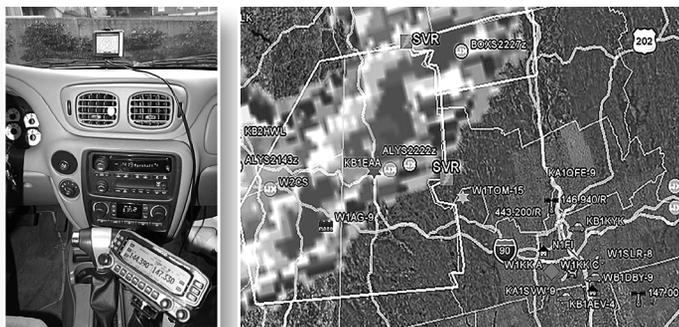


Storm Spotting and Amateur Radio



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This book is dedicated to my grandfather and elmer Fred Selley, K9MXG (SK).

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Chapter 1

Introduction

It is a Tuesday night in early February. The National Weather Service has issued a statement that there is a probability of severe weather coming into the area late that night. They have been tracking a squall line several hundred miles to the west. The storm has been producing strong winds and severe thunderstorms. Reports indicate that it has also produced hail and isolated tornadoes. A hazardous weather outlook is issued and reads “SPOTTER ACTIVATION MAY BE NEEDED”.

Long before the storm arrives a local Amateur Radio SKYWARN® group is making preparations. Two stations volunteer to handle net control duties. Several members volunteer to go mobile if needed. Several more offer to relay weather reports from their home QTH. Phone calls are made to the non-Amateur Radio spotters in the area to keep them current on what is happening. Everyone checks to make sure all is in order; radios working, batteries charged, flashlights handy, go-kits ready, and vehicles fueled. The local Emergency Coordinator stays in touch with the National Weather Service and local emergency management, keeping up to date on the latest weather information. Now all that can be done is to wait.

February is not a typical severe weather month in this area. It is usually cool and rainy. But only a year before, almost to the day, a tornado outbreak struck the area killing 57 people and causing over a billion dollars in damages. The SKYWARN spotters were well aware of what was possible even in a normally slow severe weather month. As the spotters watch the line of storms approach they realize that this may be a very serious storm. Before it arrives the net control stations activate the SKYWARN Net. One is operating from the local Emergency Operations

Center handling traffic coming in from the spotters. The other is relaying information to the SKYWARN Net one county to the east, keeping them abreast of the latest weather conditions. Mobile spotters are setting up to safely observe the storm as it approaches and being repositioned as needed. Home based spotters are calling in reports of conditions from their neighborhoods. Reports on the storm are being relayed to the National Weather Service office by radio, phone, and Internet. Reports are coming in of wind gusts at 60+ MPH, 1/4 inch diameter hail, street flooding, and a report of possible rotation in a cloud. Because of the incoming reports the National Weather Service can get a clearer picture of what is happening and can issue the appropriate watches and warnings.

The storm passes relatively quickly. In its wake come damage reports; trees down, power out, streets flooded, buildings damaged by wind. The spotter’s job is not done. Calling in reports of damage is the next step. These after the event reports play a key part in understanding the weather. The local spotters, most also Amateur Radio Emergency Service (ARES) members, continue to submit reports. The local emergency manager has also asked that they assist with search and rescue efforts in a flooded area and help provide communications for a local shelter that has been set up.

This scenario is not new for Amateur Radio operators that serve as volunteer storm spotters. Amateur Radio has played a part in severe weather for decades. But long before SKYWARN, radar, the Internet, even before Amateur Radio, there was a critical need to get real time, ground truth information on severe weather that could be used to warn of approaching storms and aid in forecasting. To understand how we got to where we



Benjamin Rock, WX9TOR, storm spotting. (WX9TOR photo)

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are today we should first look at severe weather in the US, the history behind severe weather observation, and the role communications have played.

HISTORY

Weather in the United States is about extremes. One of the earliest weather observations tells us this. In the 1600s William Bradford, governor of the Plymouth Colony, noted about winters in America “sharp and violent, and subject to cruel and fierce storms, dangerous to travel to known places, and much more to search an unknown coast.”¹ Throughout American history there are accounts of deadly floods, tornadoes, thunderstorms, hurricanes, and wildfires.

Starting in the 18th century regular observations of weather conditions began to be made. The founding fathers were keen observers of weather. Thomas Jefferson made regular observations from 1772 - 1778 and used a thermometer and barometer. He even noted on July 4, 1776 the temperature in Philadelphia was 76°. George Washington kept daily weather observations in a diary until the day before his death. And Benjamin Franklin’s weather experiments are part of popular American folklore.

