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ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
U. S. Weather Bureau

Southern Region Technical Memorandum No. 19, July 1966

SEVERE STORM WARNING NETWORKS OKLAHOMA CITY AREA OF RESPONSIBILITY

Gerald J. Carter
WBAS, Oklahoma City, Oklahoma

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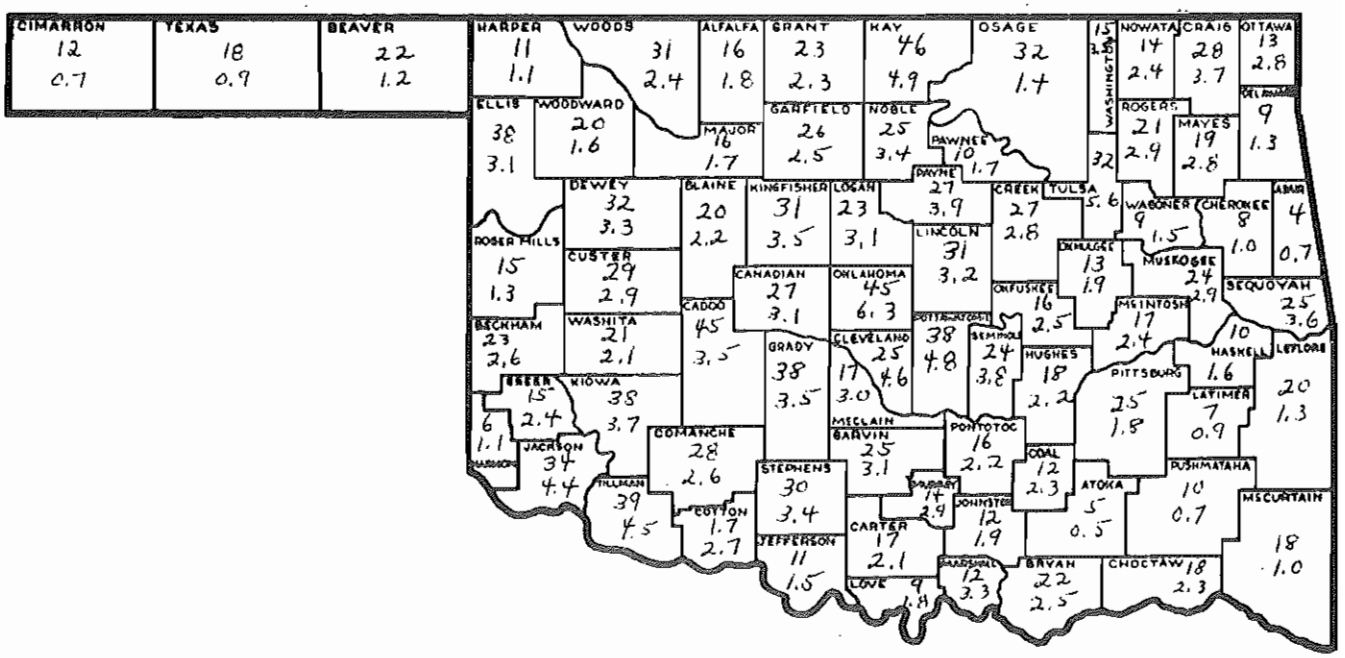
Gerald J. Carter
WBAS, Oklahoma City, Oklahoma

(Presented at First Forecasters' Conference, Southern Region Headquarters, Fort Worth, Texas, April 27-29, 1966)

1. Introduction

Oklahoma City's area of responsibility for severe weather consists of 52 counties, all contained within the state. This is approximately the western two-thirds of Oklahoma (65.7% of the state). In addition, radar "umbrella coverage" is provided for Tulsa's area of responsibility. These,together, cover a large portion of the most "tornado-prone" area on earth.

Figure 1. Tornado Occurrences Recorded by County in Oklahoma, 1875-1965 Total Number of County Occurrences Shown in Upper Figure, With Lower Figure a Ratio of County Occurrences Per 100 sq.mi.

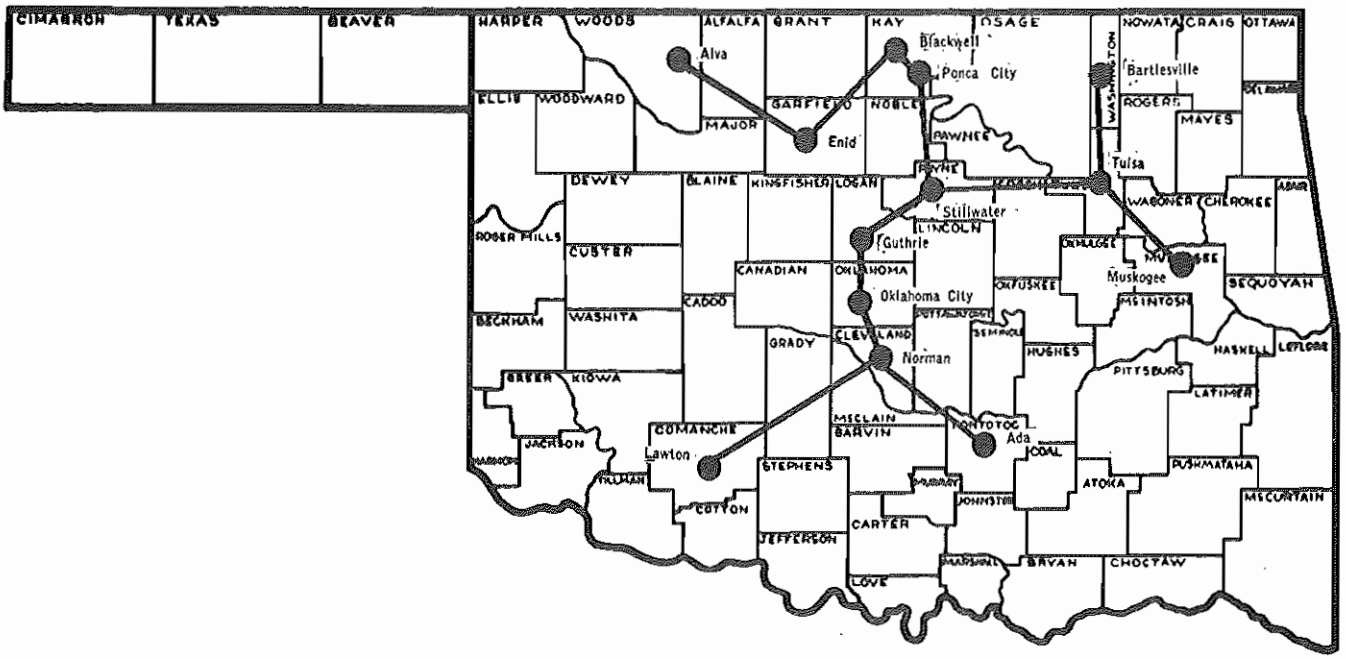


2. Oklahoma State Weather Circuit

The most important method of getting severe weather watches and warnings to the public and other users is the Oklahoma State Weather Teletype Circuit. There are 64 outlets on this circuit covering most of the large population centers. The Oklahoma City and Tulsa Weather Bureau offices are the prime originators of weather information.

Many radio and television stations are subscribing to this weather service. Associated Press and United Press International pick up severe weather watches and warnings giving them priority to their subscribers, thus providing good radio and television coverage throughout the state.

