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Regina Bridging Research and Interoperability Centre (BRIC) Public Security Broadband Network (PSBN) Experiment After Action Report

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Regina BRIC PSBN Experiment After Action Report

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1. INTRODUCTION

1.1 Background

Defence Research and Development Canada's Centre for Security Science (DRDC CSS), the University of Regina, the Saskatchewan Interoperability Interest Group (SIIG), and the Government of Saskatchewan partnered to develop an experiment with the intent of developing a better understanding of how the Public Security Broadband Network (PSBN) mobile data can enhance the response capabilities of public safety organizations. It is hypothesized that the increased and improved use of advanced communications by the public safety community will allow them to better anticipate, mitigate, prepare for, respond to and recover from emergencies and planned events.

The University of Regina has championed the development of the Bridging Research & Interoperability Centre (BRIC) initiative. The BRIC is an advanced technology initiative focused on systematic exploration of the broad range of ever-evolving public safety technologies and practices. The platform enables researchers and practitioners to examine methods to integrate the full breadth of public safety solutions so they work together and provide realistic and applied support in complex multi-faceted public safety scenarios. This initiative envisions a fully open, standards based model; operated and maintained to balance local functionalities, regional coordination and national resource sharing [1].

This experiment focused on testing the BRIC PSBN platform in a series of emergency scenarios at the newly constructed Mosaic Stadium in Regina, Saskatchewan. The PSBN was used by multiple PSBN enabled devices to augment the current communication and information sharing devices used by safety and security partners in the City of Regina during three mock emergency scenarios. In addition, this experimental technology demonstration aimed to identify gaps within the PSBN and highlight where additional research and development (R&D) should be focused in the next stage of development.

1.2 Purpose and Scope

This report provides an overview of the Regina BRIC PSBN experiment including a review of the experiment design, data collection, experiment results and finally recommendations for further research and development of the network. This report does not review the individual performance of any City of Regina emergency responders, and does not investigate the human factors component of the PSBN hardware.

2. METHODOLOGY

2.1 Experiment Conduct

2.1.1 Schedule

The experiment was conducted on May 16th, 2017 over the course of one day. Technology set-up at Mosaic Stadium occurred prior to May 16th. Table 1 outlines the general schedule.

Table 1: Technology Demonstration Schedule

Time	Activity
08:30 - 09:15	Technology testing
09:15 - 0930	Start state briefing
09:30 - 10:45	1st iteration of experiment (scenario-based)
10:45 - 11:00	Break
11:00 - 12:15	2nd iteration of experiment (scenario-based)
12:15 - 13:15	Lunch
13:15 - 14:30	3rd iteration of experiment (scenario-based)
14:30 - 15:00	Time allowance for additional tests / Break
15:00-15:45	Hotwash / focus group
15:45-16:00	Conclusion

2.1.2 Partners and Participants

Participation in the experiment was mixed between government and private sector organizations. The organizations directly involved in the experiment included:

- The University of Regina;
- Defence Research and Development Canada's Centre for Security Science (DRDC CSS);
- Saskatchewan Interoperability Interest Group;
- Government of Saskatchewan;
- Buckingham Security;
- Regina Emergency Management (EM);
- Regina Fire & Protective Services (RFPS)
- Regina Police Service (RPS);
- Regina Police Service Explosives Disposal Unit (RPS EDU);
- Regina Qu'Appelle Health District EMS
- General Dynamics Mission Systems
- Evraz Place (Mosaic Stadium); and

- International Safety Research (ISR).

2.1.3 Experiment Objectives

The overall objective of this experiment was to support the University of Regina's BRIC and its partners in facilitating a live field play scenario that would test the PSBN platform and the hardware developed for first responders/receivers. Additionally, this experiment aimed to provide BRIC researchers with a more in depth understanding of where future research and development (R&D) efforts need to be focused moving forward and how the technology can be modified from its current state to better suit the needs of the first responder/receiver community.

The specific objectives of this experiment were to:

- Showcase the available PSBN technology and elicit the potential future user requirements;
- Develop a better understanding of how mobile data can enhance public safety capabilities;
- Identify priority areas for collaboration with the University of Regina, SIIG, and the Government of Saskatchewan; and
- Identify gaps in the technology and network requiring additional research and development.

2.1.4 Control

The following structure was used to control the experiment:

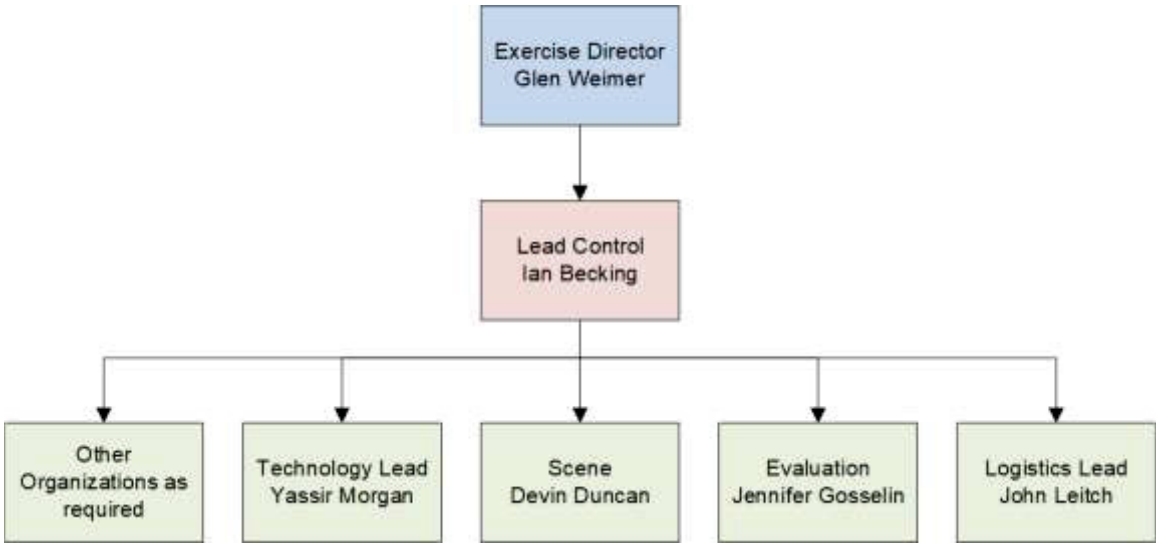

Figure 1: BRIC PSBN Experiment Control Structure

2.1.5 Scenarios

The experiment was divided into three iterations. Each iteration was run based on the premise that it was Game Day at the Mosaic Stadium, one hour prior to kickoff.

The actions taken in each iteration are described in detail in Annex A, and are summarized as follows:

Iteration #1: A suspicious package was located in the stadium. Stadium Security and an RPS Patrol unit were dispatched to the scene and examined the package, exchanged information (including video and images) with the command post, and determined that the package was not a threat.

Iteration #2: A suspicious package was located in the stadium. Stadium Security and an RPS Patrol unit were dispatched to the scene and examined the package, exchanged information (including video and images) with the command post, and determined that the package **was** a threat. The suspect was identified via the stadium security camera system, apprehended, suffered a medical emergency, and was attended to by EMS making use of PSBN technology. The EDU was called in and used the PSBN to transmit video from a robot deployed to examine and retrieve the package.

Figure 2: RPS EDU robot retrieving the suspicious package

Iteration #3: A sprinkler malfunction occurred. RFPS attended the scene and used PSBN-enabled technology to access remotely located subject matter expertise (SME) support (sprinkler vendor) to obtain technical advice on disabling the leaking sprinkler.

2.1.6 Locations

This experiment was conducted at the newly constructed Mosaic Stadium located at 1734 Elphinstone Street, Regina SK, S4T 1K1. Multiple sub-locations within the stadium were utilized for experiment trials. These locations were chosen based on multiple factors including PSBN signal strengths, stadium camera coverage, proximity to high traffic areas, etc. These locations are shown as red dots in Figure 3 and Figure 4.