In the 19th century a major advancement in communications, the telegraph, made it possible to relay weather observations to other stations. This was the starting point of weather forecasting. Advance notice of approaching weather had always been a need, but it was impossible without the ability to communicate real time observations. It was not long after the invention of the telegraph that organized observation of weather was started.

The Birth of a National Weather Service

In 1848 Professor Joseph Henry, Secretary of the Smithsonian Institution, proposed a program to observe and report severe weather. The program, The Smithsonian Institution Meteorological Project, would rely on a network of volunteers across the country. By the end of the first year the project had over 150 volunteers and by 1860 there were over 500. The system relied on the telegraph system to relay information from volunteer observers to the Smithsonian. In 1862 the Smithsonian published a pamphlet containing information about tornadoes and thunderstorms. The public was urged to take note of weather occurrences and forward the information on to the Smithsonian. As time went on other weather observation systems around the country, like that organized by Professor Cleveland Abbe in Cincinnati, would be absorbed into the Smithsonian’s network.

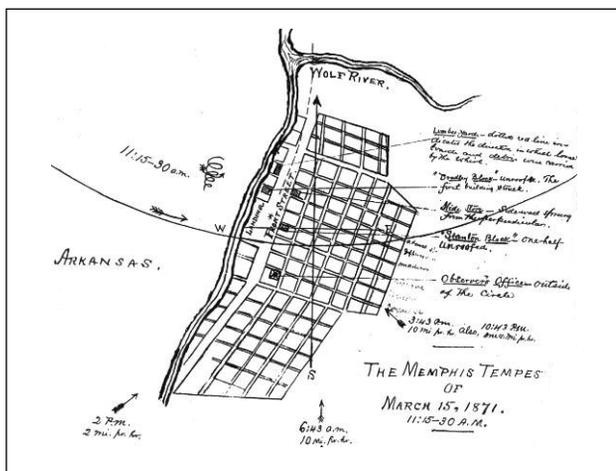
During this time Professor Increase A Lapham, a scientist, author, and student of meteorology, urged that the federal government establish a weather service that could coordinate weather observations and issue forecasts. With the support of Colonel Albert Myer of the US Army Signal Corps he succeeded in lobbying Congress to pass legislation establishing a national weather service. In 1870 President Ulysses S Grant signed a bill that moved the weather service

The first week of official observations taken in Memphis. (National Weather Service Memphis WFO)

from the Smithsonian to the Department of War. The new department was assigned to the Signal Corp and given the name The Division of Telegrams and Reports for the Benefit of Commerce. The use of volunteer observers was replaced with Observing-Sergeants who would telegraph weather reports to Washington DC. Initially there were 24 observing stations. By 1878 there were 284.

Along with the shift from the Smithsonian to the Signal Corps came the first organized weather training. There were very few professional meteorologists in the Signal Corps. The observation stations were made up of military personnel that had little or no background in weather spotting. At Fort Whipple in Virginia a course was developed within the curriculum of telegraph and signaling that covered meteorology and meteorological observation. Eventually a similar course was developed for officers. The training course lasted until 1886 when it was ended by the Secretary of War.

Due to internal turmoil the weather service was moved to the Department of Agriculture in 1890 by President Benjamin Harrison. The change created a new civilian weather bureau. The military personnel that had staffed the weather service under the Signal Corps were discharged and given the opportunity to go to the new department. With the transfer also came a name change: from 1891 - 1967 it would be known



Map documenting the first official report of a tornado. (Memphis, Tennessee). (National Weather Service Memphis WFO)

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as the Weather Bureau.

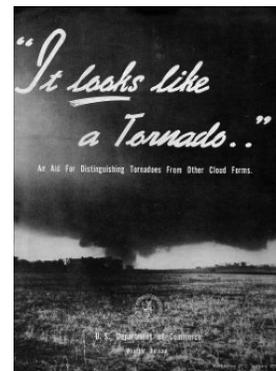
During this time monumental technological advancements greatly influenced how weather observations were reported and the ability to forecast weather. While many of these advancements were new meteorological technologies such as radar and weather satellite, the greatest advancements were in the areas of communication. In 1902 the Marconi Company began sending forecasts from the Weather Bureau to ships in the Cunard Line. And in 1905 the first weather observation from a ship at sea was sent by wireless. Wireless was a huge step forward over sending reports by telegraph. Telegraph required observation stations to be located along telegraph lines. With wireless an observation stations could be placed anywhere. As wireless advanced so to did the ability to receive real time weather observations. In 1921 the University of Wisconsin made the first transmission of weather forecasts by voice. By 1928 teletype had replaced voice for sending weather information.

