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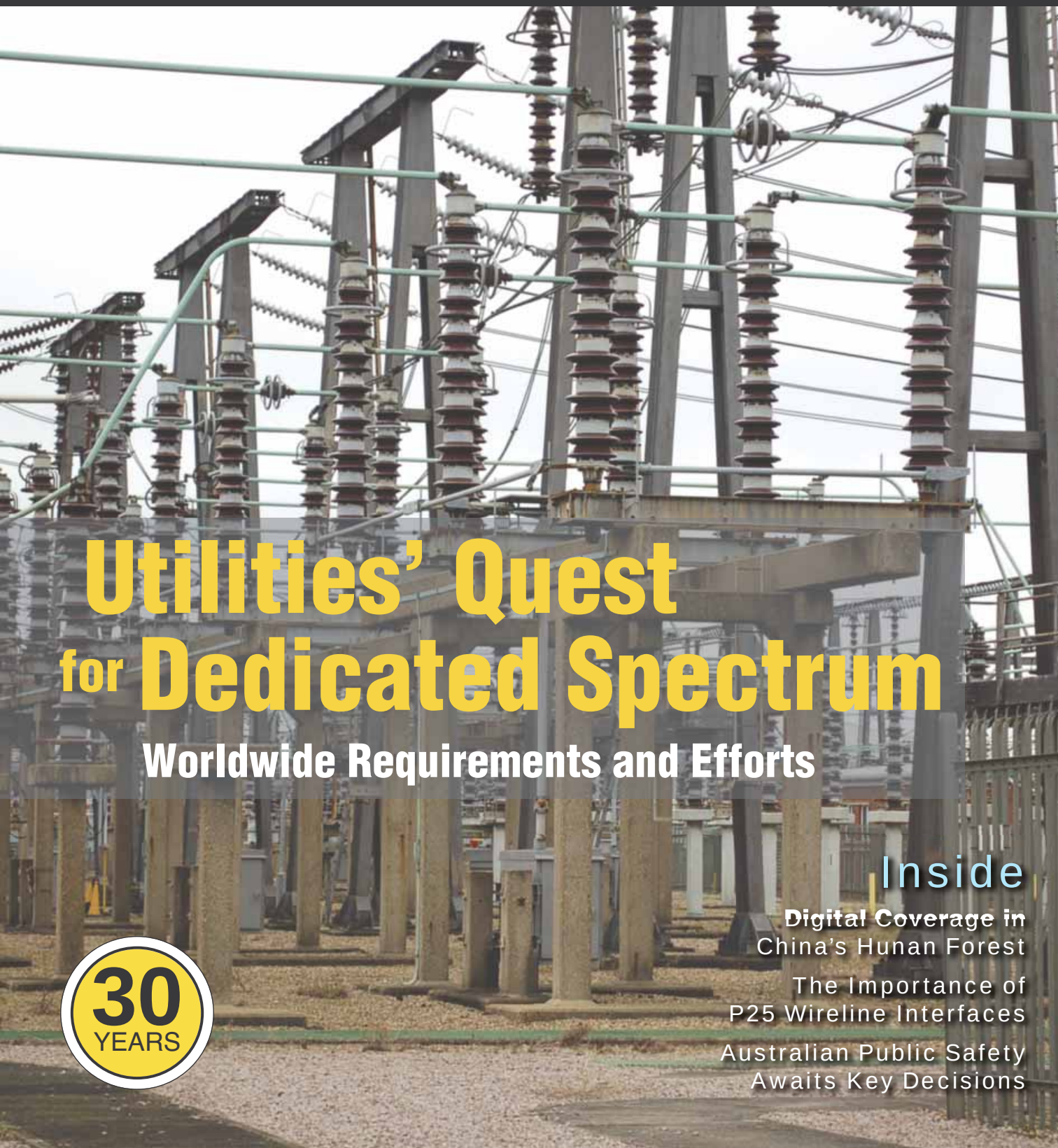

Utilities' Quest for Dedicated Spectrum

Worldwide Requirements and Efforts

30 YEARS

Inside

Digital Coverage in China's Hunan Forest

The Importance of P25 Wireline Interfaces

Australian Public Safety Awaits Key Decisions

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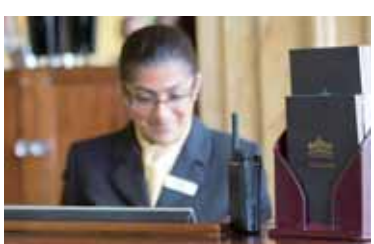

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30 YEARS

Quarter 3 2016

CONTENTS

Vol. 30, No. 4

16 Critical Communications World
The TETRA to LTE evolution was the main theme at the 2016 event in Amsterdam.
By Paulla A. Nelson-Shira

22 Utilities' Quest for Dedicated Spectrum
To prevent the next major outage, utilities in Europe and around the globe need dedicated frequencies for voice and data communications.
By Adrian Grilli

18 Digital Coverage in Hunan Forest
Hunan's vast and fertile forests make digital radio a must-have tool for forest rangers who need coverage and robust features.
By Mike O'Conner

27 The Importance of P25 Wireline Interfaces
The Project 25 (P25) Console Subsystem Interface (CSSI) and Inter RF Subsystem Interface (ISSI) require investment from manufacturers and customers to ensure widespread adoption. *By Mike Schools*

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Caribbean EMS

Photo courtesy Thomas Freteur

Trek Medics International is helping improve emergency response in rural Dominican Republic with dispatching software and trained volunteer first responders.

Outback Communications

Toyota and Flinders University are experimenting with ways to improve emergency communications in the Australian Outback using Toyota's Land Cruisers.

IN EVERY ISSUE

Dispatch 6
The transition to mission-critical voice over LTE *By Sandra Wendelken*

World News 8

Product Expo: Base Stations and Repeaters 31

New Products 36

Events 44

Global Forum 46
The Australian public-safety market awaits key decisions.
By Geoff Spring

READER SERVICES

MarketPlace 41
Advertiser Index 45
Subscription Form 45

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The Mission-Critical Voice Transition

We have all heard about the latest developments in Long Term Evolution (LTE) networks for public-safety communications. This year's Critical Communications World (CCW) highlighted the topic, and it pops up at nearly every industry conference and event around the globe.

Although LTE networks for public safety are being deployed in some countries, most industry players agree they should and will be focused on broadband communications rather than on voice communications for the foreseeable future.

The specifications work for mission-critical push to talk (MCPTT) was completed in March during Third Generation Partnership Project (3GPP) meetings in Gothenburg, Sweden. This means MCPTT will be included in LTE Release 13, also finalized at the March meetings.

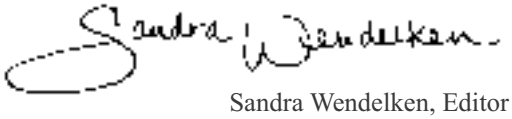
Commercially available products generally follow about two years after a standard is finalized, meaning we might see MCPTT products in 2018. But full-scale adoption will take much more time. Some question whether the industry will ever fully move to MCPTT over LTE and discard professional mobile radio (PMR) networks.

User adoption should drive mission-critical voice over LTE (VoLTE) rollouts. Users must be comfortable with the new devices, networks and services before they trust a complete transition to VoLTE.

The coverage of public-safety LTE networks will be one key factor for the migration timeline for mission-critical voice. First responders can't be dropped when they make an emergency voice call. In-building coverage, in particular, will be much stronger on PMR networks than on LTE systems for many years to come. In addition, LTE networks likely won't be hardened to the same level as PMR networks. Security is also a big issue in the potential transition to MCPTT on LTE networks.

So while LTE networks could be a new and helpful tool to public-safety officials and some critical infrastructure employees fairly soon in some countries, a full transition to mission-critical VoLTE will take much longer. Operators must build trust with public-safety users and tackle any problems before putting lives at stake with MCPTT over LTE.

Email your feedback 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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ASTRID Reveals More Information, Action Plan Following Terrorist Attacks

ASTRID, the Belgian public-safety network provider, released information from a thorough technical analysis of its TETRA network communications following the terror attacks in Brussels 22 March. Immediately after the attacks, an initial analysis offered technical and operational perspectives.

"These unprecedented terror attacks have brought a new reality to our country," said information provided to a Belgian Parliamentary Inquiry Committee. "ASTRID wants to bring all stakeholders involved in security together to see how everyone can prepare even better for potential new emergency situations."

On the day of the attacks, some of the ASTRID base stations in Brussels became saturated because of the exceptional nature of the emergency, the number of public-safety responders and the saturated commercial mobile-phone networks.

Despite an overall heavy load, not a single ASTRID system experienced a technical breakdown; the radio network, paging system and control rooms never faltered. Shortly after the attacks, seven ASTRID base stations — five in Brussels and two in Flemish Brabant, including the base station near the Maalbeek metro station — reached their maximum capacity, preventing some communications from proceeding trouble free at times, in particular between 10 a.m. and noon.

Technical action points and proposals for improvement were defined as follows:

Photo courtesy ASTRID

■ A series of technical measures in the short term were discussed with the users; in particular, a faster deployment of the mobile base station via satellite connection and a clearer framework for communications with the Federal Crisis Center.

■ The capacity of the base stations in Brussels and big cities can be increased by the end of 2016. To achieve this, ASTRID requires additional frequencies. The issue is being discussed with the Belgian Institute for Postal services and Telecommunications (BIPT) and Defence.

■ Approval of the operator's business plan and management contract will enable the optimization and technical renewal of all ASTRID systems. This is already included in ASTRID's business plan, approved by the operator's board of directors and pending approval by the Belgian government. The inter-cabinet working group started talks on the matter.

■ ASTRID already offers emergency services high-speed data transmission called Blue Light Mobile through national roaming on the country's three commercial mobile networks. ASTRID plans to expand this service to allow the emergency services to carry priority voice communications not only via the existing TETRA radio network, but also via Blue Light Mobile. Talks are being held with the Federal Public Service of Telecommunications, BIPT and the three mobile network operators.

On 25 March, ASTRID requested the User Advisory Committee to conduct an operational analysis as well. The use of the radios has an impact on network capacity. Especially during crisis situations, compliance with communications procedures and plans can prevent network saturation.

The ASTRID User Advisory Committee, which represents all emergency and security services, already launched several actions to avoid such disruptions to communications in the future. The committee included all operational aspects in a report dated 17 May, which was presented to the Parliamentary Inquiry Committee.

"We can conclude from the information available that the capacity problems were caused by both technical and operational aspects," the report said. For the operational aspects, the ASTRID User Advisory Committee cites "…that raising awareness and the training of staff still remains one of the key success factors for the optimal use of network and radio communication means."

Within the context of future improvements, the committee said, "…Therefore, improvement concerns everybody," including federal and provincial/municipal authorities, user organizations, ASTRID's technical team and the user committee.

EUROPE

BRUSSELS — The European Commission (EC) April 27 signed a contract to fund the BROADMAP project, coordinated by the Public Safety Communication Europe (PSCE) Forum. The project comprises a team of 15 public protection and disaster relief (PPDR) end user organizations working together to define the future of interoperable broadband applications, services, networks and devices.