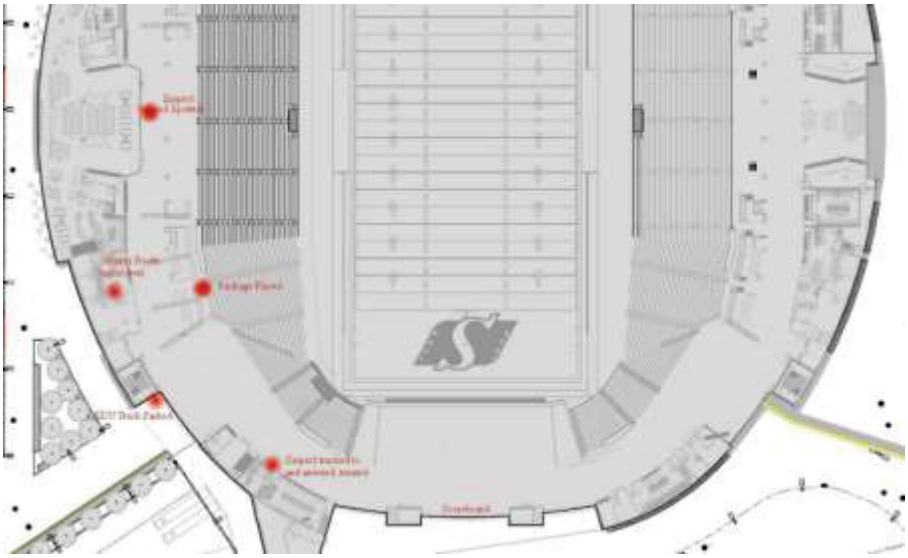

Figure 3: Iterations #1 & #2 locations[1]

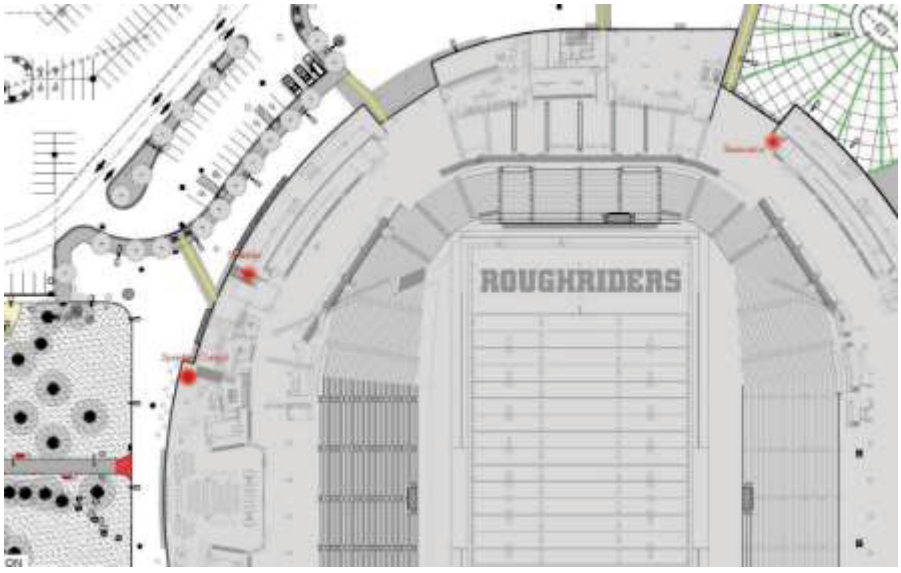

Figure 4: Iteration #3 locations[2]

[1] Image used with permission of Manager of Stadium Development, City of Regina
[2] Image used with permission of Manager of Stadium Development, City of Regina

2.1.6.1 *Control centre*

The incident command post (ICP) was established in the Security Booth on the upper level and was used to perform the following tasks:

- Stadium security operations including CCTV control;
- Inter-agency coordination;
- Fire, police, and paramedic dispatch; and
- Monitoring of feeds and information transmitted using PSBN-enabled devices (imagery, video, etc.).

Exercise control was co-located with the ICP.

2.1.6.2 *Meeting Room*

A separate meeting room on the upper level was used to facilitate the focus group sessions and to conduct the initial briefing to all experiment participants.

2.1.7 Conduct

2.1.7.1 *Iteration #1*

General

Iteration #1 was conducted in the morning on the day of the experiment. The focus of this iteration was on a simple response by stadium security to a suspicious package unattended in a high traffic area prior to a sporting event at the stadium. Responders were dispatched to the scene and responded using typical response procedures. PSBN enabled devices were provided to responders who used these devices to send still images of the suspicious package to stadium command.

The stadium security camera system was used to track and provide an ID on the suspect. Stadium Command was responsible for using the cameras, acquire an ID on the suspect and maintain an overall SA of the area surrounding the scene.

Push-to-talk (PTT)

During this iteration, the PTT software on the PSBN devices (Android Smart Phones) was used to communicate between field personnel (Security, Police) and personnel in the ICP.

CommandWear

The CommandWear software was used to send images of the suspicious package from the scene to the ICP, as well as to transmit images of the suspect (captured by the stadium cameras) from the ICP to the security and police patrol units.

Body camera

Body cameras were used during this iteration to improve situational awareness within

the ICP. These cameras were mounted onto the outside of clothing and/or PPE of the RPS officers and provided live video feeds directly from the scene.

2.1.7.2 *Iteration #2*

Iteration #2 was conducted immediately following the break for lunch and was similar to iteration #1. It included the same use of technology as iteration #1, with the following additions:

- A body camera was attached to the EDU robot to simulate the ability to transmit the feed from the robot's built-in cameras through the PSBN;
- Video was delivered to the Fire Command Truck outside the stadium from body worn cameras and the stadium cameras;
- X-ray images of the package were sent to the ICP through the PSBN; and
- The PTT system was used by a paramedic team to communicate with "dispatch" in the ICP.

2.1.7.3 *Iteration #3*

Iteration #3 involved the use of the PTT functionality to simulate radio communications between firefighters and their dispatch. Partway through this iteration it was decided to fall back to LMR as the PTT function was limited. Video was delivered to the Fire Command Truck outside the stadium from body worn cameras and the stadium cameras, which allowed personnel in the truck to track their people and observe the progression of their response tasks.

CommandWear was used to transmit images of the sprinkler system status board to dispatch, followed by images of the (notionally) damaged sprinkler head. The dispatch then notionally used those images to contact the sprinkler system vendor and rapidly obtain accurate troubleshooting instructions, which enabled the firefighters to locate and actuate the correct shutoff valve.

2.2 Evaluation

The evaluation for the experiment consisted of multiple data collection methods. Data collection was critical for this experiment as the technologies being tested are in the initial development stages and require a focused path forward for future development. The two main sources of data were the focus group held following the third and final iteration, and the participant feedback forms that were provided to participants at this session.

The focus group facilitated by experiment directors followed a series of targeted questions focusing on the participants experiences during the scenarios, and the increased capabilities that the technology did or did not provide. Participants were asked how they could see this technology augmenting the current communications systems that are used by their organization on a day-to-day basis, and how the current PSBN technology could be improved in the future. During this focus group, members of the experiment design team were present and were taking qualitative notes to capture the data.

Following the discussions, a participant feedback form was provided to participants that asked more directed questions. This form allowed participants to provide further thoughts and opinions to the experiment design team in a non-group setting. These feedback forms were analyzed and their results are discussed further in Section 3.3.

3. RESULTS

3.1 Execution

3.1.1 Iteration #1

Push-to-talk (PTT)

The PTT software froze a number of times during the experiment. While it was recognized that these issues were due to the prototype hardware and software, the participants expressed frustration with the experience.

CommandWear

The users noted that the ability to easily exchange images with the ICP (or other point of contact, such as dispatch or the staff sergeant) was very useful.

The users noted that there were some minor counter-intuitive aspects to the user interface:

- The “send” button was not obvious; and
- The use of the “acknowledge” button was not clear.