Also during the early years of the Weather Bureau the use of volunteer observers reemerged. In 1890 the Cooperative Observer Program was established and is still in use today. The program has two goals; “to provide observational meteorological data, usually consisting of daily maximum and minimum temperatures, snowfall, and 24-hour precipitation totals, required to define the climate of the United States and to help measure long-term climate changes, and to provide observational meteorological data in near real-time to support forecast, warning and other public service programs of the National Weather Service.”² In 1933 a science advisory group indicated to the President of the United States that the use of a volunteer cooperative observer network provided an extraordinary service. Today the program has more than 11,000 volunteers.

In 1940 the Weather Bureau was moved to another department within the federal government. President Franklin Roosevelt moved it to the Department of Commerce, where it remains today under the name National Weather Service, because of the role that it played in aviation and therefore the nation’s commerce. During the years of World War Two the Weather Bureau, along with the military, set up a network of volunteer storm spotters. The initial mission of the spotters was to monitor lightning near ordnance facilities. The value of real time, first-hand information was apparent and by 1945 there were more than 200 observer networks in the United States. The use of weather observers was continued after the war. A series of tornadoes between 1947 and 1951 in Texas showed that having a local storm spotting network made it possible to get warnings out faster and save lives. Throughout the late 1940s and early 1950s spotter networks continued to develop. The use of spotting networks had a noticeable impact on the number of tornadoes being reported.³ In May 1955 a tornado struck Udall, Kansas killing 80 people and injuring 273. This event prompted the Weather Bureau to recruit spotters and develop training for them. On March 8, 1959 the first official storm spotter training was conducted in Wellington, Kansas. 225 spotters received training. Along with the training the Weather Bureau issued a handbook for



The Severe Storm Reporting Handbook (1956) and It Looks Like a Tornado . . (1959). (National Weather Service)



spotters, the *Severe Storm Reporting Handbook* (1956). This was followed up in 1959 with the publication *It Looks like a Tornado..*

In 1965 another weather event impacted storm spotting networks around the country. On April 11, 1965 - Palm Sunday - 47 tornadoes struck the states of Indiana, Illinois, Wisconsin, Ohio, and Michigan. This outbreak was the largest single day tornado outbreak in US history (since only passed by the super outbreak of 1974). Over 12 hours 271 people were killed and over 3500 injured.

Following the Palm Sunday tornado outbreak the Weather Bureau realized that there were serious shortcomings in early warning, communications, and storm spotting. From this came the National Disaster Warning System or NADWARN. A phase of NADWARN was the SKYWARN program. The SKYWARN program would be coordinated by the Weather Bureau (to become the National Weather Service in 1967) and train local volunteer storm spotters. Training classes were developed and the use of publications about severe weather was continued. SKYWARN started officially in the early 1970s. Since its beginning it has expanded to cover severe weather beyond tornadoes. Today there are over 280,000 SKYWARN trained storm spotters in the United States. The concept of SKYWARN has also made it to other countries with groups such as TORRO in the United Kingdom, SKYWARN Europe, and Canwarn in Canada.

Amateur Radio and Storm Spotting

Amateur Radio has played a part in responding to severe weather long before the development of SKYWARN, even before the development of organizations such as ARES and Radio Amateur Civil Emergency Service (RACES). Starting in the 1920s we see how Amateur Radio operators were involved when severe weather struck. During these early years the role was primarily in response to severe weather instead of ahead of it. Amateurs provided communications when normal means went down, relayed health and welfare traffic, and assisted various local, state and federal agencies during recovery. If we look at some of the stories from these early years we can see many similarities to what we do today.

