

USA Mobility – Executive Summary of Paging Capabilities for Emergency Response

In order to assist municipalities, hospitals and emergency management organizations in an assessment of the communications capabilities of first responders and other emergency management personnel, USA Mobility is pleased to submit this overview of the capabilities of paging in the important area of critical and emergency communications.

About USA Mobility

USA Mobility, headquartered in Springfield, Va., is a leading provider of paging, cellular, enterprise applications and other wireless services to the healthcare, large enterprise and government sectors. USA Mobility offers traditional one-way and advanced two-way paging via its nationwide networks. In addition, the company offers mobile voice and data services as a nationwide business partner for Sprint and T-Mobile including BlackBerry, wireless Internet connectivity and GPS location applications. The company's product offerings include wireless connectivity systems for medical, business, government and other campus environments.

USA Mobility supplies mobile connectivity solutions to over 40% of all hospitals in the United States. Notable government accounts that use paging as an integral part of their emergency and disaster communications include: the Federal Emergency Management Agency (FEMA), the Department of Homeland Security, the U.S. Department of Health and Human Services' National Disaster Medical System (NDMS), VA Hospitals, the Department of Energy, and the Austin Coalition.

The Value of Paging

Emergency response organizations depend on the reliable service of paging technology for the critical, life-saving missions they must fulfill each day. There are both architectural and process-oriented reasons for this reliability. Paging technology is substantially different from that of the more familiar cellular network. Because of these differences in network architecture, important reliability advantages of paging include superior in-building signal penetration, overlapping coverage on the ground resulting from signal simulcasting, independence from the public switched telephone network and a survivability only satellite transmission can bring. In addition, USA Mobility maintains a carrier-grade network operations center in order to deliver uninterrupted performance to this important user base.



Police, fire, critical care and rescue organizations have entrusted paging technology for the delivery of their most critical messages for decades. There are several reasons for this:

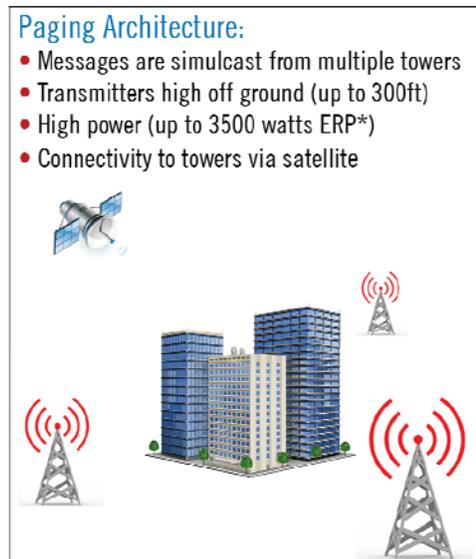
1. **Group Cap Codes** – This fast and efficient method for sending out critical messages to groups is unique to paging technology. A common address is burned into multiple pagers, whereby one message is sent, one message is transmitted, and multiple devices receive the message simultaneously. For example, when sending a message to 500 pagers sharing a group cap code, one message is sent, one message is transmitted and 500 pagers receive it. If this same message were to be sent using cellular technology, the message would need to be sent and transmitted 500 times in order to be received by all 500 devices.

2. **Cost-Effectiveness** – Paging devices are offered at a fraction of the monthly service cost of a cellular device. Large emergency response organizations can easily deploy paging devices and service at a reasonable cost. Paging works very well as a back-up communications tool.
3. **Usability** – Members of emergency response teams often have their hands occupied, making immediate voice communication impractical. A critical message can be delivered to a pager and then read at a later time. Pagers also offer extended battery life that can last up to a month, so users don't have to take time to plug them in during the day.
4. **Overall Reliability of Service** – Paging has a decades-long history of meeting the reliability demands of the Government and Healthcare industries. The USA Mobility network is supported by carrier-grade network operations facilities and procedures including 24/7 Network Monitoring and 99.9% wireless network availability. Documented Disaster Response plans include backup terminals and generators, COWs (Coverage-On-Wheels) and a nationwide team of field technicians. Dedicated support channels for medical and government accounts and network engineering support teams comprised of industry experts provide service and support. The company owns and operates a satellite uplink facility and nationwide Network Operations Centers (NOCs).
5. **Broad Coverage** – Paging offers expansive coverage both in major metropolitan areas as well as suburban and rural areas. Paging technology also offers the ability to cost-effectively establish custom coverage throughout an entire campus, including basements and parking garages. Expansive wide area coverage is used to reach off-site/off-duty personnel.

