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REVIEW OF THE LITERATURE ON ACTIVE SHOOTER/COUNTER TERRORISM EXERCISES:
LESSONS LEARNED, CAPABILITY, TRAINING, AND TECHNOLOGY GAPS

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14. ABSTRACT

   In 2016, the Tactical Behavior Research Laboratory was awarded a statement of work from the Department of Homeland Security (DHS), Science and Technology Directorate, Homeland Security Advanced Research Projects Agency, Explosives Division to conduct a review of the literature on DHS-sponsored active shooter/counter-terrorism exercises and other such events in the United States. The literature review identifies lessons learned and capability, training, and technology gaps of the responding departments based on 26 sources.

   The sources cited the lack of officer capability (a) to respond to every possible type of active shooter or terrorism scenario, (b) to ensure that procedures for the creation and functions of incident and unified command are followed, (c) to ensure fast and efficient interagency interoperability, (d) to ensure accurate and reliable coordination and communication under all circumstances among all personnel, units, and teams, (e) to ensure that all information to support a response is gathered quickly, (f) to quickly develop, record, and maintain at all times a complete picture of the incident, resources, personnel, and their locations, (g) to quickly and accurately locate, distinguish, and identify perpetrators and friendly forces, (h) to provide all teams of first responders personal protective equipment (PPE) that does not impede execution of tasks, and (i) to assure patient triage, transportation, and care are optimal in every situation.

15. SUBJECT TERMS

Active shooter   Counter-terrorism   Drill   Exercise   First responders   Law enforcement   Emergency medical service   Incident command   Unified command   Command and control   Communication   Department of Homeland Security

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14. ABSTRACT: (Continued)

Other gaps that were identified include training in (1) cover and concealment, (2) muzzle discipline, (3) contact and rescue team formation and movement, (4) clearing for a variety of areas, (5) response to explosives, suicide vests, hazardous materials, (6) intelligence gathering, (7) methods for identification of armed friendly forces, (8) response to suspicious vehicles, (9) apprehension of suspects in vehicles, (10) setting keyholes/chokepoints during preliminary search, (11) response in a variety of environments and conditions, (12) medical procedures that are appropriate for hot, warm, and cold zones, (13) patient transport in a variety of environments, (14) implementation of incident and unified commands, (15) joint law enforcement, medical rescue, facility security training, (16) determination of when and where medical teams should be deployed, (17) developing a common operating picture, (18) guideline for decision-making, (19) mechanics of radio use, channel switching, and crossing zones, (20) protocols for requesting medical aid, (21) creation and implementation of cross-agency glossaries, (22) methods of nonverbal communication in noisy conditions, (23) methods in creating communication and information flow networks, (24) control of transmissions through message prioritizations and protocols, (25) execution of personnel accountability reports over the radio, (26) message construction, and (27) selection and training for key communication personnel.

Technology gaps identified include (a) drones, (b) devices that aid in creating and maintaining a common operating picture, (c) devices that can be used for deconfliction and identification of friendly forces, (d) patient moving equipment, (e) first responder location and health tracking devices, (f) technological means of assisting runners, liaisons, and other decision makers in identifying and locating key personnel, (g) systems that support tracking of resources, (h) instruments to find victims, (i) instruments to assist in triage and retention of patient information, (j) technology that guides decisionmaking, (k) PPE specifically for medical personnel, (l) instrumentation to locate and identify perpetrator, (m) devices with relevant maps and site information, (n) devices that contain a glossary, (o) personnel protective equipment with integrated voice amplifiers, (p) equipment that gives remote access to camera feeds and other digital data, (q) tools to ensure that medical information remains with patients from triage through transport to the hospital, and (r) systems for assured communications among all parties (communication systems that are reliable and clear with wide coverage, tools that ensure interoperable communications, devices that transmit clearly in all ambient noise levels, in all weather, through all structures, and at required operational ranges, devices to clearly communicate with officers without perpetrator hearing, prevent interference of messaging, recognize and determine message priority, control transmissions based on priority, broadcasted in a way that differentiates the most critical information from normal radio traffic, quickly accommodates and facilitates required changes in channel assignments, devices that can record and disseminate messages and tactical information that can be passed on to succeeding teams or incident commanders, tools to identify, locate, and track critical points of contact among agencies, nonauditory, nonverbal communication devices for first responders, and communication systems for warning and information dissemination to civilians).

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ACKNOWLEDGMENTS

INTRODUCTION

Purpose

In 2016, the Tactical Behavior Research Laboratory was awarded a statement of work from the Department of Homeland Security (DHS), Science and Technology Directorate, Homeland Security Advanced Research Projects Agency, Explosives Division to conduct a review of the literature on DHS-sponsored active shooter/counter-terrorism exercises and other such events in the United States. The literature review was to identify lessons learned and capability, training, and technology gaps of the responding departments. This report is the result of that effort. The purpose of the report is to offer to officers and other decision makers a comprehensive report of lessons learned and identified gaps across a wide range of scenarios and settings in order to guide exercise planning and training, aid in development of novel supporting technologies, and to improve response to active shooter and terrorist threats.

Scope

This review covers active shooter or counter-terrorism exercise technical reports, after action reports, and articles that were located using the search strategy detailed in the appendix. A total of 26 sources were reviewed for the basis of this report. A references page with full citations or links to the references appears at the end of the report.

Overview

After the reports were read, categories for the lessons learned were developed based on the material. These categories were used to organize this report. They are as follows:

- Mechanics, Tactics, Techniques, and Procedures (MTTP)
- Incident Command and Unified Command
- Command and Control (C&C)
- Engagement with Victims
- Engagement with Perpetrators
- Strategy
- Communication

Because of the preponderance of issues in the literature that dealt with Communication, this category was further split into the following categories:

- Glossary
- Interference
- Channel and Communication Traffic Control Issues
- Hardware/Software Issues
- Accounting for Personnel
- Network Configuration
- Communication Protocols
- Interagency Communication
- Communication from Command to Teams
- Communication from Teams to Command/Dispatch
- Inter-team Communication
- Information Flow from Tactical Unit to Succeeding Tactical Unit
- Communication of Information through the Medical Rescue Phase

- Communication of Information from incident commander to succeeding incident commander
- Selection and Training

There is considerable overlap in the information in the sections; the redundancy was retained so that each section may be read as a standalone work without much reference to the other sections. Sources are not cited individually within the text; however, at the beginning or end of each section, a bibliography lists the sources used as the basis for that section. A references page with full citations or links to the references appears at the end of the report.

The Importance of Exercises

The value of this type of training is the first lesson learned from active shooter or counter-terrorism exercises. Participants cite practice for the nonroutine response and training of specific skills as reasons for the importance of undertaking these events (ref. 1). Moreover, exercises assist organizers in recognizing weaknesses in order to correct them (ref. 2). Exercises that incorporate after action discussion with law enforcement (LE) and the people they are trying to protect (e.g., students and teachers on campus) allow each to see the emergency situation from each other's perspective (ref. 3). From an opposing view, an academic paper found that students who watched an active shooter response training video reported increased feelings of preparedness; however, there were also increased feelings of fear among women (ref. 4). The authors questioned the worth of these training videos. However, one might speculate that actual exercises confer a benefit over and above training videos.

RESULTS

Mechanics, Tactics, Techniques, and Procedures

This section covers the observations, lessons learned, and recommendations for specific mechanics, tactics, and techniques that were noted in reports of active shooter exercises (ASE). While a good bit of the information is included in other sections, they are listed here as items that may be considered "low hanging" fruit; that is, simple improvements and suggestions that can have great impact on first responder performance.

Mechanics, Tactics, Techniques, and Procedures – Pre-incident Procedures

Reports based on ASEs at schools made many recommendations for preparations and planning (refs. 3, 5, and 6). In general, these recommendations focus on facilitating building access coordination between school districts and responding officers. The recommendations are as follows:

- Make provisions for officer access to locked buildings. This includes instructions to student and teachers on when to allow persons into the building and access to keys. There was also a call to have the number of keys limited for ease of use or to implement methods of campus-wide electronic access (cards).

- Label buildings, floors, and locations throughout the school buildings and campus.

- Mandate familiarity tours for neighboring LE. Distribute electronic versions of a campus map, detailing the layout of key infrastructure

of the school. Create maps, floor plans, and schematics that are easy to use and free from extraneous information.

- Build a web-based global information system accessible to internal and external public safety agencies to identify campus infrastructure and locations with hazardous materials as well as contain campus maps and building floor plans.

- Develop standard rallying points throughout the campus for the school personnel and neighboring agencies.

Mechanics, Tactics, Techniques, and Procedures – Bomb/Hazardous Materials (HAZMAT) Response

As reported in the sources, in general, officers were less prepared to deal with bomb, suicide vest, and hazardous material threats compared with shooters (refs. 6 through 10). There was some uncertainty about the appropriate responses, indicating a training gap and need for standard operating procedures and guidance. Points to be covered included the appropriate method for inspecting backpacks, vests, bags for bombs, targeting a perpetrator wearing a suicide vest, hazard distances while engaging with persons carrying explosives, and emergency evacuation commands ("Mayday!"). The need for personal protective equipment (PPE) requirements and guidance appropriate for explosive and hazardous materials was recommended in more than one report. Conversely, it was observed that typical PPE (e.g., helmets and ballistic vests) was lacking for special teams, such as personnel handling bomb-sniffing dogs.

Finally, one report criticized the bomb squad for opening doors on suspicious cars. The report noted that there was a danger that the cars may be rigged to detonate when doors were opened. Equipment that can accurately detect explosives would be welcome.

Mechanics, Tactics, Techniques, and Procedures – Building Approach

The few recommendations for building approaches were made (refs. 9 through 11):

- Bounding and over-watch should be used on approach.

- Cars, telephone poles, and other good covers can be used.

- Use multiple points of entry when possible.

Mechanics, Tactics, Techniques, and Procedures – Communication

Much of the material for this section on mechanics for communication overlaps with information in the larger section on communication in this report (refs. 6, 7, 8, and 10). Because of the overall importance of the issue, the lessons learned and recommendations bear repeating in briefer form. However, readers are also encouraged to read the larger communication chapter in this work as well.

Recommendations stemming from the observations are as follows:

- Officers should pay attention and follow communications. There were instances in the reports where hails were ignored or not heard or information was disregarded, resulting in lost time and extra efforts. Response to alerts, like a suspicious vehicle, should be prompt and not require repeated calls.

- Prior to any event, guidance and training are needed to ensure that responders understand the code words being used (e.g., "Code 10," "red or green" patients, etc.) as well as how to deconflict and distinguish other armed LE officers from suspects. Training and guidance regarding the use of radios, especially on the changing of zones and talk groups, were also recommended.

- The LE first responders on the scene must know the proper protocols for requesting additional assets, mutual aid, and medical assistance.

- Critical information, e.g, shooter location, should be given attention and wide dissemination. This is especially true when the shooter may be outside the confines of the room or building and is escaping.

- The mechanics of communications between successive teams were emphasized. Contact teams coming into a situation need to find the teams with information or witnesses, find out where shots were fired, and go toward the shots. Other vital information to be passed on includes: locations that were already cleared, how many perpetrators were in hand, taken away, or still to be apprehended, what to do about explosive devices, and what distances around the devices needed to be cleared.

Mechanics, Tactics, Techniques, and Procedures – Deconfliction

Issues of deconfliction (distinguishing between friendly forces and suspects) arise in active shooter scenarios where there is a possibility of multi-jurisdictional response, plainclothes officers, off-duty officers, and even legally armed civilians (refs. 7, 10, 11, and 12). Recommendations are to issue procedures for persons to identify themselves as friendly forces, such as specific terminology to be used, clothing or vests, or signs. Immediate self-identification as part of friendly force is especially important upon entering an area. In instances where an off-duty officer is already in a gun battle with the perpetrator, one report suggested that the off-duty officer should maintain a view of the entrance and the active shooter to be able to relay intentions to the arriving responding officers.

Mechanics, Tactics, Techniques, and Procedures – Engagement with Victims

A few tactics and techniques were mentioned in regard to interactions with escaped/freed hostages, victims, and witnesses (refs. 6 and 9). More material can be found in the chapter on Engagement with Victims; readers are encouraged to examine that section as well.

Intelligence needs to be gathered from escaped/freed hostages, victims, and witnesses; responding officers should make every effort to gather as much information as possible in real time. Upon entering, officers should be able to discern a direction based on the locations of victims and should ask for any intelligence they can give. Even when an active shooter is neutralized, officers

should not assume that there are no more shooters elsewhere in the vicinity or in hiding; victims and witnesses may indicate otherwise.

Escaped/freed hostages, victims, and witnesses should not be assumed to be nonhostile. They need to be searched for weapons as well. Fleeing persons should not be assumed to be nonhostile; they also should be apprehended and searched.

Mechanics, Tactics, Techniques, and Procedures – Equipment

Throughout the reports, lack of equipment was cited as a problem (refs. 7, 9, 10, 13, and 14). The equipment listed in the following section is categorized as equipment that existed but was not available and those pieces of equipment that need to be developed.

