MAR/APR 2019 Vol.6 No.3

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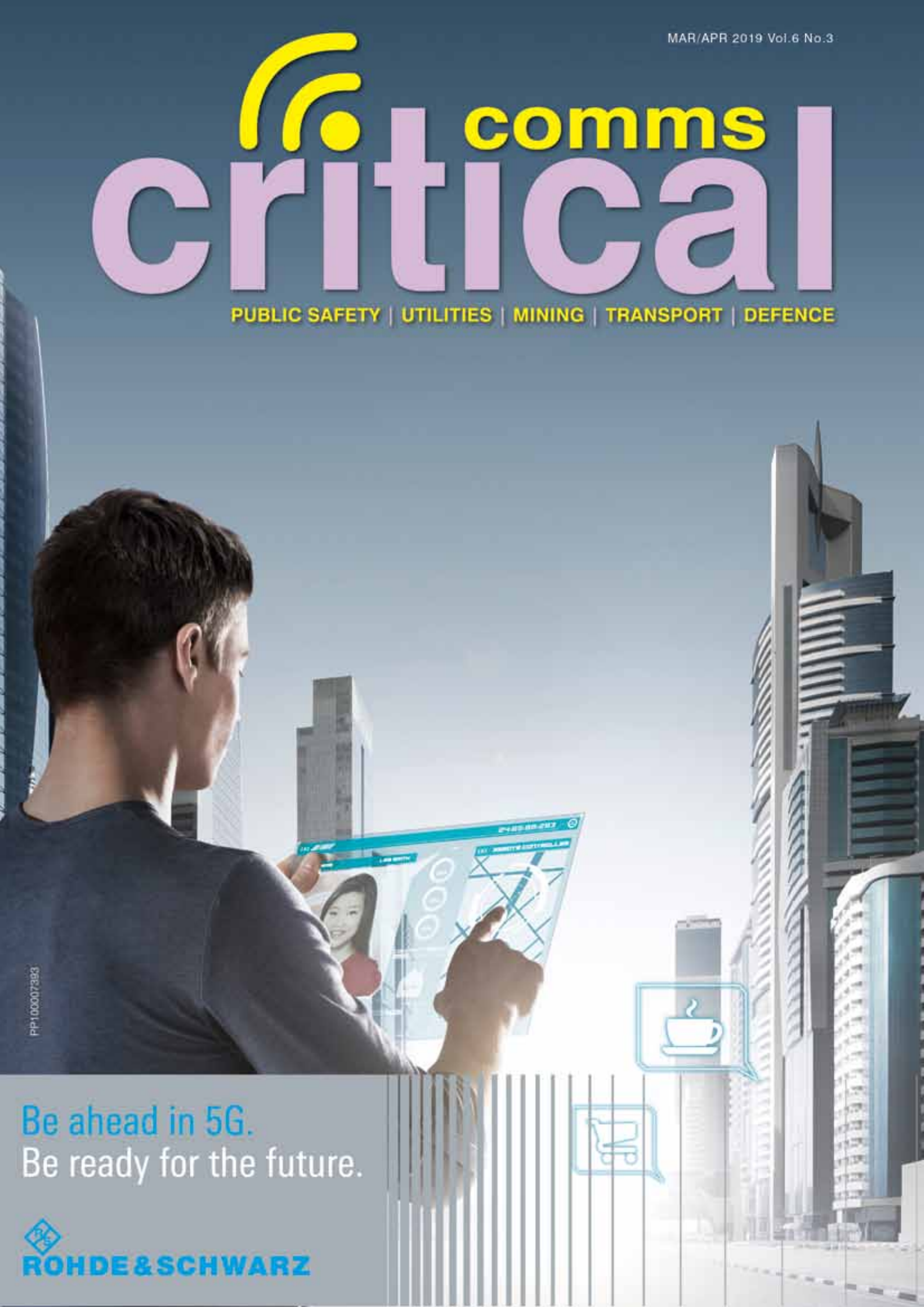

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Inside

Mar/Apr 2019

ON THE COVER

Rohde & Schwarz offers test solutions for 5G, for example for generating and analysing 5G New Radio (NR) signals in line with the latest 3GPP specifications. The R&S FSW signal and spectrum analyser analyses 5G NR signals in the uplink for the development of 5G devices and components such as power amplifiers, and in the downlink for 5G base station tests. The R&S SMW200A RF vector signal generator produces the required signals for uplink and downlink receiver tests. Both instruments are suitable for characterising the Doherty amplifiers needed for 5G base stations. The two-path SMW200A generates highly synchronised signals, while the FSW provides analysis functions for optimising the properties of Doherty and other amplifiers.

New for performance tests on 5G NR base stations is the wideband R&S SMW-B15 fading simulator option integrated into the signal generator. To test base station data reception under realistic conditions, the SMW200A wideband version simulates the required high-precision transmit signals in the millimetre wave range in line with the test specifications for 5G NR Rel. 15. Signals with bandwidth up to 2 GHz and fading channels with bandwidth up to 200 MHz can be generated with carrier frequencies up to a maximum of 44 GHz, at the press of a button. The SMW-B15 option adds fading capability within the FR2 frequency range to the single-box signal generator, enhancing existing FR1 frequency range capability for performance testing of LTE and 5G NR base stations.

Rohde & Schwarz (Australia) Pty Ltd
www.rohde-schwarz.com/5G

Transmit

Telstra and Optus have begun installing their 5G infrastructures around the country. It will be interesting to see how quickly 5G takes off and what the public demand will be. My guess is that consumers won't be able to get enough of it, fast enough. Will it be an nbn-killer?

Of the issues of concern in the mission-critical comms field at present, the one that continues to get the most attention is public safety mobile broadband (PSMB). Emergency services organisations have an ever-increasing need for data to supplement the traditional land mobile radio, and so we're seeing PSMB taking shape in many jurisdictions around the globe. Leading the pack is the US with its First Responder Network (FirstNet). Now well and truly up and running, so far FirstNet seems to have been a great success. Closer to home, though, and we're still waiting for more clarity on what Australia's proposed PSMB network will look like. Some details have been made public — as Geoff Spring relates in the Spectrum column in this issue — and we are all looking forward to learning more as the year progresses.

PSMB, 5G and other important topics will be on the agenda at both Comms Connect Auckland (1–2 May) and Sydney (12–13 June). These events promise to be better than ever, with many local and international experts on the list of speakers. You can find all the program and registration details on the Comms Connect website (comms-connect.com.au). And don't forget to take a look at the workshop offerings and book yourself a place at the RFUANZ and ARCIA gala dinners. See you there!

Jonathan Nally, Editor
jnally@wfmedia.com.au

Calendar

May

Comms Connect Auckland 2019
1–2 May
SKYCITY Auckland
comms-connect.co.nz

Critical Communications World 2019
18–20 May
Kuala Lumpur, Malaysia
critical-communications-world.com

June

20th PSCE Conference
4–6 June
Lancaster, UK
www.psc-europe.eu

Australian and New Zealand Disaster and Emergency Management Conference 2019
12–13 June
RACV Royal Pines Resort, Gold Coast
anzdmc.com.au

Comms Connect Sydney 2019
12–13 June
Rosehill Gardens
comms-connect.com.au

August

AFAC19
27–30 August
Melbourne Convention & Exhibition Centre
afacconference.com.au/afac19-powered-by-interschutz/

November

Comms Connect Melbourne 2019
20–22 November
Melbourne Convention & Exhibition Centre
comms-connect.com.au

For a full list of industry events, see criticalcomms.com.au/events

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Introducing the new KENWOOD range of DMR Tier 3 infrastructure and terminals

SAFE SOLUTION

Jonathan Nally

When Shell needed an intrinsically safe system for its largest APAC petrochemical production and export centre, it chose a Sepura TETRA solution.

Shell's Pulau Bukom Manufacturing Site is an integrated oil and petrochemicals site with manufacturing facilities for fuels, lubricant-based oils and speciality chemicals, located on an island 5.5 km south-west of Singapore. The island is one of a group that has been identified by the Singapore Government for petrochemical manufacturing.

