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SPEECH IMPEDIMENTS

While radio capacities differ, the basic issues that challenge fireground communications can be divided into two broad categories: operability and interoperability. By John Facella and Dirk Young

From the earliest days of the fire service, fireground communications have posed a challenge. The first major improvement was the megaphone or speaking trumpet, which allowed an officer with a decent set of lungs to yell orders to firefighters over the din of the fireground. The first truly portable radios were introduced in the early 1960s, and firefighting took on a new dimension. Officers could command the fireground with radios and communicate both with dispatchers and on-scene units.

Today the U.S. fire service is quite diverse, from rural volunteer departments to suburban combination departments to huge urban career departments, and each has a unique set of communications needs based on risks encountered on the job and funding available to address those needs.

SAFECOM, the Department of Homeland Security's public safety communications and interoperability program, has created a lexicon of the various communications networks. This terminology includes the jurisdictional area network, or the day-to-day radio system that dispatches calls through the radio network within a jurisdiction; incident area network, or on-scene communications; personal area network, which is a firefighter tracked with a PASS device, SCBA monitor, body-vitals reader or portable radio; and extended area network, through which radio dispatchers and chief officers communicate with other cities, counties or state agencies during a large incident that requires mutual aid, regional hazmat teams or other specialized resources.

On a day-to-day basis, most departments dispatch on their JAN using either trunking or conventional radio systems. Many departments create a fireground IAN by switching to a radio-to-radio tactical channel that allows on-scene units to communicate with the incident commander, who will talk to both the dispatcher and on-scene units using multiple channels, multiple radios or other techniques. Therefore, from the time the 911 call center receives a resident's call

for help and dispatches an appropriate response until that company returns to the station, radio communications is one of the most critical needs that must be in place.

Fireground communications challenges vary based on size and type of incident. Although the specific communications tools used can differ, the basic issues that challenge fireground communications can be divided into two broad categories: operability and interoperability.

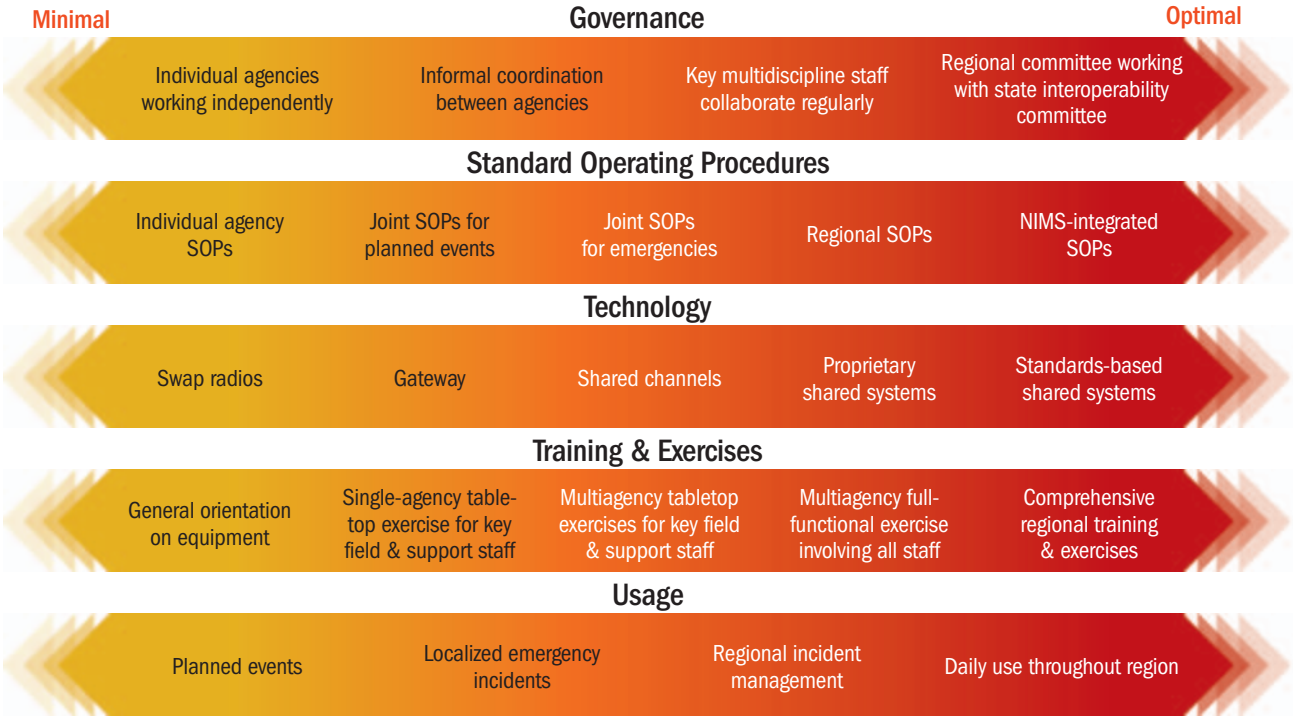
The most common communications operability concern is radio coverage. In structural firefighting, interior-attack and search teams must stay in contact with the incident commander and safety officer to report on and be advised of fire conditions. In rural and suburban areas, most structures are frame or brick of one to three stories, so communications aren't usually a problem; however, urban areas have high-rise structures of steel, reinforced concrete and tinted glass, all of which reduce the ability of radio waves to penetrate. Subway tunnels, underground parking garages and other such structures also pose special problems.

