REPORT ON FOUR TECHNOLOGIES DEMONSTRATED AT UCF ON JULY 27, 2007

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Special Thanks to

Dr. James Pearson, Mr. James Uhlir, Jr., Mr. Brian Dunn, Mr. Libo Yang for their contributions to prepare the demo.

Thanks to vendors

Madahcomm, Athoc, ConnectED, and ViaRadio for participating the demo.

Please Note: Although specific hardware and systems were demonstrated in the 27 July test and in previous emergency alert/communications demonstrations at UCF, this report as well as the previous demonstration report, should not be interpreted as providing an endorsement of any vendor or provider by the University of Central Florida.

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Introduction

UCF has been conducting research on Intra-Campus Emergency Mass Notification (EMN) Communication systems within the Florida state universities and community colleges since 2005. During the first stage research, we set up three key requirements for an alert system:

a. Alert as many people and as quickly as possible in a normal condition
b. Alert as many people and as quickly as possible without power and phone service
c. Constantly deliver alerts to specific groups of people in different locations.

After evaluating several technologies (including single siren covering the whole campus, conventional FM radio and weather radio, phone tree systems, hosted systems), we issued the following recommendations assuming limited funds in Feb 2006:

1. Carefully examine a siren/audio system for main campuses, combined with campus FM to establish a basic alert system for requirements (1) a and (1) b. The FM system should be utilized even if the siren is not chosen for installation.
2. Implement a high-speed reverse 911 system to provide very basic service to all 39 universities and colleges for requirement (1) c.
3. Endorse a host-based emergency notification service and encourage students, faculty, and staff to sign up on a voluntary basis. This will enhance our capability to meet all requirements.
4. Each campus should develop or enhance other means of notification such as bulk email, phone hotline, website, campus TV, campus WLAN, etc. Most of these will use existing facilities and thus be low cost. Education and promotion is essential to improve the effectiveness of any notification systems. These efforts will enhance our capability to perform mass notification for a wide range of emergency events.

During demonstration on Feb 6, 2006, several problems surfaced, mainly, (a) several sirens are needed to cover 1700 acres of UCF main campus with only tone coverage. Sirens are very intrusive. Since none of nearby counties has ever used sirens for emergency alert, local residents are not used to siren tones. Siren tone often just carries one message. Frequent tests reduce its effectiveness. Over the last past 18 months, new technology called distributed voice speakers system has drawn our attention. The key idea is to distribute the clear voice message to the specific zoom that could just cover a building or two or entire campus. It is much more expensive, but in term of dollar per student it is good option for colleges and universities with high student population. MadahComm provides such a technology. (b) For FM, only around 5% students, staff and faculty members carry FM receivers on campus, and it just broadcasts voice message to a wide area. However, in Florida, FM and TV stations often recovered first after a major hurricane or a severe thunder storm. Typical down time for a FM radio or TV station are a few minutes to a

few hours. Typical power or telephone outage lasts from hours to days. So it is good candidate for emergency alert, if we can equip with major offices in each building a radio receiver and if we can deliver the specific message to a specific receiver. ViaRadio provides such a technology. (c) As we shown in the first demo, phone tree system and hosted system may be not effective to inform people on highly populated campuses due to trunk and cell tower capacity. But these systems are effective and efficient to inform students and staff members off-campus or small campuses typically embedded inside other communities. In the first demo, we not only evaluated how quickly and how many calls the system can perform, but also how quickly the system can terminate undelivered calls waiting in the queue. Both Send Word Now and 3N delivered very good results. In the first demo, we just called about 1000 phone numbers which is less than 2% of students and staff population. More importantly, we believe that when students input their phone numbers, many could be wrong numbers or invalid numbers. It is important to evaluate how to handle invalid numbers. We selected ConnectED and AtHoc to perform the test driver. ConnectEd was selected by Mr. Brian Dunn who is responsible for selecting a vendor to provide hosted mass notification for UCF main campus. AtHoc was recommended to us by MadahCom due to the inter-operability between MadahCom and AtHoc system. We regretted that AtHoc decided not to perform our test of 5000 calls, so there is no result for this company in this report on hosted call capability.