The yearlong BROADMAP project began 1 May. PPDR end users from 15 European countries will work to establish a common road map for future evolution of EU PPDR radio communications. A series of workshops will be held around Europe between June and August to consult with an even broader community of end-user stakeholders.

Specifications and transition road mapping of future broadband PPDR radio communications in Europe will be available in 2017. Requirements, specifications, solutions and road maps will lead to new interoperable broadband capabilities deployed with

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an operational expectation within eight to 10 years, a statement said.

Eight of the participants represent the ministry within the country responsible for public safety and seven represent other PPDR end user organizations and public-safety network operators. Forty-eight additional PPDR organizations signed letters of support for the BROADMAP project, expanding geopolitical coverage within seven additional EU and associated countries plus support from stakeholders in the U.S. BROADMAP workshops will further expand these numbers.

The BROADMAP proposal formation was initiated in 2014 on the request of PSCE's user committee members. It has taken 16 months to gather the team of end users and necessary contractual arrangements to start the project. The outcomes are essential to support the future procurement of necessary research and development (R&D) and innovative products needed to fulfill the validated requirements for broadband interoperable networks for PPDR and critical communications.

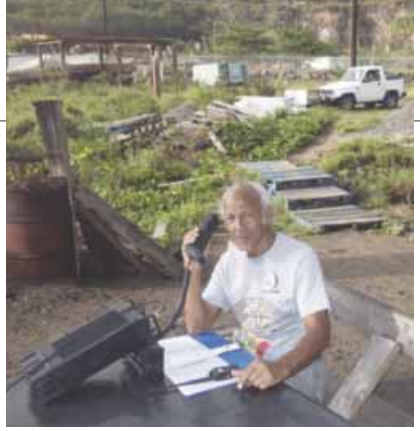
"It's been a lengthy process but the collective enthusiasm of the partnership is unprecedented," said David Lund, president of PSCE and coordinator of BROADMAP. "We have a truly motivated and influential team."

CARIBBEAN

KINGSTOWN, St. Vincent and the Grenadines — Barrett Communications signed a two-year contract with the Rainbow Radio League (RRL) in the Caribbean under which Barrett is supplying HF equipment, and RRL is installing, operating and maintaining the system.

RRL is a nonprofit community service organization with limited fixed and portable assets based in the Caribbean. The organization, launched in 1995, comprises mainly volunteer amateur radio operators from different fields of work.

A sizeable consignment of demonstration and new equipment from Barrett Communications was shipped by air cargo and is being field tested before being installed at six locations in St. Vincent and the Grenadines.



RRL Director/Secretary Donald Riggs field tests HF equipment in the Caribbean.

Testing the equipment in legacy mode has been ongoing using a variety of antennas in different configurations to determine which works best under local conditions. The results so far, even at low power, are encouraging. The 2090 unit has an outstanding receiver, important because even if users can't communicate with base, they can hear life-saving announcements or commands.

RRL still needs at least three vessels for maritime search and rescue (SAR), an aeronautical response capability and a proper headquarters from which to conduct operations. For more information, contact rainbow_radio_league@yahoo.com.

ASIA PACIFIC

HEARD ISLAND — Inmarsat Government supported the 2016 Heard Island Project, a multidisciplinary expedition to a remote island in the Southern Ocean. The purpose of the three-week expedition, undertaken by Cordell Expeditions, was to provide new information about Heard Island's harsh volcanic environment and to validate satellite communications in severe, and extremely isolated, environments in the Antarctic.

Inmarsat Government provided satellite communications services used to enable radio propagation analysis, TV broadcasts, video secondary school classroom education, video communications and blogging. During the expedition, Inmarsat's Broadband Global Area Network (BGAN) service kept worldwide followers updated promptly about expedition activities. Inmarsat Government provided terminals and managed communications services to support the base station and remote scientific teams collecting samples and important documentation of the environment, including its unique flora and fauna.

Inmarsat's BGAN service played a key role in the expedition's radio science medium frequency (MF) and HF propagation experiments as they contacted more than 75,000 other stations during unusual solar geomagnetic conditions. It also enabled reliable communications with the science teams when they travelled to a number of areas remote from the base camp to gather samples and conduct high-resolution photography of the many unusual features here.

The group also carried out a major amateur radio operation using the call sign VKØEK. The Cordell Expeditions group developed a unique technology that enables near real-time internet display of the radio operations. The system, called DXA, uploads the radio log data through Inmarsat satellites to an internet server once per minute, providing viewers with an almost real-time graphical interface to the expedition. The latest version, DXA3, was deployed on Heard Island.

INTERNATIONAL

LONDON — Two new market research reports show a strong critical communications market for the foreseeable future.

The global professional mobile radio (PMR) market is expected to record a compound annual growth rate (CAGR) of more than 10 percent until 2020, according to the latest research report from Technavio. The report considers revenue generated from the sales of PMR users' handheld devices

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with technologies such as TETRA and Digital Mobile Radio (DMR), PMR transceiver devices and gateways.

Other driving forces behind the growth of the global PMR market are the penetration of PMR into diverse industries, increased demand for broadband data on PMR devices for public safety and the need for TETRA in the transportation sector.

The PMR market is experiencing a significant demand for TETRA in the transportation sector such as railway stations, metros, seaports, bus stations and airports. As of 2015, the transportation sector contributed more than the public-safety domains in terms of the number of individual networks deployed worldwide.

An IHS report found that the market will be worth US$18 billion by 2019. The two largest market segments are command-and-control solutions and licensed mobile radio terminals, which together account for more than two-thirds of critical communications revenue.

"Between 2013 and 2019, the market will grow an impressive 33 percent," said Thomas Lynch, director of critical communications research at IHS Technology. "Economic constraints have forced public sector cuts in many countries, yet we are seeing strong growth on a global scale."

The transition to digital continues as users in all vertical sectors, from utilities to public safety, switch from conventional analog systems to digital technologies. The installed base of cost-optimized digital technologies is forecast to increase from nearly 5.7 million radios in 2014 to more than 15.7 million radios in 2019, the most growth of any two-way technology.

Cost-optimized digital technologies have given price-sensitive users access to digital technologies. These technologies, including Professional Digital Trunking (PDT), DMR, digital private mobile radio (dPMR) and NXDN, have various price tiers that appeal to a wide range of customers.

Although Long Term Evolution (LTE) has been on the critical communications agenda for some time, its market entry has been slow and protracted. Challenges surrounding spectrum remain at the forefront.

"With more than 74,000 device shipments estimated for 2016, private and public LTE systems for critical communications users will now start to have a direct effect," Lynch said. "End users from several sectors are

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implementing LTE, and some have chosen it over TETRA or DMR. As well as public safety, this is occurring mostly in small and contained networks, often in remote locations — for example, oil and gas platforms and in mining operations. This is a trend in Africa, for example, where it has been easier to leap over technology generations rather than set up a mobile radio infrastructure beforehand."

"Given the high availability of PMR and the prospect of using LTE technology in critical communication processes, the demand for devices that support LTE and PMR networks is rising among organizations," said Rakesh Kumar Panda, a Technavio lead industry analyst for machine-to-machine (M2M) and connected devices. "The use of LTE in commercial spaces to maintain public safety is expected to gain significant momentum over the next four years, and consequently the global PMR market will also grow."

NEW YORK — Motorola Solutions Chairman and CEO Greg Brown highlighted the company's recent Airwave acquisition and the public-safety Long Term Evolution (LTE) market as key growth opportunities for the company.

"Airwave is an acquisition that we would do all day long," Brown said during a U.S. investor conference. Of the company's $6 billion in revenues, about 60 percent is from products and the rest comes from managed and support services. About 25 percent, or $1.5 billion, is recurring revenue, something the company hopes to see increase, Brown said. "Airwave is a key factor there," he said.

Managed and support services have been a significant growth driver for Motorola, Brown said. During the past five quarters, those revenues have grown in the high single digits each quarter. In the first quarter of 2016 alone, the company saw 30 percent growth, mostly because of the Airwave acquisition, in managed and support services. Even without the Airwave acquisition, managed services still increased about 6 percent in the quarter, Brown said.

He said managed services and support can increase at a multiple of the product side.

Brown highlighted public-safety LTE as a key growth opportunity for the company as well. He also said the command center market is another key growth area. He said the company's strong position in the incident management market, as well as its software portfolio, give it a good opportunity to offer integrated command center solutions that marry incident management with situational awareness.

Satellite Navigation System Upgrades, Buildouts Move Forward

The world's four major satellite positioning systems — Europe's Galileo, China's BeiDou, Russia's GLONASS, and the U.S. GPS systems — have all been bolstered with updated satellites that provide longer service, updated functionality and interoperability with other navigation systems. The systems are expected to play an increasing role in future services and tools that affect public-safety and mission-critical communications.

Coverage provided by Europe's Galileo system is increasing after the European Space Agency (ESA) launched the ninth and 10th satellites to its planned constellation of 30 satellites in medium earth orbit, including 24 active satellites and six spares. The satellites were launched in September 2015 and underwent in-orbit testing before beginning live broadcasts earlier this year. A Galileo control center in Oberpfaffenhofen, Germany, tested command-and-control functions, while a control center in Fucino, Italy, tested navigation messages to users.

The Galileo system is a collaboration of the European Space Agency (ESA) and the European Commission (EC) to build an independent satellite positioning system under civilian control. The system is expected to be interoperable with other satellite navigation systems, including GPS.

China has been busy filling out its constellation of 21 planned satellites that will make up its BeiDou navigation system. In February, China launched its 21st BeiDou satellite into space from the Xichang Satellite Launch Center in Sichuan Province. Chinese media reported that the satellite is entering a testing phase and is already successfully transmitting signals back to earth.

The first 16 satellites in the constellation focused coverage on China and neighboring regions. The second phase, which includes five satellites to date, is expected to expand coverage worldwide. The new satellites are testing intersatellite cross links and a new navigation signaling system.

China began development of the BeiDou system in 2000 and expects the completed constellation to include 35 satellites in both geostationary and nongeostationary earth orbits by 2020.

A modernization and renewal effort on Russia's Global Navigation Satellite System (GLONASS) began in the early 2000s, and the system was restored to 24 satellites in 2011. In December 2015, the system was declared officially completed. Russia continues to launch satellites to replenish GLONASS satellites, including a launch of a Soyuz rocket carrying the 51st GLONASS satellite in early February. Newer generation satellites with longer service life are being developed and are expected to launch in the next couple of years.

The U.S. GPS system also has been undergoing a modernization effort aimed at replacing aging equipment and introducing new capabilities. The U.S. Air Force successfully launched the 12th and final IIF category satellite in February aboard an Atlas V 401 rocket. The next phase, GPS III, is underway. The Space and Missile Systems Center (SMC) released a request for proposals (RFP) in January for GPS space vehicles.

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CC Finland celebrates 14 companies cooperating with open standards.

Keynote panel session discusses the TETRA to LTE transition.

