CHAPTER 3: GENESIS AND EVOLUTION OF THE NOAA WEATHER RADIO PROGRAM

3.1: The First VHF-FM Weather Broadcasts

As we have seen, the presence on commercial airwaves of Weather Bureau personnel was not to survive for long. While weather forecasts and warnings provided by the Weather Bureau had for more than 30 years been broadcast via government (Naval) radio facilities⁸⁹ never had the civilian weather agency taken upon itself continuous, direct, Bureau-controlled transmissions⁹⁰—not until 1951.

An early clue in the search for the beginnings of NOAA Weather Radio is found in the May 1951 issue of the United States Weather Bureau monthly organ *Topics*, which reported an increasing burden of meeting "the aviation weather service demands at many of the larger airport stations"—demands that were deemed "larger than can be handled by any foreseeable staff." In response, the Weather Bureau announced that it was conducting an "experiment" in the dissemination of weather information at New York's LaGuardia Field. The article stated that the Weather Bureau had "obtained the frequency of 162.55 megacycles"⁹¹ and station call KWO35, a station that would transmit an "automatic, continuous recorded FM broadcast of aviation weather information most generally required by aircraft operators."

⁸⁹ United States Weather Bureau. "Distribution of weather forecasts, warnings, and information by naval radio for Atlantic Coast, Gulf of Mexico, and Caribbean Sea." 26 October 1920.

⁹⁰ United States Weather Bureau. *Topics*. February 1960: 30.

⁹¹ 162.55 Mhz. remains to this day a primary NOAA Weather Radio channel.

Those earliest VHF-FM broadcasts, "delayed by technical difficulties,"⁹² began on 1 November 1951, and ran daily from 6 a.m. to 6 p.m. in the fall and winter, and 6 a.m. to 7 p.m. in the spring and summer.⁹³ The article pointed out that while the broadcast was targeted to aviators, "anyone with receivers capable of listening on 162.55 megacycles will, of course, be able to get the latest aviation weather information at any time without having to call the Weather Bureau." The Bureau solicited user comments, and in less than two years it reported, "The success of the New York broadcast led to the establishment of a similar broadcast at Chicago in May 1953, employing the same frequency on station KWO39."⁹⁴

3.2: VHF Broadcasts Cease, then Restart

These first experiments in VHF-FM aviation weather broadcasts identified a number of facilities problems: "(1) because of line of sight reception, the range of receivability was too limited; (2) the frequency was non-standard so far as availability of receivers to pilots was concerned; and (3) the transcribing equipment, which employed one continuous-loop tape, was not adaptable to the inclusion of the latest weather observational reports, specials, and PIREPS because of the frequent changes that would be required in keeping information current."⁹⁵

The Weather Bureau thus continued its search for improved, labor-saving radio dissemination to pilots. As part of that effort, a separate aviation-weather broadcast service, equipped with better frequencies for pilots and better transcribing equipment for

⁹² United States Weather Bureau. *Topics*. 10.12 (1951): 224.

⁹³ United States Weather Bureau. *Topics*. February 1960: 30.

⁹⁴ Ibid.

⁹⁵ Ibid.

weather personnel, began to take center stage in the flying community during the second half of the 1950s—a parallel experiment undertaken as a cooperative effort between the Weather Bureau and the Federal Aviation Administration.⁹⁶ Continuous weather broadcasts were inaugurated over FAA low- and medium-band radio facilities in Washington, DC in 1954, and by 1960 the program had been expanded to facilities in Los Angeles, Denver, Fort Worth, Indianapolis, Chicago, Cincinnati, Cleveland, Boston, New York, and Pittsburgh.

The January 1960 issue of *Topics* stated that "the appropriation for fiscal year 1960 provided the required financial support for establishing the program on a nationwide basis," a plan that called for a total of 87 L/MF broadcast facilities. Owing to their more accessible and long-distance band—each station boasted a range of 125 miles—aviation weather broadcasts were shifted entirely to the L/MF facilities in 1960. By May 1961, 45 of the L/MF stations were up and running.⁹⁷

The Weather Bureau was thus left with two orphaned VHF transmitters, in need of a new mission. Larry Krudwig, a retired Weather Service technical specialist who was involved for years in construction of the weather-radio network, said in a 9 March 2002 telephone interview that it was Charlie Knudsen (meteorologist-in-charge, New York City⁹⁸) who first recommended changing the VHF-FM broadcasts to a marine forecasting system. Krudwig subsequently elaborated: "Knudsen was a U.S. Navy Reserve Captain. He had very close ties to and understanding of the operations of harbors around New York. He believed Weather Radio would work for this type of service because the

⁹⁶ United States Weather Bureau. *Topics*. January 1960: 8.

⁹⁷ United States Weather Bureau. *Topics*. May 1961: 83.

⁹⁸ Dye, Scott. National Weather Service Office of Systems Development (retired). Telephone interview. 10 October 2002.

shipboard radios on the tugs and other vessels used high-band VHF... All they had to do was install the proper crystal in the receiver."⁹⁹

Those early VHF transmitters benefited from other champions as well: while Krudwig cites Knudsen as a founding father of the Weather Radio network, Estelle stated in an email on 11 July 2002 that then-acting Chief of Engineering at the Weather Bureau, Harold McBirney, should at least share the title. Estelle said in a subsequent telephone interview that McBirney "was in love with all kinds of radio broadcasts." Estelle added, "We were such a poor agency in terms of having money, but McBirney would find money to build…these broadcast stations."

Louis Boezi, retired Weather Service Deputy Director for Modernization and former Weather Radio program manager with the agency's Engineering Division, advised in a 5 October 2002 telephone interview that he would "shy away" from trying to ascribe to any one person the title "Father of NOAA Weather Radio." The network was built, according to Boezi, "by a number of very dedicated civil servants."

Wherever the recommendation originated that the VHF stations be continued in operation as a boater's service, it obviously found favor: *Topics* reported in May 1960 on the shutdown of the New York and Chicago FM stations, but added, "The usefulness of KWO35 and KWO39 for weather dissemination has by no means ended because as soon as arrangements can be made these facilities will be devoted to the broadcasts of boating and harbor weather information."

¹⁰⁰ In that capacity, two months later KWO35 and KWO39 were again on the air.

⁹⁹ Email to the author. 5 November 2002.

¹⁰⁰ United States Weather Bureau. *Topics*. February 1960: 38.



Figure 8. U. S. Weather Bureau Brochure announcing VHF boaters' broadcasts in the Chicago area, courtesy of the NOAA Central Library in Silver Spring, MD



Figure 9. Inside page of Chicago brochure

"That effort succeeded," said Krudwig, "first in New York and then other locations. And the program took off, primarily at first in service to mariners."¹⁰¹

Krudwig said, "Next, still in the 1960s, the program underwent significant evolution toward public products, with the tone alert capability emerging in the late 1960s, which greatly increased public interest."¹⁰² In 1968 Radio Shack introduced its first consumer radio receivers capable of picking up the broadcasts; and the company's

¹⁰¹ Telephone interview. 9 March 2002.

¹⁰² Ibid.

famous weather-radio "cube" entered the market in 1970¹⁰³, although this product did not yet have the ability to self-activate upon receiving a warning tone.

3.3: Expanding Reach and Mission

The numbers of VHF-FM weather broadcasting transmitters began their first

noticeable expansion during the 1960s, with the target audience of the weather

transmissions increasingly widened from mariners, toward the general public, depending

on the location each broadcast served. The 1 April 1967 issue of the internal Bureau

annual technical report, Operations of the Weather Bureau, described the evolving

VHF-FM service:

Objective: To make weather information available to the public at all times, day or night, by means of VHF-FM continuous weather broadcasts.

