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Transforming UK emergency services

Ian Thompson Bursary winner Tom Morgan draws on his knowledge as an ex-firearms officer to give an overview of the vital role emerging technology will inevitably play in public safety operations going forward

Effective multi-agency emergency response hinges on swift, seamless communication between central command and first-responders. This is a critical factor that determines response times, resource allocation and, ultimately, public safety outcomes.

Having served as an operational firearms officer in a busy metropolitan police force, I have witnessed first-hand how timely and accurate information can mean the difference between order and chaos in high-stakes critical incidents. This experience drives my passion for exploring innovative solutions to enhance emergency response systems across diverse operational contexts.

In this analysis, I investigate the transformative potential of cutting-edge technologies such as artificial intelligence, the Internet of Things (IoT) and Geographic Information Systems (GIS). These tools have the power to improve situational awareness, resource deployment and decision-making during crises.

Drawing from case studies, I highlight both successes and challenges in applying these technologies, offering actionable recommendations for investments, policy shifts and inter-agency collaborations.

From AI-enabled threat prediction to IoT-powered responder health monitoring and GIS-driven dynamic mapping, the possibilities are vast. However, implementation requires overcoming hurdles such as data security, interoperability and training.

By embracing innovation and fostering collaboration, we can reimagine emergency response to address evolving global complexities and safeguard communities more effectively.

Real-time information

Real-time information empowers first-responders to enhance situational awareness by providing a clear understanding of unfolding incidents, thus prioritising actions effectively. This improved situational awareness – coupled with interoperable systems that ensure seamless communication between agencies – fosters better co-ordination and collaboration.

Accurate, real-time data also optimises resource allocation by ensuring resources are deployed where most needed, ultimately reducing risk and improving responder safety by minimising exposure to hazards.

However, achieving these benefits requires robust systems and emerging technologies to overcome challenges such as data overload, connectivity issues and technological fragmentation.

Crucially, effective utilisation of these systems and technologies necessitates comprehensive training for all personnel within the organisation.

Existing key systems
Integrated command and control systems
The Incident Command System (ICS) provides a standardised approach to emergency management. It ensures a clear hierarchy and consistent communication protocols across all emergency response organisations. For example, during Hurricane Katrina, ICS facilitated a co-ordinated response among federal, state and local agencies, enabling first-responders to operate efficiently despite the scale of the disaster.

In the UK, the Joint Emergency Services Interoperability Principles (JESIP) framework emphasises collaboration between police, fire and ambulance services. Tools like Multi-Agency Information Transfer (MAIT) integrate JESIP principles into digital platforms. This allows control rooms to share accurate information quickly, ensuring that responders have access to consistent and actionable information.

Advanced data-sharing platforms
Platforms like Canada's Integrated Public Alert and Warning System (IPAWS) and the UK's MAIT system centralise data from multiple agencies. These systems provide:
- Real-time alerts. Critical updates are sent directly to responders' devices
- Secure communication. Encrypted channels protect sensitive information
- Standardised data sharing. Uniform formats ensure consistency across organisations.

Emerging technologies
Artificial intelligence
AI enables predictive analytics, automated decision-making and real-time data processing. Applications include:
- Incident forecasting. AI models predict the progression of incidents, such as wildfires or floods

- Resource optimisation. AI algorithms recommend optimal resource allocation based on incident data
- Situational awareness. AI-powered dashboards provide real-time updates and actionable insights.

AI is the future, something which was clearly demonstrated to me when I attended NENA Florida in July 2024 as part of the British APCO Ian Thompson Bursary programme. Every organisation exhibiting at NENA had some AI technology they were demonstrating at the event.

Also, the large number of interactive sessions and tech talks were also heavily AI-focused. This demonstrated the industry's investment in the technology, and its willingness to embrace artificial intelligence to improve multi-agency responses to incidents.

An example of AI's use in the field came during the 2020 wildfires in California. AI-driven tools like IBM's Watson AI analysed satellite imagery and weather data to predict fire spread patterns. First-responders used these insights to prioritise evacuation efforts and deploy firefighting resources more effectively.

Historically, accurate prediction of incident progression, such as wildfire spread or flood patterns, presented significant challenges. Traditional methods relied heavily on human expertise, requiring analysts to interpret complex datasets encompassing numerous variables and often unpredictable factors.

While experienced personnel frequently demonstrated skill in forecasting, this process was inherently time-consuming and labour-intensive. The analysis itself involved meticulous examination of historical data, current conditions and predictive modelling, often relying on subjective interpretations and estimations.

This manual approach was particularly problematic during time-critical emergencies where rapid decision-making was paramount. The delay inherent in the process could lead to suboptimal resource allocation, slower response times and, ultimately, increased risks to both responders and the public.

"The advent of AI-powered predictive analytics offers a transformative solution"

The advent of AI-powered predictive analytics offers a transformative solution, enabling faster, more accurate and data-driven forecasting based on complex algorithms capable of processing vast datasets far exceeding human capabilities.

This allows for more efficient resource allocation and more informed strategic decisions, mitigating the time constraints that often hampered traditional methods.

The Internet of Things
IoT devices, such as sensors and wearable technology, provide real-time environmental data to responders. Applications include:
- Environmental monitoring. Sensors detect hazardous conditions, such as gas leaks or temperature changes
- Responder safety. Wearable devices track vital signs and location, ensuring responder safety
- Incident management. IoT-enabled drones provide aerial views of affected areas.

An example of the use of IoT is the Smart City pilot in Singapore. Emergency services deployed IoT sensors across the city to monitor ➥

air quality and detect fires. During a high-rise building fire, these sensors provided real-time data to firefighters, enabling them to locate and extinguish the fire quickly.