Body camera

Personnel in the ICP noted that body cam footage was useful, though it was observed that a “command interface” would be needed to allow the user to switch between different body cam feeds, as many personnel would be deployed and monitored by a single station.

3.1.2 Iteration #2

During this iteration, the stadium camera system failed due to a service issue with the camera vendor. This was caused by an operating system upgrade made urgent by a global cyber-attack that was ongoing from 12-15 May 2017[3]. Since the PSBN is separate from the standard telecom networks, it continued to function during this time. This had the benefit of demonstrating the utility of having a separate network dedicated to public safety.

3.1.3 Iteration #3

This feedback from this iteration reflected that gathered in the first two iterations; the firefighters were frustrated by the lack of reliability of the PTT software, but saw benefit in the use of the body cams and CommandWear software to share images and video.

[3] The “WannaCry” cyber attack targeted a known exploit in some versions of Microsoft Windows that had not yet been patched or were no longer being supported. For further details see: https://arstechnica.com/security/2017/05/windows-7-not-xp-was-the-reason-last-weeks-wcry-worm-spread-so-widely/

3.2 Focus group

The focus group was conducted as a facilitated discussion, loosely guided by a series of questions (see Annex B for a list of the questions). The results of the focus group are gathered into the Discussion section (Section 4).

3.3 Participant Feedback Forms

3.3.1 Overview

Thirteen participants completed the Participant Feedback Form, representing Regina Police, Regina Fire, RQHR EMS, and Mosaic Stadium Security.

3.3.2 Technology effectiveness

The participants were asked to assess the effectiveness of the PSBN technologies in facilitating communications between first responders and the ICP (Figure 5), between multiple partners simultaneously (Figure 6), in improving overall situational awareness (Figure 7), and in providing reach-back access to remote SMEs or other partners (Figure 8). Overall, the majority of participants assessed the PSBN technologies as “Somewhat Effective” in these categories, or 2 out of 5 on the assessment scale.

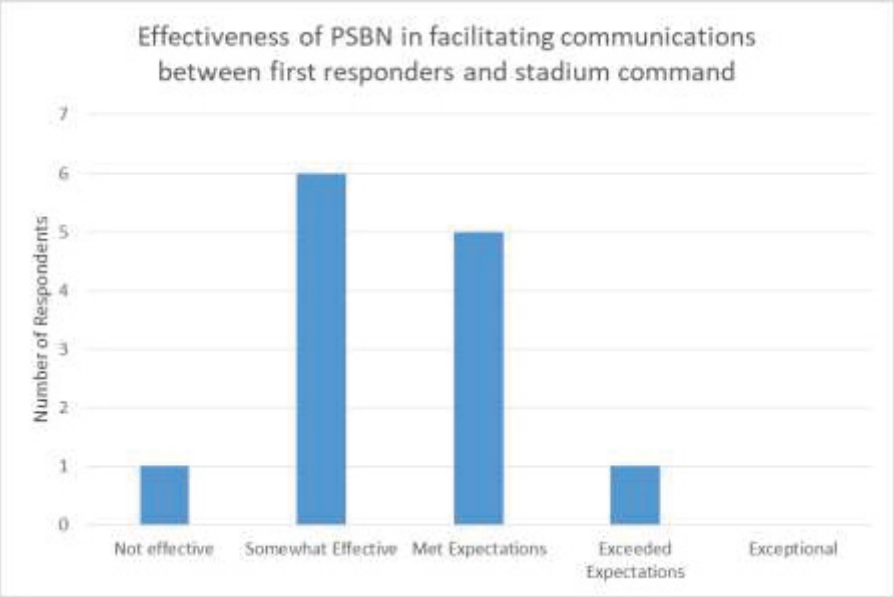

Figure 5: PSBN effectiveness in facilitating communications between first responders and stadium command

