Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Review of the Emergency Alert System	)	**EB Docket No. 04-296**
	)	

To: The Commission

COMMENTS OF RURAL CELLULAR ASSOCIATION

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SUMMARY

Rural Cellular Association ("RCA"), as representative of approximately 100 small and rural market wireless service providers across the United States, agrees that it is time to evaluate the Emergency Alert System ("EAS") and consider how it can be improved in this era of heightened security concerns.

Responding to the Commission's observation that EAS messages might be delivered through cellular phones, RCA retained a telecommunications industry expert on wireless industry standards to examine the feasibility of delivering EAS messages through cellular systems. That individual, David Crowe, prepared a "white paper" that is attached to these Comments in which he reports his findings on the feasibility of using "Short Messaging Service" ("SMS") or, alternatively, "Cell Broadcast" as a means to retransmit EAS messages. In both scenarios, Mr. Crowe found and reports on significant limitations and disadvantages that would be encountered if wireless service providers attempted to deliver emergency messages to large numbers of wireless phone users. Mr. Crowe also reviewed the functions of the interface device required between the emergency alert provider and the wireless service provider, and identifies in his paper the tasks that would be undertaken by the carrier in validating and disseminating emergency alerts.

RCA also reviews in these Comments the findings reported by the Partnership for Public Warning and the National Science and Technology Council. Both groups recognize the considerable resources already dedicated by the Federal government to delivery of warning messages through the National Weather Service radio system ("NWR"). That system currently has the capability to reach 95% of the U.S. population and can be used to target delivery of messages to 1/9th sections of a county through input of Specific Area Message Encoding ("SAME") codes into the receiving device. RCA believes that if more consumers had portable devices that incorporate receivers for NWR signals, and EAS messages were broadcast over the NWR network, the effectiveness of the EAS

would be increased dramatically. There would be no need for wireless service providers to retransmit EAS messages if consumers had better access to NWR receivers that would turn on automatically to receive a public warning.

Considering all of the complications and limitations inherent in a wireless carrier's retransmission of EAS messages, RCA is not of the view that cell phones are an appropriate device for reception of emergency alerts. At the very time when cell phones can be expected to be heavily used for communication, the wireless networks should not be called upon to retransmit emergency messages.

RCA is not unaware that there is considerable interest by Members of Congress and policy makers in making use of cell phones as a part of the EAS. If there is to be a role for cell phones in the EAS, RCA urges the Commission to study the feasibility of incorporating into cell phones receivers that would monitor NWR broadcasts. The attached Declaration of Art Prest provides information about a portable receiver for NWR broadcasts that can turn on automatically and is capable of receiving messages pinpointed to a small geographic area if the user inputs SAME codes. RCA believes that a cell phone could be designed to include a similar receiver for NWR broadcasts. Perhaps the most challenging issue associated with design of such a cell phone would be to dynamically program the relevant SAME code into the NWR receiver contained within the cell phone based on the SAME codes that may be broadcasted by the nearest operating NWR stations and the location of the cell site that is controlling calls to that handset, and then to make changes to those codes automatically as the cell phone user moves from place to place.

Importantly, RCA asks that the Commission carefully consider the financial burden that would be faced by small and rural wireless carriers if any new requirements are mandated. Without a large subscriber base small carriers would face a disproportionate burden in meeting costs associated with network modifications required to comply with government public safety mandates.

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Rural Cellular Association ("RCA")[1], by its attorneys, respectfully submits these Comments in response to a Notice of Proposed Rulemaking ("*NPRM*")[2] issued by the Federal Communications Commission ("FCC" or "Commission") to evaluate the Emergency Alert System ("EAS") as a public alert and warning system and to determine if the EAS in its present form is the most effective mechanism for dissemination of emergency information to the American people and, if not, how EAS can be improved.

I. Introduction

The Commission seeks information to evaluate whether the current means for delivery of emergency information to the American public is outdated and whether a new model should be implemented. The Commission quite appropriately does not reach any tentative conclusion on whether there is need or reason to alter the current channels of communication to the public, but asks

1 RCA is an association representing the interests of approximately 100 small and rural wireless licensees providing commercial services to subscribers throughout the nation. Its member companies provide service in more than 135 rural and small metropolitan markets where approximately 14.6 million people reside. RCA was formed in 1993 to address the distinctive issues facing wireless service providers.

2 *Notice of Proposed Rulemaking* in EB Docket No 04-296, (FCC 04-189) released August 12, 2004 (69 Fed. Reg.

if those channels should be supplemented to include other means, specifically cellular telephones. The Commission's consideration of delivery vehicles for EAS includes not only broadcast type mechanisms such as cellular distribution systems but also point-to-point delivery systems, among them the landline telephone network and broadband delivery systems. And, as the *NPRM* mentions, there are other delivery systems for consideration, for example low earth orbit satellite systems, paging, direct broadcast satellite (DBS), digital television (DTV), satellite Digital Audio Radio service (satellite DARS), and In-Band-On-Channel Digital Audio Broadcasting (IBOC DAB), that currently have no EAS requirements.[3] [4]

RCA's comments herein focus on the feasibility and effectiveness of the prospective use of cellular telephones as a delivery tool for the EAS. RCA retained David Crowe, a telecommunications industry expert on wireless industry standards, to analyze the capability of cellular systems to be integrated into the national EAS network. As the attached "white paper" prepared by Mr. Crowe on

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52843, August 30, 2004).
3 *NPRM* at 5.

4 Unlike most communications and consumer electronics devices, landline telephones are generally not turned off at night. For this reason the most effective means for a Presidential message to reach the 93.8% of Americans who have landline phones may be through the landline network. *See*, "Telephone Subscribership in the United States (Data through July 2004)" by Alexander Belinfante, Industry Analysis and Technology Division, Wireline Competition Bureau, released October 2004. As observed by the Commission in the *NPRM*, several companies offer landline-based interactive notification systems that would convey national, regional, and local emergency messages via the public switched telephone network to wireline telephone subscribers located in the specific geographic areas affected by emergencies. *NPRM* at 13 (fn. omitted) Legislation would probably be required to grant authority to the Commission to adopt regulations relative to EAS and the landline telephone system. *See*, "Emergency Warning Act of 2003" S. 118 (sponsored by Senators Hollings and Edwards) to improve the national warning system proposed use of "traditional telephones, including special alert rings to warn individuals in their homes or businesses."

the matter indicates, cellular systems were not designed as a vehicle to disseminate Presidential messages or other emergency information simultaneously to all cellular subscribers, nor are they easily modifiable to offer that capability. As Mr. Crowe explains, in any given geographical area where an EAS message might be directed, there may be different wireless phones operating with any of the different network technologies in use today in the United States (e.g., AMPS (analog), N-AMPS (narrowband analog), TDMA (Time Division Multiple Access), CDMA (Code Division Multiple Access), GSM (based upon various specifications), UMTS/Wideband CDMA (based upon various specifications) and/or iDEN (based upon proprietary Motorola specifications). Some of those wireless devices may be idle (not currently in a call), some may be in a call, some may be operating a data service, some may be receiving a text message and some may be in a transitional state (e.g., transitioning from a control channel to a traffic channel). Such a wide variety of operating technologies and status modes presents significant complications for an effective dissemination of emergency messages through cellular telephones. Further, as will be reviewed herein, there are no standardized interfaces from external devices to wireless networks. Beyond that, the text messaging capabilities to deliver EAS messages vary with the network technology in use, but in all cases the capacity to transmit text characters is limited or extremely limited. And, aside from the operating variables from network to network and user to user, there is an overriding issue of network capacity to deliver EAS messages at the very time when cellular phones are likely to be in heavy use for voice and text communications relating to the emergency situation at hand. All of these variables and issues lead RCA to recommend that the Commission not incorporate cellular telephones into the system for delivery of EAS messages.

Nevertheless, if the Commission concludes that it must pursue a means for cellular phones to

deliver EAS messages, RCA in these comments will suggest a concept for further study. That concept involves integration into the cellular handset of a supplemental reception capability so that subscribers may receive messages that are broadcast through the existing national weather alert radio network. Cellular handsets with that capability would not require an integration of approximately 165,000 cell sites nationwide[5] into the EAS delivery system, nor would dual-function handsets require direct participation by cellular system operators in determining what messages should be transmitted to which subscribers. Messages of importance to all would be receivable by all; messages of a local character such as severe weather alerts would be received from the National Weather Radio ("NWR") station in nearest proximity to the cell phone user. RCA acknowledges that further study as well as research and development would be required to allow the wireless network to dynamically program the Specific Area Message Encoding ("SAME") code that corresponds to the area being sent an alert by a local national weather station into the supplemental NWR receiver in the handset as that handset moves from cell to cell.

The *NPRM* notes that both the Partnership for Public Warning ("PPW") and the Media Security and Reliability Council ("MSRC") "...advocate upgrading, not replacing EAS. In particular, PPW asserts that any new public warning system design should take advantage of the existing EAS infrastructure and should be able to accommodate existing EAS equipment in place, noting that it would be difficult to replace or rebuild such a capability today at a reasonable cost." [6] RCA submits that more effective use of the network of radio stations operated by the National Weather Service and

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5 The Cellular Telecommunications and Internet Association estimates that there are approximately 165,000 operating cell sites at this time in the United States.