CCW: A Glimpse into the Future of Critical Communications

The evolution from TETRA to LTE was the paramount theme at the 18th annual Critical Communications World in Amsterdam. By Paulla A. Nelson-Shira

Amsterdam, with its diverse and progressive culture, was the perfect city to host the 18th annual Critical Communications World (CCW). With new technology tracks covering control rooms and data apps to cybersecurity and emerging technologies, the 2016 CCW demonstrated that it has successfully evolved from a European TETRA event to a global, comprehensive critical communications conference that is diverse and progressive. This year's show boasted 61 new exhibiting companies. It was the largest CCW to date, with more than 150 exhibitors, and nearly 4,000 attendees. There were so many sessions it was difficult to choose which ones to attend.

The opening reception at CCW was well attended with champagne flowing at the Critical Communications Finland booth. The user-driven pavilion celebrated 14 companies coming together in cooperation for the benefit of Finland's citizens and was a real-life example of how open standards can work to improve operations. Exhibitors unveiled new smaller radio terminals, hybrid devices that incorporated Long Term Evolution (LTE) and new apps. For more product information, please go to Page 36.

A recurring theme was that TETRA is not dead and should be around for at least 10 – 15 years. For the first time, however, LTE was not a taboo word in the TETRA community. It was readily acknowledged that LTE would be used to stream broadband, and the future would include hybrid networks for several years to come. According to David Lund, president, Public Safety Communications Europe (PSCE), when northern U.K. flooded recently, all the LTE networks were down, yet the TETRA system worked.

Many users will continue to use their TETRA networks for the foreseeable future because they've invested a lot of money, and it simply costs too much to run two systems. According to Tor Helge Lyngstol, director general of Norwegian Directorate for Emergency Communication (DNK), "Users should not be concerned about technology. They need to focus on the services they need."

The adoption of LTE for public safety varies greatly by country. In a small country with an aging system, LTE might be the answer, as it was in Kenya. In a mature TETRA market, it could take many years to transition to LTE. It takes spectrum and more money than many countries can afford. Society, however, is getting more dependent on broadband, and many politicians don't understand how the technology works in a public-safety environment. There are tremendous security and backup issues, just to name a few.

Gordon Shipley, program director, U.K. Emergency Services Mobile Communications Programme (ESMCP), was steadfast in his timeline for UK's new public-safety LTE network. The goal is to complete the system and

Panel session: You will be hacked; deal with it!

Gordon Shipley presents the U.K.'s Emergency Services Network plan.

begin the transition phase by the fourth quarter of 2017. It's a daunting task to say the least. When Motorola Solutions bought Airwave, the U.K. public-safety network, many people questioned the decision. The acquisition will likely turn out to be a smart move. It is highly unlikely that the transition to LTE will happen overnight, so Motorola will continue to see the benefits of recurring revenue. Plus, the company will also benefit from first-hand experience with a major public-safety LMR-to-LTE transition.

Even if a country has secured both adequate spectrum and the funds to replace its existing professional mobile radio (PMR) system or augment it with LTE, the next big hurdle to overcome is security. Commercial LTE systems are not public-safety grade, and building a physical and cyber secure LTE system from the ground up is expensive.

If the network is not built securely from the onset, the cost to fix it will be even greater. Not only does the network need to be secure, but every app and connected device must also be secure. There needs to be end-to-end encryption because a system is only as secure as each of its components. According to the cybersecurity panel, the overconfident company is the one most likely to be hacked. Although standards are important, the ability to be agile and to keep up with the quick-paced internet industry could prove difficult for systems bogged down by legislation.

Each country must also consider privacy. Some societies that value safety over privacy may agree to have sensors and cameras at every street corner, while nations that value privacy more than security will be limited in their use of such devices. For years Motorola has been showing the "connected" officer, who basically has eyes in the back of his head and data streaming both in and out of his gear in real time. Perhaps an officer in China might agree to this, but I doubt any public-safety official in the free world would concede.

CCW was more than educational sessions; it was also the perfect setting to network with industry decision makers and see the latest product offerings on the market. (See Page 36.) To top it off, who could pass on a favorite beer at the Heineken event or Rohill's fresh-made Stroopwafles. When in Amsterdam …

Next year's CCW will return to Hong Kong. ■

Paulla A. Nelson-Shira is the publisher of *RadioResource International* magazine. Contact her at pnelson-shira@RRMediaGroup.com.

Photo copyright Chensiyuan

Digital Coverage in Hunan Forest

Hunan's vast and fertile forests make digital radio a must-have tool for forest rangers who need coverage and robust features. Other industries, such as mining, are also deploying digital radio technology for similar reasons.

By Mike O'Connor

China's Hunan province holds a famous place in Chinese history. The region first entered China's written history near 350 B.C. under the rule of the kings of the Zhou Dynasty. Today, Hunan's fertile forests provide agricultural and forestry exports that are vital to the region's economy, contributing to a gross domestic product (GDP) of about US$300 billion annually.

Rich natural resources make up about 60 percent of the province's total surface area, but for forestry workers, Hunan's rugged, natural landscape can pose potential risks for bushfires and other emergencies.

In forestry, as with any sector where worker safety can never be compromised, having reliable, instant

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As RF energy is introduced into more and more industries, there is a greater need to detect and minimize personal exposure. As with all things, when such a need is created there is a rush to fill that gap with cheap and questionable imitations. While it might be okay to buy a knock-off Rolex, the same practice, when applied to RF safety could be quite hazardous to your health.

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Mining is one of several sectors where application development in two-way radios has brought considerable safety and productivity benefits.

voice communications is absolutely essential. Voice communications protect workers by connecting them to their colleagues and associates in the field, as well as control room operators who have an overarching view of their operations.

With worker safety and protecting natural resources in mind, Hunan province chose a radio solution that integrates digital two-way radios and repeaters with a control room dispatch console application for centralized control and monitoring of the radio network and workers at all times. Additionally, Hunan's MOTOTRBO network uses the internet to extend radio network coverage across a vast geographic area to reach the region's counties and cities.

With the new radio system, Hunan's forest rangers are working across a wide geographic area and can use radio communications to report the first signs of fire. This helps ensure that emergency resources are deployed quickly and effectively to protect lives and the region's natural resources.

The new system also supports data transfer. By using GPS to pinpoint the location of nearby team members and resources, the control room can improve response time in critical moments, giving forestry operations greater control and flexibility in emergency situations.

Rich natural resources make up about 60 percent of the province's total surface area, but for forestry workers, Hunan's rugged, natural landscape can pose potential risks for bushfires and other emergencies.

Forestry workers are also increasing their daily operational efficiency through the exchange of text messages and automatic alerts between the province's control room and radio users in the field. The radio handsets can withstand the hardest knocks while providing clear voice communications with enhanced noise-canceling features for reliable operation in the noisiest environments.

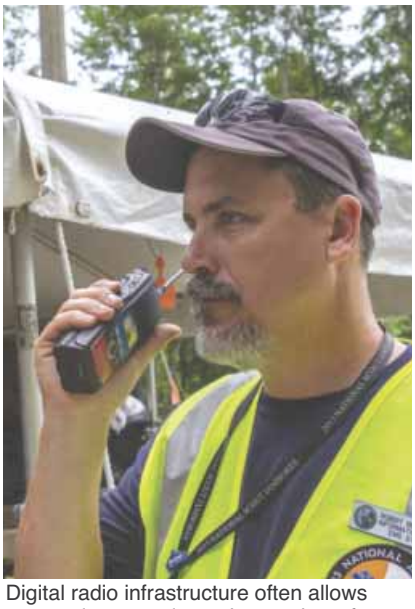
Other Mission-Critical Industries

Increasingly, digital radio solutions are helping forestry organizations and many other safety-exposed industries achieve their operational objectives for worker safety and productivity. In support of safety and productivity, an ecosystem of application developers can enhance the two-way radio experience.

Pressure on costs and resources continues to build in safety-exposed industrial sectors including mining, oil and gas, manufacturing and transportation. At the same time, increasing customer expectations place additional pressures on these industries to reach higher levels of productivity and performance.

These sectors are also experiencing significant change within their workforces. The next generation of employees expects to use smartphones, tablets and other devices as their primary communications tools at work. This trend has had a major influence in the development of new technologies such as broadband push-to-talk (PTT) services that enable traditional radio systems to communicate securely and reliably with Android and iOS-based personal devices via broadband.

In an industry such as mining, the need for greater worker safety has propelled the development of more smart two-way radio applications to pinpoint the location of employees. Consider, for example, the important



Digital radio infrastructure often allows companies to scale up the number of users through temporary use of radio channels.

In an industry such as mining, the need for greater worker safety has propelled the development of more smart two-way radio applications to pinpoint the location of employees.

difference that GPS and indoor location tracking services can make when it comes to ensuring staff are safe and accounted for on mine sites before activities such as blasting take place. Radio handsets also come equipped with additional safety features, such as emergency alert buttons and man-down features that automatically trigger alarms in control rooms when workers may be injured.

As the push for greater productivity and reduced downtime continues, another important innovation has been the ability to provide remote software updates on digital radios. In a manufacturing environment, this capability could enable workers to continue their daily tasks while live software updates are completed in the background — a substantial improvement over having to physically plug in every radio to upgrade it with new software.

Another key development has been the evolution of radio infrastructure through technology to rapidly scale up the number of radio users through the efficient, temporary use of radio channels, reducing capital investment costs while providing access to radio networks to more users.

These industrial sectors strive for more ways to boost productivity while protecting employees. There is considerable opportunity for more new applications to increase the capability and value of digital two-way radios. ■

Mike O'Connor is vice president radio channel sales, Asia Pacific and Middle East at Motorola Solutions. Email feedback to editor@RRMediaGroup.com.

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Utilities' Quest for **Dedicated Spectrum**

To prevent the next major outage, utilities in Europe and around the globe need dedicated frequencies for voice and data communications.

By Adrian Grilli

Since the 1950s, utilities have used radio communications to monitor and control their networks. Voice communications with staff in the field has always been a valuable asset for improving efficiency and safety. The ultimate beneficiary, the customer, gains reliable and affordable electricity, gas and water supplies. Sustainability has been added as a third dimension, creating the utility "trilemma" — reliable, affordable and sustainable.

The focus on reducing carbon dioxide emissions through widespread deployment of renewable energy, demand management and energy efficiency requires more extensive communications than previously necessary. While public networks can meet many utility telecommunications requirements, some critical core needs are likely to require specialized networks. Radio is ideally suited to meet these needs, but dedicated radio spectrum is necessary to guarantee operations.

Radio spectrum below 1 GHz is ideal for obtaining resilience and geographic coverage. That spectrum is supplemented in some cases by spectrum in the 1 – 3 GHz range for increased capacity. Voice communications is important, but existing and future utility data requirements are intrinsically different from public mobile data networks, including the following:

- Typical data rate requirements that are much slower than consumer data rates, from 2.4 kilobits per second (kbps) to possibly 10 Megabits per second (Mbps)
- Enhanced resilience that enables networks to operate in the absence of main electrical power for extended periods
- Geographic coverage to include less populated areas if they contain significant utility infrastructure
- Exacting availability, latency, jitter and synchronous requirements
- Upload centric, opposed to download centric for public data networks
- High levels of security to prevent malicious disruption of utility operations
- Longevity of product support in recognition of longer utility investment cycles

Harmonization of spectrum allocated to utilities on a Europewide basis will bring industrial support benefits,

Harmonization of spectrum allocated to utilities on a Europewide basis will bring industrial support benefits, reduction in cross-border interference and lower costs to energy consumers.

reduction in cross-border interference and lower costs to energy consumers.

