

# Advanced ICT for future Emergency Response

The recent joint response exercise in Croxteth, Liverpool, stands as a wonderful example of how emergency services can work together well when responding to a Major Incident.

In this article, we take a look at how advanced ICT and innovative and inclusive approaches might help our emergency services respond more effectively to Major Incidents in the future and how such innovation can assist services in embedding the Joint Emergency Services Interoperability Programme (JESIP) doctrine across all blue light services.

As ICT widens opportunity for visually impaired (VI) pupils, we reflect on how future thinking can engage their strengths in challenging the 85% VI unemployment rate.

Efficient communication and coordination are amongst the major challenges experienced by coordinators during first response to a Major Incident, whether it is a natural disaster, a major transportation accident or a deliberate act of war, sabotage or terrorism. Incidents can span national borders, and may exceed the response capability of one country, requiring international cooperation. Teams from different agencies are typically

involved; five weeks after the Asian Earthquake and Tsunami of 2004, for example, over 80 agencies had registered with WHO as providing healthcare services in Sumatra.

In future, emergency services personnel and vehicles may be equipped with Body Area Networks (BANs) and Vehicular Networks. The emergency services vehicles would have Vehicular Networks which communicate with the BANs of the emergency services personnel on the ground and with incident commanders and control centres.

A BAN is a body worn network of devices such as sensors, cameras and microphones which gather information and communicate wirelessly with other networks via a mobile device such as a smartphone. The BAN includes wearable microelectronics incorporated into the uniforms of the emergency services personnel to support wellbeing monitoring and positioning as well as providing audio and video communications with control centres.

Different specialist BANs would be used in a Major Incident. A BAN for police officers would enable hands free audio and video communication between the officer, police

vehicles and incident control centres. It would also track location of the officer and incorporate sensors such as stress sensors and drop sensors to indicate when an officer is in difficulty. Fire fighter BANs would have similar functionality and also include environmental sensors to measure, for example, external temperature and gases such as carbon monoxide and carbon dioxide.

Paramedics would fit each casualty with a trauma patient BAN which would measure vital signs and transmit them to the ambulance and the receiving hospital. Each paramedic would wear a paramedic BAN which enables audio and video communication with the ambulance, ambulance control the A&E Department and can assist in triage by linking a casualty's BAN data to their EMR or emergency dataset. Paramedic BANs would also enable telepresence and an augmented reality experience of the scene for hospital staff.

Indoor positioning and tracking is an area of current research which has the potential to increase safety of first responders as well as increasing the effectiveness of the operation. When this technology is mature future BANs should support indoor as well as outdoor tracking of personnel.



Problems are compounded if communications systems are disrupted through destruction of infrastructure or by a surge in traffic following a major incident. This means that the scene of the incident may become a communications "black hole". A tenfold increase in cell phone traffic in Sichuan province following the 2008 earthquake caused congestion in three switching stations and more than 2,300 cell phone base stations failed due to power failure or congestion. Reuters reported that infrastructure and services including power and cellular networks were still unavailable in many areas of Japan 11 days after the 2011 earthquake. Disasters can happen anywhere and at any time, so the ability to create an emergency communications network at the scene would assist with communication and coordination for first responders as they do a very challenging job under difficult circumstances.

We envisage that in future the emergency services' BANs and Vehicular Networks could link together to create an ad hoc emergency communications network at the scene. The BANs and Vehicular Networks comprise nodes that connect to form mobile ad hoc networks (MANETS) to support intra- and inter-service communications. Such networks may provide the only communication possibility for the emergency services by providing islands of communication whereby professionals at the scene can

communicate. Ad-hoc networks, unlike infrastructure networks, are a collection of nodes that form a self-organizing network without any support from an infrastructure network. Further, these ad hoc networks should be able to discover and communicate with any surviving telecommunication infrastructure, thereby connecting over damaged infrastructure networks with disaster and emergency services' coordination centres.

This future vision benefits from feedback from paramedics of the Dutch Ambulance Service, trauma surgeons at Medisch Spectrum Twente (a regional trauma centre in the Netherlands which was involved in the Enschede fireworks disaster of 2000), from the Watch Manager and members of Green Watch at Durham Fire Station, County Durham & Darlington Fire and Rescue Service, and by senior ICT staff at Cleveland Fire Brigade.

The intention is that the technologies described in this future vision would help to increase safety, effectiveness and efficiency in first response. Furthermore, it is the aim of St Vincent's Education and Enterprise village to pilot future thinking ideas alongside our pupils as we simultaneously work with Police Cadets and Fire Cadets in project-based learning initiatives. Track us as we work together @ StVincentsL12

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Dr John Patterson is Principal at St Vincent's where the Education and Enterprise village is best summed up as developing VI pupil strengths via research informed, collaboratively driven, outcome focused and project-based reverse inclusion. He is currently working with Inspector Sue Stribling in connecting the village concept via the 'L24' project:  
[www.helpingliverpooltosee.co.uk](http://www.helpingliverpooltosee.co.uk)

Photographs show Emergency Services working together at the Joint Endeavour exercise in Liverpool.

The exercise was the culmination of the Joint Emergency Services Interoperability Programme (JESIP).

Photographs courtesy of Tony Thomas.