Description of Program: At certain selected cities VHF-FM radio transmitters will be installed in order to cover an area of about 40-50 mile radius. Local radio and TV stations will be able to copy and rebroadcast the material even though land lines in the area may be disrupted. For this reason the VHF-FM program is considered part of the NADWARN system...¹⁰⁴

Currently four stations have VHF-FM service with 15 more locations to be installed during calendar year 1967.

¹⁰³ Muhurin, Allen. Radio Shack corporate spokesman. Email to the author. 20 September 2002.

¹⁰⁴ NADWARN—the National Disaster Warning system—was created in response to the Palm Sunday outbreak of tornadoes on 11 April 1965. A post-mortem survey by the Weather Bureau cited weaknesses in warning dissemination; NADWARN was instituted to coordinate the responses of various federal agencies with warning and disaster-response duties. Brooks, Harold E., Charles A. Doswell III, and Alan R. Moller. "Storm Spotting and Public Awareness Since the First Tornado Forecasts of 1948." 1 Oct. 1998. 17 Nov. 2002

<http://cimms.ou.edu/%7Edoswell/spotter_history/spotter_history.html>.

One year later, the May 1968 issue of *Operations* reported that 17 transmitters were up and running on its "VHF Radio Weather Service," primarily along the east and Gulf coasts, ¹⁰⁵ with five more transmitters scheduled for installation the following year.¹⁰⁶

3.4: Tone Alerts

The 1970s can be reckoned a golden age in the development of Weather Radio VHF-FM broadcasting. The program experienced undeniable growing pains attributable to bureaucracy and a confused procurement process. Still, progress toward a truly national alert infrastructure accelerated throughout the decade. In October 1970, the United States Weather Bureau—renamed the National Weather Service, and under the aegis of the Commerce Department's newly created National Oceanic and Atmospheric Administration—was operating 29 VHF-FM weather-radio transmitters.¹⁰⁷ In July 1971, plans were announced for the installation of 15 more transmitters by year's end,¹⁰⁸ and the October 1971 issue of *Operations* reported that an additional frequency—162.40 Mhz.¹⁰⁹—had been allocated to the service to accommodate regions where 162.55 Mhz. transmissions overlapped and interfered with one another.

Weather Radio got an immense boost in capability, and in its potential for attracting greater interest on the part of consumers, with official announcement of its

¹⁰⁵ United States Weather Bureau. *Operations of the Weather Bureau*. 15 May 1968: 143.

¹⁰⁶ Ibid.: 142.

¹⁰⁷ National Weather Service. *Operations of the National Weather Service*. October 1970: 157.

¹⁰⁸ National Oceanic and Atmospheric Administration. *NOAA Magazine*. 1.3 (1971): 64.

¹⁰⁹ National Weather Service. *Operations of the National Weather Service*. October 1971: 166.

famous tone-alert feature. The October 1971 issue of *Operations* describes the radio network's distinctive new self-activating feature as follows:

"As an added refinement, NWS can turn on specially designed radio receivers by means of a tone signal. This signal is transmitted at 1050 Hertz for three to five seconds before announcements of hazardous weather conditions. The tone signal alerts schools, hospitals, churches, and other places of assembly, public utilities units, emergency forces, and news media to be ready for critically important weather messages."¹¹⁰

So, through this network of VHF-FM transmitters, our civilian weather agency was at last finding its own distinctive voice—a voice empowered in ways none other was: simple, robust and reliable, here was a service that citizens could count on to alert them even when telephone, commercial broadcast, and other privately owned media were disrupted. Here was a novel way government could, if need be, wake people in the dead of night and warn them of approaching danger.

By 1974, the VHF-FM weather-broadcast program was dubbed, officially, NOAA Weather Radio, and it boasted 66 transmitters nationwide.¹¹¹ In July of that year about one tenth of the area of the contiguous states, and an estimated 44 percent of the U.S. population, were reportedly within receiver range of NOAA Weather Radio broadcasts.¹¹²

¹¹⁰ Ibid. The notation does not state when the tone-alert feature was first conceived or implemented, but the previous year's issue of *Operations* makes no mention of its existence.

¹¹¹ Weigel, Edwin P. "NOAA Weather Radio: Stormalert." Brochure from the National Weather Service. 1974.

¹¹² Ibid.

Notably, by this time consumer receivers were becoming available that could act upon the "tone alert" feature first conceived during the 1960s.¹¹³ The network seemed poised, with this new silent-standby, home-alert capability, to attract favorable publicity when the right circumstances presented themselves.

Certainly, the system's architects needed all the boosterism they could muster, for they had pushed the network's construction nearly as far as they could absent a shot of cash from Congress. Boezi said that in the early 1970s money was a huge problem for Weather Radio: "The system was funded and put together piecemeal, and it really just sort of caught on by word of mouth."¹¹⁴ Boezi added that during these early days, lacking any specific Congressional mandate, Weather Radio was "patched together... mostly a hobby shop endeavor staffed by a very few dedicated civil servants trying to introduce new technologies for the betterment of the agencies' public service."¹¹⁵

Funds for new transmitters were mostly drawn from various other Weather Service programs.¹¹⁶ For fiscal years 1967-1975, Congress appropriated only \$339,000¹¹⁷ to expansion of the Weather Radio transmitter network; during the same period the

¹¹³ Testimony of Carol C. Goodman of the Chicago Display Company, before the Subcommittee on Communications, Committee on Interstate and Foreign Commerce, House of Representatives. *Hearing on a National Warning System.* 13 May 1976. Serial no. 94-111: 36. Goodman said, "Back in 1973-74, we designed the first low-cost, affordable tone alert receiver," a unit the company called "Weather Alert."

¹¹⁴ Boezi, Louis. Telephone interview. 7 July 2002.

¹¹⁵ Boezi. Email to the author. 9 July 2002.

¹¹⁶ Testimony of Richard Hallgren, Dep. Director, National Weather Service, before the Subcommittee on Communications, Committee on Interstate and Foreign Commerce, House of Representatives. "Hearing on a National Warning System." 13 May 1976. Serial no. 94-111: 46.

¹¹⁷ Testimony of Dr. John W. Townsend, Associate Administrator, National Oceanic and Atmospheric Administration, before a Subcommittee of the Committee on Appropriations, House of Representatives. *Departments of State, Justice, and Commerce, the Judiciary, and Related Agencies: Appropriations for 1976.* 14 April 1975. Part 4: 259.

Weather Service, citing the "urgent requirements" of the program in light of recent, highprofile tornado disasters, obtained an additional \$1,057,500 through "reprogramming" within the agency's budget¹¹⁸—that is, redirecting funds originally targeted to other Weather Service projects. And so the transmitters kept coming: 77 were up and running in the spring of 1975.¹¹⁹

And yet, "reprogramming" within the Weather Service budget (money taken "out of hide," an expression the author heard more than once while researching this paper) could only carry the program so far. If NOAA Weather Radio was ever to truly blanket the nation with alert coverage, Congress would eventually have to get involved. The nation's collective purse strings would have to be pried open for NOAA Weather Radio to live up to its full potential.

3.5: Superoutbreak Brings a New Mandate

Congressional help was on the way, borne on the wings of disaster, as bureaucratic and governmental change so often seems to be. On 3-4 April 1974 a devastating tornado outbreak, today remembered as the "Superoutbreak," laid down a barrage of 148 tornadoes, striking 13 states in 16 hours, killing 330 people, and injuring 5,484.¹²⁰ Thirty-three died in the town of Xenia, Ohio. A NOAA Public Affairs document recalling the events of that day contains telling quotes from National Weather Service Central Region Director Richard P. Augulis, who spoke of a warning-dissemination system pushed to its limit: "Our forecasters would issue a tornado warning for a certain

¹¹⁸ Ibid.

