

Experience from major emergencies around the world, including the recent bushfires in Australia, reconfirms the need for applying distributed C4I (Command, Control, Communications Computing and Information) technologies for managing large scale fire and multi-agency events. Stephen Prendergast of VectorCommand looks at the development of the Command Support System (CSS), an advanced interoperable, distributed C4I system being developed by his company for the London Fire Brigade and a growing number of UK, Australian, international fire services and emergency agencies.

# Fighting



*The Country Fire Authority of Victoria has 58,000 full time and part-time (mainly part-time) firefighting personnel, 1,000 rural fire stations, 1,200 tanker appliances, 200 pumping appliances, firebombing and fire monitoring aircraft, and light and medium helicopters (Getty Images).*

**M**obilising firefighting resources to deal with major events such as the recent bushfires in Victoria is like mobilising a medium-size army and air force, except that the time frame in which the mobilising must be done can be counted in minutes and hours, not days and weeks, and the speed, number, scale, ferocity and unpredictability of such fires means that trying to keep track of threats and allocating resources can become a command and control nightmare. Only when the 58,000 full and part-time (mainly part-time) firefighting personnel, 1,000 rural fire stations, 1,200 tanker appliances, 200 pumping appliances, firebombing and fire monitoring aircraft, and light and medium helicopters, have been taken into account can the scale and complexity of the challenges facing the state of Victoria's Country Fire Authority be appreciated fully.

But perhaps even more of a challenge, once resources have been mobilised, is how to help commanders of fire teams fighting particular incidents stay up to date on where their teams are on the ground, how fires are developing and the direction in which they are travelling (situational awareness). An additional challenge is helping them decide how they want to deploy their limited resources on the ground and communicating these decisions

(establishing a common operational picture) under conditions of great stress and with potentially poor communications. The opportunities for misunderstandings and mistakes are magnified hugely under such conditions.

According to Dr Mike Griffin, technical director for VectorCommand, wildfire and bushfire operations are challenging with respect to the scale of operations that need to be managed. Although modern IT systems can provide a wide variety of sources, for this to be truly useful information needs to be extracted in a meaningful way to assist command decision making. For example, although it is possible to relay live video images from the incident scene, what is more useful is establishing the precise grid references for the fire front and plotting them on a GIS quickly and accurately, and monitoring the known positions of resources with respect to this. Imagery is useful for damage assessments (particularly with respect to residential properties) but this is a highly specialist requirement and geo-aware imaging systems work best for this.

"The timely tracking of resources and the future requirements for these situations is particularly important. As incidents are fought over very large geographies and very extended timescales (days to weeks) the husbanding of precious assets and their continual support and refreshment is critical to success. Thus, forward planning facilities and AVLS and logistics management systems are essential capabilities.

"Finally, there has been a lot of discussion about the alerting of the general public in sufficient time to effect shelter-in-place or evacuation strategies. There is no doubt that tying 'reverse 911' capabilities into modern command and control software must be a highly desirable capability for future generations of systems."

Post-event investigations of major disasters routinely conclude that there is always room for improvement when single and multi-agency emergency response organisations deal with complex, large-scale multi-site incidents. They highlight the compelling need to explore how best to maximise the contribution that advanced computing and communications technologies can contribute to helping support commanders during major emergency incidents. Commanders during such events need high levels of situational awareness, dynamically updated to keep them informed on new and fast moving



# the bushfire war



developments (fire front extent and direction, for example).

The world is full of high powered and exciting new technologies offering great promise for emergency services. But how can the usefulness of these new technologies – digital mapping, high bandwidth wireless communications, live imagery streaming, mobile computing and touch screen displays – be optimised to provide better support for fire and multi-agency emergency managers? What tangible, real world benefits can these new technologies deliver to commanders at all levels of an incident?

Fire and rescue services (and other emergency services), are regularly offered the prospect of new technologies to support

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their work. But often these new technologies are provided on a piecemeal basis. As individual technologies they are exciting, but they tend to exist in isolation; how they relate to and integrate with other technologies (if at all) is not always clear.

New computing and communications systems should be supporting a much more integrated and technological approach to fire and emergency management, but to date there has been no single, integrated technological solution that comes close to equalling the kind of fantasy functionality movie makers deploy on a regular basis. This issue has become even more pertinent now that emergency services are gearing up for the introduction of a new generation of high-tech incident command vehicles requiring equally high-tech emergency management systems.

Other key drivers for the development of a new, more mobile, distributed and interoperable command and control system (as distinct from mobilising/despatch systems often confusingly and inaccurately labelled ‘command and control’ systems) have come from emergency services in major cities such as London (where multiple terrorist attacks and other public safety threats have fuelled demands for improved situational awareness, large scale

working and enhanced interoperability across different agencies).

With the launch of the Command Support System, from UK command systems developer VectorCommand, an emergency management software system now exists that matches and exceeds the levels of command, communications and display functionality required by emergency services. VectorCommand developers have worked closely with senior command staff around the world to understand their requirements, develop solutions appropriate to their needs, and conduct robust user acceptance testing of the finished system. (In doing so the company has built on its experience supplying virtual reality-based fire command training systems and emergency exercise management systems for emergency services in the UK, US, Australia, New Zealand, Europe and the Middle East.)

In the South Australian Metropolitan Fire Service, for example, where the Command Support System has been selected for use in the State Coordination Centre, mobile command vehicles and throughout the command hierarchy, the Australian Inter-service Incident Management System (AIIMS) organisational structures and roles will be pre-populated into CSS, enabling functions to expand to meet the needs of the Incident Management Team.