Bukom has a crude distillation capacity of around 500,000 barrels per day. At 243 ha, it is Shell's largest wholly owned refinery globally and its largest petrochemical production and export centre in the Asia–Pacific region.

Shell had a need to replace the site's analog radio network with a new, state-of-the-art system to improve security, coverage and connectivity. The solution would have to provide:

- improved coverage and capacity
- improved audio quality
- secure communications
- intrinsically safe hand portables
- up to 2000 devices/terminals for use across the network
- maintenance management and service support for 10 years
- integration with other critical applications.

Sepura was successful in winning the contract to implement a new intrinsically safe TETRA communications system for the client, with a system that comprises:

- two base stations
- five desktop radios
- 80 fixed radios
- 1000 hand-portable ATEX-certified radios.

"As well as suffering degradation from age, the [client's old analog] system was not intrinsically safe, and did not have the significant operational advantages of TETRA in terms of reliability, redundancy, data capability, integration with existing systems and so on," said Terence Ledger, Sepura's Sales and Marketing Director.

"The tender was issued in late 2014, so this was a long process with a complicated technical brief that took considerable investment to plan and then implement. There was a competitive response to the tender and the end user wanted to be sure that the chosen solution was fully compliant and best answered their needs," said Ledger.

"The customer also had to consider various financing models, as well as the switch in technology to TETRA from their previous analog system," added Ledger. "All these factors contributed to the final award decision taking 12 months before solution planning and implementation could be started. As the tender involved a managed service as well, there were significant discussions with bidders around this element of the proposed new solution."

The equipment selected was the reduced-keypad STP8X100 hand portable, while vehicles and offices were fitted with SRG3900 mobile and desktop radios. One of the key factors affecting this choice was that the STP8X100 has a dedicated button for quick responses in an emergency, ensuring that staff have a 24/7 safety mechanism.

To support the client's Movement Control Room (MCR), which manages the loading and unloading of products from ships, the radios are integrated with the instrumentation system. This gives those in control of loading the ships the option to command a quick 'pump trip' function using their radios, to shut down the pumps in the case of an emergency.

Challenges

Oil refineries present a difficult technical challenge for a number of reasons, such as the size of the site (usually very large)

Images courtesy Sepura

and the ways in which radio frequencies interact with metal. Black spots are a particular concern, so communications solutions have to ensure that these are minimised.

Some of the buildings on the Shell site are blastproof, reinforced with thick steel and concrete walls and defence structures. "On these buildings we used passive antennas to ensure signal was received both inside and outside across the site," said Ledger.

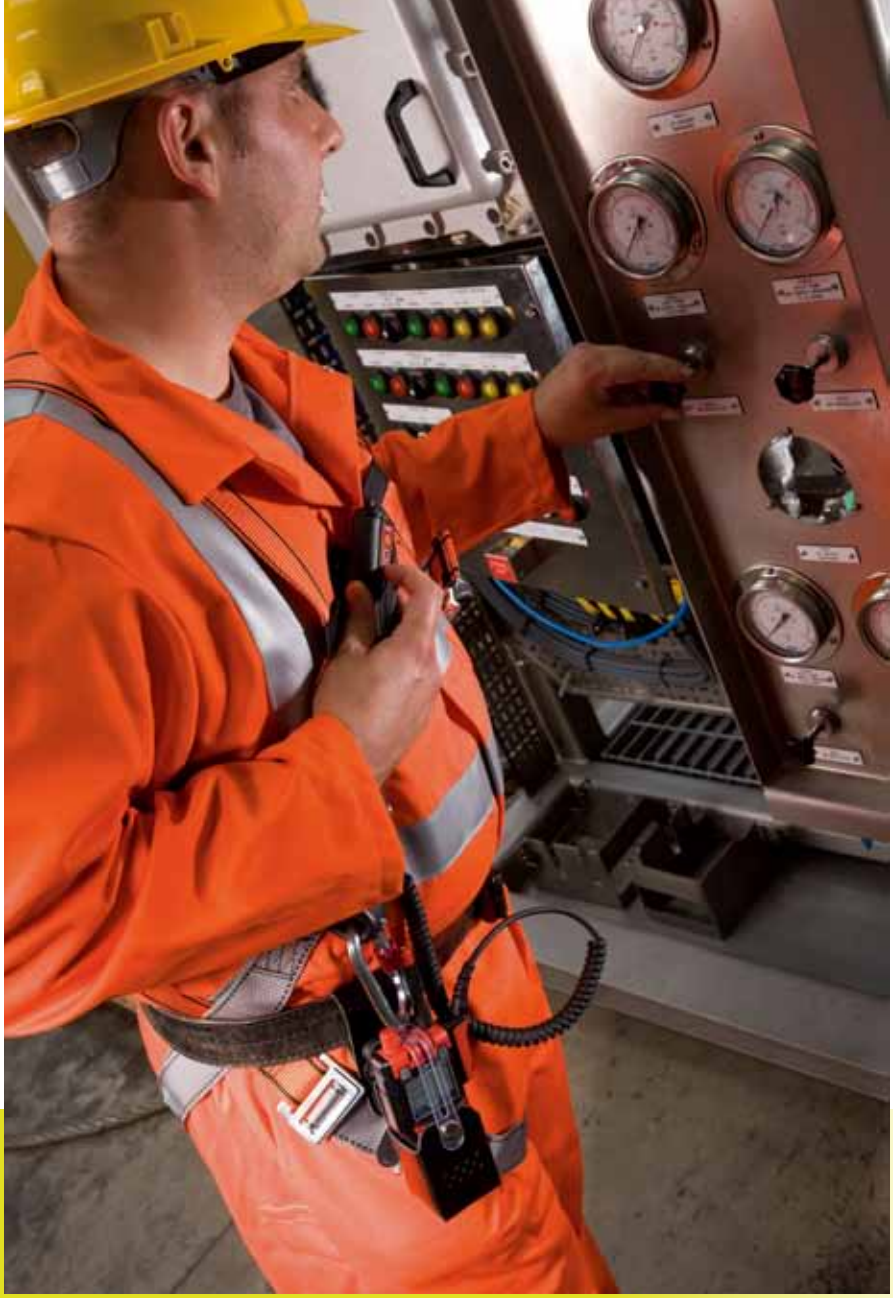
"It also needs to be remembered that the site is an island," added Ledger. "Whilst it is relatively easy to move people via the regular ferry crossing, equipment has to be pre-booked on freight movements to the island. These logistical challenges have to be carefully planned to ensure that the right equipment is in the right place at the right time, and is properly accounted for."

Flexibility is the name of the game, too. During installation of the TETRA infrastructure, it was realised that there was a very large, four-storey steel piping structure in front of one of the sites earmarked for a base station. So the station had to be moved to another location to ensure that communications were fully functional, but as this was also in the middle of the intrinsically safe area it meant that there were limited options to achieve this. Nevertheless, the problem was overcome

Another challenge is that the largest ships do not dock directly at the site, but instead dock 5 km offshore and load and unload from an underground pipeline. Radio coverage therefore needed to reach this fuelling point, without frequency spill into other systems in Singapore and neighbouring countries.

Because of the critical nature of the site, Sepura arranged a managed service agreement with Shell. Radio specialists are permanently on site and 24/7 support is in place should issues occur (so far there have not been any emergency issues with the network). Remote monitoring manages risk and monitors system status. And preventive maintenance is carried out quarterly to ensure that system health is maintained, by pre-emptively arresting issues before they happen.

What is it about TETRA that made it the most suitable radio standard for this contract? "TETRA offers the end user a secure, robust solution, proven in hazardous environments," said Ledger. "It has a number of core benefits that enhance safety and site operations — a range of intrinsically safe terminals and accessories, multiple talk groups, voice-recording capability, data functionality and the ability to be scaled up or to have functionality enhanced when the customer requires. The system is currently handling an average of 7500 calls per day, but capacity could easily be increased if required.



> BLACK SPOTS ARE A PARTICULAR CONCERN, SO COMMUNICATIONS SOLUTIONS HAVE TO ENSURE THAT THESE ARE MINIMISED.

