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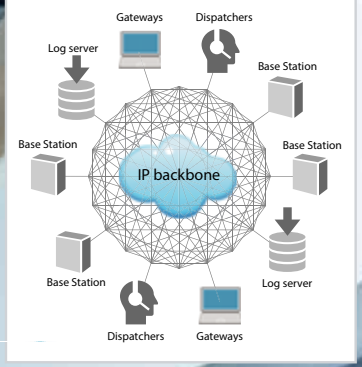

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Photo courtesy Thales

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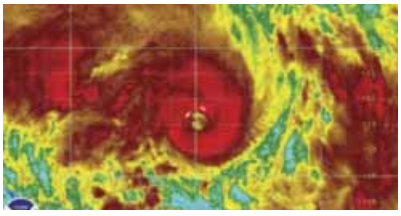

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Cover photo courtesy Hong Kong Police Force

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TETRA Turns 20

The TETRA standard is celebrating its 20th anniversary this year. The technology has seen two dynamic decades with many ups, a few downs and strong growth worldwide. Duncan Swan takes us through the standard's history and its current crossroads in his article beginning on Page 14.

TETRA continues to serve its users well around the globe. A mature TETRA network is in place in Hong Kong. On Page 24, Jolly Wong outlines how the Hong Kong Police Force's communications system was used and adapted during the 79-day Occupy Central movement last year. The tenuous situation was effectively managed and controlled because of reliable communications among public-safety officials.

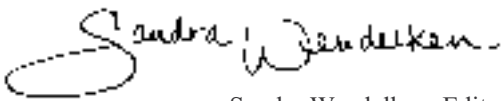
Swan and Wong are both members of the *RadioResource International* advisory board, and our editors rely on their expertise for comprehensive coverage of TETRA and all mobile radio technologies used throughout the world. To that end, we are pleased to welcome Tero Pesonen as the newest member of our advisory board.

Pesonen is a critical communications professional at TietoPiiri, and last September, he was named the TETRA + Critical Communications Association (TCCA) Critical Communications Broadband Group (CCBG) chairman. Pesonen has a long career in developing critical communications operational models and related technology within Nokia and EADS/Cassidian (now Airbus Defence and Space). In 2013, he became an independent consultant. He was one of the authors of our Quarter 4 2014 cover story on Finland's hybrid network approach to Long Term Evolution (LTE) services.

We are thrilled to have Pesonen join our board and look forward to working with him.

We hope to meet many of our readers at the Critical Communications World (CCW) event in Barcelona, Spain, in May. Please stop by stand A109 and say hello to our staff. Give us your feedback on the magazine, our website and other digital products. We look forward to seeing you there.

We value your opinions! Please email your feedback to me at swendelken@RRMediaGroup.com.



Sandra Wendelken, Editor
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RadioResource INTERNATIONAL

RadioResource International delivers wireless voice and data information for mobile and remote mission-critical operations for professionals who reside or do business outside the United States and Canada. The magazine covers private and trunked mobile radio, wireless data, location technologies, public safety communications, microwave radio, satellite, paging/messaging, remote monitoring, and other wireless applications. Editorial content is international in scope and encompasses emerging technologies, industry reports and trends, innovative applications, product information and comparisons, news, standards, and troubleshooting tips.

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European Parliament Partners with Airline Industry for 1-1-2 Awareness Campaign

The European Parliament, in cooperation with the European Emergency Number Association (EENA), launched a campaign aimed at increasing awareness of the 1-1-2 emergency number among travellers in Europe.

The campaign follows a report that found only 27 percent of European citizens identify 1-1-2 as the number to call in an emergency anywhere in the European Union. Seventy percent of those surveyed said they have not come across any information about the European emergency number in their countries.

European Parliament Vice President Adina-Ioana Valean helped launch the campaign. Airports and airlines will participate by displaying promotional materials, including posters and banners, in key areas such as departure gates, information desks and exits, as well as in airline in-flight magazines, websites and brochures. Airlines also were asked to make an announcement upon arrival informing passengers about 1-1-2.

"We proactively initiated this campaign with airports and airlines because they offer wide visibility for people travelling in Europe," said Valean. "I am very happy that our campaign benefits from large support, but this is not enough and more should be done every day. As a citizen, and the vice president of the European Parliament, I urge everyone to join this cause and take their share in raising awareness."

EENA Executive Director Gary Machado said the lack of awareness of 1-1-2 is unsatisfactory. "We believe that access to potentially life-saving information is a right of European citizens. We would like to thank all participating organizations and to invite all European airports and airlines to join this campaign."

Thirteen European airports, seven European airlines, the Airports Council International Europe (ACI-Europe) and the Association of European Airlines (AEA) have joined the initiative or are looking into ways they can support it.

EUROPE

WARSAW, Poland — The city police forces of Lodz, Krakow and Szczecin in Poland chose **Sepura**'s TETRA technology for their secure communications.

Lodz Police will replace its current infrastructure, which has been in place for 13 years. Sepura will work with partners SRS Poland and RadioPartners for the deployment, which includes base stations, dispatch consoles, a fully redundant central switch and TETRA portable radios with encryption, short data service (SDS) and packet data functionalities.

The network overhaul was prompted by the need to increase efficiency of public-safety organizations in the city, with a main priority of facilitating multiagency communications. The new TETRA system will be used by emergency services, fire and the regional crisis management center.

BAD MÜNDER, Germany — Hytera Mobilfunk was chosen to provide radio technology to the Etixx – Quick-Step cycling team to support riders and staff. The company will deliver a full range of radios and wireless headsets.

Etixx – Quick-Step was founded in 2003 and consists of 27 athletes from 12 countries. Since its inception, the team has won nearly 500 races. Hytera inked a similar contract with the German professional women's cycling team earlier this year.

"The new partnership with Hytera is another big step in our aim for excellence in everything we do," said Rolf Aldag, sport and development manager Etixx – Quick-Step. "Communication with our riders and within the team is essential for the day-by-day life of the team, and of course, is part of our success in races."

ASIA/PACIFIC

MELBOURNE, Australia — Motorola Solutions signed an agreement with the Victorian government valued at A$41.5 million (US$32.4 million) to extend the management of Victoria's Metropolitan Data Network (MDN) for an additional two years, with an option for two additional one-year extensions, from March 2015.

MDN, the first emergency communications network to be procured under a build, own and operate public-private services model in Australia, was deployed in 2005 and provides secure data communications for Victoria Police and Ambulance Victoria. The network provides coverage across the greater Melbourne metropolitan region but has roaming capability on to a commercial network for coverage beyond the metropolitan area.

The contract also positions the Victorian government to deliver against a key goal outlined in its emergency management long-term communications plan to "establish a statewide, sector-wide broadband capability."

This is the second time the contract for MDN has been extended with Motorola Solutions, following a decade of service delivery. The new agreement will see Motorola Solutions maintain MDN to its current mission-critical standards while trialing new and emerging technologies including 4G broadband data and a range of new terminal devices.

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ITU, Companies Send Equipment to Vanuatu for Tropical Cyclone Pam Relief Effort

The International Telecommunication Union (ITU) deployed emergency telecommunications equipment to Vanuatu following the devastation caused by Cyclone Pam, a Category 5 tropical storm that hit the South Pacific Ocean archipelago 13 March.

ITU sent 40 satellite phones, 10 broadband global area network (BGAN) terminals and 35 solar panels to the island nation to support relief coordination efforts.

"Severe Tropical Cyclone Pam, which hit Vanuatu with devastating force, paralyzed telecommunications and affected rescue and rehabilitation efforts," said Brahima Sanou, director of ITU's Telecommunication Development Bureau. "ITU is committed to assisting member states restore telecommunication links in the aftermath of natural disasters to facilitate humanitarian response to support the affected populations."

Joe Natuman, prime minister of Vanuatu, thanked ITU for the support and noted that all 83 islands in Vanuatu suffered substantial devastation as a result of the cyclone.

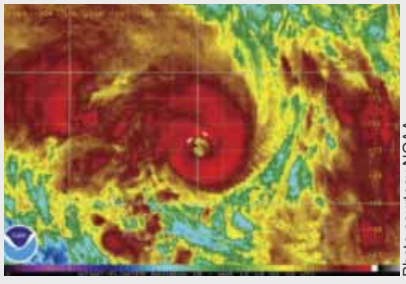

Photo courtesy NOAA

"As communications are down, the ITU emergency equipment, which we have received and distributed throughout the country, will help us coordinate the relief efforts as well as report the situation in outer islands," said Natuman.

SES and Digicel Pacific also donated satellite capacity and equipment to help restore vital communications networks across Vanuatu. Digicel is using capacity on SES's NSS-9 satellite to re-establish communications networks and optimize relief operations and disaster recovery efforts in the country.

Cyclone Pam slammed into the Vanuatu archipelago, including its capital Port Vila, on Efate Island. Winds are estimated to have reached 250 kilometers per hour (kph) with gusts peaking at around 320 kph, causing damage to the infrastructure, impacting services such as electricity and leaving debris across the capital.

According to the U.N. Office for the Coordination of Humanitarian Affairs (OCHA), an estimated 90 percent of structures were damaged or destroyed in Efate. More than 2,000 people are sheltering in more than 25 evacuation centers in Efate, Torba and Penama. Vanuatu has a population of 267,000 spread over 65 islands. About 47,000 people live in the capital.

"With widespread devastation across Vanuatu, humanitarian organizations are working to deliver food, water and supplies as quickly as possible," said Michael Murphy, Asia-Pacific CEO at Digicel. "Re-establishing communications networks is hastening this process and helping the people of Vanuatu connect with anxious family and friends across the country."

The agreement will eventually allow for a wider choice of devices and applications, including the option to integrate bring your own device and application (BYOD and BYOA) solutions, without compromising MDN's security and reliability.

The Emergency Services Telecommunications Authority (ESTA) managing the MDN contract and monitors delivery on behalf of the Victorian government. Motorola also manages the Metropolitan Mobile Radio network for ESTA and the emergency services agencies it supports. Motorola Solutions designed and built that network as well and has managed it for the Victorian government since 2004.

INTERNATIONAL

SCHAUMBURG, Illinois, USA — **Motorola Solutions** acquired two public-safety software companies in recent weeks. Terms of the transactions were not disclosed.

Motorola bought Emergency CallWorks, a privately held provider of emergency number call-taking software for public safety. The company is now a wholly owned subsidiary of Motorola Solutions. Motorola will retain the company's 42 employees, said Tom Guthrie, vice president, Motorola Smart Public Safety Solutions business.

The company consolidates emergency number call-taking into a single, simplified software solution. The software can be deployed either as an on-site implementation or as a remote hosted solution, making it scalable to small public-safety agencies.

Motorola also purchased PublicEngines, a privately held provider of cloud-based solutions that deliver crime analysis, predictive policing and citizen engagement capabilities for law enforcement agencies, governments and other organizations. PublicEngines, which serves 2,000 customers, offers four intelligence-led public safety and citizen engagement products. The firm's 18 employees will be retained by Motorola.

The acquisitions are part of Motorola's strategy to advance mission-critical communications by connecting public-safety and commercial customers with real-time data and intelligence, a statement said.

Separately, Motorola Solutions made a strategic investment in CyPhy Works, a developer of unmanned aerial vehicles (UAVs), also known as drones. Terms of the investment by

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MOTOROLA

Thales was awarded a contract by the state of Qatar to secure its new commercial port, one of the largest and most technologically advanced ports in the world. Thales will deliver and install an integrated solution, including a TETRA network, for the protection of the infrastructure and its environment, in addition to ensuring the port operations run safely.

Motorola Solutions Venture Capital were not disclosed.

Founded by Helen Greiner, co-founder of iRobot, CyPhy Works developed a drone technology and business roadmap that pioneers use of "microfilament tether" technology to enable long-duration or persistent flight with secure streaming of high-speed data and high-definition video.

