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fireground to replace whiteboards and accountability boards because of negative experiences with computers should get over it.

ver the years, computerization of the fire service has provided many enhancements to operations. However, computers or mobile data computers (MDCs) often don't offer the speed, reliability and ease of operation that's needed for initial response operations in fire apparatus and command vehicles.

The moment the dispatch is sent for an emergency response, the immediacy of access to response data is necessary and must be available within seconds upon entering the apparatus. Tablet computers, or tablets, offer speed (instantly on), quick processing, reliability, ease of operation, built-in GPS location, wireless connectivity, an intuitive graphical user interface via touch-screen capability and affordability.

When it comes to integrating tablets, there has been resistance to moving away from the traditional paper and/or whiteboard systems for incident command system (ICS) and accountability. Much of the resistance has come from negative experiences with computer lockups. Nevertheless, there are signs of significant success of tablets used for ICS.

### The right stuff

What is required to determine the successful integration of tablets into ICS? In addition to their aforementioned attributes, tablets must be large enough to provide an effective data-entry tool and visual representation of the fire scene through their own screen or via connection to a larger monitor. Tablets' internal GPS location must be capable of providing automatic vehicle location, which can be captured within the tablet app. During the ICS automation, tablets must be able to operate in the absence of connectivity and be able to sync up when connectivity is restored.

All that said, the app (software solution) is just as important. The app determines functionality, integration with other systems, effectiveness and capability to streamline the ICS automation.

The app must mirror the traditional ICS operational procedures and documentation and have the capability to pull in relevant data from computer-aided dispatch (CAD) systems and apparatus staffing data programs. It must conform to ICS forms, worksheets, checklists and other required documentation for both immediate operations and post-incident after-action reports. It must be compatible with the Blue Card system of ICS operations, which is used to standardize incident operations throughout the organization.

The app must provide the ability to effectively assume and transfer command and document this command process. It also must allow for a command override and for a higher-ranking officer to assume command even if unable to be relinquished by the officer in command at the time of desired command transfer.

Richmond Hill (Ontario, Canada) Fire and Emergency Services (RHFES) incorporated the use of tablets for ICs about two years ago. Approximately 12,000 incidents per year are run through the system. RHFES Fire Chief Steve Kraft explains that any tablet that his department employs can request to take over the incident. "If the request isn't answered in one minute, [the request] automatically is transferred to the person who requested it."

Connectivity should allow remote access to the template or worksheet that's being used in the field by any given incident commander (IC) at all incident scenes. This provides real-time situational awareness to any/every officer to understand the magnitude of the incident, the tasks that are being assigned, and the resources that are on scene and are assigned to various tasks.

The tablet/app solution must enhance dramatically the ease and accuracy of ICS documentation through custom-designed templates, checklists and worksheets that can interface with and pull data directly from CAD, staffing software, etc.

The San Bernardino County, CA, Fire Department has used tablets for ICS for five years. The department's assistant fire chief, Jeff Birchfield, says, "A new feature recently added is the unit's ability to add notes to the call, which then populate into the CAD notes and stay with the call for documentation purposes. This feature allows us to reduce unnecessary radio traffic and prevent sensitive information from going over the radio waves."

### Mapping

As the incident unfolds, templates can be selected for each incident type to outline specific tasks that are required. The app must utilize a mapping feature to mark and capture apparatus locations and crew tasks/locations, with capability to date/time stamp automatically as assigned/completed. Also, access to pre-incident planning, hazmat data, hydrant locations and other water supply resources is required. Integration with Esri, which is a major geographic information system (GIS) company, can allow for integration of the localities' GIS systems to access even more information regarding the property that's involved. Automatic population of the templates or worksheets from CAD as to available on-scene resources and updating of the remaining resources is a must.

The tablet/app solution must be able to designate command and supervisory

assignments and document as required by the National Incident Management System (NIMS). As incident tasks are completed, task status should be updated easily by touch screen to update/document the crew/task/status.

