C. Communications

General Background: Communications

Across every level of emergency response, communication is critical to effective incident management. Some researchers have noted that in the context of responding to active fire incidents, "decisions are not explicit, but intertwined in the conversations and the situated actions."[14] Many times fire crews respond to unclear or ambiguous situations, necessitating them to use situational cues to, "actively interact to create meaning by the enlargement of small cues and forming a structure to provide meaning."[15] In other words, to respond to a fire incident effectively the fire crews on the scene and the personnel in public safety dispatch must communicate clearly and effectively to support fire crew sensemaking of the incident scene.

Communicating real-time information during fire emergency response involves two essential communication modalities: face-to-face communication and radio communication.[16] Face-to-face communication is ideal because it enables both the receiver of the communication and the sender of the communication to gain additional context and understanding through, "nonverbal gestures such as a head nod."[17] Discerning whether a communication is understood may be difficult without these gestures, requiring certain practices to assure understanding of a message delivered by other modalities like a radio.

Recognizing that fire rescue crews often must communicate using radio communication rather than face-to-face communication, there are a number of best practices and standards adopted by fire departments to best facilitate communication via radios. Generally, radio communications should follow a standard format to ensure that there is a closed communication loop. Researchers studying firefighting team effectiveness have hypothesized that effective teamwork include mutual trust, a shared mental framework, and closed loop communication.[18] Closed loop communication, which has also been linked to the establishment of team's shared mental framework, has three characteristics:

1. A message being initiated by the sender
2. That message being received, interpreted, and acknowledged by the intended receiver

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[14] Jonas Landgren, Making Action Visible in Time-Critical Work, CONFERENCE ON HUMAN FACTORS IN COMPUTING SYSTEMS 201-210 (2006).

[15] Jonas Landgren, Making Action Visible in Time-Critical Work, CONFERENCE ON HUMAN FACTORS IN COMPUTING SYSTEMS 201-210 (2006).

[16] Zachary O. Toups & Andruid Kerne, Implicit Coordination in Firefighting Practice: Design Implications for Teaching Fire Emergency Responders, CONFERENCE ON HUMAN FACTORS IN COMPUTING SYSTEMS 707-716 (2007).

[17] Shannon L. Marlow, Christina N. Lacerenza, Jensine Paoletti, Eduardo Salas, & C. Shawn Burke, Does Team Communication Represent a One-Size-Fits-All Approach? A Meta-Analysis of Team Communication and Performance, 144 ORGANIZATIONAL BEHAVIOR AND HUMAN DECISION PROCESSES 145-170 (2017).

[18] Elise Jouanne, Camilo Charron, Christine Chauvin, & Gael Morel, Correlates of Team Effectiveness: An Exploratory Study of Firefighter's Operations During Emergency Situations, 61 APPLIED ERGONOMICS 69-77 (2017).

3. A follow-up by the sender ensuring that the message was received and appropriately interpreted

In the context of fireground radio operations, closed loop communication is integrated into the Blue Card Command Program training for radio communications. The Blue Card system uses the Standard Order Model to structure communications, which involves the following steps for radio communication:

1. When the sender is ready to transmit a message, they call the receiver to determine if they are ready to receive the message;
2. The receiver then acknowledges the sender;
3. When the sender receives the readiness reply, they can transmit the message;
4. The receiver then gives a brief restatement of the message to acknowledge the receipt of the message; and
5. The sender restates the message if misunderstood.

This standard protocol for radio communications lessens the risk of misunderstanding among incident responders and dispatchers. Additionally, it mitigates the loss of nonverbal cues in communicating to others.

Policies and Standards Applicable to Howard County Department of Fire and Rescue Services: Communications

The Maryland Fire Service Health and Safety Consensus Standard[19] requires each Authority Having Jurisdiction (AHJ) adhere to the following communications practices:

- Include guidelines and/or procedures for radio communications that provide standard protocols and plain language terminology for all types of incidents
- Maintain standard operating guidelines and/or procedures to support all types of incidents, from routine to unusual, without difficulty
- Establish standard terminology to transmit emergency and non-emergency information
- Establish a standard method for prioritizing emergency and non-emergency messages to all levels of command within a given emergency incident; and
- Use established Incident Management System as standard operating guidelines and or procedures to support emergency operations