LONDON — Global research organization IHS predicted that the installed base for TETRA terminals in North and South America is set to increase by 14 percent by 2019, mostly driven by significant uptake in the transportation, utilities and industrial sectors. Notably, shipments into North America are projected to more than double from 2014 to 2019 with more than 30,000 TETRA terminal shipments forecast in the region.

"One of the most interesting developments around TETRA has been the traction gained in North America, with an increasing number of contracts being won for the technology in the region," said Elizabeth Mead, HIS senior analyst, critical communications. "The traditionally strong feature set of TETRA devices is resulting in the technology seeing considerable success in sectors outside the public-safety markets, specifically in transportation and utilities."

IHS further estimated a significant LMR analog installed base — more than 70 percent of existing mobile radio users — has yet to convert to digital, indicating that the potential for growth of TETRA technology across all major regions remains strong.

"TETRA technology now represents 24 percent of the digital technology market for LMR worldwide and has achieved record shipment growth of 17 percent in 2014 in the Europe, Middle East and Africa (EMEA) region," said Mead. "Even with an increase of digital technologies like Digital Mobile Radio (DMR) or digital Private Mobile Radio (dPMR), the TETRA market continues to develop."

GENEVA — The International Telecommunication Union (ITU) and the European Telecommunications Standards Institute (ETSI) agreed to a new standard to measure the energy efficiency of mobile radio access networks (RANs), the wireless networks that connect end-user equipment to the core network.

The standard is the first to define energy-efficiency metrics and measurement methods for live RANs, providing a common reference to evaluate their performance. Its application will build uniformity in the methodologies employed by such evaluations and establish a common basis to interpret the results.

The new standard, Recommendation ITU-T L.1330 "Energy efficiency measurement and metrics for telecommunication network," accounts for the fact that optimizing the energy efficiency of equipment within a network does not guarantee the optimization of its overall energy efficiency. The standard takes a more comprehensive view of a RAN, incorporating impacts on energy efficiency caused by the interactions of interconnected equipment within complex networks.

The scope of the standard extends to radio base stations, backhauling systems, radio controllers and other infrastructure radio-site equipment. The technologies covered include Long Term Evolution (LTE).

"Improving the energy efficiency of ICT (information and communications technology) has become central to all fields of technical standardization at ITU," said ITU Secretary-General Houlin Zhao. "We are moving towards a world that will host billions of connected devices, things and objects, making energy efficiency essential to the functionality and environmental sustainability of ICT networks."

LONDON — Axell Wireless announced that its integration into **Cobham** will be fully completed by July, following its acquisition by Cobham in 2013. Axell Wireless, together with test and measurement company **Aeroflex**, acquired by Cobham last September, will form a new business unit, Cobham Wireless.

Senior Vice President Ian Langley will lead the Cobham Wireless business unit, which will be a part of Cobham's Communications and Connectivity sector.

The completion of the Axell integration enables the former Axell business to take advantage of the combined capabilities in the Cobham portfolio.

"In the months since the acquisition, we have concentrated on integrating the portfolios and building on Axell's existing credentials in the public-safety and cellular industries," said Fred Cahill, senior vice president, Cobham Communications and Connectivity. "Going forward, we will use this expertise to enhance our offering to existing Cobham customers in vertical industries and increase the range available to Axell's current customers."

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20 Years of TETRA Technology

TETRA networks have supported large-scale sporting events, including the 2004 Olympic Games in Athens, Greece.

Photo courtesy Duncan Swan

A look back at TETRA's 20 years as a mission-critical communications standard and its current crossroads.

By Duncan Swan

TETRA's roots go back as early as 1989 when initial work on the Mobile Digital Trunked Radio System (MDTRS) commenced in Europe led by four companies — Ericsson, Motorola Solutions, Nokia and Philips. During the same year, work began across the Atlantic Ocean in North America on a suite of standards for interoperable digital voice communications now known as Project 25 (P25). While P25 was a collaboration of the North American public-safety community, TETRA was developed within the European Telecommunications Standards Institute (ETSI) with support from suppliers, users and regulators.

The early days of TETRA developed key foundation stones for the springboard that any successful standard requires. In 1993, a commitment across the professional mobile radio (PMR) industry to develop products was increasing, and the roots for ongoing success with a strong trade association in place were solidified in December 1994 when the TETRA MoU Association got its start. As a trade association, the TETRA Association played — and continues to play — a significant role in shaping not only the development of TETRA but also safeguarding interoperability, driving new market opportunities, and fighting fierce competition from other standards and technologies.

MDTRS metamorphosed into the Trans European Trunked Radio (TETRA) standard in 1991, and around the time that TETRA became a recognized standard, its global ambitions were clear when the TETRA acronym morphed to Terrestrial Trunked Radio. In December 1995, the European national standards organizations approved the TETRA air interface as a full European Telecommunications Standard (ETS).

TETRA was ambitious in the diverse target markets it was developed to address. Contrary to popular myth, it was neither a specification for public access mobile radio (PAMR) that happened to meet public-safety requirements, nor vice versa. TETRA has proven to be a versatile standard with systems that are scalable in terms of switch and base site numbers, as well as the level of redundancy and resiliency required, making it ideal for business, mission- and safety-critical requirements. The standard offers core

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TETRA Timeline

1993-PMR industry commits to develop products

1989-Work begins on Mobile Digital Trunked Radio System (MDTRS)

1994-TETRA MoU Association launched

1996-Jersey launches TETRA trial

2001-Airwave goes live with TETRA in the UK

2002-VIRVE and ASTRID launch networks in Finland and Belgium respectively

2006-TETRA Enhanced Data Service (TEDS) standard published

2011-FCC permits TETRA in U.S.

2011-TETRA Association rebranded as TETRA + Critical Communications Association

features that include group, broadcast and emergency calling, fast access (typically less than 300 milliseconds call setup), back-to-back or direct mode operation (DMO), various levels of encryption, telephony (including full duplex), and support of an array of communications control room requirements. At the time of inception, data speeds were comparable with existing technology, now slow in comparison, but the standard offered powerful status and short data messaging, as well as mission-critical packet data.

The industry that surrounded TETRA was dogged in its determination not to let detractors undermine the standard and its strengthening ecosystem. Health and safety had a specific industry group set up to rationally explain TETRA amid an initial hullabaloo around pulsing and radiation. The mobile communications industry takes health and safety seriously, with significant investments in research by industry and government bodies alike. TETRA is no different. RF-sensitive working areas were safeguarded with a new feature for TETRA terminals called transmit inhibit mode that enabled users to work around sensitive medical equipment in ambulances and hospitals, or measuring equipment, such as speed detectors or breath analyzers, without compromising the legality of measurements.

Spectrum

The availability of harmonized spectrum for TETRA was one of the keystones for its global success. An open standard needs sufficient harmonized spectrum to achieve reasonable economies of scale, maintain a competitive multivendor market and ensure choice. It was in the early 1990s that the European Conference of Postal and Telecommunications Administrations (CEPT)'s European Radiocommunications Office started work to identify suitable spectrum for TETRA. During the mid-1990s, following consultation with NATO and others, decisions were ratified that released 2 x 5 megahertz in the 380 – 400 MHz band for use across

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TETRA Terminals

Source: Mason Advisory

Europe by public-safety users. Work in CEPT also identified blocks of spectrum in the 410 – 430, 450 – 470 and 870 – 921 MHz bands for TETRA. The 380 – 400 and 410 – 430 MHz bands were also widely available in other regions of the world, with 806 – 870 MHz a common option.

While there may have been initial concerns about whether sufficient spectrum would be available to plan and implement high-density TETRA networks with sufficient coverage and capacity, the ever-improving technical RF characteristics of terminals meant that third-generation terminals could operate in a wideband configuration from 380 – 430 MHz. This has enabled the combination of 380 – 400 and 410 – 430 MHz spectrum to provide additional coverage and capacity where needed, and if the spectrum was available. TETRA has also proven to be spectrally efficient. The number of national networks that coexist within the 380 – 400 MHz bands and the complicated cross-border coordination that was set out in the early days prove this point.

PAMR — Dolphin

In addition to PMR systems, TETRA was developed to support commercial PMR requirements, or PAMR. Recognizing a potential market opportunity — primarily based on the company's significant market share of analog PAMR users — Dolphin Telecom launched a series of European TETRA networks in 1999 to support public access requirements in the United Kingdom, France, Belgium, Germany, Spain and Portugal. For a variety of reasons, the company's business model faltered, and in 2001, Dolphin Telecom in the U.K. went into administration. A rescue plan was hatched but failed, and in 2004 the Dolphin networks were switched off. More recently, a variation of the PAMR model using TETRA was launched in Belgium and the Netherlands by Entropia Digital with an interesting array of enterprise clients already signed up.

Global Sporting Stage

TETRA has proven to be a major factor in the underpinning IT and communications infrastructures at some of the world's major sporting events. The Commonwealth Games in Manchester in 2002 was the first big sporting event to see TETRA in use with Airwave, and this has been repeated for subsequent Commonwealth Games, Asian Games, football World Cups and the biggest global sporting festival, the Olympics. Indeed, the past three Olympics — Athens, Greece, in 2004, Beijing in 2008 and London in 2012 — all had two TETRA networks supporting the events, one for public safety and law and order, and the other for organizers to support event logistics. The management before and during an event such as the Olympics is on a grand scale, and the traffic during the event is colossal. Figures published by Airwave for the 2012 London Olympics highlight not only how versatile TETRA is for such events, but also the limits to which many hundreds of terminals operating from a small concentration of radio sites stretches the infrastructure. TETRA will continue to defend its position as the top communications infrastructure in Rio de Janeiro for the 2016 Olympics.

TETRA Release 2

As early as 1999, members of ETSI Project TETRA recognized the need to provide enhancements to the standard, and in September 2000, ETSI approved a new work item for TETRA Release 2. A number of work items were approved, including the provision of high-speed data, the evolution of the TETRA subscriber identity module (SIM), interworking and roaming between TETRA and public mobile networks, and full backward compatibility and integration of the new services with the existing standard. Not all of these work items subsequently made it past the drawing board, but recognition that the standard needed to evolve in terms of data rates was key; the evolution of GSM to GPRS, EDGE, 3G and now Long Term Evolution (LTE) did not go unnoticed.

