

UNDER THE RADAR:



National Weather Service
Aided by SKYWARN® Spotters



THINKSTOCK/HAMERA

by Greg Waxberg

"National Weather Service Doppler radar has indicated a severe thunderstorm ..." When you hear or read this statement, it is advantageous to be forewarned of a storm's location, direction, and speed. But the most effective reports for severe weather preparation include information about damage or ground conditions—details that are furnished by volunteer weather spotters in the NWS's SKYWARN® system.

Doppler radar, based on the Doppler effect, is a curious creature. After an antenna transmits radio waves toward rainfall at consistent speeds, the waves bounce off raindrops and return to the antenna. The radar system measures how those bounces change the speeds of those transmitted signals, and so they calculate the distance and direction of the rain. The challenge is that, due to the upward tilt of these radar beams in relation to the curvature of the earth's surface (a tilt that begins at 0.5 degrees), Doppler radar can only analyze data at a minimum of 1,000 feet above ground level. So while it is helpful to have colors on a weather map, indicating predicted or actual severity of a severe weather system, those colors cannot tell you what is actually happening on the ground.

Because of that limitation, the NWS needs reports from people on the ground to know how a storm is actually impacting an area, which, in turn, helps meteorologists make decisions about issuing warnings. The roots of the SKYWARN system can be traced back to 1847, when a network of about 150 volunteers used telegraphs to submit severe weather reports to the Smithsonian Institution Meteorological Project. That system was designed by Joseph Henry, the Smithsonian's first secretary, to research the dynamics of American storms. Fast-forward to 1955, when a deadly tornado in Udall, Kansas, killed 80 people and wounded 273. In response to this event, the United States Weather Bureau conducted its first-ever official storm spotter training for 225 people in Wellington, Kansas, on March 8, 1959.

Palm Sunday, April 11, 1965, proved to be one of the deadliest tornado outbreaks in United States history: 82 tornadoes were reported, severe weather was reported in 14 states, 271 people were killed, and more than 3,000 were hurt. This time, the Weather Bureau (which would be renamed the NWS five years later) established the Natural Disaster Warning System, which included the tornado-specific SKYWARN program to train volunteer spotters.

One might question why the NWS relies on volunteers, instead of professional meteorologists, to provide on-the-ground data. According to Chris Maier, NWS national warning coordination meteorologist and SKYWARN co-lead, "Meteorology has grown as a profession through the decades, but, when SKYWARN was created—and prior to the 1960s—there weren't many profes-