Figure 2. OKLAHOMA STATE WEATHER TELETYPE CIRCUIT - 61 Outlets



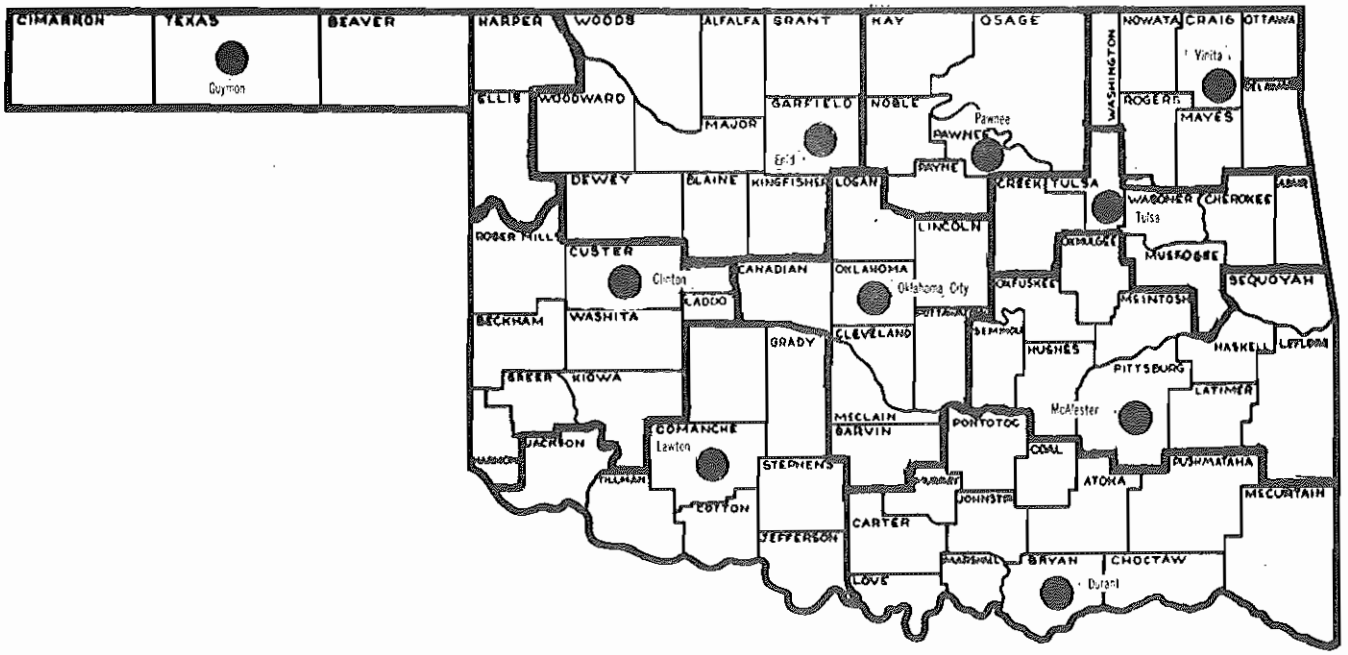
Included among the subscribers are 11 Civil Defense and law enforcement agencies, many having transmitting capability of the Circuit. The police departments in this system broadcast significant weather information and they are monitored by other police and fire departments.

3. Law Enforcement in the Weather Watches and Warnings

One of the most important disseminators of significant weather information is the Oklahoma Highway Patrol Communications Division. This division has send and receive capability on the weather circuit. When a severe weather watch or warning is received, it is transmitted over their internal radio and teletype facilities to all district headquarters within the state. The district headquarters in turn broadcast this information to their patrol cars. Most of police and sheriff's officers maintain two-way communication with some highway patrol district headquarters, thus providing good coverage to law enforcement agencies throughout the state.

Firemen, highway patrolmen and other law enforcement officers are alert, well-trained weather observers. When tornadoes or other severe weather occurs, the highway patrol, police or civil defense unit having transmitters on the weather circuit, relay this information directly on the loop to the Weather Bureau and all subscribers. On occasions the highway patrol has sent units into towns to spread the alarm during approaching tornadoes and other severe weather.

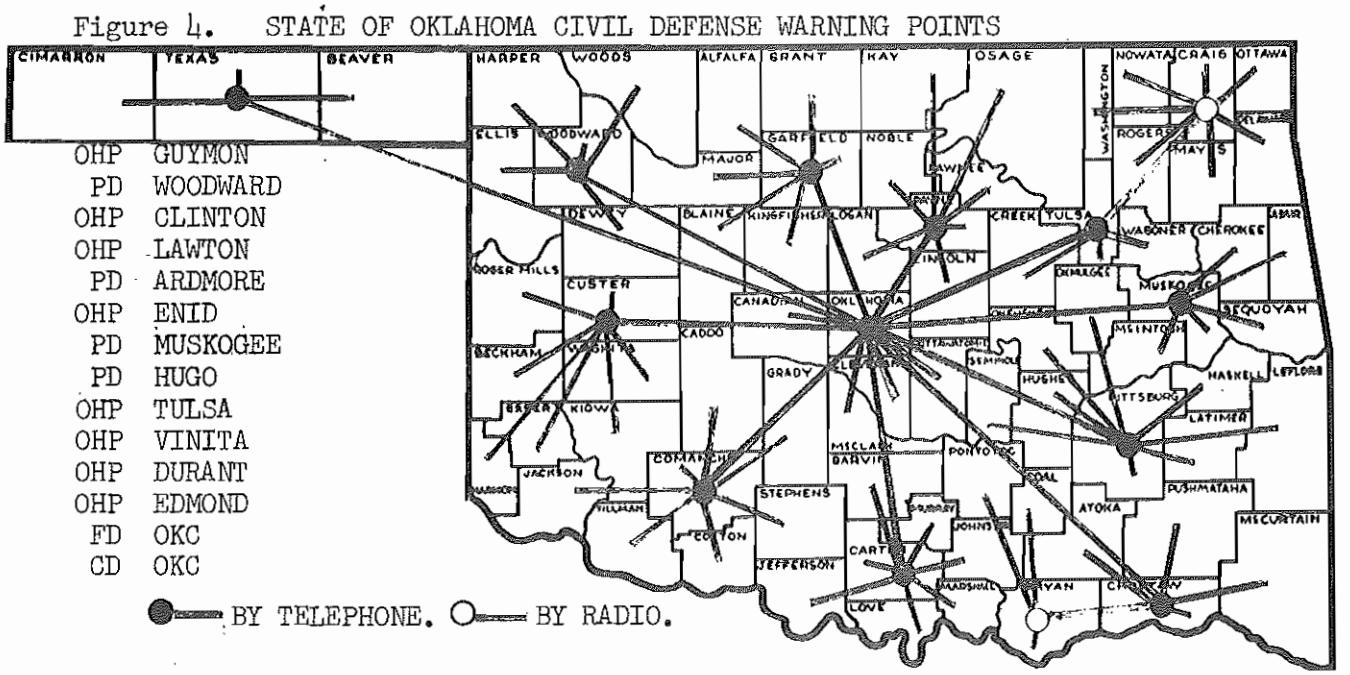
Figure 3. OKLAHOMA HIGHWAY PATROL DISTRICT HEADQUARTERS



4. National Civil Defense Warning System

A telephone to the state civil defense warning points is located in the radar room. This is a part of NAWAS and provides "hot line"service between Oklahoma City Weather Bureau and the major warning points within Oklahoma. The major warning points have the responsibility to transmit information by radio to county seats of nearby counties. The major points are reached by voice call. Any message to one point is heard by all on the direct line. This method of communication has already proved its usefulness to those being reached by voice call.