Two paths were mapped out for the provision of higher data speed. TETRA Advanced Packet Service (TAPS) was based on an evolution of the GPRS/EDGE standard, and TETRA Enhanced Data Service (TEDS) required a second high-speed data standard. TEDS eventually won as the preferred route for the majority of PMR users, and a debate began to select a preferred technology from five choices. Attempts to reach a consensus delayed a decision for some time, but the standard was finally published in 2006. Some observers say this was an indifferent start for TETRA 2 — and TEDS in particular. Indeed, for a standard so successful, the uptake of TEDS has been extremely disappointing. From the outset, Nødnett, the Norwegian public-safety network, included TEDS in its contract let in December 2006. It wasn't until 2010

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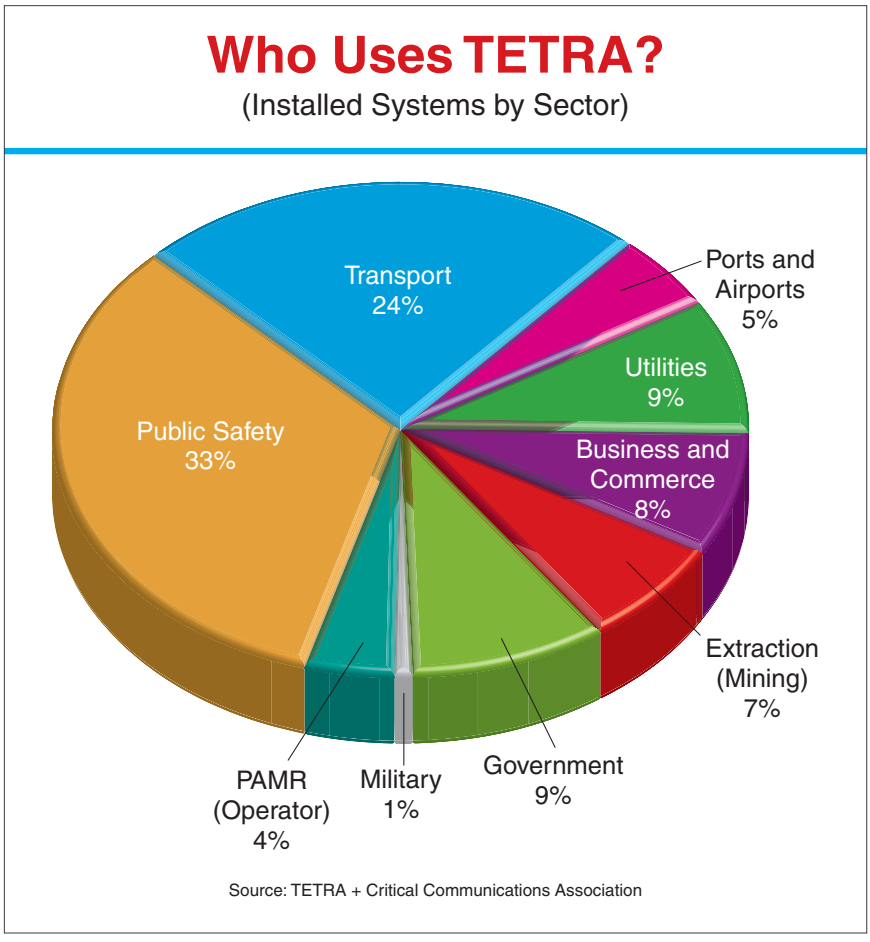

that TEDS started to gain more traction with other networks, such as when VIRVE in Finland successfully trialed TEDS and subsequently commenced implementation.

TETRA and Data

Any history of TETRA will show it has been unbelievably successful in its use of short data. A whole supporting industry is in place writing applications suited to the user radio terminals and the TETRA bearer, delivering real-time critical information from mobile resources back to central control systems — essentially efficient machine-to-machine (M2M) operation. The transport sector, in particular, has found TETRA a highly effective and efficient means of operating for metro systems in densely populated metropolises such as Hong Kong, Singapore and London; bus systems such as in Barcelona, Spain; and numerous airports across the globe. As terminals evolve with higher specification displays and greater internal computing power, the application developers have continued to enhance their offerings.

Specific TETRA interest groups have ensured development of the Peripheral Equipment Interface (PEI) to a common standard, enabling the widest possible number of supported peripherals, and for supervisory control and data acquisition (SCADA), where low speed, low latency data transfer is safety critical in mining, oil and gas pipelines, and electricity and water distribution.

By far the biggest data application that uses TETRA is location information. Most TETRA terminals are equipped with GPS capability. Supporting the transmission of location information is second nature for TETRA, whether it be to track and update resource location, help pinpoint a man-down location or determine where an emergency button activation has occurred. Having GPS data also enables accurate time stamping of information for status and short data messages, or for one of the newer features of TETRA terminals that have recently come to market — capturing high-definition photographs. This capability uses the TETRA terminal as a tool rather than just a communications device. Images are captured, stored securely in a nontamper environment and made available to download from a built-in data card.

The early years of TETRA, however, were an example of why to be careful marketing a standard. Claims that TETRA could support 28.8 kilobits per second (kbps) data rates at a time when GSM was only able to support 9.6 (kbps) were incorporated into many user business cases but proved unrealizable for some time. The first packet data transmissions using a single timeslot were realizable in 2000, but it was not until at least 2005 that multislot packet data was finally available.

Interoperability

Interoperability and test certification are at the heart of open standards. For TETRA, this is achieved through the interoperability certification process, a tightly controlled regime run by an independent test house. The process was originally developed by the TETRA MoU Association, and in 1999, the first certificates were awarded to four companies that remain key within today's TETRA market — Marconi (now Selex), Motorola (now Motorola Solutions), Nokia (now Airbus Defence and Space), and Simoco (formerly Philips Telecom). Today, more than 750 interoperability certificates have been issued, each with a specific infrastructure-radio terminal combination.

TETRA and North America

The whys and wherefores of TETRA entering the North American market are the subject of a separate history lesson. It was with much fanfare that, in April 2011, the U.S. Federal Communications Commission (FCC) issued a waiver notice allowing TETRA to finally be implemented in the country for all but users in some

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public-safety spectrum, which is undergoing band reconfiguration.

In September 2012, the FCC issued a permanent change to permit the unrestricted use of TETRA technology for critical communications in the 450 – 470 and 809 – 824/854 – 869 MHz bands. The rulemaking stated: "The record is clear that TETRA is a valuable option for licensees requiring a spectrally efficient wireless solution. We find that TETRA offers adjacent channel protection that is often better than other narrowband systems currently operating in the LMR bands."

In many ways, the timing for North America has provided an excellent opportunity for a mature product set along with supporting accessories, peripherals and a raft of proven applications to be brought quickly to market. This has proven to be the case and there are already some major systems implemented in the transport and utility markets, undoubtedly with more to come.

Key TETRA Systems

In June 1996, the Channel Island of Jersey was the first country to trial TETRA, and for the next few years, a number of trial systems were implemented around Europe. At the same time, major national networks were being sanctioned and work started to plan and procure networks to support public-safety communications. Key milestones include:

- VIRVE (Finland) commenced work in 1995, construction started in 1998 and a nationwide system was in place in 2002;
- ASTRID (Belgium) also commenced work in 1995, construction started in 1998 and the network officially went live in 2002;
- PSRCP/Airwave (U.K.) had an initial contract let in 1997 for a design study, construction started in 2000 and first users went live in 2001;
- C2000 (Netherlands) commenced work in 1999, and a nationwide system was in place in 2004.
- In 2007, BD-BOS in Germany started the procurement of a national network for blue-light services, and that network is the single largest TETRA network in the world.

Every PMR market segment is being served by TETRA. The largest market is public safety following the lead of early adopters. Across Europe and the Middle East, in particular, there are significant national networks deployed with all emergency services and a huge array of first responder organizations represented. A key facet of TETRA is that it offers autonomy for routine communications and full interoperability with other agencies during emergency situations.

The industry that surrounded TETRA was dogged in its determination not to let detractors undermine the standard and the strong ecosystem that was developing.

The transportation market is the next fastest growing market, especially for mass rapid transport systems and major airports — two key first adopters in the United States. The success and market uptake of TETRA has attracted a range of different manufacturers, as well as application developers and suppliers of associated peripherals and related services.

The TETRA marketplace continues to thrive, and in 2013, IHS reported that 600,000 new TETRA radio terminals were shipped, with an estimated 3.2 million terminals in active operation. This represented 8 percent year-on-year growth.

2015: A crossroads at 20?

In November 2011, the TETRA Association changed its name to the TETRA + Critical Communications Association (TCCA) to demonstrate its immediate focus on mobile broadband for professional users. A Critical Communications Broadband Group was established to "drive the development and adoption of common global mobile broadband standards and solutions for users who operate in a mission critical or business critical environment." This group has seen users from a range of technologies, markets and territories come together to champion the development of one common global broadband standard. In parallel, the ETSI group that developed TETRA renamed itself Technical Committee (TC) TCCE (TETRA and Critical Communications Evolution) and changed its terms of reference.

The events suggest that this point in history presents a crossroads for TETRA and TCCA in particular. There are still markets for which a broadband solution is unsuitable, uneconomic or ruled out by spectrum. TETRA remains very much a technology of today and one that will undoubtedly continue to come across strong opposition. It still needs a strong, focused trade association to champion the suppliers of infrastructure, terminals, peripherals and applications. That TETRA works hand in hand with other mobile bearers has long been proven, especially with mobile carriers. The use of 4G LTE networks to provide a broadband capability to complement TETRA — and indeed P25 — systems is already a given. But at what point will self-provisioned LTE networks supporting both critical voice and data actually become direct competition to TETRA? And how will that chapter in TETRA's history look? ■

Duncan Swan is a director of U.K. IT advisory firm Mason Advisory and a member of *RadioResource International's* editorial advisory board. Swan has more than 25 years of experience in the telecoms industry. His clients include emergency services worldwide, and he has been involved in projects surrounding TETRA since 1995. He is a fellow of the Institution of Engineering and Technology (IET), a chartered engineer and a member of the Institute of Directors. Email comments to editor@RRMediaGroup.com.

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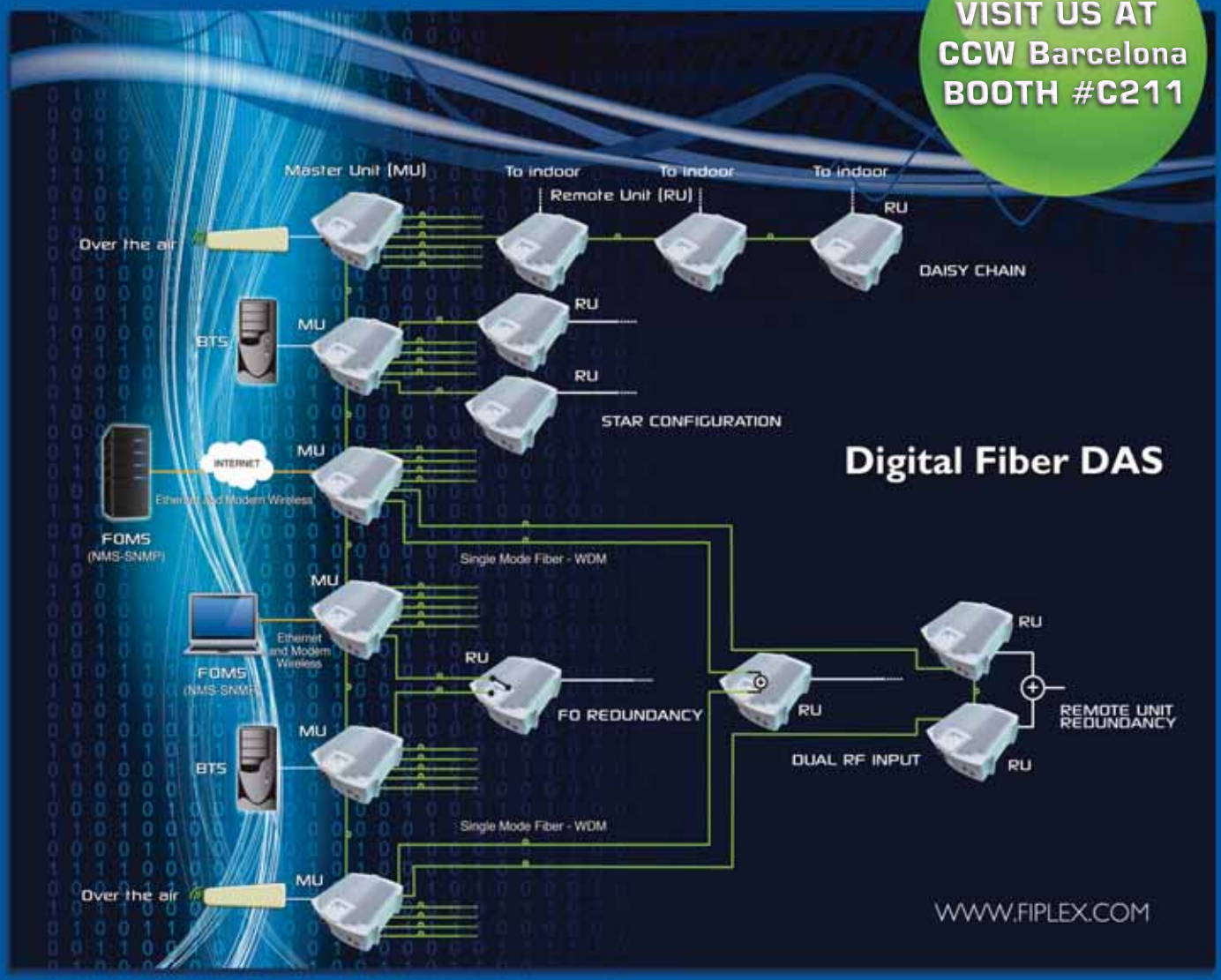

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Photos courtesy Hong Kong Police Force

TETRA Critical During Protests

The Hong Kong Police Force (HKPF) modified and capitalized on its network for communications during a 79-day protest.