¹¹⁹ Ibid.: 14.

¹²⁰ National Oceanic and Atmospheric Administration. "NOAA and the 1974 Tornado Outbreak." 17 Nov. 2002 http://www.publicaffairs.noaa.gov/storms/>.

location at a certain time. With so much severe weather happening at one time, it didn't take long for the queue...to get backed up. We simply couldn't transmit them quickly enough out of our offices. Commercial radio stations had their own problems re-

Augulis also confirmed the importance of the Superoutbreak in Weather Radio history, in that the disaster identified weaknesses in the public-private dissemination scheme that was and is prevalent in American warning broadcasts. He said that "the April 3-4, 1974, outbreak definitely marked a milestone for NOAA Weather Radio. As good as our relationship and cooperation with the media have been, that outbreak showed a clear need for us to issue warnings directly to the public by the fastest means possible."¹²²

Two months after the Superoutbreak, when the disaster was still a fresh memory and clean-up efforts were still under way, the *New York Times* reported that Weather Service officials had begun campaigning in earnest ("ambulance-chasing" that was fully justified, in the view of Boezi¹²³) for Congressional support of the Weather Radio program. "Estimating that as many as 1,000 schoolchildren might have been killed if the severe tornado outbreak of April 3 and 4 had struck Xenia, Ohio, during school hours, United States weather officials have requested extra spending this year on tornado warning systems."¹²⁴ The *Times* article also pointedly told of the Weather Service's necessity of re-directing in-house funds for new Weather Radio transmitters, and that in

¹²¹ National Oceanic and Atmospheric Administration . "1974 Tornado Outbreak Showed Need for NOAA Weather Radio." 17 Nov. 2002

http://www.publicaffairs.noaa.gov/storms/wxradio.html.

¹²² Ibid.

¹²³ Telephone Interview. 7 July 2002.

¹²⁴ McElheny, Victor K. "Tornado Danger Spurs Funds Bid." *New York Times*. 10 July 1974: 26.

the previous year's budget, "no funds were included specifically for [NOAA Weather Radio] warning transmitters."¹²⁵ When in the following spring the Weather Service submitted its fiscal year 1976 budget request of an additional "\$3,560,000 to complete the VHF-FM" network by 1979, it cited the April 3-4 1974 outbreak, stating that it "clearly showed the urgency of a reliable public warning and alerting system." The document continued, "For example, there was no effective means to forewarn the affected schools during the April episode. Only one factor saved many lives in the schools; the tornadoes occurred after school hours. The timing could be less fortunate on future occasions. In addition, NOAA Weather Radio affords the only method of disseminating severe storm warnings to mariners, recreational boaters, campers in remote sites, and others away from usual communications."¹²⁶

Already, in January 1975, the system's growing reach, combined with its unique alert-tone feature, had led to White House designation of the network as "the sole government-operated radio system" for communicating official warnings to home receivers—not just weather bulletins, but "attack alerts" and post-nuclear attack instructions as well.¹²⁷ This policy statement by the White House Office of Telecommunications Policy came as an "outgrowth of a November 1971 White House policy decision calling for development of a home warning system in which acquisition and use of home warning receivers is a completely voluntary decision on the part of each

¹²⁵ Ibid.

¹²⁶ United States Government Printing Office. *Hearings before a Subcommittee of the Committee on Appropriations*. 14 April 1975. Part 4: 162.

¹²⁷ National Oceanic and Atmospheric Administration. "Home Alert Job to NOAA Weather Radio." *NOAA Magazine*. April 1975: 66.

citizen."¹²⁸ The 1974 Superoutbreak brought renewed urgency to that inquiry, and the resulting directive remains in force to this day.¹²⁹

It might have turned out differently. Krudwig said there were during the early 1970s powerful forces in government pushing for their own vision of a national radioalert system, a vision that did not include NOAA Weather Radio. He wrote in an email, "FEMA, then called the Defense Civil Preparedness Agency (DCPA), developed a concept for a national warning system called DIDS"—Decision Information Distribution System—that would consist of a powerful network of transmitters "that ensured every corner of the country would be covered by not less than two separate transmitters capable of reaching into almost any building at any level." Krudwig added, "However, it was conceded that for this system to be successful, every radio/TV receiving device would have to be equipped with this extra receiver and decoding device."¹³⁰ He also stated that post-Superoutbreak Congressional inquiries concluded that the American populace was so transient—"census data suggested that 20 percent of the U.S. population changed homes every five years"-that keeping their DIDS receivers programmed for their shifting localities would prove overly burdensome and costly. Moreover, Krudwig said, one important, if somewhat esoteric, influence in quashing the DIDS vision of placing radio-alert receivers in television sets and home and car radios across America was George Orwell's futuristic novel, 1984—a title, and a date, that in the 1970s gave citizens, including politicians, acute reservations about government insinuation into

¹²⁸ Weigel, Edwin P. "NOAA Weather Radio: Stormalert." Brochure from the National Weather Service, 1974.

¹²⁹ Harned, Steve. Meteorologist-in-Charge, National Weather Service Forecast Office, Raleigh, NC. Personal interview. 3 April 2002.

¹³⁰ 5 November 2002.

people's daily lives. "Therefore," said Krudwig, "any participation in any such warning system would have to be voluntary on the part of the public."¹³¹

In the end, NOAA Weather Radio won the battle in the alert-system competition because it was already substantially in place, it was relatively inexpensive, and it was voluntary in nature, leaving the onus on the individual citizen to purchase a receiver if he or she wished. (The DCPA people did not take the defeat of their DIDS proposal easily: Krudwig said that relations between the Weather Service and FEMA were "chilly for many years" thereafter.) NOAA Weather Radio at last received its much-needed shot in the arm from Congress, which approved the Weather Service's augmented budget request. Estelle said that not only did the \$3.5 million come through for fiscal year 1976, but for a number of additional years thereafter, ensuring rapid growth of the Weather Radio network during the remainder of the 1970s. "This was very significant in that it represented the first time that Congress was involved in an appropriation for the program."¹³²

Its mission expanded and its budget fattened, the Weather Radio network hit its most prodigious growth spurt yet: more than 100 transmitters were in place by July 1976.¹³³ Public interest increased again when in 1977 Radio Shack began marketing a consumer receiver that could stand silent until activated by the tone-alert feature—price: \$29.95.¹³⁴ By 1978 the transmitter count passed 200¹³⁵ and expansion in the program was

¹³¹ Ibid.

¹³² Email to the author. 8 November 2002.

¹³³ National Oceanic and Atmospheric Administration. "Stormalert '76: NOAA's Expanding Weather Radio." *NOAA Magazine*. July 1976: 45.

¹³⁴ Muhurin. Email to the author. 4 October 2002.

¹³⁵ National Oceanic and Atmospheric Administration. "Weather Radio Network Passes 200, Goal is 340." *NOAA Magazine*. July 1978: 59.

still gaining momentum. Adding a further public-relations boost, commercial media outlets, including radio and television stations and cable-TV systems, began rebroadcasting NOAA's transmissions as well—yet another manifestation of the American public-private dissemination model. Such retransmissions served to familiarize whole new audiences with NOAA Weather Radio. Estelle, whose duties as branch chief of the Meteorological Services Division during the late 1970s included "overall responsibility for implementing the NWR program,"¹³⁶ was quoted in *NOAA Magazine* in October 1978 stating, "We are delighted by the various ways the electronic media are cooperating in this program. They are undoubtedly helping us to do a more effective job..." Estelle also acknowledged the public/private dissemination arrangement: "While we are sure the number of NOAA Weather Radio receivers in the hands of the public will continue to grow, we also know that commercial radio and television will continue to be the primary means by which most people get their weather information."¹³⁷

¹³⁶ Email to the author. 2 November 2002.