Available Equipment First Responders Lacked. The available equipment that the first responders lacked is listed in the following bullets:

- PPE for emergency medical personnel and bomb squad/K-9 team (e.g., ballistic vests and helmets)

- Ample supplies of flexible hand cuffs or restraints for surge

- Specialized weapons or tools

- Breaching tools for locked doors

- Key equipment to move patients in the environment (stairs, narrow doorways)

- Clothing that identifies officers from other jurisdictions that indicates that they are also part of a LE unit

- Long weapons

- Dry-erase markers to write on any surface for incident commanders

Equipment That Needs to be Developed. The equipment that needs to be developed is listed in the following bullets:

- Helmets that provide protection but do not interfere with hearing

- Patient moving equipment that can navigate stairs and narrow doorways

Mechanics, Tactics, Techniques, and Procedures – Management of Entry and Exit of Responders

Much of this paragraph overlaps with the material in the incident command and C&C sections. The reader is encouraged to refer to these larger chapters as well.

A couple of reports cited deficiencies in controlling entry into the area of the incident (refs. 6, 8, 10, and 15). One source noted that an area of improvement was to better identify the hot zone boundary and manage the ingress and egress of the area. Another report observed that too many

officers were being sent into the building without coordination of responsibilities. Lack of coordination of entering teams with teams already engaged was also cited as a problem. That is, entering teams immediately went into action without consultation with prior officers. Proper training in control of entry and exit into the incident and procedures for entry into the hot zone is indicated.

Mechanics, Tactics, Techniques, and Procedures – Medical/Rescue

Medical rescue issues were of paramount importance in the reports (refs. 6, 7, 13, and 16). Prior to any event, joint LE and medical personnel training was recommended. Training could provide interagency coordination and communication practice. For example, LE must address the threat before medical rescue can begin; therefore, they must adhere to the protocol for summoning medical assistance and communicating with medical personnel when patient extraction can begin.

In addition, because LE must protect the medical personnel, guidance must be given, and training must be practiced on how protection is accomplished. Sources gave their lessons learned in several aspects of this problem. The LE escorts were criticized for not accompanying the medical teams from entry to evacuation, abandoning the teams when shots were heard, lacking a rear guard, and spreading charges out too thinly to afford adequate protection. On the other hand, medical rescuers lacked PPE and lacked guidance on actions during an active shooter event. It was observed that a lack of protective equipment was not a consideration in the decisions to allow rescuers into the warm zones and in the duration of their stay.

In another exercise, teams were praised for the flexibility to create modified contact team formations and impromptu escort teams to extract victims/patients to suit the situation and resources. For example, one report questioned the wisdom of moving persons with minor injuries farther into the building versus sheltering in place until evacuation could safely take place. The sources emphasized that joint training would allow LE and medical teams to discuss feasible tactics and increase their joint functionality.

Several reports noted lack of guidance on what type or level of medical treatment can be given in the hot and warm zones (i.e., providing care versus extracting the victim and treating them in the cold zone) both by LE or medical personnel. For example, one source reported that LE were unsure if they were supposed to apply emergency care (such as a tourniquet) before medical rescuers arrived. In another source, it was observed that LE personnel were distracted in attending to a wounded officer outside in an open area near a building and failed to maintain security (snipers could have been watching in the windows).

Use of a color code system by emergency medical staff to triage patients was a strength in dealing with a large number of victims with a variety of injuries in one report. For example, red tags indicate more severe injuries, orange or yellow tags indicate less severe injuries, and green tags indicate the walking wounded. Tags with these color codes and detailed information should remain with the patient from triage, extraction, and treatment until transport to the hospital.

Triage of casualties was problematic in instances where rescuers lacked key patient transportation equipment, where patient information cards were poorly completed, and where there was no designated medical branch director present. Moreover, placement of color coded tarps (according to injury level) created difficulties in rendering treatment, and patients were left unsupervised for long periods of time. In that event, guidelines for searching for victims also appeared to be lacking. For example, two people in critical condition and five others in one room were overlooked for more than 5 min before rescuers doubled back and started getting them out.

Training in use of patient carriers was recommended. In this event, the use of the carrier for an unconscious or hand-cuffed patient was problematic, especially under the threat and time pressure of an active shooter. Their problem also underscores the need for a patient transport system that can be adapted to fit the circumstances of the patient and that can be quickly and easily used.

Mechanics, Tactics, Techniques, and Procedures – Movement

Movements in building entry as a team with patients and room entry were topics of lessons learned in many reports (refs. 7 through 11, 13, and 17 through 18).

Movement in Building Entry. A few sources reported issues with approach to areas of buildings to engage with an active shooter. In one case, first responders went to the wrong location due to disregarding of a transmission of the location of the victim. Lack of bounding and over-watch skills was mentioned in a few reports as well. The reports emphasized that officers should use cars and telephone poles for cover. Finally, one report cautioned that officers should not make themselves easy targets for perpetrators inside by walking in front of windows or glass doors.

Team Movement. The importance of movement as a team was frequently mentioned in reports. Expectations about team movements included developing into teams right away and moving toward shots fired or toward teams already engaged. Coordination can be established by using information from a prior team to guide movement toward perpetrators.

Speed of the team should not create a large spread among the officer teams; the lead should slow up to allow the rear to catch up. A team should have adequate forward coverage as well as a rear guard. Teams can split as needed to, e.g., as a gatekeeper in cleared areas, but team members should remain in visual/audio range.

Officers should not be walking backwards and should not hug the wall too closely (because of increased possibilities of injury due to ricocheting bullets). Officers should be able to distinguish between material that can be used for cover (protection against bullets) versus concealment (hides the officer but offers no protection). Movement on stairs was cited as an issue in one report.

Rescue/Movement with Patients. Movement with medical rescue teams and their patients presents issues that can be corrected with training and the right equipment.   Force protection for rescuers as they do their work was variable among the reports; in some cases, modified contact teams or impromptu escort teams were formed to accompany teams to extract victims and patients from the hot zone. Further joint training was planned to further develop guidelines.

In other reports, less than optimal movement occurred because of abandonment, keeping farther from the rescuers than was necessary to the medical team, or lack of a rear guard that left the rescue team vulnerable. In some cases, while LE provided force protection to the teams for extracting a victim, they did not always wait to escort the rescue team back to the warm zone or left when additional shots were heard.

In one instance, the first responders were criticized for moving witnesses and victims farther into the building instead of sheltering in place until evacuation was possible. Guidance is needed on where to move patients before an all clear is given.

Finally, there was difficulty in movements of patients because of a lack of key equipment to move the injured or lack of skill in using equipment to move patients. This was

especially true in the case of the unconscious and victims with handcuffs. Use of the patient transport "mesh" was problematic on this type patient.

Movement in Room Entry. Finally, the movement approaching the shooter was especially noted in one report. As stated in the report, an officer should not be "peeking" around the corner at the shooter. Officers should be stacked and ready to go at the sergeant's command with another officer located in a different position to provide cover. Recommendations were that in room entries with shooters, officers should not stand in the middle of the doorway, and, upon entry, the team should keep pressing toward the shooter.   In one case, the observation was made that officers talked about searching for another entrance; however, no search was made before moving into the room.

Mechanics, Tactics, Techniques, and Procedures – Outside of Building

Few scenarios made observations pertaining to security outside of a building (refs. 9 through 11). These recommendations were made for officers located outside (i.e., in a parking lot or vestibule) before engaging a threat inside of a building.

- Officers need to take cover; shooters could be in the windows.

- Perimeter security should be set up to catch escaping perpetrators.

- Officers should not make themselves easy targets by walking in front of windows or glass doors.

- Do not let up on security measures while tending to wounded outside of buildings.

Mechanics, Tactics, Techniques, and Procedures – Response to Shooter

The themes from the lessons learned focus on information gathering, strategy, and communication before the engagement with the perpetrator (refs. 8 through 11, 14, and 16). Critical information and discussion includes possible entrances for the officers and exits for the shooter. Upon building entry, the perpetrator should be engaged quickly. During the engagement, the focus is on strategy and communication among team members, pressing toward the shooter, and quick suppression with weapon usage once engagement starts.   Engagement with the active shooter is a turning point in the incident, forcing the shooter into a defensive posture; there should be no delay in reaching that point, one source remarked. Should the shooter escape, officers should investigate the available exits from the rooms and building, possibly alerting perimeter security around the building.

Crowds and hostage situations are a more difficult, complicated picture because of the increased possibilities of civilian injury and death. At a hotwash after the event, trainers asked whether or not officers experienced tunnel vision in targeting the perpetrator among other people. The officers answered that "training" kicked in, and there was no hesitation in engaging the perpetrator among others in the crowd. In the hostage situation, the trainer observed that once the hostage was executed, officers should press forward toward the shooter with speed.

Multiple units arriving at different stages of the operation present a more complicated scenario, with the possibilities of crossfire among different teams.   One source described a scenario where the shooter had retreated into a narrow alcove where the danger to people was reduced by the limited field of fire for the shooter. One unit ensured that the perpetrator could not move from that spot and moved injured to a safe location out of the line of fire. Another unit covered their actions

from defensive positions. At one point, one unit was trapped between the fires of the perpetrator and an arriving team; however, the situation was corrected during the exercise. Sniper teams positioned themselves at advantageous spots while another unit in an armored vehicle drove between the perpetrator and emergency medical personnel so that the injured could be triaged, treated, and transported. The scenario illustrates a multi-unit, coordinated response to the shooter and possible problems of crossfires.

During an exercise with another hostage situation, helmets prevented the officers from hearing the threats of the perpetrator. This observation leads to the need for PPE that does not interfere with other aspects of the task to be completed. More specifically, helmets that do not interfere with hearing should be developed. Suicide vests require aiming fire toward an impact area that results in incapacitation but does not result in detonation of the explosives (i.e., head or groin). Barriers that offer only concealment should not be used for cover (which offers concealment and protection).   Several reports mentioned this error on the part of officers.

Mechanics, Tactics, Techniques, and Procedures – Room Entry/Search

Observations of room entry mechanics were briefly mentioned by sources (refs. 7, 9, 11, 16, and 18).   The importance of having maps, floor plans, or schematics was emphasized as critical for planning and strategy before entry. This recommendation is also found in other sections of this report.

Within the reports, there were no firm guidelines for the number of persons needed for room entry and search, although one report suggested four as the optimal number – two go into the room and two to provide them force protection with forward and rear coverage. Reports agreed that there should never be a single person going to clear a room alone, and teams should not break up to search two different rooms. If there are not enough officers and shots are not actively being fired, officers in that position may want to wait for reinforcements.

In addition to the recommendation for the ideal number for room entry and search, there were recommendations for preparation for entry. One report commented that prior to breaching, officers need to set up or stack, communicate, and first ask, "Ready to go in?" Then, open the door.   Last person in should function as rear guard. Once room entry is breached, officers should keep moving into the room and cover different parts.

Finally, in one event, it was observed that an officer was calling out loud to find persons. However, trainers remarked that perpetrators will not respond with their location information or could respond pretending to be innocent school personnel needing help to draw officers into ambush. Therefore, this tactic was discouraged.

Mechanics, Tactics, Techniques, and Procedures – Vehicles

Issues and recommendations for control, staging, and placement of vehicles were mentioned briefly (refs. 6, 9, 10, and 11). Reports recognized the importance of early identification of the need for mutual aid for perimeter protection and securing the scene. Formal declarations of staging areas and stage command were recommended.

Car placement should be beyond a possible explosive hazard distance, if that possibility exists. Officers should consider driving and parking closest to where injured parties may be lying (as guided by dispatch) as opposed to arriving on the first parking spot in the vicinity.

During active shooter events, officers should be on the lookout for suspicious cars that should be searched for possible explosives in any nearby parking lot. In addition, training is needed for an

appropriate response to the possibility of a hazardous vehicle. If the possibility of such a threat is found, alerts should be given immediately so that people can move to safe distances, and elements of staging and the response can be relocated if necessary.

Perimeter security should be in place around the building to see a shooter who exits the building to reach a getaway vehicle. For this case, training is needed for apprehension of suspects in cars using hazardous vehicle stop techniques to grab suspects from the car. In the case being reported, officers incorrectly took cover and concealment behind Jersey barriers and failed to use flashlights to inspect the interior of the car. The criticism was that the officers should have been much quicker with everyone rushing the vehicle at the same time.

Mechanics, Tactics, Techniques, and Procedures – Weapon Handling

Various mechanics concerning weapon-handling were mentioned in reports (refs. 6, 9, 10, and 11). As emphasized in one report, no gun should be holstered during an active shooter incident (ASI). Upon arrival to an ASI on building and room entry, when a suspect's weapon is observed and when rounds are being fired, an officer's gun should be unholstered.

Muzzle discipline issues were frequently observed, including one caused by a door slam that startled an officer and during a bottleneck upon room entry. One report observed that officers had muzzles pointed up when they were trained to point muzzles downward. Other errors were officers running with their gun pointing out and directing people with the gun as well as crossfire muzzle discipline issues.

In one instance, an officer was firing too close to another officer's head and ears, which might have resulted in injury if real weapons were being fired. A recommendation was made to check ammunition after each engagement and cross load as necessary. Finally, one report recommended against verbally announcing being out of ammunition during an active shooter situation.