Reliability of Paging Technology

Paging technology is particularly well suited for emergency response organizations. Here are some of the unique features of paging technology that impact its reliability characteristics:

1. Paging networks provide redundant wireless coverage on the ground to best serve the coverage needs of mission-critical users. As emergency events often involve physical damage to property (including wireless transmitters), having overlapping coverage is critical for continuation of service. Cellular networks are not designed with such redundancies.
2. With the paging network architecture, all messages are “simulcast” from multiple towers within a specific coverage zone at the same time. These transmitters are high off the ground (up to 300 feet compared with approximately 90 feet for a cellular tower). Radio transmissions for paging service utilize high power, as well, resulting in superior in-building coverage. Paging transmitters operate with an ERP (Effective Radiating Power) of up to 3,500 watts. For comparison, cellular transmissions operate with an ERP of approximately 100 watts. If one paging tower is downed, other towers in the area can still receive messages.
3. Paging networks utilize satellite connectivity between the core messaging network and the transmitter towers in the local area. Using satellites eliminates a critical point of failure for many wireless systems. Because message data is transmitted back to the network core via satellite, the local public telephone network that is often affected or downed as a result of a disaster



situation, as with Hurricane Katrina, is bypassed. The satellite dishes are situated at ground level, making restoration of an offline tower a function of restoring power using a generator and re-pointing the satellite dish.

4. The core network elements of USA Mobility's network, specifically, are fully redundant to prevent a distant problem from affecting the network. This redundant infrastructure includes diversity on WAN/LAN, messaging switches, power sources and satellite uplinks. USA Mobility owns and operates its own satellite uplink facilities and Network Operations Centers in Plano, Texas and Stockton, Calif. This redundancy is intended to ensure operational continuity of all network systems.

Additional Benefits of 2-Way ReFLEX Messaging

In addition to the benefits already mentioned regarding one-way paging for emergency response organizations, 2-way messaging offers additional levels of utility and reliability. Pagers with enhanced text displays and QWERTY keypads, 2-way messaging devices allow for real-time communication between first responders and emergency management personnel.

The 2-way network architecture involves wireless "mesh networking" at the base station level that permits mobile devices to communicate bi-directionally with multiple base stations simultaneously. This delivers unprecedented, always-connected service and coverage reliability for mobile devices compared with the single base station, single link implementation of all other packet data networks such as broadband cellular or Mobitex networks.

"Assured Message Delivery" provides a high degree of message delivery reliability for critical communications in the field. ReFLEX systems intrinsically operate in such a way that multiple attempts will automatically be made to deliver both outbound and inbound messages. These multiple delivery attempts are essentially invisible to user.

With the "Store & Forward Operating Mode", if for any reason the 2-way device is unable to receive an incoming message (out of coverage area, too deeply underground, device is turned off), the network will continue to attempt delivery until it receives a positive receipt acknowledgement from the device.

It is important to note that this ability of a 2-way pager to overcome an initial delivery attempt failure cannot be matched by real-time systems such as cellular. In a cellular system, if an outbound or inbound call cannot be completed when initiated, the attempt has failed completely leaving the initiator no choice but to retry the call manually. During peak traffic periods, such as those that occur during an emergency, frequent "retry" attempts can produce an "avalanching" phenomenon, which dramatically increases system traffic loading to leave cellular, and other real-time systems totally "gridlocked" and useless.

ReFLEX also features inherent capabilities for battery consumption. It is typical for ReFLEX devices to operate in coverage with normal use continuously for several weeks on a single AA battery.

Note: While 2-way pagers do not feature group cap codes, there are several group messaging options available for rapid message distribution within the ReFLEX protocol.

Preparing for Large-Scale Emergency Response

Here are a few things that have been said about paging, following two of the most significant emergency response efforts in U.S. history.

9/11:

“From the initial wireless message to notify our police, fire, EMS, County Manager and ECC staff about the crash at the Pentagon, wireless messaging from USA Mobility has performed flawlessly. All day, every day, wireless messaging has been a reliable aspect of inter- and intra-agency communications. Wireless messaging has always been an integral part of our public safety life here, but it has proven to be mission critical to the work we do. Effective communications is vital to an operation such as this, and we have relied on it and continue to rely on USA Mobility to provide this critical function.”

*Lisa Thompson
Wireless Communications Systems
Manager Arlington County, Va.*

“Almost all aspects of communications continue to be problematic, from initial notification to tactical operations. Cellular telephones were of little value... Radio channels were initially over saturated... Pagers seemed to be the most reliable means of notification.”

*Quote from the 9/11 Commission
Staff Statement No. 14.
“Crisis Management”*

Hurricane Katrina

“I am with an Urban Search and Rescue for FEMA and with the cell and data service down and systems being flooded. I just want you and your readers to know that [USA Mobility’s] ReFLEX [network] is working fine and communications are flowing through the units! We are allowing people to send e-mails to loved ones to let them know they are alive and well.”

*Carter C. Blumeyer
Communications Specialist, Boone County Fire/ MO-TF1 (COMS)
US-Forrest Service (COML, COMT)*

USA Mobility’s dependability became more evident after Katrina when other cellular and paging providers lost service and the USA Mobility system was still going. The problem was that you could not get in touch with anyone by landline or cell phone. The phone numbers being sent to customers had 504 area codes. Calls to phone numbers in this area code could not get through due to Bell South’s system being out of service. Plus, many employees that carried pagers either left them at their homes as they evacuated or lost them during the evacuation. USA Mobility was able to supply them with 70 replacement pagers overnight.