As part of this ongoing work, the UCF team performed a live demonstration of effective all-hazards EMN solutions for campuses. The UCF team is led by Dr. Lei Wei, Assoc. Professor in the Department of Electrical and Computer Engineering [(407) 823-5098, leiwei@mail.ucf.edu] and supported by Dr. Jim Pearson, Special Asst. to the VP for Research and UCF coordinator for homeland security programs [(407-823-6858, jpearson@mail.ucf.edu]. The research has been funded to date by the US Department of Homeland Security, Office of Domestic Preparedness FY05-06 funds assigned to the Higher Education Subcommittee of the Florida State Working Group for Domestic Preparedness, by the UCF Office of Research & Commercialization, by hardware funding from Prepare Florida, and by donations from Madahcom, Inc. The first stage research report can be found at http://ec.creol.ucf.edu/ or http://LLIS.dhs.gov. The result of second demonstration will also be posted at both websites.

It is important to mention that this is just one test. One needs to carefully read the test procedure before interpreting the data and our observation. Our test setting often represents worst case situation and often non-typical operation condition.

Demonstration Procedure and Results

Hosted System (ConnectEd)

Procedure: We comprised of list of 5000 dummy phone numbers and 177 valid phone numbers in Harris Corporation Engineering Center building. The dummy numbers represent bad numbers and surge of truck traffic mimics the surge of call volume during the emergency. The valid numbers are uniformly distributed inside the dummy numbers. The list was handled to ConnectEd at 9:15 am and demo was started at 10:10 am. Our first request was to send message #1 (“this is testing message #1 from ConnectEd, repeat Message #1”). A few minutes later, we requested ConnectEd to terminate the first message on the remaining undelivered phone numbers and immediately started the second message (“this is testing message #2 from ConnectED, repeat Message #2”). Before the test, we distributed evaluation forms to each faculty and staff members for their office phone and lab phone. After the test, we collected the form and compared these results with Dial log from ConnectEd.

We select 5000 dummy numbers since significant portion of phone numbers in student registration data base could be bad numbers or invalid. It is an extremely rare case that a large portion of number is invalid. We believe the system can handle most of real situations on invalid

numbers, if a system can handle this extreme case. We did not provide this list to the vendor, so that it is impossible for them to find it out beforehand.

We also did not inform ConnectEd about our trunk capacity. It is impossible to push 5000 calls through our trunk. The realistic number is around a few hundreds of calls during the test period. So, around 10 to 20 valid calls would be delivered. This is the worst case situation. Typically, a service provider knows the trunk or cell tower capacity beforehand, so they can limit their call capacity not to overflow the trunk or cell tower. However, it is hard to estimate the exact capacity during real emergency, since the capacity in one zoom is typically influenced by other zooms. It is our own decision not to have the provider to limit the call flow to accommodate the trunk capacity.

We examined the capability of terminating undelivered call since during the real emergency the message could change from time to time. During the first demo, some vendors could not terminate the first call on time, many of our observers received second call first, then the first call. This is unacceptable. For example, if the first message is “Shooting alert, but campus is still open” and the second message is “evacuating the entire campus and campus closed”, a wrong order must be avoided. ConnectEd did not know when we would request to terminate the first call, so no intervention can be performed beforehand.

Key observation and results: At 10:10 am, we requested ConnectEd to send message #1 to all 5177 phones. The number of calls exceeded the company representative’s account limitation. We were glad to see that it just took 2 minutes for them to solve the problem and start the calls. After that, the representative recorded live message #1 and initiated call #1 around 10:12 am. As shown in Table 1, about 9 observers received the first call around 10:13-10:17 am. According to ConnectEd call log about 23 valid phones have received the first call, including all 9 observers who submitted their reports. It projected that the total number of calls reached to UCF is (5177/177)*23=672 calls, which is very good result since our trunk is less than 500 simultaneous calls. Examine closely on their log, they reached 4508 phones, many of them were identified as “bad number,” “busy,” “no answer,” “answering machine,” “network busy,” “fax/modem,” etc. As our engineer indicated to us, the unclear test results were probably resulted from our local carrier, rejecting the calls or providing an "all circuits busy" message, could be interpreted as an answering machine, etc. It's important to know this, so as not to give a false impression that the problem is worse than it really is.