### **Reliability and training**

As for accountability monitoring, this ICS-integrated solution must include incident timers and have access to the responding companies and their assigned personnel from staffing programs. Without this, recommendations for the personnel accountability report (PAR) actions that automatically alert ICs to initiate the PAR check and document accountability status for all crews and personnel can't be provided. All of this will be accessible if an on-scene emergency occurs to quickly identify personnel assignments and locations within seconds at the touch of the screen.

When it comes to reliability, Birchfield says his department has used a tablet solution on thousands of incidents. "Our agency responds to approximately 150,000 calls for service annually, with over 1,500 structure fire responses and over 1,500 vegetation responses, many of which are multiple alarms." He says tablet failures have been very infrequent and often have been IT issues on the agency's side.

As with any introduction of new technology, there first must be operational guidelines or standard operating procedures that provide the how, when and where a tablet solution will be deployed. This must include an adequate training program to ensure that all personnel who use the technology understand its use and are proficient with its use during various types of incidents.

Kraft says his department's training was straightforward and uncomplicated. "We provided two-hour sessions for all officers" and "additional training to our platoon chiefs to ensure that they were comfortable using [the app] as a tactical worksheet."

Birchfield use the term "simple" to describe the user/interface experience. He tells *Firehouse Magazine* that it requires minimal instruction. That said, he concedes that "it takes an incident commander to

run a few incidents to build the muscle memory while under stressful conditions."

### On the same page

Service and responsiveness from the tablet vendor are absolute necessities. This is important to deal with performance issues, operational failures, training and maintenance and to provide a means for continued product development. It's important that the tablet vendor have a strong relationship with the agency's IT department, CAD vendor, GIS vendor and other interfaced information systems, such as staffing programs. This ensures the most effective and ongoing path for full integration and successful operation.

"The most difficult part of the transformation was getting our CAD vendor, our police department and [the app vendor] all working together," Kraft explains. "Obviously, everyone has different priorities, and they don't always align."

Although the new technology will enhance the safety of personnel, improve operational effectiveness, provide real-time situational awareness and capture various performance measures, there always must be a backup plan, such as whiteboards and the traditional accountability boards. With all electronic technology advancements, there will be hardware. software and/or app failures, as infrequent as they might be.

### Simplify and expedite

Tablet integration into ICS has a very promising future. The automation of the traditional use of pen, paper, whiteboards and accountability boards during ICS creates a much-improved operational effectiveness, with far reaching situational awareness and enhanced safety that will be impactful throughout a department. The ability to use electronic worksheets simplifies and expedites the documentation process to capture data more accurately and to review specific performance measures. Integration of CAD, staffing programs, GIS and other

data provides a way to maximize this aggregated data into one fully integrated operational solution. The full process is streamlined to guide ICs with the ease to

assign, update and document incident tasks with the touch of the tablet screen.

The time has come to transition to tablet ICS integration.

CHARLES WERNER, who is a Firehouse contributing editor, is a 45-year veteran of public safety. He served with the Charlottesville, VA, Fire Department for 37 years, serving the last 10 years as chief. Following retirement, Werner served for two years as senior adviser and acting deputy state coordinator for the Virginia Department of Emergency Management. He has chaired: DHS SAFECOM Executive Committee; IAFC Technology Council; National Information Sharing Consortium; and DHS/White House Incident Management Information Sharing SubCommittee. He currently serves as the director of DRONE-RESPONDERS Public Safety Alliance, chair of the National Council on Public Safety UAS and chair of the Virginia Secure Commonwealth UAS Sub Panel. Werner was inducted into the Firehouse Hall of Fame in 2018.



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Photo courtesy of FirstNet Authority

The evolution of the way that first responders are contacted and directed to emergency scenes is underway.

oing back to the watchmen's rattles and the clanging gong in the town square, firefighters continually sought ways to be alerted to an alarm. Although "putting the wet stuff on the red stuff" remained our strategy for decades, changes in technology allow for vast improvements in how we get our calls.

Because of this, the firehouse siren and joker tape—at one point, marvels in their own right—are giving way quickly to devices that provide critical information to volunteers regardless of their location and control numerous functions inside of the stations of career departments.