Mechanics, Tactics, Techniques, and Procedures – Capability Gaps

Officers currently lack:

- The ability to respond to every possible type of scenario.

- Reliability in communications.

- Access to critical site map information.

- Guidance on methods for deconfliction.

- Protective helmets that do not interfere with hearing.

- Protective equipment for medical personnel and other specialized teams.

- Methods to find and engage perpetrators embedded in crowds.

- Methods to keep patient information with patient from identification and triage to arrival at medical facility.

- Patient transport that is quick and easy and adapts easily to the situation.

Mechanics, Tactics, Techniques, and Procedures – Training Gaps

Several types of training were suggested by reports (refs. 6, 7. 8. 10, and 17):

- Joint LE and fire rescue for extraction of victims from a hot zone.

- Response to suicide vests (head shot), explosives, or hazardous materials.

- Movement up and down staircases.

- Radio use, crossing zones, and talk groups.

- Real-time intelligence gathering from witnesses.

- Proper protocols for requesting medical aid.

- Location specific training for area clearings (e.g., small rooms, narrow hallways, large open areas, etc.).

- Muzzle discipline training.

- Cover and concealment training.

- Response to suicide vest threats.

- Methods for deconfliction.

- Response to suspicious vehicles.

- Apprehension of suspects in vehicles.

Finally, cross training for standard training principles for joint responses was suggested. This type of training is also suggested in other sections of this report for interagency coordination.

Mechanics, Tactics, Techniques, and Procedures – Technology Gaps

- Technology that can be used for deconfliction.

- Helmets that provide protection but do not interfere with hearing.

- Patient moving equipment that can take stairs and narrow doorways.

- First responder location tracking devices.

Incident Command and Unified Command

Many sources report observations relevant to incident and unified command (refs. 6, 7, 9, 10, 13, and 15 through 25). Of particular note was the publication, "4 Best Practices for Active Shooter Incident Management | C3 Pathways" (ref. 19). This report compiled lessons learned from 10 ASEs, focusing on formation and function of incident and unified command.

Incident Command and Unified Command Incident Command Formation

A plan for staffing an incident command post (ICP) needs to be formulated and included as part of the active shooter LE response. While the first arriving LE officers are moving to engage an active shooter, the first arriving supervisor should immediately establish command by forming, staffing, and allocating responsibilities for an incident command and begin getting situational awareness of the scene and of the position of officers. As the incident command grows in size and positions change, the command structure and overall incident objectives should be communicated to responders.

Incident Command and Unified Command Incident Command Responsibilities and Tasks/Activities

Incident Command and Unified Command Coordination and Communication among Commanders. First responders should be trained on the establishment and operation of a unified command, which may avoid logjams at the command center during decision making conversations. Coordination of perimeter security, rescue task force, and additional units' response should be directed by the unified command. Clear, concise communication between a clearly designated central dispatch and the incident commander is necessary. Uniform positioning/staging of the incident command may help ensure satisfactory communication with dispatch.

Incident objectives and directives need to be communicated succinctly and efficiently from incident command to all first responders and may need to be repeated. To help ensure accountability, the incident command should conduct multiple personnel accountability reports over the radio. The incident commands that remain in the cold zone may be able to communicate with dispatch more easily and maintain overall situational awareness of the incident. The order of units being sent in is information that a tactical operations center needs to know. Smooth and efficient transfers of command between outgoing and incoming incident commands are an important part of a successful exercise.

Incident Command and Unified Command Perimeter Security. Perimeter security should be set up as soon as possible. Family members of victims and concerned parties should not be allowed to interfere with incident command operations; they should be directed to another area away from the active incident command.

Incident Command and Unified Command Resource Management. Better coordination of support teams may help avoid long delays at the start of an exercise. In one instance, the first rescue task force was sent in almost an hour after the start of the exercise. To avoid wasted time in the response zone, responders have to receive clear directions as to where to go once deployed. Effective record keeping may be enhanced by the use of a CommandBoard™ and/or a dry-erase HAZMAT board at the ICP. Combining this with incident sign-in sheets from the planning section, the incident command was given a complete picture of available resources and of those still en route. Rescue teams require proper staffing to ensure swift removal of injured victims and casualty collection points (CCP) should be set up in suitable locations with location notifications radioed to all responders.

Incident Command and Unified Command Incident Command Conversion to Unified Command and Staffing

Incident Command and Unified Command Transition. The C3 Pathways has outlined a suggested process for building the incident command (ref. 19). They reported that as the incident was unfolding, it was significantly more effective to build out the incident command system (ICS) organization from the bottom up and not the top down, using this sequence.

The first supervisor establishes command, directly managing the first officers on the scene in the danger zone. The next arriving supervisor then assumes command and assigns the initial incident command to manage the contact group. The new incident command is focused on identifying the hazard areas and establishing perimeters.

Next, a higher ranking supervisor arrives, gets a quick briefing, and assumes command, now assigning the second incident command as LE branch. The incident command assigns a fire/emergency medical services (EMS) chief to be medical branch. The incident command then builds out the ICS organizational structure as needed to support the incident, remaining as a single incident commander until transitioning to unified command.

A new group of (higher ranking) supervisors stands up unified command, and the incident command becomes the operations section chief reporting to unified command. A smooth and efficient handoff from one incident command to another is a necessity, and the unified command should be an upgrade to the incident command, not a separate entity.

Incident Command and Unified Command Communication and Coordination. Multiple problems were seen at a 911 dispatch center: observers were unable to determine whether the shift supervisor assigned the right communication channels, whether a proper, common channel was assigned to all field responders, and whether additional manpower was called in when necessary. There was no knowledge of a unified command structure at the 911 center, and the dispatchers did not know, or were not told, who the incident commander was. Saying that various offices did not cooperate well, some key components of the command structure were not achieved.

Some of the areas that seemed to show a lack of overall cooperation and coordination were: (1) there was no coordinated entry at the front of the school nor a person designated to be in charge, (2) there was no unified command since LE set up incident command in the command post while fire set up in the rear of their truck, (3) the operations section chief and subordinate divisions and teams were never set up, (4) and the sheriff's office commander made all tactical decisions from the command level.

At one location, several communication/coordination breakdowns were seen. During the exercise, the on-scene ICP did not communicate any information between the campus incident management team and vice versa. This was an incident management team that had not been included in the planning process for the exercise. At the same exercise, an LE representative worked well with incident command to form the first part of a unified command, but EMS units stayed on their normal dispatch channel instead of using a mutual aid channel. This lack of communication resulted in EMS units driving to the scene without the incident commander's permission.

Incident Command and Unified Command Staffing. Several exercises reported a lack of unified command representation by any school district personnel or campus incident management team members at drills that took place at schools or college campuses. There were some successful attempts to establish a unified command and some exercises that incorporated several teams into their ICS structure, but there were other reports of a designated ICP without any creation of a unified command.

Incident Command and Unified Command Capability Gaps

Officers lacked methods for giving incident command a complete picture of resources available and en route. There was also a lack of global adoption of incident and unified command procedures and a lack of assured communication systems.

Incident Command and Unified Command Training Gaps

The most critical training gaps are needed for incident and unified command training. Several districts commented on the value of incident command training. One district reported that facility incident management teams can benefit from using the concept of the ICS to manage their operations. Another district stated that the delegation of incident commander and supporting roles should be planned ahead and included in protocols, and county and municipality public safety agencies should be offered a basic ICS training course.

Incident Command and Unified Command Technology Gaps

The incident and unified command technology gaps consist of technology that tracked everyone's location and devices for effective record-keeping.

Command and Control

The C&C has a large number of components. Numerous reports offered lessons learned across many topics (refs. 6, 7, 9, 10, 13, 16 through 20, and 22 through 27). Two areas of primary concern were decision-making and communications relevant to C&C.

Command and Control Decision-making

Decision-making relevant to incident C&C was an issue in many reports (refs. 6, 7, 13, 17 through 19, and 22 through 26). The C3 publication (ref. 19) offered the following lessons learned from their 10 ASEs:

> "There are 6 Imperatives for incident command: Assess situation and Identify Danger Zone, Establish Command, Establish Staging (can use Fire Department), Establish Perimeter, Request Resources, Maintain Accountability. The first supervisor is making command decisions about assignments and actions, and is by default in Command of the incident. Best practice was for the first supervisor to immediately establish Command (e.g. 'Dispatch, Sgt. 1 establishing Command'), and begin getting situational awareness of the scene and position of officers. This created a single point of contact for decisions and actions, for example to organize or designate officers on scene as identifiable teams (e.g. Team 1, Team 2, or Contact 1, Contact 2, etc.). Best practice was for the second arriving supervisor to assume Command and designate the first supervisor as responsible for the Danger Zone and the assigned resources, for example 'Sgt. 2 to Sgt. 1, I'm assuming Command, you will be Contact Group, tell me what you need.' This action enables the first supervisor (e.g. Sgt. 1) with the best situational awareness to continue focusing on the task at hand – get the bad guy. The new Incident Commander (e.g. Sgt. 2) takes a broader view of managing the incident and remaining priorities knowing contacting the shooter is delegated to Sgt. 1(e.g. Contact Group)" (ref. 19).

The roles and responsibilities within a unified command should be established prior to an event in a documented protocol to ensure efficient decision-making response during an actual incident. Personnel that are eligible to serve as incident commanders for their respective departments should be empowered to make decisions in the absence of senior leaders. If commanders arrive before their resources are available, it is a good opportunity to learn about the incident and prepare plans for execution once resources are on site.

As the incident command structure grows in size and positions change, responders can become confused as to who their supervisor is and become unsure of the overall incident objectives. Commanders should make a point of airing incident objectives and the basic incident command structure over the radio to all responders. Leadership and directives given by the command post need to be clear, concise, and methodical. Management of the contact/rescue teams need to be strictly controlled to ensure proper clearing and evacuation of the structure.

It is critical that incident command request and use the appropriate support needed in an incident in an efficient manner. Unified command should be established as soon as possible to ensure proper coordination of the resources available. Commanders from each vital department, including LE, fire, EMS, HAZMAT, and bomb squad, should be included in the unified command structure. Dedicated personnel at the command post can be used to track resources effectively. Commanders should retain resources until it is verified that their help is no longer required to ensure sufficient support.

The C3 publication (ref. 19) offered the following lessons learned from their 10 ASEs. The responsibilities of the staging area are: organize incoming units; log agency, unit identification (ID), type, and time; keep command informed of total numbers (e.g., "6 ambulances," not unit IDs like "Amb 1, Amb 2, etc"); when making assignments, units should be told (1) where they're going, (2) who they're reporting to, and (3) their assigned radio channel; and solve radio and interoperability problems in staging. Commanders should carry along dry-erase markers or other writing tools to be able to quickly display information to necessary parties.

The C3 publication (ref. 19) also suggests that there are three critical elements to utilizing the staging effectively in an active shooter response. First, establish staging early in the response in a safe location well clear of the incident. For example, "Command to Dispatch, all incoming units to Staging at 1st and Broadway." Do not wait until command is overloaded with resources and has lost situational awareness as well as span of control (ref. 19).

Second, have only one staging area. Do not allow separate staging areas for LE and fire/EMS. Separate staging areas will simply add to confusion and communication problems. No purpose is served by separate staging areas (ref. 19).

Third, assign a staging officer. Many fire departments have a policy directing the first resource arriving in staging to become the staging officer, but this is less common in LE. Command may also direct the assignment when establishing staging, for example, "Command to Dispatch, all incoming units to Staging at 1st and Broadway. First unit to assume Staging" (ref. 19).

Command and Control Local Security/Administrators. Local security and administrators can provide key input about the facility and should be consulted and used where possible to support command decisions. Local security and administrators must follow the directions of the LE response teams and only lend support when it has been requested.

Command and Control Rescue Task Force/Emergency Medical Services/Warm Zone. Commanders should supply the needed resources to ensure an efficient rescue operation as soon as the environment allows for extractions. Enough rescue team members should be deployed to ensure the most efficient and safe extraction of the injured. The rescue task force should accompany and support the LE teams versus remaining with the EMS in the warm zone. Officers that are available can support EMS in treating victims and separating victims from potential suspects, gathering information from witnesses, and correctly sending victims out from the scene in groups.

Personnel that are eligible to serve as incident commanders for their respective departments should be empowered to make decisions in the absence of senior leaders. Supervisors designated as incident commanders should resist the drive to jump in and help but should step back and perform the job of the commander by requesting and allocating the appropriate resources based on the need. The assignment of a medical branch provided the supervisor controlling EMS resources to begin discussions and planning with the LE branch.

Location of warm zone and CCP should be communicated as soon as they have been established. A leader that is in communication with incident command should be available for the CCP to coordinate assessments of the injured, triage them, and determine the best course of action based on their injuries. Fire/EMS personnel should not be brought into the warm zone before victim locations are identified to avoid wasting time and resources. The injured should be categorized appropriately in green, yellow, or red to help facilitate more efficient urgent care.