By Jolly Wong and Team

The 2014 Occupy Central movement, formally called Occupy Central with Love and Peace, was a movement promoted as a peaceful civil disobedience campaign mobilizing protesters to stage a mass sit-in to blockade Hong Kong's Central District as a means of forcing Beijing to allow what the protestors consider genuine universal suffrage. The Hong Kong Police Force (HKPF) launched Operation SOLARPEAK to cope with a series of massive demonstrations associated with the movement. Some major roads were blocked, and many confrontations occurred in the Admiralty, Causeway Bay and Mong Kok districts during the 79-day protest.

HKPF's TETRA radio system played an important role in supporting police operations and maintained communications between commanders and officers in operation areas. The TETRA radio system provides both trunked and direct-mode communications. Apart from supporting HKPF, the radio system also serves as a unified digital communications platform to other government departments, providing effective communications for joint operations.

Occupy Central started July 1 and ended Dec. 12. To deal with the 2014 campaign, the communications branch of HKPF provided comprehensive technical support from July 1 onward. Experts from different aspects and task force teams were in position to provide immediate hotline and on-site support.

For the TETRA system, the number of busy calls and private calls in operational areas of the movement in Admiralty, Causeway Bay and Mong Kok decreased dramatically compared with the number of busy calls and private calls taken in previous public order events. An emphasis on radio user discipline correlated with the decrease of the number of busy calls. However, lessons were learned from the sudden surge of radio traffic that was generated by operations in different areas. System fine-tuning in operation basics will be conducted for operation support.

Network Preparation

Radio traffic was expected to be high, particularly in certain strategic

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Hong Kong Police Force's TETRA system played a key role during the demonstrations.

locations, and radio traffic shifted with the movements of protestors, making radio traffic patterns unpredictable. The following measures were deployed to help avoid radio traffic congestion:

Pre-operation Maintenance. All maintenance teams advanced the schedule of maintenance work, including equipment health checks, preventive maintenance and operation drills, well before the public order events. Maintenance activities with the potential to interrupt service were avoided during the public order event.

Cell Site Refarming. Portable TETRA base stations were deployed to temporarily serve command posts at different locations instead of using the capacity of existing cell sites.

Temporary refarming of base station radios with low traffic requirements was done before the operations. Preparation work, including analysis of the radio traffic patterns of different days, times, holidays and special events, was required. Limited spectrum resources for the TETRA system were carefully studied to evaluate the possibility of refarming the existing spectrum and making it ready for use in strategic but radio-congested areas.

Radio User Segregation. Different groups of radio users were segregated into cell sites to effectively use radio resources in each specific area. For example, selected groups of a few hundred radio sets were connected only to a specific group of base stations (site A), while other radios were connected to another group of base stations (site B).

As a result, radio capacity for areas with multisite coverage was significantly increased. This user segregation was changed dynamically in the network management center to cater to the ever-changing situation during the operations.

Furthermore, special talk groups were granted higher priority to acquire channels in case of radio traffic congestion, ensuring important messages made it to the frontline. Direct-mode repeaters were also installed on rooftops for localized communications, decreasing dependence on the capacity of base stations and significantly improving issues associated with congestion.

Limited spectrum resources for the TETRA system were carefully studied to evaluate the possibility of refarming the existing spectrum and making it ready for use in strategic but congested areas.

The TETRA private call service was one of the key features used by the frontline officers, especially in locations with poor mobile coverage. Long communications for private calls was anticipated. Therefore, TETRA private call service was temporarily suspended for users deployed to areas with excellent mobile coverage. This special arrangement significantly improved radio capacity.

Ad Hoc Operation Support. To support operational needs, additional hand portables were checked and reprogrammed to support different users on an as-needed basis. Technical staff conducted on-site field strength measurements along the public order event route and fine-tuned the radio sites throughout the operations. Finally, temporary frequencies were ready for replacing strategic cell sites in case of interference.

Communications Support

Effective communications was the key to the operation's success. Three tiers of support teams were formed during the operation period to enhance effective communications with fast response to user needs.

A team of officers ranked police inspector or above with both police and technical backgrounds acted as a tier one bridge, as well as the first line of support for communications requirements. Support was provided 24 hours a day, seven days per week. A tier two team of technical support staff provided in-service support for urgent requirements.

Provisioned TETRA network management terminals with real-time radio traffic were monitored by tier one, tier two and network management center staff. Weekly meetings were held among users and different tiers of support teams to gather updated information and provide instant response during operations. ■

Jolly Wong is a telecommunications engineer with the Hong Kong Police Force. Wong's staff contributed to this article. Email comments to editor@RRMediaGroup.com.

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Photo courtesy Airwave

Europe Considers Commercial LTE

A new European Union study researched whether commercial networks are viable options for the migration of mission-critical networks.

By Simon Forge and Robert Horvitz

A report on the use of commercial mobile networks and equipment for mission-critical broadband across three sectors finds there would be a case for relying on commercial mobile network operators (MNOs) — but only under strict conditions that require new powers for regulators and would transform the operators' business models.

Governments spend large sums of money on mission-critical networks for emergency services, usually on dedicated voice communications networks for public safety. SCF Associates estimated that in Europe, EU member states have invested more than €19 billion (US$23 billion) in TETRA and Tetrapol networks. Ensuring continuous operation for utilities and transport systems has become equally essential. In the transport sector, European railways are deploying a variant of GSM to replace the patchwork of local train control and communications systems. These GSM-R networks could cost more than €25 billion (US$32 billion). However, the future of GSM-R is unclear, with few equipment suppliers and commercial MNOs planning to retire GSM within a decade.

As a result, the concept of mission critical is expanding to guarantee the economy's smooth functioning for everything from smart grids for utilities to video with real-time control signals for road traffic management, as well as medical imaging and data for emergency medical teams and advanced policing. Such applications depend increasingly on mobile broadband data channels.

Meanwhile, EU member states still face budgetary constraints as a result of the financial crisis of 2008. Most have national debts amounting to 90 percent of annual gross domestic product (GDP), the highest levels since 1945. Enough publicly funded communications projects have come in expensive and over budget that, in times of public sector spending being slashed, EU governments are considering lower-cost, next-generation mission-critical networks, including public mobile networks. If mission-critical users can take advantage of the same advanced data technology, infrastructure and spectrum bands as mass-market consumers, the economic and technical advantages could be considerable.

Europe's MNOs are rolling out Long Term Evolution (LTE), an IP technology for mobile broadband data based on the European Telecommunications Standards Institute/Third Generation Partnership Project (ETSI/3GPP) standards. The U.S. government's decision that the First Responder Network Authority's (FirstNet)

planned nationwide public-safety broadband network (NPSBN) will be based on LTE has kick-started global interest in the technology for mission-critical uses.

All of these issues are explored in a new study for the European Commission, "Is Commercial Cellular Suitable for Mission Critical Broadband?" The commission sought an independent review of the advantages, limitations, risks, costs and benefits of using commercial broadband technology for road and rail transport, utilities, and public protection and disaster relief (PPDR). The requirements mandated scenarios that compare and contrast use of commercial public networks with private dedicated networks with hardened equipment, in shared or exclusive frequency bands to support all three sectors, plus analysis of hybrid networks.

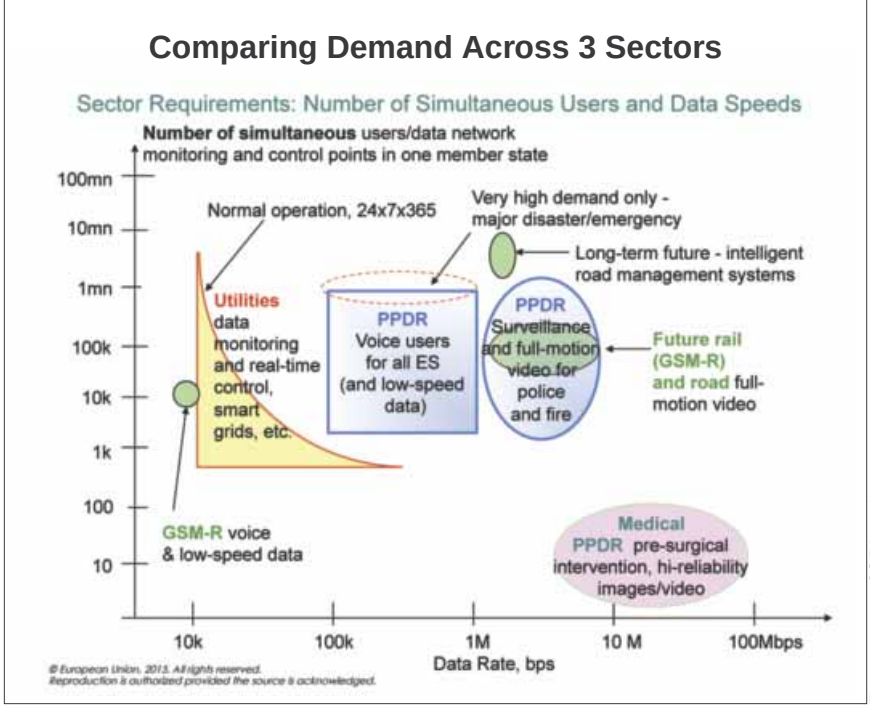
Three Diverse Sectors

SCF Associates was asked to explore the options for supporting all three sectors through a detailed examination of five scenarios. The first challenge was analyzing each sector's requirements in depth. Each has specific needs, characterized by data rate and number of users. A second challenge was determining whether sharing networks across sectors is feasible. Finally, the study team compared the costs and benefits of the various scenarios.

Are Commercial Networks a Fit?

On cost and technical grounds, the capital expense (capex) per user for hardened commercial LTE networks with geographic coverage extended to 99 percent of national territories would be less than the capex per user for dedicated LTE networks. This scenario is also the most attractive in terms of value for money when capex and operating expense (opex) are combined, though the cost advantages vary according to which frequency bands are used. At 450 MHz, the per-user cost of a dedicated network is cheaper in capex by more than 40 percent compared with commercial mobile broadband at 800 MHz. But when 10 years of opex is taken into account, sharing infrastructure costs favor the commercial networks, whether operating at 450, 700 or 800 MHz. A commercial LTE network operating at 800 MHz can have a capex cost per user that is 40 percent less than a dedicated LTE network at 700 MHz. If MNOs decide to operate commercial mission-critical networks in the 700 MHz band, the capex could be up to 20 percent less than a similar network at 800 MHz.

LTE, with future enhancements for resilience, seems destined for mission-critical communications. But it is less clear whether commercial networks deploying LTE can provide the resilience, reliability, extensive coverage, continuity of ownership and price stability needed by mission-critical services — unless the networks meet



Figures courtesy SCF Associates

these requirements by new regulations, possibly with new license conditions.

The research found that all three mission-critical sectors are reluctant to rely on commercial mobile services. Two reservations were common:

- Can MNOs provide reliable services under fixed-price contracts over long periods of time?
- Can MNOs provide the required level of network availability, resilience, response, service quality and coverage, particularly during emergencies?

The mobile industry has benefited from "light touch" regulation in the 1980s and 1990s, but market position has changed significantly. Since 2004, mobile subscribers have exceeded fixed-line subscribers globally. Industry consolidation and the continuing growth of mobile broadband is giving MNOs more market power than fixed-line telcos ever had. MNOs are the new incumbents, and changing the ground rules governing their commercial behavior could be justified.