At 10:17 am, (5 minutes into the first call), we requested ConnectEd to terminate the first calls. Its representative called the call center to manually terminate the remaining undelivered calls. None of observers reported received call #1 after 10:17am. This is the best result we have seen so far. Then, it took a minute for the representative to record live message #2 and initiate the second call. This time 11 observers reported and 27 valid phones have received the second call within 4 minutes. This is consistent with the first call. Most importantly, none of observers reported that they received calls at the wrong order. All procedures were terminated at 10:27am.

Table 1: Observer record

phone number	**Time Rx #1 call**	**time Rx #2 call**
4078232341	n/a	10:24am
4078232784	10:17am	10:25am
4078233957	n/a	10.25am+10:26am
4078820128	10:23am not sure #1 or #2	
4078822313	10:16am	10:23am
4078232750	10:17am	10:25am
4078232782	10:17am	10:25am
4078820133	10:15am	10:23am
4078232779	10:17am	10:25am

4078232622	10:17am	10:25am
4078233027	10:13am	10:25am

Distributed Speaker Systems (MadahCom)

Procedure: We are fortunate to receive a Madahcom system hardware/software donation. Three weeks before the demo, Madahcom engineers came to UCF campus to install their donation equipment in Harris Corporation Engineering Center (HCEC) and CREOL building. The central controller is located in HCEC Lab 334. The central controller is connected via a cable to antenna on the top of roof. It then connected to CREOL unit via wireless connection. Each wireless unit then connected a number of speakers via wires. 4 directional speakers cover hallways at the first floor in the HCEC building, two speakers cover the common outdoor area between HCEC and CREOL buildings, several speakers cover the CREOL building addition area.

We put the MadahCom system under the following simulated situation. 10 am in the morning, police department and fire station receive information that fire alarms set off in three buildings: Engineering building 1, HCEC building, CREOL building, simultaneously. Quickly check video camera record the police department identified a suspicious package at the open area connected to three buildings. Now we need to use MadahCom system to inform people inside three building to evacuate the buildings but not via the exits near the package. We requested the MadahCom engineers to deliver three different messages to different zooms simultaneously.

Key observation and results:

During the preparation stage, installation of the system needs many wall penetrations for speaker cables, Antenna installation requires roof access. Some buildings have been designed to accommodate these installations, while others were not and could be troublesome. In any case, hazard areas are needed to be avoided. Installation cost is expected between 30% to 50% of the total cost, which is typical for such a system.

To cover twenty buildings like HCEC buildings, it is estimated that more than 10 antennae will be placed on the roofs; although the antennae are small in size, it does raise questions on their survivability through storms, since roofs are hard-hit areas in a major storm or hurricane. According to Madahcom engineers, Madahcom currently served areas in Key West and the Gulf Coast and have never had the antenna damage problem over the last several years.

During installation at CREOL building, MadahCom engineer showed us the possibility of using fire alarm intercom to make voice alert. However this capability was not demonstrated though MadahCom has dozens of such installation. We are aware of fire alarm code (NFPA72) regarding mass notification using fire alarm. We will make some comparison study between MadahCom system and voice evacuation systems manufactured by fire alarm companies.

During installation and demonstration day, Madahcom engineers have shown us that its controller unit can be moved from one location to another easily. According to Madahcom engineer, two controller units located in different locations can control the system from either location via its own wireless link or via internet. Via wireless link shall be reliable to against any intentional interference due to its military proved spread spectrum frequency hopping technology. Via internet, its capability of anti-virus and anti-hackers for university networks needs to be evaluated by network security expert, although it is worth noting that the MadahCom WAVES system has been approved by the NMCI (Navy Marine Corps Internet) network.