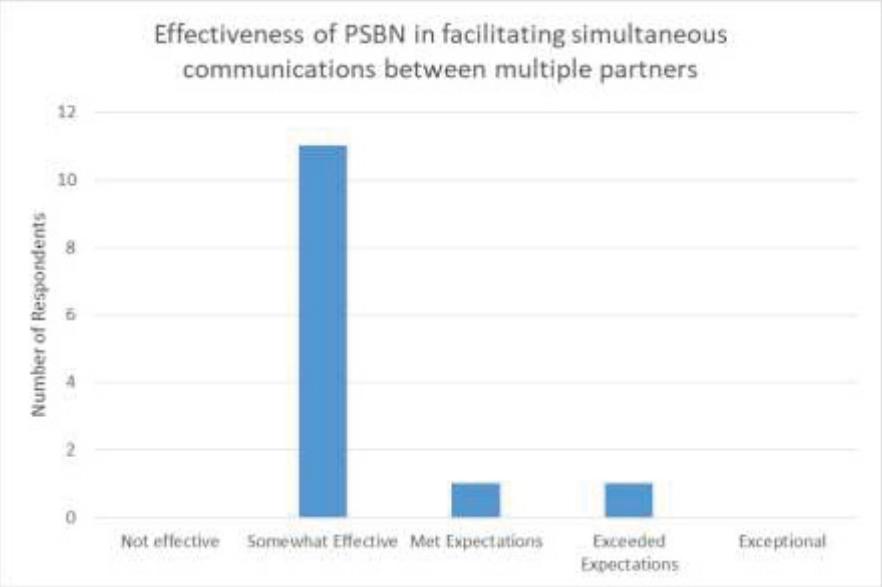

Figure 6: PSBN effectiveness in facilitating simultaneous communications

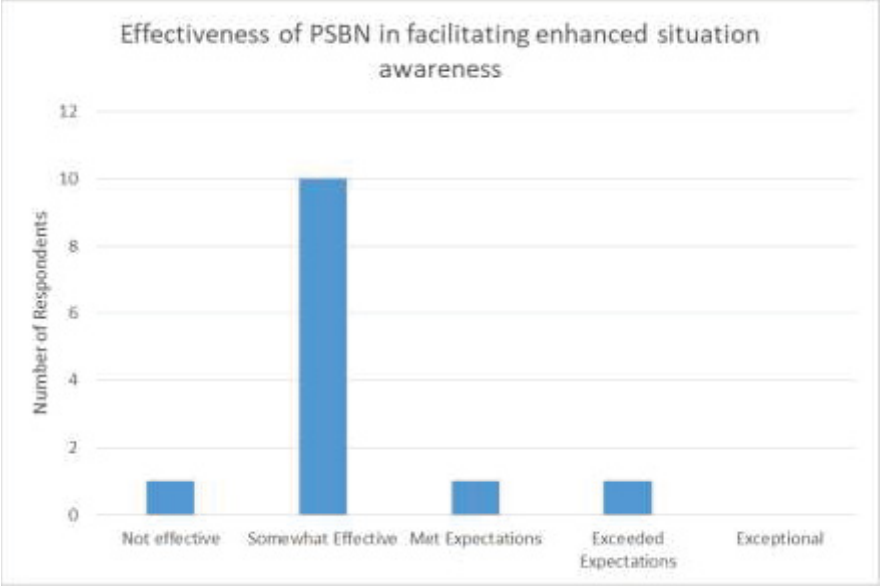

Figure 7: PSBN effectiveness in facilitating enhanced situation awareness

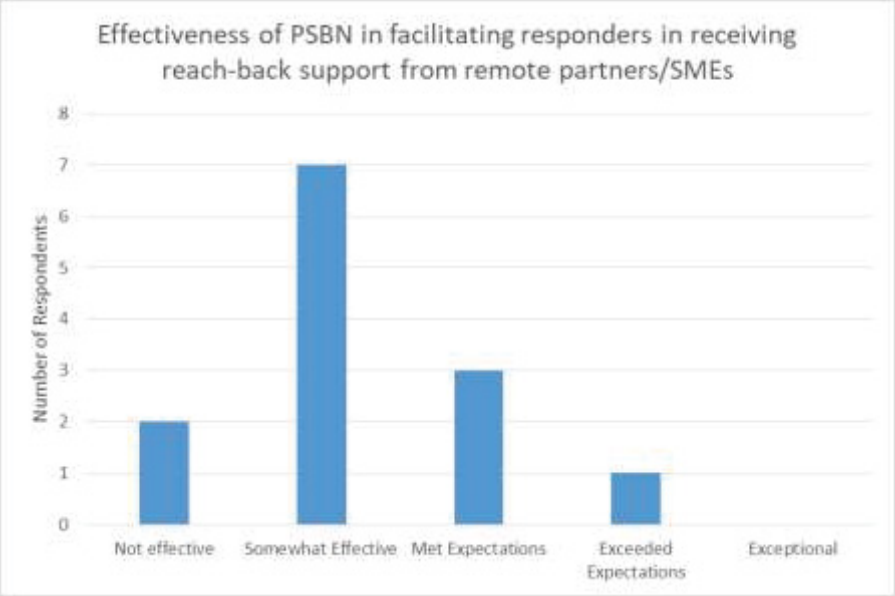

Figure 8: Participant assessment of effectiveness of PSBN

Participants were also asked to assess how the speed of communications was affected by the use of PSBN technologies (Figure 9). Most of the participants indicated that the speed of communications was significantly decreased. This was likely due to the prototype nature of the equipment, where participants were learning to use it while operating it.

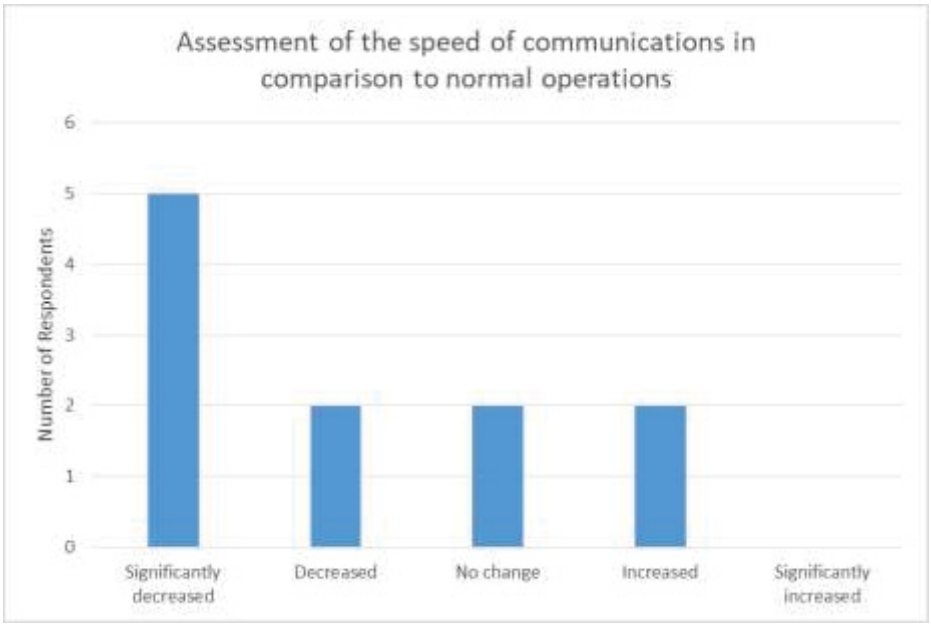

Figure 9: Assessment of the speed of communications in comparison to normal operations

3.3.3 Technology use

The respondents indicated that the technology could be used to fill the following operational gaps that currently exist in their organizations:

- Sharing of photos and videos (4 respondents);
- Sharing of information with multiple partners simultaneously (1 respondent);
- Sharing situational awareness with remote partners (2 respondents); and
- Availability of a backup network for LTE outages (2 respondents).

The respondents also indicated challenges in using the technologies demonstrated in their day-to-day jobs:

- Unreliability of the technology (10 respondents);
- Difficult to use due to the complexity of the operating system (4 respondents);
- Difficulty operating with PPE (4 respondents); and
- Inefficient applications (2 respondents).

The respondents were asked to indicate which phase of an emergency they believed the PSBN would provide the greatest benefit Figure 10.

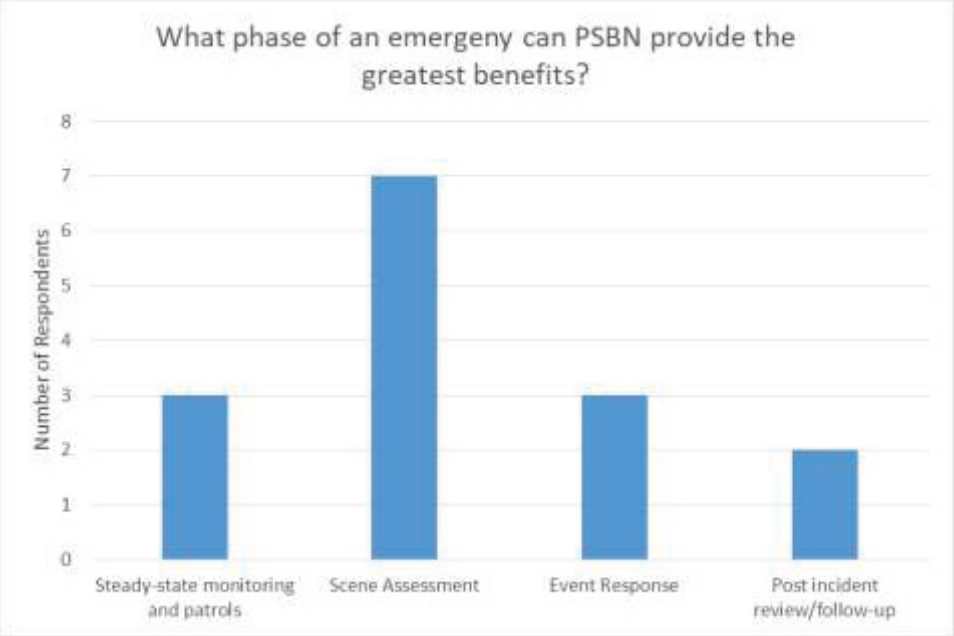

Figure 10: The emergency phase where PSBN can provide the greatest benefits

3.3.4 Suggestions for modifications to PSBN technology

Respondents were asked to indicate what modifications should be made to the technology to improve its effectiveness. Their responses were:

- Improve the system reliability (4 respondents);

- Improve the system coverage (4 respondents);
- Automate the device setup and simplify the user interface (1 respondent); and
- Provide audio capabilities on the body cameras (1 respondent).

Additionally, respondents were asked how the technology could be developed in the future:

- Improve the ease-of-use of the devices (3 respondents);
- Provide hands-free operation and/or better hardware mountings (3 respondents); and
- Provide secure image sharing capability (1 respondent).

4. ANALYSIS AND DISCUSSION

4.1 Overview

Findings are presented in this section based on the results collected during and after the experiment. Each finding is paired with a recommendation to either close a gap, maintain a strength, or implement a best practice.

4.2 Findings

Finding 1: PSBN technology cannot add new tasks to users or divert their attention from their ongoing work.

The participants noted that they do not have the capacity to add additional tasks in order to use a new piece of technology, or the ability to divert their attention to focus on a device while responding to a call.

For example, the PSBN PTT app required the user to hold the phone in one hand, look at the phone to see the talk button icon on the touchscreen, push the talk button with another, as well as to have to position the phone correctly to speak into. This operation is more complicated than current radio operation for first responders, where the handset is fixed to the collar of the uniform and can be used with one hand without needing to look at it.

The first responders pointed out that if they were to use a PTT app to replace land-mobile radio, the app and associated technology would need to at least match, if not improve on, the current level of effort and attention required to operate a radio hand-set.

It was also noted that a completely hands-free capability would be desirable. The open-mic and/or voice-activated systems that have been used with EDU bomb suits was given as an example of how this could work.

Recommendation: PTT implementation requires hands-free operation, ideally, or at least meet the minimum requirement of “eyes-free”, single-handed operation. Tethering to the individual’s uniform is desirable as well.