NWS

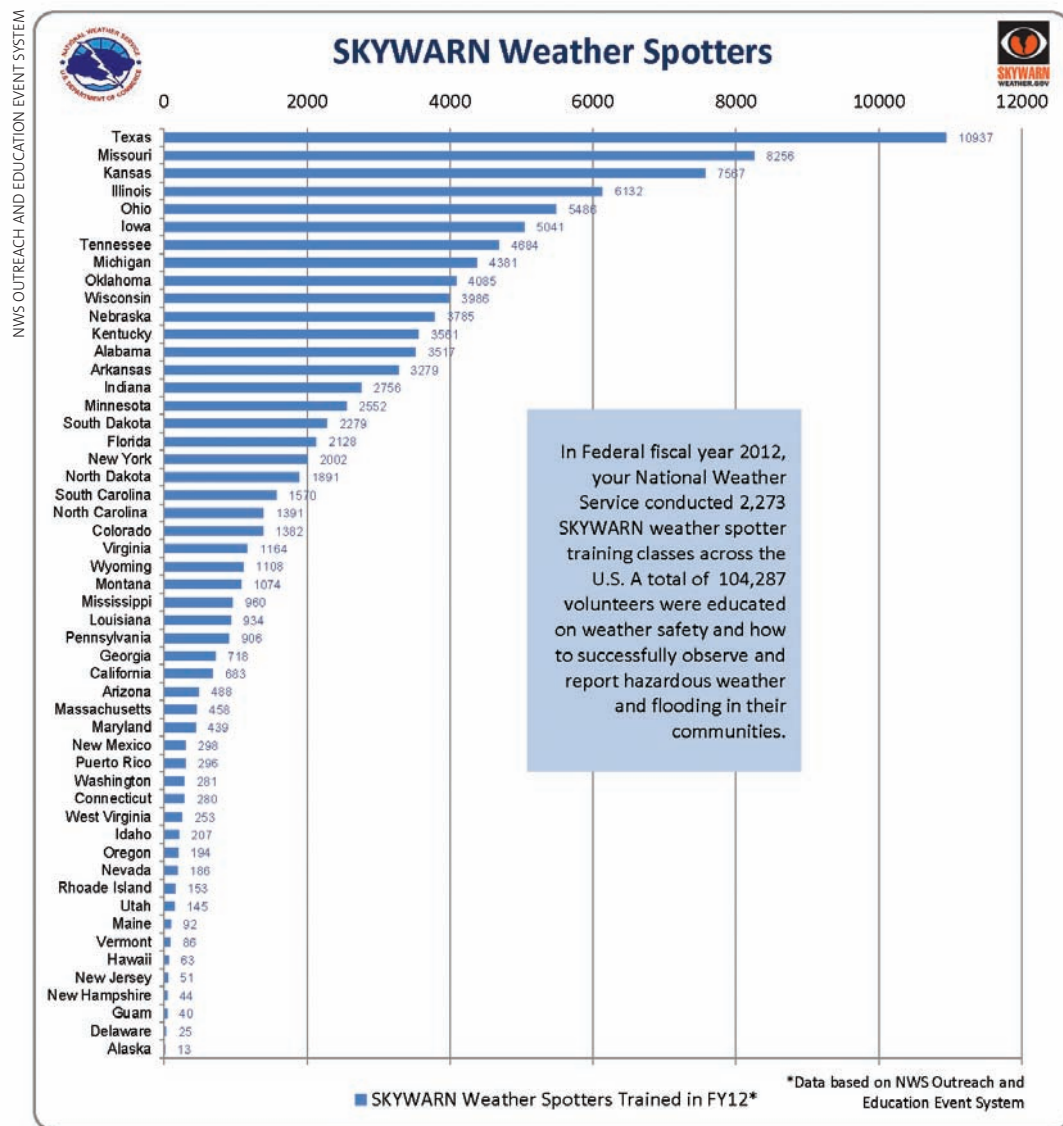


Figure 1.

sional meteorologists. It was probably easier to train a network of willing citizens. Even today, it is much more effective for the NWS to have all of these volunteer citizens helping, in addition to professional meteorologists.” He estimates that there are over 350,000 spotters in all 50 states, though no one knows the exact number; having 122 NWS offices with individual databases and ongoing recruitment, as well as hundreds of individual groups who act as spotters, makes it impossible to generate a definitive number.

These spotters represent a cross-section of the population, including amateur radio operators, first responders (fire, police, and EMS), truck drivers, airplane pilots, public utility workers, and other citizens who are interested in learning more about weather and who want to be active in their communities. People affiliated with hospitals, schools, churches, and nursing homes, and who have a responsibility for protecting others, have also become spotters.

“Because of SKYWARN spotters, forecasts from the National Weather Service are more complete, accurate, and timely,” said Tanja Fransen, NWS warning coordination meteorologist in Glasgow, Montana, and SKYWARN co-lead. She continued:

On rare occasions, some people call with reports that prove to be false, only because those spotters think they saw something that they actually didn't. The clouds can be tough to read at times. We don't take every report as “absolute,” because we have to ask ourselves if the information makes sense based on the atmospheric conditions. So the radar and additional spotters are critical. Overall, spotters help us immeasurably and have helped save lives and property.

Although tornadoes were largely responsible for SKYWARN's creation, the program keeps

an eye on a lot more than tornadoes and severe thunderstorms. Spotters report the impact of such extreme weather conditions as hail, freezing rain, ice storms, dust storms, flash flooding, rising creeks, dense fog, new snowfall and cumulative snow totals, and visibility during blizzards. Because of the need to track all these conditions, SKYWARN operates in all 50 states.

Maier reports that SKYWARN recently finalized its first-ever official NWS policy directive, which was intended to help explain SKYWARN's scope, define the program's responsibilities, and make recommendations for implementing the program. In doing so, "You have to represent the local community approach. SKYWARN has always been a grassroots program and needs to remain this way," he asserted. "To pick an extreme example, emphasizing winter weather hazards, earthquakes, and tsunamis is much more important than training for tornadoes in Alaska. Those are very rare," Maier explained.

With that in mind, it is easy to understand why the reports provided by trained volunteer spotters are valued so highly by the NWS. In fact, SKYWARN has marine weather spotters on boats who look for any meteorological data they can gather, ranging from wave heights to wind speeds to freezing spray. Having hundreds of thousands of spotters across the mainland and in the water does sound like a comprehensive way to cover weather; however, the numbers do not tell you where all of the spotters are located.

Loren Nichols of Frazer, Montana, a SKYWARN spotter, farmer, and amateur radio operator, said, "We are so sparsely populated that every set of eyes is important. Sometimes, if nobody says anything, there's no way to know that severe weather is coming. That's a problem for us because of the impact on livestock. Weather is our life here. It makes us or breaks us." Every year Nichols reports such common weather events as severe thunderstorms, hail, and a few tornadoes. "The challenge is figuring out what the storm is going to do, especially slow-moving storms that change directions."

Nichols, like other spotters, derives satisfaction from helping people and knowing that his reports can provide sufficient warning for nearby towns and cities. In over 20 years as a spotter, he has learned a great deal about the formations of thunderstorms and how to identify safe and dangerous clouds. Fittingly, he also uses his weather knowledge for farming, such as determining how much hail insurance to buy for his crops.