¹³⁷ National Oceanic and Atmospheric Administration. "NOAA's Ubiquitous Radio: Have Your Forecast Wherever You Go." *NOAA Magazine*. October 1978: 12, 13.

Year	Sales in thousands (est.)
1977	167
1978	255
1979	268
1980	281
1981	294
1982	307
1983	320
1984	178
1985	354
1986	227
1987	242
1988	252
1989	247
1990	221
Table 1.	Weather-radio receiver sales figures from RadioShack, 1977 to 1990. ¹³⁸

Radio Shack reported in 1987 that since its entry into consumer weather-radio receiver sales in 1968 it had sold "some 1.3 million" units.¹³⁹ The company refused a request for more recent figures.¹⁴⁰

3.6: Popular Interest and Support Keep Growing

By July 1976, a third frequency had been made available to the network-

162.475 Mhz.—and NOAA planned for the network to incorporate a total of more than

300 stations by the end of the decade.¹⁴¹

¹³⁸ Data for years 1977-1983 and 1985 provided by the National Weather Service. "NWR Receiver Sales Continue Strong." *Disaster Preparedness Report*. March 1986. Data for years 1984 and 1986-1990 are estimates provided by a former buyer at RadioShack from personal records. The provider of this information requested anonymity.

¹³⁹ National Weather Service. "NWR and Radio Shack." *Disaster Preparedness Report*. December 1987: 10.

¹⁴⁰ Muhurin. Email to the author. 30 September 2002.

A primary aid to this momentum was help from the states:

The growing popularity of NOAA Weather Radio is shown by a new type of sponsorship in which states share the cost of installing and maintaining a system with the National Weather Service. Kentucky was the first.

In an agreement signed last March by Kentucky Governor Julian M. Carroll and Weather Service Director George P. Cressman, state and federal officials set in motion a plan by which Kentucky obtained eight Weather Radio transmitters—enough to blanket the state—within a few months.

Before, Kentucky had none.

Other states in the South quickly perceived the advantages of a Kentucky-style agreement and launched similar efforts. By late spring, Mississippi Governor Cliff Finch had signed legislation authorizing such a plan, and Alabama and South Carolina were not far behind.¹⁴²

On 2 May 1978, the 200th NOAA Weather Radio station—WXK84 in Memphis,

Tennessee—went into service. Estelle predicted the goal of 340 stations reaching 90

percent of the nation's population "should be met easily" by the following year.¹⁴³

He was driving hard toward making that vision a reality, working with the staff of

Kentucky's United States Senator Walter "Dee" Huddleston to consummate the

Kentucky partnership and to make it a national template—the "Kentucky model"¹⁴⁴—

an arrangement that came to make possible the installation of hundreds of transmitters

nationwide. Estelle recalled in an email, "I proposed that we work with the state

governments to set up the system. Most of the state contributions were in the form of

¹⁴¹ National Oceanic and Atmospheric Administration. "NOAA's Expanding Weather Radio: Stormalert '76," *NOAA Magazine*. July 1976.

¹⁴² Ibid.

¹⁴³ National Oceanic and Atmospheric Administration. "NOAA/Update." *NOAA Magazine*. July 1978.

¹⁴⁴ Estelle said a member of Huddleston's staff named Sue Lewis—"a real steel magnolia"—deserves much credit for making the Kentucky model work. Telephone interview. 7 October 2002.

providing free space on existing towers, free maintenance, free use of state microwave links, etc. I think we eventually signed up about 35 states. Their total contributions saved the NWS millions it did not have."¹⁴⁵ Estelle said that even as he worked on the Kentucky model, the head meteorologist at Mississippi's main Weather Service office in Jackson, Clifton W. Green, was making similar deals in his state, ¹⁴⁶ ensuring donation by the Weather Service of transmitters while reaping the benefits of state-provided tower space, microwave links, and maintenance agreements. Both Green and Estelle forged "piggyback" arrangements with state Educational Television organizations for microwave bandwidth and tower space. In 1978, the two men won Department of Commerce Gold Medals¹⁴⁷ for their work toward creating a model of partnerships with government entities and civic groups that has continued to enlarge the Weather Radio transmitter network ever since. Krudwig said that he too forged numerous state agreements—"with Colorado, Wyoming, North Dakota, Nebraska, Kansas, Iowa, Minnesota, and Wisconsin."¹⁴⁸ The possibility of state and private partnerships proved a timely and fortuitous vision: in the early 1980s, the Reagan administration cut funding for a second phase of federal program expansion that had been intended to double the number of transmitters in the system.¹⁴⁹ Partnerships became the workhorse funding vehicle for NOAA Weather Radio.

¹⁴⁵ Estelle. Email to the author. 11 July 2002.

¹⁴⁶ Telephone interview. 10 July 2002.

 ¹⁴⁷ National Oceanic and Atmospheric Administration. "Medals: 1971-1990."
 15 May 2001. 17 Nov. 2002

http://www.history.noaa.gov/hallofhonor/medal1971.html>.

¹⁴⁸ Email to the author. 5 November 2002.

¹⁴⁹ National Weather Service. Aware. Spring 1994: 14.



Figure 10. Growth of the program: transmitter locations in 1970 and 1979 respectively, taken from Dept. of Commerce Weather Radio promotional brochures.¹⁵⁰

All this expansion led to inevitable growing pains within the broadcast program during the late 1970s. Lee O. Falwell said that when he joined the National Weather Service in December 1977 as a communications specialist assigned to effecting a further network build-up, he found the program "overextended and overspent," making his job of completing additional site installations a tricky one.¹⁵¹ Federal and state government interests were still pressing for more transmitter sites, with pressures increasing for a warning capability for nuclear-reactor emergencies, improved flash-flood warning services, and with "requests from congressional members who want to expand NWR services for their constituents not now being served."¹⁵² Even so, not only were budgetary constraints beginning to burden the program, but already-completed transmitters were again putting a squeeze on NOAA Weather Radio's available frequency allocations. The increasing numbers of transmitters nationwide were leading to interference among

¹⁵⁰ U.S. Dept. of Commerce brochures: "NOAA VHF Radio Weather." NOAA/PI 70035 1970; "NOAA Weather Radio." NOAA/PA 76015, rev. July 1979.

Weather Radio stations, and even, along the northern fringe of states, with land-mobile communications systems of the Canadian government.¹⁵³

Falwell presented an analysis to his superiors on 31 March 1978 in which he spelled out his concerns that the system's three available frequencies would not suffice if Weather Service managers' desire to pursue yet more program expansion were ever to be realized. Falwell said in a telephone interview, "I told them we needed six additional frequencies, and they all laughed—said I was nuts." Still a newcomer to the organization, only four months into his service tenure, Falwell said he replied, "Well, I don't know any of you gentlemen, but I am well-read on radio interference, and I have never read an article from a Weather Service engineer discussing the subject."¹⁵⁴ Falwell undertook a two-year campaign within the Weather Service and other federal agencies for allocation of six additional channels to the Weather Radio network. On 19 November 1978, Falwell was appointed NOAA Weather Radio Program Manager for the Weather Service's Office of Technical Services. He finally secured, at a 12 August 1980 meeting of the National Telecommunications Information Agency and the Interdepartmental Radio Advisory Committee, four additional frequencies, for a total of seven—a spectrum backbone upon which the network has continued to expand into the twenty-first century.¹⁵⁵ Falwell wrote in a 19 March 1981 memo, "While we didn't get all that we asked for, we did increase

¹⁵¹ Falwell, Lee O. Chief, Dissemination Systems Branch, National Weather Service (retired). Telephone interview. 7 October 2002.