In 1923 the Arkansas River, which crosses northeast Oklahoma, flooded. Normal lines of communication between

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Tulsa and the near-by town of Sand Springs were lost. Amateur Radio operators Edward Austin, 5GA, Raymond McKinney, 5SG, and John Lewis, 5WX, of Tulsa and Halton Friend, 5XBF, and Howard Siegfried, 5GJ, of Sand Springs used Amateur Radio to maintain communication. The operators handled messages between the towns and relayed information from reporters to their newspapers. The operators continued this for three days when normal communication lines were restored.⁴

On January 8, 1937 an ice storm struck the central states of Missouri, Illinois, Arkansas, and Oklahoma. Across the region communication lines were down. Amateur Radio operators in the affected areas assisted by providing communications for almost a week before normal communication lines were restored. Traffic was handled for utilities such as electric and gas companies, telephone companies such as Southwestern Bell, the Associated Press, Western Union, and railroads. One station, W9PYF, logged 103 hours of operation, handing 183 messages.⁵

In September 1941 a hurricane struck the Texas Gulf coast. The hurricane, a category 3, known as Hurricane 2 (naming of hurricanes was not standardized until 1951) struck between Freeport and Port O'Conner on September 23. The storm caused a great deal of damage and took out communication lines in the areas around Galveston and Houston. An Amateur Radio operator, James 'Salty' Johnson, W5LS, of Houston, Texas volunteered to assist with communications. Before the storm made landfall he took a truck containing a 300W transmitter, generator, and receiver and went to the area where it was thought the center of the storm would strike. He waited the storm out in the city jail at Palacios, Texas. Salty was not alone, other Amateur Radio operators along the coast set up and prepared for the storm and to provide communications after it made landfall. Amateurs from around the state and around the country were ready to assist with disaster communications.⁶ The death toll was only four. This was attributed to early warning and preparedness.

On the morning of September 29, 1938 a storm system moved into the Carolinas from the Gulf of Mexico. The storm produced five tornadoes that struck South Carolina. Two of the tornadoes were rated as F2 and three were rated as F1, resulting in 32 killed and around 100 injured. Assisting in the response to the devastation in Charleston, South Carolina were local Amateur Radio operators. As soon as power was restored to some areas amateurs went on the air and began handling traffic. Although telephone lines were not completely down they were overloaded by people calling to reach family and friends. Amateurs also assisted local law enforcement with communications for the police force and rescue efforts.⁷

Prior to World War Two most of Amateur Radio's involvement with severe weather was in response. The reason for this was the limited ability to forecast weather. Most Weather Bureau offices were still relying on little more than a thermometer, anemometer and wind vane, and barometer to detect changes in the weather. Innovations such as radar and weather satellites would not come until after the war.

W.E.R.S. EXPANDED

ON APRIL 10th some important changes were made by FCC in the regulations governing WERS, Part 15 of the FCC Rules, acting upon a request filed by ARRL about a year ago. As the regulations have read, WERS stations must be licensed primarily in connection with national security and defense and, although the regulations were changed some time ago to permit *such* stations to operate during natural-disaster emergencies, no provision has hitherto existed for the organization of WERS primarily on behalf of the relief of disasters. The regulations are now expanded to permit the CD type of WERS stations to operate in an emergency jeopardizing public safety, and new networks may be established and existing licenses renewed even though the Citizens' Defense Corps or equivalent civilian defense organizations are no longer active in the areas involved. WERS is the only agency through which amateur services may be utilized in the traditional duty of the amateur to cope with communication difficulties flowing from public emergencies, so this is a very significant expansion, as we comment upon in this month's editorial.

Article from the June 1945 QST on the War Emergency Radio Service.

The first effort at organizing any form of Amateur Radio network to do storm spotting came during World War Two. The War Emergency Radio Service (WERS) was started by the Federal Communications Commission in June of 1942. The regular Amateur Radio service was suspended during the war, but there was still a need for communications that Amateur Radio operators could fill. WERS was made up of licensed hams that operated WERS stations that were licensed to a community. The purpose was to assist with air raid warning and eventually expanded to include natural disasters and severe weather. Severe weather spotting was a secondary function that developed during the war. The original idea was to report on severe weather near military ordnance facilities. The weather observing component of WERS was formalized in 1945.

Following the war most Amateur Radio activity related to severe weather was still in providing assistance after the storm struck. Amateurs continued to set up emergency nets to relay traffic and assist with rescue efforts. Throughout the post-war years a combination of events changed the way Amateur Radio was involved in severe weather. Forecasting severe weather was advanced by the use of radar and weather satellite. The first tornado warning was issued, setting a precedent for future weather warnings. Amateur Radio technology was advancing to make it easier for stations to operate mobile and portable. Many of the storm spotter networks that started in World War Two were still active and new ones were being formed. Storm spotter training was beginning to take off. When SKYWARN finally came into being it was a perfect match with Amateur Radio.

STORM SPOTTING TODAY

Since the start of the SKYWARN program storm spotting has continued to evolve and advance. Originally the