Finding 2: The ability to identify the sender of a message in the PTT application was very useful.

When using the PTT app, the participants were able to see who was sending a message on the screen. This was seen as an improvement over LMR, as traditional radio communications can cause confusion as to who is sending a message. Standard voice procedure has been developed to account for this, but an immediate visual indication of who is transmitting would be useful.

Recommendation: The ability to quickly identify a message sender for first responder voice apps should be maintained and further developed.

Finding 3: New technology must be reliable to be useful for public safety.

The participants expressed frustration regarding the repeated freezes of the PTT software that required intervention from a technician to resolve. They noted that first responders do not have time to troubleshoot technology when they are on a call; as soon as something goes wrong, the piece of technology is abandoned for more traditional methods.

The participants expressed interest in participating in further experiments with more mature PSBN technology.

Recommendation: The next demonstration or experiment involving first responder participation must include a full walkthrough “dry run”. Any technology that does not function reliably (as determined by the experiment director) should not be used during the experiment.

Finding 4: When new technology is introduced that provides access to new information, that information must be filtered and meet specific needs of the receiving user.

Participants noted that while the ability to share camera feeds, static images, and other media to personnel in the field, this information risks overwhelming them with a “flood of intel”.

Recommendation: The development of new information sharing capabilities (video and still image apps) must be based on the needs of the person on the receiving end. This means that specific information requirements need to be defined for the role(s) that will be using the technology.

Finding 5: LTE access provides a useful tool for stadium security and first responders.

In situations where there is no established internet infrastructure available to field personnel (e.g., when an event occurs where there is no WiFi, and they are not equipped with commercial LTE devices), the PSBN provided this capability. Participants noted that even without the use of the custom apps used in this experiment, internet access was useful in supporting security operations.

Recommendation: Investigate the utility of providing LTE service and commercial off-the-shelf devices & software to security personnel and first responders.

Finding 6: The implementation of new technology requires adequate training for users.

The participants had trouble using the technology they were presented with, since they had fairly short training sessions. While this was expected as part of this experiment, it was noted by the participants that the target audience (first responders and security compliance officers) do not always have a high degree of technical aptitude. They expressed a desire for new technology to be as simple and intuitive as possible. Vendors developing new apps and devices must balance the training burden of a new piece of technology against the benefit that it provides.

It was observed that making apps and devices function in a similar fashion to commercial devices reduces the difficulty in learning how to use them; in other words, “it’s easier to learn if it works like my smartphone”.

Recommendation: User interfaces and device design should leverage commercial design best-practices.

Finding 7: Devices to be used by first responders need to be usable with PPE.

First responders wear gloves for a wide variety of reasons (weather, PPE, etc.), and they therefore cannot use touchscreens reliably. Devices that they are expected to use must be usable while wearing gloves and other PPE.

Recommendation: Touch-screen apps need to be useable with a stylus. Hands-free (voice activated) or mechanically controlled (e.g., an actual button) operation is preferred.

Finding 8: Real-time geo-location of field assets would be a useful feature for ICP situational awareness.

Security and first responder supervisors and dispatchers expressed interest in seeing where their deployed resources are located on a map or similar georeferenced situational awareness tool. CommandWear that was used during the experiment, and other commercially available applications have that capacity currently using commercial LTE networks.

Recommendation: Future demonstrations of PSBN should investigate using GPS information transmitted over 700MHz to provide geo-reference situational awareness to ICP staff. In addition, it would be interesting to investigate how accurate positional data could be generated for personnel inside a stadium where it can be challenging to obtain an accurate GPS fix.

Finding 9: The capability that CommandWear and similar applications provided to send images was an improvement over current media-sharing methods that police use.

The RPS participants indicated that they currently do not have a method to share images related to a response. For example, they currently use email to share X-ray images of suspect packages/devices. The use of software with the capability to assist with managing and sharing sensitive media to trusted recipients was seen as highly beneficial.

In addition, it was noted that this type of tool has the potential to reduce the time it takes to distribute time-sensitive information; for example, sending out images of missing children during a football game at the stadium.

Recommendation: Continue to develop applications like CommandWear through consultation with first responders to elicit specific technology requirements.

5. CONCLUSIONS

5.1 Conclusions

This experiment successfully demonstrated the enhanced capabilities that the PSBN can provide to first responders during event response and demonstrated the reliability and robustness of the network infrastructure. Through the use of targeted apps and devices, first responders were able to provide command with a higher level of SA on scene.

While this experiment provided first responders with an initial look at the PSBN technology and related apps/devices, it was identified that further effort is required to improve the reliability of devices on the network, and to investigate the technological needs of first responders. The technology that was used during the experiment presents physical challenges to first responders as it is cumbersome for use during emergency events and requires responders to conduct additional tasks.

5.2 Summary of findings and recommendations

The key findings identified through the experiment trials are summarized in Table 2 below. Each finding corresponds with a recommendation for future updates, research and/or changes to the PSBN apps and devices. Along with each recommendation is the organization responsible for implementing the recommendation, and an ideal timeframe for doing so.

Table 2: Findings and Recommendations Summary Table

No.	Finding	Recommendation	Responsible Organization	Suggested Timeframe
1	PSBN technology cannot add new tasks to users or divert their attention from their ongoing work.	Update the PTT software and device to allow for hands-free operation.	PTT Vendors	6 months
2	The ability to identify the sender of a message in the PTT application was very useful	Maintain and develop the ability to quickly identify the sender of a message in PTT software.	PTT Vendors	N/A
3	New technology must be reliable to be useful for public safety	Technical demonstrations such as this or experiments involving first responder participation should include a full walkthrough "dry run"; Any technology that is not able to function reliably during the dry run should be removed from use for the experiment.	All	6 Months
4	When new technology is introduced that provides access to new information, that information must be filtered and meet specific needs of the users	Develop or continue to develop information requirements for target user groups for information sharing.	All	N/A

No.	Finding	Recommendation	Responsible Organization	Suggested Timeframe
5	LTE access provides a useful tool for stadium security and first responders	Investigate the utility of providing LTE service and commercial off-the-shelf devices & software to security personnel and first responders.	Mosaic Security, RPS, RPFS, EMS	12 months
6	The implementation of new technology requires adequate training for users	User interfaces and device design should leverage commercial design best-practices.	All developers	N/A
7	Devices to be used by first responders need to be usable with gloves	Touch-screen apps need to be useable with a stylus at a minimum. Hands-free or mechanically controlled (e.g., an actual button) operation is preferred.	Software vendors	6 months
8	Real-time geo-location of field assets would be a useful feature for ICP situational awareness	Future demonstrations of PSBN should investigate using GPS information transmitted over 700MHz to provide a geo-referenced situational awareness product (status map) to ICP staff. In addition, it would be interesting to investigate how accurate positional data could be generated for personnel inside a stadium where it can be challenging to obtain an accurate GPS fix.	All	6 to 12 months
9	The capability that CommandWear and similar applications provided to send images was an improvement over current media-sharing methods that police	Continue to develop CommandWear through soliciting requirements from first responders.	CommandWear vendor	12 Months

REFERENCES

[1] Morgan, Dr. Y.L., The Bridging Research & Interoperability Collaboration - Public-safety in the 21 Century, Collaborative Centre for Justice and Safety, University of Regina, 29 May 2013.