"We were able to integrate the radio solution with a number of existing systems, ensuring cost efficiencies. For example, ship captains can operate the ship's refuelling system through their TETRA radio, ensuring they have an emergency stop on the fuel pump if this is required," he added.

The TETRA system can also interface with both analog radio systems and the Singapore marine channel, reducing the risk of critical messages not being received.

The TETRA system in Bukom is also integrated with the PABX system to enable mobile and telephony calls to be connected to TETRA radio users, and, in the opposite direction, TETRA radios can make calls over the telephone network. The solution is flexible enough to enable users to determine who can be offered this functionality, so that the limited bandwidth usage can be controlled.

"The success of this project and long-term partnership with Shell proves our ability to provide our customers with the best possible TETRA solution to meet their needs, working closely with them to meet their requirements," said Ledger. "The new network has delivered safety, efficiency and future capabilities to Shell, and we look forward to developing their system further."

"Working closely with the Shell stakeholders and building rapport with user's focal points was the key success factor to ensure that the delivery could proceed," added Peter Tan, Project Manager, Sepura. "In the maintenance phase, these relationships help provide a smooth transition process from the old to the new system, helping to ensure that issues and concerns are raised to the maintenance team for remediation as soon as possible."

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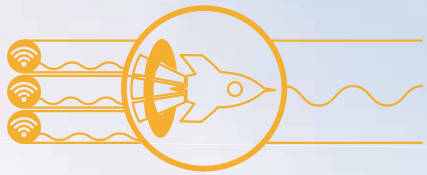

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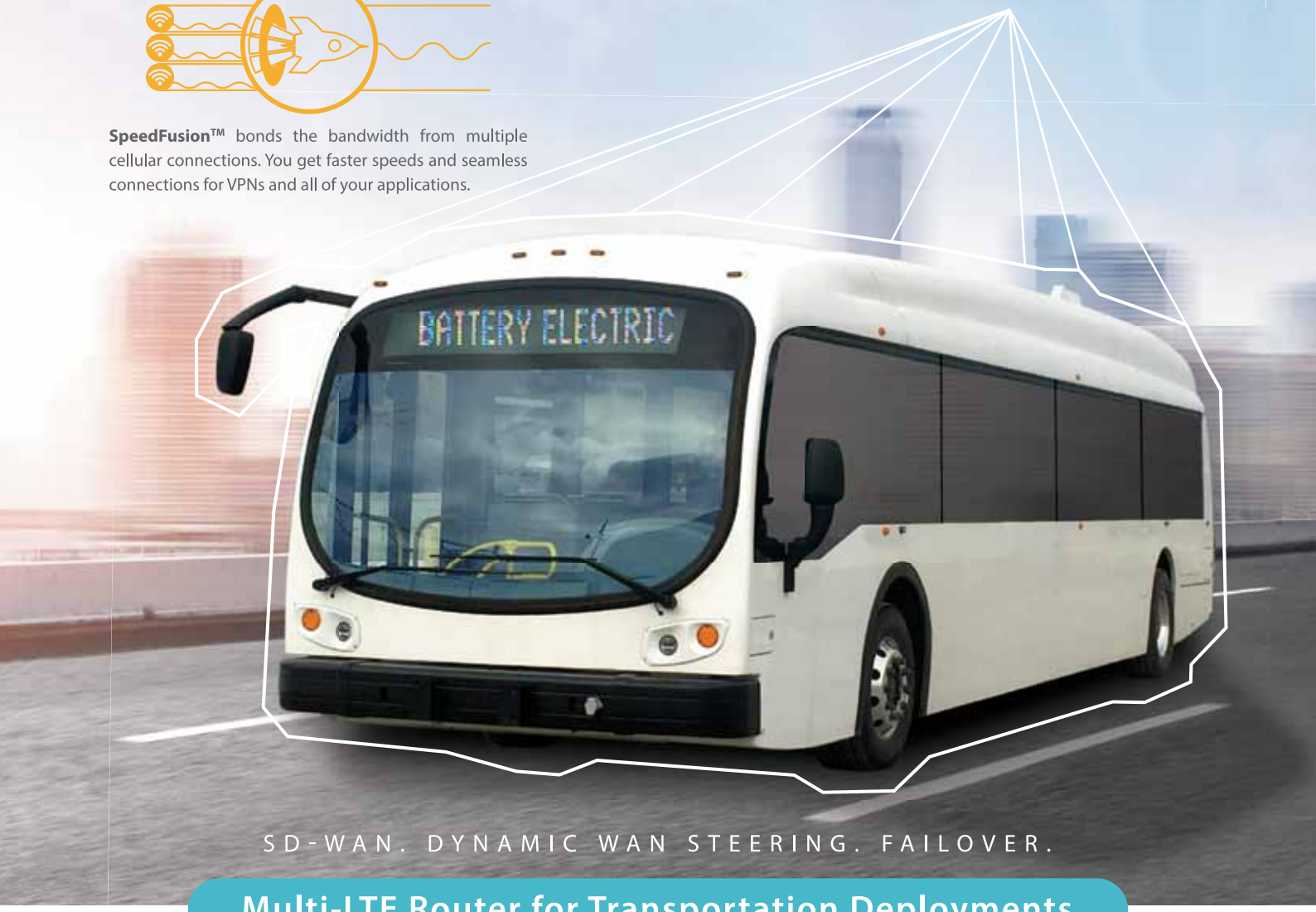

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News

Photographer: ABIS Bonny Gassner, ©Commonwealth of Australia.

SIMULATOR TRAINS COMMS SAILORS

The Royal Australian Navy has implemented a new learning system simulator for training new sailors on communications and information systems. The simulator will be deployed at the Defence Force School of Signals Maritime Wing at HMAS Cerberus. The learning system simulator was developed by Cirrus Real Time Processing Systems, an Australian-owned and -operated firm. The simulator is based on a generic communication centre in an enhanced frigate and is designed to mimic the operational environment at sea, using scenarios that may be encountered by communicators embarked in Major Fleet Units. Minister for Defence, Christopher Pyne, said the simulator would significantly enhance the Royal Australian Navy's ability to conduct complex operations.

R&S SPECTRUM MONITORING FOR TAIWAN

Taiwan's regulatory authority has commissioned a nationwide spectrum monitoring system produced by Rohde & Schwarz. The Taiwanese National Communications Commission (NCC) system uses an integrated hybrid geolocation method that combines angle of arrival (AoA) and time difference of arrival (TDOA) measurements. This allows the NCC to locate sources of interference in the radio spectrum quickly and efficiently, even in dense urban environments. The rollout will include equipping three control centres, among them the NCC headquarters in Taipei. The NCC additionally ordered 44 fixed, nine mobile and eight transportable monitoring systems. This will also include local infrastructure work, system integration and installation at the individual stations, site and factory acceptance testing (SAT/FAT), as well as operator training.

Fibre PON power meter and microscope

The JDSU OLP-87 PRO is designed for the qualification, activation and troubleshooting of B-PON, E-PON, G-PON, XG-PON and 10G-EPON networks. As well as being part of the JDSU SmartClass family, the OLP-87 PRO combines an FTTx/PON power meter with a P5000i microscope for both testing and inspection analysis. It is available for rent from TechRentals.

The FiberChek software and P5000i probe allow for pass/fail fibre inspection analysis and reporting. Suitable for end-of-line testing, activation and maintenance of all FTTx/PON signals. The compact field unit performs simultaneous measurements for voice, data and video signals (through-mode capability).

The OLP-87 PRO has a touchscreen interface and USB connectivity, simplifying usability for technicians in the field. Features of this power meter and microscope include: 1490 and 1550 nm wavelengths (λ) downstream, 1310 nm λ burst mode upstream, and onboard storage and reporting software. It is supplied with various tip adapters.

TechRentals

www.techrentals.com.au

DC-UPS power supply systems

The Technology Dynamics CP-RK-BBU Series DC-UPS power supply systems are designed to provide clean, uninterrupted power to critical DC loads in the event of AC (utility) power loss.

The DC-UPS power supply provides backup power for a certain amount of time, depending on the load of the battery capacity. It is available in several power levels and configurations, which are designed for exact applications.

