An Improved Alerting Solution for Public Safety

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Public Safety needs access to new methods for wide-area alerting. Traditional one-way paging systems provide no confirmation from pagers receiving an alert, and they provide no feedback from responders as to their disposition or course of action. Newer 900 MHz Narrowband PCS technologies provide these features at a cost comparable to traditional paging, and the NPSTC should take steps to gain control of spectrum compatible with these systems.

I Overview

Wide area alerting is a critical component of any public safety communications system. At present, this function is usually performed by use of traditional, one-way display and voice pagers, with underlying technology that has remained unchanged for over a decade. While traditional paging is extremely simple and reliable at what it does, it also has serious limitations. Most notably, an alerting system based on one-way paging requires other, potentially unreliable paths of communication for responders to acknowledge receipt of instructions.

Many newer technologies available to public safety have "acknowledged alerting" features, but none of them can provide usable, primary alerting capabilities on any meaningful scale. Existing mobile data systems are too expensive for wide deployment to volunteer battalions, and they are too bulky for continual personal use. Several contemporary PCS technologies have integrated voice, data, and paging, but they involve expensive monthly charges and an unacceptable reliance on commercial networks. Broadband solutions such as 802.11 provide high-capacity local-area connectivity but they have neither the coverage nor the resilience for wide-area alerting.

In contrast, 900 MHz Narrowband PCS (N-PCS) provides acknowledged alerting capabilities in an implementation uniquely suited for public safety. Small belt-worn devices with long battery life, powerful group alerting features, and high-power simulcast coverage combine to provide capabilities not seen with other technologies. Numerous vendors provide N-PCS equipment at costs comparable to that of traditional paging, with available product ranging from consumer-grade messaging units to GPS location transponders to hardened devices specifically designed for fire and EMS.

Unfortunately, the FCC auctioned all available N-PCS spectrum to commercial carriers in auctions 1, 3, 41, and 50, and while N-PCS devices themselves also operate in the 900 MHz SMR band, this spectrum is only available to public safety under waiver of operation. Lack of spectrum has prevented widespread adoption of this otherwise extremely well-suited technology, but the FCC recently announced plans to auction 199 channel pairs from the 900 MHz private land mobile radio pool. *It is vital that the NPSTC secure a public safety allocation from this pool prior to any such auction.*

II The Benefits of N-PCS Alerting

From an agency standpoint, the benefits of N-PCS alerting over traditional paging and mobile data methods are vast. This section attempts to summarize some of the more relevant features.

- **Acknowledged Alerts**
  Upon receiving an alert, N-PCS pagers transmit real-time feedback to the originating party, including,

  - *acknowledgement that the pager received the message,*

  - *acknowledgement that the user viewed the message, and*

  - *optional responses from the user.*

- **Assured Delivery**
  N-PCS networks hold messages for users that are out of range and deliver them when they reenter coverage.

- **Low Cost**
  N-PCS pagers are comparable in cost to alphanumeric pagers, and less expensive than analog voice pagers.

- **Long Battery Life and Small Size**
  N-PCS pagers are small belt-worn units with battery life measured in terms of days or weeks.

- **Interoperability**
  N-PCS pagers are scanning devices. A pager based in one county can register for service in another county on another frequency. A pager leaving agency coverage can roam onto a national carrier. During periods of mutual aid, systems can be dynamically configured for interoperability according to real-time, changing requirements. This activity is completely transparent to the user, who continues to seamlessly receive alerts.

- **High Performance**
  An N-PCS network can alert a response group in less than 5 seconds. The group size is unimportant; 50, 500, or 5000 responders can all receive the same alert message at the same instant and then reply individually.

- **User Message Initiation**
  N-PCS pagers are input devices as well as alerting devices, allowing users to generate their own messages. This streamlines response procedures requiring key personnel to escalate/propagate alerts from the field.

- **Over-the-air Encryption**
  Homeland security and emergency healthcare often require encryption to protect operational security and patient privacy. While traditional one-way pagers have no viable encryption standard, N-PCS systems provide effective over-the-air key programming and 128-bit encryption.