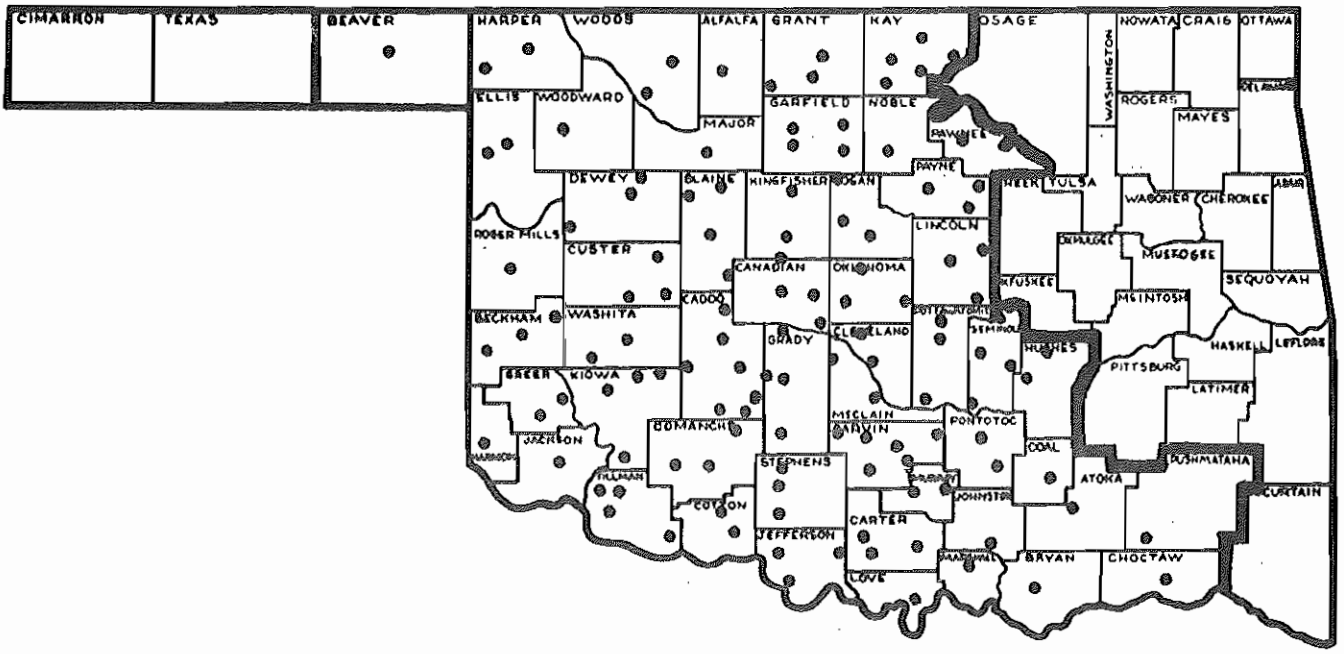
Figure 4. STATE OF OKLAHOMA CIVIL DEFENSE WARNING POINTS



5. Activating the Storm Warning Networks

Because of the high tornado frequency, storm warning networks remain fairly active most all the year. Storm warning networks are popular in Oklahoma and 126 such networks are known to exist within Oklahoma City's area of responsibility.

Figure 5. U. S. WEATHER BUREAU, OKLAHOMA CITY, OKLAHOMA
AREA OF RESPONSIBILITY FOR SEVERE WEATHER WARNINGS
TELEPHONE NUMBERS IN 126 CITIES



About the first of February each year, letters are mailed to each of the 126 towns, requesting telephone numbers in the event we have severe weather information for them. At this time we offer our assistance in any way possible in preparing and carrying out their community's storm warning program. This is the signal to begin arousing interest in their local storm warning networks.

Within one week from mailing our letters, most all recipients have replied. The telephone number at the top of the list is usually one that is answered 24 hours each day and belongs to a police or fire department. The person or department heading the list acts as the communications co-ordinator for the local network and is our chief contact with his network.

6. The Networks to be Discovered

In the event of a severe storm threatening a town where no telephone numbers are on file, we generally call their police or fire department. It was with such a call last year we made our first contact with a small town in Western Oklahoma using 20 two-way radio cars in its local network. No doubt there are more well-organized networks yet to be discovered.

7. The Individuality of the Networks

Local storm warning networks in Oklahoma vary about as much as people. The one thing they seem to have in common is their eagerness and ability to communicate with each other when severe weather threatens. Police, fire,and civil defense units usually provide the communication facilities. Smaller towns proudly point out how they help the larger towns and cities; larger towns and cities also take great pride in the number of other towns they advise about severe weather conditions.

Communication between the networks can be fantastic at times. It is not uncommon for a storm to build over the Eastern Texas Panhandle and within a few minutes all law enforcement in Western Oklahoma to know its location and movement. The Oklahoma Highway Patrol usually takes an active part in spreading this type of information if the storm is likely to affect Oklahoma.

Some networks utilize outlying residents along with a few two-way radio cars. Others use many two-way radio cars consisting of various law enforcement officers and Citizen Band radio groups. Several towns also maintain "Weather Watch Towers" equipped with telephones, two-way police radios, highway patrol receivers, auxiliary power and at least one such tower has an anemometer owned by the Civil Defense Director. Many police and civil defense units have arrangements to broadcast severe weather information on local radio stations and cable television and at least one broadcasts in theaters as well. Storm warning sirens are usually sounded by the fire or police department with a pre-determined and well-advertised type of blast or blasts.

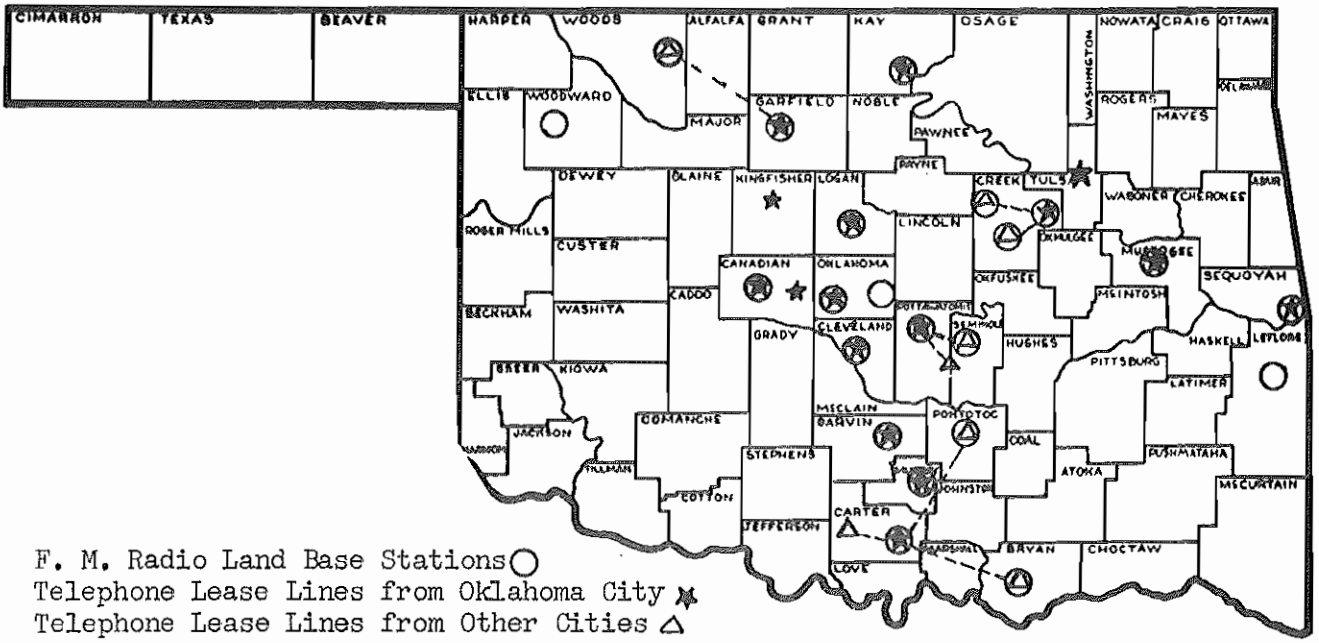
8. The Highly Mobile Networks

The networks using many two-way radio cars are able to expand or contract, almost at will, to meet the present need of their city or county. Highway patrol units are rightfully considered an important part of every network in the state, sheriff's officers in their own counties, and police and fire units in their cities. The incorporation of Citizen Band radio groups has increased the density and range of the networks. An interesting illustration of this expansion feature was provided by a city network in Northern Oklahoma. The Blackwell Police reported a tornado in progress near Enid, some 40 odd miles away, an area where good networks also exist. Some time later, the Chief of Police was asked how he was able to receive and relay this information to the Weather Bureau before the network in the area had reported. The answer was really quite simple: The affected network had its hands full, and anyway a member of his network was down there to follow the storm into Kay County.