The DC-UPS is designed for harsh environments such as military and industrial-grade applications. It is a full-function DC-UPS battery backup system, complete with internal sealed lead-acid batteries. The rack mount system is rugged, efficient and suitable for critical systems where downtime cannot be tolerated. It contains a primary power supply, batteries and LVBD circuit.

It is available in 12, 24 and 48 VDC outputs with power levels to 3 kW. Standard run times include 10, 20 and 30 min on battery backup, depending on load requirements. Extended run times are available with additional battery racks. Options include extended temp operation, power factor correction, conformal coating, 400 Hz operation, chassis slides, analog or digital meters, MS connectors and more.

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News

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NEW WHS GUIDANCE FOR SMEs

New guidance material to help small business owners and operators understand their responsibilities under WHS laws has been released by Safe Work Australia. "If you make or influence the significant financial or operational decisions for a business then you may be an 'officer' under WHS laws," said Safe Work Australia's Chief Executive Officer, Michelle Baxter. "As an officer, you have a duty under WHS laws to look for ways to lead on WHS matters. Our new guidance material includes videos of real officers explaining how they fulfil this important role within their business." The guidance material, including short videos, is available on a dedicated web page.

CODAN UNDERGOES REBRANDING

Codan Radio Communications (a division of Codan Limited) has now rebranded to Codan Communications. The new name reflects continued product portfolio expansion that strategically strengthens the division as a full communications solutions provider, rather than simply a 'radio supplier'. Codan Communications provides end-to-end communications solutions with the aim of saving lives, creating security and supporting peacekeeping worldwide. In a statement, the company said that "the name change does not impact the way in which we support any of our existing customers, rather broadens what we supply". The firm has recently had significant contract wins in Afghanistan, Bangladesh, Malaysia, West Africa and the Americas.

2RU hot swappable DC power system

MPS Ultra is a line of 2RU preconfigured, hot-swappable DC power systems for wireless base station applications. Three factory preconfigured models provide 2.8, 3.5 or 5.6 kW of 48 or 24 VDC power.

The MPS Ultra combines high efficiency hot swappable power modules and a range of features to meet the requirements of installers and site managers for backhaul, radio access network and other demanding wireless applications.

Every model includes the ICT Intelligent Control Module to provide full TCP/IP remote monitoring and control of all system functions. The 2.8 kW and 3.5 kW systems include dual 100 A battery disconnect breakers, a 150 A low-voltage disconnect and configurable, fully managed load outputs rated at 20 A each. The 5.6 KW model is designed to provide bulk power for charging large-scale battery banks.

The Intelligent Control Module in the 2.8 and 3.5 kW models provides advanced battery management features, including battery state of charge, estimated run time remaining and battery discharge testing.

The MPS Ultra DC power system provides benefits including a load distribution capability that allows connected loads to be power-cycled remotely over Ethernet, either to reboot a device or take it offline for energy savings or scheduled maintenance. The MPS Ultra can be installed without having to remove any covers. All connections are accessible from the rear, making it one of the easiest and fastest DC power systems to install.

Helios Power Solutions
www.heliosps.com.au

Test mode software upgrade

The AFL FleXpress test mode is the latest software upgrade for the AFL FlexScan OTDR.

The test mode enables dual-wavelength network verification in less than 5 s per fibre, as compared to around a full minute with previous applications.

It includes automated remote control of optical switches for testing MTP/MPO connections and/or high fibre count cables and stores test results automatically as .SOR files, which can be uploaded for reporting using the TRM 2.0 Test Results Manager software.

The test mode is available for the FlexScan FS200-300 (high dynamic range, 1310 and 1550 nm) and FS200-304 (high dynamic range, 1310, 1550 and 1650 nm) models.

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News

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JVCKENWOOD, RADLINK TO SUPPLY SA TERMINALS

JVCKENWOOD Australia and partner Radlink Communications have successfully bid for the supply of Kenwood Viking P25 terminals to SA Power Networks, which will use the terminals as part of its future communications strategy. As South Australia's primary electricity distributor delivering power to about 860,000 customers, SA Power Networks is recognised for its industry-leading safety, reliability and efficiency. Integration of SA Power Networks' operational communications into the SAGRN will provide a widely available and reliable solution for communicating with crews in the field, including during outage and emergency responses.

BARRETT EXPANDS WITH NEW US OFFICE

Perth-based Barrett Communications has plans to open a new company office and facility in New York, USA. The new office and facility will house sales, engineering, product verification and distribution capabilities. Barrett's new facility will add synergy to the existing Barrett Communications business located in South America. The company is expanding its presence due to the increased demand for its products in North and South America and with US-funded programs globally. "Barrett is committed to growing our presence throughout this region and this new facility based in the United States is the ideal location for Barrett's strategic plan going forward," said Andrew Burt, CEO of Barrett Communications.

Vehicle mobile 'network radio'

The updated IMPULSE Wireless vehicle mobile 'network radio' is designed to provide reliable PTT over LTE communications, with a radio-like device that offers ease of use and the familiarity of a radio.

The VM2 improves on the VM1; with dual-SIM internal Telstra/Optus/Vodafone-compatible 4G modem, along with other hardware and software improvements.

One benefit of the VM2 is its compatibility with Australian 4G and 3G telco bands. Support for the right frequencies, including all of LTE Band28 (not just half of it), is crucial for proper operation and coverage.

Other advantages include the all-important front-facing speaker for loud and clear audio; a rugged fist microphone; four programmable function buttons; large SOS button; colour touchscreen; and it even supports Bluetooth and Wi-Fi.

Enhanced GPS tracking and live location services, SOS/duress alerts, messaging, statuses and third-party Android applications are all supported. Front-panel programmable buttons further add to the flexibility and ease of use.

The IMPULSE Wireless VM2 is powered from 12–24 VDC and is fully Australian approved (ACMA/RCM).

A 'radio-like' solution, the VM2 provides the benefits and coverage of PTT with an easy transition for radio users.

IMPULSE Wireless

www.impulsewireless.com.au

Interference locator

The R&S MNT100 RF interference locator detects, analyses and locates even complex pulsed interference signals. With the direction finding (DF) and PC-based radiolocation software upgrade, sources of interference can be located automatically and quickly.

The R&S MNT100 guides the operator to the interferer location based on 600 bearings/min in combination with sophisticated statistical analysis.

R&S MNT100 features real-time signal processing with integrated preselection, fast automatic location of interferers from a moving vehicle and triangulation of interferers with a directional antenna.

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PREPARING FOR THE 5G ROLLOUT

Meik Kottkamp, Technology Manager Wireless, Rohde & Schwarz

Test and measurement vendors will need to evolve their software and hardware for 5G, to benefit both themselves and their customers.

As the rollout of 5G starts to ramp up in 2019, we move a step closer to enjoying the much-anticipated benefits it will bring. Higher data rates will radically improve the experience of using mobile networks for both business and leisure activities. Reduced latency will enable new applications which require a deterministic real-time response, such as autonomous driving, remote surgery for e-health, virtual reality and cloud robotics for Industry 4.0. Finally, increased capacity will significantly reduce or eliminate congestion issues and facilitate M2M communications at a scale that will take system interconnectivity to a new level.

The three main focuses of 5G enhancements, namely enhanced mobile broadband (eMBB), massive machine type communications (mMTC) and ultra-reliable low latency communication (URLLC), all come with their own technology challenges, including the spectrum shift to higher frequencies and the need for advanced antenna arrays to enable beamforming and Massive MIMO.

Network and end-user equipment developers have been making steady progress in addressing these challenges over the last few years. But critical to the successful rollout is the development of test and measurement (T&M) equipment that enables developers to evaluate the performance and standards compliance of this new equipment in the lab, in production and in the field.

To get 5G equipment to market quickly, efficiently and economically requires T&M vendors to work closely with both the top-tier equipment makers and the standards authorities to resolve their own set of technical challenges and provide a complete spectrum of T&M solutions that are both fit for purpose and have a low cost of ownership.