Command and Control Entry Teams. The roles within the entry teams should be decided before entry. The leaders within the entry teams should use the experience of other team members keeping the mission's best interest at hand. The communication structure should allow for frequent updates and dialogue between the incident commander and the entry teams. Supervisors designated as incident commanders should resist the drive to jump in and help but should step back and perform the job of the commander by requesting and allocating the appropriate resources based on the needs.

All entry teams must coordinate with incident command. This includes land and air teams. As teams progress through an incident area, command should be made aware of their movement plans and progress. If special, nonstandard equipment is required, this too should be coordinated with the incident command. Teams should cover various parts of the incident area, communicating to team members and incoming support teams which areas are covered and which areas need to be cleared.

Large fire fights in the presence of numerous bystanders can result in avoidable casualties. Contact teams should evaluate the best approach to engage perpetrators in order to minimize casualties.

Command and Control Approach and Movement during Incident

Responding officers' initial entry and subsequent movement should be based on the directives of an incident command person. Due to a lack of direction, in one scenario, the first team never drew their weapons and did not engage with the suspects. This mistake was problematic because there were several suspects in the crowd who were not cleared. When the second team came out with their weapons drawn, the first team officers then realized their mistake. Building entry, by a response team and not a single officer, should be coordinated by direct communication from incident command.

Communication from other team members as well as the command position should not be disregarded. This will help ensure that responders are going where they are most needed and may reduce the possibility of confliction. When responders such as an EMS unit drive to the scene without the incident commander's permission, they may be putting themselves as well as victims and other first responders in a very dangerous position. Communication between all responding units and the command position should be ongoing and frequently updated.

Command and Control Safety

Local security supervisors were able to help with identification, care, and transport of victims. When a team member is acting unsafely or mishandling a weapon, teammates should address the issue with urgency.

To avoid having first responders enter the hot zone without direction from the command position, a clearly defined hot zone boundary should be established, and entry and exit should be monitored. Although LE team members responded quickly and appropriately to protect them, EMS units should only go to the scene with the incident commander's permission.

Whenever possible, triage and treatment areas should not be left unattended. Before entering the school to provide triage and treatment, EMS safety was taken into consideration as they coordinated with LE to ensure security.

Command and Control Planning and Preparation

Exercises incorporating interactions with stadium security are helpful in practicing coordination among security forces, LE, and rescue teams. Park security forces could be better utilized if they were active participants in scenario design and execution. Joint trainings may improve use of park security during response to terrorism events.

The LE "hunter" contact teams did not always follow the same protocols. The use of color-coded ICS vests and the use of ICS signage may reduce confusion by helping responders quickly locate supervisors. First responders may benefit from additional training regarding unified command and the delegation of roles through ICS.

Fire departments and EMS need to do more joint training with LE, schools, and hospitals. This may help increase familiarity and trust among disciplines and lead to specific policies regarding coordinated emergency response. Having portable white boards or large sticky notes may be helpful with recording messages for later reference during drills.

Command and Control Communications

Observations about communications relevant to C&C were made in several reports (refs. 7, 8, 11, 13, 15, 17, 23, and 26). The material in this section overlaps with material in the larger specific "Communications" chapter; readers may want to examine that section as well. As can be expected, the reports discuss that, in general, the better the communication functions during the event, the better the C&C of the event. Of particular importance was a good link-up between entry teams and unified or incident command.

Communications from Command to Teams. Once incident command is established, the fact that it is established, its location (e.g., what intersection, campus area), a brief description of the incident, and additional resource needs must be told to central dispatch and other units. Because of the importance of messages from command to officers, it is vitally important these messages get to their targets.   Sometimes, messages from unified and incident command did not reach the officers, primarily because of competing traffic over the radios. Suggestions included designating certain radios as a priority so those transmitted messages override all the others. For example, the radio network could be configured so that incident command transmissions would always be broadcasted.

Important information reported by sources that need to go from unified and incident command to contact and rescue teams includes deconfliction (friendly forces that might be arriving or already present), directions to incoming officers, and areas that are safe or cleared (although there was a question of whether victim movement and police clearing should be announced over the air). In some cases where officers appeared to lack direction, analysts were unable to tell if there was a lack of directives issued from incident command or orders were simply not heard or ignored. The incident command's failure to send directives was commented on in a few of the reports.

Communications from Teams to Command. Important information that needs to go to unified or incident command for decision-making and for issuing directives includes possibilities of additional suspects, establishment of warm zones, number of shooters, how many perpetrators, how many shots, number of injuries, and when the shooter is down.

Communication Failures in Command and Control. Failure to either receive communications from C&C or to follow directives was reported. When officers fail to execute a directive transmitted by command, it is difficult to identify the root cause. The possible causes were (1) the transmission was interrupted, (2) not heard, (3) heard but ignored, or (4) heard and not ignored, but execution was delayed due to uncertainty about the validity of the directive. Instances such as these were reported by sources.

For example, in one scenario, officers went to the wrong location despite being instructed on where the victims were. An area of ongoing hostage executions remained uninvestigated by officers; trainers who were viewing the videos were not sure whether or not incident command had issued directives to go and engage the terrorists in that location or if the directives were received but were ignored because of shooting with other perpetrators in other areas. In any case, how communication issues affect C&C, especially reception and compliance with communications, are an important area of study.

Observed errors in communication may not be due to problems in communication per se but with other obstructions. For example, in one instance, there was a delay after several incident command communications for the rescue team. Upon closer examination from many video-recording angles, it was found that the team was waiting for an additional directive from their fire chief. This incident speaks to the need for delineation of C&C guidelines of who can send transmissions to deploy resources into hot or warm zones.

Interagency Communication for Command and Control. Establishing a unified command requires interagency communications, particularly between LE and fire/rescue teams. Reports particularly pointed out that interagency communication should be free of conflict in order to establish a unified C&C. Also important was communication between local security supervisors (e.g., campus or ballpark facility) and incident commanders. Reports observed that in their events, local security forces with access to their own campus or facility network of cameras and communications could give commanders updates on the unfolding situation. Incident commanders sent information to these local security personnel so they could direct crowd and rescue movements toward cleared and safe areas.

Aids to Communication in Command and Control. A source reported that during their events, some incident commanders designated their teams with a letter, number, or their jurisdictional name before sending them into the hot zone. This helped with radio and verbal communications during the response. This source also reported that communications for C&C were helped by a fire map that allowed room designations to follow on tactical or medical updates.

Communication issues may have been the cause of a failure of a sergeant to cede incident command to a newly arrived lieutenant. The sergeant remained at incident command throughout the event, despite higher level officers coming on scene. Trainers who were reviewing video recordings of the event speculate that there may have been a miscommunication or perhaps lack of communication.

Capability Gaps – Command and Control

Officers lack:

- A system of assured reliable coordination and communication among units

- General decision-making strategies for all situations

- Record keeping system and methods to track resources and locations

Training Gaps – Command and Control

- Joint operations training

- Decision-making training

- Gathering of information from witnesses

- Medical procedures appropriate for hot, warm, and cold zones

Training should be provided to aid teams conducting joint operations with other departments. Major gaps include: developing an understanding of a common operating picture, setting keyholes/chokepoints while conducting the preliminary search, setting up an incident/unified command, LE's determination of where medical teams should be allowed, and how soon to bring in medical teams (ref. 7).

Technology Gaps – Command and Control

- Technology to find victims

- Technologies to assist in triage and retention of patient information

- Technology for assured communications

- Technology that guides decision-making

- Personnel accountability/tracking

- Tracking of resources

- Record-keeping technologies

Engagement with Victims

Lessons learned from engagements with victims were drawn from several sources (refs. 2, 3, 6 to 11, 15 to 17, 20, and 23). There is overlap in this section with other sections, including MTTP and Communications. Four general areas are categorized in the following paragraphs.

Initial Contact with Victims

A fast elimination of the threat by quickly engaging the shooter is essential and may require bypassing some victims. When pursuing a shooter, officers should not stop to check on victims or move them. However, when possible, officers should be prepared to offer quick verbal reassurance to victims as they pursue the shooter. This has a positive impact on victims, allaying fears and feelings of abandonment, as one source reported.

When possible, victims should be taken out of the line of fire and moved to a protected position. They should not be directed to go where gunfire is heard. Officers should not use their guns as pointers when directing personnel. No deceased persons should be touched, and bodies should be left at crime scene.

Engagement with Victims Communications

Message communication with civilians should be as fast as possible and provide enough information for recipients to identify danger and take some action. Terms used in communications to responders and victims should be clear to all. For example, in one exercise, some people felt that the word "contained" was confusing and meant the exercise was over. When dealing with hidden people, officers should be prepared to prove they are police officers and to use clear, simple language to communicate.

Officers should be prepared for victims who are trying to protect themselves and others. Victims should be aware that officers may mistake an armed person for the shooter. In several instances at one school exercise, an armed parent or teacher was mistakenly shot by an officer. When officers don't wear earpieces, they should be aware that suspects, who may be posing as victims, may be able to hear their radio traffic and act accordingly.

Engagement with Victims Intel Gathering and Search

When not dealing with the pursuit of a shooter, officers can get useful information from injured victims such as a description of a perpetrator. One source reported that officers often ignored the information and/or assistance offered to them by teachers, students, and principals, even when active gunfire was not driving their response. Although principals offered master keys, teachers tried to give the shooter's description, and students offered to show officers back hallways to access rooms, but most of these offers were ignored.

When the situation is uncertain, treating victims as potential suspects may be warranted and a safe approach. All should be questioned and searched, including children, hostages, and victims. Processes should be in place to detain and interview all witnesses and participants to determine true culpability and role within an incident.

When a shooter is not active in a school situation, a report suggested that officers should use available resources to help them prepare their strategic assault. For example, the report from a school exercise remarked that officers should be prepared to tell teachers and principals what they can do to help get students to safety, and teacher training should include instructions on listening to the police when they arrive.

Engagement with Victims Patient Care

Fire/EMS teams that entered warm zones with force protection were able to provide care and extraction much sooner than they would have if they waited in the cold zone. However, team configuration (ratio of LE officers to fire/EMS personnel) is an important consideration for warm zone operations. In addition, Fire/EMS personnel need appropriate PPE and guidance on what medical procedures to perform in cold, warm, or hot zones.

Use of a color code system by emergency medical staff to triage patients was a strength in dealing with a large number of victims with a variety of injuries in one report. When dealing with casualty collection points, there is a need for an overarching command to establish leads or a medical director to determine the best course of action based on injury. Triage and treatment areas are not to be left unattended.

Placement of casualties should be handled carefully. For example, in one event, injured were placed near suspicious vehicles. Responders need to attend to downed officers in a timely fashion. This recommendation was found in a report where a downed plain clothes officer was bypassed despite a visible weapon and badge.

Capability Gaps – Engagement with Victims

Officers lack:

- A means for assured clear communication with civilians

- A method for distinguishing perpetrators from others

Training Gaps – Engagement with Victims

- Gathering of information from witnesses

- Medical procedures appropriate for hot, warm, and cold zones

Technology Gaps – Engagement with Victims

- Technology to find victims

- PPE specifically for medical personnel

- Technologies to assist in triage and retention of patient information

- Technology to communicate with civilians

Engagement with Perpetrators

Unsurprisingly, many sources volunteered recommendations and lessons learned for engagement with perpetrators (refs. 2, 7 through 11, 14, 17, 18 and 26). Some of this material can also be found in the section on Mechanics, Tactics, Techniques, and Procedures.

Engagement with Perpetrators – General Information

- During an ASI, guns should never be holstered.

- In a scenario involving different jurisdictions, not all officers defined "active shooter" the same way, and their response to the situation varied as a result. A common operating picture would need to be developed before engaging with the perpetrator.

- A report recommended that officers should always be pressing upon building and room entry, and, once a hostage is down, officers should press forward.

- In one scenario, officers were instructed by the trainer that the first task for the team was to link up with the patrol that first engaged the shooter. Then, they were instructed to find out where shots were fired and go to the shots. In addition, officers need to let sergeants know when shots are fired.

- Perpetrators should be engaged quickly; however, before engaging targets, any weapons should be identified and their intention of use. During the engagement, the focus is on strategy and communication among team members, pressing toward the shooter, and quick suppression with weapon usage once engagement starts.

- Should the shooter escape, officers should investigate the available exits from the rooms and buildings, possibly alerting perimeter security around the building.

- A fire alarm may impede the ability of LE entry teams to locate the perpetrator due to loud background noise, exacerbate the situation, and trigger the perpetrator to begin shooting.

- Hostage situations were reported on in a few sources. Communication among incident command, officers, and perpetrators was found to be especially critical during a hostage scenario. In one scenario, actor-hostages were executed because of a failure to communicate threats from the perpetrator to officers. In these hostage situations, a trainer observed that once the hostage was executed, officers should press forward toward the shooter with speed.

- Officer communications with the hostage-takers and other perpetrators also may be negatively affected by the headgear worn by responding officers. During a hostage scenario, members of a responding Special Weapons and Tactics (SWAT) team were not able to clearly hear the gunman during four attempts to communicate because of helmets that reduced the team's ability to hear. Therefore, the team failed to react to the gunman's threats about the detonation of explosives.

