Crisis Response Journal R&D

Ian Portelli and **Megan Mantaro** introduce a new regular section prompted by the popularity of our online Research and Development blogs

From pocket-size drones to better protective suits for Ebola caregivers, remarkable innovations have been made across science and technology. If properly implemented, many of these innovations have the potential to revolutionise the way that disaster preparation and response are managed. The *Crisis Response Journal's* blog discusses such new innovations and how they may be adapted for use in disaster situations. We cover innovations that help responders collect information about disasters, safely reach and treat victims, communicate with those affected or other responders, or complete any other number of tasks.

After a disaster occurs, responders must collect information in order to better co-ordinate their operations. They need to find survivors, determine which areas are safe to enter, and learn about the reach of the disaster. Researchers across the world have developed fascinating innovations to help them complete such tasks.

Drones and robots help responders explore dangerous areas remotely. A robotic snake developed by OC Robotics can explore areas that are inaccessible or too dangerous for first responders; an ape-like robot developed by NASA's Jet Propulsion Laboratory is able to move around on both rough and smooth terrain, is equipped with seven cameras, and can pick

Just three words can determine any location

Four billion people have inconsistent, complicated, or inadequate addresses. Because of this, they may not be able to receive deliveries or aid, and it is much more difficult for the communities in which they live to prepare for emergencies.

Yet, in order to prepare for disasters, communities must understand the risks they face. Risk experts need to collect information from various data sources to identify flood-prone areas, infrastructure, building quality and living conditions, but the collection of this information depends on having accurate location identifiers. Without accurate location information, communities cannot address the risks.

The lack of adequate addressing is also a concern for first responders. Location information is incredibly important in an incident: first responders must use this information to identify victims rapidly and to navigate in changed post-disaster environments. Rescue teams, unfamiliar with the local environment, need directions that do not rely on traditional landmarks and descriptions. Teams also need location information that works even when infrastructure is disrupted owing to power outages or loss of connectivity.

It is therefore evident that communities and first responders need an adequate location referencing system. This system should be unambiguous, easy to use, and fast to implement. It should also have support communication that empowers user groups, and should overcome the shortage of available infrastructure. However, most location referencing systems used today do not meet all these requirements.

First responders have a few location referencing options. They may use a traditional addressing system, the Global Positioning System (GPS), P-codes, or another alphanumeric code. Each of these systems has benefits and drawbacks. However, one new system, what3words, has come up with a solution that compensates for most of the drawbacks.

Traditional addressing systems, determined by different levels of government or postal authorities in different countries, are attractive because they are memorable and have intuitive number systems. However, addresses are not necessarily determined or maintained by the same organisation. Ambiguity can arise because one street may have multiple names, or because the same street or village names may appear many times throughout the country. Further, addresses may not be assigned to every location and the addresses that have been assigned may not have an accurate latitude/longitude pair attributed to them.

The Global Positioning System (GPS) uses longitude-latitude co-ordinates to give an exact location on the earth's surface, and can serve a purpose for specifically trained groups of responders. However, the co-ordinates are too long, complicated in syntax, and unmemorable to be used in everyday life. Because of this, they can often contain errors when communicated by untrained people and their use in a disaster situation excludes the affected community from easily or effectively participating in location sharing.

P-codes, another location referencing system, are unique geographic identification codes that use combinations of letters and/or numbers to identify a specific location or feature. They are usually a composite of country code, administrative level code, and incremental settlement numbers. Because they are created within specific nations or regions, they cannot be used universally. Further, extensive inter-organisational co-ordination is necessary to keep

up and manipulate objects; a scorpion-like robot developed by Toshiba has cameras and a fully manoeuvrable tail that allows the robot to right itself if it tips over; and a pocket-size drone that weighs no more than 18 grams can provide 25 minutes of live high-definition video with a range of more than 1.5 km.

Other advances allow responders to reach and treat victims of a disaster or other emergency situation safely. An ambulance drone can deliver an automatic external defibrillator and comes equipped with a camera, microphone and speaker, so a remote paramedic can navigate the drone and guide someone at the scene through the process of using the defibrillator. Wireless electronic implants, developed by researchers at Tufts University and the University of Illinois, fight and eliminate infections before dissolving safely.

The XStat rapid haemostasis system is a portable and easily stored system that can seal gunshot wounds in the pelvis or shoulder area in about 15 seconds.

A variety of other innovations will enable better communication in a disaster zone. Two phone cases – Beartooth and SATcase – provide a typical smartphone with the ability to communicate even when the cellular or WiFi network is unavailable, failed, or congested. The SATcase is also equipped with a mix of emergency features, including an SOS button, two-way rescue communications, online track and trace for live monitoring, and silent alarms and infrared strobes for kidnapping victims.

Additionally, Google's Project Loon – which aims to provide a mobile network of balloons around the world – would give responders the ability to deploy a mobile network and promptly supply a disaster-struck region with cell signal.

The devices and projects mentioned above are just a few of the ingenious innovations that are covered on our blog – innovations that help us to predict future crises better, and to obtain more information about disasters as they occur; that help us to save lives and improve quality of care during and after disasters; and that facilitate communication between governments and citizens, responders and victims, and people and their loved ones.

New innovations in science and technology have, and will continue to, influence all aspects of disaster management – from planning to response to recovery – so it is important to be aware of how new technologies might affect the field.

The *Crisis Response Journal*'s R&D blog helps readers stay up to date with interesting and important developments in science and technology as they relate to disaster management and response. C•RJ

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the system functional and to avoid the existence of multiple P-code versions within the same area. Perhaps of most concern to first responders, P-codes are not designed for point referencing to a few metres of accuracy, limiting their use in a disaster.

Other alphanumeric codes are regularly proposed to compensate for the complications and limitations of the location referencing systems mentioned above. However, these are often still too long to be memorable or usable by untrained people and have few demonstrable benefits over GPS coordinates.

What3words has proposed an alternative method. Studies have proven that we can remember words much more easily than a series of numbers and letters, so what3words created a system that refers to locations with sets of three words, which greatly increases the usability and memorability of the addresses.

Its system is based on a global grid of 57 trillion three-metre by three-metre squares. Each of these squares has been pre-assigned a fixed sequence of three words from the dictionary, which means that any location on the planet can be precisely referenced with an accuracy of nine square metres.

What3words can be easily and quickly remembered, spoken, heard, written, read, sent via SMS, emailed, or even sent via Morse code. The system is simple to understand and requires little training, which means that both technical and non-technical people will be able to communicate locations more quickly and easily than with any other system. Additionally, because all 57 trillion three-word addresses are pre-assigned for the entire world, what3words is already ready for deployment and implementation. The what3words app can be easily installed on most phones and tablets and works on various operating systems. It can identify a three-word location offline where there is no data connection, and offers an offline compass mode.

What3words is already being successfully utilised for humanitarian response around the world. It is being used to deliver post in Rio's largest favela and to deliver medicine in a South African township, and it will monitor the distribution of mosquito nets in Tanzania. With these and many other practical applications, what3words presents an innovative alternative to traditional addressing.

■ *www.what3words.com*