These structures require extra equipment to push a stronger radio signal throughout the building so that interior teams can communicate. This equipment can be installed ahead of time or carried to the scene by a response team. Permanent solutions include an extra radio tower or an in-building amplification system. If no permanent fixture is in place, a vehicular repeater or suitcase-sized portable repeater can be brought to the scene. The portable repeater can be set up inside a building to provide communications from the interior teams to the incident commander and safety officer outside.

Another situation in which portable or vehicle-mounted repeaters must be used is in wildland firefighting. Resources can be dispersed in remote areas where a JAN hasn't been established and over a wide area where the terrain might be hilly or mountainous; the main obstacle is getting coverage from the incident commander or the sector commanders to their dispersed teams. Because these incidents can last days or weeks, providing continuous power to temporary repeaters is a concern. Solar power can be used but may be limited when the sunlight is blocked by smoke; portable generators need to be fueled and are therefore an additional logistical burden.

Another issue regarding operability is a system's capacity, though chief officers often don't worry about it. Local systems usually are designed, preferably by an independent consultant, to handle all of

SAFECOM's Interoperability Continuum



In this interoperability continuum, departments that are operating at a minimal level have limited leadership, planning and collaboration among areas with minimal investment in the sustainability of systems and documentation. Departments operating at the optimal level have just the opposite.

the many workgroups and teams needed for day-to-day communications. When a significant number of additional resources are brought in for assistance, however, capacity can become an issue.

One of the best ways for a JAN to handle extra capacity is through the use of a trunking system, which can assign priorities and share channels among agencies. When a major incident occurs, the additional talk groups automatically will pre-empt other routine communications, making more capacity available for mission-critical messages. The lower-priority messages will experience a busy signal during such times. In addition, new technologies are near at hand to increase the surge capacity of JAN radio systems, using time instead of frequency techniques.

Trunked radio systems can provide a large degree of flexibility for operational needs; however, if a department's practice is to go off the trunked network at the fireground, this won't help. It is possible to allow some level of communications to stay on the network (for senior commanders, for instance) yet still allow interior teams to be off the network and use direct radio-to-radio communications and portable or vehicular repeaters.

If the JAN isn't a trunked system but rather a conventional system, then additional channels will be required to create the needed hierarchy of networks to support a large incident or several simultaneous incidents. Such additional channels may already have incumbent users, so there will be some confusion and contention as other users attempt their work on unrelated incidents.