9. Other Information Sources

Other sources for receiving severe weather information include 400 two-way radio cars belonging to the Oklahoma Highway Department, utility company dispatchers, and ham radio operators. It was a dispatcher from Oklahoma Gas and Electric Company with the first report of a tornado moving across the Red River into Love County during 1965. This same company reported to Oklahoma City funnel clouds near Coweta in Wagoner County and a tornado at Enid in Garfield County, both near the time of occurrence during 1966.

Figure 6. OKLAHOMA GAS AND ELECTRIC COMPANY COMMUNICATIONS NETWORK



F. M. Radio Land Base Stations ○
Telephone Lease Lines from Oklahoma City ★
Telephone Lease Lines from Other Cities △

10. Summary

Community storm warning networks are quite popular in Oklahoma. Because of the high tornado frequency, these networks remain fairly active throughout the year. Each exhibit their individualism, but somewhere near the heart will be found a civil defense unit, police department, or fire department. Cooperation between the networks is good and there is an orderly flow of weather information from one community to another.

The most important method of distributing severe weather watches and warnings is the Oklahoma State Weather Teletype Circuit. Many radio and television stations are subscribers to this service. In addition, the news services give priority to weather watches and warnings to their subscribers, thus providing good radio and television coverage throughout the state.

Civil defense and law enforcement agencies broadcast significant weather information. The Oklahoma Highway Patrol transmits weather information by teletype and radio to each district headquarters and these in turn broadcast to their mobile units and police departments. This alerts a most important element of virtually every network in the state.

NAWAS provides "hot line" service to many civil defense and law enforcement agencies. These points are responsible for transmitting information to the county seats of nearby counties.

Commercial telephone is used to contact a network when a severe storm is suspected or is known to exist in their area. Frequently it is found that they are already aware of the storm through other channels of communication.

Improvements in communication during the past decade has increased the effectiveness of the storm networks. Weather presentations by television meteorologists have made the general public more weather conscious. Programs by Weather Bureau meteorologists to the storm warning networks have also created a lively interest in weather. However, each small element of a network or communication system is not foolproof. As further advancements in communications occur, a corresponding improvement in network effectiveness is also likely.

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SEVERE STORM WARNING NETWORKS, TULSA AREA OF RESPONSIBILITY

William O. Garrison, WBAS, and G. T. Grosser, CD
Tulsa, Oklahoma

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SEVERE STORM WARNING NETWORKS, TULSA AREA OF RESPONSIBILITY

William O. Garrison, Weather Bureau Meteorologist in Charge, and
G. T. Grosser, Civil Defense Communications and Warning Officer
Tulsa, Oklahoma

1. Introduction

For the Tulsa Weather Bureau, the area of County Responsibility for severe weather warnings consists of twenty counties, all located in the northeast corner of Oklahoma. Their location is compatible with that of the Oklahoma Civil Defense Area 2. Utilizing the communication system of the Tulsa City-County Civil Defense Office is most helpful in the Weather Bureau's severe local storm warning system.

2. Organization

After years of piecemeal independent warning systems, using various kinds of communications from rural hand-cranked telephones to elaborate commercial radio equipment, a functional warning system with correlated communication channels has been established. The system is established on the principle of mass distribution through teletype, telephone, and radio communication warning networks. The twenty-county area is completely organized for severe weather information dissemination with the county Civil Defense offices acting as key distributors. Each county Civil Defense office has its own county (community) warning and observing network. An Emergency Operations Center (EOC) of the CD in each county acts as a clearing house or filter center for receiving storm reports and relaying them to the Weather Bureau. Each EOC also serves as a distribution center for warnings and other severe weather information to its county and adjacent areas.

The individual county networks vary according to local requirements. Most of them have a combined telephone and mobile radio weather spotter network. Mobile units may be equipped with Ham or Citizen Band radio, or be Police cars or Sheriff patrols. Functional diagrams of county networks are shown in Figures 7 and 8. Five counties have direct hot line commercial radio broadcast facilities used in conjunction with blowing of the Civil Defense sirens for tornado warnings and other emergencies.

3. Operations

The warning system for Northeast Oklahoma is better understood by following through a typical severe weather situation to demonstrate the different modes of communication used in operations.

A. The Oklahoma Weather Teletype Circuit is the origination channel for all weather warnings and storm reports from ESSA-Weather Bureau in Oklahoma for mass dissemination to the public by radio and TV. (Fig. 1) Storm warning coordination procedures between weather offices at Tulsa and Oklahoma City have resulted in minimum duplication of effort and effective use of manpower. Each office has pre-assigned circuit entry functions during severe weather situations, most of which can be accomplished without at-the-time coordination. Although the weather offices are the prime contributors to the net, storm and damage reports are entered on the circuit by the Oklahoma Highway Patrol.

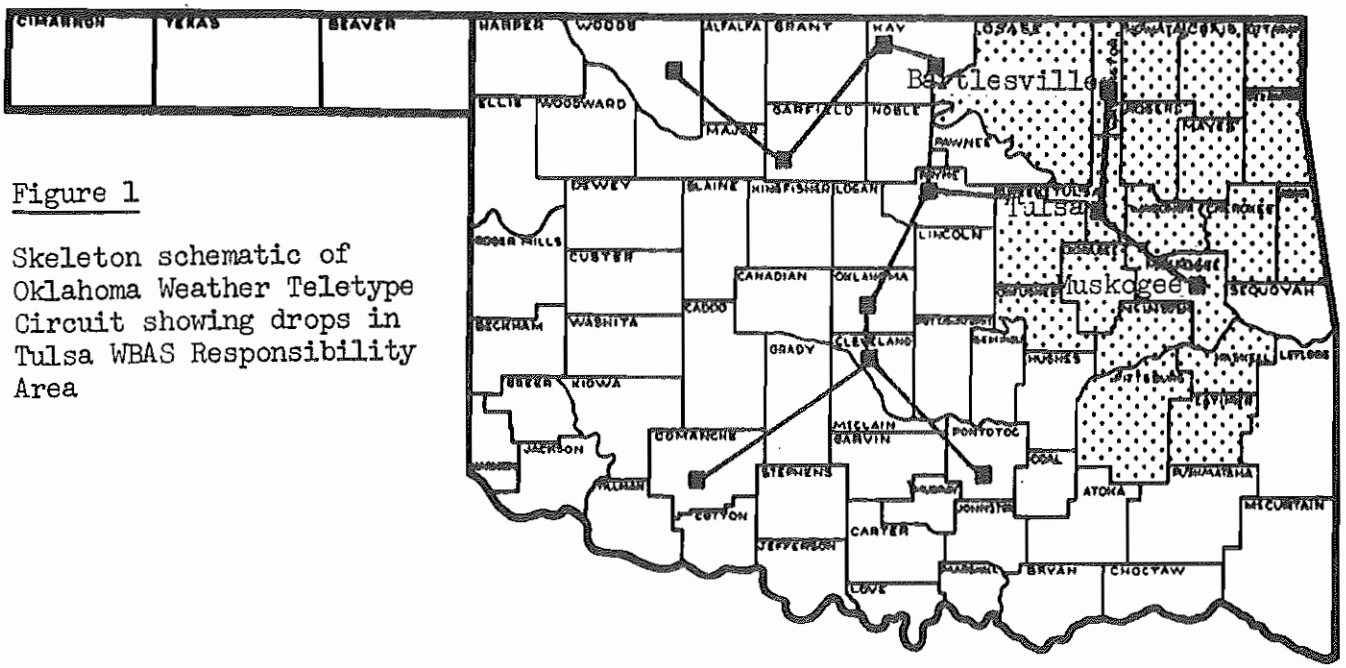


Figure 1

Skeleton schematic of Oklahoma Weather Teletype Circuit showing drops in Tulsa WBAS Responsibility Area