¹⁵² Memorandum from Merritt N. Techter to James E. Ogle. "Request for Additional Radio Frequencies for the NOAA Weather Radio Network." 16 June 1980.

¹⁵³ Falwell. Telephone interview. 8 October 2002.

¹⁵⁴ Ibid.

¹⁵⁵ Memorandum from W. O. Van Winegarden, Acting Director, Office of Radio Frequency Management, to Merritt N. Techter, National Weather Service. "Request for Additional Frequencies for the NOAA Weather Radio Network." 10 September 1980.

our radio frequency resources by 133 percent—when the general consensus of the [Weather Service] Engineering Division and frequency management staff was that nothing could be done."¹⁵⁶

For his work, Falwell garnered a NOAA Administrator's Award consisting of a plaque and \$1,000, presented at a luncheon at the Andrews Air Force Base Officer's Club in Camp Springs, Maryland, on 1 October 1982.¹⁵⁷ Then, having reached the grade of Chief of Dissemination Systems, Falwell retired the following December after only five years with the Weather Service.

3.7: Digital Signaling—NOAA Weather Radio Keeps Pace

One of the traditional weaknesses in the NOAA Weather Radio system was that whenever a Weather Service office issued a warning for any county in its area of responsibility, all weather radios within range of the involved transmitter would pick up the bulletin and sound an alarm. This posed a decided usability problem because, for instance, people naturally do not wish to have their sleep disturbed for sake of a thunderstorm warning affecting some locale 50 miles distant. Users would often deactivate their radios rather than suffer through a series of false alarms. (The alarms on some weather radio receivers are quite loud.)

The development of Weather Radio Specific Area Message Encoding (WRSAME, or SAME) went far toward reducing that problem. SAME technology uses frequency shift key signaling, commonly used in modems, to transmit digital information bursts that accompany bulletins—the now-familiar "duck-quacking" sound that

¹⁵⁶ Memorandum from Lee O. Falwell to James R. Neilon. "Annual Performance Ratings." 19 March 1981.

¹⁵⁷ Letter from John V. Byrne to Lee O. Falwell. 20 September 1982.

consumers hear just before and after official warning announcements whenever the Emergency Alert System is activated. This digital information package includes Federal Information Processing Standards (FIPS) location codes¹⁵⁸ to allow equipped receivers to screen out alarms that do not apply to a specific location,¹⁵⁹ reducing the "boy who cried wolf" syndrome of weather-radio receivers alarming for warning events occurring miles away. In addition to location codes, the digital burst also includes an "event code" so that consumers can program their radios to sound only for certain types of alarms. For instance, the user may choose to have the receiver sound for tornado and hazardous-materials warnings, but not to have his sleep disturbed for less urgent notices such as winter weather statements.¹⁶⁰

Other parts of the SAME information package include the identity of the agency that originated the warning, the expected duration of the warning condition, and the time the warning was issued. These elements allow modern receivers not only to emit an audible alarm when a bulletin is issued, but to display visual cues and text information for the duration of the danger. Thus, if a homeowner is out of the house or otherwise away from the weather-radio receiver when it actually alarms, he or she can still have notification upon returning.

¹⁵⁸ National Weather Service Forecast Office, Hanford, CA. "NWR-SAME & FIPS Codes." 17 Nov. 2002 <http://www.wrh.noaa.gov/hanford/yournws/fips.htm>.

¹⁵⁹ The FIPS codes sent over NOAA Weather Radio are mostly used to specify individual counties. It is also possible to specify one-ninth parts of a county. The oneninth sections are not currently implemented in most areas, but use is increasing, especially in geographically large counties where a localized threat, such as a tornado or flash flood, might not affect all residents of a given county. *Effective Disaster Warnings*: 26.

¹⁶⁰ The author possesses a 1999 model-year "7 Channel WRSAME Weatheradio® with Alert" made by RadioShack®, whose programming features allow the user to screen out many event codes, but not to eliminate codes of the most urgent nature, such as tornado and hurricane warnings, or bulletins dealing with national emergencies.

The government periodically reviews and revises the digital codes list. One event code was assigned earlier this year to child-abduction cases.¹⁶¹ Although no national agreement exists as yet with the Weather Service for transmission of such announcements over NOAA Weather Radio,¹⁶² individual Weather Service offices are working with local authorities in some areas to make such announcements more common in the future. The type and format of information permitted broadcast over NOAA Weather Radio are strictly regulated by Weather Service headquarters,¹⁶³ and, as noted, subject to state and local agreements where localized needs exist.¹⁶⁴

SAME technology was deployed in the network nationwide in 1997,¹⁶⁵ but, as with other changes in a government system of such reach, it had been a long time coming. The undisputed father of SAME, Lawrence Krudwig, retired Manager of Field Systems for the National Weather Service Central Region Headquarters in Kansas City, described the development of this feature in a 14 2002 July email: "The idea first came up in early 1979 when I saw an ad in the *Kansas City Star* for American Cable bragging about their service having gone to 50 channels. When I noticed only six channels were local and only four had any news service, it struck me how badly we were isolating the public from local sources of emergency information." Krudwig said he had to submit two proposal letters to Weather Service headquarters, one in the fall of 1979 and another "refined" proposal three years later, before he finally won the blessing of his chiefs to

¹⁶¹ Federal Communications Commission "Report and Order." 26 Feb. 2002. 17 Nov. 2002 http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-02-64A1.doc.

¹⁶² Watling, Richard G. Deputy Chief, Meteorological Services Division, National Weather Service Eastern Region headquarters. Telephone interview. 17 September 2002.

¹⁶³ National Weather Service Operations Manual, chapter C-64. 1998.

¹⁶⁴ Watling.

¹⁶⁵ National Weather Service. Aware. Summer 1997: 14.

proceed with testing. On 17 February 1983 the Weather Service funded an exploratory project. "Remember," said Krudwig, "we were taking this whole project on out of our own staff hide, so it was slow." Still, by March 1985, Krudwig had a pilot program in place in Kansas City, with two demo sites installed—"the central hub of American Cable, and WDAF TV. The TV unit was later moved to a fully automated radio station, KJLA." Krudwig recalled that his early development of the SAME concept used analog tones dual-tone multifrequency (DTMF), an industry-standard tone package, generated, for instance, by telephone keypads. But Weather Radio at last started to enter the digital age when in February 1989, according to Krudwig, "we began testing a new format using FSK—frequency shift keying—like that used in a computer modem, and using microprocessors in the encoder and decoder. It was formally approved for use on May 3, 1989."

Implementation of SAME, like the transmitter network itself, was frustratingly slow. The Weather Service did not provide funding for full-scale development until 1995, with nationwide roll-out, as noted, taking place in 1997. The development of SAME thus traced an 18-year path from conception to implementation.

Krudwig was recognized for his work on the Weather Radio network with a Department of Commerce Silver Medal in 1993, and again last year—adding to two bronze medals he had also garnered for his work "in warning preparedness and warnings communications."¹⁶⁶

¹⁶⁶ Krudwig. Email to the author. 5 November 2002.