Telecommunications Applications

Electric utilities are dominant in the use of utility telecoms to add intelligence to their networks for diverse applications, including:

■ Teleprotection to isolate parts of the network when a fault is detected, while at the same time avoiding interruptions to other users of the network. These systems operate before fault currents reach levels at which protective circuit breakers operate, minimizing disruption to supplies and reducing the risk of damage to infrastructure because of excessive current flows.

■ Supervisory control and data acquisition (SCADA) systems to initiate controls and monitor voltage, current, temperature levels and switch positions throughout the network, with the capability to reconfigure the network remotely in response to changing demand and faults.

■ Remote smart metering to monitor consumption, electricity supply quality and demand management either by switching loads directly or indirectly, the latter by time-of-use price.

■ Distributed automation whereby monitoring and control functions are embedded in the network to remotely control equipment and reconfigure the network automatically without operator intervention, reporting automation system actions to the control room.

■ Dynamic asset management to continuously monitor the condition and loading of assets on a dynamic basis, increasing capacity and avoiding the need to re-enforce networks. Real-time measurements can also help predict failures, avoiding breakdowns and interruptions to customer supplies.

■ Mobile voice to enable communications between the control room and field staff for routine operations, safety and emergency restoration of supplies.

■ Closed-circuit television (CCTV) to oversee remote sites for security, safety and monitoring of assets.

Gas transmission and distribution companies make extensive use of SCADA to monitor and control their

Utility telecommunications growth will come from increasing geographic coverage of the monitoring networks and speed of response, rather than increasing data rates.

networks. Gas network losses are proportional to pressure; the lower the pressure maintained throughout the network while maintaining adequate outlet supply, the greater the efficiency. Mobile voice and data networks are also used to maximize proficiency in managing field staff's response to leakage reports.

Energy supply requires telecommunications to facilitate management of smart meters, dynamic tariffs, demand management, off-supply detection and fraud detection.

Water companies use extensive SCADA systems to manage clean water supplies, wastewater/sewage removal and floodwater defense. The SCADA systems direct the network to curtail pressure while maintaining a fixed minimum, thereby reducing energy use and leakage. They also monitor water quality to guarantee public drinking water safety.

New technologies and requirements are emerging, calling for additional telecommunications provisions. In electricity, devices called synchrophasors can enhance network stability as a more distributed renewable generation is incorporated into electricity networks, reducing the likelihood and severity of catastrophic cascade failures. In gas, future networks will encompass a wider range of gases from diverse sources requiring more complex control to maintain calorific value and flame quality. In water, increasingly stringent environmental standards and challenges to water management, brought about by climate change, will require more extensive SCADA.

Why Do Utilities Need Radio?

Utilities make extensive use of fixed network solutions, using commercial telecom facilities and their own copper and fiber-optic cables. In the case of electricity, data can be transmitted by modulating the 50/60 hertz supply on the power cables.

However, radio is also essential. The telecoms architecture can be designed for communications needs rather than following the physical infrastructure of the electricity grid. With radio, numerous geographically spread (decentralized) assets can be reached easily and quickly. Radio systems are better able to withstand weather-related incidents that disrupt and destroy physical infrastructure. When fixed infrastructure is damaged and needs repairing, the priority is restoring the primary service, leaving the telecoms support structure unmended. If an embedded telecoms cable fails, the primary service often cannot be interrupted to repair the telecoms element. Radio serves remote areas and can be deployed rapidly in response to changing requirements. Radio is essential to maintaining communications with the mobile workforce maintaining and repairing the network.

Overall, time scales for energy and environmental policy do not permit the deployment of significant additional fixed telecoms infrastructure, necessitating the deployment of radio solutions if agreed policy goals are to be achieved.

Utility Requirements?

Although recent developments facilitate carrying utility communications over commercially available networks, utilities retain a number of unique requirements. Utility telecommunications growth will come from increasing geographic coverage of the monitoring networks and speed of response, rather than increasing data rates. Commercial and domestic requirements are moving toward 30 Mbps and possibly 100 Mbps, but many utility requirements can be met with 2.4 kbps per site, which could potentially increase to 10 Mbps.

Geographic coverage includes less populated areas, especially where power lines traverse remote regions, so there are few incentives to attract commercial telecom operators. Renewable energy and water resources are also often in remote locations. Enhanced resilience is necessary if networks are to operate in the absence of main electric power for extended periods, which may range from a few minutes to 72 hours and beyond.

Telecom signal latency and asymmetry requirements in the electricity industry are linked to voltage levels, requiring latencies as low as 6 milliseconds (ms) with associated asymmetry of less than 300 ms if protection systems are to function correctly. These requirements emerge from the need to compare in-cycle values across an electricity network in real time where the duration of a half cycle is 10 ms to maintain stability and identify faults.

Commercial networks are inherently download centric, but utility

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networks are upload centric with a small number of control rooms remotely monitoring large geographic areas. Utilities need high levels of security for their telecoms networks, not only in terms of integrity to prevent malicious disruption of utility operations, but also for guaranteed access where denial of service occurs either from network congestion or malicious intent, blocking utilities' network visibility.

While consumer telecom product cycles are decreasing so that products can be obsolete within a year, utility infrastructure has a typical life of 50 years. Telecoms equipment embedded in a large plant operates continuously; replacing obsolete equipment is a major exercise, unlike replacing a Wi-Fi router.

Different Spectrum Requirements

As well as the obvious differences among gas, water and electricity infrastructures, utilities operate in different physical environments with different legacy assets. In dense urban areas, for example, a utility will have access to underground infrastructure with several commercial telecoms providers, but a rural utility will have a lot of aboveground infrastructure and possibly only one commercial telecoms option. Financial considerations also play a role in that some utilities have substantial investments in fiber-optic cables, whereas others may have significant investments in radio towers.

The European Utilities Telecom Council (EUTC) identified a portfolio of spectrum needed by a typical utility with a total of 16 megahertz of dedicated spectrum required in the critical sub-3 GHz region.

Around the globe, utilities are focusing on similar requirements with coordination through a global utility telecommunications council. Although they are unfamiliar with the internecine world of radio regulation, utilities are learning to engage with the European Conference of Postal and Telecommunications Administrations (CEPT), the European Commission (EC) and Parliament, plus the Inter-American Telecommunication Commission (CITEL). In addition, an emerging African UTC is seeking to establish links with the African Telecommunications Union (ATU).

Unless access to suitable spectrum is granted quickly, it is difficult to see how supply quality can be maintained.

Sixteen megahertz for operational utility requirements represents only 1.3 percent of the 1.2 gigahertz of spectrum identified in the European Radio Spectrum Policy Programme (RSPP) to meet the increasing demand for wireless data traffic to allow the development of commercial and public services — a small price to pay for reliable utility services that sustain life and welfare.

Utilities do not have any substantive objections to sharing spectrum or networks with other users, but sharing must support utility requirements, especially for guaranteed access to the network within the specified parameters. However, because systems such as teleprotection and SCADA operate continuously, sharing has to be on a geographic basis.

Emerging Threats

Security is a new area driving utility telecom requirements. This applies to the prevention of malicious network disruption and privacy of customer data, be it individual consumers who do not want third parties snooping on their lifestyles or commercial users vulnerable to rogue traders distorting the energy market.

Recent attacks on utility networks — most spectacularly, the disruption of the Ukrainian electricity networks by an unknown assailant in December 2013 which left 225,000 people without electricity — demonstrate the potential vulnerability of utility supplies to malicious intrusion. The response is ever-expanding security measures, which increase data traffic across utility networks coupled with air gaps between utility control networks and public networks to create secure barriers against denial of service attacks.

Deployment of "smart" utility networks is driven by energy and environmental policy goals rather than commercial requirements, the immediate challenge being the EU 2020 agenda of a 20 percent cut in emissions of greenhouse gases by 2020 compared with 1990 levels, 20 percent increase in the share of renewables in the energy mix and 20 percent cut in energy consumption.

To achieve these goals, progress toward accessing the spectrum must be identified quickly, with access to the full portfolio by 2020 or shortly thereafter.

Unless access to suitable spectrum is granted quickly, it is difficult to see how supply quality can be maintained. In the case of electricity networks, the risk becomes increasing network instability, raising the prospect of astounding cascade failures as seen in the United States in August 2003 and Europe in November 2007. According to reports, a July 2012 incident in India resulted in 650 million people losing their electricity supply. Preventing the next major outage depends on access to reliable, secure and resilient communications for utility networks. ■

Editor's Note: This article was written with assistance from Peter Moray, Utilities Technology Council (UTC) director global development, and Joy Ditto, Bobbi Harris and Atossa Shafaie also of UTC.

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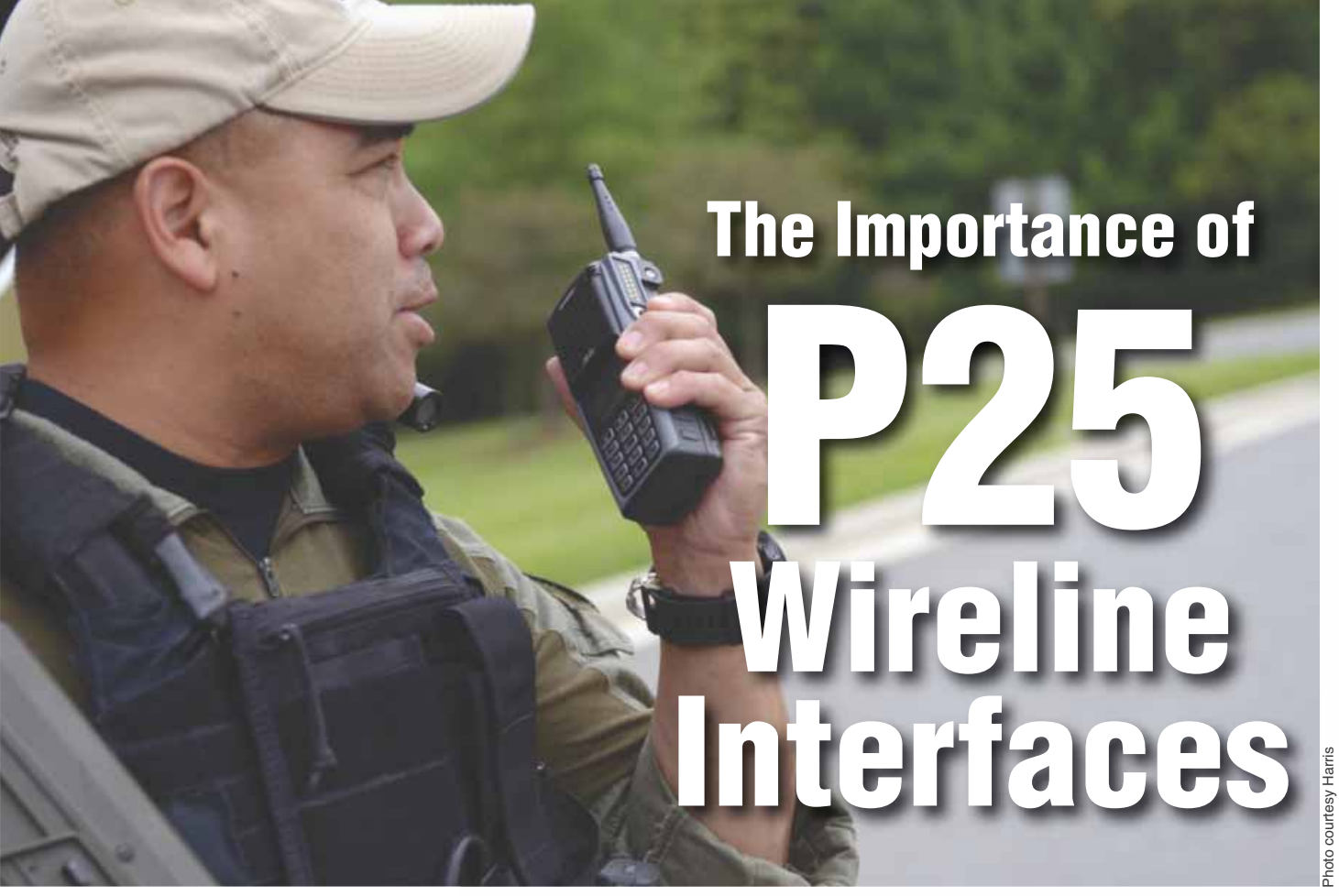


The Importance of P25 Wireline Interfaces

Photo courtesy Harris

The Project 25 (P25) Console Subsystem Interface (CSSI) and Inter RF Subsystem Interface (ISSI) require investment from manufacturers and customers to ensure widespread adoption.