In Point Pleasant, West Virginia, amateur radio operator and SKYWARN spotter Jeff Holstein knows that "if everything else fails, we're able to talk," referring to the fact that amateur radio operators provide emergency communication for the NWS and anyone else who needs it. That important service means one thing, in Holstein's words: "You could be the person who saves a life because of the information that you give the National Weather Service. Since they're look-



NWS HUNTSVILLE, ALABAMA

Two North Alabama SKYWARN liaisons, Jonathan O'Rear, KD4MPW, and Doug Hilton, WDoUG, working at the NWS Huntsville, Alabama, amateur radio station, WX4HUN.



The Doppler effect: Change of wavelength caused by motion of the source.

ing at Doppler radar, and you might be 50 miles away, you could see something they can't see."

Though Arizona is mostly arid, it has a summer monsoon season, and this is when time-lapse photographer and videographer Mike Olbinski, of Phoenix, Arizona, loves to storm chase. "I see a lot going on, so I felt like it was my responsibility to educate myself on spotting severe weather and, most importantly, how to report it, so that I can help the NWS," he said. More so than monsoons, however, dust storms cause some of Arizona's most severe weather, and they are capable of causing car accidents and major highway delays. "The challenge in reporting them is judging visibility. You could be on one area of Interstate 10, and the visibility is next to nothing, while, a half-mile up the road, it's a lot more clear. The goal is to get an overall feel for what is happening with the dust storm, how thick it's going to get, and if it's worth reporting."

The importance of wind strength cannot be over-emphasized, which is a factor mentioned by spotter and Milwaukee, Wisconsin-area

SKYWARN association executive director Skip Voros, who oversees spotters and conducts training for NWS. "A downed tree lying across the road represents damage, which helps us infer how strong the winds were. Local law enforcement needs to know which roads are blocked. Or, someone could be experiencing impassable streets in a torrential downpour—that needs to be reported so the National Weather Service understands the magnitude of the situation," he said. Since Milwaukee is on the edge of Lake Michigan, the area experiences waterspouts and occasional derechos.

Voros relates a story about what led him to be so involved with the SKYWARN program. A tornado was moving through the local city of Saint Francis, a suburb within Milwaukee County. Voros, an amateur broadcaster at the time, made an urgent announcement over the radio about the tornado, based on reports he received from local weather spotters. A man who was listening to his scanner radio heard Voros's radio announcement; he called his mother, who lived in the affected area, and told her to go to the basement. That tornado went through her backyard and caused damage. About six months later, the man again heard Voros on the amateur radio and called to thank him for his community service that kept his mother safe. According to Voros, the personal satisfaction from that one call made his SKYWARN efforts "all worthwhile."



Dust storm in Phoenix, Arizona.



THINKSTOCK/ZONAR

When asked about knowledge gained and lessons learned from volunteering for SKYWARN, the spotters share valuable advice. At the top of the list is this: Always know where a storm is located and where it is expected to go, and always have an escape route. "Preparation to be safe is critical because storms are so unpredictable," Voros declared. "Advanced preparation and evaluation will keep you safer. The problem is that people aren't always able to identify a threat or evaluate the risk from that threat. Think about a cloud structure that develops before a tornado starts. Someone could just think it's a weird-looking cloud, but knowing what to look for helps make the risk more obvious."

The weather spotters are just some of the people who have enabled SKYWARN to grow during the past five decades. Partnerships with emergency managers and the Spotter Network have contributed to the program's development. Emergency managers act as spotters and help recruit spotters; they also benefit from SKYWARN by using information provided by local SKYWARN amateur radio networks to help agencies respond to events (these reports are also fed to the NWS), and the agencies partner with SKYWARN to prepare citizens for severe weather. "We can't change the number of tornadoes, floods, ice storms, and lightning occurrences, but we can change the public's attitude and action before, during, and after these events," said Lloyd Colston, director of the Altus Emergency Management Agency in Altus, Oklahoma.

The Spotter Network, founded by Tyler Allison in 2006, uses a map to show where spotters and chasers are located. "SKYWARN is a collection of ideas and directions," Allison said, adding, "The actual operational and implementation work is left to individual NWS offices. The most advanced offices utilize the Spotter Network as part of their umbrella of SKYWARN capabilities." A local NWS office can contact spotters instead of waiting to hear from them, and the office can rely on the Spotter Network's "quality control," which blocks unreliable or false reports. Fransen notes that many Spotter Network spotters are not only SKYWARN spotters in their communities, but also avid storm chasers, which causes them to leave their local areas in pursuit of storms. Through its apps, the Spotter Network gives them a way to submit reports to the NWS without having to contact a specific office.

Maier anticipates further expansion of SKYWARN in the coming years by way of partnerships. If you would like to become a spotter, contact your local NWS office to complete training. Sessions usually last about two hours, and they focus on how to identify severe weather, how to submit reports, and how to remain safe while spotting. Though the training requires two hours, it takes only two minutes to help save someone's life. **W**

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