- Downed shooters should be searched as soon as possible. Suspect's guns should be taken away immediately.   If the perpetrator's weapon falls, it needs to be picked up and secured. No deceased persons should be touched, and bodies should be left at crime scene.

Engagement with Perpetrators – Deconfliction of Friendly Forces

During the LE engagement with a perpetrator, embedded off-duty officers or other unidentified friendly forces need to clearly identify themselves or risk being shot as a perpetrator.

Protection during Engagements with Perpetrators

Officer protection suggestions were made. Specifically, it was observed in one report that the officers staying out in the open, in the parking lot or lawn area, were "sitting ducks" for the shooters. Since wooden doors can be shot through, they should not be used as cover. Finally, officers should not walk in front of windows or glass doors, making themselves easy targets for perpetrators inside.

A couple of reports observed that communications that are broadcasted via radio or discussed among officers may be overheard by a shooter. The information heard by the shoot adversely impacts LE tactical advantage. Failure to use radio ear buds/plugs may unintentionally alert the suspect to the responders' location.

Capability Gaps – Engagement with Perpetrators

- Lack means to locate and identify perpetrator

- Lack means for deconfliction

- Ability to clearly communicate with officers without perpetrator hearing

- Lack helmets that do not interfere with hearing

Training Gaps – Engagement with Perpetrators

- Cover and concealment

- Deconfliction

Technology Gaps – Engagement with Perpetrators

- Lack means to locate and identify perpetrator

- Lack means for deconfliction

- Ability to clearly communicate with officers without perpetrator hearing

- Lack helmets that do not interfere with hearing

Strategy

Although many strategies were seen in a wide variety of active shooter simulations, certain approaches and training practices stood out as being applicable to varied locations and venues (refs. 5, 7, 8, 11, 12, 14, 15, 18, 23, and 26).

Initial Law Enforcement Response

Prompt establishment and appropriate positioning of incident command is generally viewed as essential. An incident commander that is not part of the response teams seemed to be most effective. The initial designation of incident commander at the site and how that role is passed on to arriving officers will vary with different departments. The establishment of an on-site incident commander with input from some type of command center provides an overall view of the entire scenario, allowing real time responses in a very fluid environment.

Coordination of Responders

While it seemed to be universally understood that a speedy elimination of the threat is essential and forms the primary objective of search teams, the establishment of a unified command for joint operations appears to be an important part of a quick and successful response in a large, long-term active shooter situation. Incorporation of a unified command approach, at some point, may cut traditional lag time in providing care for victims and potentially reduce loss of life. Training, which combines LE and fire/EMS personnel working together, may improve performance, response time, and patient/victim extraction time.

Supervisory Assistance to Responders

Numerous comments were made by ASE participants regarding a lack of familiarity with the physical layout of many of the structures where an ASE took place. There was a wide range of venues, including such diverse locations as Fenway Park in Boston, the New York City subway, a suburban synagogue, and rural and urban schools, hospitals, and colleges across the country. A lack of knowledge by responders regarding the physical makeup of these sites proved to be another obstacle in achieving a quick resolution of an ASI. Problems such as responding to the wrong building, not starting entry at the best entry point, or not being aware of additional exits and doorways were common occurrences. Frequent trainings at the various sites would probably help with this problem. An example of this was the New York City subway ASE where both LE and EMS were not well practiced in a group response to an underground threat. Having clearly marked buildings and distributing electronic campus maps or building floor plans to new responders was suggested. Using supervisory staff as part of a unified command might also mitigate this problem. Having a building supervisor, school administrator, building security person, or custodian involved with a unified command approach could potentially reduce these problems.

Law Enforcement Response

When responding to an active shooter event, LE responders, led by a team leader, should be aggressively pressing forward. They should be prepared to take decisive action against an identified gunman and not be waiting for another group such as a SWAT team. An example of an inappropriate LE response was a team of officers moving forward with weapons still holstered after hostages had already been shot. Achieving a fast elimination of the threat is the primary goal of LE responders. A recurrent theme is that prompt, leader-led action against a known perpetrator will result in the best outcome.

Emergency Medical Response

Hot, warm, and cold zones need to be established in any large-scale response to an active shooter event. Triage deployment and setup with clearly defined patient categories based on severity of injury is a key element in any response to a large-scale active shooter situation. While certain drills concentrated solely on LE response, some districts successfully employed an embedded warm zone technique that allowed mixed LE/fire/EMS teams to follow the initial LE "hunter" teams. This mixed team approach, following threat neutralization, requires cooperation, coordination, and communication by all responding groups.

Deconfliction Concerns

During search operations that involve LE officers from different jurisdictions working together, some standardized method of identification to fellow officers should help reduce the possibility of "blue on blue" casualties. Communicating a standard verbal police identifier to other officers or wearing easily recognizable "POLICE" clothing may reduce the risk of injury to officers from another jurisdiction, plainclothes officers, off-duty officers, or units entering an active area of conflict.

Capability Gaps – Strategy

- Lack of ability to access location site maps.

- Lack of ability to deconflict, distinguishing perpetrator from armed friendly forces.

Training Gaps – Strategy

- Incident and unified command implementation

- Joint law enforcement and medical rescue training

- Training in a wide variety of environments

Technology Gaps – Strategy

- Device with relevant maps and site information.

- Devices that aid with deconfliction.

Communication

Development of a shared vocabulary, nomenclature, or uniformity of terms was recommended by several after action reports (refs. 7, 13, 17 through 20, 22, 23, and 25). It was noted that among different groups of responders, some terms had different meanings. Survey answers on a post-event questionnaire noted that "(law enforcement) did not know (fire department) color coding systems for victims. Understanding and utilizing common terminology in describing aided individuals, mayday, 10-13 or evacuate orders need to be clarified."

Errors in this category point toward inconsistencies in terminology, need for communication on procedures, or lack of coordination among agencies. Especially evident was the difficulty in cross-agency terminology, especially when LE attempts to summon medical assistance.

The following concepts were problematic among the reports and, therefore, are suggested for inclusion in a cross-agency glossary of terms. Such a glossary needs to have an explanation of terms, possible equivalents, and appropriate tactical responses to communications with these words. For example, the establishment of a warm zone may indicate that rescue forces may now initiate rescue operations under the protection of law enforcement. The implications of these communications should be part of the glossary.

Law Enforcement Terms Communication

- Active shooter or more generally the threat type. Officers may not understand the threat term in the same way, resulting in differences in tactical responses.

- Emergency evacuation, mayday, landslide (e.g., in response to bomb threat).

- Location terminology/designation, by specific address, compass directions, map or global positions system (GPS) coordinates, zone designations (e.g., "in front of the grid").

- Distinctions between civilians, hostages, prisoners, perpetrators or "perps," victims. These terms were used interchangeably; however, they are distinct groups that imply different levels of care or security.

- Composition of tactical units and distinctions between them may have to be clarified. For example, "Rescue Task Force 1" required a detailed explanation to central dispatch in one case.

- Termination of threat, for example "All clear" or "Contained."

- Language identifying friendly forces, team names.

- Equipment (e.g., Chemlights). One after action reported regional differences in terminology of equipment.

- Terms for danger zone or hot zone (e.g., "downrange").

Patient Treatment Terms

- Language to request medical resources and support, specifically language that LE will use when asking for fire/EMS extraction teams.

- Designation of injury status and death (e.g., red/orange/yellow/green codes for victims.

- Warm zone declarations and explanations of whether rescuers are allowed in.

- Triage group: identify the severity sorting, number, and location of injured persons. Ribbon or tag patients.

- Treatment group: in a safe area near transport, render stabilizing treatment and apply triage tags to injured persons.

- Transport group: Moves injured persons based on severity to appropriate medical facilities by air or ground ambulances.

As an example, the Adams State College report included a glossary of terms (tables 1 through 3).

Table 1
Status reporting (nonemergent) from Adams State College, Colorado (ref. 16)

Available	Ready to respond to calls; location is optional
Responding	Used to specify an apparatus movement to a specific location in response to an alarm (noncode)
In quarters	Used to indicate that a resource is at station
In service	Unit is operating but not in response to a dispatch
Arrived	Used to announce apparatus arrival at a nonemergency location
Clear	Used to indicate a unit is released from a scene
Break	Used to indicate a unit still has control of the channel but needs a break before continuing transmission
Same traffic	Used when a unit has the same message as a preceding transmission and does not want to repeat same traffic

Table 2
Status reporting (emergent) from Adams State College, Colorado (ref. 16)

Responding emergent (location)	Used to specify an apparatus movement to a specific location in response to an alarm (code)
On scene	Used when units arrive at the scene of an incident
Under control	Used by incident command to denote when an incident is stabilized
Transporting number	Used to designate how many patients medical units are transporting
Emergent	Used to designate if patient transport is a "code" run
Nonemergent	Used to designate that patient transport is "non-code"
Evacuate	Used to designate removal of civilians
Cancel	Self-explanatory
Rescue	Used to mean civilians are in immediate danger and must be removed; firefighters have verified the location of the civilians
Search and rescue	Used to mean civilians are endangered, but their location is unknown
Primary search	Used to mean that there is not a known life safety problem (unknown if occupied)
All clear	Used to mean that a primary search has been done or occupants have confirmed no civilians are in danger
Withdraw	Used to mean that an orderly, proactive removal of firefighters is necessary
Abandon	Used to mean that firefighters are in immediate danger – exit quickly by whatever means necessary; an audible alert of three air horn blasts should also be used.
Emergency break	Clear the channel for emergency traffic
Mayday	Used by firefighters to indicate that they are in trouble and in need of intervention; repeat three times. May also be used for developing emergent situations on any emergency scene.
Intervention	Used to mean immediate and calculated removal of endangered firefighters whose location is known and verified by the teams' supervisors and RIT; also used to mean actions taken by RIT to ensure safety and survival of members operating at any emergency scene.
Command terminated	Used to indicate the last unit is clear, and the incident is terminated.

Table 3
Standard replies from Adams State College (ref. 16)

Affirmative	Yes
Negative	No
Can handle	Used by first arriving unit to announce ability to manage an incident without further assistance
Copy	Used to acknowledge a message received
Disregard	Self-explanatory
Repeat	Request to repeat unclear or unintelligible radio traffic
Standby	Request to hold radio traffic momentarily
How do you copy	Request for report on transmission quality
Loud and clear	Self-explanatory
Unreadable	Self-explanatory

Capability Gaps – Communication. There are no standardized guidelines in creation of a glossary.

Training Gaps – Communication. Training and practice in creation of cross-agency glossaries and glossary use during events are indicated.

Technology Gaps – Communication. There is no technological device that contains a glossary of possible terms used by first responders.

Communication Interference

A diverse set of communication interferences was noted in the reports (refs. 5, 6, 12 to 14, 17, 18, and 23). In general, the active shooter event is inherently loud in addition to chaotic. Of course, alarms can be expected during emergency events as well as yelling, screaming, and gunfire or explosions that may be echoing throughout the building. Radio transmissions and voice communications are therefore in competition with the noise of the event. Earphones may assist in increasing the signal to noise ratio in these instances. However, problems with extreme noise level may still prove to be a problem, as demonstrated by an event that included a helicopter insertion of a team onto the roof of a building.

Even outside of the hot zone at the ICPs, noise interference can be an obstruction to good communication. In one particular ICP, the loud broadcasts of three radios were combined with discussions and with loud talking in the van. During the height of operations, officers were "shushing" others in the van in attempts to listen to radio transmissions.

The PPE may interfere with communication. For example, helmets prevented a SWAT team from clearly hearing a gunman's four attempts to communicate. The gunman, who was behind a locked door in a concrete room, was threatening to detonate explosives if the police did not back off. Gas masks proved problematic in one exercise, and the use of respirators interfered with communications in another exercise. Research into available voice amplifiers for these instances was suggested.

Street to subway level communication was compromised because of signal blockages (for LE but not the fire department) in one event. In a similar manner, buildings and other structures also were reported to block radio transmissions in other exercises. Installation of signal repeaters may assist in this regard. Weather events also create problems in communications. During an ASE, a stiff wind blowing over the radio microphones created constant interferences with communications.

Capability Gaps – Communication Interference. There exists no communication system or method that can reliably transmit communications in all noise environments.

Training Gaps – Communication Interference. There are no formal guidelines or trainings for nonverbal communications among first responders.

Technology Gaps – Communication Interference. There exists no communication device that can effectively block ambient noise in all weathers and situations. There exist no nonauditory/verbal communication devices for first responders. There is no communication device that is not subject to some kind of signal blockage due to structures in the environment. There are no widely available specific voice amplifiers that are integrated into PPE.

Channel and Communication Traffic Control Issues

Radio channel assignment problems were highlighted in several exercises (refs. 3, 6 through 10, 13, 18, and 23). Several sources indicated that one common channel among all agencies is required at a minimum. But as can be expected, the greater the number of agencies and units involved, the greater inundation of the channels and the greater difficulty in preventing the interference among messages and transmissions. One report cited message interference over two dozen times during an exercise.

The primary difficulty is maintaining the balance between two critical needs:

- Communication links to all units.

- Clear prioritized communication, free from logjams or people talking at the same time.