The solutions to these challenges are both evolutionary and revolutionary. Since both 4G and 5G are based on orthogonal frequency-division multiplexing (OFDM), existing equipment designed for 4G can often be upgraded, in some cases just with software, to make it suitable for 5G. This is the case with signal generators and spectrum and signal analysers from established T&M equipment vendors, such as Rohde & Schwarz, that design in this futureproofing in order to reduce not only development costs for themselves, but notably also the total cost of ownership of their products for their customers.

In other cases, hardware evolution is required. This is the case, for example, with vector network analysers, which are now required to have true multiport test capabilities to support Massive MIMO. A top-of-the-range 5G analyser can now boast support for up to 24 ports in real time, which can be increased to 288 ports using a switch matrix. This is important as Massive MIMO antenna arrays typically have 128 antenna elements or more. Simultaneous testing of LTE and 5G terminal devices, necessary for the network architecture favoured by the majority of network operators, also requires hardware enhancements, in part because over-the-air (OTA) measurement solutions need additional shielded chambers.

Where evolution of existing T&M equipment or designs is not feasible however, technological revolution is required. A clear

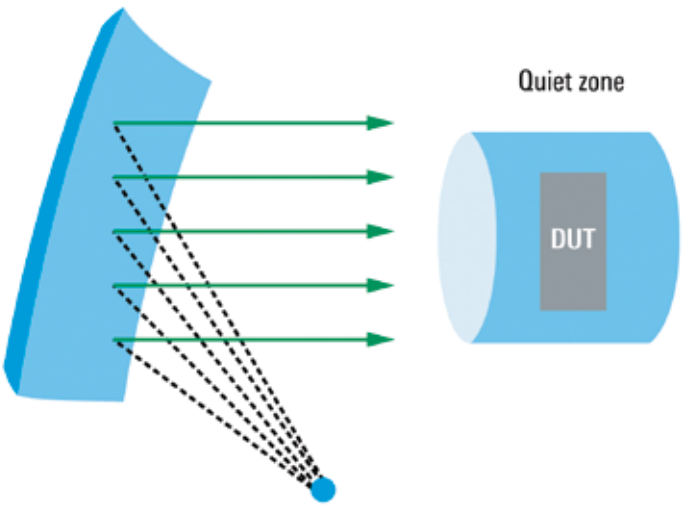

Figure 1. OTA testing at sub-6 GHz frequencies is very difficult, but could be resolved by making near-field measurements under far-field conditions.

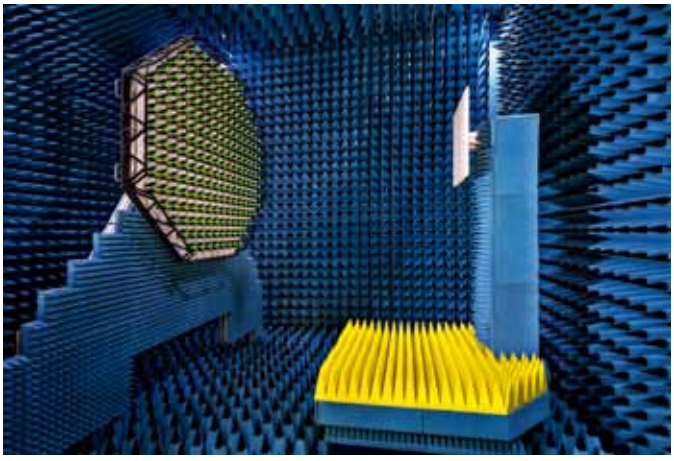

Figure 2. Using an antenna array, it is possible to create a planar field that allows for a quiet zone.

example in this category is a consequence of the introduction of new frequency bands. The implementation of components, chipsets, modules, wireless devices and base stations in the 28 GHz or 39 GHz band requires higher integration density and the use of active antenna systems in order to enable efficient beamforming. The need for low path loss and small size lead to highly integrated PCBs that include antennas, amplifiers and analog phase shifters. As a result, RF connectors are no longer available. This means that OTA test solutions have to be rolled out to replace existing conducted measurement methods. However, OTA testing at sub-6 GHz frequencies is very difficult as far-field analysis would require very large chambers measuring 10 metres or more.

One innovative solution to this problem is to make near-field measurements under far-field conditions. At cm/mmWave frequencies, compact antenna test range (CATR) solutions apply, which create far-field conditions in close vicinity to the DUT (Figure 1). CATR realises the NF-FF transformation with a well-designed and highly accurate produced mirror. The reflector weight significantly increases below 6 GHz operation, since massive MIMO antennas easily reach radiating dimensions greater than 70 cm or 80 cm. The cost, fabrication time and handling of large, heavy mirrors becomes prohibitive. Using an antenna array, it is possible to create a planar field that allows for a quiet zone of 1 metre in diameter within a measurement distance of 1.5 metres, thus enabling much more convenient and cost-effective equipment to be used (Figure 2).

As mentioned, with the introduction of mMTC and URLLC in particular, 5G facilitates a whole new range of applications, from automated driving to IoT and cloud robotics. This broadens the field of test and measurement to encompass additional requirements such as safety and security, where reliability, deterministic low latency, authentication and encryption are critical. A T&M equipment supplier with products already in these markets and an experience in topics such as cybersecurity and radio monitoring will have much to contribute to 5G testing in these areas.

Clearly, 5G test and measurement is a complex and rapidly evolving topic. Successful T&M equipment suppliers will need to build on their success and experience in 4G, evolving the software and hardware where feasible to minimise costs both for themselves and for their customers. They will need to leverage their close relationships with those customers and work together to develop solutions for 5G that will enable those customers to access the new markets first. Taking an active role in driving the new standards from within the standards bodies, particularly the 3GPP, is providing the advanced insight that will also facilitate early market access.

Finally, as new 5G-enabled applications evolve, it is expected that today's single-source, broad-range T&M suppliers will have most to offer to companies which are keen to make early gains in those developing markets.

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Industry Talking

The year is off and running and ARCIA members have been busy across a number of areas. It was very pleasing to see that out of our involvement in school careers events, Karera Communications initially gave a work-experience placement to a student and has now offered him an apprenticeship. Hopefully we will see this happening in other areas around Australia as well.

ARCIA had a first meeting with new ACMA staff, and together we have outlined some key areas on which we would like to work together — they include enforcement, LM8 licensing guidelines, industry training and market trends. ARCIA has worked hard over the last few years with the ACMA on a variety of issues to ensure that we have good lines of communication with this critical federal agency. One of the areas we discussed is where the next trained people are going to come from… those who will understand and manage spectrum in the real world. This is an industry-wide problem and one that will affect the ACMA as well as industry. On that theme we are hoping that we see more ACMA staff at our ARCIA and Comms Connect events, and there may even be some shared training. Please reach out to any ACMA staff and make them feel welcome.

ARCIA held its annual planning days in February in Brisbane. We are fortunate that we are able to gather our committee and partners together over two days; this really sets the platform for the year and helps us all better understand where to direct our energies. One of the key items for 2019 is to find a replacement for our retiring executive director, Ian Miller… which, as we all appreciate, is going to be a difficult task. Ian's passion and industry knowledge is going to be very difficult to replace.

The planning days cover all of the ARCIA events and how we invest members' funds into complimentary projects such as training. We also meet with our key industry partners to find out how they see the industry and what they would like to see ARCIA do. All of the committee members who attend are taking time out of their busy schedules with the backing of their employers; we thank them for their continued support.

2019 will see further engagement with PSCE in Europe, FirstNet in the USA and control room groups. A recent example of such engagement was a joint submission with the University of Melbourne to the federal government, on the importance of critical communications for smart cities. We feel it is important that ARCIA advocates for all users of critical communications, including LMR and future technologies such as LTE. The technology used is not the critical question, it is the recognition that there are a group of users that require specialist access and features, and that these communications needs extend beyond the traditional boundaries. Smart cities, the IoT and Next-Gen 000 are now all becoming part of the one critical communications ecosystem. Internationally, the TCCA has taken up this role, and it is important we learn from our international colleagues, users and suppliers.

Finally, we should have the new ARCIA website up and running in 2019 and we hope it will be easier to use and manage. Make sure you check out the events in your local state and put them in your calendar now. Perth is the first event for the year (28 March), so for our Western Australian members… we hope to see you there.