### The now

Perhaps the most pervasive lifestyle changer of the past 25 years is the cell-phone. Many people seem to be connected if not by the hip, then at least by the thumbs, to these ubiquitous devices. eDispatches leverages them as tools to offer alerting capabilities in addition to

their conventional uses. According to a spokesperson, "In recent years, we have added [the features of] availability and response. Responders can set their availability throughout the day before calls occur, so the department can see who is or is not available. Additionally, once a call is dispatched, personnel can identify if they are going to the station, scene or not going on the call." Real-time tracking enables the incident commander to know the number of firefighters who are available as well as their identities and proximity to the scene. Because cellphones have evolved to combine functionality that formerly was provided by a number of disparate devices—in other words, the smartphone—eDispatches touts not having to carry separate electronics for personal and fire service purposes as a comparable benefit.

John Martyn, who is senior product manager for Zetron, which produces mission-critical integrated notification hardware and software, says changes in a number of diverse components have led to improvements, and a steady stream of solutions across the ecosystem are evidence of a broad switch to all-internet protocol (IP)-based technologies. "This lends itself to greater interoperability between the emergency control center,

# Answering the Call New Alerting Solutions

Zetron, which produces mission-critical integrated notification hardware and software, recently combined its MAX Dispatch system with its MAX Fire Station Alerting offering into a common core and user interface. This provides a simplified layout to an emergency control center.

Photo courtesy of Zetron

the firehouse, the radio network and the mobile data terminals. The widespread use of IP solutions means the days of the rip 'n run printer are fading away and replaced with the latest CAD system provider capabilities that digitally push the request for assistance to the mobile device. The ever-increasing use of digital radio and even the recent expanded use of cellular notification via the multiple commercial PTT (push-to-talk) offerings means the quality and choices of transmitting the alerts is greater than ever before."

Although excited about the prospects, he offers a word of caution. "Access to increased data will make the fire service more efficient, but with modern technology turning to IP solutions, the need for cybersecurity is also increased. Traditionally, departments have not been exposed to that concern."

Since there seemingly is no end in sight to the current shortage of telecommunicators, strategies that can improve efficiency are in high demand. Locution Systems is a purveyor of automated human voice solutions that help to reduce dispatcher workload. Using the prerecorded voices of real people, alarm assignments are broadcast in a consistent order, which helps to create standardization. Additionally, the firm manufactures scalable devices for station alerting that can notify selected zones or sleeping areas. According to Ryan Riggins, marketing specialist, there has been a significant amount of research carried out over the past couple of years regarding the negative effects of alerting



methods. "Ramped tones and lights have grown in popularity significantly as a front runner of ways to improve." He adds, "As an example, we developed our red Night Vision alerting lights to put out the exact amount of light to alert responders while ensuring night vision is not impaired, focusing all the way down to pupil contraction."

#### The future

Regardless of the format that's used for alerting, there must be a medium over which to transmit the details of the dispatch. Enter FirstNet. With more than 15,000 agencies and more than two million connections nationwide already online, the platform is well on its way to achieving the goal of coast-to-coast interoperability.

This global change in the way that we communicate obviously affects the way that we are notified of emergencies. As with any period of transition, departments will find ways to integrate legacy systems into the process while new seamless applications are developed. According to Gary McCarraher, who is FirstNet Authority's senior public safety advisor for the fire service, "My organization is

specifically looking for feedback from the fire service on how we can evolve FirstNet to meet firefighters' needs.

"What's important to remember is that FirstNet is an LTE [Long Term Evolution] network that provides public safety with a wide, safe and secure pipeline for voice, video and data." He explains that FirstNet Authority actively works with industry to provide insights to manufacturers who are interested in developing applications and devices in the fire service technology space.

How will the firefighters of the future be alerted to alarms? Will it be through enhancements made to current devices or by technology not yet imagined? One thing that is clear: No matter how we receive it, we'll be answering the call.