The Madahcom system can deliver a live voice message to any or all zones, even if its main controller malfunctions. However, it is limited to two simultaneous live messages. Madahcom's solution is to deliver live voice message to the wireless transceiver in each zone, then activate those messages and repeat using short command codes. This capability was not verified during the test.

On the demo day, Madahcom system had delivered clear voice messages in three areas. Due to control errors, some of messages were played at a wrong place.

FM Subcarrier Alert system (ViaRadio)

Procedure: FM subcarrier is typically used for delivering text message to FM receiver. The message could be the title of the song or information of music band. Now this technology has been utilized to deliver text messages to 4000 unique receivers, each assigned to a unique code and can be specified for a unique location. Unlike weather radio, which often covers a large area like a county and is often different to access by local authority such as UCF police, the ViaRadio system can be controlled by UCF police to send specific text messages to all receivers or one specific receiver. Its receiver can be activated even through its FM radio receiver has been turned off. With interaction with other devices such as display board, stroke, text to voice, it provides a unique way to alert main offices in each building. Furthermore, it is cost effective. With around $100K to $150K, we can cover 4 main offices per building and 120 buildings on the UCF main campus. With proper emergency procedure in place, we have a simple alert system robust to power outage and down telephone service to cover all buildings. According to ViaRadio, the ViaRadio receiver can integrate with NOAA weather radio. One receiver could get alert messages from three sources: UCF FM broadcast, NOAA weather radio, and ViaRadio subcarrier broadcast.

Key observation and results: On the demo day, ViaRadio representative demonstrated its capability to activate one or all receivers in the building. Activation can be done via web. LED displayer and text to voice device were also displayed.

Integrated Software Controller (AtHoc)

Procedure and key observation: Given so many alert technologies, the need to unify, manage and control all alert systems under one web-based console becomes a challenging task. AtHoc solves this problem and demonstrated its capability to activate – under one web-based console – a hosted telephone dialing systems (with one or two users), desktop pop-up audio/visual alert, and the Madahcom speaker system. Similarly, Madahcom can control and activate AtHoc control unit. AtHoc uses a third party hosted system. According to AtHoc, it also can integrate with the local PBX switch to facilitate campus-wide alerts in addition other popular hosted systems, based on requests by customers.

The AtHoc desktop alert is of particular interest. After AtHoc activated the alert, within a minute or two, an alert window popped up on the computer screen with audio and visual alerts and detail instructions on how to proceed. The user can press a button to acknowledge the person has received the alert. This type of application could potentially reach 20,000 PC's (estimated the number of personnel computers on a typical campus) in a few minutes very cost effectively by leveraging network and PC infrastructure that we already own. However, in their technology, each PC checks the server for alert once every two minutes. It is unknown to our engineers whether 20,000 PC's polling every 2 minutes (that's a pretty big load) could have big impact on the network infrastructure capacity. But according to AtHoc, since each round-trip polling per PC is only 1KB, most (if not all) campus network infrastructure can already support this network load. The best design could be for such a host server to sit in our data center at the core, resulting in the most efficient use of network resources since it eliminates transient traffic. We will further examine this capacity question in future.

Recommendations

Recommendation for hosted system:

FM radio and mobile phone are the only two ways to inform students and staff members who are on the way to or from the campus. Be aware of trunk and cell tower capacity when a hosted

system is used. The capability of terminating undelivered calls is just as important as the simultaneous call volume. Avoid cheap short message service (SMS) since those SMSs are often delivered at the lower priority. Need to implement a termination button on its operation website, so an operator can terminate the remaining call as simple as pushing a button. ConnectEd is one of the best hosted systems that we have ever evaluated, based on our test.

Recommendation for distributed speaker systems:

Distributed speaker system is probably the only way to deliver all hazard alerts to both indoor and outdoor areas, especially with high student population, particularly when power and telephone service are down. So, it is necessary to establish such a system for highly populated areas such as the student union building and buildings containing hazard material at UCF. Madahcom is the primary alert equipment supplier to the military, so its technology is tested and of high quality. MadahCom has also installed many non-military systems including at 4 other universities. MadahCom's ability to readily integrate with other systems is also a big advantage. Over the next 12 months, we will further study the system and make a comparison between Madahcom system and other distributed speaker systems.