There were suggestions that center around assignments for channels based on what talk groups make sense. Proposed channel separations were between agencies, between units, between incident command, and between dispatch and tactical units. A lesson learned from one exercise acknowledged the great value of a common channel but also noted that separate fire and LE might have improved agency-specific performance of tasks. Fire personnel were concerned about overburdening the LE channel and suggested that patient extraction would be more efficient having a channel to focus on coordinating patient care.

Reports from captains in an exercise indicated that it was tough to work because of the traffic over the air. Their first suggestion was to have a designated radio person. Another was to have designations of certain radio channels as a priority so transmission would override all the others when they spoke. Incident command would be configured to always be broadcasted.

In another exercise, officers attempted to hail central dispatch, but there was no response. Again, participants recommended that officers have their own channel, and a single person would control transmissions to and from central dispatch. It was reported in another exercise that incident command kept interrupting the contact team; a suggestion was that incident command channels to the contact team be separate from the channels linking contact teams.

Not only are radio transmissions in competition with each other, but they are also in competition with "in-person" communications. There was a case where radio information was ignored because of talking among the team during search operations. Therefore, the officers did not pay attention to radioed critical messages about presence and location of an improvised explosive device.

In general, reports indicated that methods of signaling message priorities may be adopted so that sequencing of messages flooding into central dispatch or from incident command can reflect relative importance. The signaling may be done at the start when the identification of the transmitter is made, e.g., "Priority Message." Alternatively, there may be a hardware way of indicating priority in messaging similar to the red flag or exclamation point on emails that indicate a high priority message.

Circumstances may also require personnel to quickly switch channels. For example, in an ASE at a school, students commandeered a radio from a "downed" officer to radio information. However, they did not know how to properly work the radio and effectively blocked all transmissions from the first responders. A quick thinking dispatcher moved first responders from their initial channels to alternatives so that the communications could be re-established. Finally, although there are recommendations that a channel be assigned specifically to officers, in at least one complex ASE, members of the tactical operations center could choose what channel to be on. Channel switching was allowed throughout the exercise. However, given this freedom, they also expressed uncertainty of which was the best channel to use and indicated the need for guidance and a more formal communication plan.

Capability Gaps – Channel and Communication Traffic Control Issues. Currently, there are no technologies or procedures that can be relied upon to optimize channel allocation and channel traffic.

Training Gaps – Channel and Communication Traffic Control Issues. Training solutions may in part mitigate channel problems. A simple recommendation was made that training and practice in channel switching and emergency, interagency communication procedures, and protocols are vital. Guidance and decision-making training for logical channel assignments is necessary based on communication needs of the first responders.

There is a lack of training in protocols that may prevent people from interfering with each other's transmissions. For example, from one event, audio recordings of central dispatch communications revealed specific transmission protocols were in place. Transmitters stated their identity at the start of the communication and did not begin their message until central acknowledged them. During the height of the scenario, this protocol was abandoned and more than one person at a time tried to speak, resulting in unintelligible transmission. When this occurred, central would warn that they were "stepping on each other" and would designate, if possible, who had the right to speak based on message priority. Training in these types of protocols may mitigate the problems of overcrowded channels.

Technology Gaps – Channel and Communication Traffic Control Issues. There appear to be great opportunities for development to fill. Officers lack a communication system that can prevent interference of messaging, recognize and determine message priority, control transmissions based on priority, broadcasted in a way that differentiates the most critical information from normal radio traffic, and quickly accommodate and facilitate required changes in channel assignments.

Hardware/Software Issues

The most frequently cited problems in communication were hardware issues, principally radio failures because of noninteroperability of devices, poor reception, and signal blockages (e.g., in buildings and subways). Computers are increasingly being used to access digital information, yet the infrastructures needed to support these capabilities were lacking. Reports noted that software was not user-friendly, applications froze up, and server and web applications were down and unusable. Recommendations and issues were numerous.

Technologies that enhanced radio coverage in the areas were frequently recommended. Installation of 800-MHz repeaters (devices that receive and retransmit signals) within stadiums, campuses, and other buildings was proposed in particular. While first responder groups are not in control of campus or stadium technologies, encouraging installations of these technological enhancements may be productive.

Hardware or software was sought for bridging or patching between noninteroperable radios, such as between very high frequency and 800-MHz radios, as well. See references 22 and 23 for an example of one such device. The ability to program interoperability into agency devices on the fly is very valuable. Without such an application, agencies must ensure that radios are preprogrammed at the minimum with the correct frequencies to include the mutual aid or common channel. Practice in using these seldom used channels was urged.

Improvements in communication devices themselves were suggested. Devices that feature enhanced clarity with minimal static are always needed. Backup plans including redundant devices or alternative means of communications also were recommended should the devices fail.

Technology assists for location information have been suggested. A web-based geographic information system accessible to internal and external public safety agencies was proposed by a report on an exercise on a campus. The purpose would be to identify infrastructure, locations with hazardous materials and to store campus maps and building floor plans. Distribution of electronic versions of a campus map to local law enforcement was also suggested.

The ability or external remote access into cameras and other data information was desired to improve situational awareness of unfolding events. In a similar fashion, fast remote access into student records assisted in learning about the suspect and his victim. This type of information may help resolve the situation.

Moreover, to support these web-based applications, the report also urged server upgrades to ensure a high level of "up time" for their use during emergencies.   In one exercise, broadband connectivity issues caused serious delays in the ability to access the internal camera system to review video. While first responder groups are not in control of campus or stadium technologies, collaborations on these technology upgrades may be beneficial.

Outside of the internal means to improve communication devices, their reports demonstrated a need to improve the infrastructures for communication. In some exercises, cellular service was poor. Pressures to obtain improved coverage for these areas may be indicated. Foreknowledge of areas with poor service could also lead to contingency plans to improve the possibility of continued information flow.

Other technological enhancements that were proposed include text-to-speech functions for phone alerts during an emergency. The reverse function, speech to text, may also be useful to incident commanders for information logging or display during an event. Incorporation of this ability

into an overall communication system may be highly effective, assuming the accuracy of the speech to text function.

Hardware that increased "eyes on" the scene was requested. For instance, microphone capabilities with video cameras were requested to give dispatchers a better understanding of the incident and to assist in determining when shots are fired.   Officers in another exercise requested access to closed circuit televisions for situational awareness. These officers also suggested incorporation of drones in the ranks of first responders. These drones would be able to insert a camera into the hot zone to provide more information for planning tactical response. Sources that formed the basis of this section can be seen in references 5 through 8, 13, 16 through 18, and 20 through 23.

Capability Gaps – Hardware/Software Issues. Officers lack the ability to have reliable, clear radio communications in all areas. They also lack the ability to create radio interoperability on the fly. Officers lack the ability to gather information within the hot zone in order to plan a response. They lack the ability to gather information relevant to response and lack a method to turn verbal messages into text for information storage and dissemination.

Training Gaps – Hardware/Software Issues. None noted.

Technology Gaps – Hardware/Software Issues. The following technological solutions are needed to fix these issues:

- Reliable, clear radio devices with wide coverage

- Portable signal boosters

- Radio patching or bridging methods for instant interoperability

- Remote access means to access camera feed and digital data

- Cellular service and server infrastructure to support communication needs during an event

- Drones for insertion into the danger zone

Accounting for Personnel

Several events reported lessons with accountability of personnel (refs. 7, 9, 10, 24, and 25). Unsurprisingly, reports emphasized the importance of maintaining awareness of team members' locations and coverage areas. In addition, as with any communication issue included in this review, interagency coordination and training on each other's communication resources was suggested to improve accountability.

However, in some cases, contact teams failed to take the time to communicate back to incident commands or dispatch and weren't aware of other teams' locations.   One report suggested the incident command emulate firefighter procedures for "Personnel Accountability Reports" over the radio.   This is a roll call procedure to confirm that all personnel are physically accounted for.   The incident command alerts units that a roll call will be held, waits a reasonable amount of time (1 to 2 min), and then requests response from units as to the number of personnel accounted for and their current location and mission. This procedure is typical for firefighters; the procedure was recommended for adoption by LE as well.

Low-technology aids were mentioned as assisting in accountability. For example, dry-erase boards with accountability information were highly recommended in several reports. However, there was at least one case where command personnel ran out of board space. Exercise controllers in another event suggested that the incident command have a dry-erase marker with them at all times and use whatever surface happened to be available to write out situational reports.   In addition, another report observed in a few teams that incorporation of a fire map allowed coordination of tactical, medical, and accountability information.

Higher-technology solutions for accountability have been developed and at least demonstrated at DHS-sponsored active shooter events (refs. 11, 17, and 23). The aerial pictures or blueprints are overlaid by a grid with measurement units and an alphanumeric coordinate system used to locate areas within the response area. Personnel wear trackers that allow the map to display their whereabouts during the event. Finally, one report recommended against naming injured officers over the radio to avoid possible detrimental effects of the job performance of officers who overhear the information.

Capability Gap – Accounting for Personnel. The ICP lacks the ability to track locations and health of personnel during an active shooter event.

Training Gaps – Accounting for Personnel. Training for performing personnel accountability reports over the radio.

Technology Gaps – Accounting for Personnel. Incident command needs technological solutions to tracking location and health of personnel throughout the event in different environments.

Network Configuration

While there are several sources that commented on lessons learned from radio usage, there are fewer comments on the configuration of the communication network with elements besides radios (refs. 6 to 8, 16 to 18, 20, 23, and 24). A core radio channel issue is the inability to reach parties or receive vital information because of nonoverlapping information streams among radio channels; other means of communication are therefore required. In the reports, these other means of communication have been observed to be runners, cell phones, and in-person discussions. Implicit in these reports is the idea that these nonradio connections are a critical part of the overall communication network during emergencies; however, less attention has been given to these types of information flows.

In the more complex multi-agency responses, informal or opportunistic (overhearing of broadcasts) communications are required because of the nonoverlapping streams of radio channels. As reported by a captain during his event, there is no overlap in the radio communication streams except at the "person" level. That is, in order for the captain to obtain LE information from any channel other than the channel he was on, he needed to be in close proximity to an individual who carried radios for any of the other channels. He noted that if the person walked away, that stream of information was lost. The issue is even more difficult in cross-agency communications, those between LE and rescue first responders, where the stove-piping of information is more pronounced.

At that same event, a tactical operations center office suggested assignment of aides to decision-makers. The aide could be on one channel while the decision-maker would be on another, and any critical information the aide heard could be relayed to the decision-maker. Another procedure that was observed at that event was that the decision-maker kept close to other decision-making personnel who chose to be on other channels. Suggesting another configuration, the tactical operation center decision-maker proposed to another that while he remained on the overall central

dispatch channel, his captains used the tactical channels for communication with the operation teams.

The utility of dedicated liaisons was noted by more than one report. These liaison officers were assigned to act as messengers between units. Those liaisons that connected the ICP with other units were particularly effective. These individuals may have had the sole responsibility of relaying information to other individuals in other agencies. Guidance and identification of appropriate liaisons to contact for interagency would be needed, especially in the initial stages of locating command posts. From the beginning of the emergency, agencies needed to search out appropriate points of contacts; formal guidance on who to look for may be appropriate. The report recognized that this type of formalization may not be possible because of the fluid nature of command post setup; however, it proposed that simple direct guidelines could shorten the time before these vital person to person connections can be made.

In contrast to the use of liaisons, it was observed that some units communicated with fellow team members solely through cell phones, thus eliminating any chance of other units overhearing any information from that unit. Thus, these cell phone only units needed to be in-person contact with another central location for the information to be disseminated. For example, it was observed that an incident commander had to directly instruct an intelligence officer representative to "put over" the description of the perpetrators to central dispatch. However, at the tactical operations center, it was pointed out that the intelligence unit should be directly sending perpetrator descriptions to them rather than hearing information secondhand over a broadcasted channel.

Clearer guidance on the appropriate recipients of information was reported as an issue. As an illustration, a returning rescuer had to be instructed by a tactical operations commander to relay information to another task force lead, not to him. While this issue may not result in critical errors, the event illustrates the need for guidance on direction of information flows. The creation of "deliberate communication network configuration" was proposed by one report. That is, it would be beneficial to have some predetermined guidelines of (1) who talks to whom and by what means and (2) who should get information from whom and by what means.

Network Configuration Problems. The sources reported problems with these types of communication avenues. First, the additional elements (e.g., liaisons, runners, aides) also increase the possibilities of human errors such as repeating information or requests that were already fulfilled or the relaying of incomplete information. Moreover, face-to-face interaction requires that parties be present at the same time in the same place. Therefore, a potential weakness in this communication method is the need to look for the right people with which to initiate and maintain contact. In one event, it was observed that initially during the setup of unified command, LE and rescue elements sought each other out, and contacts were made. However, with the ongoing incident, a concerted effort had to be made to search for people in order to (1) relay information or (2) find information.

For example, an environmental protections officer first informed the incident command that he would stay at the post to assist with response to the airborne gas threat. However, when incident command required from him the information about wind direction, the officer had disappeared. A similar situation occurred in trying to contact the hostage negotiation team at the same event. The officer needed to search the area in order to find the team. In this particular event, the weather and terrain aided in the visual search for people; however, this search strategy would not be effective, for example, during night time or in urban areas where there would be visual obstructions.