BARRY FUREY, who is a Firehouse contributing editor, provides consulting and training services in emergency communications. He is the former director of the Raleigh-Wake Emergency Communications Center in North Carolina. During his 50-year public safety career, he has managed 9-1-1 centers and served as a volunteer fire officer in three other states. In 2005, Furey received a life membership in the Association of Public-safety Communications Officials (APCO) International for his continued work in emergency communications. Furey was inducted into the Firehouse Hall of Fame in 2017.

# The New NFPA 1802 **Portable Radio Standard**

**Better** ruggedness, ease of use, voice quality and functionality result from the manufacture of radios and RSMs that are compliant to the new standard.



ince the 1970s, the portable radio has been a vital tool on incident scenes. Unfortunately, the extreme physical environment that's encountered by firefighting, hazmat and technical rescue punishes these devices.

Furthermore, the hazard profile of residential structures dramatically increased because of furnishings that burn faster and hotter, engineered building materials that can fail and open space architecture that requires longer supports.

In June 2011, two San Francisco Fire Department firefighters tragically perished in a residential fire. The investigation revealed that both firefighters' remote speaker microphones (RSMs) failed because of high heat. Therefore, they couldn't transmit a mayday that they were trapped. Unfortunately, this wasn't an isolated incident. Communications are one of the five most frequent contributing factors in National Institute for Occupational Safety and Health (NIOSH) reports. As a result, there were calls for

a new standard to define radios that are better suited for the hazard zone.

The NFPA established a committee in March of 2013 to define a more rugged portable radio. This new standard, NFPA 1802: Standard on Two-Way, Portable RF Voice Communications Devices for Use by Emergency Services Personnel in the Hazard Zone (2021 edition), defines for the first time a radio and speaker microphone that are designed for the inherently hostile environment in which firefighters, hazmat teams and other agencies operate.

Thirty-five Technical Committee members worked on this effort, along with another 21 committee alternates and several other noncommittee observers. The group classifications on this Technical Committee included users, enforcement,

manufacturers, labor, testing laboratories, consumers and special experts. Fire departments represented major areas and suburban/rural departments. The committee was led by Robert Athanas, who served on the FDNY for 36 years. He was assisted by NFPA Staff Liaison David Trebisacci.

### Overview

The technical committee worked on three major areas to define these new devices: ergonomics, feature set and environment. Decisions were made at the beginning:

• The standard would encompass both the radio and the RSM, because the RSM often is the most exposed item to the fire environment

- The standard only would concern twoway voice devices
- The standard would be agnostic to the specific technologies that are used, such as radio frequencies and communications technologies (analog vs. digital modulation; trunking vs. nontrunking; LTE 4G as found in broadband devices); the result is that this standard will be useful even as voice communications advance

*Author's note*: The standard is very wide-ranging. Therefore, the summaries that are below are highlights and not allinclusive. For specific details refer to the standard, which can be found at nfpa.org.

### **Ergonomics**

Emergency incident scenes are stressful and distracting. Multiple researchers have discovered first responder "tunnel vision" when a situation deteriorates. Thus, every first responder's wireless lifeline device must be simple to use, to reduce the chances for error. Some of the key issues addressed:

- · Radio control knobs and cable connectors must be able to be manipulated by responders who have large hands and/or who are wearing structural firefighting gloves
- The emergency alert (mayday) button must be easy to find
- Manipulation of the radio's controls is difficult or impossible if a member is trapped or injured or the radio is worn under the turnout coat or in the coat radio pocket; therefore, some important controls must be available from the RSM, which typically is worn on the outside of the turnout coat: the RSM is required to have an emergency alert button, and it can have at least one programmable button, which can be used for various purposes, such as reverting back to a home channel/talkgroup; the cable that's between the radio and the RSM is monitored; problems create an alert
- NFPA 1802 radios and RSMs will include voice announcements of various actions, including channel/talkgroup changes: if there is radio traffic, the voice announcement is delayed and then played when the radio traffic ceases; announcements while the radio

- is operated in the hazard-zone mode are louder
- The radio must provide clear voice transmission and reception; speech intelligibility is objectively measured with an internationally recognized test method that's used by cellular telephone carriers, called POLQA

### **Feature set**

At minimum, every radio must allow for analog conventional (nontrunked) transmission. This requirement provides for lowest-common-denominator communications among all emergency scene radios, even if all of the supporting radio infrastructure should fail.