As the Authority Having Jurisdiction, the Howard County Department of Fire and Rescue Services adopted several General Orders to meet the MOSH consensus standard. First, embedded in General Order 300.07 Incident Command System, which establishes the Howard County Department of Fire and Rescue Incident Command System, are instructions of how units should report information on the radio. In the order, units are to "report the conditions they have, the actions they have taken, and their needs for additional resources or actions of others, and end the report with their PAR (Personnel Accountability Report) status."[20]

Second, General Order 410.01 Communications applies to the Howard County Department of Fire and Rescue Services as well as the Howard County Department of Police, Information Technology Bureau, Communications Division (Communications Center) that administers all 911 call-taking and fire dispatch services in Howard County. The Communications Center coordinates all Howard County Government radio communications—including facilitation of Police, Fire, and Emergency Medical calls—24 hours a day, 7 days a week. It is fully operated by the Howard County Department of Police, with a uniformed Fire Captain and Fire Lieutenant serving as liaisons from Fire and Rescue Services to support Fire Operations. The Fire Captain is on an administrative work schedule and does not have any official management function in the Command Center. There is no official oversight of Fire and Rescue incidents, only unofficial oversight when the Fire Liaison is on duty.

While General Order 410.01 Communications provides a comprehensive overview of communication procedures for the Howard County Department of Fire and Rescue Services, the

[19] MD. OCC. SAFETY. AND HEALTH: MARYLAND FIRE SERVICE HEALTH AND SAFETY CONSENSUS STANDARD (MD. DEPT. LABOR, LICENSING, AND REG. 2002).
[20] Howard County Dept. of Fire and Rescue Services, General Order 300.07 Incident Command System (2016).

portion of this order pertinent to the Internal Safety Review Board is Section 11 (Incident Communications Practices and Procedures). Within General Order 410.01 Communications, Section 9.3, the Order Method for communication is described as the radio communication method for Howard County Department of Fire and Rescue Services.

Third, Howard County Department of Fire and Rescue Services General Order 300.04 MAYDAY Situations provides the policies and procedures for MAYDAY situations, defined as when "an imminent life-threating situation exists."[21]

[21] Howard County Dept. of Fire and Rescue Services, General Order 300.04 MAYDAY Situations (2013)

Woodscape Drive Incident Overview: Communications

The Howard County Department of Fire and Rescue Services radio communication system has standard Zones and Talk Groups as established in General Order 410.01 Communications. Under the order, Alpha 1 is used to alert and dispatch units and is the typical channel used to alert stations of an incident. The talk group Bravo 1 is the initial operational channel for an incident. Should an incident expand, Bravo 1 is maintained as the Incident Command channel while other talk groups in the Bravo Zone are used if necessary. During the Fire Incident at 7005 Woodscape Drive on July 23, 2018, radio transmissions occurred on the following Talk Groups: Alpha 1, Bravo 1, Bravo 2, Bravo 3, Bravo 4, and Bravo 6.

Communication during the Fire Incident at 7005 Woodscape Drive primarily occurred in two distinct, but connected, locations: the Fireground and the Communications Center. For clarity within this report, each location is addressed separately.

Communications Center

On the evening of July 22 – 23, 2018 the Communications Center had three civilian fire and rescue dispatchers working. Each dispatcher was assigned to a primary radio talk group (Alpha 1, Alpha 2, and Bravo 1). At 01:51 on July 23, 2018 a resident of 7005 Woodscape Drive called 911 advising the dispatcher that there was a strong smell of smoke from the residence and that they had evacuated the building. Although this information was verbally communicated to the 911 call-taker, it was not transcribed into the Computer Aided Dispatch (CAD) notes for the responding units. The Communications Center, following General Order 410.01 Communications, alerted Paramedic 56, Engine 51, Engine 101, Tower 10, and Battalion Chief 1 of a local alarm for a single-family home with visible smoke from a lightning strike on talk group Alpha 1. Operations were then switched to the Bravo 1 channel. After Engine 51 arrived on-scene and confirmed that the single-family dwelling had visible smoke, Engine 51 directed the Communications Center to dispatch a full box alarm, which it did following the protocols in General Order 410.01 Communications.