6 *NPRM* at 8 (footnotes omitted).

modification of consumer products to receive such broadcasts would be a desirable and efficient approach to improvement of the EAS system.

II. Critical Objectives for Delivery of EAS Messages

RCA proposes that whatever delivery vehicle(s) are ultimately selected for EAS messages, each must be capable of providing ubiquitous, timely, geographic specific emergency alert messages:

1. Messages must be delivered in real time and message delivery systems must be able to deliver emergency messages without delay;
2. Messages must contain enough information to be useful in an emergency situation;
3. Messages must be delivered to the area where the emergency is occurring;
4. Messages must reach all people in the area of the emergency;
5. New message systems must be interoperable with legacy systems; and
6. All emergency message systems should utilize a standard message protocol.

As the Commission considers the alternatives before it, the ability of each delivery system to meet these objectives for effective EAS operation should be a threshold determination.

III. Integration of Commercial Wireless Networks into the EAS is not Efficient or Effective

Mr. Crowe, in his attached "White Paper on Emergency Alert Systems using Cellular Technology" observes that wireless phones, including those used as part of cellular, personal communications and enhanced specialized mobile radio systems

> ...are now important communications tools for most Americans, for talking with friends, colleagues and in times of emergency. Most phones now provide not just voice services, but also text messaging and sometimes more exotic capabilities, such as still pictures or even video. [Crowe White Paper at 4]

Given the phenomenal acceptance of this technology by consumers it is reasonable for the

Commission to consider whether cellular phones should be used as a delivery vehicle for emergency information, and alternatives to doing so.

The fact that the Commission did not mandate that commercial wireless licensees make use of any particular network air interface has resulted, for good or bad, in a patchwork quilt of varying digital protocols used by cellular, PCS and E-SMR systems throughout the country. Mr. Crowe lists no fewer than five digital technologies in use by wireless service providers in the United States today, in addition to analog wireless systems.[7] Commercial wireless service providers are licensed to operate in various spectrum bands, most commonly the cellular 800 MHz band, the PCS 1900 MHz band and the E-SMR 700 and 800 MHz bands, but also in the 700 MHz band currently used for analog broadcasting and in higher bands such as 2.3 GHz where mobile use is not prohibited. The challenges associated with transmission of EAS messages through the networks of system operators that use such a wide variety of digital operating systems and so many different frequency bands are considerable, and would add layers of complexity to an efficient system for wide dissemination of emergency information on an immediate basis.

A. SMS: Text Messaging through Point-to-Point Short Messaging Service

Digital cellular phones have the ability to receive text messages through a capability known as Short Messaging Service or "SMS." Systems making use of GSM, TDMA and CDMA support SMS. As Mr. Crowe explains, there are a number of problems with the use of SMS for EAS:[8]

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7 Mr. Crowe observes that analog (AMPS) phones have, at the most, extremely limited text messaging capabilities. Only a small number of characters and symbols can be used in such messages, rendering analog phones not suitable for receipt of text alerts of emergencies. At the same time, analog phones and digital phones with analog capability remain in widespread use especially in rural areas of the United States where service availability through analog signals remains superior to digital service.

8 Crowe White Paper at 5.

- Alerts can be turned off in the phone or may be at too low a volume to be heard in a noisy environment or when the phone is in a bag;
- Capacity used for sending a short message to every mobile in a geographic area (and receiving an acknowledgement, and retrying when necessary) will be taken away from the capacity for other purposes, such as setup of voice calls (e.g. by emergency workers); and
- Systems may need to be over-engineered to ensure that the capacity for emergency alerts is always available.

In addition, SMS does not function in a manner that relates to the location of the cellular phone user. SMS is non-geographic in nature, meaning that for any message that is not intended to reach all subscribers, such as critical information about the path of a tornado or a flash flood alert, the message would not be targeted to cell phones actually in the vicinity of the problem. This could lead to two different errors:[9]

- Transmission of an emergency alert to a mobile whose home system is in the region of the emergency, but that is currently roaming elsewhere; or
- Inability to transmit an emergency alert to a mobile that is roaming in the region of the emergency, but that has a home system in another region, possibly even another country.

Mr. Crowe explains that the non-geographic nature of SMS is an important limitation for delivering emergency alerts:[10]

> Emergency alert organizations will presumably only have relationships with wireless carriers in their geographical area, and thus will send alerts to them. Sending alerts to all subscribers would cover too large an area, so it will be necessary for the receiving system to identify the cellsite that each mobile is currently operating in and send short messages only to the mobiles in the target area. This is functionality that is not part of standard SMS which is designed to send messages no matter where mobiles are currently located.

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9 *Id.* at 5-6.
10 *Id.* at 6.

> If emergency alerts enter the network through a [TIA-41] Message Center (MC) there is a further limitation. This network element queries the HLR using an SMS Request message that only returns a routing address. This is the address of an MSC (Mobile Switching Center) not one of the many cell sites that it controls. Consequently, there would be no way to send messages to a small geographic area.

Beyond these limitations of SMS are still others of importance. If an essential purpose of EAS remains to deliver a Presidential message, SMS is limited to text messaging. And, aside from the absence of the President's voice in communication of the message, there are limitations in the length of the text message that can be transmitted by SMS.

The Commission explained in the *NPRM* that

> The EAS protocol, including any codes, may not be amended, extended or abridged without Commission authorization. EAS header codes identify the party that originated the emergency message, the nature of the event or emergency, the location of the emergency, and the valid time period of the message. The national level EAS activation audio message is unrestricted in length. However, for state and local implementation of EAS, the audio portion is restricted to two minutes. [para. 19, footnotes omitted]

An emergency activation of EAS uses a four part message: (1) preamble and EAS header codes; (2) audio attention signal; (3) message; and (4) preamble and EAS end of message codes.[11] Given the text messaging constraints of SMS (and of cell broadcast), compatibility with the EAS would be a not insignificant limitation to overcome before cellular system operators could participate in the delivery of EAS messages that had enough content to be of practical use. In short, text messaging of any practical type does not meet the requirements set forth earlier.

B. <u>Cell Broadcast</u>

Simply described, cell broadcast is a method of sending text messages to all idle mobiles in

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11 *NPRM*, fn. 36.

range of a cell site. Unlike SMS, it is not targeted to any group of subscribers but instead is geographically targeted and can limit distribution of an EAS message to the area coincident with the emergency. It follows that roamers in the area of an emergency will be able to receive cell broadcast messages, and home system customers outside the relevant emergency area will not be sent a message that is of no practical use.

As Mr. Crowe points out, there are also a number of problems to consider with use of cell broadcast for EAS:[12]

- Cell broadcast messages are not acknowledged so it is not possible to know which mobiles in the cellsite coverage area received each message.
- Mobiles that are currently in a call will not receive cell broadcast messages unless they are sent on every active traffic channel as well as on the cell broadcast common channel.
- Mobiles operating in a mode (such as analog) that does not support cell broadcast will not receive these messages.
- Mobiles that are turned off will not receive cell broadcasts.
- In some technologies the size of a message is quite limited.
- The presentation of cell broadcasts by the phone is not specified, consequently:
    - Broadcasts may not be distinguished from point-to-point short messages.
    - Information on the priority of the message will not necessarily be displayed.
    - Messages may be presented in order received instead of in order of priority.
    - Silencing the short message alert may result in no audible alert for cell broadcast messages as well.
- Each type of broadcast is identified by a numerical identity. These are not currently standardized for emergency alerts. This coordination will be needed if mobiles phones are to process emergency alerts specially.
- The quantum of emergency alerts is based on the National Weather Service [SAME] system, which uses counties, parishes, cities or marine areas (or portions of).
- Cells that are not entirely within the emergency area will result in the broadcast of emergency alerts to some mobiles outside the emergency area.

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12 Crowe White Paper at 6-7.

- There is currently little incentive to implement cell broadcast because there is no way for carriers to charge for information carried in (non-emergency) cell broadcasts. This is because messages are received by all mobiles and acknowledge by none. Consequently there is little incentive for carriers to invest in the network equipment and software to support this technology (unlike point-to-point SMS that is sent to an individual mobile, is acknowledged, and therefore is subject to billing).
- Mobiles must be designed to ignore some categories of cell broadcast information. If this is implemented by an 'inclusion list' (i.e. list of categories to display) rather than an 'exclusion list' (list of categories to ignore) then emergency alert broadcasts will not be displayed unless every mobile's inclusion list is modified.
- Mobiles might not be programmed to delete emergency alerts that are no longer valid because they have expired or the mobile has moved outside the emergency area.

Each of these limitations and problems serves to undermine the utility of cell broadcast as an effective means for delivery of EAS messages. In addition, Mr. Crowe observes that

> Cell broadcasts have relatively small maximum lengths. Even for GSM, which allows alerts up to 1395 characters, they would not accommodate the maximum two minutes allowed for non-presidential emergency alert announcements (about 300 words or 1725 characters). Consequently, alerts will have to be rewritten for the wireless technology that provides the shortest messages (currently CDMA, which has a 256 character limit, allowing about 45 words, or about 18 seconds of speech). [p. 11]

RCA submits that any benefits achieved through incorporating cell broadcast into the national EAS network are outweighed by the limitations, and concludes that there are other, better means for delivery of critical information to the public.