By Mike Schools

Everyone dreads them: Large meetings where people from across the organization come together to talk about "the project." Things begin slowly, but as the intrusiveness of the project is revealed and the imminent threat to the status quo is exposed, discussions heat up and the gloves come off.

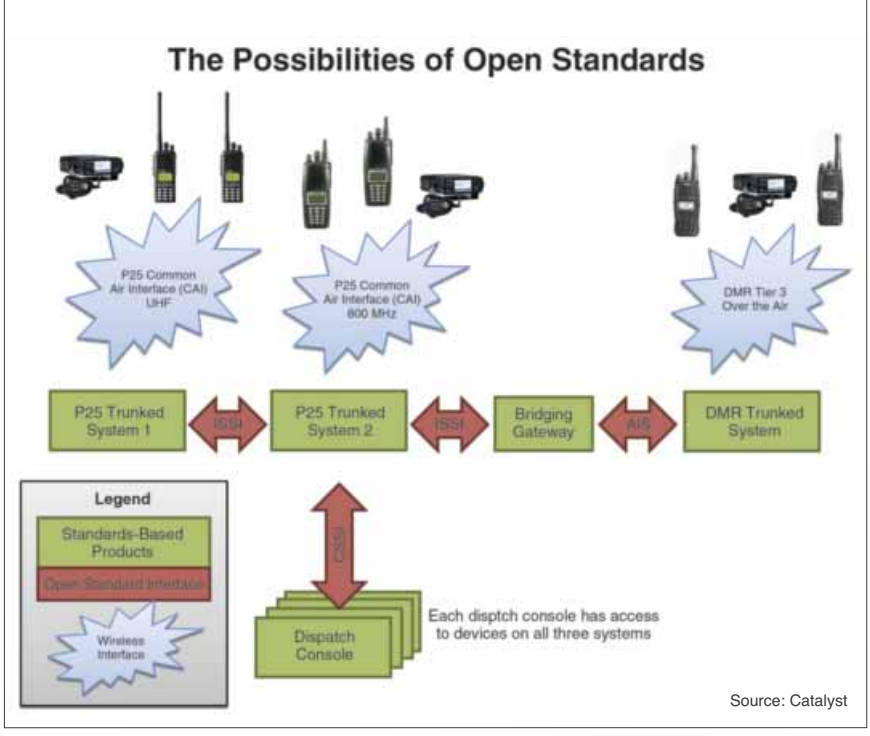
As a project team continues to work together, solutions begin to take shape, and assumptions, limitations and compromises are reluctantly agreed upon, and real progress can be seen. But sometimes the length and scope obscures objectives, and a process check is required to see if the project is still on track.

In many projects, the design participants work for the same organization and presumably have the same or similar strategic goals. But as the benefits of cooperation and open standards have been recognized, more projects consist of participants who work for different companies and may include customers and governmental agencies, as well as manufacturers and suppliers. When participants work for competing organizations, their natural instinct is extreme caution. Consequently, developing open standards is a long-term commitment that can span years.

The Project 25 (P25) team is to be congratulated for all that has been accomplished in overcoming tremendous obstacles, finding common ground, creating workable standards and continuing to persevere for more than 25 years. Many changes have happened in those 25 plus years, not only in the professional mobile radio (PMR) industry but also with information technologies and other communications industries. P25 is at a crossroads with several wireline interfaces. The purpose of this article is to do a process check on the progress of several P25 interfaces. Where does the industry stand in adopting and using the standards that have been created thus far? Do customers have a clear understanding of P25 that allows them to make informed decisions? What are P25's critical next steps?

P25 Common Air Interface

One of the first major components of P25 that was developed and the first chapter in P25's success story is the Common Air Interface (CAI) specification. The CAI describes the wireless, digital voice and data that flows between mobiles, portables and repeaters. The assumption that all



P25-compatible equipment will use CAI to communicate in both conventional and trunked modes is accepted by customers and manufacturers. The CAI's core features work between manufacturers and support a mechanism for vendor-specific features.

P25 mobiles and portables from multiple manufacturers work on a trunked system made by another manufacturer. Configuration isn't trivial and sometimes requires help from the radio manufacturers, but it demonstrates that manufacturer cooperation and open standards work. Universal adoption of the CAI as the only over-the-air (OTA) interface for P25 by manufacturers and customers has removed a barrier to entry for radio manufacturers to get subscriber units access to another vendor's P25 trunked radio system.

But what if a customer wants to use a dispatch console on a P25 trunked radio system provided by a different manufacturer? And what if functionality that is only possible through an infrastructure (wireline) level interface is needed? Or what if a user needs to connect to the P25 trunked radio system of another municipality built by another radio manufacturer? The user then needs to consider the P25 wireline interfaces Console Subsystem Interface (CSSI) and Inter RF Subsystem Interface (ISSI).

Wireline Interfaces

The gains possible from using wireline interfaces are potentially even more far reaching than an OTA interface. Wireline interfaces are RF technology agnostic. What frequency band is this trunked site? The wireline interface doesn't care. Is it FDMA or TDMA? The wireline interface doesn't need to know. The wireline interface mainly needs to know the vocoder — the algorithm used to digitally encode and decode voice — that is being used and the encryption key for encrypted voice.

Many dispatch console and radio gateway providers have developed their own implementations of the CSSI/ISSI and integrated them with multiple vendors. The specification for these standard interfaces works, but because the documents do not spell out every minute detail, connection to each vendor's implementation of the interface must be separately tested and qualified.

The Economics

There is an economic component for each manufacturer in developing and deploying these interfaces that often isn't considered. Building, qualifying and testing the interfaces are expensive, resource intensive and time consuming. So, when manufacturers discuss how products can integrate with each other, the first technical question asked is: What is a common standard interface that we both have developed? A common interface potentially allows companies to integrate immediately and address a business opportunity. And even if one organization must develop an interface to communicate with the other's product, that new development is more likely to be on the table if the companies use an open standard that promotes opportunities with other vendors as well. Gone are the days of asking, "We need to interface with you guys. What hardware should we use, and what should message number one look like?"

Theoretically, for new systems, a handful of open interfaces that could run the gamut of communications paradigms could be used for all applications such as push to talk (PTT) and telephony. Manufacturers would focus on making their core interfaces work reliably and robustly. Having to support only these foundational interfaces would free resources for substantive issues and critical features: enhanced and more intuitive user interfaces, innovative user devices, better in-building tracking and coverage, improved security and other technology needs. IP has shown that when everyone uses a standard communications interface, creative solutions to technically challenging problems become the focus rather than communications incompatibilities. Similar to the CAI, the CSSI and ISSI should be candidates for classification as core interfaces. However, many vendors continue to use their own internal, proprietary interfaces.

Next Steps, Refinements

The CSSI and ISSI standards are defined in largely P25-centric ways: limited to using only P25 vocoders, providing OTA data that is largely superfluous in the wireline world. What exists is a tremendous step forward and a great foundation, but some limitations, such as considering connections only between P25 systems, should be eliminated in future

revisions. Fortunately, these are living standards that can and will need to be refined and extended if, similar to the CAI standard, they are to become the only way that P25-compliant subsystems communicate to other subsystems. Future standards work should be done to replace proprietary console and intersystem interfaces.

System designers know that the less the interfacing subsystem needs to know about the technology being used on the other side of the interface, the better. A subsystem interface that hides implementation and technology details about the subsystem it is communicating with is said to have low coupling. When two subsystems communicate such that each is highly dependent on the internals, timing and technology of the other, they are said to be highly coupled.

Managing coupling is critical in software program development as well. Experienced software developers know that the lower the coupling

The gains possible from using wireline interfaces are potentially even more far reaching than an over-the-air (OTA) interface.

between modules and the more abstract the interface, the easier it is to create and maintain the programs in which they are used. Two big payoffs come to systems that adopt a low coupling approach:

- Major changes to the inner workings of a subsystem can be made completely transparent to connecting subsystems as long as the interface does not change.
- Subsystems not planned for or even in existence at the time of interface development may use the interface if the new subsystem can emulate a supported subsystem at its interface.

As an example of the second payoff, a P25 trunked system and Digital Mobile Radio (DMR) trunked system can be connected using ISSI and the Application Interface Specification (AIS), DMR's wireline interface, even though these two systems were never designed to interoperate with each other. To the P25 trunked system, the DMR radios look like P25 subscriber units, and to the DMR trunked system, the P25 radios look like DMR subscriber units. Subscriber units won't roam onto the other system because of RF-side limitations, but customers benefit from this type of seamless interoperability.

A Watershed Moment

Open standards offer benefits that are difficult to overstate: freedom of choice for customers; lower overall

cost of development, which is ultimately paid for by customers; vendor confidence that development can be re-used and refined; and freedom for both customers and vendors to focus on real issues including innovations that reduce costs and enhance productivity. The results of our process check indicate that P25 standards are off to a great start, but require more investment, further refinement and full adoption.

These potential benefits materialize only if the standard is adopted extensively, not only by manufacturers but also by customers and the consultants who advise them. In the consumer world you can see many examples of standards that thrived because customers invested in products that used them. VHS succeeded over Betamax not because it was a superior technology, but because customers bought and invested in it first. Blu-ray won out over HD-DVD for more complex reasons, but ultimately, customers only embraced Blu-ray. Cutting-edge technologies in their day, both eventually became reliable and inexpensive. But customer buy-in and acceptance was critical to continued investment and additional refinements by industry. No matter the technical potential of a solution, adoption and economics drive its development and maturation.

Every technical person in every industry I've ever worked in believes at some level that their industry or organization has special requirements that just aren't like anyone else's and that they need a custom, special-purpose solution. Technology is expensive to build, maintain and support. Simply put, accommodating proprietary interfaces is more expensive than using one standard interface.