- **Highly Redundant, De-Centralized Systems**
  N-PCS networks use distributed architectures with redundancy at every level. Low interconnect costs allow hot standby equipment located miles away from primary equipment, redundant coverage through additional base stations, and standby communications paths. In cases of absolute catastrophic and

complete network failure, N-PCS devices continuously scan channels to find secondary networks.

- **Spectral Efficiency**
  N-PCS operates over 12.5 KHz channels and supports 20,000 or more devices per channel pair.

- Flexible System Implementation
  N-PCS networks support simulcast, zoned, and cellular designs using high-power or low-power sites, allowing agencies to optimize coverage and capacity on a case-by-case basis.

- **Simplified System Management**
  Day-to-day management of traditional paging systems require hard contact programming to provision and maintain user equipment. N-PCS networks perform most of these tasks autonomously over-the-air, allowing user equipment to be managed remotely without physical interaction. This greatly reduces recurring management effort and secures the network against unauthorized use.

III The Need for N-PCS Alerting

In late 2004, the Boston Globe reviewed public records of 3.3 million building fires collected by the National Fire Incident Reporting System from 20,000 fire departments nationwide. They concluded that only 35% of departments were able to reach 90% of building fires within the six minute window required by the NFPA.[1] These statistics point to a lack of resources as the root cause; however, communications shortcomings also play a critical, exacerbating role. All responses begin with an alert, and the alert must successfully mobilize the response force before any other operational issue even becomes relevant. While problems during the alert phase will delay or disrupt the response, early and accurate feedback from alerted responders helps commanders marshal their limited resources more effectively.

One-way paging is famous for alerting responders successfully, and it is equally famous for its missing acknowledgement path. During the terrorist attacks on September 11, 2001, this was endemic to the response process. From the *Arlington County After Action Report on the Response to the September 11 Terrorist Attack on the Pentagon,* two juxtaposed statements summarize this paradox:

> The paging system seems to be the most reliable recall device, but most firefighters are not issued pagers.[2]

> Directed "call-back" confirmation calls acknowledging receipt of pager instructions further compounded the overwhelming telephone traffic.[3]

Thus, while paging systems reliably notified responders even during this period of profound system failure, PSTN and commercial cellular congestion prevented responders from reliably acknowledging receipt of their instructions.

This dangerous shortcoming is instantly remedied with the use of N-PCS pagers on agency-operated 900 MHz N-PCS networks. This solution is available now, at very reasonable cost, using proven, veteran technologies from a variety of competitive vendors. From the *Homeland Security Journal*,

Narrowband PCS has demonstrated compelling benefits in terms of functionality, geographic coverage, in-building penetration, and the ability to support reliable delivery in difficult environments. It is positioned to be extremely helpful to emergency personnel for public safety and other homeland security applications through its wireless instant messaging, broadcast messaging, email, and location capabilities.[4]

IV Conclusion

Traditional paging systems rely on separate, unprotected channels of communication for acknowledgement. This reliance creates vulnerability during alert phase of the response, which in turn places the entire response process at risk. During large-scale events or events involving volunteers, the risk of disruption or delay is particularly severe.

Such vulnerability is unacceptable and unnecessary. 900 MHz N-PCS provides a proven, vastly superior, more appropriate, and more affordable alerting solution with its own acknowledgement path. Access to an allocation of 900 MHz channel pairs will make N-PCS technology available to public safety agencies, and this will create safer, more reliable, and more resilient overall communications systems. With an upcoming auction, the 900 MHz PLMR pool is an excellent place to seek such an allocation.