C. <u>Issues with External Interfaces and Network Devices</u>

For an emergency alert message to be transmitted, the EAS provider must have an interface with all systems required to convey the message. If wireless system operators are integrated into the message delivery system this means that the EAS provider must have an interface with every commercial wireless system that is required to carry the message.

In his analysis Mr. Crowe explains that, unfortunately, interfaces from external devices to wireless networks are not standardized. GSM's TS 03.41 states, for example, that "No mandatory protocol between the CBC [cell broadcast center] and the BSC [base station controller] is specified by GSM, this is a matter of agreement between CBC and PLMN operators".[13] Mr. Crowe states: "This lack of an external protocol could result in a proliferation of proprietary interfaces. Even where interfaces have been defined for cell broadcast, they are unlikely to have the special data elements to support the requirements identified below."[14]

Mr. Crowe proceeds to list a number of requirements for this type of interface and the processes that it initiates:[15]

- Verification of the identity of the sender, e.g. through an authentication algorithm or through the use of direct physical links.
- Protecting messages on the link from unauthorized modification (e.g. by use of a physically secure link or message encryption).
- Specifying the geographical area for the alert. This will involve standardizing the type of shape (e.g. polygon) that can be provided to circumscribe this area, the limits on the complexity of this shape (e.g. maximum number of sides) and whether only a single area can be provided, or multiple disjunct areas.
- Validating the area of the alert against the authorized operational area of the emergency services provider.
- Mapping the validated alert area onto the coverage area of cell sites by the wireless carrier.
- Maintenance of accurate records of cellsite coverage in the network element receiving. As [CEASA] points out, this is proprietary information. Some carriers may require this database to be within their control to prevent this information leaking out to competitors.
- The mapping between the validated alert area and the cell coverage areas must be done accurately to minimize the distribution of emergency alerts outside the zone of the emergency. Some leakage is unavoidable as cell coverage areas will not often match the area of the emergency exactly.

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13 *Id.* at 7.
14 *Id.*
15 *Id.*

RCA questions the practicality of requiring every cellular and cellular-like service provider in the United States to assume the obligations associated with authentication of the sender of EAS messages. Beyond that, there is potential for unauthorized modification of messages, requiring processes to minimize the possibility of bad conduct by anyone with the capability to engage in such action. There is the additional complication of validating the area to which the message would be sent against a wireless carrier's network and its numerous cell sites. These and other issues identified by Mr. Crowe suggest again to RCA that other means to deliver emergency messages to the public are more secure, practical and feasible.

IV. Supplementing the Receiving Capabilities of Cellular Handsets in order that National Weather Service Broadcasts with EAS Messages are Receivable

The Commission is fully aware that "...the technology exists to have consumer electronic devices turn on automatically in the event of an emergency...[and] NOAA Weather Radios currently supply both these functions."[16] The Commission then asks: "Would mandating the adoption of such technology to other consumer electronic devices enhance the effectiveness of EAS and other PAW [public alert and warning] systems?" [17]

In a November 2000 report titled "Effective Disaster Warnings" a working group of the President's cabinet level National Science and Technology Council ("NSTC") made the following observation:

> Effective warnings should reach, in a timely fashion, every person at risk who needs and wants to be warned, no matter what they are doing or where they are located.

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16 *NPRM* at p. 15, referring to the MSRC's identification of two primary functionalities of a future warning system as the ability of a device to turn itself on and to automatically tune into the channel carrying the warning.

17 *NPRM* at 15.

> Such broad distribution means utilizing not only government-owned systems such as NOAA Weather Radio and local sirens, but all privately owned systems such as radio, television, pagers, telephones, the Internet, and printed media. ..... What if a warning-receiving capability were simply an added feature available on all radios, televisions, pagers, telephones, and such? The technology exists not only to add such a feature, but to have the local receiver personalize the warnings to say, for example, 'Tornado two miles southwest of you. Take cover.' What does not exist is a public/private partnership that can work out the details to deliver such disaster warnings effectively.[18]

The report included several recommendations, including the following:

> **A standard method should be developed to collect and relay instantaneously and automatically all types of hazard warnings and reports locally, regionally, and nationally for input into a wide variety of dissemination systems.** The National Weather Service (NWS) has the most advanced system of this type that could be expanded to fill the need. Proper attribution of the warning to the agency that issues it needs to be assured.[19]

The National Weather Service ("NWS") radio signals are already accessible to 95% of the American population in the fifty states, Puerto Rico, the Virgin Islands, Guam and the Mariana Islands.[20] However, only between 8% and 13% of United States households have NWS receivers and less than half of those receivers are portable, according to a national survey.[21] It follows that if more consumers had portable devices that incorporate receivers for NWS signals, and EAS messages were broadcast over the NWS network, the effectiveness of the EAS would be increased dramatically.[22]

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18 *Effective Disaster Warnings*, Report by the Working Group on Natural Disaster Information Systems, Subcommittee on Natural Disaster Reduction, National Science and Technology Council, Committee on Environment and Natural Resources, November 2000, Executive Summary, p. 6 (emphasis added).

19 *Id.* at 7 (emphasis added).

20 *NPRM* at fn. 72, citing the PPW May 2003 Report at 14-15.

21 *Id.*

22 In the attached Declaration of Art Prest, information is provided about one portable radio for reception of NWR signals. The model described is small in size, light in weight, inexpensive, and allows the user to input SAME codes to specify local areas where the user frequently travels. Battery life was impressive even without a rechargeable battery.

The NSTC continued in its report, *Effective Disaster Warnings,* and provided a recommendation:

> We believe that the most logical nucleus for a national system for collecting warnings for dissemination should be built around the NWS systems. NOAA/NWS already calls their systems All-Hazards and currently receives earthquake information directly from the USGS National Earthquake Information Center in Golden, Colorado, and space weather information from the Space Environment Center in Boulder, Colorado. NOAA/NWS has had agreements with nuclear power plants in place for many years and more recently with the Chemical Stockpile Emergency Preparedness Program (CSEPP) for utilizing NOAA Weather Radio in the event of an incident at one of their facilities. NWS has reciprocal agreements with each state for data exchange for state-level incidents. Warnings issued by local emergency managers in most states go directly onto EAS without going through the NWS.
>
> **RECOMMENDATION: A standard method should be developed to collect and relay instantaneously and automatically all types of hazard warnings and reports locally, regionally, and nationally for input into a wide variety of dissemination systems. The National Weather Service (NWS) has the most advanced system of this type that could be expanded to fill the need. Proper attribution of the warning to the agency that issues it needs to be ensured.**[23]

Issued four years ago this recommendation warrants appropriate attention now that the Commission is working with other government bodies to consider improvements to the EAS.

There are some admitted problems with the existing EAS system as described by PPW.[24] Some of them include:

- EAS currently can only be focused on people at risk by county, but broadcast stations typically reach many counties. Thus, EAS in many cases may warn large numbers of people not at risk. Additional codes to specify 1/9th portions of counties are available, but are not in common use.

- The EAS national distribution system for Presidential messages, the Primary Entry Point system (PEP), utilizes 34 major broadcast stations and one broadcast network.

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23 *Effective Disaster Warnings*, at 24-25 (emphasis added).

24 See, *A National Strategy for Integrated Public Warning Policy and Capability*, PPW, May 16, 2003 at 13-14.

- It does not currently reach all state EAS entry points and it uses standard telephone circuits as the main communications link from the Federal government to the PEP stations. Regular tests conducted by the FOC and FAOC often do not trigger and successfully test all 34 stations.

- Successful state and local EAS operation depends on development of state and local plans that specify which messages will be sent, who can originate messages, how originators and broadcast and cable systems are linked, and regular testing procedures. Many regions do not have such plans.

- EAS alerts, warnings and other messages are sent using specific digital codes that control operation of the EAS equipment. In 2002, the FCC agreed to add many important codes, including several for all-hazards warnings, with one for Amber child abduction alerts. EAS equipment must be upgraded to respond properly to these new codes, but the FCC did not make upgrades of equipment already installed mandatory.

Even with these problems it seems reasonable to believe that it would be less expensive and quicker to provide the funds and resources for resolving such problems with the existing EAS and NWS NWR systems than to build an all-new EAS system that would probably end up having its own problems that would take years to resolve.

Not only is the NWS radio infrastructure already in place but it is especially suitable for delivery of geographically targeted EAS messages. The NSTC explained that

> National Weather Radio ("NWR") uses code numbers for counties specified in the Federal Information Processing Standard ("FIPS"). It is also possible to specify one-ninth parts of a county. Up to 31 different counties or 1/9th sections of counties can be specified in a given transmission. The 1/9th sections are not currently implemented in most areas, but use is increasing. Buyers of certain NWR receivers and EAS decoders can enter their county codes determined, for example, from a website (http://www.nws.noaa.gov/nwr or http://support.tandy.com/support_audio/doc40/40482.htm) or by telephone (1-888-NWR-SAME). Some counties are very large and flash floods or tornadoes may only affect a small part of a county. Also, some unused FIPS codes are being assigned for specific sites or needs such as for a nuclear power plant, offshore areas, and CSEPP sites. The NWS also uses a form of the FIPS codes in their Universal Generic Code, which is included in many NWS products to identify the affected area by county.