Adoption enables our industry to expand its available offerings by leveraging the combined efforts of every vendor in the industry. That would mean that the wireline P25 standards — CSSI, ISSI and the Fixed Station Interface (FSI) — should be the only interfaces used for core P25 wireline communications, regardless of what vendor supplies the individual pieces of the subsystem, though manufacturers could continue to differentiate using proprietary extensions to the standards.

If customers are not buying and supporting these interfaces, they are locking themselves or their successors into purchasing from a single vendor for 20 years. Users could be forced to throw out a perfectly good radio system, when all that is really needed is to update one piece of it. The most important way to help our industry thrive is for consultants and customers to embrace P25's open standards. ■

Mike Schools, Catalyst Communications Technologies' vice president of engineering, has more than 30 years of experience building software solutions for data and voice communications systems. Email feedback to editor@RRMediaGroup.com.

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Airbus Defence and Space

The TB3p series is a small TETRA base station that can form a TETRA network by itself or serve as part of a larger network together with its related equipment. The series consists of different, versatile models. The 4-watt (W) TB3p has one TETRA carrier while

the 10 W TB3hp has two carriers. The middle-sized TB3c and the large TB3 have up to eight carriers and provide 25 W. The base stations can also be integrated with a DXT3p switch to create a large system.

www.securelandcommunications.com

Barrett Communications

The Barrett 4050 HF SDR is an advanced HF software-defined radio (SDR) with IP network connectivity that simplifies integration with existing networks. Onboard Wi-Fi allows for secure and seamless operation

and control of the HF transceiver via iOS-, Windows- or Android-based devices. When teamed with other Barrett HF products, the SDR transceiver can also provide secure email, data transfer and telephone within an HF network, as well as international telephone network and internet connectivity.

www.barrettcommunications.com.au

BelFone Telecom

The BF-RT7500 is a cost-effective Digital Mobile Radio (DMR) repeater that covers VHF and UHF bands, has 99 channels and supports multisite coverage using IP.

The repeater has power output up to 50 watts (W) and is compatible with the DMR Tier 2 air interface in both digital conventional and FM analog conventional modes. The product can switch automatically between analog and digital, depending on the received signal. With an IP connection, the repeater can further expand coverage, and IP connectivity allows users to link multiple conventional repeaters installed at different sites.

www.belfone.com

Bird Technologies

Bird's digital signal booster operates in the UHF band with 1 – 28 programmable digital

filters for both uplink and downlink. Features include digital filtering, spectrum display, oscillation detection and management, Ethernet with simple network management protocol (SNMP) 3.0, local and remote access, and a pilot signal. Filter center frequency and characteristics are fully programmable to meet the demands of various systems and

signals. Filter bandwidth is user programmable from 6.25 kilohertz to 1.5 megahertz. All product components are protected by a National Electrical Manufacturers Association (NEMA) 4 enclosure.
www.birdrf.com

BridgeCom Systems

BridgeCom's 30- and 40-watt (W) FM repeaters, repeater/controllers and repeater/controller combinations create wide-area logic trunked radio (LTR) net-

works. The rack-mount repeaters are available for UHF, VHF and 220 MHz bands and include built-in 10-ampere (A) power supplies, battery backup and community tone/code panels. A combination unit includes a complete repeater and LTR controller in a two-rack-unit (2U) rack. Features include linking of up to 20 channels, built-in ID validator and airtime logging. Combination units that connect multiple repeater sites to create seamless wide-area LTR trunked networks are available.
www.bridgecomsystems.com

BTI Wireless

BTI Wireless' outdoor distributed antenna system (DAS) products can rapidly enable dense capacity in urban areas, or extend

coverage across challenging terrain. Featuring best-in-class linear amplifiers, the outdoor DAS product has high output power and power density (watts per cubic liter), with convection-cooled solutions up to 40 watts (W) per band and active-cooled remote units up to 80 W per band. The product is compatible with 2G, 3G and 4G Long Term Evolution (LTE) and supports all common frequency bands. A modular architecture allows configuration flexibility and fast and cost-efficient upgrades, company officials said.
www.btiwireless.com

Codan Radio Communications

The Cyclone is a drop-in replacement for existing conventional core radio repeaters

and base stations that comes with a full Project 25 (P25) Digital Fixed Station Interface (DFSI) for future migration to a standards-based network and backhaul over Ethernet, reducing the need for costly leased lines and T1 connections. The device uses Avtec's RIC-M technology to replace existing legacy conventional P25 repeaters with the v.24 interface at a fraction of the cost of other options, company officials said. An MT-4E design provides extreme lifecycle duration in even the harshest conditions.
www.codanradio.com

Damm Cellular Systems

The BS422 is an outdoor base station that features four technologies in one box: analog, Digital Mobile Radio (DMR) Tier 3, TETRA Enhanced Data Service (TEDS) and TETRA. The base station operates across technologies, and high output power, an integrated combiner and a powerful central

processing unit (CPU) make it a power-efficient platform. The base station was engineered for maximum efficiency, providing an infrastructure system that is easy to design, commission and expand, company officials said. The device is scalable from single to large multisite networks and comes with integrated TetraFlex voice and data logging and dispatcher and network management. Open application gateways ensure seamless integration with third-party applications.
www.damm.dk

EF Johnson

The ATLAS 4500 multimode station is a small, fully software definable IP-based linear base station that operates in Project 25 (P25) Phases 1 and 2 with the capability to

deploy conventional, trunked, simulcast and hybrid systems. Available in analog and P25 mixed-mode, the product is designed to build the company's ATLAS distributed architecture system solution in a cost-effective and scalable manner. Each base station uses 50 percent less power than comparable products in the marketplace, saving ATLAS users more than $4,000 in energy costs over the life of each base station, company officials said.
www.efjohnson.com

Global Wireless Technologies

The LCS Long Term Evolution (LTE) base station platform is a high-performance, cost-optimized solution designed for multi-

ple markets with a focus on robustness, dynamic control and ease of deployment, company officials said. The platform is the basis for a variety of products that extend 4G coverage and generate additional capacity in a small 2.3 – 6.8 kilogram body. Each system includes a commercial eNodeB as well as an optional LTE evolved packet core (EPC) for an additional level of capacity and redundancy or for stand-alone functionality. The product supports any band between 70 MHz and 6 GHz.
www.globalwirelesstech.com

Harris

The MASTR V base station provides secure, digital trunked communications for

mission-critical applications across the VHF, UHF and 700/800 MHz bands, operating on the company's secure and scalable Project 25 (P25) IP network. The station incorporates P25 digital voice and data using a signal processor for maximum design versatility, paired with an easy-to-use software interface that provides flexibility, simplified setup and easy remote maintenance. Operating modes include P25 conventional, trunking and linear simulcast.
www.pspc.harris.com

Hytera Communications

The RD982S repeater can be upgraded to trunking in the future as user capacity requirements increase. The analog version

of the repeater provides organizations with an easy migration path to digital technology, company officials said.

www.hytera.us

Icom

The IC-FR5000/FR6000 series is a 50-watt (W) VHF/UHF repeater and base station that combines analog FM and IDAS digital

modes with an auto-sensing function. The IDAS digital mode uses 6.25-kilohertz narrowband FDMA technology and offers users a flexible choice of NXDN or digital Private Mobile Radio (dPMR) protocols with common hardware, company officials said. The repeater works with the company's IC-FC5000E dPMR Mode 3 external controller that provides up to 32 trunked channels in a site. Up to 32 trunking controllers can be connected over an IP network to accommodate a large number of users with wide-area coverage and high spectrum efficiency.

www.icom.co.jp/world

JRD Communications

The NP2000RVC series receiver voting comparator is a digital signal processor

(DSP)-based voter offering noise, received signal strength indication (RSSI) and signal-to-noise and distortion (SINAD) voting. Other features include dynamic simulcast control with synchrotone 3, browser-based management and inbound audio delay for use with VoIP. Users can store multiple profiles to enable a redundant network design, and the voter features graceful degradation to support mission-critical applications in the event of card failure. The product supports 14 sites per rack and simple network management protocol (SNMP) alarms and can be expanded by interconnecting rack frames.

www.jrd.com.au

JVCKENWOOD

The NXR-5700/5800 NEXEDGE digital-capable repeaters are more than seven times faster and have 15 times more capacity than previous models, company officials said. Extensive data storage allows the products to support everything from

analog/digital conventional systems to a sophisticated NEXEDGE Generation2 (Gen2) multisite digital trunked network. Upcoming support for digital simulcast makes the repeaters futureproof, company officials said.

http://comms.kenwood.com

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www.halcomm.com

Kirisun Communications

The TR850 supports both Digital Mobile Radio (DMR) and FM analog modes with a 100 percent continuous duty cycle for 25 and 50 watts (W). The device has smart digital-to-analog auto detection for smooth migration between the two technologies and

a 26-pin external port reserved for second development. The product supports IP Connect, enabling repeaters in different areas to switch voice and data by a transmission control protocol (TCP)/IP-based network. Other features include nine LEDs that indicate the repeater's status, integrated alternating current (AC) power supply and a three-rack-unit (3U) design that leaves enough space for an added duplexer.

www.kirisun.com

Leonardo Finmeccanica

The ECOS-D RBS4000 is a 19-inch three-rack-unit (3RU) single carrier all-in-one multimode radio base station that supports analog FM, Digital Mobile Radio (DMR)

Tiers 2 and 3, and Project 25 (P25) Phase 1 conventional. The product operates in the VHF, UHF or 800/900 MHz bands. The base station embeds a 110 or 25-watt (W) RF power amplifier (PA) and a 12 or 48 volts of direct current (VDC) or 110 or 220 volts of alternating current (VAC) power supply. Other features include voted simulcast over IP with internal GPS receivers or point-to-point-based synchronization, a site trunking controller and a distributed multisite call control manager. Standard Application Interface Specification (AIS), session initiation protocol (SIP) and SIP trunk, and proprietary SIP-based AISIP protocols are available for third-party integration.

www.finmeccanica.com

Motorola Solutions

The reliability and serviceability of the full-featured ASTRO 25 system makes it ideal for mission-critical systems, company officials said. The product meets demand for IP

networks and narrowband radio operations with the GTR 8000 base radio/expandable site subsystem. The GTR 8000 offers software-based upgrades and migrations, no single point of failure, hot swap hardware, front access serviceability and integrated battery charging. The compact design enables everything from analog conventional to advanced Project 25 (P25) TDMA trunking on the same hardware.

www.motorolasolutions.com

Radio Activity

KAIROS is a compact and rugged transceiver based on "soft radio" technology. A Linux core makes the product suitable for applications ranging from a single repeater to Digital Mobile Radio (DMR) Tiers 2 and 3 multisite systems. The device also supports POCSAG

and tunnel applications using synchronization via PTP1588 protocol. The transceiver is optimized for simulcast operation, supporting IP and narrowband RF links between base stations. The product has two receivers for soft space diversity reception and supports session initiation protocol (SIP) and real-time transport protocol-IP (RTP-IP) for dispatching and phone applications. The transceiver operates in the 66 – 88, 136 – 174, 350 – 400, 400 – 470, 450 – 527 and 841 – 961 MHz bands.