3.8: Synthesized Voice

The Weather Service modernization program of the 1990s cut the number of Weather Service forecast offices from 216 to 121, leaving some facilities responsible for originating transmissions over as many as 13 separate weather-radio stations¹⁶⁷ a formidable work load, especially during severe weather. Labor-saving automation became a primary goal of Weather Radio and modernization-program architects. Therefore, as an integral part of the modernization effort, the Weather Service announced in 1994, "an effort is under way to upgrade and automate [NOAA Weather Radio] in order to overcome increasing maintenance and work load problems" in the existing broadcast system.¹⁶⁸ The idea—embodied in a development program called, within the Weather Service, the "Console Replacement System," or CRS—was to replace old, analog Weather Radio audio consoles with programmable, computer-based systems capable of ingesting weather messages from other automated forecast office systems, converting text messages to voice, and broadcasting the messages instantly over NOAA Weather Radio. CRS would offer "a programmable speech synthesis capability and data base with an unlimited vocabulary" allowing customization of pronunciations to a given locale.¹⁶⁹

In essence, CRS would permit forecasters to transmit routinely generated weather information automatically, and weather warnings at the push of a button, with no need for

¹⁶⁷ Jackson, William. "NWS Hires Fresh Talent for Weather Radio." *Government Computer News*. 7 Jan. 2002. 17 Nov. 2002 < http://www.gcn.com/21_1/tech-report/17682-1.html>.

 ¹⁶⁸ National Weather Service. *Aware*. Spring 1994: 14.
 ¹⁶⁹ Ibid.

a time-consuming process of manually typing and then pre-recording messages for transmission.

A development contract for CRS was signed with Communications and Power Engineering, Inc. (CommPower) of Camarillo, California, on 1 December 1994. The company offered for federal review a preliminary design of the new system in May 1995, with a "critical design review" meeting 29-31 August of that year between Weather Service officials and company representatives at CommPower headquarters. A prototype was delivered for evaluation to the Weather Service Headquarters in January 1997; four forecast offices—Charleston, West Virginia; Birmingham, Alabama; Pleasant Hill, Missouri; and Oxnard, California— started field-testing the new system in March of 1997.¹⁷⁰

The Weather Service and CommPower signed a production contract on 28 July 1997, with field implementation planned for all field offices "to begin in September 1997, continuing through completion in September 1998."¹⁷¹ In fact, the final installation entered service in November 1998¹⁷²—a remarkably aggressive roll-out in comparison with the 18-year odyssey of the development of WRSAME.

It would be hard to overstate the importance of this labor-saving innovation to the Weather Radio program, allowing even fast-changing weather information to be transmitted more quickly than ever before. Even so, the system was not perfect. The computerized voice, affectionately known inside the Weather Service as "Paul," was a PC-based DEC-talk product popularly used by persons afflicted with voice impairment,

¹⁷⁰ Nathan, Joel. CRS Support Team Leader, National Weather Service Headquarters. Email to the author. 23 October 2002.

 ¹⁷¹ National Weather Service. *Aware*. Summer/Fall 1996: 11.
 ¹⁷² Nathan.

such as famed physicist Stephen Hawking. But Paul provoked complaints from regular listeners, some of whom began to ridicule the vaguely Nordic-sounding delivery and mispronunciations. *Newsday* called the voice an "international man of mystery," and reported, with unwelcome mirth, "His is a voice tinged with a puckery accent and vaguely haughty tones punctuated by robotic pauses and unpredictable intonations. Is he...Finnish?"¹⁷³ Eventually, *Newsday* reported, boaters in the northeast began referring to the voice as "Igor," or "Sven."¹⁷⁴ More soberly, the *Washington Post* stated the simple truth, that "citizens and professionals who rely on the weather reports complained that Igor could be difficult to understand, a risk when the garbled information concerned potentially deadly storms and floods."¹⁷⁵

With reviews like those, the synthetic Paul was not destined to last. Some forecast offices, especially those broadcasting information for locales with place names that the system could not pronounce correctly, were even forced to revert to the tried-and-true method of pre-recording critical warnings, which clearly defeated the time-saving purpose of synthetic voicing. An improvement in voice quality would be necessary for automated voicing to be accepted, not only by the public, but by Weather Service field personnel. So even while Paul was being implemented around the country during 1998, Weather Service Headquarters was already assembling a "Voice Improvement Study Team" to tackle the issue.

¹⁷³ Haberstroh, Joe. "Paul Was Just Misunderstood; NOAA Seeking Replacement for Computer Voice." *Newsday Nassau and Suffolk Edition*. 15 July 2001: A25.
¹⁷⁴ Ibid.

¹⁷⁵White, Ben. "Weather Voice: Hazy, Maybe Clearing; NOAA's Broadcasts Are Due for Clearer Computer Diction." *Washington Post.* 24 Aug. 2001: A25.

Joel Nathan, who serves on the Weather Service's CRS support team, said in an email that "in the early 90s, when CRS was being defined, there were basically two methods of providing artificial speech: concatenated and synthesized."¹⁷⁶ The synthetic route had, of course, already been implemented. The alternative, concatenated speech, consists of human recordings of words and phrases along with software used to link them together into sentences. Therein lay a promising possibility for voice improvement. However, because concatenated systems rely on pre-recorded sounds, they will not translate speech not already contained in a recorded database of words and phrases. The Weather Service requirements for CRS are, according to Nathan, "anything but a limited vocabulary," and it seemed that concatenation would have to be ruled out simply because the needed word-and-phrase inventory would be too large to manage.

Fortunately, though, concatenation technology improved even as the Weather Service was weighing its options. During the summer of 2000, Weather Radio program directors began considering "phoneme concatenation"—human recordings of sounds at the sub-word level. According to Nathan, concatenated phoneme systems can use a smaller number of recordings—perhaps 40 or 50—and software available in 2000 could link the phonemes together with much better delivery than was possible even two years previous.

In the spring of 2001, the National Weather Service published a Request for Proposals,¹⁷⁷ "with bids due in mid-April" for replacement text-to-speech software.¹⁷⁸

¹⁷⁶ Nathan.

¹⁷⁷ National Weather Service. "Voice Improvement Processor." 2 July 2002. 17 Nov. 2002 <http://205.156.54.206/nwr/VIPstatus.htm>. The RFP Number was 52-DDNW-1-90021.

¹⁷⁸ National Weather Service. Aware. Spring/Summer 2001: 9.

In addition, the Weather Service conducted focus groups and posted a number of potential replacement voice samples from various vendors on its web site. The agency solicited public feedback, and as a result got more than 19,000 comments.¹⁷⁹ In August and October of 2001, NOAA awarded development contracts to Siemens Information and Communications Networks, Inc. of Boca Raton, Florida, and SpeechWorks International, Inc. of Boston, Massachusetts. Finally, in January 2002, *Government Computer News* was able to report, "The National Weather Service is firing Igor and hiring Donna and Craig to take his place forecasting the weather."¹⁸⁰ The Weather Service reported, "The new NOAA Weather Radio voices will debut on the air nationwide in May and June 2002."¹⁸¹

Anyone can hear samples of the automated voices, old and new, on the Internet at the following URL: http://205.156.54.206/nwr/newvoice.htm.

Importantly, an automated Spanish voice is planned for implementation in the summer of 2003, which will allow the transmission of critical warning information to Spanish-speaking listeners, even from Weather Service forecast offices with no Spanishspeaking personnel.

3.9: The Gore Initiative and Other Weather Radio Promotional Efforts

As it had before, the Weather Radio network received a boost in the aftermath of catastrophe, gaining renewed White House attention, publicity, and impetus for expansion after the 17 March 1994 Palm Sunday event, when tornadoes ripped through

¹⁷⁹ Ibid.

¹⁸⁰ Jackson.