*Mike Meyers
Manager – Information Systems
Tulane University Hospital & Clinic*

While 9/11 and Hurricane Katrina are the two most widely referenced disasters in recent U.S. history, local government officials give them only abridged consideration (at best) when making policy decisions. The damage to property and infrastructure was monumental, as were the rescue and continuity efforts. In terms of scale, these two events were catastrophic beyond reasonable budgetary and personnel considerations.

Even in population centers on par with New York City and New Orleans, the natures of these two disasters are just too grave for many municipalities to translate into their general preparation efforts. The 9/11 terrorist attacks and Hurricane Katrina tend to come into play only when planning for the “worst case scenario.”

Let us, then, turn our attention to the bridge collapse in Minneapolis on August 1, 2007. This event was very much localized in scope. The death toll was limited to 13, only 79 were injured, missing persons numbered in the 20-30 range and only a few hundred yards of roadway were destroyed. Officials knew what happened, where it happened and to whom it happened. In short there were very few “unknowns” with which to contend.¹

Even under these comparatively narrow circumstances, cellular phones were rendered useless as a reliable communication system for first responders and other rescue personnel. Many news outlets reported that cell phone service in the greater Minneapolis area went down, citing the fact that cell phone towers and antennae were overloaded by the sheer number of users trying to place calls.¹

Why do cellular phone networks congest in the wake of emergency situations? Answer: private citizens.

First of all, 911 lines are flooded with people seeking assistance. People place many of these calls while in close proximity to the emergency situation--likely using cellular phones.

Human nature is also a culprit. As a disaster situation unfolds, people are naturally going to talk about it.

"Where are you?"
"Are you safe?"
"I'm just calling to let you know I'm alright."
"Have you seen the news?"
"How bad is it?"



Cellular networks simply are not built to handle such large call-volume spikes. Regardless of the magnitude of the event or the extent of the damage to the cellular infrastructure, cellular networks have failed in emergency situations. What's more, they will continue to do so. It is not a matter of physical damage to the cellular network; it is instead a matter of congestion.

The key thing to remember is that cellular networks do not (necessarily) “break” during emergencies. They simply were not built for these capacity levels in the first place.

This situation doesn't appear to be getting better anytime soon. During the record-breaking 38 days and 261 rounds of the Federal Communications Commission's 700 MHz spectrum auction, the national commercial-public safety D-Block license was the one “black eye.” Not only did D Block fail to meet its reserve price, it only received one bid².

Under the FCC's auction rules, the D Block was supposed to be shared between public-safety and consumer users, with first-responders having priority access during emergencies. The D Block winner was to have to negotiate a network-sharing agreement with Public Safety Spectrum Trust Corp., the non-profit first responder D Block licensee².

Paging, on the other hand, is not subject to the same congestion issues as cellular phone service. The reasons are simple: Paging networks are built to accommodate a high percentage of users at times of congestion. Both 1-way and 2-way paging are sequential in nature, with the first message in being the first message out. Paging also has fixed message lengths, which, in contrast to the unlimited connection time for cellular, allows for more equal sharing of bandwidth. With cellular, one person can monopolize a

channel for a particular cell site for a long period. In paging, your message is handled and done, with the system moving on to the next message.

One popular, albeit mistaken, train of thought is that in the “worst case scenario”, all communications will likely be down anyway, so cellular makes good sense for emergency communications up to that point. This logic is flawed in two ways. First, as has been demonstrated, cellular networks will fail due to congestion well before reaching a “worst case scenario.” Second, one communication method—paging—has a well-documented history of surviving the most dire of circumstances, including 9/11 and Hurricane Katrina.

USA Mobility’s Commitment to First Responders

Throughout recent disaster situations, one network has proven its ability to deliver reliable wireless communications to those who need it most. Emergency response groups in federal, state and local government agencies, police and fire departments, hospitals and other critical care facilities, search and rescue operations, paramedics and utility services are all among the list of critical personnel who have counted on USA Mobility’s First Responder Communications Network through countless emergency situations.

With wireless technology that is fully deployed nationwide and tested over decades, USA Mobility’s wireless messaging capability has enabled continued communications throughout natural disasters and other crisis events. In preparation for disaster situations, USA Mobility’s First Responder Communications Network is built, hardened and proven.

Conclusion

Hopefully, this document will serve as an important resource when considering short- and long-term plans for emergency response and emergency management communication. USA Mobility trusts that the advantages of paging technology over that of cellular phones for emergency communications have been made both clear and compelling.

Paging represents clear advantages over cellular phone service:

- Proven communications survivability and utility, even in the worst of situations
- Communications that will not suffer from congestion in the wake of an emergency
- High-power, simulcast transmissions
- Superior coverage, including in-building penetration
- Satellite connectivity
- Unique group messaging capabilities
- ReFLEX message delivery assurance
- Cost-effective service, designed with First Responders and Emergency Management in mind

References

1. Thomas Wailgum, "Minneapolis Bridge Collapse: Why Cellular Service Goes Down During Disasters," *CIO.com*, 3 Aug. 2007
2. Dan Meyer, "IT'S OVER: 700 MHz Auction Ends After 38 days, 261 Rounds", *RCR Wireless News*, 18 March

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