www.radioactivity-tlc.com

Royal Communications International

MICOM high frequency/single sideband modulation (HF/SSB) transceivers operate in the 1.6 – 30 MHz band and come standard with embedded automatic link establishment (ALE), 200 simplex or half-duplex

channels and 1,000 ALE channels. The product complies with Mil-Std-810F and electromagnetic interference (EMI) requirements and meets many regulatory standards. The unit can be controlled, operated and programmed from a remote location via RS-232, IP, leased phone line or fiber optics. The base station transceivers are rated at continuous-duty transmission for voice and data at 125, 500 and 1,000 watts (W).

www.royal-communications.com

Samhoo Science and Technology

The SIS8600 portable repeater has a compact structure for easy transport and does not require installation. The product is integrated with a receive and transmission module, carrier control module (CCM),

power supply module, power amplifier, and duplexer antenna feeder and antenna. The repeater supports IP connections and Professional Digital Trunking (PDT) conventional and trunking, Digital Mobile Radio (DMR) Tiers 1 and 2, MPT 1327 analog conventional and analog trunking in six operation modes. A built-in battery guarantees continuous operation, and the CCM provides solid backup for system safety, company officials said.

www.samhoo-pmr.com

Satel

The SATELLINE-EASy Pro is an IP67-classified UHF radio modem with a high-power transmitter, a tuning range from 403 – 473 MHz and selectable channel

spacing. The device is well suited for outdoor use under varying weather conditions, company officials said. The product's high transmitting power allows for connection at distances of up to 80 kilometers. The device's casing and connectors are waterproof and secured against dust. The radio modem is equipped with an LCD that indicates the current operating status — frequency, channel number, power level, voltage level and field strength — and allows users to change the modem's setup.

www.satel.com

Sonik Messaging Systems

The PTX-150 all-digital paging transmitter is

unlike other paging transmitters that are modified conventional analog transmitters limited to two-level-only POCSAG paging, company officials said. The unit is available with a 100- or 250-watt (W) internal power amplifier (PA) and an optional internal isolator. The unit handles the entire VHF spectrum from 138 – 174 MHz, is designed for continuous-duty applications, handles all digital paging protocols on the fly and includes Windows-based diagnostics software. The transmitter is designed for 19-inch rack mounting and includes a 5- or 10-megahertz reference input.

www.sonik.com

Spectra Engineering

Spectra Engineering completed interoperable tests on its MX800 Project 25 (P25) base stations with various P25 console brands covering European and Australasian markets. Extended controls manage audio and data messages via consoles with compliance to the P25 Digital Fixed Station Interface (DFSI) standard, offering interoperability between base stations and consoles of different makes and ensuring easier equipment selection based on user needs, performance and budget. An extension to the company's modular design is an IP-based network capability where all radio sites sync and link automatically, forming a multicast IP mesh network without additional or external voting hardware.

www.spectraeng.com.au

Tait Communications

The TB7300 is a software-flexible, rugged base station/repeater for Digital Mobile Radio (DMR) Tiers 2 and 3 systems or analog repeaters. The product integrates seamlessly with the company's TB9300 series high-performance base station. Features include a slim one-rack-unit (1U) design, software-flexible migration path between platforms and exceptional receiver performance. The product is an intelligent building block of an end-to-end network solution, which includes a base station, terminals and network management software applications.

www.taitradio.com

TecNet International

The TecNet UDM series provides a two-in-one communications device that allows repeater mode communications through a base station or vehicular-mounted mobile with a talk range up to about 100 meters. In addition, the product offers on-site intercom capability of about 50 meters of talk range. The wireless speaker microphone has two separate push-to-talk (PTT) buttons for ease of use. The repeater unit interfaces with most mobile radios, and intercom capability is up to 16 units with dynamic programming of each. Desktop or vehicular charging capabilities are available.

www.tecnetusa.com

Teltronic, part of Sepura Group

NEBULA infrastructure for TETRA mobile radio networks delivers outstanding coverage, security and reliability in a platform designed for efficient implementation and cost-effective scalability, company officials said. The 100 percent Ethernet and IP-based system allows the construction of a secure and reliable network with distributed switching and intelligence, complete fault-tolerant redundancy and commercial off-the-shelf (COTS) equipment for lower network costs. eNEBULA infrastructure for Long Term Evolution (LTE) mobile radio networks delivers excellent coverage, security and reliability in a platform designed for efficient implementation and cost-effective scalability. The design and implementation of the LTE infrastructure has been optimized for professional networks, delivering broadband services and value-added services through available and reliable communications.

www.sepura.com

Westel Wireless Systems

The TRS-25 VHF/UHF multirepeater package provides up to three full-duplex Project 25 (P25) or analog repeaters or base stations in a single 48-centimeter chassis. The three radios can operate independently or be set to a link-repeater-link configuration for remote areas, highways and pipeline applications. VHF/UHF cross-band and analog/P25 digital cross-mode configurations are supported with 12 kilobits per second (kbps) CVSD for legacy users. The product also provides built-in P25 vocoding, direct connection to 4-watt (W) lines and digital encryption standard-output feedback (DES-OFB) encryption and can be connected to tone-based console systems. The repeater supports the company's PC console, VoIP and web-based diagnostics and can be software upgraded to support P25 trunking.

www.westelwireless.com

Wireless Pacific

The RDX Pico is a small, self-contained Project 25 (P25) suitcase repeater designed to allow instant deployment in most radio environments. The product allows six configurations and features MERLAN P25 to deploy IP connected end-to-end encrypted multisite P25 networks anywhere. The 8.5-ampere-hour (Ah) built-in battery management system provides more than 12 hours operation at a 10 percent duty cycle and can be recharged by any available 8 – 30 volts of direct current (VDC) or alternating current (AC) power. RF output power is set to 5 watts (W) to ensure balanced talk-in/talk-out to field portable units. The product weighs less than 4.5 kilograms but delivers strong P25-to-analog repeater performance and has global internet connectivity from any LAN, Wi-Fi or 3G network, company officials said.

www.wirelesscorpltd.com

TETRA Radio and Video Mic

Motorola Solutions' ST7000 small TETRA radio combines high-quality audio and a touchscreen user interface in a pocket-sized design for business-critical operations, company officials said. The radio features a semi-integrated antenna, touch-sensitive buttons and integrated Bluetooth 4.0 wireless technology. A reversible USB C connector for flexible charging and programming and a 3.5-millimeter audio connector are available for the radio. Vibration alerts and haptic feedback are available for discrete use, and a white organic light-emitting diode (OLED) screen with a touch user interface helps with navigation.

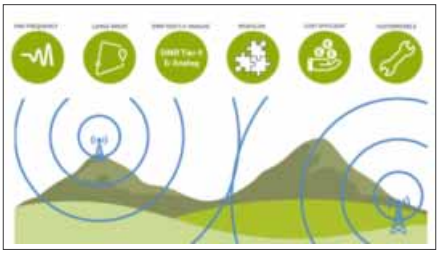
The Smart Interface (SI) Si500 Video Speaker Microphone (VSM), a combination of body-worn video camera, radio speaker and microphone, and cloud-based, digital evidence management software, collaborates with TETRA digital two-way radios. The camera has CommandCentral Vault software and a 210-degree range-of-motion camera lens that users can wear facing in or out. Other features include an adaptive audio engine that adjusts audio settings based on the user's position and environment, five integrated microphones and a loud 0.5-watt (W) rated speaker, as well as integrated Wi-Fi and a full-screen tempered-glass display.

www.motorolasolutions.com

ATEX Radio and DMR Simulcast

Hytera introduced the PT790 Ex TETRA handheld ATEX radio that has an "ia" certification, meaning it can be used in areas with explosive atmospheres of air and flammable gases, vapors or mists permanently (Zone 0). The radio has an IP67 rating for water and dust protection and meets Mil-Std-810F/G for shock resistance. The radio has man-down and lone-worker functionalities to ensure worker safety. An integrated Global Navigation Satellite System (GNSS) module collects positioning data via GPS, GLONASS and Beidou and transmits data to the control center for further evaluations.

The DS-6310 Digital Mobile Radio (DMR) simulcast system networks with IP technology to offer a high level of flexibility in the system architecture, company officials said. The product platform caters to local public transport networks and municipalities looking to modernize existing analog single-frequency radio systems. DMR technology allows users to hold two conversations at the same time on a single frequency. The entire simulcast radio network can be administered centrally with a network management system, and applications can be incorporated.



www.hytera-mobilfunk.com

TETRA/LTE Infrastructure

Sepura's latest TETRA infrastructure is a hybrid TETRA Long Term Evolution (LTE) solution for tactical operations based on the company's eNEBULA digital communications network, company officials said. The product provides first responders and armed forces with coverage and broadband capacity through professional LTE technology compliant with most military-grade equipment, as well as the ability to share real-time video from urban, mobile and body-worn cameras. The infrastructure can be combined with TETRA technology in a hybrid deployment, offering communications solutions, including comprehensive mission-critical voice services.

The company also introduced the IP66 MBS Lite, a standalone outdoor TETRA base station. Built for either indoor or outdoor use, the product requires no additional unit or shelter at its base and provides coverage for business-critical applications such as mines, industry, hotels, commercial centers or sporting events. The single box contains both RF and control elements and a fanless design. The station uses all TETRA standard functionalities, including voice, data and security services and can be linked to another MBS to create a two-carrier base station. Availability can be maximized by configuring one of the carriers as a hot standby redundant unit.

www.sepura.com

TETRA/LTE Handheld Devices

The PUMA T4-TLE by **Leonardo Finmeccanica** combines TETRA voice with broadband Long Term Evolution (LTE) technology and provides the security and robustness of a traditional TETRA radio with the advanced features available on smartphones, company officials said. Features include a large full-touch display; Android OS with supporting video, imaging and operational/clerical tasks; and TETRA trunked mode/direct

mode operation (TMO/DMO) voice and data capabilities, including DMO repeater function and multislot TETRA Enhanced Data Services (TEDS) data transfer. The handheld has local communications capability including Wi-Fi, near field communications (NFC) and Bluetooth. The PUMA T4-TLK has similar functionalities with the addition of a keyboard. Both radios transmit and receive images and video and provide access to database, remote office automation and enhanced multimedia capabilities.

www.leonardocompany.com

DMR Radios

BelFone Telecom introduced a series of Digital Mobile Radio (DMR) radios for small and middle business users in commercial markets interested in digital migration. The radios are compatible with all conventional analog and DMR radios, have longer standby and working time than other radios, provide superior high-definition (HD) voice quality with an AMBE +2 vocoder, offer TDMA two time slots in a 12.5-kilohertz (kHz) single channel frequency, as well as CTCSS/DCS for analog and color code for digital, company officials said. The BF-TD505 model is a 5-watt (W) radio with keypad and display that is upgradable to 800 channels and roaming functionality in an IP multisite system. The BF-TD506/BF-TD371/BF-TD821 are each 3, 5 or 8 W radios supporting 32 channels and are compatible with BelFone's DMR IP multisite conventional system. All of the radios are approved under the CE standard and meet industrial standards for user reliability.

