Gamewell FCI FIRE CONTROL INSTRUMENTS

Case Study

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Mass Notification System on Duty at Fort Knox

The severity and frequency of recent occurrences such as Hurricane Katrina, September 11 terrorist attacks, the Oklahoma City bombing, Khobar Tower and others have led policy-makers in key organizations, as well as state and federal lawmakers, to realize that good planning and an effective means of mass notification can be crucial to the survival of large numbers of people.

Mass Notification System Standards

The Department of Defense (DOD) has long taken a proactive stance with matters concerning natural disasters and national security. Instigated by numerous weather-related tragedies and heinous acts of terrorism, the DOD developed anti-terrorism standards. A portion of these standards culminated into the Unified Facilities Criteria (UFC) or document UFC 4-021-01, outlining design requirements for mass notification systems (MNS) for all DOD properties.

"As a result of the tragedy of Khobar Tower in Dhahran, [Saudi Arabia], the Department of Defense decided they needed a method of supplying large groups with information quickly in an effort to save lives and minimize damage," says Marvin Gunderson, chief fire and emergency services officer at Fort Knox, Kentucky. "This led authorities to create the UFC mass notification system requirements."

Khobar Tower was an eight-story structure where foreign military, including United States Air Force personnel from the 4404th Wing (Provisional), were housed. Altogether 19 U.S. servicemen were killed and 372 others wounded in a terrorist-staged explosion in June 1996. It's believed an MNS would have saved lives by providing critical

instructions to individuals in specific areas of the facility at a time when chaos and confusion were at a height.

According to the UFC, “Mass notification provides real-time information and instructions to people in a building, area, site, or installation using intelligible voice communications along with visible signals, text, and graphics, and possibly including tactile or other communication methods” (Paragraph 1-1, UFC 4-021-01, 9 April 2008).

Within the UFC are detailed directives pertaining to the administration and implementation of an MNS. Some of the areas covered by UFC guidelines include the *where*, *when* and *how* of installation. Of special importance are procedural data related to procurement of funds, acceptable equipment, supplier criteria and selection methods of qualified engineers, installers and service personnel.

The UFC was formerly the only comprehensive document of its kind in existence within the United States. However in June 2009, the National Fire Protection Association (NFPA) formalized an MNS standard of its own. Referred to as Emergency Communications Systems, these codes fall under Chapter 24 of the 2010 edition of NFPA 72: *National Fire Alarm and Signaling Code*. The UFC mass notification requirements and NFPA’s emergency communications systems codes hold strong similarities. Reportedly, the U.S. Air Force originally partnered with NFPA experts to create the UFC guidelines.

Fort Knox Mass Notification

In 2005, Chief Gunderson and other Fort Knox personnel embarked on the arduous task of implementing an MNS within the purview of UFC requirements. The primary challenges involved installation timing and an aging fire protection infrastructure, one in growing need of attention.

“We were [already] involved in the process of upgrading a lot of outdated and antiquated fire alarm systems for which it was increasingly difficult to obtain replacement parts,” says Chief Gunderson. “Many of these systems were not as serviceable and reliable as we would have liked. This, and an understanding of the new UFC, led us to decide it was time to install a base-wide mass notification system.”

The UFC specifically calls for traditional fire alarm technology to be utilized as the backbone for an MNS. Fire alarms are engineered to fault-tolerant specifications. In addition to fire protection, these systems can notify occupants and a central monitoring station of emergencies or any supervisory conditions. Combination fire alarm/mass notification systems also contain an Emergency Voice/Alarm Communications (EVAC) system, capable of warning large numbers of people using a mix of multiple tones, visual and audible devices, digital signage and verbal means.

The use of established fire alarm technology as the platform for an MNS, in both new and retrofit applications, is believed to provide a substantial cost savings. Collaborating with local facilities and emergency command, Chief Gunderson's team began implementation of a city-wide MNS structure, working from associated guidelines contained within the UFC.

"At the time we did this, the UFC established requirement and need. It basically directed us to develop an MNS on the [Fort Knox] Installation. This is all the clearance we needed to begin work," says Chief Gunderson. "As we entered the development [stage] through the selection process, normal rules of accountability applied. Different agencies [on the Installation] acted within their scope of responsibility to develop the technical solution which was presented to the approving authority, which in this case was the Garrison Commander."

Solution Selection

Fort Knox is not your stereotypical military base. This 170-square mile installation is a certified city in the state of Kentucky, with a population of over 23,000 soldiers, family members and civilians. With military roots dating back before the Civil War, an entire community has grown up around this particular US Army post. Fort Knox is home to the Army Recruiting Command headquarters and its largest organization, the Armor Center and School for training all armor soldiers and marines. The US Bullion Depository and Patton Museum of Armor and Calvary attract hoards of visitors to the area daily.

Planning for a base-wide mass notification system, capable of protecting such a wide array of buildings and occupants, required immense coordination. The Fort Knox departments involved in selection and implementation included Fire and Emergency

Services, the Directorate of Public Works, Directorate of Information Management and Contracting and Resource Management.

Per UFC requirements, Gunderson's team needed a fire protection engineering company trained and certified in the technology. The same company also had to integrate other building subsystems throughout the city with the new MNS. The intent was to provide full interoperability across the board in a coordinated manner. According to Chief Gunderson, competitive bidding was used to find the best company at the best price.

The fire alarm systems integrator selected for the job was Freedom Communications of Louisville, Ky. The E3 Series Expandable Emergency Evacuation system, manufactured by Gamewell-FCI, was the MNS chosen for the job.

"After some study, we decided to use the E3 Series MNS system. The Gamewell-FCI engineers helped us adapt everything to the new UFC codes," says Freedom Communications Vice President, Brian Banta.