Conditions for Success

Consequently our overall conclusion is that it is possible for commercial mobile networks to be used for mission-critical purposes, but only if five conditions are met.

1. The behavior of commercial MNOs must be constrained to provide the services needed by mission-critical users while preventing the use of "lock in" techniques to exploit this expansion of market power. Changes could

include contract condition revisions with price caps, length of contract, ownership continuity, quality of service and mission-critical traffic priority. Measures are needed that go beyond commercial service level agreements (SLAs); new regulations governing MNO services are required.

2. Commercial networks must be hardened and modified to provide more than 99 percent availability. Geographic coverage must also be extended and indoor signal penetration improved at agreed locations.

3. Hardening and extended coverage, along with the addition of essential mission-critical functions and resilience, must be accomplished at reasonable cost. No more should be spent on modifying commercial networks for mission-critical use than it would cost to build a dedicated national LTE network for that purpose.

4. Hardened LTE networks must provide the services required by each of the three sectors. Each sector uses broadband in different ways — not just for streaming video and imaging with database access but for low-latency telemetry and real-time control for utilities and transport — at ultra-low cost.

5. Will commercial networks be able to overcome deep-rooted preferences for state control of any network for public safety? This is not simply a legal, regulatory or economic question.

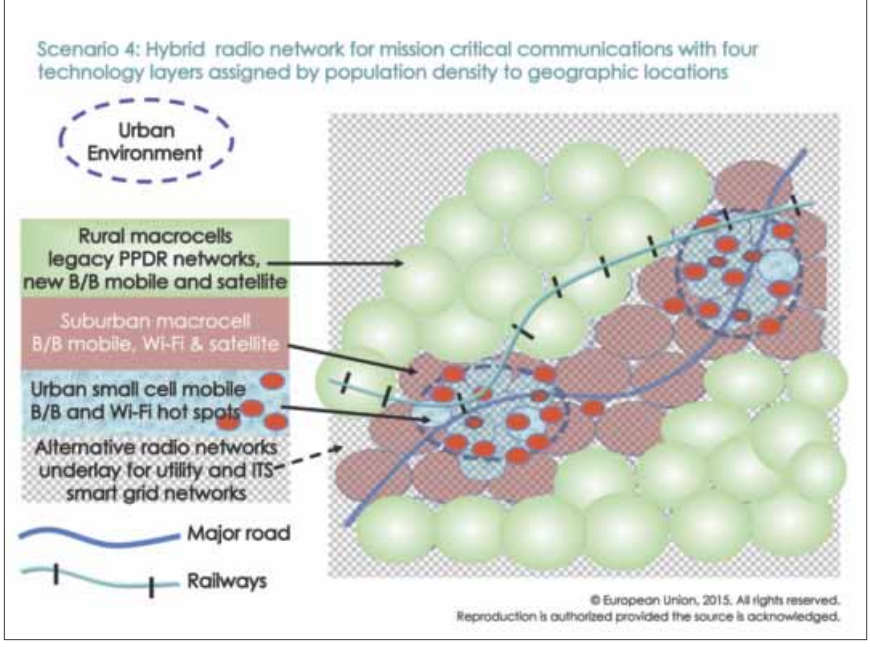
With increasing pressure on budgets, each member state may eventually consider moving to commercial networks if the five conditions above can be met. A key tenet of this approach is that governments pay for commercial network hardening, rather than for a dedicated network, because they will still save money.

The commercial MNO model is planned for the U.K. government's Emergency Services Mobile Communication Project (ESMCP), now under negotiation using the national MNOs in a three-contract tender.

Five Scenarios Examined

The study built five scenarios. The scenarios were based on different deployment configurations, ranging from dedicated networks with specialized equipment to commercial networks and equipment, with various permutations including more advanced networks and hybrids.

Costs and the added benefits of broadband were the basis for comparing these scenarios to assess their relative value to their users and to society. The first scenario — continuing with current dedicated networks and equipment — provided a baseline. Scenario 2 considers the use of hardened commercial networks. But other factors, including the degree to which all the sectors are supported, must be considered as well. In that vein, although the hybrid network in scenario 4 (shown on Page 32) is more expensive than the other options with its complex architecture, it should serve utilities and



intelligent transportation systems (ITS) better than either a commercial or dedicated network, with the flexibility to incorporate existing networks and enable progressive migration.

New Regulations

Specific regulatory measures may be needed to reassure the three sectors — particularly utilities with legal obligations on continuity of service — and to ensure that MNO performance is maintained over decades. Measures in specific areas are needed to build the confidence of users in the MNOs by following these four guidelines:

1. MNOs must be prepared to upgrade to high standards of reliability and fix service failures quickly without diminishing that commitment over the long term.

2. MNOs must accept 15- to 30-year contracts with mission-critical customers, while keeping to the contracts for the term, without arbitrary changes in service conditions.

3. MNOs must cooperate with other MNOs and mobile virtual network operators (MVNOs) in handing over a mission-critical call to another operator with a better local signal, for example.

4. There must be readiness to submit cost-based pricing analyses of tariffs with open-book accounting for national regulatory authorities (NRAs) and government clients, with a willingness to offer new charging regimes (e.g. flat-rate unmetered use). That also implies removal of excessive charges for international roaming across the EU and avoidance of surprise charges for agreed services.

To realize these obligations, the

current powers of NRAs could need certain key expansions:

1. NRAs would need the authority to mandate MNO support for mission-critical services. There are two logical ways to implement this, both of which set specific conditions to operate a service. First, as a condition of operation as an MNO or an MVNO, future licensees must agree to provide mission-critical services. That would entail hardening for resilience. Another alternative is that any purchase or exercise of a spectrum license brings with it the obligation to support mission-critical services for as long as the license is valid, with its concomitant conditions on resilience and coverage. The grant of spectrum conditioned on mission-critical provisions offers NRAs the power to reassign the spectrum to a new operator if the original one fails to perform. This mechanism ensures that the spectrum is not lost.

On the positive side for the MNO, it is a rare obligation that brings with it a new revenue stream accompanied by long-term government investment in resilience that would benefit all users of the network long term and further drive revenues.

2. NRAs also need the power to introduce regulations that support and reinforce the provisions of long-term MNO contracts with mission-critical users. Measures for vigilance throughout the terms are needed as well.

3. NRAs should be authorized to grant priority access for mission-critical communications, including call handovers between MNOs.

4. NRAs should support governments in setting tariffs for mission-critical services by researching the actual costs of MNO operation, using forensic accounting and comparative cost studies with other NRAs.

Within the right regulatory framework, commercial mobile networks could be suitable for mission-critical communications. In Europe, each member state must decide independently what approach to take. However, guidelines from the commission on NRA roles, actions, powers and responsibilities vis-à-vis MNO contracts with mission-critical users could be useful to support a transition to a commercial broadband platform. ■

Simon Forge, director of SCF Associates, has more than 25 years of experience in the information industries, principally in the United Kingdom, France and Italy. His strategy and economic studies have been used by major systems vendors, government and telcos to establish new directions, often on spectrum policy.

Robert Horvitz has been involved with spectrum policy issues for more than 35 years, initially as a radio journalist and more recently as director of the Open Spectrum Foundation in Amsterdam. He co-authored the recent EC report on commercial cellular's suitability for mission-critical applications with Forge and Colin Blackman. Email comments to editor@RRMediaGroup.com.

Brazil's World Cup Lessons

Photo courtesy Motorola Solutions

Brazil takes advantage of its World Cup public-safety LTE and P25 networks as it readies for the 2016 Summer Olympics. **By Paulo Cunha**

The average citizen is likely unaware of the complexity of what it takes to communicate effectively and clearly using a wireless device. It requires a complex system of communications infrastructure spread over a large area and operated by personnel dedicated to making sure the right people get the right information when it's needed. When it comes to managing large-scale events and public safety, these complex systems become critical. They enable public agencies and departments to coordinate responses and plan for what's next in a timely and efficient manner.

2014 World Cup

Brazil hosted the 2014 International Federation of Football Association (FIFA) World Cup and now prepares for an even larger event, the 2016 Summer Olympic Games.

The FIFA World Cup attracts millions of fans from hundreds of countries around the world, convening in several cities in one nation. Planning and construction for the 2014 World Cup in Brazil started years in advance. A two-year trial of the country's public-safety Long Term Evolution (LTE) broadband network, and enhancements made to its existing Project 25 (P25) radio network, were put to the ultimate test by 5 million tourists, athletes and local residents.

Because of Brazil's unique geography, upgrades had to be made to the radio network to provide for greater interoperability and to ensure more effective communications across departments and cities. This was done with a variety of solutions and upgrades including new APX radios, new and upgraded P25 radio systems and new dispatch centers.

In preparing for the 2014 FIFA World Cup, the Brazilian Army was tasked with updating existing LMR systems to improve interoperability between agencies. More than 80,000 military personnel supported the World Cup and millions of visitors, and their security and safety was the main focus for the public-safety agencies working together to ensure a successful event.

To coordinate this large event taking place over several days and multiple locations, the army worked with Motorola Solutions to deploy in-vehicle LTE modems for faster connections and better surveillance of popular areas in the capital city of Brasilia. Installed in patrol cars, motorcycles, boats and other vehicles, the LTE modems proved to be

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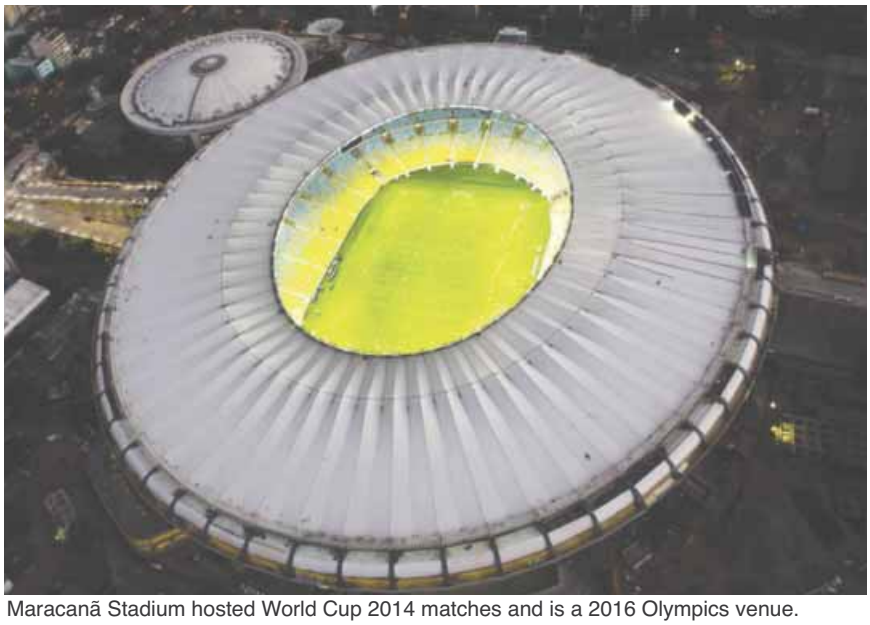

Photo courtesy www.olympic.org

Maracanã Stadium hosted World Cup 2014 matches and is a 2016 Olympics venue.

critical links in coordinating team transportation and monitoring airports, hotels and stadiums. The in-vehicle LTE modems were also installed on motorcycles used to escort authorities, allowing for high-quality images of hard-to-reach areas to be transmitted to the region's defense coordinator. The imaging solution made possible through LTE was seen as an instrumental operational asset, giving military officers exceptional situational awareness in places that were previously difficult to monitor.

The state of Minas Gerais used 1,150 new radios and deployed a trunked radio system with stationary and portable digital repeaters to extend its communications to surrounding areas that had little or no coverage previously. The state of Amazonas made updates to its existing P25 system to prepare for the World Cup, which officials say resulted in response times being cut in half.