Interoperability is guaranteed among all NFPA 1802-certified radios and all NFPA 1802-certified RSMs by means of the inclusion of a universal connector.

Visual and audible indicators of battery status are displayed.

Hazard-zone operation is different from the nonhazard zone, and the radio defaults to the hazard-zone mode when it is powered on initially. In the hazard zone, the radio's volume is louder. Radios can be programmed so that inadvertent powering off of the radio can be reduced when in the hazard zone.

Bluetooth technology allows the use of wireless SCBA microphones/speakers, RSMs, etc. As well, the radio periodically self-checks, and it must have a data logger that stores recent events, such as mayday activation. The purpose is to provide information for both the fire service and its vendors regarding proper performance of this equipment under stress.

### **Environmental & testing**

Overtemperature events are detected, recorded and alerted, and the radio and RSM must be rated nonincendive (Class I Division 2). Optionally, the radio and RSM can be certified as intrinsically safe-rated (Class I Division 1).

Radios and RSMs must undergo very extensive environmental testing. After most tests, the radio and/or RSM must undergo successful voice quality and operational checks. Here are a few highlights:

• Six complete cycles of 15 minutes of baking at 350 degrees F (177 degrees

- C), followed by immediate immersion in water for 15 minutes
- A three-hour vibration test
- Impact tests are performed on three devices by dropping on a concrete floor from 9.8 feet (3 meters), as if dropped from the bed of a ladder truck or engine
- Corrosion test includes high humidity and a salt spray
- A high-temperature test exposes the device to 500 degrees F (260 degrees C) for five minutes
- Heat and flame test first exposes the device for 15 minutes to a temperature of 203 degrees F (95 degrees C), after which the device is subjected to a 1,742 degrees F (950 degrees C) flame for 10 seconds
- A temperature stress test exposes the device to multiple cycles of warm-hotwarm-cold temperatures

### Now what?

The committee didn't address the provision of SCBA audio devices (microphones and earpieces). This will be the responsibility of the committee for NFPA 1981: Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services. When NFPA 1981 includes this, voice intelligibility will improve significantly.

Radios and RSMs that meet this standard will have new levels of ruggedness and ease of use and improved voice quality and functionality, which will result in improved safety for firefighters and others who work in the hazard zone.

Although the standard only recently was issued, several manufacturers plan to introduce NFPA 1802 radios and RSMs.

JOHN FACELLA has been on the committee for NFPA 1802: Standard on Two-Way, Portable RF Voice Communications Devices for Use by Emergency Services Personnel in the Hazard Zone since its first meeting in 2013. He also has been on the committee for NFPA 1221: Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems. Facella has a Bachelor of Science in electrical engineering from Georgia Tech, is a registered professional engineer, and is a life member and current officer of the Radio Club of America. He has more than 35 years of public safety radio industry experience, having worked for the two largest radio manufacturers. Facella served 38 years as a part-time firefighter/EMT in suburban and rural fire departments in four states. Today, he has a communications consulting practice and serves on a rural fire department in Maine.



By Lori Moore-Merrell

# The Importance of Data to the Fire Service

The reasons are numerous. The true challenge is how to process more data faster—for preparedness, prevention, operational insights, and firefighter safety and well-being.



n 2006, Clive Humby, who is a British mathematician, coined the phrase "Data is the new oil." Later, George Firican wrote that "Both oil and data can be transformed into different products. From oil you can produce anything from gas and plastics to detergents, toiletries, dyes and movie film. Data can be converted into information that fuels human and AI [artificial intelligence] decision-making processes, which in turn enable self-driving cars, improve a company's efficiencies, develop speech-recognition software, find cures to diseases and much more." These two statements only begin to describe the importance and the power that data can mean to the fire service. Data—and the knowledge that it imparts—is, in fact, the life blood of the fire service for the future.