According to Banta, large-capacity network and advanced intelligibility capabilities, along with the certified approval of a national testing authority such as UL (Underwriters Laboratories), are crucial elements every large-scale MNS should possess.

The Fort Knox system employs network technology run on one cable of UTP (unshielded, twisted-pair) wire. A single pair of wires carries fire alarm sensor information, command and control data, and multiple voice instructions with or without identifiable tones. All of this information can be simultaneously carried in a bi-directional manner at 625K bits per second for up to 3,000 feet of UTP wire or 6,000 feet of fiber-optic cable - twice that of most systems.

One of the most detailed sections of UFC and NFPA requirements concerns intelligibility. Through live demonstration for Chief Gunderson and other base personnel, Freedom Communications had to prove its MNS solution's ability to dispense critical instructions in a measurably clear and concise manner.

Lastly, a listing from an NTL (National Testing Laboratory) is a significant element of a proven MNS solution. In the fire alarm/life safety industry, only three NTLs exist: UL, Factory Mutual and ETL. Considering these laboratories thoroughly analyze systems before granting an approved "listing," most municipalities allow only systems possessing

an NTL's approval. Due to NTLs' rigorous testing procedures, which can sometimes span more than a year, many so-called "mass notification solutions" do not carry these listings.

System Components

Mass notification systems consist of three basic components, as outlined in the UFC:

- Individual Building MNS – includes notification within all structures as well as surrounding outdoor areas
- Wide Area MNS – applies to all outdoor areas
- Central Control Station – responsible for 24-hour monitoring of all MNS signals and emergency response communications

"The facility MNS side of the project was relatively easy as we were already installing fire alarm systems in all new and renovated buildings," says Chief Gunderson. "These systems transmit alarm signals to a central receiving center (a.k.a. central monitoring station) located within the fire department. All we did was include the appropriate MNS specifications for voice evacuation systems in all contracts."

The Installation's individual building MNS was found to provide ample outdoor coverage. Consequently, officials decided not to implement the wide area component at this time.

"The facility's 100-plus buildings' mass notification systems have external speakers. This gives us good coverage within 100 feet of our critical buildings, which includes parking lots, walkways and smoking areas," says Chief Gunderson. "We do have a high power speaker array, but it's a separate, stand-alone system, as is the tornado warning system. We are working towards integrating these into our mass notification system so all systems integrate into one operating console."

Radio Telemetry Network

Two-way communications between individual building MNS and the Central Control Station at Fort Knox is accomplished using an ultra high frequency (UHF) radio system. Established radio links are capable of full supervision, which enables trouble alerts to be sent locally when a maintenance issue develops within any building's MNS or the radio system itself.

Providing background design and programming support for the Fort Knox MNS was Gamewell-FCI Project Manager, Dick Aldrich.

“We worked with Freedom Communications to ensure this system performed the required functions at the Fort Knox facility,” says Aldrich. “Interfacing the facility’s radio network with our E3 Series mass notification system offered big benefits. This integration provides bi-directional status and control with one-way audio live voice paging and recorded message selection and control.”

On Fort Knox, integration with the E3 Series MNS was accomplished using electromechanical relays, which allows totally dissimilar subsystems to communicate with one another. Integration can also be accomplished through the development of firmware capable of interpreting the data from one system so it can be used by another.

According to Aldrich, the base wide radio network system issues various commands by means of relay contact closures. The E3 Series broadband system detects the individual relay commands and performs the required functions as programmed by Freedom Communications using the internal Boolean Logic or CAM (conditional action map) programming capability. The MNS functions include the activation of the visual indicators, pre-recorded audio tones and voice messages, and the most important of all, base-wide live voice communications.

Mike Tucker, a Fort Knox fire inspector and technician, indicated the radio system used was originally provided by the Department of Army. Although more than 25 years old, Tucker affirms it provides a high-tech means of networked communications.

“We integrated it into our mass notification plans and procedures. We are using two systems to provide the same data simultaneously -- one for outside and another one for inside and close to each facility,” says Tucker.

The use of radio technology has its advantages, which was realized during a major ice storm in the Fort Knox area during January 2009 (see sidebar). Throughout the area, many aerial power and telephone lines collapsed under the immense weight of several inches of ice. The use of radio technology helped to ensure signals reached each individual MNS system throughout the Installation.

*****Side Bar 1*****

Putting MNS to the Test

In January 2009, the Fort Knox area was hit by one of Kentucky's worst ice storms on record. Its MNS was put to the test as 3,000 housing units with more than 20,000 inhabitants were stranded without power for days.

"When the post initiated their relocation plan and set up shelters, we used the mass notification system to get out key messages, such as shelter locations, emergency numbers, fire alarm system deactivations (due to power outages that exceeded the battery backup potential), and the like," says Marvin Gunderson, chief fire and emergency services officer at Fort Knox, Kentucky. "This was a key tool in getting out pertinent emergency information during this crisis."

Probably the biggest challenge Chief Gunderson's team faced was the longevity of the various batteries powering the new MNS. Per the UFC (Paragraph 4-4.5, UFC 9 April 2008), the individual building MNS must comply with minimum requirements set forth in NFPA 72, which is 24 hours. The system is required to support communications for a period of 60 minutes at maximum load. The mandatory standby period for high powered speaker arrays is 72 hours with a subsequent period of 60 minutes of operation at full load.

According to Chief Gunderson, "The ice storm was just another positive reason why Fort Knox is headed in the right direction. It also served to illustrate to persons in positions of responsibility that installing a MNS was the right way to go."

The process of fitting additional Fort Knox buildings with effective MNS technology is ongoing.

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