Recognizing that there was a working fire incident, the Communications Center supervisor moved a fourth dispatcher from training in police operations to fire operations to staff an additional tactical channel as is standard practice. Following General Order 410.01 Communications, the Incident Commander provided the Communications Center a fifteen (15) minute progress report, in which they requested additional assistance from a task force. The Communications Center dispatched the task force that included Squad 1, Engine 61, Engine 91, On-Call Public Information Officer, On-Call Safety Officer, and On-Call Fire Investigator.

At that point in the incident a MAYDAY call was transmitted over Bravo 1. Realizing that Incident Command was unsure of the location of the MAYDAY call, the Communications Center informed Command of which radio transmitted the MAYDAY call over Bravo 1. Following protocol from General Order 300.04 MAYDAY Situations, the Communications Center placed a channel marker on Bravo 1 as the channel that transmitted a MAYDAY call.

Then, following the instructions of the Incident Commander, the Communications Center initiated a second alarm that was maintained on Bravo 6. At 02:33 hours Communications notified Command of an emergency identifier from FF Flynn's radio, which was set to Bravo 2, then attempted to contact FF Flynn over that channel. The Communications Center did not advise the Incident Commander that the transmission occurred on Bravo 2.

At 02:49 Incident Command advised the Communication Center to call a third alarm to the scene, which the Communications Center completed at 02:50. At 03:04 the Communications Center advised all units that Bravo 6 would no longer be monitored and to switch to Alpha 2 if anything was needed. Bravo 6 was unmonitored due to the dispatch of another box alarm overwhelming the staffing in Communications Center.

Fireground

Howard County Department of Fire and Rescue Services arrived on the scene of 7005 Woodscape Drive by 02:00 on July 23, 2018. The units from the initial alarm verified that there was an active fire incident, notified the Communications Center to upgrade the assignment to a Box Alarm, and continued operating on operations talk group Bravo 1. Units on scene primarily operated on Bravo 1, as dictated by General Order 410.01 Communications.

At 02:20 a MAYDAY sounded on Bravo 1, clearly transmitting the MAYDAY signal but with unrecognizable words afterward. Immediately seeking to identify the person who placed the MAYDAY call, the Incident Commander worked with the Communications Center to identify the radio calling MAYDAY as portable Engine 101A. There was brief confusion among the responders, with Command and the Communications Center initially believing that Engine 101A had fallen into the basement rather than Engine 101A calling MAYDAY on behalf of FF Flynn. During these communications on Bravo 1, FF Flynn transmitted a MAYDAY call on Bravo 2. Unfortunately, that transmission occurred simultaneously to a transmission on Bravo 1, which was the priority operations channel, and was heard neither by the Incident Commander nor by the Communications Center.

Findings and Recommendations: Communications

The Internal Safety Review Board (ISRB), after an extensive review of available information regarding the 7005 Woodscape Drive Fire Incident, identified the following communication issues. These findings and associated recommendations are divided into three areas: communications center related, fireground related, and equipment related.

Communications Center Related

Although the Communications Center personnel overcame inefficiencies in the process of scaling up to support a large incident, there were communication gaps between the 911 call taker and the fireground personnel. First, although the residents of 7005 Woodscape Drive clearly stated that all residents had evacuated from the structure, that information was not transcribed into the CAD notes for the responding personnel. Without information in the CAD notes, the Incident Commander and other crews on the fireground did not know that the life-safety risk of the residents was avoided until conferring with the residents and transmitting the "all clear" at 02:12:41.

The County's 911 call takers are not utilizing the Fire Priority Dispatch System, Emergency Fire Dispatch Protocol (EFD), which has become a standard in many surrounding jurisdictions and the Region. This system guides the call taker in collecting all necessary incident information and automatically relays this information through the CAD system. If the County had adopted the EFD, important information would not have been left out of the CAD notes. ISRB recommends adopting the EFD.

Second, the Communication Center is understaffed for responding to HCDFRS incidents. The Fire Operations section in the Communications Center has three dispatchers, each assigned a radio talk group. These dispatchers consistently monitor talk group Alpha 1, Alpha 2, and Bravo 1, however the dispatcher on Bravo 1 often fulfills other responsibilities when there is no active incident requiring the operations channel. In the event of high incident volume or complexity an additional dispatcher may be reassigned from call taking operations to Fire Operations as staffing permits.