References

[1] The Associated Press. Report: Firefighters Responding Slower. Retrieved February 10, 2005 from http://www.msnbc.msn.com/id/6886107

[2] Arlington County After Action Report on the Response to the September 11 Terrorist Attack on the Pentagon, p. A-36

[3] Ibid. p. A-39

[4] Kapsales, Peter (March 2004). Wireless Messaging for Homeland Security/Using Narrowband PCS for Improved Communication During Emergencies. Retrieved February 10, 2005 from http://www.homelandsecurity.org/journal/Articles/displayarticle.asp?article=110

Attachment I — Typical Agency N-PCS System Implementation
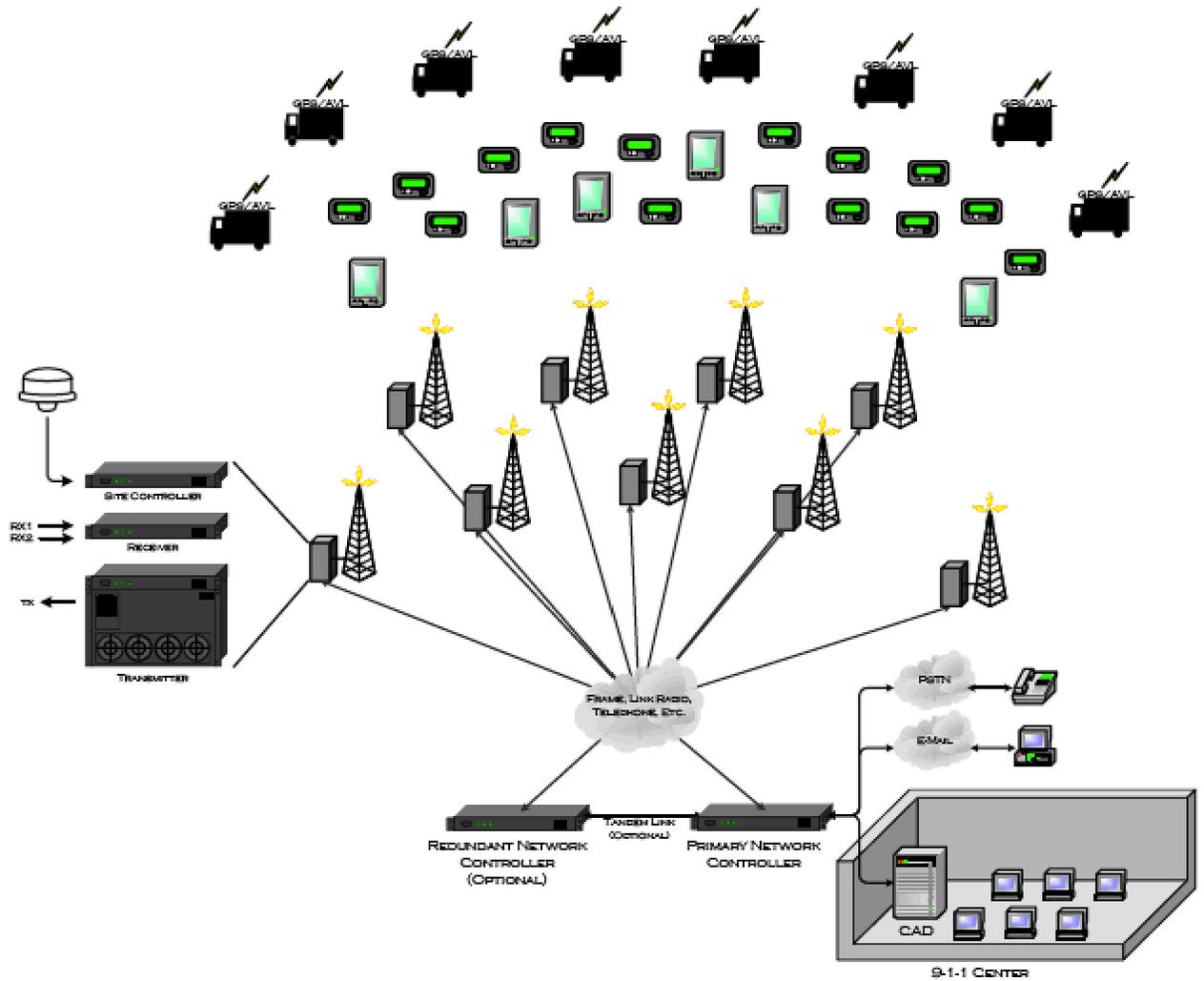
Attachment II — Examples N-PCS Subscriber Equipment