Hamish Duff, President
Australian Radio Communications Industry Association

IoT wireless sensor devices

Advantech's WISE-4210 series of IoT wireless sensor devices includes a wireless LPWAN-to-Ethernet AP and three wireless sensor nodes. The device-to-cloud total solution provided by this series allows IT, OT and cloud platform system developers to easily implement a private LPWAN, acquire field site data and achieve seamless integration with both public cloud, such as Microsoft Azure, and private enterprise clouds.

Based on proprietary LPWAN technology, the WISE-4210 series minimise frequency band interference, support a wider data transmission range, are compatible with lithium batteries and enable cloud platform integration. By locking the sub-GHz frequency band, WISE-4210 series significantly reduce susceptibility to interference for 2.4 GHz wireless communication technologies such as Wi-Fi, Bluetooth and Zigbee. By supporting a network transmission distance of up to 5 km, the WISE-4210 series meets the requirements of large-scale interior environments such as data centres, factories and warehouses for collecting and applying a wide range of interior data.

With LPWAN technology, only three 3.6 V lithium batteries are required to operate the nodes for up to five years, eliminating the need for additional wiring and frequent recharging. Additionally, the WISE-4210 series supports multiple transfer protocols, including MQTT, RESTful, Modbus/TCP and Modbus/RTU, for simple device-to-cloud connections.

The WISE-4210 series of LPWAN IoT wireless AP and sensor nodes provides the necessary device-to-cloud integration functions for conventional automation and emerging IoT applications. The WISE-4210 series allows users to easily deploy private networks and quickly develop systems.

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Introducing the CM60 Series

Designed, engineered and manufactured in Australia for the toughest conditions, the CM60 Series provides a robust solution ideal for both the large systems integrator with an extensive network of mobiles, portables and repeaters, or the small operator with a single site.

The CM60 Series provides an analogue solution with optional licensing upgrades for P25 in Conventional, Trunk and AES 256-bit Encryption.

The advanced User Interface Control (UIC 600 Series) features an OLED screen for high-visibility characters, back-lit keypad, powerful front facing speaker and a secure in-vehicle interactive bracket.

All CM60 variants are compliant with AS/NZS 4295 (LMR). UHF variants are compliant with AS/NZS 4365 (CB) and all P25 variants are CAP (Compliance Assessment Program) compliant, conforms to TIA-102 Standards.

GME

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AUSTRALIAN MADE

P25

China's pipeline lifeline

A Hytera-provided radio communications system is helping to keep the world's longest gas pipeline running smoothly.

Australia is no stranger to oil, gas and water pipelines running through inhospitable terrain; we have some of the longest and remotest pipelines in the world. Providing reliable communications along such pipelines is always a challenge, so spare a thought for the engineers who had to design a radio system to cover the world's longest pipeline, the 10,000-kilometre-long China-Asia Gas Pipeline. The China-Asia Gas Pipeline runs from the border of Turkmenistan and Uzbekistan, through central Uzbekistan and southern Kazakhstan, and then into China. Each year around 300 billion cubic metres of natural gas is transferred to China, equal to half the country's domestic natural gas production in 2007. More than US$7 billion was invested by the China National Petroleum Corporation to construct the pipeline, which has important strategic significance for the Chinese Government and for the country's economic development.

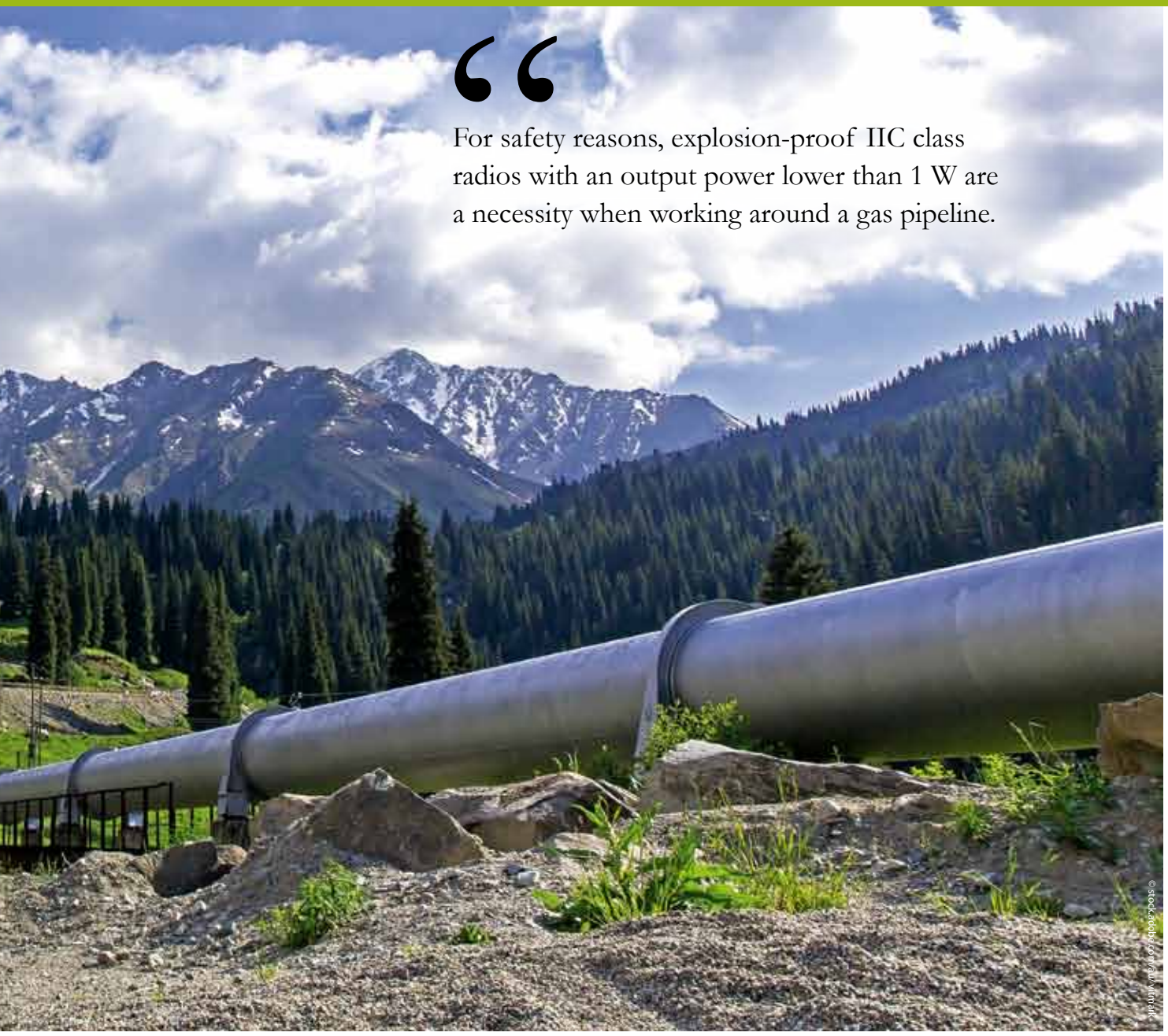
Safe solution

In order to ensure the project ran efficiently, a comprehensive technology solution was needed to cover many aspects of the pipeline's operation, including:

- GSM system
- Video monitor system
- Trunked radio system
- Comprehensive dispatching and management functions

The detailed project requirements included:

- Coverage greater than 95%, and a one-time call termination rate greater than 99%
- Interconnection between the trunked radio system and PSTN/PABX
- Ability to use conventional radios with the trunk system



- Taking future expansion into account with readiness to upgrade into the digital era
- Comprehensive engineering capability
- Data applications — as well as basic voice dispatching, SMS and status message functions were also needed

Hytera took part in the project as subcontractor of the trunked radio system provider. After analysing the technical requirements, Hytera designed the specific solution, which included:

- 1 control centre
- 7 base stations
- 3 TS-8600 vehicle-mounted mini-trunk systems
- 40 RD98X repeaters
- 180 portable radios
- System management for terminals and dispatchers

For safety reasons, explosion-proof IIC class radios with an output power lower than 1 W are a necessity when working around a gas pipeline.