When a call taker is reassigned to assist Fire Operations, there is significant time delays in the transition. The three regular Fire Operations dispatchers were heavily engaged in critical tasks, with one dispatcher monitoring multiple channels at the same time, during the incident. The Communications Center was in the process of transitioning a call taker to be an additional dispatcher at the time of the MAYDAY. As reported by the dispatch staff, it takes three to five (3-5) minutes due to login procedures with the dispatch console.

Although Communication Center staff are well trained to support Fire Operations, many critical tasks are performed by memory and are not supported by a job aid, such as a checklist. Additionally, there is no procedure to provide just-in-time training, which is a way to provide employees necessary information at the moment they need it to complete a critical job function. This includes procedures for handling a MAYDAY call. While staff are able to access HCDFRS General Orders through a network drive, the process is impractical during an active incident.

When the Fire Liaison is present, they provide fire operations expertise to the Communications Center Staff. At times, such as when the MAYDAY call happened during this incident, when the Fire Liaison is not on-duty such expertise is missing. A just-in-time training or job aid would help ensure a minimum level of fire operation expertise among call center staff when there is not a Fire Liaison available to advise. Additionally, the General Orders—including General Order 300.04 MAYDAY Situations—are lengthy and difficult to glean operational value from during a critical event.

During this particular incident, neither Fire Liaison was present in the center to assist dispatchers. This lack of in-person Fire Operations guidance, just-in-time training, or job aids made it difficult for dispatchers to contact other jurisdictions for mutual aid support efficiently. Fire Operations leadership within the Communications Center during the incident could have also aided the influx of radio traffic and the process for escalating alarms.

Findings	**Recommendations**
C.1. Communications Center Fire Operations staffing levels limit the ability to expand operations for multiple incidents while maintaining focus on critical tasks and transmissions. This includes the absence of a 24/7 Fire Operations supervision from a HCDFRS officer.	C.1.1. The Communications Center should adopt and implement the EFD protocol. C.1.2. The Communications Center should increase staffing levels to support critical Fire Operations and develop a written staffing plan that adequately fulfills Fire Operations staffing needs. C.1.3. HCDFRS should increase its leadership presence at the Communications Center by establishing a Fire Liaison position 24/7 to support Fire Operations dispatchers. C.1.4. HCDFRS should have full operations and management oversight of Fire Operations dispatchers.
C.2. General Order 410.01, Communications, does not reflect current operational practices for HCDFRS or industry consensus standards.	C.2.1. HCDFRS should review and revise General Order 410.01 Communications to reflect the consensus standard for communications, the operational reality of the Communication Center staff, and current field practices and technology.

Findings	Recommendations
	C.2.2. Establish a Communication Center workgroup among the Baltimore/Washington metropolitan region to identify gaps among Howard County Communication Center operations and develop an improvement plan.
C.3. Dispatchers lack readily accessible job aids to assist during critical events. This led to inefficiencies in accessing mutual aid as well as deviations from protocols established in General Orders.	C.3.1. The Communications Center, in coordination with HCDFRS, should develop just-in-time and job aids training for call takers and dispatchers. C.3.2. Communications Center staff, in coordination with HCDFRS, should engage in a training program that aligns with the duties and capabilities required by Fire Operations dispatchers. Scenario-based training and integration with live company and battalion evolutions, similar to spring 2018 MAYDAY trainings at the American City Building, would be particularly beneficial.

Fireground Related

In reviewing communications and actions on the Fireground, the ISRB identified several critical instances where actions were taken but not communicated with Command or among other crew members. First, many responding apparatus failed to announce their response or staffing levels as ordered in General Order 410.01 Communications. This may contribute to Command Officer confusion since they may not be aware of what units are responding with what staffing level.

Second, many units on the fireground did not follow the procedure for reporting their status while in the Hazard Zone, as established under General Order 300.07 Incident Command System. Under the established department procedure to report their status, units should report the conditions they have, the actions they have taken, their needs for additional resources or actions of others, and end the report with their PAR status. This did not occur at several critical moments during the incident, including a lack of announced initial entry into the structure, units not notifying command of withdraw from the structure, and units not reporting deployed tactics to attack the fire. Crew members recognized deteriorating conditions but did not advise their company officers of their observations. Critically, information about conditions, obstacles encountered, and change in crew location were not communicated to the Incident Commander clearly either in-person or via radio communications. These critical gaps in communication between crew members and Incident Command likely contributed to the circumstance where by crews entered the structure through Side C on the first floor despite early identification of a basement level fire.