¹⁸¹ National Weather Service. "Voice Improvement Processor. 2 July 2002. 17 Nov. 2002 http://205.156.54.206/nwr/VIPstatus.htm>.

areas of Alabama, Georgia, Tennessee, and the Carolinas. At 11:35 a.m., a long-track tornado devastated the Goshen United Methodist Church in Piedmont, Alabama, while 150 parishioners were convened for morning services. Twenty fatalities and 90 injuries occurred when the main sanctuary collapsed onto the congregation.¹⁸² A post-event site survey contracted by NOAA found that "an interior hallway in the church could have provided adequate shelter for all 150 occupants had they sought shelter there."¹⁸³ The Birmingham National Weather Service Forecast Office issued a tornado warning for the Piedmont, Alabama area 12 minutes before the tornado struck the church.¹⁸⁴ But because the church did not have a NOAA Weather Radio—and even if it had, no transmitter existed within range—the storm struck the church without warning.

Vice President Al Gore visited the site two weeks later on 30 March and pledged improvements to the nation's disaster-warning system, including a renewed effort to expand the NOAA Weather Radio transmitter network into more rural areas. Thendirector of the Weather Service Dr. Elbert "Joe" Friday said Gore telephoned him from Marine 2 as the vice president was flying from the Piedmont disaster site back to his plane in Atlanta, and discussed ideas for augmenting NOAA Weather Radio coverage.¹⁸⁵ Within two weeks, Gore's office announced a government initiative to seek more

¹⁸² National Oceanic and Atmospheric Administration. *NOAA Report*. 3.11 (1994): 1. 25 Nov. 2002 http://www.publicaffairs.noaa.gov/nr/pdf/nov1994.pdf>.

¹⁸³ Marshall, Tim: "Goshen United Methodist Church Damage Survey." March 1994. 17 Nov. 2002 http://www.stormtrack.org/library/damage/goshen.htm>.

¹⁸⁴ National Weather Service Forecast Office, Birmingham, AL. "NOAA Weather Radio." 17 Jan. 2000. 17 Nov. 2002

<http://www.srh.noaa.gov/bmx/aware/noaawxr.html>.

¹⁸⁵ Friday, Elbert. Director, Board on Atmospheric Sciences and Climate, National Academy of Sciences; former Assistant Administrator, National Oceanic and Atmospheric Administration; former Director, National Weather Service. Personal interview. 26 March 2002.

vigorously public-private partnerships in installing additional Weather Radio transmitters, especially in rural areas, with the goal of raising the proportion of the nation's population covered by weather-radio broadcasts from 75 percent to 95 percent.¹⁸⁶

Mindful that even ubiquitous transmitter coverage would be meaningless if people do not avail themselves of weather-radio receivers, Gore said, "We will aggressively pursue public and private participation in the placement of NOAA weather radios where people gather and ultimately in homes, so that they will soon be as common as smoke detectors."¹⁸⁷ Both Gore and Richard Sterban of the popular music group The Oak Ridge Boys taped television and commercial-radio promotional spots for the weather-radio service, which for a time got play in some markets.¹⁸⁸

The Gore Initiative sought to extend not only the geographical reach of NOAA Weather Radio, but its missions as well—to make it, officially, an "all-hazards" warning network covering emergency announcements such as hazardous-material accidents. The Multi-Agency Working Group of Vice President Gore's National Partnership for Reinventing Government subsequently issued a report to the vice president, touting the benefits of NOAA Weather Radio, and listing the following public-warnings recommendations:¹⁸⁹

¹⁸⁶ Office of the Vice President. Press release. 31 Mar. 1994.

¹⁸⁷ Ibid.

¹⁸⁸ Copies on file.

¹⁸⁹ United States Department of Agriculture, Federal Emergency Management Agency, and the United States Department of Commerce. Report by the Multi-Agency Working Group the National Partnership for Reinventing Government. "Saving Lives with an All-Hazard Warning Network." P. 29. Dec. 1999. 17 Nov. 2002 <http://www.nws.noaa.gov/om/all-haz/all-haz2.htm>. More specific recommendations contained in the report's Appendix: 30-33.

- 1. The Federal Government [should] enhance the use of existing technologies.
 - Put NOAA Weather Radio receivers where people live, work, and gather;
 - Provide a model for the rest of the country by buying and installing NOAA Weather Radios in all federal facilities that are within range of a transmitter;
 - Include NOAA Weather Radios in new buildings;
 - Encourage donations of NOAA Weather Radios to schools, hospitals, public facilities, community centers, day care centers, places of worship, and other places where people gather;
 - Encourage more 'customer-friendly' designed combinations of weather radios and other common radio receivers;
 - Increase public awareness about NOAA Weather Radios;
 - Expand and enhance the coverage and transmission capacity of the existing NOAA Weather Radio system; and
 - Use the existing NOAA system as the backbone of a National all-hazard warning network.
- 2. The Vice President should direct the Multi-Agency Working Group to:
 - Ensure that the emergency alert system keeps pace with technological advances;
 - Identify ways to improve warnings; and
 - Identify ways to refine the hazard warning network.

The report proffered a laudable and far-reaching vision, and some of the recommendations are slowly being met, although more as a result of private initiatives, and of state and local government actions, rather than federal. For instance, the *Atlanta Journal and Constitution* reported on 26 July 2001 that in College Park, Georgia, "hotels and many other large facilities received emergency weather radios thanks to the College Park Police Department and a state grant."¹⁹⁰ North Carolina has in the past two years, through its Division of Emergency Management, purchased some 15,000 weather-radio receivers for placement in all of the state's licensed schools.¹⁹¹ Montgomery County, Maryland, citing Homeland Security and more mundane public-safety concerns, recently

¹⁹⁰ Suggs, Ernie. "College Park Prepares for Storm Weather; Hotels, Others Receive Emergency Radios." *Atlanta Journal and Constitution South Fulton Extra*. 26 July 2001: 3JK.

¹⁹¹ Ditt.

announced that it was placing weather-radio receivers in all of its schools—some 478 units.¹⁹² Private companies have undertaken weather-radio initiatives of their own. The *Christian Science Monitor* reported in 1998 that Arkwright Mutual Insurance Co., based in Waltham, Massachusetts, spent \$1.2 million on weather-alert radios, installing them in at least 10,000 policyholders' buildings as part of the company's risk mitigation program.¹⁹³

These initiatives are not unusual. Any Internet search can turn up myriad such localized efforts, which have become the driving force behind most weather-radio promotions. Federal leadership began to falter not long after the initial flurry of activity flowing from the 1994 disaster. Friday said that while the Gore Initiative began with the best of intentions, it never really panned out as intended—that such improvements to the network as have been made would have been made regardless of the vice president's involvement. Friday said the initiative found implementation in "a much less than satisfactory manner"—that the support for funding to make rapid improvements possible was never forthcoming from the Clinton/Gore administration. George Wilcox, a corporate liaison with NOAA,¹⁹⁴ said that Gore made a \$50 million budget request for the network, but that the Office of Management and Budget struck it down.¹⁹⁵ Friday

¹⁹² Cottman, Michael H. "Keeping an Ear on the Weather." *Washington Post.* 5 Sept. 2002: B3.

¹⁹³ Spotts, Peter N. "Weather Radio Comes to the Rescue in Sudden Storm Conditions." *Christian Science Monitor*. 12 Mar. 1998.

¹⁹⁴ In 2001 Wilcox was awarded a Department of Commerce Silver medal for his work in Constituent Affairs, wherein as liaison between NOAA and industrial interests, Wilcox championed awareness efforts and expansion of the NOAA Weather Radio network. National Oceanic and Atmospheric Administration. "Gold and Silver Awards— 2001." *Access NOAA*. 4 Dec. 2001. 17 Nov. 2002

http://www.accessnoaa.noaa.gov/dec0401/goldsilver.html.

