were listening to Nebraska stations and hence didn't receive it.

Dr. CRESSMAN. Right.

REMOVE ALERTING DEVICES

Senator EAGLETON. How many remote alerting devices similar to those to be installed in Louisville will go nationwide?

Dr. CRESSMAN. I can't give an exact number. I would judge it is approximately 40 to 45.

Senator EAGLETON. Can you give me a rough estimate of cost?

Dr. CRESSMAN. I believe I had this in the testimony. I believe it was $15,000.

Senator EAGLETON. Each?

Dr. CRESSMAN. No, sir. I mentioned we were presuming about $300 to install a warning message alerting device.

NWS EXTENSION TO ALL STATES

Senator EAGLETON. Dr. Townsend, since the electronics media is the primary means of informing the public of impending national disasters, why isn't NWS service in each radio and TV station in the country?

Dr. TOWNSEND. Well, sir, the system we are using now is available when we have the weather wire in the State. To provide connections for all of the TV and radio stations in that State, they have to share some of the expense.

Senator EAGLETON. As I understand it, if a TV or radio station requests the weather wire service, they must assume the cost of the equipment and its operating cost.

Dr. TOWNSEND. That is correct.

Senator EAGLETON. I think in your testimony you may have mentioned how many stations currently subscribe to the service. Did you?

Dr. TOWNSEND. I don't believe I did mention that number; no, sir. We can provide that for the record, sir.

[The information follows:]

NOAA Weather Wire Service
List of National Weather Service and Non-Weather Service Drops by State
As of 1/30/74

	Weather Service Drops	Non-Weather Service Drops	Total Drops
Alabama	5	68	73
Alaska	...	...	...
Arizona	...	...	...
Arkansas	4	60	64
California	...	...	...
Colorado	6	22	28
Connecticut	...	...	...
Delaware	1	1	2
*Florida	14	150	164
Georgia	9	43	52
Hawaii	...	...	...
*Idaho	7	16	23
Illinois	7	118	125
Indiana	5	85	90
Iowa	4	61	65
Kansas	6	95	101
Kentucky	3	42	45
Louisiana	7	78	85
Maine	...	...	...
*Maryland	4	3	7
Massachusetts	...	...	...
Michigan	11	110	121
Minnesota	...	...	...
Mississippi	4	75	79
Missouri	6	93	99
Montana	...	...	...
Nebraska	...	...	...
Nevada	...	...	...
New Hampshire	...	...	...
New Jersey	4	15	19
New Mexico	...	...	...
New York	1	...	1
North Carolina	6	40	46
North Dakota	...	...	...
Ohio	9	82	91
Oklahoma	3	90	93
Oregon	10	34	44
Pennsylvania	8	58	66
Rhode Island	...	...	...
South Carolina	4	88	92
South Dakota	...	...	...
Tennessee	8	54	62
Texas	24	334	358
Utah	...	...	...
Vermont	...	...	...
*Virginia	5	11	16
Washington	...	...	...
*West Virginia	5	30	35
*Wisconsin	5	55	60
Wyoming	4	16	20
	199	2,027	2,226

*Partial Coverage

BROADCAST STATIONS RECEIVING FORECAST SERVICES

Senator EAGLETON. But it would probably be a small percentage of the total number of stations in the country, wouldn't it?

Dr. TOWNSEND. Of those States that have a weather wire service it is a reasonably good percentage. It wouldn't be a small percentage.

Senator EAGLETON. But is NOAA, as a matter of national public policy in order to more effectively warn people, considering undertaking the total cost of disseminating disaster warning information to every station in the country?

Dr. TOWNSEND. Yes, sir. We have considered it and rejected that. We have considered it at least twice since I have been with NOAA and its predecessor. This is about 6 years. There are two problems. One is the very large cost. Two, there is a question of redundancy in a city like Washington where you have a great number of radio stations. The question is do you need to put it in all of them, even the very small ones.

It is a policy decision, sir, and was felt, that as part of the responsibility that any public communications media has, that they ought to consider, very strongly, supporting some share of this cost.

As you know, when the FCC issues a station license, it is issued in the public interest and the station is to provide public service. Warning service is a brownie point, if you will excuse the expression, for any station licensed.

FISCAL YEAR 1975 BUDGET REQUEST

Senator EAGLETON. In your statement, Dr. Townsend, you indicated that disaster warning and dissemination systems have been given the highest priority in recent Presidential budgets; yet, when you look at the details of fiscal year 1975 you find that the funding and manpower in the following 2 years remains the same, between 1974 and the new budget of 1975.

The two that remain the same: hurricane warning and dissemination, 44 positions, $1.1 million; tornado and severe storm warnings, 31 positions, $500,000.

Are we really beefing up our system of disseminating warning information if the funding level for those two areas remain constant?

Dr. TOWNSEND. We will have to do some checking on which items you have in mind. I believe the two you described are probably the research efforts in these areas and they are not being augmented in either fiscal year.

On the other hand, as we pointed out, we have made a very sizable investment in local use radars, in network radars, in the weather wire service itself which we discussed, and in our remoting devices which remote a radar scope picture to a station that doesn't have radar.

We have made sizable investments in computers. We have two brand new IBM 360–195's which were just installed.