Capacity is closely related to the second category of fireground communications: interoperability. Whenever mutual aid operations bring outside resources into a jurisdiction, there has to be a method for integrating resources into communications, both when they're dispatched and when they arrive. It's important that whatever methods are chosen to create interoperability, they must meet some important operational criteria. (*See "SAFECOM's Interoperability Continuum," above.*)

Standard operating procedures that adhere to the National Incident Management System will aid in communications. Incident command is especially important at larger mutual aid or catastrophic incidents, where the sector and branch commands and operations, logistics and finance all must work together. It's important that there be multiple communications networks so that sector commanders can talk to their resources without cross conversations from other sectors. At the same time, it's important that safety officers and incident commanders have their own network to communicate urgent strategic messages that differ from the many tactical messages being passed at the branch or sector level.

New operational, procedural and regulatory changes in the fire service will require unique approaches to fire service communication. The Federal Communications Commission is mandating all agencies that use radio communications in the VHF and UHF bands halve their channel bandwidth to provide more capacity by 2013; agencies on the 700MHZ band must do so by 2017. These changes

will require much advanced planning; chiefs should talk to their communications vendor and an independent radio consultant to understand the options, as many new technologies provide more cost-effective systems than in the past. Furthermore, NFPA 1800, Electronic Safety Equipment for Emergency Services, is requiring that portable radios survive higher temperature extremes.

However, new technologies promise solutions to these challenges. New digital voice technologies allow fire departments to meet future narrow-banding mandates from the FCC while also providing privacy and security. New hybrid systems also will allow a mixture of analog and digital signals so that those in the fire service who wish to continue to use analog radios can do so.

SCBA-integrated microphones and earpieces can overcome problems associated with fireground noise and firefighter panic. Data can be sent over jurisdictional and IANS at speeds sufficient to handle large data files or images. Department data systems can store address information in the computer-aided dispatch system to tell both the dispatcher and the responding units if there are hazardous materials at that location. It also may tell them where the lock box is located or provide the code needed to gain entry through a secure gate. Central records-management servers can store more and more detailed information, such as preplans with blueprints and address inspection history.

New software applications provide an incident commander with tools to manage large and small incidents on a handheld computer and then send that information to other commanders and dispatch over the JAN.

Video technologies provide small cameras that can be mounted to a telescoping mast on the command vehicle to get a bird's-eye view of the scene, and then transmit the information to other locations using Internet protocol standards.

Communications systems are becoming more standards-based, using IP technologies, off-the shelf equipment and APCO Project 25 standards to reduce the total cost of ownership. One new standard under Project 25, the Inter Systems Signaling Interface, allows city, county and state systems of different vendors to link together in regional systems, creating an extended area network. New IP-based interoperability solutions, some of them using the Project 25 standard, link older legacy systems of different technologies and vendors together.

Many of these solutions are available today from vendors; other technologies aren't far out. The technology already exists, but the challenge is to make all of this highly reliable in the extreme environments that the fire service enters, and at affordable prices.

Radio has vastly improved fireground communications since the days of the speaking trumpet. However, new operability issues of coverage, capacity, and procedures and regulations, as well as interoperability issues, are challenges faced today. New technologies are meeting these challenges and providing improved fireground communications today, paving the way for the future. [FC]

John Facella is the director for public safety markets at M/A-Com Wireless. He has 23 years of experience in public safety radio communications and is a registered professional engineer. Facella is a member of the Association of Public Safety Communications Officers, the International Association of Fire Chiefs and the National Fire Protection Association, and is a vendor member of the IAFC Communications Committee. He is an active firefighter/EMT with more than 20 years of experience and is certified as a Firefighter I/II and a Fire Instructor I.

Dirk Young is a national manager for public safety markets at M/A-Com Wireless. He has 11 years of experience as the chief of the Satsuma (Ala.) Fire Department, was the EMS director for Mobile County, Ala., for five years, and was a paramedic and flight paramedic.