

An airborne mesh system combining multiple technologies is providing reliable comms for firefighting efforts.

In 2018, the National Aerial Firefighting Centre (NAFC) recommended deploying Silvus Technologies meshing data radios for use on aerial firefighting assets in Australian states and territories. The purposes envisioned for data links in aerial firefighting assets are:

1. To provide video and data links to command and control from sensor platforms such as optical and infrared cameras installed on fire surveillance helicopters, facilitating real-time situational awareness of emerging developments and ongoing firefighting operations.
2. To provide a subset of that information (typically video feeds without data) simultaneously to ground crews and other aircraft operating in the vicinity of the helicopter.
3. To provide a data feed from command and control to ground crews and other aircraft, allowing near real-time updating of these crews' situational awareness packages from control. This ensures that the crews have access to the very latest information at all times, again enhancing both safety and efficiency.

The key to this is the presence of real-time metadata (primarily positional information) along with the video feed, and a bidirectional network connection to the aircraft, enabling direct interfacing from the command and control systems to the inflight sensor platforms. The availability of this information for the control centre significantly enhances the ability to manage the safety and operational efficiency of ground crews.

These facilities are typically provided by cellular connections and will increasingly be provided by the public safety mobile broadband (PSMB) system. The subsequent improvements in management efficiency have been demonstrated to be so significant that the associated workflows have rapidly become critical to the day-to-day operations of emergency services that have deployed these resources.

The ultimate goal is to connect a helicopter for video and metadata transmission as well as all types of assets, which lie within the coverage area.

One way this could be achieved is to utilise an integrated mesh system, where network data is able to hop from one radio to another to another, cross-linking through mesh radios, telco sites and terrestrial networks. This



A Silvus dual transceiver radio unit mounted on a pole.

AERIAL MESH COMMS FOR FIREFIGHTING

Ross Caston and Dale Stacey

capability can be used to link all assets into a single operational picture.

Challenges with existing infrastructures

Although cellular and PSMB connections may be available 99% of the time, it has been regularly demonstrated that they cannot be guaranteed in an emergency situation. The infrastructure that they depend on may be compromised. This is especially true during natural disasters such as bushfires or floods, and public happenings such as large stadium events. Often during natural disasters, physical damage to infrastructure can occur, while at public events, cellular systems can be overloaded by the presence of large numbers of people gathered in one small area accessing the networks.

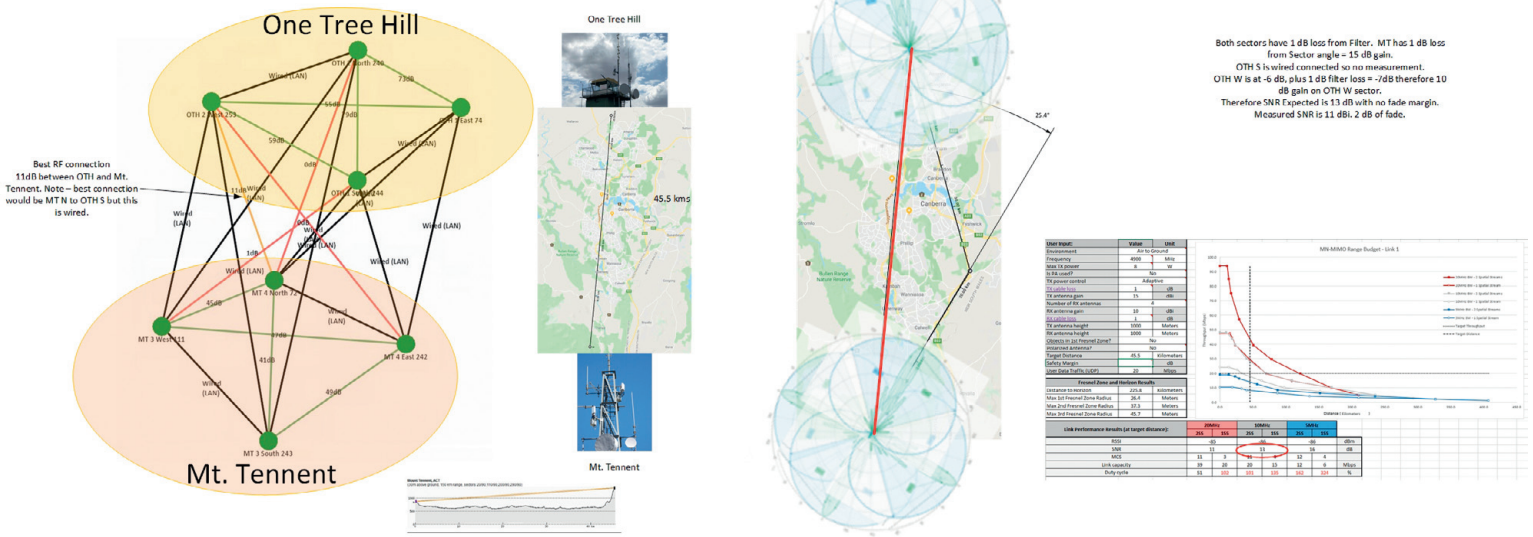
It is during these 1% of occasions that emergency services are especially vital, and in remote or compromised areas the mesh system can assume the networking duties in their entirety, with links back to a central network established where required and feasible.