Recommendation for FM subcarrier system:

FM subcarrier system is cheap and reliable. Once we equip the technologies at the main offices, key lecture theaters in each building, and key hallways in student dormitory buildings, combined with stroke or LED displayer, we will have mass alert system (independent of phone and power) for most of indoor campus residents. On August 2, all 85 schools in Brevard county, Florida installed ViaRadio systems at the total cost of $11,000, which will alert school leaders with specific text messages during emergency. It can alert one to all schools instantaneously. It is faster and more efficient than one by one telephone calls.

Recommendation for Integrated control console and Desktop Pop-up Audio/Visual Alert:

Given complexity of multiple alert technologies, it is essential to have an integrated approach to put all technologies under one console and controlled by a method as simple as pushing a button. However, it shall also know the risk to rely on a single software platform to do all control and command tasks. So, it is essential to ensure that the command control tasks can be also executed in distributed ways, even in manual operation mode which by-passes all computer and machines.

Desktop pop-up alert with audible and visual alerts are very attractive, low cost solution for most of offices and lecture theaters equipped with computers. It can be easily implemented and activated. It would be much better if a pre-stored sketch draw of the building that the PC is located can be displayed in the pop-up window, marked with exits and hazard locations. Similar alerts shall also pop up in every cell phone, TV screen, and desktop phone in a specific zone, as described in our future USBEE alert system architecture in 2004.

DEMONSTRATION ANNOUNCEMENT & INVITATION

All Hazards Campus Emergency Mass Notification Communication Systems

Background

UCF has been conducting research on Intra-Campus Emergency Mass Notification (EMN) Communication systems within the Florida state universities and community colleges since 2005. As part of this ongoing work, the UCF team will perform a live demonstration of effective All-Hazards EMN solutions for campuses. The UCF team is led by Dr. Lei Wei, Assoc. Professor in the Department of Electrical and Computer Engineering [(407) 823-5098, leiwei@mail.ucf.edu] and supported by Dr. Jim Pearson, Special Asst. to the VP for Research and UCF coordinator for homeland security programs [(407-823-6858, jpearson@mail.ucf.edu]. The research has been funded to date by the US Department of Homeland Security, Office of Domestic Preparedness FY05-06 funds assigned to the Higher Education Subcommittee of the Florida State Working Group for Domestic Preparedness, by the UCF Office of Research & Commercialization, by hardware funding from Prepare Florida, and by donations from Madahcom, Inc. The first stage research report can be found at http://ec.creol.ucf.edu/ or http://LLIS.dhs.gov.

Demonstration Plans for Emergency Alert & Communications Systems

Date: July 27, 2007
Location:

- Briefings and central observation of demos: UCF Harris Engineering Building, Room HEC 125 (Auditorium) See http://campusmap.ucf.edu/flash/index.php?select=b116 for location on the UCF campus and directions
- Demonstrations: several UCF campus locations, including Harris building and CREOL building

Agenda:

9:00 am: Registration

9:30 am: Overview of first stage study results, demo results, test-bed planning – Dr. Lei Wei, Study PI; School of Electrical Engineering and Computer Science, UCF

10:00 am: Demo of Connect-ED hosted system http://www.ntigroup.com/interstitial.asp

10:20 am: Demo of MadahCom system for indoor and message board (Harris and CREOL buildings). http://www.madah.com/

10:40 am: Demo of ViaRadio technology for indoor (text message to particular receivers) http://www.viaradio.com/

11:00 am: Demo of MadahCom alert system for outdoor (outside of Harris and CREOL buildings)

11:20 am Demo of integrity capability of MadahCom central controller (video surveillance system, AtHoc, http://www.athoc.com/AtHocSite/default.asp etc).

11:40 am: Question and Answers

12:30 pm: Event completed.