This code enables users to specify the locations they want information on.[25] In this manner the "SAME" codes can provide a high degree of granularity and allow EAS messages to be targeted to receivers in as small an area as 1/9 of a county.[26] SAME codes can also be used to identify areas within a county of critical importance during emergency situations, such as military bases, airports and nuclear power plants.

Reception of the NWR signal does not require a dedicated, sole purpose radio device. The receiver can be incorporated into any number of consumer devices and already is a part of many car radios and portable AM/FM radios. NSTC points out that

> Advanced receivers are available that will turn themselves on and set the volume in order to broadcast a warning when it is received. These receivers can also be set to the Specific Area Message Encoder code so that only identified events for a specific location will set off an alarm. Access to NWR would be substantially increased if the signal could be detected by most standard radios.[27]

In a 2003 report, the PPW made similar findings:

> Many brands and types of NWR receivers are available. Some are now being built into car radios, televisions, and other general use devices. The receivers provide warning access to the deaf and hearing-impaired community. A recent national

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25 *Id.* at 26 (emphasis added).

26 PPW reported that, "[e]ven after all of above locations are cataloged, there are still hundreds of unused FIPS numbers that could in theory be used to identify unique areas and situations such as nuclear power plant zones, military bases, neighborhoods, and even groups of individuals such as police, emergency personnel, etc. Therefore, EAS might in the future be better targeted to any of these unique areas and situations, provided procedures and equipment are in place ahead of time. Oregon and Washington are two states now using unique FIPS codes in certain special warning areas. Other areas are considering using unique FIPS location codes." *The Emergency Alert System (EAS): An Assessment, Partnership for Public Warning*, February 2004, page 18. Thus, it appears that by using additional FIP codes, the existing SAME codes could be expanded to give a much higher level of granularity than is available even by dividing counties into 9 sections. In fact, looking at the FIP county codes (which is a 3 digit number that can be reused in each state), most states use a small fraction of the 999 county code possibilities. Texas uses about 500 FIP county codes but most states use less than 100 FIP county codes. The result can be very high levels of granularity by assigning more FIP "county" codes for smaller geographic areas than counties. In fact each state could have as many as 8991 discrete geographic locations each having its own SAME code.

27 *Id.* at 32.

> survey of 1,000 people concluded that depending on region of the country from 8% to13% of U.S. households have NWR receivers (eBrain.Consumer Research for the Consumer Electronics Association, 2002). Many of these receivers have the important technical capability to "wake themselves" when not in use to alert users of an emergency. Some commercial radio, television, and cable TV stations, depending on their state EAS plans, have EAS equipment installed that includes a built-in NWR receiver programmable to automatically and immediately rebroadcast NWR warnings as an EAS activation. The warnings received over NWR may also be used at the discretion of broadcasters as non-EAS broadcasts. Many state and local governments have provided NWR receivers to schools and hospitals. NWR stations are also used by a number of biological and chemical weapons storage areas and nuclear facilities as their mandated warning systems. FEMA, in 2002, reaffirmed NWS responsibility to deliver all-hazard warnings via NWR and its other dissemination systems. NWS systems are available for dissemination of all-hazard warnings by national, state and local emergency management agencies. While a growing number of these agencies provide civil warnings to NWR, the usage is inconsistent.
>
> * * *
>
> While the infrastructure for NWR is a significant national asset, as noted above only from 8% to 13% of the population actually owns the special receiver and less than half of those receivers are portable. Few people carry these receivers with them every day. The principle shortcoming of NWR in broadcasting terminology is listener market penetration.[28]

It is possible that cell phones could be adapted to incorporate receivers that would monitor NWR broadcasts. Perhaps the most challenging issue associated with design of such a cell phone would be to dynamically program the relevant SAME code into the NWR receiver contained within the cell phone based on the SAME codes that may be broadcasted by the nearest operating NWR stations and the location of the cell site that is controlling calls to that handset, and then to make changes to those codes automatically as the cell phone user moves from place to place. Further study would be needed with appropriate input from cell phone manufacturers to evaluate the feasibility of producing such phones, and from the industry standards organizations regarding the development of the ability to

dynamically program SAME codes into the NWR receivers.

Holding aside the question of whether cell phones can be designed to change SAME codes dynamically, other consumer devices designed for fixed use in homes and offices could be used to improve access to EAS messages. The NSTC made findings and a recommendation on this point:

> It is now technically feasible to have radios, televisions, telephones, pagers, and other commonly used equipment contain a small amount of circuitry that monitors continuously for emergency signals and when appropriate, turns the equipment on and emits a message or alarm. The EAS system contains the digital codes to activate such systems and more sophisticated codes may be available in the future. It is also technically feasible to make these receivers "smart" so that they can understand what warnings the owner wishes to receive, and can even know their location relative to the hazardous event. One issue will be to keep the cost down. Another problem is that appropriate standards to facilitate market deployment of such systems do not exist. Since warnings are primarily issued by governments and these receivers are built and owned by private entities, there is a significant need for all stakeholders to work together to develop appropriate standards and approaches, perhaps with government seed money.
>
> * * *
>
> **RECOMMENDATION: The greatest potential for new consumer items in the near future is development of a wide variety of smart receivers and the inclusion of such circuits within standard receivers. A smart receiver would be able to turn itself on or interrupt current programming and issue a warning only when the potential hazard will occur near the particular receiver. Some communication channels where immediate expansion of coverage and systems would be most effective include NOAA Weather Radio, pagers, telephone broadcast systems, systems being developed to broadcast high-definition digital television (HDTV), and the current and Next Generation Internet.**[29]

With the benefit of such studies RCA urges the Commission to adopt the findings and recommendations of the NSTC which provide a solid foundation for improvements to the EAS.

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28 *A National Strategy for Integrated Public Warning Policy and Capability*, PPW, May 16, 2003 at 14-15.

29 *Id.* at 36

Whether or not cellular phones are among the consumer devices that should be adapted to retransmit NWR signals is a question that may call for further study.[30] In essence, is it a technically and financially viable proposition to modify cellular phones to receive and retransmit NWR signals on a geographically targeted basis? RCA cannot answer that question at this time, but it is apparent to RCA, based upon Mr. Crowe's analysis as summarized in his white paper, that it is not feasible to require every commercial wireless system operator in the United States to rebroadcast EAS messages through either SMS or cell broadcast methodologies.

V. Cost Recovery is Needed if Wireless Carriers are Required to Transmit EAS Messages

Wireless carriers represented by RCA, approximately 100 in number nationwide, serve small and medium sized markets. As such, they lack large numbers of subscribers. Without a large subscriber base small carriers face a disproportionate burden in meeting costs associated with network modifications required to comply with government public safety mandates. For example, many RCA members operate in states where no cost recovery from the state is available in conjunction with provision of E-911 services. In such situations the carriers risk losing customers if they add higher surcharges to bills than do large wireless carriers. At the same time, small carriers must compete with large carriers' service rate plans. The result is extraordinary pressure to keep rates and charges in line with those of large national carriers.

These are the types of reasonable business concerns of which the PPW took note:

> **Government leadership should not infer unfunded government mandate. Many companies have avoided public warning out of fear of government mandates.**

30 Such a study cannot be completed overnight, but it need not delay implementation of a decision to make more effective use of NWR in the provision of EAS messages. As a part of its proposed "Plan for Action" the PPW urged that "within two years. . .[that a federal agency lead an effort to] [d]evelop and test a prototype standard protocol for warning messages that will enhance interoperability." *Id.* at 27.

> There are two clear examples. Broadcasters, as a condition of their licenses, operate the Emergency Alert System while the FCC can and does mete out fines for non-compliance. The need to locate cellular telephones when they are used to call 911 is also now mandated on the telecommunication industry. In both cases, **unfunded government mandates have not typically led to the most effective solutions.** Public warning may require some level of government-enforced standardization and a minimum standard of service, but such decisions need to be based on consensus of the many different stakeholders and the acceptance of most organizations affected. Appropriate standards can ensure interoperability while allowing for trade secrets and proprietary information in certain sectors. Through an effective public/private partnership, government can keep the control it needs while encouraging the enthusiastic participation of others.[31]

If there is an unfunded mandate that wireless carriers participate in the EAS, and if considerable costs will be encountered to modify networks, small and rural wireless carriers will face increased financial pressure to leave the market entirely through sale of their spectrum and subscriber lists to large, nationwide carriers. The public interest will not be served through a lessening of competition in small and rural markets. Small carriers typically provide better service in those markets, with a focus on the needs of the smaller communities. It would not benefit consumers in such markets to lose their choice of a smaller carrier in order to obtain emergency messages from a large wireless carrier if the same emergency messages could otherwise be received in an effective manner.

RCA endorses the recommendations of PPW that

> **The President and Congress should:**
>
> • Make an integrated public warning capability a priority for the nation.
>
> • Assign lead responsibility to the Secretary, Department of Homeland Security.
>
> • Establish a process by which all national stakeholders can participate effectively in the development of this national capability.

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31 *Id.* at 25 (emphasis added).

• Provide appropriate Federal funding for integrating public warning policy and capability.