Looking back on the 2014 World Cup, the various public-safety agencies involved benefited greatly from the enhanced connectivity and communications provided by the updated P25 system. A Motorola Solutions-installed gateway system provided connectivity among the country's disparate radio systems, building on the existing P25 system to give public-safety users improved

Because of Brazil's unique geography, upgrades had to be made to the radio network to provide for greater interoperability and to ensure more effective communications across departments and cities.

interoperability during the games. This allowed police teams inside the stadium to communicate over radio to aircraft and groups outside, something that was previously not possible with such a large crowd in one location. The gateway system also made it possible for P25 and TETRA users to seamlessly communicate with each other on a variety of devices.

Brazil did not experience any major security problems during the World Cup, and thanks to investments in communications and infrastructure, it was well prepared to swiftly handle a variety of situations. The event was seen as an excellent opportunity by the country to upgrade its public-safety capabilities beyond the 2014 games. Brazil was able to fast track deployments and system implementations to ensure commanders had real-time communications and coverage in all 12 host cities. Paired with LTE modems in Brasilia and other solutions in host cities, the Brazilian Army and participating public-safety agencies now have greater interoperability, enhanced video monitoring and secure solutions that ensure safe delivery of transmitted information, regardless of origin.

2016 Summer Olympics

Making the World Cup a success was years in the making, and it was also considered the country's first test of the enhanced networks and infrastructure upgrades implemented before the first international match.

While the World Cup was large in scale, the 2016 Summer Olympics in Rio de Janeiro will be an even bigger challenge. More than 9 million tickets were sold for London's 2012 Summer Olympics, and the 2016 games could experience even more visitors with tourists eager to visit Brazil's beaches and cities during a major international sporting event. The Olympics will give Brazil a chance to act on communications

lessons learned from the World Cup and ensure a peaceful and safe atmosphere for millions of international visitors. Managing an event of this scale is no easy task, and the army and public-safety agencies are actively preparing and planning for the even bigger event taking place next year by leveraging the country's past experiences.

With just more than a year until the 2016 Summer Olympics, Brazilian public-safety agencies are actively planning for additional upgrades and expansion of the public-safety LTE system. The Brazilian Army is building upon and using its networks in preparation for the Olympics and is planning for a potential merger of the P25 and LTE systems. Brazil's World Cup experience and Olympic preparations are being watched around the globe.

Brazil's Lessons Learned

Throughout the World Cup, first responders recognized the critical need to have both mission-critical P25 solutions and enhanced dedicated data networks to ensure situational awareness for officers on the street. Brazil demonstrated how collaboration among governments, military branches and local police agencies served as a driving force in making sure the initial deployment was successful and could serve as a learning environment on how to deploy public-safety LTE in a highly populated area such as Brasilia.

In the United States, there are parallels with LTE deployments in metropolitan areas such as Harris County, Texas, and the LA-RICS system in California. As these networks evolve, it will be informational to understand how first responders use this technology to take advantage of new applications and how faster connections and more readily available information can enable more effective policing.

The timing has never been better for a major investment in public-safety communications. As events and situations unfold, enhancing the ability for public-safety officers to communicate in real time with data and voice is critical. The modernization of the public-safety communications infrastructure can bring advancements such as mobile broadband, which will in turn bring with it another wave of innovation. Connected emergency management personnel speaking with doctors in real time, and officers with body-worn cameras streaming their points of view to command centers are just two examples of how a prioritized network for public safety can greatly assist citizens and public-safety personnel with better information for more informed decisions. Firefighters and police officers will directly benefit from enhanced situational awareness data applications, such as building blueprints and live video feeds, and collaborate using data that has traditionally not been available at an incident scene. ■

Paulo Cunha is president of Motorola Solutions in Brazil. Cunha has more than 20 years of experience in the IT industry. Cunha has a degree in engineering from ITA (Aeronautics Technological Institute) and is specialized in marketing and finance by Fundação Getúlio Vargas (FGV). Submit comments to editor@RRMediaGroup.com.

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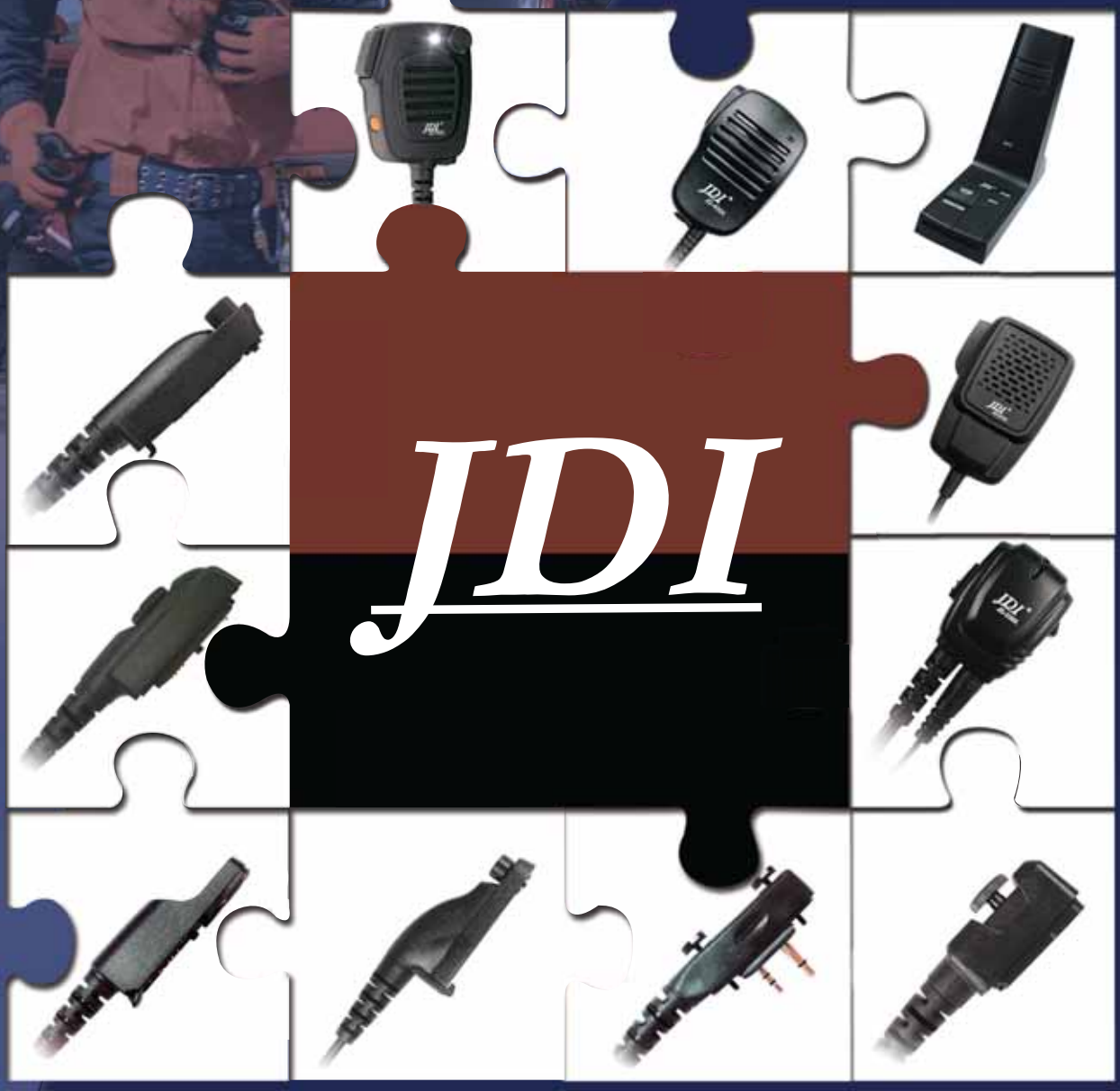

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4RF

4RF's high-capacity narrowband supervisory control and data acquisition (SCADA) radios bring speed and security to critical infrastructure. The Aprisa SR+ is the highest capacity licensed narrowband point-to-multipoint radio, delivering more than 200 kilobits per second (kbps) in 50-kilohertz channels, with seven times greater range than others, company executives said. The point-to-point Aprisa XE provides a wider range of sub-3-GHz frequencies, increased security standards and simple network management protocol (SNMP) management. Supporting both serial and IP, the radios offer over-the-air software upgrade and security key change to ensure smooth, uninterrupted SCADA traffic in standard and 1+1 hot standby protected station configurations.

www.4rf.com

Anritsu

The LMR Master S412E is ideal for field technicians and engineers who test the system performance of narrowband professional mobile radio (PMR) voice and Long Term Evolution (LTE) broadband systems for public safety and critical infrastructure. The product combines over-the-air analysis and coverage mapping of narrowband analog, digital and broadband data systems with a benchtop-class vector network, cable and antenna, spectrum and interference analyzer in a single rugged, handheld instrument. The product is the ultimate field solution for deploying and maintaining critical communications systems, company officials said.

www.anritsu.com

Bird Technologies

The SignalHawk cable and antenna analyzer brings a modular approach to analyzing RF spectrum. The product has the same spectrum analyzer functionality as the company's handheld models (SH-36S, SH-361S and SH-362S) and rack mount products (SH-36S-RM) but is configured as a standalone unit. Weighing 1.6 kilograms, the analyzer is a lightweight solution in a small 19- by 17.8- by 7.6-centimeter package. No special connectors are required to connect the analyzer to a computer because it communicates directly through a standard USB port.

www.birdrf.com

BroadWave Technologies

Model series 552-308-050 is a 50-watt (W) power-rated conduction-cooled termination that has been deployed in commercial and military applications. The 50-ohm device has an operating frequency range of DC to 4 GHz and features maximum VSWR of 1.35:1. The RF connector is N male. Additional heat sinking is required for safe operation of this device at 50 W, requiring the case temperature to be maintained at 100 degrees Celsius or less. The nickel-plated copper enclosure provides excellent thermal conductivity at an affordable price, company officials said. Conduction-cooled terminations are appropriate where space is limited and heat-dissipating metal is available.

www.broadwavetech.com

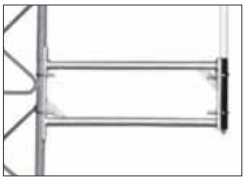
Cobham AvComm (formerly Aeroflex)

The 8800S radio test set combines bench-level performance and features with the portability and ruggedness of a field-level instrument. The set offers a large color display, easy-to-use interface, auto test and alignment, Project 25 (P25) Phase 2 testing, digital modulation analysis, and exceptional power accuracy, company officials said. Fully equipped for field tests — such as repeaters, antennas and RF distribution networks — the test set offers a lightweight, rugged design with 30 G shock and Mil-Prf-28800 Class 3 ratings. The product includes a 2.5-hour internal battery, high power input, fast VSWR/return loss and cable fault measurements, and a measurement range of -140 decibel-milliwatts (dBm) to 500 watts (W).

ats.aeroflex.com

Comtelco

The Tower Side Mount Kit was designed for use with Comtelco XL series base stations. The heavy-duty side mounts feature a galvanized finish. Each kit comes with 4.45-centimeter stainless U-bolts for easy installation on a Rohn 45-type tower. For a larger tower leg, stainless steel strapping (not supplied) can be used.



www.comtelcoantennas.com

Davicom, div. of Comlab

Site monitoring systems from Davicom allow users to remotely monitor and control transmitter sites, reducing operating costs and downtime. Immediate access to real-time site information, such as transmitter status, RF power, antenna VSWR, audio/video levels, mains power presence, temperature, tower lighting, fire alarm and building security status can be easily accessed, company officials said. The units provide automation with decision-making features and commands that go beyond conventional telemetry systems.

www.davicom.com

DragonWave

The Harmony Enhanced is a high-capacity, long-reach, multiservice radio operating in the 6 – 42 GHz spectrum bands. The radio merges the performance and reliability of DragonWave's flagship Harmony