Upon receipt of a Severe Weather Watch from the National Severe Storms Forecast Center at Kansas City, the Oklahoma City office enters the forecast message on the state circuit as received. In the mean time, each radar office is plotting the area to be affected by the Watch using similar maps. Through standing agreement the Oklahoma City radar office outlines on the circuit the area in Oklahoma affected by the Watch. Coordination between the Oklahoma City and Tulsa offices in defining the area is rarely required. As necessary, either office may further define the area by counties or similar geographical areas. Tornado watches (and warnings) are followed by general severe storm information and safety rules transmitted by pre-cut tapes. As judged necessary, warnings are preceded by requests for Emergency Action Notification Signals and immediate broadcast, again using pre-cut tapes. Regular progress reports, including negative statements, radar reports and reports received from the observer networks are transmitted over the state circuit. All-clear and false-rumor statements are transmitted as required.

B. Ham Radio and/or Telephone Network The primary point-to-point Severe Weather Service distribution in Northeast Oklahoma is through the Civil Defense Radio Amateur Communications Emergency System (RACES) (Figs. 2,3, and 4). At the time of receipt of a Severe Weather Watch or local issuance of a severe weather warning, the senior forecaster on duty at WBAS Tulsa calls the Tulsa City-County Civil Defense Communications and Warning (CW) Officer, activitates the CD-WB 2-meter radio and the local direct broadcast commercial radio transmitter. The Civil Defense CW officer activates the CD Emergency Operation Center (EOC) and the WB-CD Warning network. Although Tulsa Weather Bureau personnel are radio telephone operators, the CD dispatches a HAM operator to the WBAS to operate the 2-meter radio and CD emergency telephone. This relieves the meteorologist for more pressing duties.

Continual contact between the WBAS and Tulsa CD, PD, Sand Springs PD, and OHP is maintained by voice over the 2-meter net. A similar severe weather network, perhaps not quite as elaborate, is maintained by each County Civil Defense EOC.

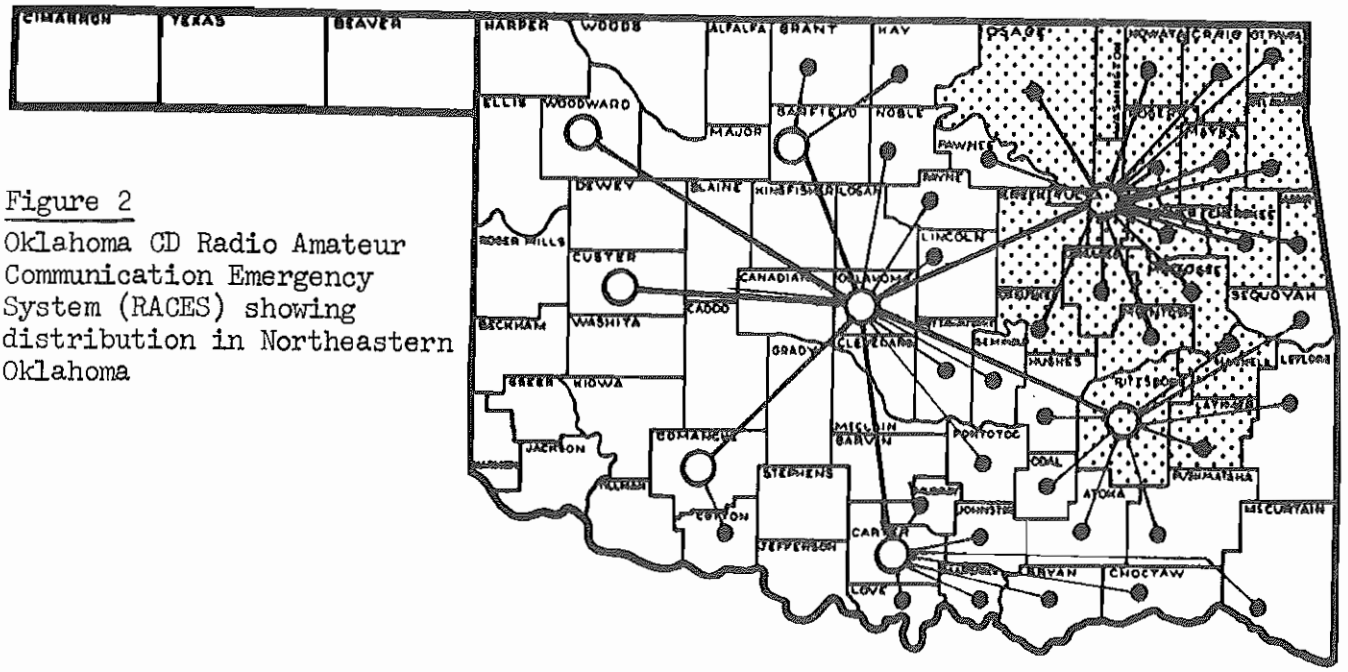


Figure 2

Oklahoma CD Radio Amateur Communication Emergency System (RACES) showing distribution in Northeastern Oklahoma

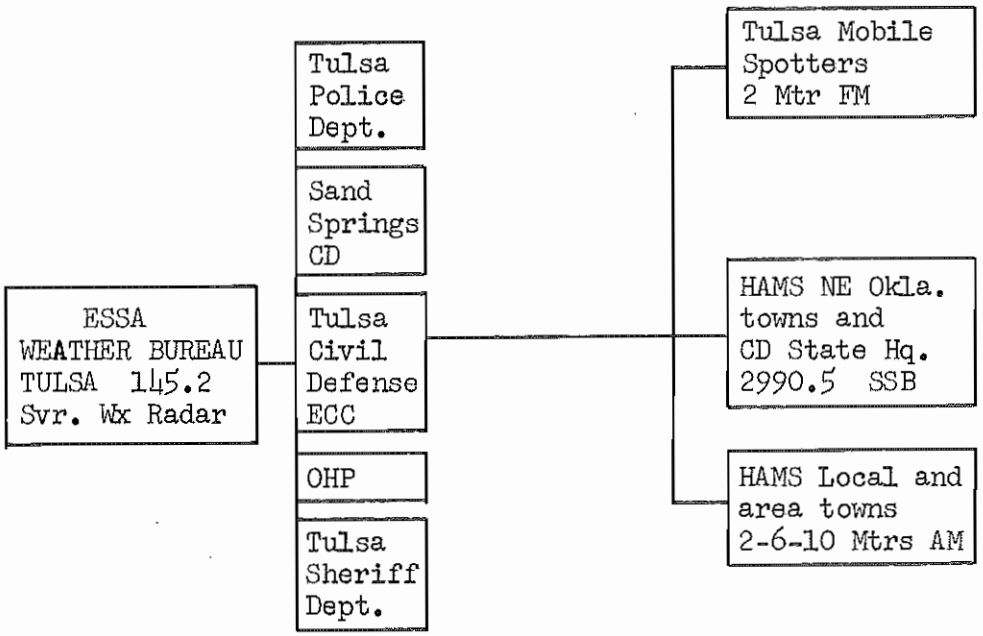


Figure 3 RACES NETWORK as used in WBAS, Tulsa, Okla. Severe Weather Warning Network

During a typical severe storm situation there is a constant flow of information, including warnings, storm and damage reports, observations and progress reports over the network. Weather statements are started out over the radio and telephone at the same time. As soon as one warning of a series is acknowledged by the recipient, the superseded one is automatically canceled. Logs of all transmissions are maintained in the WBAS as permanent records.

