Paper 2E – Portable Mobile Radio solution deployed across Olympic venues and the Olympic Route Network

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The Apollo network, built by Airwave (see Fig. 1) for the London 2012 Olympic and Paralympic Games, was designed to meet the Private Mobile Radio (PMR) communication requirements of LOCOG. The network used TETerrestrial Trunked Radio (TETRA), a digital mobile radio technology employed by a wide range of PMR users in the public safety, utilities, transport and other commercial and industry sectors.

The network solution utilised identical equipment to that used for providing critical mobile communication services to Airwave’s Public Safety customers, and adopted many of the established techniques used in delivering this vital service. This proven performance, together with a network architecture designed to support secure, all-informed calls between groups of users, made it the perfect choice to meet LOCOG’s PMR requirements.

The network was built with the resilience and capacity to meet demanding Service Level Agreements for availability and Grade of Service (the design target was that less than 1% of calls should queue, for less than 1 second).

Resilient transmission links were used, together with a high level of redundancy in key network components. Enhanced operational support was deployed during Games time, ensuring that a rapid response was possible in the event of a fault. A range of capacity management techniques was also used to ensure the Grade of Service was delivered.

The primary means of communication was Group calls, with telephony and individual call capability for certain users.

The main components of the network are shown in Fig. 1, and performed the following functions:

- Two switch sites contained the main PMR switching equipment, subscriber management, call control and network management sub-systems. One site operated as a live primary and the other as a hot-stand-by with 100% equipment redundancy.
- Forty-five base stations provided radio coverage to all venues, the Olympic Route Network (ORN) in London and various other areas. All coverage areas passed extensive testing beforehand.
- Control room equipment provided access to dispatcher-based services at management and control locations operated by LOCOG.
- Transmission circuits provided resilient connectivity between the switch sites and base station sites/control rooms.
- The Airwave Network Management Centre accessed the network management sub-systems located at the switch sites.
- End user services were provided by hand-portable, vehicle-fitted and desktop mounted TETRA radios.

The network was designed to support up to 18,000 radio users, performing a range of operational, security, transport...
and event management functions. Each user group had specific communication requirements, which were catered for by the definition of approximately 1500 Talkgroups.

To ensure the Grade of Service requirement was met, and to minimise the risk of network congestion, it was necessary to use a range of capacity management techniques. The capacity of each base station was designed to meet the radio traffic predicted for the users in each area, and careful network planning ensured that only the required traffic was generated at each site.

To limit the number of users who might access a particular base site, the TETRA Subscriber Class feature was used to define the sites which a radio was able to use. The Subscriber Class used by a radio was dependent upon the Talkgroup selected, providing flexibility to use a common radio configuration for all users at all venues.

Each Talkgroup was configured to be valid on only a sub-set of available base sites, preventing unnecessary duplication of traffic. Together with the Subscriber Class feature, this ensured that traffic generated at each base station was kept within predicted limits.

Up to 2500 users could be accommodated under the footprint of base stations covering the Olympic Park area, and common secondary control channels were deployed on these sites to ensure enough capacity for call control and mobility management signalling.

In terms of actual performance, the network exceeded all key requirements, with over 7 million calls being carried by the system over the period of 27th July to 9th September (from the day of the Olympics opening ceremony to the day of the Paralympics closing ceremony).

Most of the network was installed and fully operational fifteen months in advance of the Olympics opening ceremony, providing ample opportunity to fully test the system and the operational processes depending on it. However, some parts of the network could only be
delivered within a specific time window, such as the temporary installations required for supporting the cycling road races and the venue technology centres. With such a limited time to install and test these installations, this provided the biggest challenge in the whole programme. However, a good degree of co-operation between Airwave and LOCOG technical staff ensured all problems were overcome.

With the heavy demand on radio spectrum from network operators, broadcasters and others, it was essential that a robust spectrum plan was drawn up in advance of the Games in collaboration with Ofcom to mitigate possible effects of interference. Spectrum in the 385–400 MHz range was temporarily allocated to Airwave, and this was used to provide the full range of LOCOG services. The small number of interference issues encountered during the Games had only a relatively minor impact on services, and were quickly investigated and resolved by Airwave and Ofcom engineers working collaboratively to identify the sources of interference.

An example of the hand-portable radio used is shown in Fig. 2.

As many of the radio users were volunteers, the majority probably with limited experience and knowledge of PMR, the user interface on each radio was designed to be as simple as possible. This limited users to basic functions, with restricted access to any of the more advanced features of the radios. Each user was given basic training in the use of the radios, but in order to assist in the resolution of any operational issues with the radios during Games time, Airwave ‘Ambassadors’ were present at each venue to offer practical help and advice to users.