Benefits of mesh technology

The prescribed Silvus data meshing system provides a transportable, mobile networking structure, which can operate either together with, or in the absence of, regular cellular or PSMB services.

This is achieved using different processes, either by 'bonding' cellular and Silvus links into a single large link or by switching between links in a prescribed order of preference, which is set typically as the most affordable. For example, Silvus Link (free) followed by

AERIAL COMMS



Topology of the Silvus mesh communications system.

cellular connection (not free) and then satellite link (expensive but available anywhere that the sky can be seen).

In either case, if any link can be found by the system, it will be made available without operator intervention. This means that the operators (crews, command and control) have a far greater chance of being able to use their normal data-dependent workflows without interruption.

The Silvus system uses meshing to establish distributed data connections whereby every radio in a network relays data from every other radio. For example, this could enable a helicopter to establish a link with a ground station while a search and rescue team ventures into a cave, and relay video from the end of the cave through intermediate radios right back to a hovering helicopter, and

then back to command and control, enabling full, real-time video observation of the situation in the cave at any point in the chain.

Solution

After much research, NAFC selected Silvus MN-MIMO radios as their network link of choice for aerial applications. The Silvus system has been extensively used in the USA and Europe for similar applications, with great success.

Silvus has a family of mesh radio products specifically designed to address the growing demand for distributing video and other high bandwidth data in harsh tactical environments. Silvus StreamCaster radios, featuring MN-MIMO at the core, join together to form a robust, self-healing, self-forming fluid mesh network.

SAT Pty Ltd and Amber Technology worked closely under the auspices of NAFC with Microflite and McDermott Aviation, providers of helicopter surveillance services to several emergency services operations across Australia, to design, install and integrate a bonded mesh solution, establishing phase one of the system. This comprises the ground receive sites and the bonded helicopter fit-out.

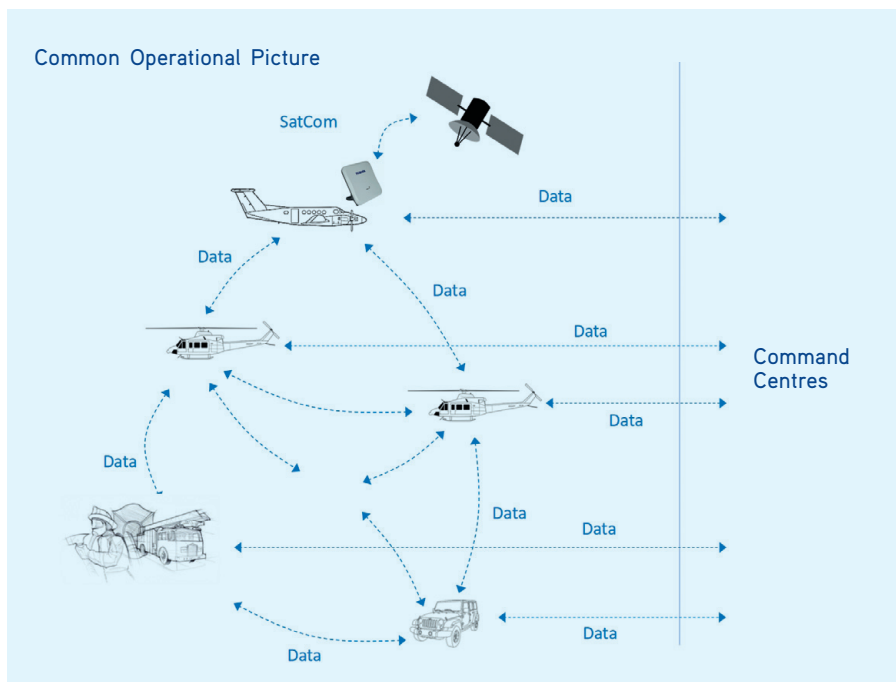
The result is demonstrated network links from a helicopter to a state's emergency network from a range of around 150 kilometres from the receive sites, delivering video and metadata to control, and feeds to ground crews, either with or without service from the cellular system.

An easy-to-use graphical interface enables monitoring, control and configuration of all radios on a single screen, from any node on the network. An extensive application programming interface enables full interaction with a wide range of ISR and management systems.

Emergency services operating with this system are able to utilise this technology for a number of major emergency scenarios including real-time communication regarding the specific location of a bushfire to ground crews, enabling the crew to navigate through smoke-filled bushland quickly and safely to tackle the flames. There are a great number of locations that do not provide any cellular coverage, making this solution a significant emergency asset for every Australian citizen.

Ross Caston is General Manager, DLES, Amber Technology Limited; Dale Stacey is Technical Director of SAT Pty Ltd. Caston and Stacey, along with Mark Austin (Director ICT & Capital Works, Justice & Community Safety, ACT Government) will present this case study in depth at Comms Connect Melbourne 2019, at 4 pm on 27 November. Visit <https://melbourne.comms-connect.com.au/program/> for more details.

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Mesh and telco communications combined.