Third, while there was an attempt to maintain closed-loop communications on the fireground there were a number of communications loops either left open or disrupted by other communication traffic. For example, shortly after Incident Command was established the BC Aide signaled a communication to command and was provided a go-ahead to speak. When the BC Aide attempted to provide a situation update a simultaneous communication from E51 interrupted the BC Aide's report with non-critical information, forcing the Incident Commander to request that the BC Aide re-transmit the status report. While this example was relatively minor, it is illustrative of the communication confusion during the fireground operations.

Findings	**Recommendations**
C.4. Fireground Communications were ineffective at relaying critical information among fire crews and to Command.	C.4.1. All crew members would greatly benefit from additional training on appropriate and effective fireground communications. This includes: ○ (C.5.1) Effectively communicating reports to crew leaders and group/division supervisors by providing clear and concise status reports.
C.5. Responding crews failed to follow protocol in communicating which units are responding and with what staffing level is included in the response.	

Findings	Recommendations
C.6. Responding crews failed to verify that all crewmembers were operating on the same Talk Group before engaging the fire and a critical communication was transmitted over Bravo 2, an unmonitored channel.	○ (C.5.2) HCDFRS should incorporate standard naming convention for structure floors and train all personnel to use common terminology on the fireground. ○ (C.6.1) Properly announcing responding apparatus with staffing level as ordered in General Order 410.01 Communications. ○ (C.7.1) Tactical radio communications when entering and exiting an incident hot zone. ○ (C.7.2) Crew selecting and verifying the appropriate tactical channel for fireground operations. ○ (C.7.3) HCDFRS should train all personnel to follow closed-loop communication best practices during fireground operations. This process has been effectively executed among other fire departments to enhance crew and command understanding during active incidents. HCDFRS should develop protocols for verifying that all personnel responding to and operating on an incident scene have their mobile and portable radios selected to the correct tactical radio channel. This could be actualized by requiring crew
C.7. Responding crews left communication loops open, failing to use the Order Method. This led to responding crews interrupting and cross-talking on the operational radio channel.	

Findings	Recommendations
	officers to announce when their crew is entering a hot zone which will ensure that the officer is on the correct tactical radio channel, accounts for the crew's entry time, and provides accountability of the unit for the Incident Commander. ○ (C.8.1) For example, implementing the recommended complete loop communication recommended by FEMA in 1999.

Equipment Related

Although the ISRB determined that FF Flynn's MAYDAY transmission on Bravo 2, which was neither identified by the Communications Center nor any crew at the incident scene, likely had no impact on the survivability of FF Flynn. However, the issue of a crew member operating on the wrong tactical channel has implications for the safety during future incident operations. As such, the ISRB conducted an extensive review of the radio equipment and have made recommendations to mitigate safety concerns identified by the ISRB.

First, FF Flynn affiliated his assigned portable radio to Bravo 2, which was the incorrect Talk Group for the incident. In Spring 2017, HCDFRS deployed the Motorola APX8000XE portable radios with an associated programming change. Previous portable radios allowed for manual switching of radio channels with the radio in the "off" position. The APX8000XE radios power up to the previous Talk Group and channel regardless of the channel selector knob or talk group toggle position. Manual manipulation of the knob or toggle with the radio in the "off" position does not change the radio channel selection once powered "on". There is evidence that FF Flynn affiliated first with the Alpha 2 Talk Group, then switched to Bravo 2 Talk Group and remained on that channel until extricated from the structure.

Second, FF Flynn's MAYDAY communication was transmitted on Bravo 2. This transmission occurred around the exact time that Engine 101A was transmitting a MAYDAY communication on Bravo 1. Any radio on the assigned Bravo 1 Talk Group and in scan mode defaulted to the selected channel of Bravo 1, hence not allowing the Bravo 2 transmission to be heard.

Third, FF Flynn's radio transmitted an emergency identifier, likely because of the man-down function, and the emergency identifier was transmitted on Bravo 2. No one on the scene or in the Communications Center recognized that the emergency identifier was sounding on the Bravo 2 Talk Group. The ISRB determined that the failure to recognize that the emergency identifier operated on the Bravo 2 Talk Group likely had no impact on the survivability of FF Flynn as the RIC had already been deployed and was rapidly gaining access to FF Flynn at the time of the activation.