• Fund research and operational capability for information gathering systems that will make warnings more reliable.[32]

And further that:

Private industry should:

• Participate actively in the development of interoperable standards.

• Commit to standards-compliance and on-going industry tests to verify compliance.

• Explore options for integrating warning capability into their products and services.

• Evaluate the role of warning in their business reliability and continuity plans and address these needs.[33]

If the EAS remains essentially an unfunded Federal government mandate, the PPW believes it is "inhomogeneous and prone to failure, unlike the earlier EBS [Emergency Broadcast System] where more operational plans were in effect."[34] [35]

The Commission itself recognized that many of the topics discussed in the *NPRM* would likely require participating services to incur additional costs. "While large companies may have the

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32 *Id.* at 29.

33 *Id.* at 30 (emphasis added).

34 *The Emergency Alert System (EAS): An Assessment, Partnership for Public Warning*, February 2004, page 11.

35 PPW reported: "The Department of Justice is now making available several million dollars in matching grants for state AMBER programs. This funding is not specifically intended for EAS and could be spent in other areas specific to recovery of abducted children such as changeable highway signs. Within the grant's guidelines, each state must determine what aspects of its AMBER program will receive the funding. While some of this money could be used to improve state EAS infrastructure, it is unlikely this funding will be of any significant benefit to the EAS. There is no way of knowing if this funding is going to be only a onetime opportunity. Therefore, the AMBER funding source cannot be counted on to provide near term or sustaining support for EAS. *Id.* at 24.

resources to absorb equipment upgrades and staff, small business entities may not."[36] That is certainly a true statement as to the carriers, both Tier III and Tier II according to number of subscribers, who are members of RCA. Any costs attributable to carrier compliance with new EAS requirements should be funded by the Federal government. Alternatively, non-nationwide carriers should be given the opportunity to "opt-out" of EAS obligations.

VI. Conclusion[37]

RCA respectfully urges the Commission to avoid an unnecessary and wasteful duplication of scarce resources, both in the public and private arenas, entailed by any requirement that commercial wireless system operators use their systems to retransmit messages intended for the EAS. Neither the SMS nor the cell broadcast capabilities of wireless system operators were designed for, nor are they well suited for, retransmission of EAS messages. A review of six critical objectives of an effective EAS, as listed in Section II of these comments and consideration of the limitations of SMS and cell broadcast, as reviewed in Section III of these comments, yields the conclusion that wireless system operators should not be ordered to retransmit EAS messages.

Analysis of the potential for improvement of the EAS, performed by the PPW and the NSTC, leads to the conclusion that more effective use of the National Weather Service network of radio

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36 *NPRM* at 18.

37 RCA wishes to acknowledge with appreciation the research and conclusions of David Crowe whose attached "white paper" was prepared on short notice but which succinctly reviews the issues associated with a potential use of SMS or cell broadcast in the EAS. RCA also acknowledges the considerable efforts of Art Prest of Art Prest & Associates in the formulation of these comments. Specifically, Mr. Prest was instrumental in RCA's recommendation that the Commission initiate a feasibility study of incorporating into cell phones a receiving capability of NWR broadcasts. Mr. Prest's testing of a small device that automatically turns itself on and tunes to any of several NWR stations according to pre-programmed SAME codes persuaded RCA that there is an alternative to SMS and cell broadcast as a means to allow millions of cell phone users nationwide to receive EAS messages through their cell phones. *See*, Declaration of Art Prest.

systems would enhance the effectiveness of the EAS. Added capability of numerous consumer devices to receive NWR broadcasts would serve to update the EAS in the most efficient manner.

By improved use of the NWR system, RCA agrees with the PPW when it concluded:

> The EAS system of tomorrow can be built today, if we utilize the existing EAS technology already in place. We have available for our use as a foundation, a system with a build-out that includes over 14,000 broadcast stations and 10,000 cable systems. With minor modifications, the system is capable of delivering reliable warnings to large and small geographic areas and populations. This existing infrastructure should be used to meet our national need for a viable system. Any new system design should take advantage of this existing infrastructure and be fully backwards compatible with the existing equipment that is in place. It would be difficult to replace or rebuild such a capability today at a reasonable cost.[38]

Respectfully submitted,

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38 *The Emergency Alert System (EAS): An Assessment, Partnership for Public Warning*, February 2004, page 28.

Cellular
Networking
Perspectives

White Paper on Emergency Alert Systems using Cellular Technology

October, 2004

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About David Crowe:

David Crowe has been involved in technical aspects of cellular systems since 1984, and standardization since 1988. He was a cellular switching systems software developer from 1984 to 1992 at NovAtel, and an active participant in the TIA TR-45.2 standards subcommittee since 1988. He is now the chair of TR-45.2 and also of 3GPP2 ERA (Evolution, Requirements and Architecture). He is the editor of J-STD-036 (E911 Phase 2 network support), TIA-928 (TIA-41 support for MEID) and TIA-945 (TIA-41 support for Enhanced Security Algorithms). He was approved as a 'forensic expert in the field of wireless technology' by the Ontario (Canada) Superior Court in 2003.

David has consulted, since 1992, for many major organizations in the wireless industry, including Alcatel, AT&T Wireless, Tandem (now HP), Agilent (formerly HP), Qualcomm, CTIA, and ATIS. He is the International Roaming MIN and SID administrator for IFAST. David has written columns and articles since 1995 for a number of industry magazines, including Wireless Telecom and Wireless Review, and publishes two newsletters: Cellular Networking Perspectives and Wireless Security Perspectives.

Introduction

This report was prepared at the request of the Rural Cellular Association. It provides a technical analysis of the possibility of providing an Emergency Alert Service in the United States using available cellular phones and networks. It is based on publicly available documents, including government publications and industry standards.

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Wireless Emergency Alerts

Wireless phones (cellular, PCS, E-SMR etc.) are now important communications tools for most Americans, for talking with friends, colleagues and in times of emergency. Most phones now provide not just voice services, but also text messaging and sometimes more exotic capabilities, such as still pictures or even video.

In times of crisis, government agencies often attempt to communicate critical information through the public media, such as television and radio broadcast stations. Some have suggested that the text messaging capabilities of wireless phones be used to complement these existing services.

The most widely used form of text messaging is "Point to Point", with the destination being a single phone. Standards for 'cell broadcast' text messaging have also been defined, where a single text message is transmitted to all mobiles in the broadcast area of a cell that are currently listening.

Background on the Current Emergency Alert System

The current Emergency Alert System was described in a paper by the National Science and Technology Council, within the Executive Office of the President of the United States [NDIS WG]:

> *The Emergency Alert System (EAS) is the national warning system designed primarily to allow the President to address the nation reliably during major national disasters. All radio and television stations (and soon all cable systems) are mandated by the Federal Communications Commission (FCC) to have EAS equipment and to issue national alerts. The stations and cable systems may choose whether they wish to transmit local warnings and they may also delay transmission for many minutes. The warnings consist of a digital packet of information and a verbal warning of up to two minutes in length [except for Presidential messages, which are unlimited in length]. The EAS interrupts normal programming or at least adds a "crawl" to the margin of the television screen*

This report addresses a number of issues that can arise with emergency alerts:

- Alerts may be received by people outside the affected areas.
- Too many alerts that do not affect them leads people to ignore warnings.
- People may be asleep at the time an alert is broadcast or in places where radio and television broadcasts are not normally received.
- Broadcasters wish to minimize interruptions to programming.
- There are liability issues when the broadcast fails (e.g. due to a power failure).

The report also defines a number of characteristics of effective emergency alert messages:

"An effective message should:

- Be brief (typically less than two minutes [for spoken messages] and preferably less than one minute)
- Present discrete ideas in a bulletized fashion
- Use nontechnical language
- Use appropriate text/graphics geared for the affected hazard community and general population
- Provide official basis for the hazardous event message (e.g., NWS Doppler Radar indicates tornado, police report of chemical accident, etc.)
- Provide most important information first, including any standardized headlines
- Describe the areas affected and time (e.g., "pathcasting" for moving events such as weather systems, volcanic debris or element dispersal, etc.)
- Provide level of uncertainty or probability of occurrence
- Provide a brief call-to-action statement for appropriate public response (e.g. safety instructions for protection of life and property, any evacuation instructions, shelter or other care facilities, etc.).
- Describe where more detailed follow-up information can be found"

Background on Cellular Service

There are a significant number of wide area public cellular, PCS and cellular-like wireless sytems currently in use in the United States:

- AMPS (analog).
- N-AMPS (narrowband analog).
- TDMA (Time Division Multiple Access, e.g TIA/EIA/IS-54, TIA-136).
- CDMA (Code Division Multiple Access, e.g. TIA/EIA/IS-95, IS-2000).
- GSM (based on various ETSI and 3GPP specifications).
- UMTS/Wideband CDMA (based on various ETSI and 3GPP specifications).
- iDen (based on proprietary Motorola specifications).

Wireless phones commonly operate in two, three or more modes, with the modes defined based in differences in:

- Frequency bands (e.g. cellular 800 MHz and PCS 1900 MHz).
- Technology (e.g. AMPS with TDMA, CDMA or GSM).

The choice of technology and frequency, when several choices exist, is based on an algorithm programmed into the handset or SIM/UIM ('smart card').