www.belfone.com

Upgraded Command Systems

Zetron integrated its AcomNOVUS command-and-control system with Long Term Evolution (LTE) push-to-talk (PTT) over Cellular (PoC). The LTE solution can be used in conjunction with radio standards such as TETRA, Project 25 (P25) and Digital Mobile Radio (DMR). The system uses a carrier-integrated

service rather than a proprietary PTT over-the-top (OTT) service because of the high quality and reliability of carrier-integrated PTT services, company officials said. The company also announced that its AcomAUTOMAX dispatch and mobility suite now includes data dispatching, case and incident management, and reporting and video analytics, along with traditional voice dispatch.

www.zetron.com

Vehicle Data Network

Sierra Wireless announced the AirLink MP70, a Long Term Evolution-Advanced (LTE-A) vehicle router for mission-critical applications. The router enables multiple high-bandwidth applications and connects to a high-speed vehicle area network with both gigabit Ethernet and 802.11ac Wi-Fi. The device shares a secure LTE-A cellular connection that enables dispatchers to access all systems in real time at 300 Megabits per second (Mbps). The product provides Global Navigation Satellite System (GNSS) and inertial navigation and has an integrated events engine, built-in vehicle I/O and AirLink Vehicle Telemetry support, company officials said.

www.sierrawireless.com

Connector System

The OptiFlex Hybrid Connector System (OHCS) from **RF Industries** provides reliable installation or retrofiting of a hybrid cable and combines multiple fiber-optic and power connections into a single connection, company officials said. The system has a single connection point, ergonomic one-third-turn locking feature, built-in multifiber push on (MPO) or miniature unit (MU)

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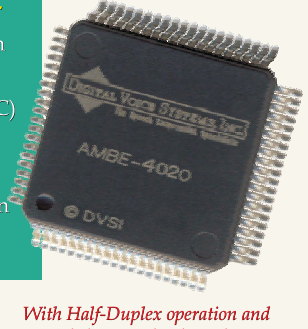

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Project 25: Advances in Interoperability and the Technology's Future is packed with invaluable information for every agency that uses Project 25 (P25) technology, is planning a P25 upgrade, or considering a new P25 system. Download your FREE copy today at MCCmag.com/eLearning/e-Books.

Contents

Foreword: *Sandra Wendelken, Editor, MissionCritical Communications* 4
Section 1: Standards Update
25 Years of Project 25, *James Downes and George Crouch* 8
How Far the Standard Has Come and Future Outlook, *Sandra Wendelken* 15
The Importance of P25 Wireline Interfaces, *Mike Schools* 22
New P25 ISSI Features Set to Boost Demand, *Sandra Wendelken* 28
P25 Security Considerations, *James Downes* 32
700 MHz Narrowbanding Deadline Eliminated, P25 CAP Encouraged 37
What You Should Know about P25 Roaming, *Andy Davis and Bill Janky* 39
Section 2: Interoperability and Technology
P25 CAP Advisory Panel, Vendors Debate Next Steps, *Sandra Wendelken* 44
Paging Considerations for a P25 Upgrade, *Marco Stadler and Philipp Zimmermann* 48
Independent Lab Requests Funding for P25 CAP, *Sandra Wendelken* 54
Suppliers Participate in P25 Trunked Interoperability Event, *Sandra Wendelken* 56
Time Delay Interference Affects P25 Coverage, *Adam Nelson and Neil Horden* 58
The Keys to Interoperable Encryption, *Scott Wright* 64
Non-P25 Digital Technology Hurts Interoperability Efforts, *John Powell* 69
Is P25 Public Safety Grade? *PTIG Staff* 73
Section 3: FirstNet and P25
Why FirstNet Should be Data Only, *John Facella* 80
House Hearing Finds FirstNet Will Not Replace Public-Safety Networks 86
Study Item to Standardize LMR to LTE Moves Forward, *Sandra Wendelken* 88
DHS Researches LMR, LTE Integration, *John Merrill* 90
Section 4: User Deployments
Local Officials Save Money with Open P25 Procurements, *Sandra Wendelken* 98
Alabama's P25 System of Systems, *Ernie Blair and Chuck Murph* 100
P25 Coverage Below the Capital, *Manuel Ojeda* 105
Super Bowl Official Details Regional Effort 110
Coordinated Encryption in Canada, *Todd Brown* 112
P25 Equipment Vendors by Product Category 117
Section 5: P25 Around the World
P25 App Targets Firefighter Safety, *Jeff Perry* 119
Robust Data with P25 Phase 2, *Yacov Lazar, Eldad Barzilay, Eli Weissbart, and Alberto Schliserman* 122
P25 Revival in Asia, *David Lum* 128
Australian Utility Extends Coverage, *Martin Cahill* 132
P25 Deployments Around the World 137
Sponsor Profiles 138

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www.rfsworld.com

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14 – 17 August: APCO Conference & Expo, Orlando, Florida, USA. Association of Public-Safety Communications Officials (APCO) International: www.apco2016.org

7 – 8 September: Wireless China Industry Summit, Beijing. InfoEX-World Services: www.wirelesschina-summit.com

13 – 16 September: VSAT Global, London. Informa Telecoms & Media: http://vsatevent.com

21 – 22 September: Emergency Services Show, Birmingham, United Kingdom. Broden Media: www.emergencyuk.com

26 – 28 September: 5G Asia, Singapore. Informa Telecoms & Media: https://5gasiaevent.com

27 – 30 September: European Utility Telecom Conference, Frankfurt, Germany. European Utilities Telecom Council (EUTC): www.utc.org/europe

10 – 12 October: LTE Voice Summit, London. Informa Telecoms & Media: http://voice.lteconference.com

25 – 26 October: Offshore Energy Exhibition and Conference, Amsterdam. Navingo: www.offshore-energy.biz

1 – 3 November: Smart Metro and CBTC World Congress, Copenhagen, Denmark. Global Transport Forum: www.smartmetro.eu

7 – 8 November: Critical Communications Middle East, Dubai, United Arab Emirates. TETRA + Critical Communications Association (TCCA) and Informa Telecoms & Media: www.criticalcommunications-me.com

9 – 10 November: B-APCO Autumn Event, Newcastle upon Tyne, United Kingdom. British APCO (B-APCO): www.bapco.org.uk

14 – 17 November: ITU Telecom World, Bangkok. International Telecommunication Union (ITU): http://telecomworld.itu.int

15 – 17 November: LTE Africa, Cape Town, South Africa. Informa Telecoms & Media: http://africa.lteconference.com

22 – 24 November: PMR Expo, Cologne, Germany. Bundesverband Professioneller: www.pmrexpo.de

23 – 24 November: Comms Connect, Melbourne, Australia. Westwick-Farrow Media: http://melbourne.comms-connect.com.au

23 – 24 November: PSCE Conference, Athens, Greece. Public Safety Communication Europe (PSCE): www.psc-europe.eu

30 November – 1 December: U.K. Security Expo, London. U.K. Security Expo: www.uksecurityexpo.com

5 – 9 December: International Microwave & RF Conference (IMaRC), New Delhi. Institute of Electrical and Electronics Engineers (IEEE): www.imarc-ieee.org

6 -7 December: Critical Control Rooms, Prague. TETRA + Critical Communications Association (TCCA) and Informa Telecoms and Media: https://criticalcontrolrooms.com

13 – 15 December: International Conference on Information and Communication Technologies for Disaster Management (ICT-DM), Vienna. Public Safety Communication Europe (PSCE): www.ict-dm.org

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27 – 31 March: International Wireless Communications Expo (IWCE), Las Vegas. Penton Media: www.iwceexpo.com

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❑ 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 _____

Q316

Australian Public Safety Awaits Key Decisions

By Geoff Spring

Australia is moving toward another federal government election 2 July, while the Australian public-safety communications community is waiting for government decisions following advice provided by various departments since 2010.

The advice is based on submissions from government agencies, associations, industry and academia in response to discussion papers on the key components of the mission-critical communications' ecosystem, including smart infrastructure for future Australian cities, a public-safety broadband network, the triple zero services and spectrum access.

There was a potential win for mission-critical communications with the Australian Parliament's Standing Committee on Infrastructure, Transport and Cities recommendation that the government recognize public-safety communications systems as "critical infrastructure" and continue to support the development of these systems, including funding research, promoting implementation and providing national coordination. The committee's central recommendation calls for a smart infrastructure task force — based on the U.K. model — to provide national coordination for the development and implementation of smart information communications technology (ICT) for existing and future infrastructure.

In 2010, the Australian government began considering the need for a mobile broadband capability for Australia's public-safety agencies. Five years later, the government commissioned the Productivity Commission to look at the best way to provide a long-term, secure, mobile broadband capability to public-safety agencies. The commission's 22 December research report found that mobile broadband offers significant potential to improve how public-safety agencies deliver services, saving lives and property.

The commission advised the government that the most economical way to deliver a public-safety broadband capability is by relying on commercial mobile networks and spectrum but noted concerns that the quality of commercial services is insufficient to support mission-critical situations. The commission's report also noted that the network capacity that public-safety agencies require is uncertain, agencies will seek a higher quality of service (QoS) than what is available on commercial networks, and the standards required are not specific.

In the likelihood that the individual states and territories implement a public-safety mobile broadband capability, the commission identified implementation challenges such as jurisdictions agreeing to common interoperability protocols and arranging for sharing information and network capacity among agencies. The commission also said that Australian government intervention in spectrum allocation is not necessary to support a public-safety mobile broadband capability because spectrum should be priced at its opportunity cost to support its efficient use.

In July 2014, the Australian government commissioned the department of communications to review the triple zero service, which began operation in 1961. About two-thirds of triple zero calls come from mobile phones. The review was an important step in exploring how the triple zero service could take advantage of telecommunications advances and respond to changing community expectations.

Submissions to the review closed in August 2014 with the intention that the review would be completed by March 2015 and a competitive tender issued in 2016. The review report and an implementation strategy were released 4 May and advised postponing the 2016 tender for the emergency call person for up to two years so that long-term policy and technology objectives, including location-based information capability and timing for the transition of triple zero to an IP-based environment, can be resolved first.

The Australian Telecommunications Regulator and the Australian Communications and Media Authority (ACMA) in October 2012 announced its strategic approach to meet the spectrum needs of Australia's public-safety agencies into the future. ACMA is now part of the department of communications and the arts, which in March released a consultation paper on the proposed radio communications bill.

The proposed bill treats Australia's public-safety agencies under the heading of public or community services, undermining the importance of the agencies and eliminating transparency in the process through which "fit for purpose" public-safety spectrum is provided to meet public expectations of service delivery.

Other projects, such as the U.S. First Responder Network Authority (FirstNet), the U.K. Emergency Services Network (ESN) and South Korea's nationwide public-safety network are progressively undertaking research, making decisions and awarding contracts to provide public-safety mobile broadband networks.

Plenty of decisions related to mission-critical communications projects await the next Australian government, and officials should leverage the lessons learned and experience gained from other countries moving forward at an increasing pace, albeit with different business models. ■

Geoff Spring is the senior industry adviser to the University of Melbourne Center for Disaster Management and Public Safety. Spring is an editorial adviser to *RadioResource International* magazine.

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