Background of the Second Demonstration

Although the majority of K-12 schools in Florida have intercom or PA systems in place that would be used to alert students and faculty of an emergency situation and notify them of specific action to take, most higher education institutions have no equivalent system. Universities and Colleges require systems and procedures to rapidly pass critical information in emergency situations to all buildings classrooms, laboratories, and offices to alert students, faculty and staff regarding emergency situations such as a terrorist event, active shooter, bomb threat, hazmat release, or natural event such as tornado. The Virginia Tech incident highlighted the importance of EMN systems and procedures on campus to be compliant with the CLERY ACT (see http://www.securityoncampus.org/schools/cleryact/).

In the first stage of study, we evaluated several technologies, including FM radio, phone tree systems, sirens, and hosted systems, using three key criteria:

(1) provide an alert to the campus population as quickly as possible;
(2) alert and inform the campus population in multiple areas with different instructions that could change rapidly;
(3) provide at least a means of basic communications under extreme situations such as a power outage and/or downed telephone service.

These criteria must also consider the limitations of the disabled. Unfortunately, single siren systems do not effectively cover a campus of 1700 acres such as UCF.

During the last 18 months, several additional technologies have been identified. They are: (a) PA system with distributed speakers (Madahcom); (b) FM sub-channel emergency alert system (ViaRadio). The Madahcom system can deliver a clear voice message to zoomed speakers to cover campus indoor and outdoor environments. The ViaRadio system can deliver text messages to selected radio receivers located in each building via FM radio sub-channel.

In the July 27 demonstration, we will also show small phone tree systems to link up a group of hundreds of observers and attendees and show effectiveness of hosted systems to dial in 5000 phones on campus. The demonstration results will be distributed to Florida Public Universities and Colleges as guide for future evaluation of their emergency mass notification system requirements and the best way to meet the requirements.

Summary of the First Stage Study and Demonstration Results.

Funded initially by UCF, and later by the Florida Department of Education, the study began in May 2005. We selected three campuses out of 39 Florida public universities and colleges to perform an initial study of the requirements for an all-hazards emergency communication system. The key results are outlined in the following paragraphs.

(2) *Three key requirements for an alert system:*

a. Alert as many people and as quickly as possible in a normal condition
b. Alert as many people and as quickly as possible without power and phone service
c. Constantly deliver alerts to specific groups of people in different locations.

(3) *None of the three campuses selected for study have the capability to meet all requirements listed in (1).* Only one campus meets a partial requirement of (a).

(4) *It is very difficult to have a single design for an all-hazard alert system on a dynamic campus environment.*

a. *A variety of buildings on one campus*: Most of the buildings have been built over the last fifty or more years with a vast variety of infrastructure installed, renovated, operated, and maintained by many users, and based on many building design codes. Several buildings are shielded from any radio signal; thus even FM radio could not penetrate the building walls.

b. *A variety of facilities*: For example, at the UCF main campus, fifty percent of the buildings do not have a fire alarm intercom system, which can be used to announce an alert message to all residents in the building. Many lecture theaters do not have a telephone set. In those with a telephone set, almost no one in the department knows their phone numbers. Fifty percent of the buildings have TV sets in their hallways.

c. *A variety of buildings and campus settings across different campuses*: Building types and campus settings vary significantly from one campus to another. Some of them have many high-rise buildings squeezed in one small area. Others have one-story or two-story buildings spread over a wide, woody, and hilly site.

d. *Widely spread campuses and study centers*: Each college or university has multiple campuses and large study centers spread over a wide area and that often blend into the nearby community. These physical limitations make it very difficult (almost impossible) to rely on one system design to perform emergency alert for all hazards and all environments.

(5) *It is difficult to have an all-hazard alert system that will cope with all dynamic behaviors on campus.*

We highlight a few survey results here and discuss their consequences.

a. 50% of students and faculty will not immediately pick up a ringing phone.
This indicates that a reverse 911 type of service will have limited effectiveness for notifying students and faculty.

b. 95% of those surveyed prefer to be notified by mobile phones.
This shows the importance of collecting a mobile phone database, however cell phone reception could be limited in lecture rooms and in buildings that block radio signals due to their construction. Furthermore, before starting the lecture, faculty often ask students to turn off their cell phones.

c. 95% of survey respondents do not know the difference in meaning between an alternating steady siren and wail siren tones.