Complete system

The system Hytera provided included IP-over-satellite capabilities to provide communication between the mini-trunk vehicle and fixed trunk systems. Hytera also conducted site planning and product performance assurance activities to achieve the necessary one-time call access requirements. As far as the radios are concerned, Hytera enlarged coverage by adjusting one RD98XM to repeater mode under every base station. The DMR RD98XM supports analog while leaving open the option for future upgrades to digital. The company also connected the trunked radio system to the PSTN/PABX network using two-time dial-up. In addition to providing the equipment, Hytera assisted the customer with system installation and commissioning, tower purchase (including installation and frequency applications) and tailored solutions such as a specific-size MPT base station.

“Hytera understood what we do, and helped us extensively,” said Eric Liu, Project Manager, China National Petroleum Corporation. “It didn’t matter what documentation was required, what technical communication was needed or what delivery required supporting, Hytera performed as an experienced international company. We were so happy to cooperate with Hytera, and we hope we will continue to work with them in the next stage of the gas pipeline project.”

Hytera

Hytera Communications (Aust) P/L
www.hytera.com.au

SPOTTING AND STOPPING THE SPECTRUM SABOTEURS

The SOCRATES project aims to shield the electromagnetic spectrum from disruption by malicious parties.

A new research project has been launched with the aim of developing a system for detecting threats to the electromagnetic space. Led by Spain's IMDEA Networks Institute, the SOCRATES project has recently been awarded funding by NATO's Emerging Security Challenges Division's Science for Peace and Security Programme (SPS).

The collaborating partners on the project are the ElectroSense non-profit association of Switzerland (a crowd-sourcing initiative that collects and analyses spectrum data) and Katholieke Universiteit Leuven of Belgium.

The security of the electromagnetic spectrum has tremendous strategic importance to society. In particular, the wireless infrastructure that carries services such as cellular networks and GPS is especially critical.

However, the cost of commodity radio technology prices is now so low that access to it is no longer restricted to governments and network operators. It is now affordable to individuals, giving them the potential to become malicious intruders.

More frequent and more sophisticated threats from such infiltrators could wreak havoc and are among the most serious challenges faced by society. Unauthorised transmissions could threaten the operation of networks used by air traffic control systems, police, security and emergency services, for example.

The SOCRATES project will deliver a security system to protect the electromagnetic environment and the services and users that depend on it.

"SOCRATES will provide an accurate, autonomous, fast and secure system based on a novel and disruptive IoT (Internet of Things) architecture," said Dr Domenico Giustiniano, IMDEA Research Associate Professor and coordinator of the project.

"By detecting and locating unusual RF signal and source activity it will identify intruders in the electromagnetic space, before a threat can become serious, learning about its physical layer features and its geographic location.

"IMDEA Networks will lead the investigation of the quality of spectrum sensors in a crowdsourced system, challenged by the large amount of data processed by the system, and of the distributed localisation of emitters, challenged by the lack of synchronisation among the spectrum sensors — two areas in which we build upon our extensive expertise."

The SOCRATES solution will need to be suitable for real-world implementations. According to Giustiniano, the project plans to test the SOCRATES system in controlled and realistic conditions, operating in both licensed and unlicensed spectra. Experiments will showcase the system's ability to detect the waveforms and wireless technologies of adversaries who are misusing wireless resources.

"We'll also demonstrate how the physical location of an intruder can be swiftly identified. Adopting an agile approach, we'll build, demonstrate and showcase early prototypes throughout the project," he said.

By providing the capability to detect, identify and locate potential threats to electromagnetic infrastructure security, SOCRATES represents an important step in ensuring society's readiness to respond effectively to them, and will shield economic and social structures from those who would harm them.

The project's work will be concluded by May 2021.

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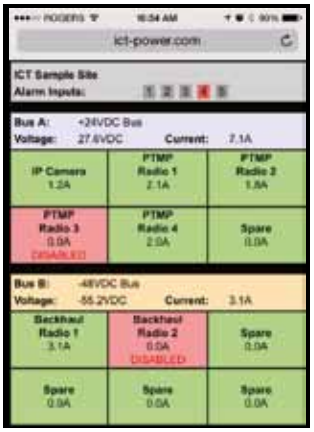

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FIRSTNET POWERS AHEAD

Jonathan Nally

Band 14 spectrum has been deployed in more than 500 US markets, with FirstNet connections exceeding 425,000.

Image courtesy FirstNet.

The LTE coverage area for AT&T's network and the FirstNet public safety communications platform was expanded by more than 130,000 square kilometres across the US in 2018, covering an additional 1 million individuals.

"The demand for data has been on a nonstop, upward trajectory for years," said Marachel Knight, Senior Vice President, Wireless and Access Engineering, Construction and Operations, AT&T.

"Our ongoing work to launch new sites and build out our LTE network is delivering increased network speeds and capacity. By the end of this year, we expect our network capacity to increase by 50% since the end of 2017 while simultaneously laying the foundation for a 5G future."

AT&T has deployed Band 14 spectrum in more than 500 US markets, with more than 5250 public safety agencies using 425,000-plus connections on FirstNet as of this month. The latter figure represents a more than 60% increase in the number of connections since the end of October 2018.

"We're less than a year into the Band 14 build and months ahead of schedule. And we already cover more than 40% of our total FirstNet Band 14 rural and non-rural coverage targets. That's about a 10% jump in the FirstNet square miles covered since last October," said Chris Sambar, Senior Vice President, FirstNet at AT&T.

"Witnessing the real, tangible and — at times — life-saving impacts that FirstNet had in 2018 fuels us to keep moving quickly to blanket the country with reliable connectivity. And we're set for the explosive growth ahead."

AT&T says it has three areas of focus for the continuing rollout of FirstNet:

1. Reaching rural and remote parts of the US.
2. Increasing capacity for urban responders.
3. Keeping the public safety community updated with innovative solutions.

FirstNet is being built in public-private partnership with the First Responder Network Authority (FirstNet Authority).

"FirstNet is advancing quickly — both in terms of progress and adoption. It's an incredible testament to the need first responders have for a dedicated, purpose-built network as well as the unparalleled capabilities FirstNet has already delivered. We are looking forward to the further expansion of FirstNet in the year ahead and will continue to work closely with first responders and AT&T to ensure FirstNet is being built to their specifications — coverage and capacity included," said FirstNet Authority Acting CEO Edward Parkinson.

"With the Band 14 buildout validated thus far, we're pleased that more first responders in rural and urban areas have even more access to the connectivity and modern communications tools they need."

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COMMS CONNECT AUCKLAND 1–2 MAY 2019

Jonathan Nally

A must-attend event for everyone involved in business- and mission-critical communications.

Comms Connect brings radio and wireless communications industry users, dealers, consultants, manufacturers and other stakeholders together in order that they can network, learn, share ideas and do business together.

The combined conference and exhibition presents the very latest from the sector — from narrowband radio to PTT-over-cellular, from professional LTE to satellite communications — and is a must-attend event if you are a first responder; work in public safety, transport or utilities; operate in the mining, oil and gas or the wider resources sector; work in security, defence, a commercial enterprise or government department; or if you're active in any other sector that uses radio and converged communications.

The conference will include technical presentations, case studies and workshops presented by a line-up of 30-plus top local and international speakers and subject matter experts.

TJ Kennedy, co-founder of US-based consultancy The Public Safety Network (and formerly president of the US First Responder Network Authority), will present a keynote address on 'Why we need public safety broadband now'. Kennedy will share his personal experiences to help us all understand why we need reliable global public safety LTE networks and their accompanying solutions now, not in 3 or 5 or 10 more years.