Senator EAGLETON. Doctor, let's pass this question for a moment. Maybe your budget man can answer it.

It is my information these are two line items in the hurricane and tornado warning services part of your budget: hurricane warning preparation and dissemination, 44 positions, $1.1 million; tornado and severe storm warnings preparation, 31 positions, $500,000.

Perhaps he could flip through and try to find the answer so we may continue.

Dr. TOWNSEND. It sounds as if you have the two national centers here.

Senator EAGLETON. What I am saying is I don't think they are research items.

Dr. TOWNSEND. OK, he does have it.

NATIONAL SEVERE STORM AND HURRICANE CENTERS

Yes, it looks like these numbers—and we will check it for the record—are the staffs at the two principal specialty centers. As Dr. Cressman described, the central hub of all the forecasting activities is in Suitland.

There are two specialty offices in this system: One in Kansas City—the National Severe Storm Forecast Center; they are responsible for the entire country; the other is in Miami, Fla., the National Hurricane Center—they have the responsibility for the hurricane forecasting for all over the country, at least until the storm begins to move up the coast. Then the responsibility for the minute-to-minute forecast is passed along the system.

We have set up specialty centers because of the particular problems with these severe thunderstorms, tornadoes, and hurricanes.

Senator EAGLETON. I won't belabor the point. I still have some difficulty if the 1975 budget is identical to 1974 for hurricane dissemination. When one considers inflation, it doesn't seem to me we have enhanced the service much.

COST INCREASES IN BUDGET REQUEST

Dr. TOWNSEND. This budget does consider inflation. There are adjustments to base that take care of the salary increases and the items that we can identify as having increased, such as the cost of telecommunications and things of this nature. Those are taken care of elsewhere in the budget.

There is no attrition. That is correct. We do not have augmentation of either Miami or Kansas City in either one of these budgets. We have felt that the more important parts of this system to consider were these things we have been discussing. For example, dissemination is under public weather.

Senator EAGLETON. Dr. Townsend, you indicated in your prepared statement that the disaster warning, dissemination, and community preparedness function is to be increased by $23.5 million in the fiscal year 1975 budget. However, I understand that warning dissemination, the admitted weak link in the system we discussed earlier, will be increased by only $2 million. Why isn't this entire area getting a bit more emphasis within the NOAA budget?

Dr. TOWNSEND. Sir, we do feel we are giving this area a very high priority and emphasis. In all of these systems there is a rate at which you can install. It takes engineering work. It takes planning work.

In the case of weather wire it takes a good deal of work with the local telephone companies, the people that provide the telecommunications with the radio stations, and with the TV stations. We simply do

not have the manpower to put all of these programs in at the same time throughout the entire country.

What we have done is to try to develop criteria to deal with the areas most exposed first. By most exposed I mean subject to severe weather of any type and where there is a significant population density and economic investment.

We rank areas in terms of these criteria and then we have put in the systems as fast as we are able to do it in technically sound fashion and within the constraints that any Federal budget is limited to. You do have to have priority. But believe me, this area is a very high priority area with us.

FISCAL YEAR 1973 FUNDS IMPOUNDED BY OMB

Senator EAGLETON. In the past 5 years have any disaster warning or dissemination funds been impounded by OMB?

Dr. TOWNSEND. Yes, sir. We had a situation a little over a year ago where money that was appropriated in fiscal year 1973 was impounded.

Senator EAGLETON. How much was that?

Dr. TOWNSEND. About $10 million, sir. It was $10,072,000 that was impounded in the various categories that go to make up this general area of disaster prevention warning and so forth.

Senator EAGLETON. So in fiscal year 1973 $10 million of warning money—we will call it—was impounded out of the total aggregate amount?

Dr. TOWNSEND. The increase that year was about $26 million, sir, $26,679,000, and about $10 million was impounded.

Senator EAGLETON. Have any funds been impounded in '74?

Dr. TOWNSEND. No, sir.

IMPOUNDED FUNDS AVAILABLE IN FISCAL YEAR 1974

I should make one other point clear. In essence, we got that money back. If you will notice the details of our 1975 budget you will see that there was about $30 million carried over from fiscal year 1973 into fiscal year 1974. So that I think you could sum it up by saying that some programs took about a year's delay.

Senator EAGLETON. Gentlemen, I want to thank you for your testimony. You have been frank and candid with the subcommittee both in this presentation and in earlier interviews with us.

I believe both NOAA and the National Weather Service do an excellent job. I recognize that no warning system, however sophisticated, can ever eliminate the loss of lives and injuries. We must share in making the system completely operational rapidly enough to prevent unnecessary loss of lives, unnecessary injuries and unnecessary property damage.

Therefore, the subcommittee very much appreciates your testimony. I am encouraged, I might say, with Dr. Cressman's testimony that the flood situation along the Missouri and Mississippi Rivers today, February 20, is considerably improved over what it was a month ago.

I still presume, though, Doctor, we have to be cautious since we can predict rainfall more than 4 to 5 days in advance. We can't be overconfident, can we?

Dr. CRESSMAN. That is correct.

CONCLUSION OF HEARING

Senator EAGLETON. Thank you very much, gentlemen.

That will conclude this morning's hearing.

[Whereupon, at 11:25 a.m., Wednesday, February 20, the subcommittee hearing was concluded.]

INDEX

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