ANNEX A. SCENARIO EVENT LISTS

A.1 ITERATION #1

#	Description	Location	Actor	Receiving Actors	Device	Application
0	Suspect places package; looks at camera		Actor			
1	Security discovers suspicious package and informs command.	LOCATION #1	SECURITY #1	DISPATCH VOICE	BRIC Smartphone #7	Etherstack (PTT)
2	Security takes image of package and sends to command.	LOCATION #1	SECURITY #1	DISPATCH VOICE	BRIC Smartphone #7	CommandWear
3	Dispatch Voice informs SC Security of the uploaded image	STADIUM COMMAND	DISPATCH VOICE	SC SECURITY	-	
4	SC Security accesses image	STADIUM COMMAND	SC SECURITY	DISPATCH IMAGE	Laptop	CommandWear
5	SC Security directs the camera operator to bring up additional images	STADIUM COMMAND	SC SECURITY	CAMERA OPERATOR	-	
6	The camera operator brings up Location #1 on the monitor	STADIUM COMMAND	CAMERA OPERATOR		Mosaic Security	Genetec
7	SC Security reviews the footage and informs Security #1 to establish the perimeter	STADIUM COMMAND	SC SECURITY	SECURITY #1	BRIC Smartphone #4	Etherstack (PTT)
8	SC Security updates SC Police about the suspicious package	STADIUM COMMAND	SC SECURITY	SC POLICE	-	
9	SC Police directs RPS Patrol #1 to go to the location of the package, and RPS Patrol #2 to confirm that the perimeter has been established.	STADIUM COMMAND	SC POLICE	RPS PATROL #1	BRIC Smartphone#4	Etherstack (PTT)
10	SC Police directs camera operator to send image of package to DISPATCH IMAGE	STADIUM COMMAND	SC POLICE	CAMERA OPERATOR	-	

#	Description	Location	Actor	Receiving Actors	Device	Application
11	The camera operator sends an image of the package to the DISPATCH IMAGE in the command centre	STADIUM COMMAND	CAMERA OPERATOR	DISPATCH IMAGE	Mosaic Security	Evidence.com / Email
12	DISPATCH IMAGE receives the image of the package and sends the image to the patrol officers	STADIUM COMMAND	DISPATCH IMAGE	RPS PATROL #1 & 2	BRIC Smartphone #1 & #5	Received with Evidence.com or email, sent to RPS with Command Ware
13	RPS Patrol receives the image on their smartphone	LOCATION #1	RPS PATROL #1	-	BRIC Smartphone #1 & #5	CommandWear
14	RPS Patrol #1 sends additional images of the package with description	LOCATION #1	RPS PATROL #1	DISPATCH IMAGE	BRIC Smartphone #1	CommandWear
15	DISPATCH IMAGE notifies SC Police there are additional images	STADIUM COMMAND	CAMERA OPERATOR	SC POLICE	Laptop	View on CommandWear
16	SC Police directs the camera operator to review Security footage to determine when the package was left.	STADIUM COMMAND	SC POLICE	CAMERA OPERATOR	-	
17	The camera operator reviews the Security footage and obtains a clear image of the person who left the bag.	STADIUM COMMAND	CAMERA OPERATOR		Mosaic Security	Genetec
18	SC police directs the camera operator to distribute the image to DISPATCH IMAGE for RPS Patrol and Security #1	STADIUM COMMAND	SC POLICE	CAMERA OPERATOR	-	
19	The camera operator sends zoomed in image of suspect to DISPATCH IMAGE	STADIUM COMMAND	CAMERA OPERATOR	DISPATCH IMAGE	-	Evidence.com or email

#	Description	Location	Actor	Receiving Actors	Device	Application
20	DISPATCH IMAGE distributes the image of the person of interest to RPS Patrol #1 and #2	STADIUM COMMAND	DISPATCH IMAGE	RPS PATROL #1 & #2 & Security #1	Laptop	Sent with CommandWear
21	RPS Patrol #1 and #2 and Security #1 review the image on their smartphones	LOCATION #1	RPS Patrol #1 & #2 SECURITY #1		BRIC Smartphone #1 & #5 & #7	CommandWear
22	Security #1 ID's individual as employee					
23	Security #1 informs RPS Patrol #2, who updates SC Police	LOCATION #1	RPS PATROL #2	SC POLICE	BRIC Smartphone #5	Etherstack (PTT)
24	SC Police directs RPS Patrol #2 to locate the person for information.	STADIUM COMMAND	SC POLICE	RPS PATROL #2		Etherstack (PTT)
25	RPS #2 and Security #2 locate the employee who indicates he forgot his bag. RPS #2 updates SC Command	LOCATION #1	RPS PATROL #2	SC POLICE	BRIC Smartphone	Etherstack (PTT)
26	SC Police concludes the package is not a threat.	STADIUM COMMAND	SC POLICE		BRIC Smartphone	Etherstack (PTT)

A.2 ITERATION #2

#	Description	Location	Actor	Receiving Actors	Device	Application
1	Security discovers suspicious package and informs command.	LOCATION #1	SECURITY #1	DISPATCH VOICE	BRIC Smartphone #7	Etherstack (PTT)
2	Security takes image of package and sends to command.	LOCATION #1	SECURITY #1	DISPATCH VOICE	BRIC Smartphone #7	CommandWear
3	Dispatch Voice informs SC Security of the uploaded image	STADIUM COMMAND	DISPATCH VOICE	SC SECURITY	-	
4	SC Security accesses image	STADIUM COMMAND	SC SECURITY	DISPATCH IMAGE	Laptop	CommandWear
5	SC Security directs the camera operator to bring up additional images	STADIUM COMMAND	SC SECURITY	CAMERA OPERATOR	-	
6	The camera operator brings up Location #1 on the monitor	STADIUM COMMAND	CAMERA OPERATOR		Mosaic Security	Genetec
7	SC Security reviews the footage and informs Security #1 to establish the perimeter	STADIUM COMMAND	SC SECURITY	SECURITY #1	BRIC Smartphone #4	Etherstack (PTT)
8	SC Security updates SC Police about the suspicious package	STADIUM COMMAND	SC SECURITY	SC POLICE	-	
9	SC Police directs RPS Patrol #1 to go to the location of the package, and RPS Patrol #2 to confirm that the perimeter has been established.	STADIUM COMMAND	SC POLICE	RPS PATROL #1	BRIC Smartphone#4	Etherstack (PTT)
10	SC Police directs camera operator to send image of package to DISPATCH IMAGE	STADIUM COMMAND	SC POLICE	CAMERA OPERATOR	-	
11	The camera operator sends an image of the package to the DISPATCH IMAGE in the command centre	STADIUM COMMAND	CAMERA OPERATOR	DISPATCH IMAGE	Mosaic Security	Evidence.com / email

#	Description	Location	Actor	Receiving Actors	Device	Application
12	DISPATCH IMAGE receives the image of the package and sends the image to the patrol officers	STADIUM COMMAND	DISPATCH IMAGE	RPS PATROL #1 & 2	BRIC Smartphone #1 & #5	Received with Evidence.com or email, sent to RPS with Command Ware
13	RPS Patrol receives the image on their smartphone	LOCATION #1	RPS PATROL #1	-	BRIC Smartphone #1 & #5	CommandWear
14	RPS Patrol #1 sends additional images of the package with description	LOCATION #1	RPS PATROL #1	DISPATCH IMAGE	BRIC Smartphone #1	CommandWear
15	DISPATCH IMAGE notifies SC Police there are additional images	STADIUM COMMAND	CAMERA OPERATOR	SC POLICE	Laptop	View on CommandWear
16	SC Police directs the camera operator to review Security footage to determine when the package was left.	STADIUM COMMAND	SC POLICE	CAMERA OPERATOR	-	
17	The camera operator reviews the Security footage and obtains a clear image of the person who left the bag.	STADIUM COMMAND	CAMERA OPERATOR		Mosaic Security	Genetec
18	SC police directs the camera operator to distribute the image to DISPATCH IMAGE for RPS Patrol and Security #1	STADIUM COMMAND	SC POLICE	CAMERA OPERATOR	-	
19	The camera operator sends zoomed in image of suspect to DISPATCH IMAGE	STADIUM COMMAND	CAMERA OPERATOR	DISPATCH IMAGE	-	Evidence.com or email
20	DISPATCH IMAGE distributes the image of the person of interest to RPS Patrol #1 and #2	STADIUM COMMAND	DISPATCH IMAGE	RPS PATROL #1 & #2 & Security #1	Laptop	Sent with CommandWear
21	RPS Patrol #1 and #2 and Security #1 review the image on their smartphones	LOCATION #1	RPS Patrol #1 & #2 SECURITY #1		BRIC Smartphone #1 & #5 & #7	CommandWear