This indicates that a siren may be good for general alert, but not effective to carry a precise message. It is thus important not to rely on a siren alone, but rather combine it with other alert methods.

d. Most of the students frequently check email, but faculty do not.
This shows that email is a good way to alert students, but not faculty.

(6) *It is difficult to have an all-hazard alert system with limited funds.*
A cost effective solution is critical and essential for colleges and universities.

(7) *Key recommendations*
Assuming limited funds, we issue the following recommendations.

a. Carefully examine a siren/audio system for main campuses, combined with campus FM to establish a basic alert system for requirements (1) a and (1) b. The FM system should be utilized even if the siren is not chosen for installation.
b. Implement a high-speed reverse 911 system to provide very basic service to all 39 universities and colleges for requirement (1) c.
c. Endorse a host-based emergency notification service and encourage students, faculty, and staff to sign up on a voluntary basis. This will enhance our capability to meet all requirements.
d. Each campus should develop or enhance other means of notification such as bulk email, phone hotline, website, campus TV, campus WLAN, etc. Most of these will use existing facilities and thus be low cost. Education and promotion is essential to improve the effectiveness of any notification systems. These efforts will enhance our capability to perform mass notification for a wide range of emergency events.

Note: *During the demonstration on the UCf campus, sirens had very poor voice coverage and a very limited coverage in tone as well. However, it is still the best solution on the market for a wdie-are and wide-coverage outdoor alert. Multiple sirens and speakers may be needed to cover all of a campus. Also NWR/FM receivers in each building need to be located at offices that have a good reception of the signal.*

(8) *Technologies used in recommended system*

Technologies	Scenarios	Provider type	Cost
Audio alert	1 and 2	Siren	$15K-50K per campus
telephone	3	R911/911 broadcast	$35K per small system
	3	Host based	$2-10 per user per year
Mobile phone	3	R911/911 broadcast	
		Host based	
Short message	1,3	Host based	
FM radio	1,2		No cost
NWR	1,2	Multiple vendors	$20-$100 per receiver

Potential candidates

Satellite phone		Immarsat, Vsat	~$3000 per transceiver
Indoor Audio		Tyco	TBD
Dedicated wireless		Cohda	
FM/TV subcarrier		TBD	TBD

Appendix III

Call procedure:
Around 9:00am Dr. Wei will pass phone number list (around 5200 phone numbers) to you in USB memory stick in XLS format. Please proceed with exact order we provide in the phone list.
At 10:00am, launch the first message: "this is testing message #1 from ConnectED, repeat Message #1"
Sometime between 10:05am to 10:12am, Dr. Wei will ask you to terminate Message #1
And immediately start message #2 to all phones: "this is testing message #2 from ConnectED, repeat Message #2"
10:20am terminate all message #1 and #2. Print out the call status.
11:00am, data collected from our staff members will match to call status.

Evaluation form:
Dear Sir/Madam,

In order to improve our capability to notify you during emergency event, EECS is conducting a test for different technologies on Friday, July 27, 2007. One of testing involves your phone and need your help to record what happens. Between 10:00am to 10:20am, two calls will be made to your desktop phones. The first message will be "this is testing message #1 from ConnectED, repeat Message #1." and the second message will be "this is testing message #2 from ConnectED, repeat Message #2". Please just like normal day in your job. You can pick up phone or leave them to voice messages as you usually did. If you pick up the phone, please record the time that you receive the call. If you leave them in message box, please check message at 10:30am and record the time you receive them.

If you receive the calls, please return the form to Dr Wei's mailbox by 11:00am Friday. We will analyze the data immediately and post questions to vendors. If you do not receives the call, then discard this paper.

Thank you very much for your cooperation,

Lei Wei

Your extension:_____

Did you answer the phone immediately or leave them in message box	
When do you receive the Message #1 call?	
When do you receive the Message #2 call?	

You may receive the second message before the first one. Please ensure you hear the message number.