In addition to providing information in Northeast Oklahoma, the net is used routinely to exchange information with adjacent areas of Central Oklahoma to the west and Northwest Arkansas to the east.

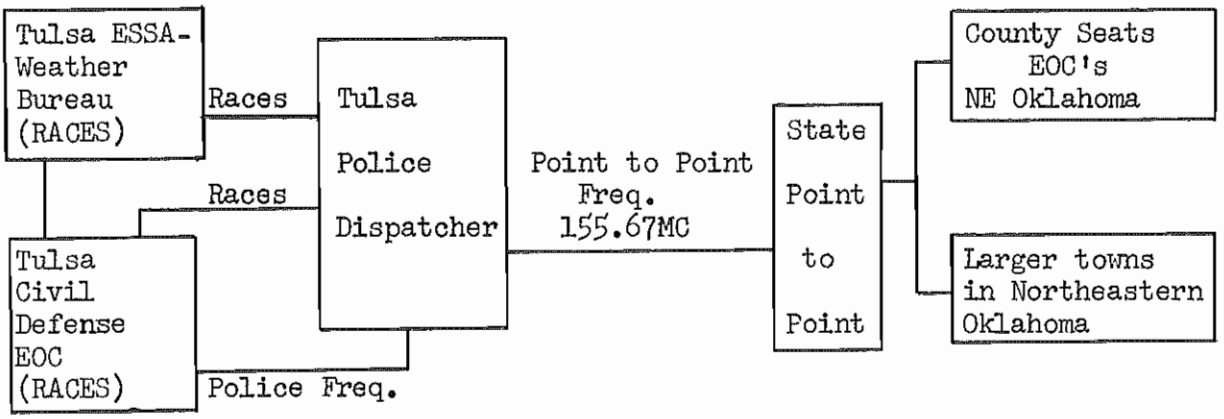


Figure 4 State Point to Point Communications Network as used for Severe Weather Tulsa Responsibility Area

C. Commercial Radio and TV Direct WB Broadcasts If conditions warrant, the WBAS makes direct voice boradcast over all commercial radio and TV stations in NE Oklahoma and adjacent portions of Kansas and Arkansas (see Fig.5). Local Tulsa stations are connected to the Emergency Broadcast System (EBS) keying station (KVOO radio) by hot lines. Stations maintain readiness for possible direct broadcast by following statements on the state teletype circuit. Within 90 seconds, the forecaster can be on the air with a live broadcast to Tulsans. In case of local communication failure, emergency procedures exist so that the live warnings can originate from the Tulsa CD-EOC.

For areas outside the Tulsa vicinity, radio and TV stations are alerted for direct broadcasts of Weather Bureau warnings by the EBS keying station. The keyer breaks the carrier and transmits a 1000 cycle frequency tone. Affected stations may either switch frequencies for live broadcasts or tape messages for immediate rebroadcast. All part-time stations have FCC permission to remain or go back on the air for emergencies.

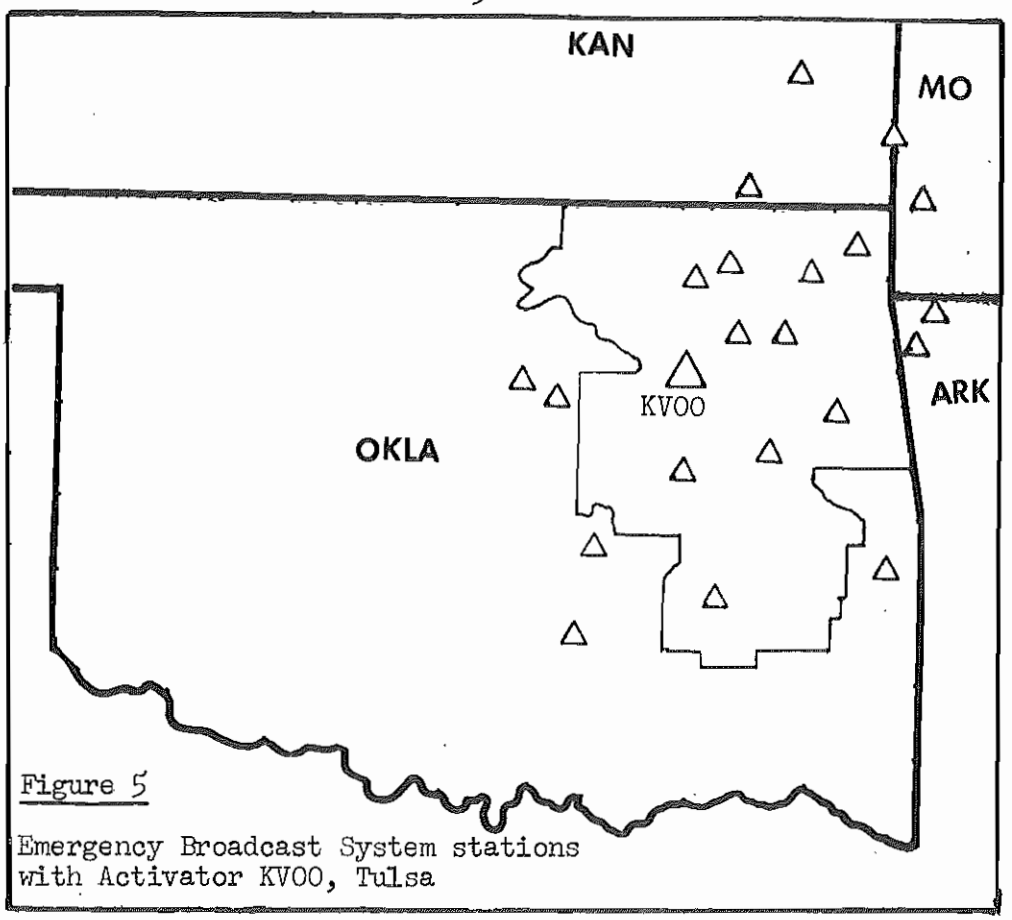


Figure 5

Emergency Broadcast System stations with Activator KVOO, Tulsa

D. Oklahoma Highway Patrol The Oklahoma Highway Patrol is a necessary and integral member of the cooperative storm warning organization. During severe weather situations the Patrol stays in constant contact with the Weather Bureau by voice over the 2-meter radio. Radio facilities of the Highway Patrol are used as auxiliary communications for the dissemination of warnings, to check suspected cloud buildups as requested by the Tulsa radar operator, and to obtain observations and damage reports. Patrol cars are especially beneficial for probing in remote areas and in relaying reports and warnings to other law enforcement agencies that may not be in contact with the RACES Network. All severe weather reports from Highway Patrol are entered directly on the Oklahoma Weather Teletype Circuit.

