

Organised chaos

A UK team is working on a suite of computer-based technologies that is designed to improve the response of the emergency services in disaster zones. **Jon Excell** reports



IN THE IMMEDIATE aftermath of the 9/11 attacks, following the collapse of the World Trade Center's south tower, police helicopters circling its stricken twin made some worrying observations.

But with the communication systems linking the emergency services stretched to breaking point the resulting evacuation warning, issued 21 minutes before the second tower came down, went unheard. And as the structure crashed to the ground, the 120 firefighters still inside — many of whom were seconds from safety — lost their lives.

It is a bleak illustration of the old adage that in the chaos of a disaster zone, information is the first casualty. From the London Tube bombings to Hurricane Katrina, the list of rescue efforts hampered by poor communications is long.

Communication systems became stretched to breaking point after the attacks of 9/11

Now, a UK team of engineers and mathematicians are working on a suite of computer-based technologies that promise to dramatically improve the response of emergency services in these kind of situations.

Jointly funded by BAE Systems and the EPSRC, the £6 million Aladdin (Autonomous Learning Agents for Decentralised Data and Information Networks) programme is a collaboration between BAE and the universities of Southampton, Bristol, Oxford and Imperial College.

The group, which is headed up by Southampton computer scientist Prof Nick Jennings, is currently developing a range of sophisticated algorithms that can assimilate and analyse data from a variety of sources, figure

out the most likely outcomes of particular situations and generally navigate a path through the chaos of an ongoing emergency.

Expected to come to an end in October 2010, the five-year programme is a continuation of an earlier project called Argus (a winner at *The Engineer's* 2007 Technology and Innovation Awards).

The aim of Argus was to enable multiple computer programs or 'agents' to communicate with each other and solve problems involving uncertainty. The partners involved, which included Qinetiq, Rolls-Royce and BAE, were interested in applying these approaches to problems relating to wide-area surveillance, air-traffic control and aircraft engine service-scheduling.

Aladdin, explained Jennings, takes the technology up a level in terms of capability and ambition: 'We were very happy with what came out of the Argus project but wanted to do something on a bigger scale. Aladdin is about 10 times the size.'

There are two key areas of research. The first relates to individual 'agents' that, in the case of disaster-response management, could be a software program or a human assisted by software within a specific area of the emergency services. The group is working on algorithms that enable these agents to bring together information from a variety of sources, analyse this data by, for instance, dealing with contradictions, and then making a prediction.

As if this weren't challenging enough, the other strand of research is focused on the tools that will enable multiple agents to cooperate with each other. 'There are a number of these agents within the system that you want to cooperate and coordinate with,' explained Jennings. 'Some might be controlled by the police, some by the fire brigade, some by the ambulances; they don't all necessarily want to do the same thing or have the same objectives and you often need to bring them together to give a coordinated response.'

What all this would mean in practice, he added, is a more coordinated response to emergencies. 'It could provide much greater support for decision makers in terms of how they can make decisions and allocate and reallocate their resources as things happen. For instance, the 7/7 [London Underground] bombings weren't isolated, there was a planned attack; a particular event happened and then related ones happened. The situation is unfolding, and systems like this would be able to detect such patterns and then make decisions about who's going to go where in terms of police, fire brigade and ambulance.'

It all sounds tremendously ambitious, but with the disaster-response community already reportedly showing an interest in Aladdin, Jennings is confident that the fruits of his group's labours will trickle through to the emergency services sooner rather than later. 'I think the simple end of what we're trying to do — decision support and prediction technologies — are just a couple of years away. I don't think we are that far away from seeing some of the simpler things that we are trying to do.'

He is also optimistic that Aladdin won't go the same way as other grand IT projects such as the NHS's Connecting For Health Program, which is widely seen as disastrous.

Indeed, he believes that communications infrastructure has improved to the extent that it would be relatively straightforward to deploy aspects of Aladdin's technology. 'For a long time the 'blue lights' [different emergency services] couldn't speak to one another because they didn't have compatible communication technology — but that base level of communication has emerged in the last two to five years.'

Making sense of the garbled, often confused and incomplete data you receive from a disaster zone is one thing, but looking further into the future, technology could also play a role in improving the quality and reliability of this data. The Aladdin team is therefore also beginning to look at some of the sensing techniques that could be used to improve situational awareness. 'When you come to an environment as a first responder,' said Jennings, 'you

want to be able to understand what's going on, and temperature readings and audio-visual information from inside a building, for instance, could all feed into your decision making.'

With sensing technology becoming increasingly ubiquitous, Jennings added that the group is particularly interested in exploiting the capabilities of existing sensor networks. 'As you get smarter buildings and more sensors in the environment you want to be able to rapidly reconfigure them to provide additional information.'

These ideas are being put to the test courtesy of a pre-existing sensor network in the Solent that was installed by Associated British Port to provide information for sailors.

Even further into the future, although it is not an active part of the project, Jennings envisages autonomous robotic systems forming a part of this data-gathering process. 'You could imagine robots potentially going into a situation, providing visual information and even guiding people out,' he said.

'You could imagine robots potentially going into a situation providing visual information and guiding people out' Prof Nick Jennings, Aladdin