One report suggested the use of color-coded vests and signage to identify decision-makers. These methods may be proposed for assisting liaisons, runners, and other decision-makers to connect with the appropriate personnel. Perhaps more technologically

sophisticated means may be developed like devices that do not rely on the seeker's vision. Finally, one report suggested the use of social network analyses for examining "deliberate configuration" of communication networks.

Capability Gaps – Network Configuration. There is a lack of ability to easily and quickly create and maintain an error-free communication network composed of formal assigned radio channels and other communication means (e.g., liaisons, runners, cell phones, face-to-face interactions).

Training Gaps – Network Configuration. Training is needed in decision-making about the creation of reliable information flows among first responder units.

Technology Gaps – Network Configuration. Technological means of assisting runners, liaisons, and other decision-makers in identifying key personnel is needed. A method for merging streams of radio, cell phone, and in-person discussions into a unified communication system is also needed.

Communication Protocols

Institution of formal protocols as well as their practice have been proposed to enhance communications (refs. 7 to 9, 16, and 23). A protocol appeared to be enforced in the beginning of one scenario, where transmitters would began transmissions with their identity (e.g., "Duty Captain") and then would wait for acknowledgment from the central dispatcher before beginning their message. In the beginning, the central dispatcher enforced this protocol: if transmitters failed to provide their identity before transmission of message, central first asked "Is there a unit raising central?" However, the protocol was abandoned in the more frenetic pace later in the exercise. The result was many unintelligible messages where persons were "stepping on each other."

Protocols for the specific language to summon medical support and resources were indicated by reports where lack of uniformity resulted in response delays. This observation focuses on the need for LE training in proper nomenclature for requesting support from fire and medical rescuers. In this case, adherence to protocols may save lives.

Nonresponse was observed to be an issue during one counter-terrorism exercise. Nonresponse was defined as one party hailing another or asking a question without receiving acknowledgement or response. Members of the tactical operations command were discussing the possible causes and solutions for persistent nonresponse. This observation points toward the need for a protocol to address persistent nonresponse to hailing or questions during an event.

Practice as well as establishment of protocol should also address the observed errors of the necessity of asking transmitters to repeat messages because of the lack of intelligibility, the large quantities of information, or the recipients simply forgetting information. Furthermore, there were instances of repeats of requests that were already fulfilled, incomplete descriptions that were relayed, and repetitions of information already conveyed. These observations focus on the need for training in emergency messaging to increase clarity of messages of the transmitter or improve information logging by the receivers.

Location designations were reported as problematic. Protocols for naming and identifying locations of important sites such as incident command and casualty collection points were recommended by at least one report.   Designation of zones, specific address, compass directions, or GPS coordinates may be considered, and a standard protocol may be developed.

Message priority rubrics were also mentioned as possible procedures that could be standardized. A protocol to rank relative message importance is the most important procedure that could be developed. In addition, protocols to signal that one has a high priority message may be created and announced at the beginning of transmissions. Adherence to these protocols may decrease the probability that critical messages are missed or buried.

Finally, in a couple of exercises, there were frequent misunderstandings of phonetically similar words. This problem was especially acute in messages directing officers to specific room numbers or staircases (for example, Room A was confused with Room K, Stairway 3 was confused with Stairway B, etc.). The suggestion was made to adopt the protocol of using a phonetic alphabet (e.g., Alpha, Bravo, Charlie, Delta) of which there are several.

Capability Gaps – Communication Protocols. There is a lack of means to control errors in communication.

Training Gaps – Communication Protocols. There is a lack of training for specific communication protocols to control transmission interference and nonresponse, summon medical support, need for repetition, designation of location and priority, and misunderstanding of phonetically similar words.

Technology Gaps – Communication Protocols. There is a lack of technology solutions to the problems of information logging by recipients of messages.

Interagency Communication

Virtually all reports cited concern about interagency communications (refs. 2, 5 to 9, 13, 15 to 18, and 22 to 25). Interagency communications were those that occurred between, for example, LE with fire/medical rescue units and targeted institutions and among specialized LE units, patrol, and counter-terrorism squads.

The minimal requirement identified by reports is a common radio frequency or channel for interagency communication. Radio interoperability was the primary concern for the majority of the exercises. Compatibility of communication devices must be ensured, and developing familiarity with other agencies' communication resources was also recommended.

Another strong recommendation was representation of all responding groups in the unified command. The unified command then directs all responding units. This procedure increases the exchange of information among the agencies. Location of separate agencies' incident commands within close proximity also aids in creating a unified command response. Some lessons learned and difficulties were reported, and consequent recommendations for interagency communications are listed in the following paragraphs.

Interagency Communication among First Responders. Prior harmonized guidance on placements of sites for unified and incident command, staging, and locations for ambulatory and nonambulatory patients was recommended. Creation of common procedures for making location decisions and communicating their locations was also proposed in one report.

During the event, certain pieces of information must be shared broadly with other agencies. It was observed in one exercise that participants did try to spread critical information, but the communication flow was described as opportunistic rather than deliberate. As noted more specifically in one report, the incident command directed that the description of the perpetrator gathered by the intelligence group should be broadcasted as widely as possible to all responders. Thus, prior discussions should be held on what critical pieces of information need to

get from one agency to another. In more than one report, the failure of LE to properly convey "All Clear" delayed medical rescue operations.

This type of preplanning was reported by one source. During a review of video taken at their exercise, LE and rescue representatives arrived at the conclusion that initial communications between their organizations at the ICP should be comprised of specific critical elements of information. Similar guidance for other interagency communications could be developed to enhance coordination.   Attention should be paid to communications with the specialized teams as well, such as bomb squad, or hostage negotiation teams. Their information needs may be more particular given the area of expertise.

A good first step for interagency communication is to ensure that radios are within the vicinity of personnel who need to receive information. For example, information about victim status was broadcasted over radios by LE; however, there were no radios in the area of the casualty collection point. Therefore, although the information was communicated, it was not received by the most relevant medical personnel.

As also discussed in the sections on channel assignments and communication networks, the degree of channel overlap between agencies is a matter of balancing the need to widely collect and disseminate information versus the need to control and prioritize message traffic. There were suggestions that center around assignments for channels that are based on what talk groups makes sense. Proposed channel separations were between agencies, between units, between incident command, and between dispatch and tactical units.

One report brought up the consideration of units that are separate but function interchangeably. In this event, each of the units maintained separate tactical channels but were sent on similar missions. Captains of the units could not communicate with the other teams, which compromised the response. In terms of C&C, units should be assigned frequency, keeping in mind that units that are interchangeable should have access to a common communication channel even if this arrangement results in an interagency talk group.

A lesson learned from one exercise acknowledged the great value of a common channel but also noted that separate fire and LE might have improved agency-specific performance of tasks. Fire personnel were concerned about overburdening the LE channel and suggested that patient extraction would be more efficient having a channel to focus on coordinating patient care. These observations indicate that pre-event discussions about overlapping agency channels would be beneficial.

Hardware or software was sought for bridging or patching between noninteroperable radios. See references 22 and 23 for an example application. The ability to program interoperability into agency devices on the fly is very valuable. Without such an application, agencies must ensure that radios are preprogrammed at the minimum with the correct frequencies to include the mutual aid or common channel.

A critical part of interagency communication is face-to-face interaction, as suggested by one report. Dedicated interagency liaisons, who would travel between units, were used in several exercises with great benefit.   Initially finding the correct persons with which to have these interactions, however, could be an issue. Solutions to facilitate identification of interagency points of contact should be pursued. One report suggested color-coded vests to help responders quickly locate supervisors; the same method could be used to facilitate a liaison's search for appropriate points of contact.   Perhaps development of more sophisticated technologies to "tag" points of contact may be developed, as well, so that efficient communications are maintained throughout the event.

The use of clear, nonjargon language in communications was emphasized throughout all the reports. This was especially important when LE must call for victim extraction teams and medical support; the correct protocols in terms of language to be used accelerates the process. Interagency glossaries covering common terminology for injured, mayday, or evacuation orders can be created. One report suggested that LE officers take emergency medical treatment training alongside the fire and rescue officers. In this way, communications and coordination between the two agencies could be enhanced.

Deconfliction of friendly forces during the heat of encounters with the perpetrator is also a concern voiced by the reports. Different LE officers from different jurisdictions and different uniforms should be able to communicate to each other to identify themselves. Communication of friendly force status could be achieved with either standardized terminology upon entering the hot zone (e.g., "Blue!" "Blue!") or an item of clothing that is available to all units that may be called.

Interagency Communication with Facility Security. Many of the reports have focused their interagency communication examinations to those between the first responders. Relatively few of the reports address interaction of first responders with the security of the targeted institution. Authors of reports who are from these institutions (e.g., heads of campus securities) do highlight the lessons learned and capability gaps of first responder units and a targeted facility's own security forces. In at least one case, the internal security forces had to take the initiative to establish communications with the external LE officers.

During preparation for one counter-terrorism exercise, researchers realized that a key component of the response to a threat was the on-site security officer team. Therefore, there was a concentrated effort on gathering their responses to the event. One of the security officers asked directly, "What can we do as security officers to help first responders?" This question was presented to the first responders at the after action hotwash. The answers to this question were written into the subsequent technical report. Moreover, during the event, the internal control center was able to communicate with the security force to keep them informed of the unfolding situations, provided the LE with information and locations of possible suspects, and directed evacuations. This incident highlights the value of coordination and communication between external first responders and internal security forces.

Capability Gaps – Interagency Communication. There is no guarantee of effective interagency communication during emergency events.

Training Gaps – Interagency Communication. Training in interagency communication is required to include establishment of unified commands, protocols and vocabulary, and identification of appropriate points of contact. Co-training among agencies is also indicated. Special attention is warranted for training with targeted institutions in addition to typical first responder organizations.

Technology Gaps – Interagency Communication. Technology is needed to ensure interoperable communications, execute identification and location tracking of critical points of contact, assist in deconfliction, and identify friendly forces.

Communication from Command to Teams

Types of information that tactical teams needed were articulated by many reports (refs. 7, 8, 10, 11, 13, 19, 22 to 24, 26 and 27). In addition to the recommendations for verbal communications, using color-coded incident command supervisor vests and signage to assist officers in identifying command elements and locating supervisors may be helpful.

The following is a list of critical information that reports recommended be issued to first responders:

- Scene summary, level/degree of emergency.

- Name of incident commander.

- Location of ICP, staging.

- Identified primary command frequency and tactical frequency.

- What resources have been requested.

- Incident objectives and the basic incident command structure – should be repeated if there are any changes.

- Locations of threats.

- What resources are being sent in so tactical teams can plan tactics.

- Threats made by the perpetrators regarding officer action.

- Tactical units being sent in need to be told mission and destination, who they must report to, and their radio channel.

- When formerly hot areas are clear.

- In addition, the information content must be tailored to the specific squads sent in (e.g., bomb squad, hostage negotiation, etc.).

Capability Gaps – Communication from Command to Teams. Officers lack standardized guidance on information that should be relayed from commanders to tactical teams.

Trainings Gaps – Communication from Command to Teams. Officers require training and practice in airing of information in a succinct and clear manner (e.g., incident command structure and objectives, location of threats, etc.).

Technological Gaps – Communication from Command to Teams. Devices that aid in creating and maintaining a common operating picture in terms of locations and availability of commanders, resources, and threats.

Communication from Teams to Command/Dispatch

Several reports noted that tactical teams needed to be encouraged to report back to incident command. At a hotwash following an exercise, the commander stressed to the participants that tactical teams are the eyes and ears of the response; therefore, they must faithfully report critical information back to the command center. Briefing to patrol participants right before entering the hot zone, the trainer emphasized the need to send back intel to the sergeant and to work with any other officers present to get the information back to central commands. Situational information that flows upward to command is necessary for developing and maintaining a common operating picture.

These are the information pieces from reports that were either emphasized as critical or that officers failed to relay back to central command:

- Acknowledgement of transmissions from commanders or dispatch

- Situation updates

- Location of personnel, and any change from original mission

- Location of evacuated persons

- Descriptions of suspects and victims as well as victim locations

- Killing of hostages

- Shooter status, number of shooters, number of perpetrators, and number of shots fired

- Resources required

- Locations that are cleared

- Exact locations of suspected explosives

- Needs for medical support and transport, number of injured, and severity of injuries

Again, the need for clear language in all cases is crucial for efficient communications. Also, incorporation of map information greatly assisted in communications with central command about locations.

Communication of all this information may lead to problems of traffic control. As discussed in another section of the report, the methods to determine message priority are needed so that more important information reaches the appropriate personnel. Other suggestions included having one designated radio person that communicated with commands and designations of specific radios that would confer priority on their transmissions over all other transmissions.

It was also emphasized by one report that an incident commander is best left in the cold zone as opposed to accompanying the team into the hot zone. The commander in the cold zone functions as a single person that could gather essential information about the unfolding event. The commander in the cold zone could more easily communicate with dispatch and keep overall situational awareness. Sources for this section include references 6 to 11, 22, 23, and 26.