E. Tel-Autograph and/or Telephone Aviation Severe Weather Warnings are transmitted via Tel-Autograph to all airlines and military operations at Tulsa International Airport. This system is backed up by telephone call lists for emergencies. Distribution of warnings to auxiliary airports in the area is handled by the International Airport Field Office, located in the same building as the Weather Bureau. Progress and radar reports are entered on the Tel-Autograph on a routine basis. Information is transmitted to FAA FSS, Tulsa Tower, Tulsa Approach Control Radar, and Riverside Airport Tower by telephone.

F. Telephone Call Lists Although the primary point-to-point network uses radio, extensive telephone call lists are available. Northeastern Oklahoma lists are maintained by the WBAS and CD offices, verified annually, and changed as new data are submitted. Civil Defense call lists include all HOSPITALS and FIRE DEPARTMENTS in the area. Watches and

warnings are telephoned individually for each anticipated occurrence of severe weather. The Tulsa CD office will soon have all hospitals in the vicinity on the RACES Network to speed up the delivery of warnings. Each county EOC has an extensive call list.

When time does not allow going through key distributors, the WBAS uses a call list for 93 towns and communities in Northeastern Oklahoma. Telephone numbers of offices open continuously are used. As a rule the list includes public service offices such as police departments, sheriff offices, marshals, power plants, utility companies, etc.

The WB radar operator is furnished a list of all towns in the responsibility area showing direction (in degrees) and distances (nautical miles) from Tulsa. This assists him in preparing weather statements for telephone, radio, and teletype dissemination.

G. Radar Warning and Coordination Circuit Continual coordination is maintained with the surrounding WB stations via RAWARC and long line telephone. This includes the exchange of radar information as well as storm reports from adjacent areas of responsibility. Periodic All System messages are transmitted summarizing warnings, observations, and damage reports.

4. General Information

Figure 6 summarizes the storm warning system for Northeastern Oklahoma. Detailed step by step duties of all activities involved in Tulsa's Severe Weather Program are documented in the Station Duty Manual, including call lists, formats for warnings, etc. Constant review and revisions are necessary. Warning networks are re-activated every year prior to the storm season. New and old network supervisors are contacted annually by mail. Yearly communication and Civil Defense seminars are conducted for the twenty counties. The Tulsa WB and CD representatives travel several hundred miles each year visiting the different counties and cities to explain the program, to assist the local agencies in developing county and community Severe Weather Warning Networks, and to train personnel in observing and communication procedures.

5. Conclusions

Through the cooperative efforts of numerous agencies in pooling their resources, manpower, and management, a very fast and workable warning system in Oklahoma has been established. The system has allowed the Weather Bureau staff to serve the public with minimum loss in time and maximum results over the years. Numerous lives have been saved and an unknown amount of property damage has been prevented by timely warnings. During recent years there has not been a single tornado strike in which warnings were not issued. On the contrary, investigations revealed numerous instances where warnings had been received through multiple channels. This could not have been possible without the assistance of a large number of devoted public agencies and citizens.