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Radio and Horizon Compact+ into a next-generation, ultra-high-capacity microwave system. The all-outdoor Ethernet solution allows agencies and operators to scale networks with industry-leading system gain, high spectral efficiency and increased capacity enabled through 112-megahertz channel support, 4096 quadrature amplitude modulation (QAM) capability, Bandwidth Accelerator+ and multiple input multiple output (MIMO), company officials said. The product delivers greater than 2 Gigabits per second (Gbps), with scalability via MIMO to 4 Gbps in a single channel.

www.dragonwaveinc.com

Fiplex

Fiplex Digital Fiber DAS, the evolution of the traditional RF over fiber (RFoF) analog distributed antenna system (DAS), improves several limitation and application issues related to analog RFoF technology. Features include channelization, far end communications preservation, wide dynamic range, large fiber distances, gain adjustment per channel, no degradation of the base transmitter station (BTS) uplink sensitivity, built-in spectrum analyzer, phase control and simulcast capability. Additional features include redundancy, no fiber-environment noise transported to RF, remote control capability, reduced inventory items, and National Fire Protection Association (NFPA) compliance.

www.fiplex.com

Keysight Technologies

The FieldFox handheld combination analyzer provides a precise and comprehensive solution for satellite ground station maintenance in the aerospace/defense and commercial markets. The analyzer quickly assures system performance with a high level of confidence to help speed satellite ground station installation and maintenance, company officials said. The product offers precision, frequency coverage up to 26.5 GHz and all-in-one capability, including spectrum analyzer, full two-port vector network analyzer and power meter, needed to perform a range of benchtop-quality measurements in difficult test environments. The analyzer incorporates Option 208, which verifies frequency converters installed in satellite ground stations and performs most required maintenance tasks.

www.keysight.com

Landa Mobile Systems

Landa Mobile Systems' gin pole products include triangular, square and round models as well as derrick units. Gin pole

classifications include class A for less than 454 kilograms (kg) gross loading, class B for 454 – 1,361 kg gross loading, class C for 1,361 – 4,536 kg gross loading and class D for greater than 4,536 kg gross loading. Construction complies with TIA-1019-A 2011. The company offers inspection and training for its gin pole products.
www.landamobilesystems.com

Locus Diagnostics

DiagnostX is an over-the-air (OTA) approach for measuring the alignment of radios. Sophisticated algorithms analyze a radio's waveform while the radio is in the field in normal operation, company officials said. The product is a long-range OTA waveform analyzer for all subscriber radios in a network, is non-intrusive to the radio system and can install at the receive antenna multicoupler. Available for Project 25 (P25) trunked or conventional and legacy systems, the product identifies alignment characteristics by radio ID and reports on frequency error, symbol error 600 and 1800, modulation fidelity, maximum frequency deviation, bit

error rate (BER), and received signal strength indicator/signal to noise ratio (RSSI/SNR) of the received waveforms.
www.locususa.com

Narda Safety Test Solutions (STS)

Narda Safety Test Solutions announced further improvements to Nardalert S3 monitors.

Units can be supplied with a climber's harness that has been tested to cause little effect on the NS3, even when wet. The well-designed pouch securely clips to a climber's harness and allows easy view of alarm LEDs and the LCD, while still adding another layer of protection for the monitor and the user.
www.narda-sts.us

Optoelectronics

The CD100 is a frequency counter/subaudible tone decoder with a frequency range of 10 MHz to 1 GHz. The decoder captures signals from two-way radios and

instantly displays the frequency along with the CTCSS, DCS, DTMF and logic trunked radio (LTR). Ideal for frequency and tone coordination during emergency situations and radio setup in the shop or at remote sites, the product eliminates the need to haul a service monitor to the job site. The battery-operated, handheld unit is easy to use even for nontechnical personnel, company officials said.
www.optoelectronics.com

PageTek

The Flex infrastructure monitor provides status reports, failure alerts and control of equipment at unattended sites, communicating by email, paging, transmission control protocol/Internet Protocol (TCP/IP) messaging and simple network management protocol (SNMP) traps over Ethernet or the public-switched telephone network (PSTN). The Flex monitors up to 72 programmable inputs and nine audio lines,

and switches up to 18 internal relay outputs. Inputs can be configured to operate in analog or digital modes, with user-defined limits, delays, qualifiers and schedules. Arbitration and control of ASCII serial devices is also supported. The Flex is housed in a 48.3-centimeter rack mount cabinet and is powered by external 120 volts alternating current (VAC) or 12 volts direct current (VDC) secondary power sources.

www.pagetek.net

PCTEL

PCTEL mobile towers are durable enough to withstand the harshest environments and are designed with flexibility to accommodate specific equipment needs, including easy deployment and towing. PCTEL's mobile towers are used for oil and gas

industry communications, network expansion and disaster recovery. The company offers lighting towers for large construction sites, rugged low-profile towers for off-road applications, and compact towers for border security and monitoring. Tower heights range from 12.2 to 36.3 meters.

www.antenna.com

Praxsym

The PST line of CW test transmitters is designed to provide test signals for distributed antenna systems (DAS), or the devices can be connected directly to an antenna to provide coverage testing. The

newest model has an adjustable output power of 0 to 22 decibels-milliwatts (dBm). The transmitter covers frequencies including 698 – 960 MHz and 1.71 – 2.17 GHz and can transmit a signal from each band simultaneously. The 12 dBm model has a battery operating time of eight hours with both channels transmitting. A 33 dBm single band transmitter is also available. Test frequencies are available in a variety of ranges from 136 MHz to 2.69 GHz.

www.praxsym.com

RF Industries

Part number RFA-4195-01 is a 4.1 – 9.5 (mini) DIN-to-N adapter kit. The adapters are used in wireless infrastructure and dis-

tributed antenna systems (DAS) installations because of their compact size and low passive intermodulation (PIM) performance. The adapters are available in kit form to keep them organized and protected. The right angle adapter features a radius internal design with constant 50-ohm impedance to 7.5 GHz. Male interfaces have stainless steel hex nuts for easy mating with a torque wrench. All adapters are manufactured with brass bodies and nontarnish, tri-metal plating and a PIM rating of less than or equal to -160 decibels relative to carrier (dBc) using two tones at 20 watts (W). Other models are available.

www.rfindustries.com

Signal Hound

Signal Hound's BB60C is a lightweight, portable and affordable USB 3.0-powered RF spectrum analyzer. The product is a

broadband real-time spectrum analyzer and RF recorder that captures and displays RF events as short as 1 microsecond. It has selectable intermittent frequency (IF) streaming bandwidths from 250 kHz to 27 MHz. With accurate operation from 9 kHz to 6 GHz over its entire temperature range (-40 to 65 degrees Celsius available), the analyzer is well suited for capturing intermittent events in addition to performing complex and remote functions. The product comes with a compiled application programming interface (API) for writing custom software.

www.signalhound.com

Smooth Talker (Mobile Communications)

Smooth Talker's signal boosters improve coverage and performance. The boosters come in complete kits for mobile, building,

open site and machine-to-machine (M2M) applications. The MOBILE X2 PRO is a powerful mobile cellular signal booster that comes with a 5.1-, 27.9- or 35.6-centimeter antenna and provides everything needed to connect on the road, minimize dropped calls, increase data speeds and provide the best mobile call experience possible, company officials said.

www.smoothtalker.com

Sunsight Instruments

The Sunsight Antenna Alignment Tool (AAT), model AAT-30, ensures RF antennas are installed to accurate RF design position in

azimuth, tilt, roll and height. The device is durable and accurate. The small and lightweight alignment tool helps tower crews install antennas accurately. The product views two satellite constellations, GPS and Global Navigation Satellite System (GLONASS), for faster azimuth lock.

www.sunsight.com

Survey Technologies Inc. (STI)

To simplify Project 25 (P25) network

testing, Survey Technologies Inc. (STI) created the Best Server Quality Measurement (BSQM) capability, which enables

entire P25 networks to be performance tested dynamically in a single drive test. All frequencies in the network are scanned and then test mobiles are tuned to the best frequencies where quality and performance measurements are rapidly conducted. Meanwhile, the scanner retests all network frequencies for the strongest signals at the next location, retuning the test mobiles again for rapid quality tests. In this way, a drive tester can quality test an entire P25 wireless network during a single drive study.

www.surveytech.com

TC Communications

Model TC8614, a four-channel analog-over-T1/E1 multiplexer, links or extends various 600-ohm analog, audio and intercom devices and dry contacts over existing

T1/E1 links. The product frequently is used to replace aging unreliable copper wire phone line circuits and to stabilize voice level settings for 600-ohm audio channels. It can also be used as a backup network to ensure business continuity, improve voice quality and increase system reliability in harsh environments. The product is available in two configurations: four-channel two-wire analog with four-channel dry contact, and four-channel four-wire analog with four-channel dry contact.

www.tccomm.com

Telewave

Model 44A, AP is a broadband RF wattmeter that covers 20 MHz to 1 GHz. Features include no band switching, five power ranges, 5-watt (W) full-scale range, -40 decibels (dB) RF sampling port and a shock-mounted meter. The device requires no elements or slugs and can operate in low temperatures. The unit measures 1 – 500 W, measures forward and reflected power, features quick-change connectors and offers an optional TC44 carrying case.

www.telewave.com

Times Microwave Systems

The Times-Protect LP-SPT RF surge protection tester provides the capability to test any lightning protection device or component to ensure its proper functioning and the capability to protect critical and expensive RF equipment. Weighing 16 ounces and powered by two 9-volt (V) batteries, the rugged, handheld unit is completely portable, making it ideal for field use.

www.timesmicrowave.com

Hybrid LTE/P25 Network

Codan launched Stratus, a hybrid Project 25 (P25) and Long Term Evolution (LTE) communications network. The integration of the two technologies leverages strengths of each and provides secure mobile communications anywhere with public cellular coverage while linking into established analog or P25 networks for wide-area coverage. The

network consists of one or multiple Stratus repeaters, Power Center and Rapid Antenna linked over encrypted channels within a virtual private network (VPN) to a fixed Stratus server and an optional P25 Digital Fixed Station Interface (DFSI) console. The network is interoperable with all P25 vendor subscribers and consoles and allows users to expand coverage of an existing network without changing existing P25 infrastructure.

www.codanradio.com

TETRA Radio

Motorola Solutions made its MPT3000 series TETRA radios more durable and added greater audio clarity, improved coverage and better connectivity. New features include IP65/66/67 ratings, coverage

at range extremes and inside buildings, enhanced location-based services, an optional RF identification (RFID) tag that delivers improved inventory and asset tracking, and Bluetooth 2.1 connectivity. The MTP3500 and the MTP3550 radios include a vibrate alert, end-to-end encryption and a man down sensor.

www.motorolasolutions.com

Multiband Mobile

EF Johnson Technologies introduced the Viking VM900 multiband mobile, which allows public-safety organizations to operate in multiple frequency bands while having the ability to upgrade their software from Project 25 (P25) Phase 1 to Phase 2, company officials said. The radio is available in

the VHF and 700/800 MHz frequencies and is compatible with SmartNet/SmartZone, P25 Phase 1 and P25 Phase 2 trunking, simulcast and conventional modes. The device supports over-the-air rekeying (OTAR) and over-the-air programming (OTAP) as well as over-the-intranet programming (OTIP), which enables secure, wireless programming for wireless fleets. Users of EF Johnson's ES series mobiles can easily migrate to the mobiles by reusing their existing equipment, including control heads and vehicle connections, company officials said.

www.efjohnson.com

LTE and DMR Solutions

Tait Communications announced Unify Voice, which bridges LMR and Long Term Evolution (LTE) networks. The product uses SLA's ESChat to integrate push to talk (PTT) over cellular (PoC) with LMR capabilities. It

allows office and field staff to communicate via LMR networks and public or private cellular and Wi-Fi networks, fill black spots, extend capacity and improve the resiliency of critical communications.