Capability Gaps – Communication from Teams to Command/Dispatch. There is a need to ensure that, throughout the event, tactical teams send back vital information to commanders.

Training Gaps – Communication from Teams to Command/Dispatch. Training and practice on delivering messages to commanders in order of priority is indicated.

Technology Gaps – Communication from Teams to Command/Dispatch. Officers lack a communication system that can prevent interference of messaging, recognize and determine message priority, and control transmissions based on priority.

Inter-team Communication

Communication within the team is important for coordinated actions. Communications among team members were cited in two reports as being problematic. Lack of communication among whole rescue teams was called a primary problem. The report went on to suggest that units should designate which team member is responsible to plan, strategize, and communicate to other team members about entry into a hostile environment. Another report states that minimal amounts of communication took place among the members of the contact team during the exercise. As a result, teams failed to develop a strategy to effectively contain the threat leading to poor results in their response for that team. Information for this section was gathered from references 7, 9, 10, and 23.

Capability Gaps – Inter-team Communication. There is a lack of means to ensure inter-team communication.

Training Gap – Inter-team Communication. Training on effective inter-team communication is needed.

Technological Gap – Inter-team Communication. There is a need to develop technology that supports inter-team communication.

Information Flow from Tactical Unit to Succeeding Tactical Unit

Of particular interest in two exercises were the communications between initial response teams and successive units (refs. 7, 8, 13, 23, 26, and 27). In complex operations, transfer of intelligence from the usual patrol or institutional security to specialized counter-terrorism units is vital to efficient response to the event. In one source, it was reported that the trainer said, "The minute two teams come together we need to analyze what was discussed. Are the arriving officers sent in the right direction? Is there proper resourcing?"

The following is a listing of issues discussed or recommendations among the reports. Are arriving teams met or informed by the previous teams? Are the actions of arriving teams based on what is already known about the situation?

Key intelligence that needs to be given to succeeding teams includes:

- Locations, packages already cleared.

- Number of perpetrators that are in hand or taken away, number that still needs to be apprehended.

- Presence of any explosive devices, plans for their containment, what distances are needed to be cleared?

- Areas that need to be cleared, areas that are warm, location of victims, and casualty collection points.

A standard marking system was proposed by a report. The markings would be stickers or signs affixed to an area to indicate cleared and uncleared areas. The Federal Emergency Management Agency's urban search and rescue teams already use such a system for clearing buildings. The system would eliminate the necessity of repeating information for successive teams and decrease the probability that this information may be missed.

Communication of Information through the Medical Rescue Phase. In a similar manner, medical information must stay with the patient from phase to phase of the rescue; however, LE that may deliver these patients may not be able to also deliver the necessary medical information. As proposed by one report, triage tags can be attached to patients so that this information stays with him or her from triage to extraction, casualty collection point, treatment, and then to transport to the hospital.

Communication of Information from Incident Commander to Succeeding Incident Commander. C3 Pathways (ref. 19) published the following as best practices for communications during transfer of command from one incident commander to the next new incident commander:

> "Best practice was for the second arriving supervisor to assume Command and designate the first supervisor as responsible for the Danger Zone and the assigned resources, for example "Sgt. 2 to Sgt. 1, I'm assuming Command, you will be Contact Group, tell me what you need." This action enables the first supervisor (e.g. Sgt. 1) with the best situational awareness to continue focusing on the task at hand - get the bad guy. The new Incident Commander (e.g. Sgt. 2) takes a broader view of managing the incident and remaining priorities knowing contacting the shooter is delegated to Sgt. 1" (ref. 19).

Capability Gaps – Information Flow from Tactical Unit to Succeeding Tactical Unit. Officers lack the means to ensure perfect tactical information flow from initial to succeeding units or from incident commander to succeeding incident commander. Medical rescuers lack the means to ensure that medical information remains with patients from triage through transport to the hospital.

Training Gaps – Information Flow from Tactical Unit to Succeeding Tactical Unit. Training in interactions and communications is needed to increase the probability that situational knowledge is passed from units to succeeding units and from incident commander to succeeding incident commander.

Technology Gaps – Information Flow from Tactical Unit to Succeeding Tactical Unit. There exist no technological means to quickly record and pass on tactical information to succeeding teams or incident commanders. There exist no technological means to ensure that medical information remains with patients from triage through transport to the hospital.

Selection and Training

A final comment on communication lessons comes from the report in reference 23. One of the officers at a tactical operations command made the comment that personnel running the logistics of the response (assuming including communications) have to be the "the right people." He did not further elaborate on this comment; however, building upon his observation, one might reasonably propose that there may be investigations into the individual difference factors and skills that are required for key communication posts such as central dispatch or interagency liaisons.

Capability Gaps – Selection and Training. Currently, there may be no formal guidelines for selection of personnel for key communication positions. This issue was beyond the scope of this review so this is an uncertain statement.

Training Gaps – Selection and Training. Currently, there may be no formal guidelines for training of personnel specifically for key communication positions. This issue was beyond the scope of this review so this is an uncertain statement.

Technology Gaps – Selection and Training. Does not seem applicable.

SUMMARY OF GAPS IDENTIFIED

Summary: Capability Gaps

Officers lack the capability:

- To respond to every possible type of active shooter or terrorism scenario

- To ensure procedures for the creation and functions of incident and unified command are followed

- To ensure fast and efficient interagency interoperability

- To ensure accurate and reliable coordination and communication under all circumstances among all personnel, units, and teams including:

  - Inter-team
  - Interagency
  - Successive teams and commands
  - Civilians
  - Perpetrators

- To ensure that all information to support a response is gathered quickly, including

  - Site location maps and schematics
  - Information from witnesses
  - Real-time information from the hot zone from officers and other systems

- To quickly develop, record, and maintain at all times a complete picture of the incident, resources, personnel, and their locations

- To quickly and accurately locate, distinguish, and identify perpetrators and friendly forces

- To provide all teams of first responders PPE that does not impede execution of tasks

- To assure patient triage, transportation, and care are optimal in every situation

Summary: Training Gaps

Sources identified training gaps in:

Training in Mechanics

- Cover and concealment

- Muzzle discipline

- Contact and rescue team formation and movement (e.g., up and down staircases, hallways, etc.)

- Clearing for a variety of areas (e.g., small rooms, large open stadiums, subways)

- Response to explosives, suicide vests, hazardous materials

- Intelligence gathering

- Methods for identification of armed friendly forces (i.e., deconfliction)

- Response to suspicious vehicles

- Apprehension of suspects in vehicles

- Setting keyholes/chokepoints during preliminary search

- Response in a variety of environments and conditions (e.g., vertical environments, campuses, subways, day/night/rain, etc.)

- Medical procedures that are appropriate for hot, warm, and cold zones

- Patient transport in a variety of environments

Training in Command and Control and Coordination

- Implementation of incident and unified commands

- Joint LE, medical rescue, facility security training

- Determination of when and where medical teams should be deployed

- Developing a common operating picture

- Guideline for decision-making

Training in Communications among Units, Agencies, and Civilians

- Mechanics of radio use, channel switching, crossing zones

- Protocols for requesting medical aid

- Creation and implementation of cross-agency glossaries

- Methods of nonverbal communication in noisy conditions

  - Methods in creating communication and information flow networks
  - Designation and identification of interagency points of contact
  - Channel assignments/talk groups

- Intersections of separated channels

- Control of transmissions through message prioritizations and protocols

- Execution of personnel accountability reports over the radio

- Message construction

  - Use of simple, clear vocabulary
  - Construction for clarity and succinctness
  - Specific content of critical information
  - Designation of locations
  - Avoidance of phonetically similar words
  - Signaling priority of message

- Selection and training for key communication personnel (i.e., dispatch, radio personnel for tactical units)

Summary: Technology Gaps

Officers lack these technologies:

- Drones (aerial or ground) for insertion into the danger zone to provide situational awareness.

- Devices that aid in creating and maintaining a common operating picture in terms of locations and availability of commanders, resources, and threats.

- Devices that can be used for deconfliction and identification of friendly forces.

- Patient moving equipment that can handle stairs, narrow doorways, any transportation situation.

- First responder location and health tracking devices to support personnel accountability.

- Technological means of assisting runners, liaisons, and other decision-makers in identifying and locating key personnel.

- Systems that support tracking of resources.

- Instruments to find victims.

- Instruments to assist in triage and retention of patient information.

- Technology that guides decision-making.

- PPE specifically for medical personnel.

- Instrumentation to locate and identify perpetrator.

- Device with relevant maps and site information.

- Device that contains a glossary of possible terms used by first responders.

- PPE with integrated voice amplifiers, specifically helmets that provide protection but do not interfere with hearing.

- Equipment that gives remote access to camera feeds and other digital data.

- Tools to ensure that medical information remains with patients from triage through transport to the hospital.

Systems for Assured Communications

- Cellular service and server infrastructure to support first responder communication needs.

- Communication systems that are reliable, clear, and with wide coverage.

- Portable signal boosters.

- Tools that ensure interoperable communications:

  - Software/hardware devices for radio patching or bridging methods for instant interoperability
  - Technology that can be used to merge streams of radio, cell phone, and in-person discussions into a unified communication system.

- Communication devices that transmit clearly in all ambient noise levels, in all weather, through all structures, and at required operational ranges.

- Ability to clearly communicate with officers without perpetrator hearing.

- Communication systems that:

  - prevent interference of messaging.
  - recognize and determine message priority.
  - control transmissions based on priority.
  - broadcasted in a way that differentiates the most critical information from normal radio traffic.
  - quickly accommodate and facilitate required changes in channel assignments.

- Devices that can record and disseminate messages and tactical information that can be passed on to succeeding teams or incident commanders.

- Tools to identify, locate, and track critical points of contact among agencies.
- Nonauditory, nonverbal communication devices for first responders (e.g., voice to text software/hardware).

- Communication systems for warning and information dissemination to civilians.

CONCLUSIONS

1) Overall communication problems exist, ranging from mechanical issues with communication systems to a lack of clear, concise, uniform communication among all types of first responders.
2) Uniformity and availability of personal protective equipment for all first responders is essential.
3) Training in the mechanics of response to a wide variety of threats, environments, conditions, and building configurations is needed.
4) First responders are in need of technologies that will aid in accurate identification of perpetrators, victims, and friendly forces.
5) Coordination of command and control and hardware/software issues related to noninteroperability of devices are both areas of concern.

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APPENDIX
SEARCH METHODS AND SCOPE

(U) Criteria for inclusion in this review was that the information in the article must be from an active shooter or counter-terrorism exercise that occurred in the US. The exercise must have been run by first responder trainers, and some analysis and evaluation was performed on actions and actual performance by law enforcement and medical first responders. Therefore, after action reports following real events or table top exercises were excluded from this review. Sources for this review were identified through the following methods.

    a. (U) Publically Available Archives

        (U) Internet search engines were used to identify sources for the review. While there were many articles on actual active shooter events, there were few articles that perform in-depth analyses of tactical-level lessons learned from active shooter or counter-terrorism exercises. Google Scholar, websites for   police academy, police newsletters, were searched. Data bases such as Web of Science, JSTOR, Federal Digital System, LexisNexis, EBSCO, and Science Direct were searched.

    b. (U) Homeland Security Digital Library

        (U) After we were approved for access, the restricted full collections of the Homeland Security Digital Library (HSDL) were also searched. The search   criteria were any instance of "active shooter" or "counter-terrorism in the text.   The specific collections targeted were Exercises and Lessons Learned.

    c. (U) National Criminal Justice Reference Service

        (U) An online request to the National Criminal Justice Reference Service was   made, and the service sent an annotated bibliography. The search strategy   used was:

    d. (U) Search Strategy: "active shooter*" AND (exercise* or train* or "best practice*" or evaluation* or drill* or DHS or "Department of Homeland Security")

    e. (U) Sources: Applied Social Sciences Index and Abstracts (ASSIA), British Humanities Index (BHI), ERIC, National Criminal Justice Reference Service (NCJRS) Abstracts Database, PILOTS: Published International Literature On Traumatic Stress, Social Services Abstracts, Sociological Abstracts, EbscoHost Academic Search Complete, EbscoHost Business Source Complete, EbscoHost EconLit with Full Text, EbscoHost MEDLINE Complete, EbscoHost Military & Government Collection, Web of Science Sciences Citation Index, Web of Science Citation Index Expanded

    f. (U) The majority of the sources were found in a publication by the Lessons Learned Information Sharing service of the Federal Emergency Management Agency [1]. The publication reviewed 23 Active Shooter Exercise Action Reports. While some of their references could not be located within the HSDL, the articles that were found were included in this review.

    g. (U) Finally, contacts made during the TBRL's Counter-terrorism/Active Shooter Drills were asked if they had any after action reports that they could share with us. DHS National Urban Security Technology Laboratory responded that they did not generate these types of reports. National Counter Terrorism responded positively, sending us their report from the Boston

Fenway Exercise [2]. Because of their customer's concerns, this is most likely the only report they are able to share with us, as TBRL was also part of the exercise.

(U) In total, 26 sources were used in this literature review, of which 7 are TBRL's.

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