#	Description	Location	Actor	Receiving Actors	Device	Application
22	RPS Patrol recognizes the individual as the subject of an intelligence report describing violent and unstable behaviour and an interest explosive materials.	LOCATION #1	RPS Patrol #1 & #2		BRIC Smartphone #1 & #5	CommandWear
23	RPS # 2 updates SC Police about the suspect's ID	LOCATION #1	RPS PATROL #2	SC POLICE	BRIC Smartphone #5	Etherstack (PTT)
23.5	Suspect walks concourse, enters washroom	Location #2				
24	The camera operator informs SC Police they have located the suspect and observed him walk into a washroom at Location #2.	STADIUM COMMAND	CAMERA OPERATOR	SC POLICE	-	
25	SC Police Directs RPS Patrol #2 to Location #2 to locate the suspect	STADIUM COMMAND	SC POLICE	RPS PATROL #2	BRIC Smartphone #4	Etherstack (PTT)
26	RPS #2 turns on body worn camera. When RPS #2 arrives at location #2 the suspect is coming out of the washroom and while resisting arrest is overcome by a delirium medical event.	LOCATION #2	RPS PATROL #2	DISPATCH IMAGE	Zepcam #1	Genetec
27	RPS #2 informs dispatch of the event	LOCATION #2	RPS PATROL #2	DISPATCH IMAGE	BRIC Smartphone #5	Etherstack (PTT)
28	DISPATCH IMAGE informs SC EMS of the event	STADIUM COMMAND	DISPATCH IMAGE	SC EMS	-	
29	SC EMS updates EMS #1 & #2, who are already on scene for the event, and directs them to Location #2	STADIUM COMMAND	SC EMS	EMS #1 & #2	BRIC Smartphone #6	Etherstack (PTT)
30	SC EMS Directs SC Police to request images. SC Police directs RPS #2 to provide images	STADIUM COMMAND	SC POLICE	RPS PATROL #2	BRIC Smartphone #6	Etherstack (PTT)

#	Description	Location	Actor	Receiving Actors	Device	Application
31	RPS #2 indicates that the body worn camera is recording. CAMERA OPERATOR receives feed.	LOCATION #2	RPS PATROL #2	CAMERA OPERATOR	Zepcam	Genetec
32	CAMERA OPERATOR sends video to DISPATCH IMAGE	STADIUM COMMAND	CAMERA OPERATOR	DISPATCH IMAGE	Laptop	Evidence.com or email
33	DISPATCH IMAGE receives the image from SC Camera and provides to SC EMS	STADIUM COMMAND	DISPATCH IMAGE	EMS #1	Laptop	CommandWear
34	SC EMS receives the image.	STADIUM COMMAND	EMS #1		BRIC Smartphone #4	CommandWear
35	SC EMS provides treatment advice to RPS #2.	STADIUM COMMAND	EMS #1	RPS#2	BRIC Smartphone #4	Etherstack (PTT)
36	SC EMS recognizes immediate need to transport Suspect to hospital and contact his EMS Dispatch to request a Medic Unit for transport.				Notional	
37	EMS #1 & #2 arrive on scene and attend to Suspect while recording their actions on ZepCam. EMS notifies SC EMS they have arrived.	LOCATION #2	EMS #1	SC EMS	BRIC Smartphone #6, Zepcam #2	Etherstack (PTT)
38	CAMERA OPERATOR can view EMS bodyworn camera feed	STADIUM COMMAND	CAMERA OPERATOR		Zepcam	Genetec
39	A Medic Unit from the city arrives at Location #2 and transports Suspect to hospital, accompanied by RPS #2					
40	SCENARIO BREAK RPS SWITCH TO EDU ROLES; Give bodyworn camera from EMS to RFPS					
41	SC Police evaluates the risk and contacts the explosives disposal unit for assistance	STADIUM COMMAND	SC POLICE	RPS EDU #1	Telephone	Voice Call

#	Description	Location	Actor	Receiving Actors	Device	Application
42	SC police directs DISPATCH IMAGE to distribute images to EDU #1	STADIUM COMMAND	SC POLICE	DISPATCH IMAGE		
43	DISPATCH IMAGE sends images of the package to EDU #1	STADIUM COMMAND	DISPATCH IMAGE	RPS EDU #1	Laptop	Evidence.com or email
44	EDU reviews the images on their laptop	Staging area	RPS EDU #1		Laptop	
45	After a voice conversation, SC Police requests deployment of EDU to assist with neutralizing the package.	STADIUM COMMAND	SC POLICE		Telephone	
46	SC Fire requests deployment of RFPS Pump and Command Truck	STADIUM COMMAND	SC FIRE		Mobile Radio	
47	SC Police works with SC Fire and SC EMS and DISPATCH IMAGE to indicate safe stagging locations outside the blast zone for the units. DISPATCH IMAGE sends out the annotated maps to Fire and EMS.	STADIUM COMMAND	DISPATCH IMAGE	EMS #1, RFPS COMMAND	Laptop	CommandWear
48	RFPS Command Truck & RFPS Pump and EMS Medic Unit arrive on scene, inform SC Fire and SC EMS and remains in staging area	Staging area	RFPS Command Truck		BRIC Smartphones	Etherstack (PTT)
49	RFPS Command Truck accesses stadium security feed from FIRE for oversight viewing by Fire and EMS personnel. This continues to the end of the scenario.	Location #1		RFPS Command & Pump and EMS #1 & #2	Laptop & BRIC USB Net#1	Genetec mobile
50	RPS EDU arrives on scene and establishes command post near package	LOCATION #1	RPS EDU #1 & #2, RPS EDU Truck			
51	RPS EDU #1 confirms the perimeter is established and the area is clear of civilians.	LOCATION #1	RPS EDU #1	SC POLICE	BRIC Smartphone #2	Etherstack (PTT)

#	Description	Location	Actor	Receiving Actors	Device	Application
52	RPS EDU #2 turns on the bodyworn camera and transmits to Stadium Command and fire while he deploys XRAY to examine package.	LOCATION #1	RPS EDU #2	CAMERA OPERATOR, RFPS COMMAND	Zepcam #1	Genetec
53	RPS EDU #1 takes XRAY image and returns to EDU Truck.					
54	RPS EDU #1 uploads image on laptop from SD Card. He reviews XRAY images and distribute to remote expert for analysis	LOCATION #1	EDU #1	EDU #3	Laptop, Wi-Fi or BRIC USB Net #2, Telephone	Evidence.com or eMail
55	RPS EDU #1 & #2 with SC Police contact remote expert to discuss images.	LOCATION #1	EDU #1 & #2	EDU #3, SC POLICE	BRIC Smartphones	Etherstack (PTT)
56	RPS EDU #1 group arrives at the decision to deploy the EDU Robot.	LOCATION #1	EDU #1 & #2 SC Police	-		
57	RPS EDU #1 & #2 deploy EDU Robot	LOCATION #1	EDU #1 & #2		EDU Robot	
58	Robot video is transmitted from the robot controller	-	-	-	Robot controller interface with Wi-Fi?	Genetec
59	Robot moves package to safe location for appropriate action.	LOCATION #1 - LOCATION #3	-	-		
60	EDU indicates threat is neutralized	LOCATION #1	EDU #1	ALL TALK GROUPS	BRIC Smartphone	Etherstack (PTT)