In a given geographical area there may be phones operating in all the different modes. Furthermore, mobiles might be idle (not currently in a call), in a call, operating a data service, receiving a text message or even in a transitional state (e.g. in the process of transitioning from a control channel to a traffic channel).

Analog Service

Analog (AMPS) phones originally had no text messaging capabilities. Later standards provided only extremely limited text messaging capabilities. [IS-91] supports point-to-point text messages of only 15 characters, for example. Only 62 different symbols can be used in these messages: upper case letters, digits and a few punctuation characters.

Analog coverage is important for cross technology roamers (e.g. a TDMA/analog phone obtaining service from a CDMA/analog carrier or vice-versa), in rural areas where service has not been updated to digital and for hearing impaired people. The FCC has ruled that cellular carriers must support the technology until February 2008 [FCC 04-22].

Clearly, mobiles operating in analog mode for any of the above reasons would not be able to receive emergency alerts.

SMS: 'Point to Point' Short Messaging (Text Messaging)

Digital cellular phones have had the ability to receive text messages for several years and, more recently, the ability to send them. This is supported by GSM, UMTS, TDMA (TIA/EIA/IS-54/TIA-136) and CDMA (TIA/EIA/IS-95/IS-2000).

There are a number of problems with the use of SMS for emergency alert services:

- Alerts can be turned off in the phone or may be at too low a volume to be heard in a noisy environment or when the phone is in a bag.
- Capacity used for sending a short message to every mobile in a geographic area (and receiving an acknowledgement, and retrying when necessary) will be taken away from the capacity for other purposes, such as setup of voice calls (e.g. by emergency workers).
- Systems may need to be over-engineered to ensure that the capacity for emergency alert short messages is always available.
- SMS is a roaming service, not a geographical service. Consequently, without special filtering of messages based on the current location of the mobile, the use of this service for emergency alerts could lead to two different errors:

- Transmission of an emergency alert to a mobile whose home system is in the region of the emergency, but that is currently roaming elsewhere.
- Inability to transmit an emergency alert to a mobile that is roaming in the region of the emergency, but that has a home system in another region, possibly even another country.

Non-Geographical Nature of SMS

The non-geographical nature of SMS is an important limitation for delivering emergency alerts. Emergency alert organizations will likely only have relationships with wireless carriers in their geographical area, and thus will send alerts to them. Sending alerts to all subscribers would cover too large an area, so it will be necessary for the receiving system to identify the cellsite that each mobile is currently operating in and send short messages only to the mobiles in the target area. This is functionality that is not part of standard SMS which is designed to send messages no matter where mobiles are currently located.

If emergency alerts enter the network through a [TIA-41] Message Center (MC) there is a further limitation. This network element queries the HLR using an SMSRequest message that only returns a routing address. This is the address of an MSC (Mobile Switching Center) not one of the many cell sites that it controls. Consequently, there would be no way to send messages to a small geographic area.

While it would be difficult to target subscribers who obtain service in the geographical area of the emergency, it would be next to impossible to contact roamers.

Roamers are cellular subscribers from other systems who are obtaining service while in a different service area. They may even subscribe to cellular service in a different country. Short messages can often be delivered to them but the short message has to first be sent to their home system. The only way to know the home systems of all roamers in the target area is to obtain a list of all mobiles currently operating in cellsites within the target area. This information is not available through the signaling systems normally used to send short messages ([TIA-41] and GSM MAP). Consequently, roamers would probably not receive emergency alerts, even if their home system was only a few miles away from the systems covering the area of the emergency.

This problem could only be solved by creating a new type of short message functionality whereby the text message was sent to a list of base stations (cellsites) which would then send individual short messages to every mobile currently active in the coverage area of the base station. This functionality can be more efficiently provided by cell broadcast, which is described below.

Cell Broadcast

Cell broadcast is a method of sending one text messages to all idle mobiles in a cellsite. It has several advantages for an application like emergency alerts as noted in US Patent #6,112,075 [Weiser]. Some of these advantages are:

- It is efficient because one message can be received by many mobiles.
- It is geographically targeted because alerts can be sent only to cellsites that intersect the area of the emergency.
- It can reach roamers as easily as home subscribers.
- It can reach mobiles that are not eligible for other types of services (such as voice calls) for a variety of reasons, such as lack of a valid subscription, roaming restrictions.

There are also a number of problems with cell broadcast for an emergency alert application:

- Cell broadcast messages are not acknowledged so it is not possible to know which mobiles in the cellsite coverage area received each message.
- Mobiles that are currently in a call will not receive cell broadcast messages unless they are sent on every active traffic channel as well as on the cell broadcast common channel.
- Mobiles operating in a mode (such as analog) that does not support cell broadcast will not receive these messages.
- Mobiles that are turned off will not receive cell broadcasts.
- The size of a message is quite limited.
- The presentation of cell broadcasts by the phone is not specified, consequently:
  - Broadcasts may not be distinguished from point-to-point short messages.
  - Information on the priority of the message will not necessarily be displayed.

- Messages may be presented in order received instead of in order of priority
- Silencing the short message alert may result in no audible alert for cell broadcast messages as well.

- Each type of broadcast is identified by a numerical identity. These are not currently standardized for emergency alerts. This coordination will be needed so that mobiles phones can process emergency alerts specially.
- The quantum of cell broadcast is the coverage area of a cell. This can be quite large in rural areas and bears little resemblance to political boundaries.
- The quantum of emergency alerts is based on the National Weather Service [SAME] system, which uses counties, parishes, cities or marine areas (or portions of).
- Cells that are not entirely within the emergency area will result in the broadcast of emergency alerts to some mobiles outside the emergency area.
- There is currently little incentive to implement cell broadcast because there is no way for carriers to charge for information carried in (non-emergency) cell broadcasts. This is because messages are received by all mobiles and acknowledge by none. Consequently there is little incentive for carriers to invest in the network equipment and software to support this technology (unlike point-to-point SMS that is sent to an individual mobile, is acknowledged, and therefore is subject to billing).
- Mobiles must be designed to ignore some categories of cell broadcast information. If this is implemented by an 'inclusion list' (i.e. list of categories to display) rather than an 'exclusion list' (list of categories to ignore) then emergency alert broadcasts will not be displayed unless every mobile's inclusion list is modified.
- Mobiles might not be programmed to delete emergency alerts that are no longer valid because they have expired or the mobile has moved outside the emergency area.

External Interfaces and Network Devices

The emergency alert provider has to have an interface to all public wireless systems in its coverage area that support cell broadcast. Unfortunately interfaces from external devices to wireless networks are not standardized. GSM's TS 03.41 states, for example, that "No mandatory protocol between the CBC [cell broadcast center] and the BSC [base station controller] is specified by GSM, this is a matter of agreement between CBC and PLMN [Public Land Mobile Network] operators". A TIA document, TSB114, similarly provides a description of information elements, without providing an implementable protocol (and TSBs, according to the TIA, cannot contain normative requirements, and thus are of less significance than an actual standard).

This lack of an external protocol could result in a proliferation of proprietary interfaces. Even where interfaces have been defined for cell broadcast, they are unlikely to have the special data elements to support the requirements identified below.

The requirements for this type of interface and the processes that it initiates include:

- Verification of the identity of the sender, e.g. through an authentication algorithm or through the use of direct physical links.
- Protecting messages on the link from unauthorized modification (e.g. by use of a physically secure link or message encryption).
- Specifying the geographical area for the alert. This will involve standardizing the type of shape (e.g. polygon) that can be provided to circumscribe this area, the limits on the complexity of this shape (e.g. maximum number of sides) and whether only a single area can be provided, or multiple disjunct areas.
- Validating the area of the alert against the authorized operational area of the emergency services provider.
- Mapping the validated alert area onto the coverage area of cell sites by the wireless carrier.
- Maintenance of accurate records of cellsite coverage in the network element receiving As [CEASA] points out, this is proprietary information. Some carriers may require this database to be within their control to prevent this information leaking out to competitors.
- The mapping between the validated alert area and the cell coverage areas must be done accurately to minimize the distribution of emergency alerts outside the zone of the emergency. Some leakage is unavoidable as cell coverage areas will not often match the area of the emergency exactly.

Cell broadcast requires a special network element known as the Cell Broadcast Center (CBC) in GSM. This is specifically outside the wireless carrier network, as GSM TS 03.41 states: "the CBC (and any originating point for cell broadcast short messages) is regarded as a node outside the PLMN [public land mobile network, i.e. wireless carrier network]".

Most of the requirements for the interface that are described above must be enforced by the carrier as they require precise knowledge of cell coverage areas. This will require a new network element within the carrier's network, one that is not described by any standards. To the external CBC it will emulate a Base Station Controller, and to the Base Station Controller will emulate a CBC. This device will also have to have the latest radio coverage information for every cell so that it can map a request from a CBC containing an emergency alert onto a list of cells, and can verify that the request is legitimate (e.g. is not directed to any cells that are completely outside the region of authority of the requestor). These new network elements will have no purpose other than validating and disseminating emergency alerts.