Geographic Information Systems

GIS technology offers real-time mapping and visualisation tools that enhance situational awareness. Applications include:

- Incident mapping. GIS maps show affected areas, resource locations and responder movements
- Resource allocation. Real-time tracking ensures resources are deployed efficiently
- Flood prediction. GIS models simulate flood scenarios to aid in evacuation planning.

During the 2011 Queensland floods, GIS tools helped emergency services map flood-prone areas and co-ordinate evacuation efforts. First-responders accessed these maps via mobile devices, enabling real-time decision-making.

Drones and robotics

Drones and robotics provide valuable support in search and rescue operations, hazardous environments and disaster assessment. This technology is one that has grown exponentially in the UK over recent years.

Many police forces have dedicated drone teams with specialist officers trained in their use. In the US, drones are able to deliver vital equipment such as defibrillators to members of the public on-scene ahead of first-responders attending.

Applications include:

- Search and rescue. Drones equipped with thermal imaging locate individuals in challenging terrain
- Disaster assessment. Aerial drones assess damage and identify hazards in real time
- Hazardous environments. Robots perform tasks in areas too dangerous for humans, such as chemical spills.

The use of drones has helped to safely police large public order events such as football matches, civil unrest and protest marches, as well as providing a tactical option during firearms and missing persons incidents. Drones and robotics are an excellent example of emergency services embracing new technology and organisations' willingness to train dedicated users in their use for the benefit of public safety.

Following the 2015 Nepal earthquake, drones were deployed to map affected areas and identify survivors trapped in rubble. These

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aerial assessments allowed first-responders to focus their efforts on high-priority locations.

Augmented Reality and Virtual Reality

AR and VR technologies enhance training and operational capabilities. Applications:

- Training simulations. VR scenarios prepare responders for real-world incidents
- On-site guidance. AR devices overlay critical information, such as building layouts, onto responders' field of view
- Remote collaboration. AR enables experts to provide guidance remotely, improving decision-making.

The London Fire Brigade uses VR simulations to train firefighters in realistic scenarios, such as high-rise building fires. This immersive training improves readiness and decision-making in complex situations.

My attendance at BAPCO last year provided first-hand experience of this transformative technology. The capacity to simulate real-world scenarios within a controlled and safe environment represents a significant advancement in first-responder training.

This immersive approach allows for realistic practice without the inherent risks associated with real emergencies, fostering improved decision-making skills and enhanced situational awareness under pressure. The potential applications extend across all emergency services, providing a valuable tool to improve responder safety while simultaneously enhancing their preparedness for a wide range of incidents.

This technology offers a crucial opportunity to standardise and elevate training practices, ensuring that all personnel are equipped to respond effectively and safely to the complex and often dangerous situations they may encounter. The benefits extend beyond improved individual skills to a more efficient and safer overall emergency response system.

Emerging technologies on the frontline

Ensuring that emerging technologies effectively reach first-responders involves integrating them into operational workflows and providing robust training.

- Centralised command hubs. Command centres process data from AI, IoT and GIS systems and disseminate actionable insights to field personnel.
- Mobile applications and devices. Mobile apps provide responders with real-time access to

The JESIP principles emphasise collaboration between emergency services

incident maps, alerts and resource locations.

- Interoperable communication networks. Dedicated networks like the UK's current critical communications network, Airwave – as well as its successor, the Emergency Services Network – ensure seamless connectivity, even in challenging environments.
- Training and simulation. Training programs familiarise responders with new tools and technologies, ensuring they can be used effectively during emergencies.

Implementation challenges

The successful integration of emerging technologies into emergency response faces significant hurdles.

Firstly, technological fragmentation severely hampers interoperability. Incompatible systems prevent seamless data sharing between agencies, creating information silos and hindering co-ordinated responses.

This lack of standardisation leads to delays in critical information dissemination, affecting the timeliness and effectiveness of emergency interventions.

Secondly, reliable connectivity is essential. Yet, network failures frequently disrupt real-time communication, leaving responders without access to crucial data during critical moments.

Thirdly, the sheer volume of data generated by these technologies often results in information overload, overwhelming responders and impairing their ability to make timely and effective decisions.

Finally, the high costs associated with acquiring, implementing, maintaining and upgrading these systems creates a significant barrier to adoption, particularly for organisations with limited resources. This financial constraint disproportionately affects smaller agencies and underserved communities, creating inequalities in access to life-saving technologies.

Addressing these challenges requires a concerted effort towards standardisation, investment in robust infrastructure and development of user-friendly interfaces to ensure equitable access and effective deployment of these vital tools.

Conclusion

To unlock the transformative potential of emerging technologies in emergency response, a strategic and collaborative approach is essential. Seamless interoperability with existing tools must be prioritised through standardised data formats and protocols, enabling efficient integration and real-time collaboration.

Reliable connectivity in remote or disaster-stricken areas can be achieved through satellite-based systems, while user-friendly interfaces will empower responders with rapid access to critical information. Comprehensive training programs tailored to the needs of emergency personnel, along with regular exercises, will build proficiency and ensure effective use of these technologies under pressure.

A shift toward data-driven emergency management is equally critical, requiring investment in infrastructure for efficient data collection, sharing and analysis, all while upholding strict privacy and security standards. Public-private partnerships and collaboration with academic institutions can accelerate innovation, reduce costs and foster equitable access to advanced tools, regardless of agency size or resources.

Ultimately, the future of emergency response lies not only in adopting emerging technologies but in implementing them strategically to enhance workflows, improve decision-making and break down silos between agencies.

By embracing these advancements collectively, emergency responders will be better equipped to save lives and protect communities during critical incidents.