ESSA-WEATHER BUREAU/TULSA CITY-COUNTY CIVIL DEFENSE
SEVERE WEATHER WARNING COMMUNICATIONS NETWORK

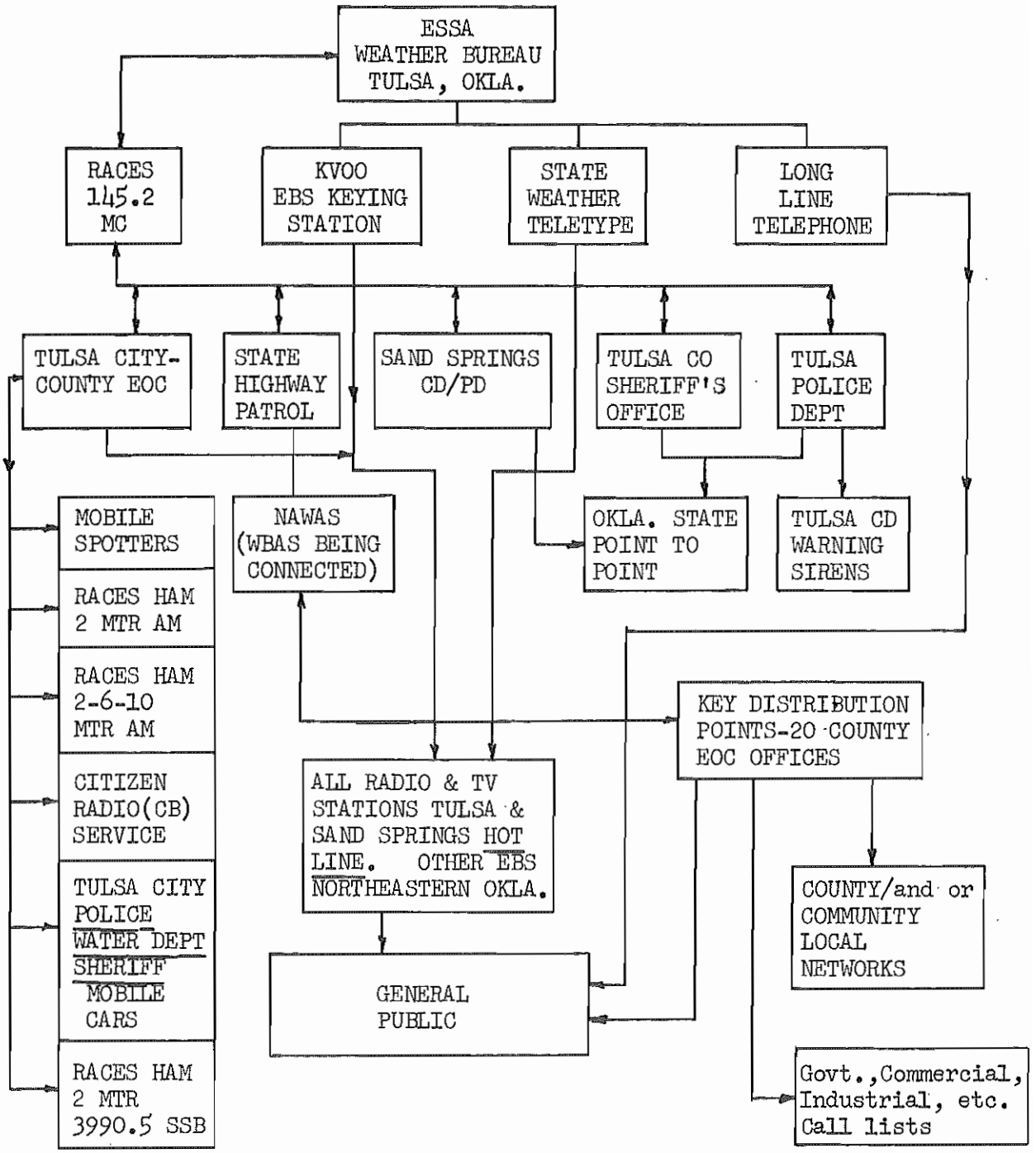


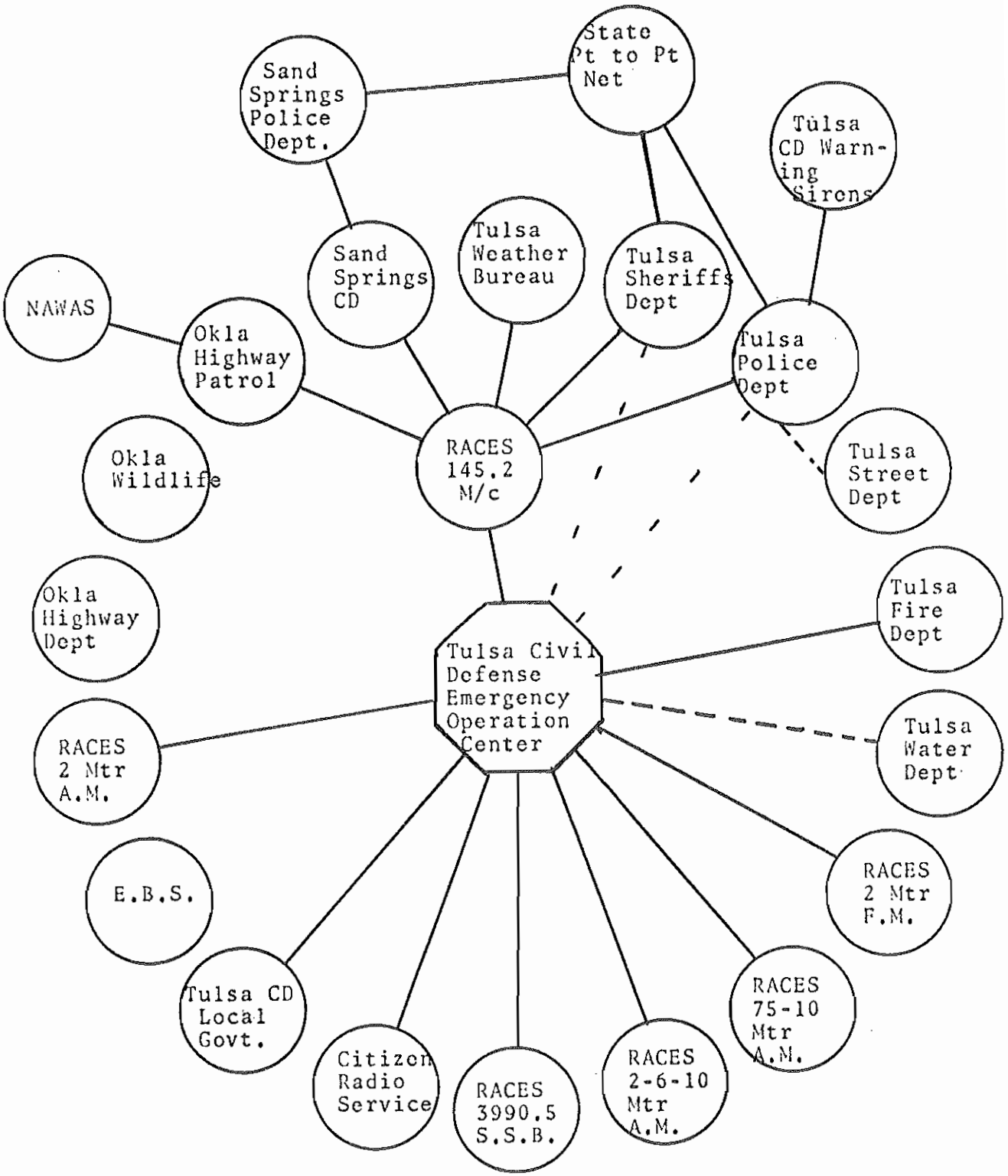
Figure 6 Communication Network

6. Acknowledgements

Personnel of ESSA-Weather Bureau and the Tulsa City-County Civil Defense wish to express sincere appreciation to all employees of the following agencies who have willingly given of their time and resources in contributing to public safety and welfare through their participation in the Severe Weather Warning System for Northeast Oklahoma:

Oklahoma Highway Patrol
Tulsa and Sand Springs Police Departments
Tulsa Fire Department
Commercial Radio and TV stations
County Sheriff's Office
Oklahoma Broadcasters' Association
Ham and Citizen Band Radio Operators

Figure 7 Communications System of Tulsa City-County Civil Defense Emergency Operations Center



——— Operational by Radio
- - - - Operational by Land Line
— — Under Construction

CIVIL DEFENSE DIAGRAM

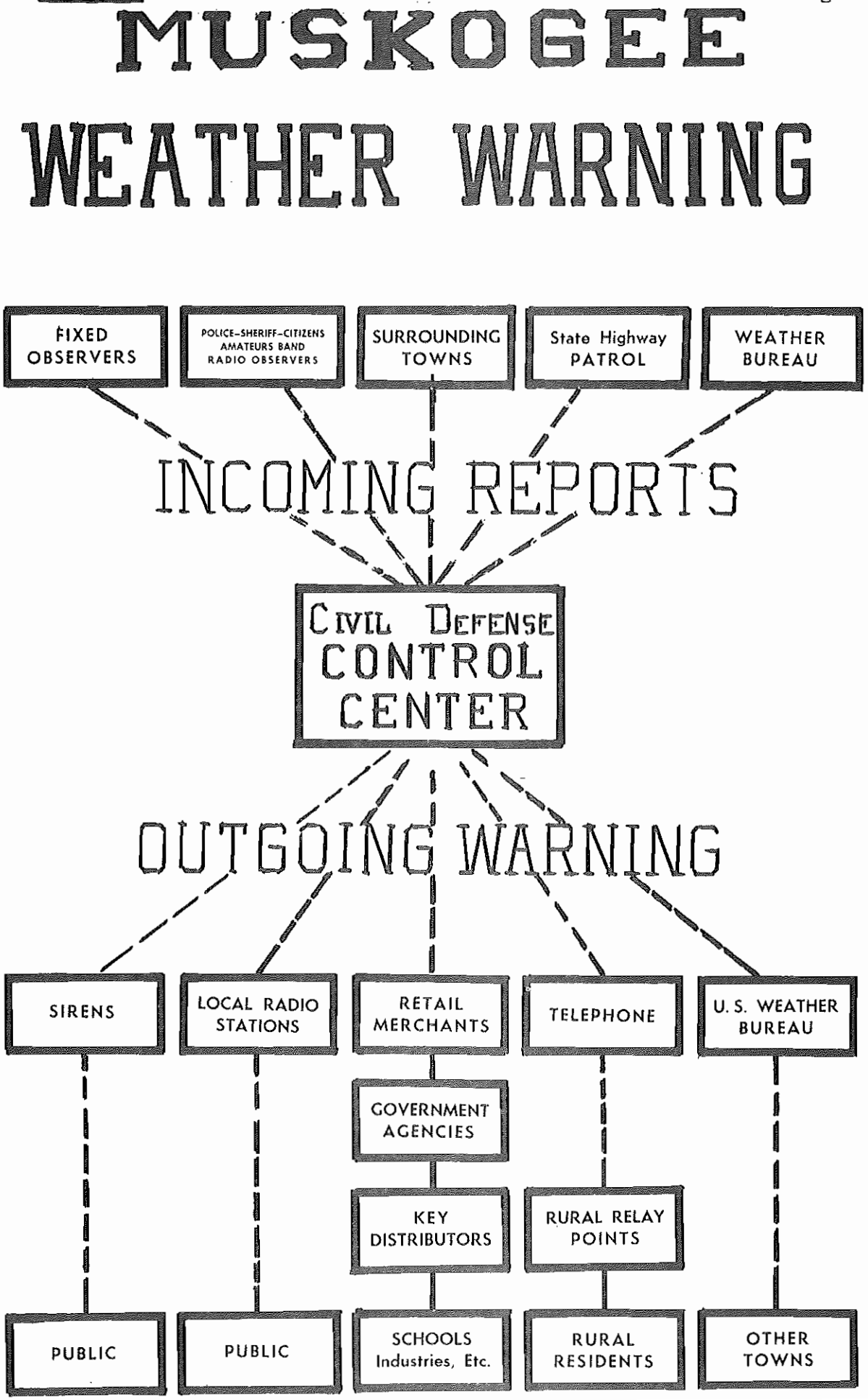



Figure 8 Muskogee Severe Weather Network Civil Defense Diagram