Mobile Handling of Emergency Alerts

There are very few requirements for the handling of cell broadcasts by mobiles in standards. In some cases, cell broadcast message have specific meanings, and will never be displayed. For the majority, since they just contain useful information (such as news, sports and weather), the display and management of messages is left to the imagination of mobile phone designers. It is likely that, given the similarity with point-to-point text messages, that those that are not filtered out will be entered into the queue of incoming short messages. This type of handling will not be satisfactory for emergency alerts.

Some of the specific requirements that can be derived for emergency alerts are:

- The method of identifying an emergency alert must be precisely defined. This probably means that one or more message types have to be reserved for this service, by industry agreement.
- They must be deleted **by the phone** when they have expired. There will have to be precisely defined rules for when an alert can be considered to be expired at which point it should be deleted or clearly marked as expired by the phone. These rules will vary with technology, but could include the phone recognizing that the sequence or version number associated with a broadcast alert has been changed, or when an alert with a particular message type is no longer being broadcast (which will require the broadcast cycle to be well defined).
- They must be deleted when the mobile moves to a cell that is completely outside the zone of the emergency. It would be simple, but unsatisfactory, to program a mobile to delete all emergency alerts whenever it recognizes that it is obtaining service from a different cell (under the assumption that the alert will be broadcast again if the new cell is still within the emergency area). This is because there may be a significant time lag between entering a cell and receiving the full emergency alert message. A mobile in a border area might never receive the full alert because of frequent serving system changes.
- They must be retained when 'deleted' by the user. In some systems the only way to recognize that a broadcast message is new is that it has an identity not currently held by the phone. If the user was to be able to delete the entire message it would reappear on the phone as a new message on the next broadcast cycle. Such retained alerts may not be displayed any more, but cannot be fully deleted until the phone has recognized that they have expired or the phone has moved to a different cell coverage area. Optionally, it may be a requirement that the alert continue to be displayed until it is no longer valid.
- They must be given display priority over other text messages. They must not simply be added to the end of the queue of received text messages.
- They must bypass any treatment in the phone that could result in the user not being notified. The audible alert must not be able to be silenced for these messages.

CDMA Cell Broadcast

CDMA cell broadcast was first defined by [IS-637] and is now defined in its replacement, [TIA-637]. The cell broadcast must fit within a single Data Burst, which is 255 bytes long. There is no facility for concatenating multiple messages. Accounting for overhead (the Data Burst Message header, the SMS Transport Layer message type and category, the SMS Teleservice Layer Message Identifier and the broadcast address), this can accommodate a maximum of about 256 7 bit characters (which covers upper and lower case letters, digits and basic punctuation characters). The precise limit may vary with the overhead of various protocol layers.

For comparison, two sample messages in [PPW, 2004] were 252 characters for a weather warning (just under the limit) and 284 characters for an AMBER alert (10% over the limit). The standard test message "This is a test

of the Emergency Broadcast System. The broadcasters in your area have developed this system to keep you informed in the event of an emergency. If this had been an actual emergency, you would have received official instructions and information." is 258 characters long, just over the limit, and therefore could not be displayed by CDMA phones.

With an average English word size of 4.75 letters [Sigurd] (plus one space character), the CDMA cell broadcast limit represents about 45 words. At a normal delivery rate of 150-175 words per minute [Utterback] this represents about 15-18 seconds of speech, much less than the two minute maximum length of the verbal message associated with a non-presidential radio or television emergency alert.

In discussions with technical industry experts, who all declined to be identified, as they were not authorized to speak on behalf of their company, it became clear that CDMA cell broadcast is not implemented in most phones nor in most CDMA network equipment sold in the US.

TDMA

TDMA (TIA-136) is an 'end of life' technology. Its major proponents, such as AT&T Wireless and Cingular, are well into the process of migrating to the GSM family of standards (GSM, GPRS, EDGE, UMTS). Consequently, it is unlikely that further major software and hardware developments for this technology will be undertaken, even when standards exist.

A cell broadcast standard for TDMA was published in late 1999 [BATS]. These broadcast messages can be sent as a number of segments, so larger messages can be broadcast when spread over a number of air interface messages.

[BATS] does not define any categories of emergency information. Categories defined in [TDMA Codes] are for data to assist mobiles while roaming or positioning functions, and for general interest information, such as news, weather and sports. The use of this protocol for emergency alerts would require the standardization of at least one new category, with accompanying software in TDMA phones to give it the correct treatment (e.g. to ensure that this service could not be turned off, unlike the information services) as well as the introduction of new network equipment for the validation and distribution of alerts.

In discussions with industry experts (who declined to be identified) it was agreed that this cell broadcast standard came too late in the life of this technology to be widely implemented (AT&T Wireless, the first company to announce a transition from TDMA to GSM, did so in 2000).

GSM and UMTS

Cell broadcast was defined in the original GSM specifications as Technical Specification 03.41. It was designed for the repetitive transmission of information, such as news and weather updates. It was designed for a capacity of about one 88 character message (about 15 words) every 2 seconds [Mouly]. It was designed to have a low priority and low bandwidth utilization. Its transmission may be stopped in times of congestion on the control channels.

As with other technologies, cell broadcasts are not acknowledged and GSM cell broadcasts can only be received by idle mobiles (i.e. not active in a call or data service). [03.41] Monitoring the cell broadcast channel does reduce the standby time of the phone and may be turned off for this reasons. [C56]

The largest cell broadcast allowed (using the default character set) is transmitted as 15 groups 93 characters (88 octets) i.e. 1395 characters. This GSM service clearly can transmit messages that are long enough for emergency alert service, but it may take a considerable amount of time. This equates to ½ of 1% of the bandwidth of a full 200 kHz GSM channel.

Each group of 93 characters takes 1.883 seconds to transmit. Including one latency period (e.g. the cellsite may have to wait until the next broadcast interval before initiating a transmission) a minimum sized cell broadcast could take up to 4 seconds to broadcast, and a maximum sized message about 30 seconds.

The standard test message is 258 characters long: "This is a test of the Emergency Broadcast System. The broadcasters in your area have developed this system to keep you informed in the event of an emergency. If this had been an actual emergency, you would have received official instructions and information." It would take 12 radio interface messages to transmit it, and up to 7 seconds.

If there are other alerts being broadcast (such as Location Services information or regular news and weather updates) there is no guarantee that their transmission would be stopped in favor of emergency alerts as this behavior is not specified.

GSM terminals must have the ability to ignore cell broadcasts of a type that they are not interested in or the user would be swamped with information they are not interested in. With a large number of broadcast types to choose

from it would be easiest for the user to allow them to specify a list of the alerts to allow, rather than a (much longer) list of alerts to deny. This would result in the filtering out of emergency alerts unless that broadcast type was on the 'allow' list or unless specifications were changed to mandate that certain broadcast types must be allowed through.

3GPP has withdrawn its specification (TS 24.012) which was being designed for use either with GSM or UMTS (Wideband CDMA). The work was transferred to the GSM-only specification TS 44.012, apparently leaving UMTS without a cell broadcast capability.

[03.41] recognizes the necessity of an interface between an outside entity and the GSM network to initiate cell broadcasts. However, this interface is deliberately not specified in detail. Only message 'primitives' are defined. This defines the contents of the interface messages, and the type of operations supported, but not the detailed encoding or transport protocol. This leaves it up to equipment manufacturers to design their own protocols.

The GSM network model assumes a direct connection between a Cell Broadcast Center and the Base Station. This would not allow proper validation of emergency alerts, and assumes that the initiator of the cell broadcast has access to cellsite coverage area (which is unlikely), so the model would have to be modified to incorporate an intermediate network element to perform the validation and distribution function. See above for more details on this issue.

Discussions with technical experts on GSM indicated that most phones supporting this technology do support cell broadcast. One company that provides cell broadcast capabilities in all their phones (all GSM) is Siemens. One of their phone manuals [C56] illustrates a number of issues with cell broadcast for emergency alert service:

- The service reduces the battery life of the phone (even when there are no messages being broadcast, due to the need to continually scan the cell broadcast channel).
- The service may be deactivated by the user (e.g. to increase the standby time of the phone). This would result in no cell broadcasts of any type being displayed.
- The phone only displays cell broadcasts that are on the phone's 'Topic List' (i.e. it is an 'inclusion list'). If a standard value for an emergency alert was agreed to it would not likely be in the 'Topic List' of existing phones.
- The user must identify additional types of cell broadcast to display (beyond those pre-provisioned by their service provider) by number rather than by name. This is error prone, and there is probably no way to validate the number being entered (except that it must be no greater than the maximum message id number).

Interactions with Other Services

There are other services that are designed to be used in times of emergencies.

One of these is Wireless Priority Service (WPS), published in September 2004, which provides priority access to voice channels for authorized emergency workers [TIA-917]. This service also makes extensive use of control channels due to the more complex call setup (particularly if a mobile is queued for a length of time). Consequently, there will be some competition for resources between WPS and an emergency alert system based on cell broadcast.

Another important service in times of emergency is 9-1-1 [J-36]. The ability to make an emergency call is also dependent on access to control channels and on the battery life of the phone (which is reduced by monitoring the cell broadcast channel).

The interactions between WPS, wireless enhanced 9-1-1 and wireless emergency alert services may be minor. However, an evaluation is probably wise before widespread implementation of wireless EAS.