Tait also introduced three Digital Mobile Radio (DMR) products for critical infrastructure industries (CII). The company's DMR Tier 2 infrastructure is interoperable with competitor radios and applications that use the DMR Application Interface Specification (AIS). Tait's intrinsically safe radios are explosion proof, meet IECEx and ATEX standards, and are IP67 rated. They support DMR Tiers 2 and 3, analog, MPT-1327, and Project 25 (P25) Phase 1 and 2. The company's GridLink solution adds supervisory control and data acquisition (SCADA) telemetry capabilities to DMR Tier 3 networks.

www.taitradio.com

Mini TETRA Base Station

Airbus Defence and Space introduced an 800 MHz version of its high-power mini

TETRA base station. The station offers up to 15 watts (W) of RF power with a low power consumption of around 100 W. The product is the size of a small suitcase and is suitable for filling coverage gaps or providing

hot spot coverage in places where normal networks may not reach. It can be mounted on a wall or used in a vehicle.
www.airbusdefenseandspace.com

DMR Tier 2 Site Linking

Sepura introduced Site Link for Digital Mobile Radio (DMR) Tier 2 systems operating in multiple locations. The system is a free upgrade for existing Sepura DMR Tier 2 users and allows up to 32 repeaters to be linked via a standard IP network. Using two-slot TDMA architecture, the software allows each timeslot to be designated as either local or wide area. Local communications are repeated only by the home repeater, while wide-area communications are transmitted to other repeaters across the network. Each wide-area slot is given an ID number, and communications are repeated to other slots with the same ID, allowing slots to be allocated independently at each site.
www.sepura.com

TETRA Gateway

TETRA Gateway-DM from **Omnitronics** is a software gateway that integrates Damm Cellular Systems' TetraFlex networks into Omnitronics' radio over IP (RoIP) and dispatch solutions. The gateway is compatible with DX-Altus and RediTALK and supports a network architecture that allows TetraFlex resources to be pooled and shared by multiple operators. The software also enables interoperability with other radio technologies and third-party applications.
www.omnitronicsworld.com

DMR Radio and Base Station

Excera Technology introduced a series of portable two-way radios and base stations that meet Digital Mobile Radio (DMR) Tier 2 and 3 standards. The company's multimode, analog and digital radios operate in trunked or conventional modes and have built-in GPS and Bluetooth. The devices operate in full-duplex mode, meet Mil-Std-810 requirements and are IP67 rated. The company's multimode DMR repeater and base station meets MPT-1327 standards, and provides DMR conventional, simulcast and trunking operation. The system allows auto switching between digital and analog and can also support multirepeater operation, wireless simulcast via IP interconnect, and local area and wide-area coverage.

Excera also introduced a multimode analog-to-digital trunking system that has an open application programming interface (API) that allows it to run third-party applications and software. The system provides high

spectral efficiency, strong security, flexible and reliable networking, and a smooth transition from analog to digital, company officials said. It also offers single-site and multisite operation with seamless roaming capability.

www.excera.com.cn

DMR Gateway

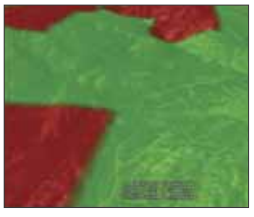
South Midlands Communications launched a gateway for Digital Mobile Radio (DMR) systems. The platform interfaces DMR networks with other systems, such as

fire alarms, GPS trackers and security systems, and runs applications tailored to those systems. The gateway translates proprietary radio protocols to IP, serial or other common communications standards, making it easier to get other applications or systems to talk to the radio network. Other features include mapping with the ability to plot radio coordinates onto a map and provide information such as history and snail trail; an alarm interface that can pass information by text message, email, short message service (SMS) and other methods; and telephone interconnect, which offers a choice of radios for the caller to contact.

www.smc-comms.com

Terrain Analysis Update

SoftWright announced version 6.3 of its Terrain Analysis Package (TAP), which enables mixed batch processing of accelerated and standard coverage studies. A run



button allows users to run the mixed batch processing with a single click. The new release also features additional accelerated propagation modules.

www.softwright.com

LTE Device Tester

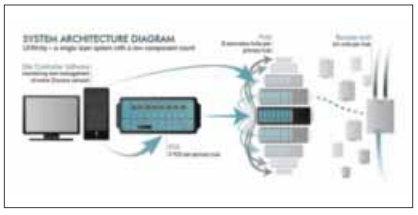
Cobham Wireless, formerly Aeroflex, announced that its TM500 network tester supports coordinated multipoint (CoMP) transmission and reception for Long Term Evolution (LTE) Advanced. CoMP support allows the device to coordinate transmission and reception between different transmitting

and receiving cells using load balancing, coordinated scheduling, and management of signal power and interference, which improves quality of service for heterogeneous networks. In the downlink, mobile terminal data throughput is improved because of reduced interference and increased received power. Uplink received signal quality and cell edge coverage is improved with coordinated reception from different receiving points on the network side.

www.aeroflex.com

In-Building Platform

UNItivity from **Zinwave** is a unified connectivity platform for in-building wireless and IP communications. The platform allows high-density venues to run multiple wireless public-safety and IP data services on a converged infrastructure. The product supports



wireless services between 150 MHz and 2.7 GHz on a one-layer network, regardless of protocol or modulation scheme. The product also includes integrated support for IP services. Core distributed antenna system (DAS) components include a compact, lightweight hub and a remote unit with integrated power supply unit (PSU), increased mean time between failures (MTBF) and an extended operating range. Supplementary components include an active point of interface (POI) that simplifies connectivity to base stations, an integrated media unit and site-controller software.

www.zinwave.com

Remote Analyzer

Narda Safety Test Solutions announced a new version of its NRA RX remote analyzers that automatically detects and takes into account the calibration of Narda antennas and RF cables. The device gives safety and monitoring measurements in units of field

strength, eliminating the need for conversion calculations or corrections. The upgraded capabilities work with any directional antenna in the Narda Test series. A three-axis antenna can be used to monitor electromagnetic fields isotropically. The NRA-Tools PC software allows users to generate datasets with calibration and correction values for antennas and cables from other manufacturers.

www.narda-sts.com

TETRA for Railroads

Damm Cellular Systems' TetraFlex Outdoor System received EN 50121-4 certification, allowing the system to be used in rail applications where that certification is required. The standard specifies emission and immunity limits and provides performance criteria for units that may interfere with other critical components or be exposed to total emissions of the railway environment. The system is rugged and ideal for installation in the dusty and humid environments of metro tunnels or the harsh conditions found alongside rail tracks, company officials said. The system features full redundancy of components and provides communications integration between operations, staff, passengers and emergency units.

www.damm.dk

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2. Which of the following best describes your organization?
❑ A Mobile Communications Dealer/Reseller
❑ B Distributor, Agent, Importer, Exporter, Rep
❑ C Commercial Trunked Radio and Other Wireless Service Providers
❑ D Government/Public Safety/Military
❑ E Business/Industrial/Transportation User
❑ F Communications Manufacturer/OEM/Software Developer
❑ G Engineering and Consulting Firm
❑ Z Other—please specify _____

3. What is your function?
❑ A Corporate/Senior Management
❑ B Operations/Administration Management
❑ C Technical/Engineering Management
❑ D Sales/Marketing
❑ Z Others Allied to the Field—please specify _____

4. Do you recommend, specify or purchase mobile communications equipment or services?
❑ A Yes ❑ B No

5. Is there any servicing of mobile communications equipment at your location?
❑ A Yes ❑ B No

6. In what areas of the world do you do business? (mark all that apply)
❑ A Western Europe
❑ B Eastern Europe
❑ C Middle East
❑ D Asia
❑ E Australia/New Zealand
❑ F Africa
❑ G Mexico/Central and South America
❑ H United States/Canada

7. What wireless technologies does your organization plan to use/buy over the next 2 years? (check all that apply)
❑ A Conventional Two-Way
❑ B Cellular/Personal Communications
❑ C Paging/Messaging
❑ D Mobile Data
❑ E SCADA/Telemetry
❑ F Microwave radio
❑ G Trunking
❑ H Location Technologies
❑ I Tone Signaling (ANI, Encryption, etc.)
❑ J Interconnect
❑ K Satellite
❑ L CAD
❑ M Wireless Broadband
❑ Z Other _____

Q215

U.K.'s Public-Safety Broadband Tender Moves Forward with 8 Bidders

By Sandra Wendelken, Editor

Eight organizations will move forward to the next stage of bidding to run the Emergency Services Network (ESN) under tender in the United Kingdom. ESN is a planned public-safety commercial broadband network set to replace the country's private TETRA network.

The eight companies, a reduction from an original 15, will begin a negotiation stage for the three lots of the contract. The main part of the contract, Lot 3, providing a resilient mobile network for the police, fire, and rescue and ambulance services, includes EE and Telefónica going forward to the negotiation stage. EE and Telefónica operate commercial mobile networks in the United Kingdom.

Airwave Solutions, UK Broadband Networks and Vodafone are no longer in the running for Lot 3. Airwave Solutions operates the current TETRA private system used by the country's public-safety officials.

KPMG is no longer in the running for Lot 1, the delivery partner, for the contract. Airwave, Astrium and CGI IT UK are out of the running for Lot 2, the user services.

With evaluation of bids complete, James Brokenshire, U.K. minister for security and immigration, said a competitive Lot 3 has produced impressive technical and cost-effective bids.

"The procurement process for the new ESN has delivered bids from the mobile industry which are beyond our initial expectations," Brokenshire said. "Not only do they match the operational requirements set by the emergency services but also offer the prospect of significant cost savings for the taxpayer over the existing system."

A statement said the competition for the contracts is leading to the Home Office goals: an enhanced, flexible and more affordable communications sytem for emergency services. The Home Office said the new network will save about £1 billion (US$1.5 billion) during the next 15 years.

"I am confident the organizations we have invited to the next stage will create a communications network that is the best in the world," Brokenshire said.

However, many professional mobile radio (PMR) experts said a commercial network can't serve the coverage, reliability and other critical needs of public-safety users. "No other European country is currently considering this total approach," said Phil Kidner, CEO of the TETRA + Critical Communications Association (TCCA). "Some of the other early adopters of TETRA are instead updating their current critical communications networks with the latest versions of that technology and are looking to add broadband data from non-critical public networks where required."

"I am confident the organizations we have invited to the next stage will create a communications network that is the best in the world."

— James Brokenshire, U.K. minister for security

Organizations going forward to negotiation include:

■ Lot 1 (delivery partner): Atkins, Kellogg Brown and Root (KBR), Lockheed Martin and Mott MacDonald. The partner will provide transition support, cross-lot integration and user support; program management services for cross-lot ESN integration; program management services for transition; training support services; test assurance for cross-lot integration; and vehicle installation design and assurance.

■ Lot 2 (user services): Hewlett-Packard and Motorola Solutions. This technical service integrator will provide end-to-end systems integration for the ESN; public-safety communications services including the development and operation of public-safety applications; necessary telecommunications infrastructure; user device management; customer support; and service management.

■ Lot 3 (mobile services): EE and Telefónica. A network operator will provide an enhanced mobile communications service with highly available full coverage in the defined Lot 3 area in Great Britain, along with extension services to offer coverage beyond the Lot 3 network.

The Emergency Services Mobile Communications Programme (ESMCP) is led by the Home Office to provide less expensive emergency services communications with commercial broadband networks. The contracts for the TETRA systems provided by Airwave Solutions begin to expire in September 2016. A replacement service is necessary, and re-competition is legally required by 2020, the expiry of existing contracts.

The ESMCP contract tender launched in April 2014. Five suppliers originally were selected to progress to the invitation to tender (ITT) stage in each of four lots. However, Lot 4, extension services, was later combined with Lot 3. ■

Sandra Wendelken is editor of *Radio Resource International*. Contact her at swendelken@RRMediaGroup.com.

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