¹⁹⁵ Personal interview. 25 March 2002.

confirmed that account, saying, "The OMB examiner told me, 'Gore doesn't run this program, I do.'" Gore's chief of staff, according to Friday, just responded, "Oh well..."¹⁹⁶

"Gore didn't follow up," Friday concluded, "and the Gore Initiative faded away."¹⁹⁷ Still, given Gore's personal interest in Weather Radio and all things technological, one suspects that a Gore administration would have continued pressing for improved dissemination services if the 2000 Florida election imbroglio had turned out differently.

Even so, not all national promotional efforts have ceased. One interesting example of NOAA's civic outreaches involves Jack Elrod, who has since 1978 penned the syndicated comic strip "Mark Trail," which runs in 175 newspapers and reaches nearly 23 million readers worldwide.¹⁹⁸ Elrod has periodically included mentions of the NOAA Weather Radio service in his fictional hero's adventures ever since 1995, when he first touted the service in a Sunday strip. Soon thereafter, the Weather Service began offering annual "Mark Trail Awards"¹⁹⁹ in recognition of community leaders who work

¹⁹⁶ Personal interview. 26 March 2002.

¹⁹⁷ Peter Ward has indicated that the lack of progress in developing improved warning-dissemination services cannot be placed entirely at the feet of the Clinton/Gore administration. Ward stated in a 13 December 2000 on-line conference, "This was an area that the VP thought was important and unfortunately, the Republican Congress did not want progress in it, for that reason." (ftp://www.emforum.org/pub/eiip/lc001213.txt.) Ward, now retired from the United States Geological Survey, is a board member of the Partnership for Public Warning (http://www.partnershipforpublicwarning.org/ppw/), a nonprofit incorporated "to promote and enhance effective, integrated dissemination of public warnings" and he chaired the Working Group on Natural Disaster Information Systems, which produced the White House report *Effective Disaster Warnings*. (http://www.nnic.noaa.gov/CENR/NDIS rev Oct27.pdf).

¹⁹⁸ King Features. "Mark Trail: The Comic." 4 Nov. 2002. 17 Nov. 2002 http://www.kingfeatures.com/features/comics/mtrail/about.htm.

¹⁹⁹ On 17 April the author attended the 2002 Mark Trail Awards luncheon on Capitol Hill. The recipients, including South Dakota Governor William J. Janklow, Judge Ray B. Stanley of Polk County, Ark., and representatives of the Sam's Club Spirit

to promote transmitter installations, receiver placements, and program awareness an award program that continues even now. On 17 April 1997, NOAA announced that the Mark Trail character would serve, officially, "as the campaign symbol for educating the public about the National Weather Service's NOAA Weather Radio program.²⁰⁰ In 1998 the United States House of Representatives passed a resolution commending Elrod for his championship of the program.²⁰¹

volunteers from Muncy, Pa. (among others), were regaled by NOAA Administrator Vice Adm. Conrad C. Lautenbacher and National Weather Service Director Brig. Gen. Jack Kelly, and other high officials, for their exemplary work in promoting Weather Radio. The food was excellent; the spirit festive; and a good time was had by all.

²⁰⁰ National Oceanic and Atmospheric Administration press release. "Mark Trail comic strip character named campaign symbol for NOAA Weather Radio program." Press release. 17 Apr. 1997. 17 Nov. 2002

<http://www.nws.noaa.gov/pa/secnews/nwr/mtrail.htm>.

²⁰¹ 105 H. Res. 437. "Commending Jack Elrod for his contributions to the United States." 14 May 1998.



Figure 11. Two 1995 Mark Trail comic strips, ©North American Syndicate, Inc., courtesy of Jack Elrod.

NOAA Weather radio has found some seemingly unlikely champions among television meteorologists—a group that would appear, at first blush, to be competitive with the Weather Service's broadcast network. In fact, television stations realize that if people are roused by Weather Radio to approaching danger they might not otherwise have discerned, they are likely to tune into their favorite local television outlet for more details, even in the dead of night. NOAA Weather Radio helps increase television viewership in times of bad weather.²⁰²

The National Weather Service continues to seek partnerships with state and local governments, non-profit corporations, and civic organizations to keep the network growing. Since 1994, several hundred additional transmitters have been installed,²⁰³ mostly through such cost-sharing partnerships, with plans yet for 300 more.²⁰⁴ The tornado-ravaged community of Piedmont, Alabama, its church rebuilt, is now covered by a NOAA Weather Radio transmitter, installed in the months following the church disaster, thanks to a matching grant awarded the Farmer's Telephone Cooperative of Rainsville, Alabama,²⁰⁵ by the Department of Agriculture's Rural Utilities Service.²⁰⁶ That agency made available again last year \$5 million in matching grant money to telephone cooperatives and other non-profit entities to cover 55 to 75 percent of the cost

²⁰² Krudwig. Email to the author. 10 November 2002.

²⁰³ Statistics on existing and planned transmitter sites (both moving targets) vary with the source cited. Herbert White, Dissemination Services Manager at the National Weather Service, stated in an email to the author on 11 November 2002 that there were "somewhere in the neighborhood of 350 or 400 NWR transmitter sites in 1994 and now we have more than 750."

²⁰⁴ National Weather Service. "Partnerships." 17 Nov. 2002 <http://www.nws.noaa.gov/om/all-haz/all-haz5.htm>.

²⁰⁵ Ibid.

²⁰⁶ Cameron, Orren E. Director, Advanced Services Division, Rural Utilities Service, United States Department of Agriculture. Personal interview. 27 March 2002.

of weather-radio transmitter installations,²⁰⁷ which typically run \$60,000 in total outlay.²⁰⁸ As of 8 October 2002, the RUS reported it had awarded \$3.4 million of its latest \$5 million allocation, ensuring the installation of 60 new transmitters.²⁰⁹ The agriculture bill signed this year by President Bush authorizes "such sums as are necessary to carry out [the R.U.S. transmitter grant program] for each of fiscal years 2002 through 2007,"²¹⁰ but Craig Wulf of the RUS said that grant applications had recently slowed, so persons interested in seeking an installation grant are encouraged by the RUS to review the grant requirements posted at the following URL:

http://www.usda.gov/rus/telecom/initiatives/weatherradio.htm

²⁰⁷ Communications Daily. "Comm Daily Notebook." 5 April 2001.

²⁰⁸ Hall, Ron. "A Life-saving 'Heads-up." USDA News. 59.5 (2000). 17 Nov. 2002 <http://www.usda.gov/news/pubs/newslett/old/vol59no5/article5.htm>.

²⁰⁹ Wulf, Craig. Program Advisor, Telecommunications Program, Rural Utilities Service, U.S. Dept. of Agriculture. Telephone interview. 8 October 2002.

²¹⁰ Public Law 107-171. "Farm Security and Rural Investment Act of 2002." Sec. 379B(d): Grants for NOAA Weather Radio Transmitters. 13 Apr. 2002. 17 Nov. 2002 http://frwebgate.access.gpo.gov/cgi-

bin/getdoc.cgi?dbname=107_cong_public_laws&docid=f:publ171.107>.



Figure 12. Weather Radio transmitter site on Pea Ridge near Ft. Payne, Alabama, dedicated a few months after the Piedmont, Alabama tornado disaster. Photo courtesy of Ed Cameron, Rural Utilities Service, USDA.



Figure 13. Map showing current coverage of NOAA Weather Radio transmitters in the contiguous U.S. 211

²¹¹ Map based on 2001 data. 25 Nov. 2002 <http://www.noaanews.noaa.gov/magazine/stories/images/wxradiocoverage.jpg>.