Using the Command Support System, fire and other emergency commanders and support staff at any location can now see across multiple incidents, assess risks, drill down into individual incidents to see what is happening in the field (through live streaming incident cameras), and assess and discuss individual commanders’ electronically shared plans for coping with specific emergency events. Commanders will also be able to allocate personnel and other resources dynamically within an integrated asset management system (which accesses despatch systems and resource databases), and share incident communications and instructions wirelessly.

## Why is such a revolutionary system required?

In the recent past Geographic Information Systems (GIS) provided a major boost to improved emergency management, but a significant weakness has been that they don’t allow for the integration of geospatial data with other important incident information and functionality that would, together, give commanders a much clearer idea of what is happening on the ground. GIS data, for example, has often only been held on headquarters terminals and within incident command unit computers; it was not possible to support dynamic information

*Left: the speed, number, scale, ferocity and unpredictability of large fires, such as those in Victoria recently, means that trying to keep track of threats and allocating resources can become a command and control nightmare (Getty Images).*

*As part of the Command Support System, situational awareness will be enhanced and a common operational picture shared dynamically, in real time (Getty Images).*



*The role of Command Support Officers will grow in importance as new, more technological ways of working become embedded in an organisation's operating procedures (photo by Rob Munro).*



sharing and interaction across all levels of major incidents during an emergency (even within a single agency) or to link geospatial data with other information.

GIS has been even less well used when interoperable information sharing would support multiple agencies managing emergencies jointly. Geographic Information Systems often remain in individual agency 'silos', rather than being shared between agencies and between all command levels to create and share a common operational picture. Now, with the Command Support System using ruggedised wireless laptops and Incident Command Unit vehicle computers, information can be shared between incident ground level devices throughout an incident and terminals at higher levels in the command hierarchy, as well as interoperably between different agencies involved in an incident.

With the Command Support System the linking of geospatial information with other different types of dynamic incident information, such as still and live streamed imagery (from UAVs, still cameras, helicopters, and CCTV systems) can be done within a single interface, creating a much more timely, accurate and comprehensive common operational picture in support of improved decision making.

The Command Support System helps senior commanders and support staff as they attempt to gather information quickly, understand better what is happening throughout an incident (especially if it is happening over a large area or in multiple locations), and make well informed and effective command decisions. It gives commanders and command support staff electronic eyes and ears on the ground. Very importantly, the system has been designed to have an intuitive, icon-based touch screen interface, making it easy to understand, learn and use by non-technical users. In other words, it can be used easily by commanders at all levels, not just technical personnel.

Other technologies specifically developed for emergency

*Personnel, asset management and GIS mapping functions are integral features of the Command Support System, providing an up-to-date, shared and dynamically updated picture of what resources are available, within a single interface.*



services and integrated within the CSS include:

- messaging and conferencing;
- access to organisational databases (for hydrants, water sources, risks, personnel, and Standard Operating Procedures - SOPs);
- clear graphical representation of organisational assets and structures, (linked to personnel databases) for dynamic, interactive management of units and command hierarchies for both single and multi-agency incidents;
- integrated web access;
- automatic incident logging;
- timeline/planning screens.

Currently, if any of these different types of data and functionality are available, they tend to be scattered throughout disparate, non-integrated systems that may be difficult or impossible to share, access or deploy. With the Command Support System they are available instantly, within one integrated interface.

Without Command Support System, the lack of integrated access to all the different types of command, display and communications functionality means that fire and rescue services are not benefiting fully from the many advantages new and emerging technologies can provide.

The Command Support System will give fire and emergency services the opportunity to integrate new technologies much more fully into their operational procedures. With the adoption of the Command Support System, new "concepts of operations" (the way in which fire services will use the system) are likely to evolve. Use of the system is not prescriptive – as familiarity grows, commanders and support staff are likely to develop innovative new ways to leverage its power. It will also enhance firefighter safety through improved situational awareness.

With the adoption of the Command Support System it is probable that the role of Command Support Officers (or their equivalent) will grow in importance as new, more technological ways of working become embedded in an organisation's operating procedures. This type of officer, a specialist operator of the Command Support System (using wireless laptops and computer systems in incident command vehicles and in the field) will be able to act as the "intelligence" gatherer and loggist of commanders (the system records all decisions automatically, for reviews and enquiries) This does not mean that non-specialist operators will not be able to use the system, merely that Command Support Officers will be able to exploit the system's many levels of functionality more fully.

The role could include gathering and annotating incident imagery from cameras, UAVs (unmanned aerial vehicles) and CCTV cameras, creating sketch maps on the fly to show a fire's progress and a commander's plans to deal with it, creating organisational asset charts to show what personnel are available (and their capabilities – BA or HazMat trained, for example) and sending and receiving messages.

The system also records, automatically, all decisions made, the information available at the time they were made and the reasons they were made. This can be used for logging, analysis and enquiry purposes. System controls are icon-based and drag-and-drop to make them intuitive and easy to use for non-technical personnel. This will enhance user adoption and system usage throughout emergency organisations.

The Command Support System has been selected by launch customer the London Fire Brigade (as well as numerous other fire and rescue services throughout the UK), the South Australian Metropolitan Fire Service, and the European Union Civil Protection Mechanism, and is creating widespread interest throughout the public safety sector worldwide.