The ability for fire service leaders to explain their department's value is essential to protecting or enhancing resources for emergency response, training and prevention. Fire/emergency services leaders have access to massive amounts of data.

Structured data typically are well organized and easily formatted in searchable databases and include incident information, such as incident numbers and response times. Unstructured data have no predefined format—thus, much more difficult to analyze—and include social media, dispatch radio recordings and traffic cameras. Data capture, procurement and preparation of both types of data are fundamental to assuring sound analytics and data visualization.

As fire and emergency services departments become increasingly data-driven, ensuring access to internal and external analysts and data scientists is essential. As data sources become increasingly nontraditional, departments must access trained researchers and data scientists who can handle multiple datasets. Data scientists are trained to use technology as well as scientific methods, analytical models and detailed algorithms to mine intelligence and insights from structured and unstructured data.

### Leveraging Al

AI is the sophisticated statistical analysis of massive amounts of data. Most AI today is known as narrow AI, which functions from engineered scripts to mine datasets and generate results. One type of narrow AI is machine learning (ML). ML has great promise for the fire service when given a consistent data feed. For example, quality incident data coupled with time of day, geolocation and community hazard/risk data can be used to "train" ML models. ML then can be asked to draw conclusions based on observed examples of tasks. For instance, apparatus move-ups often are necessary during busy times with heavy apparatus deployment. ML can assess data from various data feeds to determine where the remaining (unassigned) apparatus should be relocated.

ML involves searching data for trends, patterns and anomalies that might not be obvious to a human observer. In the case of an emergency response system, an ML algorithm would learn to send proactive alerts when apparatus deployment thresholds are exceeded.

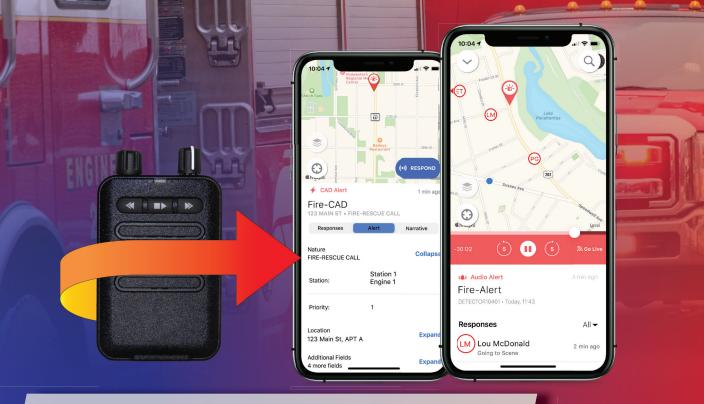
It also is possible to train ML response models with unstructured data that tend to be qualitative in nature. Data types might include social media, radio communications and video from body cameras. With this information and structured data, machine-learning algorithms for response-force model classification can be created. Text-mining and natural language processing can be used to extract intelligence from radio communication, which would contribute to more accurate apparatus move-up models.

### A data-driven future

Fire and emergency services departments should prepare for increasing data integration into everyday activities. Leaders must gain greater data acuity for responsible decision-making. Fire chiefs must ensure that they allocate financial resources for personnel and technological capability for data capture, management, protection, governance, analysis and intelligence translation. Firefighters must become increasingly data literate, to understand the value of accurate data entry and report writing.

Because the importance of using data no longer is a question, the major challenge that departments face is how to process more data faster-for preparedness, prevention, operational insights, and firefighter safety and well-being.

DR. LORI MOORE-MERRELL founded the International Public Safety Data Institute (IPSDI) after serving 26 years as a senior executive in the IAFF who was responsible for frontline interaction with elected officers, executive board members, and state, provincial and local chapter leaders. IPSDI's mission is to assure that every local public safety agency can show its response capability, reliability and operational performance using its own local data. Moore-Merrell is an expert in emergency response system evaluation and public safety resource deployment, among other areas.





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