A.3 ITERATION #3

#	Description	Location	Actor	Receiving Actors	Device	Application
1	A sprinkler malfunctions causing a drop in pressure of the fire suppression system.	LOCATION #4				
2	The sprinklers trigger an alarm at the Locke Shop alarm monitoring station. Locke Shop verifies it is a real alarm with SC COMMAND and contacts RFPS dispatch.	Security Room near South West loading Dock	Simulated Locke Shop,	SC Command	Telephone	
3	SC Command contacts Security #2 and asks him to meet an RFPS Pump Crew at Gate #3, near the Enunciator Room	Gate 3 at the North East corner of the Stadium	SC Command	Security #2	BRIC Smartphone #4	Etherstack (PTT)
5	RFPS dispatches RFPS Pump #1, manned by a four man RFPS Pump Crew on a Code Red 2 response to Gate 3 at the Stadium to meet Security #2.	Gate 3 at the North East corner of the Stadium	RFPS DISPATCH	RFPS Pump # 1, RFPS Pump Crew #1,2,3,4	BRIC Smartphone #4	Etherstack (PTT)
6	RFPS dispatch notifies SC Fire and RFPS Command Truck, which are already at the Stadium, of the response.	-	RFPS DISPATCH	SC FIRE, RFPS Command Truck	BRIC Smartphone #4	Etherstack (PTT)
7	RFPS Pump #1 responds to Gate 3 where RFPS Pump Crew meets Security #2. They enter the adjacent Enunciator Panel Room where both examine the alarm Enunciator Panel to confirm location and alarm type.	Gate 3 at the North East corner of the Stadium	RFPS PUMP #1 and Crew	SECURITY #2	-	

#	Description	Location	Actor	Receiving Actors	Device	Application
8	RFPS Pump Crew and Security #2 identify a sprinkler in LOCATION #4 as the cause of the alarm. They note that the Sprinkler Controller is located in the north end of the Harvard Lounge on the west side of the Stadium (LOCATION #5)	Enunciator Room adjacent to Gate 3.	RFPS Pump Crew, SECURITY #2		-	
9	RFPS Pump Crew #1 informs RFPS Command Truck and SC Fire of the location of the sprinkler.	Enunciator Room adjacent to Gate 3.	RFPS Pump Crew #1	RFPS Command Truck, SC Fire	Fire Radio	
10	Security #2 accompanies RFPS Pump Crew to a flowing sprinkler head in an interior stairwell across from some elevators and just inside an exterior man door near the North West corner of the stadium.	LOCATION #4	SECURITY #2, RFPS PUMP Crew			
11	The sprinkler is on a very high ceiling above descending stairs and it not immediately accessible. RFPS inform RFPS Command Truck and SC Fire there is no a safe method to plug the flowing head and they are seeking the Sprinkler Control Room.	LOCATION #4	SECURITY #2, RFPS PUMP Crew			
12	RFPS Pump Crew #1 creates and uploads images of the flowing sprinkler to COMMAND TRUCK	LOCATION #5	RFPS PUMP #1	COMMAND TRUCK	BRIC Smartphone #3	CommandWear
13	RFPS Pump Crew #1 communicates to RFPS Command Truck and SC FIRE that they will attend to LOCATION #5 to attempt to turn the sprinkler off.	LOCATION #4	RFPS PUMP Crew #1	RFPS Command Truck, SC Fire	BRIC Smartphone #3	Etherstack (PTT)

#	Description	Location	Actor	Receiving Actors	Device	Application
14	Security #2 and RFPS Pump Crew attend to LOCATION #5 and observe the sprinkler risers, gauges and related assemblies (Sprinkler Controller). They conclude they will need advice on how to turn off the sprinkler with minimum adverse effect on the rest of the fire suppression system.	LOCATION #5	SECURITY #2, RFPS PUMP Crew			
15	RFPS Pump Crew #1 turns on bodyworn camera and sends images of the Sprinkler Controller to COMMAND TRUCK	LOCATION #5	RFPS PUMP Crew #1	COMMAND TRUCK	BRIC Smartphone #3, ZepCam #1	Genetec
16	RFPS Pump Crew #1 requests RFPS Command Truck contact sprinkler vendor for advice.	SPRINKLER CONTROL ROOM	RFPS PUMP #1	RFPS Command Truck	BRIC Smartphone #3	Etherstack (PTT)
17	RFPS Command Truck receives and reviews the images.	COMMAND TRUCK	COMMAND TRUCK		Laptop & BRIC USB Net#1	CommandWear
18	RFPS Command Truck calls SPRINKLER VENDOR, describes the situation and asks for voice and data contact information.	COMMAND TRUCK	COMMAND TRUCK		Telephone	Evidence.com
19	RFPS Command Truck provides Sprinkler Controller images to SPRINKLER VENDOR.	COMMAND TRUCK	COMMAND TRUCK	VENDOR	Laptop	Evidence.com or eMail
20	RFPS Command Truck provides RFPS Pump Crew #1 with voice contact information for SPRINKLER VENDOR.	COMMAND TRUCK	COMMAND TRUCK	RFPS PUMP #1	BRIC Smartphone #3	Etherstack (PTT)
21	RFPS Pump Crew #1 contacts SPRINKLER VENDOR via mobile phone and receives advice on how to turn off sprinkler with minimum disruption to the rest of the fire suppression system.				Telephone	

#	Description	Location	Actor	Receiving Actors	Device	Application
22	RFPS takes appropriate action to stop the sprinkler flow. (Notional)	SPRINKLER CONTROL ROOM	RFPS PUMP #1		Zepcam	Genetec
23	RFPS Pump Crew #1receives confirmation they have performed the correct procedure.	COMMAND TRUCK			Telephone	
24	Security #2, still at LOCATION #5, experiences a medical event and becomes unconscious.	SPRINKLER CONTROL ROOM			-	
25	RFPS notifies SC Fire of the event, requests EMS while RFPS Pump Crew #2,3,4 begin to administer appropriate medical care.	SPRINKLER CONTROL ROOM	RFPS PUMP #1	SC FIRE	BRIC Smartphone #3	Etherstack (PTT)
26	SC Fire relays to SC EMS who directs EMS #1 & #2 at Stadium to LOCATION #5.	STADIUM COMMAND	SC EMS	EMS #1	BRIC Smartphone #4	Etherstack (PTT)
27	COMMAND Sends video from RFPS #1 BWC to DISPATCH IMAGE	SPRINKLER CONTROL ROOM	RFPS PUMP #1	DISPATCH IMAGE	Laptop	Evidence.com or eMail
28	DISPATCH IMAGE updates SC EMS that video has arrived	STADIUM COMMAND	DISPATCH IMAGE			
29	SC EMS reviews the image.				Laptop	
30	SC EMS provides treatment advice to RFPS Pump Crew.		SC EMS	RFPS PUMP Crew #1	BRIC Smartphone	Etherstack (PTT)
31	SC EMS recognizes immediate need to transport Security #2 to hospital and contact his EMS Dispatch to request a Medic Unit for transport.				Mobile Radio	
32	EMS #1 & #2 arrive on scene and attend to Security #2 while recording their actions on ZepCam. EMS notifies SC EMS they have arrived.	SPRINKLER CONTROL ROOM	EMS #1	SC EMS	BRIC Smartphone #4, Zepcam #2	Etherstack (PTT)

#	Description	Location	Actor	Receiving Actors	Device	Application
33	A Medic Unit from the city arrives at Location #2 and transports Security #2 to hospital.	LOCATION #4				

ANNEX B. FOCUS GROUP QUESTIONS

1. In what way did the technology most effectively serve the response operations within your organization?

2. In what capacity do you see the technology being the most effective in overall response operations between all organizations (even if not tested today)?
    a. If the above capacities are not aligned, is additional testing required to fully understand the technologies capability?

3. From a responder point of view, what are the next steps required for the implementation of this technology within the normal response operations of your organization?
    a. Were there any barriers or challenges you saw from today's experiment or foresee in the future for the daily use of the technology within response operations (Policy, current SOPs etc.)?
    b. What changes or modifications to the technology will need to be made before it can be widely used effectively in the response operations of your organization?

4. What other opportunities to interact either among your organization or between allied agencies would be beneficial either with this, or other similar technologies?
    a. Do you think the technology would be as readily embraced amongst other organizations or allied agencies?
        i. Why or why not?

5. What unique aspects of your organization would benefit most from this technology (HAZMAT, explosives unit, CBRNE etc.)?

6. How can this technology be modified to maximize its benefit across all response operations?

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