Conclusions

The wireless service that is most suitable for extending Emergency Alert Service to wireless phones is cell broadcast. In some ways this service is suitable for the application, in some ways it is unsuitable and in other ways it could be adapted to the requirements.

Advantage of Cell Broadcast

Cell broadcast is efficient because one text message can be sent to all idle mobiles in the cell sites within the zone of the emergency.

Disadvantages of Cell Broadcast

Cell broadcast may reduce the battery life of phones, meaning that there will be more times when a call cannot be placed during an emergency due to a dead battery. Battery life is particularly important during weather or terrorist emergencies that may disrupt the mains power supply and prevent the recharging of many cellular phones.

Cell broadcasts have relatively small maximum lengths. Even for GSM, which allows alerts up to 1395 characters, they would not accommodate the maximum two minutes allowed for non-presidential emergency alert announcements (about 300 words or 1725 characters). Consequently, alerts will have to be rewritten for the wireless technology that provides the shortest messages (currently CDMA, which has a 256 character limit, allowing about 45 words, or about 18 seconds of speech).

Cell broadcast is not provided by analog and does not appear to be implemented by TDMA systems (which are unlikely to be upgraded now). Consequently, mobiles operating in these modes are unlikely to be able to receive emergency alerts sent by cell broadcast.

Cell broadcast can only be received while a mobile is idle (unless the network is specially programmed to recognize these special messages and repeat them on every active voice channel) and only when the mobile is powered on. This means that emergency alerts will still not be received when people have their phones turned off (e.g. when they are sleeping).

Current Deficiencies

Cell broadcast has a number of deficiencies currently that could be addressed. However, these would require that all existing mobiles be upgraded or replaced. Consequently a solution based on modified cell broadcast would take several years before achieving wide coverage.

The first step is the need to define standard identifiers for Emergency Alert Service cell broadcasts so that mobiles and network equipment can recognize these special messages. Mobile phone software will have to be modified so that emergency alerts are handled with the high priority that they need and deleted only when they become invalid. New network elements are required to perform the validation of incoming emergency alerts and perform the mapping from SAME geographical areas to cellsite coverage areas, based on a continually updated list of cell coverage areas. A standard interface to these new network elements must be defined.

Cell broadcast does not appear to be implemented for CDMA or standardized for UMTS. Since both of these are technologies that are actively being developed it is possible that this will change over time.

Glossary

Term	Definition
3GPP	Third Generation Partnership Project
AMPS	Advanced Mobile Phone Service
BSC	Base Station Controller
CBC	Cell Broadcast Center
CDMA	Code Division Multiple Access
EAS	Emergency Alert System
EIA	Electronics Industry Association
ETSI	European Telecommunications Standards Institute
GSM	Global System for Mobility
IDEN®	Integrated Digital Enhanced Network
MSC	Mobile Switching Center
N-AMPS	Narrowband AMPS
PCS	Personal Communications Systems.
SAME	Specific Area Message Encoding.
SIM	Subscriber Identification Module ('Smart Card')
TDMA	Time Division Multiple Access. Often refers to IS-54/TIA-136 even though GSM is also a TDMA system.
TIA	Telecommunications Industry Association
UIM	3G User Identification Module
UMTS	Universal Mobile Telecommunications System

DECLARATION OF ART PREST

Art Prest, under penalty of perjury, hereby declare and state as follows:

My name is Art Prest and I am a principal of Art Prest and Associates. I have been retained as a technical consultant to RCA. I have over thirty-five years experience in the telecommunications industry. I began my career in the Bell System, where I worked for Bell Telephone Laboratories and Western Electric in various line and management capacities including research and development of hybrid integrated circuits, manufacturing engineering of microwave radio systems, and product line planning and management of fiber optic transmission systems. After leaving the Bell System, I worked in management roles at Polaroid, and Telco Systems Fiber Optics Corporation where I became Senior Vice President for the New Venture Division. In 1994 I moved to Washington to work for CTIA as Vice President for Science and Technology. In addition to working on a myriad of technical issues while at CTIA, I served as the wireless industry's representative on the FCC Network Reliability Council Steering Committee and on the FCC Network Reliability Council 2 in 1996, and the subsequent FCC Network Reliability and Interoperability Council in 1997. From 1998 to 1999, I was as a member of the Telecommunications Industry Sector Group of the President's Council on Year 2000 Conversion. From 2000 until 2004 I was Vice President and Chief Technology Officer for Alpine PCS and RFB Cellular, two independently owned rural wireless carriers. At Alpine PSC and RFB Cellular I was responsible for dealing with Alpine's and RFB's technical and regulatory issues. In 2003 and 2004 I served as a member of the Board of Directors of RCA, the Rural Cellular Association. I am also on the Board of Directors of the E911 Institute and Chairman of the E911 Institute Issues Committee on Rural E911 Issues. In addition I represent RCA on both the Emergency Services Interconnection Forum (ESIF) and the FCC's Network Interoperability and Reliability Council VII Focus Group 1A. In October 2004 I formed Art Prest & Associates, a consulting firm that serves the needs of rural carriers. I hold one patent involving the manufacturing of hybrid integrated circuits. I received a Bachelor's degree from Northeastern University and an MBA with Honors from Boston University.

While reviewing the status of the Emergency Alert System (EAS) in the United States, I became aware of the development and use of the National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) National Weather Radio (NWR) receivers that incorporated the Specific Area Message Encoding (SAME) digital codes that allows users to receive EAS messages targeted to selective geographic areas.

I became curious as to how portable and power efficient newer such radios were compared to older versions that I had bought previously. In my search I discovered the Oregon Scientific's handheld WR-102 NWR radio that receives all seven NOAA weather radio channels and can be programmed using Specific Area Messaging Encoding (SAME) technology to display only warnings and alerts that occur in local areas (up to six counties can be programmed). The radio continuously monitors National Weather Radio Emergency Alert broadcasts and sounds an alarm and audible message from the radio speaker whenever an alert comes through. The WR-102 runs on three AA batteries

and also has a plug-in jack for AC power. The WR-102 is a little larger than an older style cell phone and measures 2.75 x 4.25 x 1.25 inches, and weighs 4.6 ounces. The antenna sticks up about one inch. I bought the WR-102 from Amazon.com for $29.99 including shipping. The radio can be set in standby mode so that it monitors for an incoming EAS message. When an EAS message is received the radio is turned on from standby mode, a loud alert tone is heard followed by a voice message that describes the nature of the alert. At the same time a blinking green LED begins blinking red and a short text message is displayed on the LCD screen. At the end of the alert message the WR-102 resets itself to standby.

I was concerned about the battery life but to my surprise the three AA batteries lasted over seven days (168 hours) before a low battery indicator began to blink on the LCD screen. At that point the radio had been on continuously in the standby mode in addition to about twenty minutes of use listening to local NOAA weather forecasts.

A photo of the WR-102 is attached to this statement. Additional information is available from the manufacturer's website:
http://www2.oregonscientific.com/catalog/2_6_241.asp#

Integration of a NWR receiver into a cell phone would appear to be feasible at a reasonable cost assuming large volumes and sharing of components between what is required for a NWR receiver and what is required for a cell phone. Because the NWR receiver uses the 162 MHz frequency band a new antenna design would be required. Given the $29.99 cost of the Oregon Scientific WR-102, it seems reasonable to believe that the EAS specific receiver parts might add only a few dollars to the cost of the cell phone.

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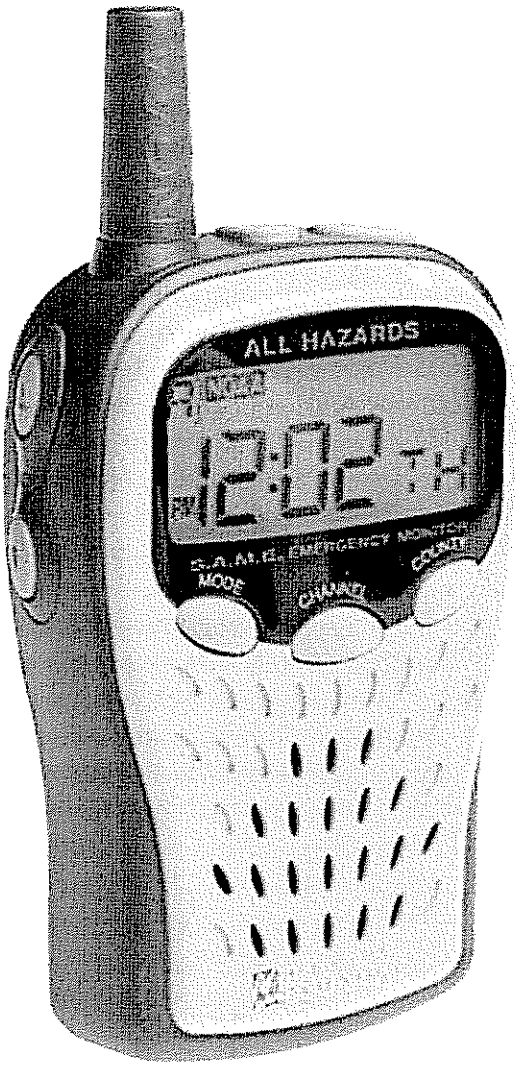
Oregon Scientific Model WR-102 SAME Weather Radio
(shown ~ actual size)