Fourth, FF Flynn wore his assigned Motorola APX8000XE radio in a leather strap and holster assembly under his turnout coat. Wearing the radio in this fashion shielded the radio and microphone cord from thermal damage. The radio and lapel microphone is rated for sixty (60) degrees Celsius/ 140 degrees Fahrenheit, a temperature that was far exceeded in the environment. Had the radio and lapel microphone been exposed to the ambient temperatures in the crawlspace, there is a high likelihood that the radio and lapel microphone would have experienced failure. Of note, the Howard County 800 MHz radio system is coverage tested with the Motorola APX8000XE radio worn at the hip position, configured in the same manner as it was worn by FF Flynn.

Fifth, the portable radio worn by FF Flynn and assigned to the Engine 101 Firefighter "B" riding position passed all functional testing. The Howard County Radio Shop tested the portable radio assigned to and worn by FF Flynn during the incident on September 18, 2018. The radio used by

FF Flynn is a Motorola APX8000XE. The testing was conducted by system engineers from Motorola Solutions, Inc. and witnessed by various members of the ISRB, fire department administration, and a detective from the Howard County Department of Police. For technical expertise, the Howard County telecommunications manager as well as the Prince George's Radio telecommunications manager provided oversight. Also, two additional radio system engineers from Motorola Solutions, Inc. were present to provide technical expertise. Although the unit had received thermal and mechanical damage consistent with the fall and environmental conditions encountered in the crawlspace, the radio and the lapel microphone passed all bench testing and functioned as designed. This test established that FF Flynn's radio was functional and working as designed.

Additionally, forensic test conducted on FF Flynn's radio determined that FF Flynn's radio was set to operate on Bravo 2 and the scan function was engaged. On November 7, 2018 a series of tests were conducted on FF Flynn's radio by Motorola Solutions at their forensics facility in Plantation, Florida. These tests verified that although the radio had been exposed to high temperatures it had not lost any functionality or tactility. In other words, FF Flynn's radio was verified by the manufacturer to be fully functional and operated as programed. Reviewing the radio programming, the manufacturer and ISRB noted that features such as the Emergency Identifier program were suboptimal because it lacked an emergency identifier revert option to place the radio on the command channel.

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Figure 20 - Photos of the radio assigned and worn by FF Flynn. Photos provided by HCPD.

Findings	Recommendations
C.8. The transmission of FF Flynn's MAYDAY and emergency identifier on Bravo 2 likely had no impact on the survivability of FF Flynn as the RIC had already been deployed and was rapidly gaining access to FF Flynn at the time of the activation. C.9. The Motorola APX8000XE portable radio assigned and worn by FF Flynn functioned as designed and programmed. C.10. Activation of an emergency button (via manual depression or man-down feature) sounds on the radio channel the radio is set to operate on.	C.8.1. Current configuration of the radio broadcasts the emergency identifier on the radio channel on which the radio is currently operating. To mitigate human error of a crew member operating on a channel that is unmonitored, an emergency identifier activation on the Bravo, Charlie, and Delta Talk Groups should revert the member to a channel that is always monitored by the Communications Center and the Incident Commander.
C.11. The Motorola APX8000XE radio is a complex piece of life safety equipment, requiring specific training to operate appropriately. As detailed in the Training Section of this report, the department training for operation of this radio system prior to its wide deployment in the field was inadequate to ensure that all crew members could effectively operate the new equipment. A major shortcoming of the training was that it provided only an emailed slideshow of how to operate the radio and did not provide any "hands-on" practice to ensure that personnel could effectively operate the radio.	C.11.1 Because of the complexities of operating the Motorola APX8000XE radio, more extensive training prior to its deployment in the field should have been established to ensure that crews can operate the radio appropriately. A thorough training program, as detailed in Section III.J, that includes a didactic portion, practical evolutions, and a competency-based evaluation is appropriate for a piece of equipment so vital to hazard zone operations as the portable radio.
C.12. The Motorola APX8000XE radio programming was suboptimal for features such as the Emergency Identifier.	C.12.1. HCDFRS should convene a work group to evaluate all programming and accessory options in the Motorola APX8000XE radio to optimize the safety,

Findings	Recommendations
	efficiency, and technology of the equipment.