The full speaker program can be found at comms-connect.co.nz, but here's a small selection of sessions:

- Chris Goldsmith (New Zealand Emergency Services) — Nationwide critical communications for New Zealand
- Assistant Commissioner Jevon McSkimming (New Zealand Police) — Vision 2030: the future world of delivering emergency services
- Aaron Prior (Aviat Networks) — Demystifying 5G wireless backhaul
- Chris Stevens (CartGiS Pty Ltd) — The use of cellular SD-WAN for DMR linking
- Geoff Waterhouse (NSW Ambulance) — The benefits of being a collaboration partner
- Station Officer Graham Tait AFSM (Fire & Rescue NSW) — Transitioning to a data-enabled world
- Grant Jamieson (Wireless Innovation) — Wireless mesh networks explained and applied
- Jason Karp (The Public Safety Network) — Communications for preparedness before, during and after disasters

- Lex Grubner (RF Test Solutions) — 5G and its over-the-air RF performance
- Dr Murray Milner (Milner Consulting Ltd) — Next-gen critical comm — lessons from overseas jurisdictions
- Sara Isoardo (Radio Activity) — Simulcast modulation options for P25 and DMR
- Sarosh Dubash (Schneider Electric) — IP-based data radios for more efficient SCADA comms
- TJ Kennedy (The Public Safety Network) — Public safety's shift to mobile-first
- Terry Burnworth (Pyramid Consulting) — LMR case study: A distributed architecture system

Workshops

A special feature will be a workshop presented by TJ Kennedy and Jason Karp from US-based consultancy The Public Safety Network, which will look at the current, global landscape and will consider, during open, facilitated discussion, just what is required to ensure the very best communications solutions are available for first responders. In particular, the discussion will consider how to prepare for and respond to natural disasters and the planning and foresight needed to ensure critical communications systems are able to be leveraged during such events.

Another special workshop will comprise a briefing from MBIE Radio Spectrum Management on radio spectrum policy, licensing and compliance in New Zealand. The briefing will be given by Len Starling (Manager, Radio Spectrum Policy & Planning), Fadia Mudafar (National Manager, Radio Spectrum Management) and Siegmund Wieser (Manager, Radio Spectrum Management Licensing). There'll be plenty of opportunity for delegates to ask questions.

Exhibition

The exhibition will cover 1000 square metres and comprise more than 40 exhibitors, including all the big names in the Australasian comms market — led by the Gold Sponsor, Zetron — with an emphasis on innovative New Zealand firms. You can see a full list of exhibitors and sponsors at comms-connect.co.nz/whos-exhibiting.

RFUANZ AGM, awards and dinner

The RFUANZ is a non-profit organisation whose membership ranges from local government authorities to transport operators, consultancies to radio dealers, and network operators to private individuals. Its mission is to protect, promote and preserve the rights of organisations and individuals who require access to the radio spectrum.

The Association's annual general meeting will take place on the morning of 1 May at the same venue as the conference, followed that evening by the RFUANZ Industry Excellence Awards and Gala Dinner (the venue for which will be the marvellous St Matthews in the City). For ticketing and other enquiries, send an email to admin@rfuanz.org.nz or visit www.rfuanz.org.nz.

Essential event

It's vital that all users of radio and converged communications in business- and mission-critical working environments — as well as dealers, manufacturers or suppliers in this sector — seek out the very latest information, technologies and solutions, and build relationships. Comms Connect Auckland will deliver that opportunity for you and your colleagues. See you there!

Comms Connect Auckland 2019

Conference:	1 May (9.00am–5.00pm), 2 May (9.30am–5.00pm)
Exhibition:	1 May (9.00am–5.00pm), 2 May (9.00am–3.30pm)
Where:	SKYCITY Auckland 88 Federal St (skycityauckland.co.nz)
Who:	More than 300 delegates and 40-plus exhibitors
Web:	comms-connect.co.nz

No smoke, no mirrors

An efficient new digital emergency alerting system has gone live in Iowa in the United States.

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For Iowa County, one of 99 counties in the largely rural US state of Iowa, a recent upgrade to digital radio has delivered a spectacular boost in communications performance. Where previously it took many minutes to contact all the emergency forces needed to cover an incident, today the whole alerting process can be completed in seconds.

In preparing for its digital rollout, which went live in August 2018, the county chose a hybrid system which combines Project 25 radio for voice communications with a POCSAG paging system from Swissphone for alerting crews. Alongside the improvement in speed, the combination delivers reliable coverage of this largely rural area at far lower cost than an all-P25 system.

The Swissphone network replaces an old tone-voice paging system which could be tricky for the dispatchers to handle. "Previously our infrastructure consisted of two tower sites for paging and the radio," explains Josh Humphrey, Emergency Management Director for Iowa County. "They had to guess: 'Do I page off the south tower or off the north one, for whichever agency is related to the event?'"

The tone-voice paging system allowed only one agency to be paged at a time. "We had a policy setting for which agency had priority over others," he adds. "So if we wanted to page the whole county, it might take us 20–25 minutes to page everyone — whereas now it takes only seconds to page everyone. So, alerting-wise, it's a huge, huge time-saver."

Better and cheaper than P-25 Paging

"We have eight paging sites now," Humphrey continues. "And the infrastructure is a lot beefier: reliability and coverage are exponentially better. We were having a lot of issues with tone-voice paging where we would get phantom pages at 3 a.m. We don't get any of that any more!"

The new system is the outcome of three years' work by a five-member radio committee, now the county's radio governance board. The supplier chosen to provide the paging network was Iowa-based RACOM Corporation, which has provided a similar Swissphone alerting system to nearby Blackhawk County.

Among the alternatives evaluated by the committee was to use the Project 25 800MHz network for paging as well as voice. This looked promising — but only one company was offering pagers at that time, and they were expensive. "Most of our agencies here are volunteer fire, volunteer EMS people," comments Josh Humphrey. "They are reliant on fund-raisers like pancakes breakfasts. So the communications committee basically said there's no way that we can go to these fire departments and say one pager is going to cost you

The options for Iowa County

	Option 1: Upgrade analog infrastructure	Option 2: P-25 Paging	Option: POCSAG paging
Infrastructure	Approx USD 1 M (AUD 1.4 M) for new simulcast controller.	Approx USD 1.5 M (AUD 2.1 M) for three new P25 sites (additional microwave backhaul required)	USD 400,000 (AUD 560,000) for turnkey infrastructure including web interfaces for fire chiefs and s.ONE
319 Pagers	- (keep old analog pagers)	USD 303,000 (AUD 424,00) (USD 950/pager) (AUD 1330/pager)	USD 92,000 (AUD 129,000) (USD 288/pager including charger and hybrid option) (AUD 405/set)
Total	USD 1 M (AUD 1.4 M)	USD 1.8 M (AUD 2.5 M)	USD 0.5M (AUD 700,000)

Swissphone's digital paging system is the most cost-effective solution for alerting multiple user organisations sharing a single network.

$1000. How many pancake breakfasts does it take to buy one fireman his equipment?"
A further drawback of the P25 paging option was that extra radio sites would have been needed to achieve adequate radio coverage across the county. While a DiCal site costs less than USD 20,000, a new P25 site can cost half a million dollars, and three of the towers which today carry DiCal paging transmitters would not have been suitable for P25. "Those towers wouldn't be able to support the microwave backhaul," explains Steve Holmes, Senior Project Manager at RACOM. "So that would have been an additional big expense, to install a bigger tower that would support the backhaul. That in itself is a huge saving."

Stewards' decision

Yet another possibility was to convert the existing network to simulcast paging, retaining its tone-voice pagers. However, simply to add the simulcast controller could have cost as much as $1 million.
Swissphone's network plus more than 300 brandnew digital s.QUAD pagers for the county's volunteers worked out USD 500,000 (AUD 700,000) cheaper than just upgrading the old analog network and keeping the old analog pagers. "It was pretty much no question that this was the best solution," Humphrey declares. "As a steward of taxpayer money, how would you justify not [choosing the new system], knowing that with simulcast tone-voice paging we were still going to get those phantom pages in the middle of the night, we'd still have reliability issues with the pagers such as battery issues.

The s.QUAD X35 delights with its robustness, outstanding reception and its volume.

> "Not having to rely on an IP backhaul and not having to deal with simulcast overlap leading to signal interference is a big advantage of Swissphone's network architecture versus other solutions," says Steve Holmes, Senior Project Manager at RACOM.

"Now we are seeing anywhere from six to eight weeks on a battery without charging it, and I'm getting every page on my pager."

Direct and resilient connection

A key feature of the Swissphone technology is that its sites do not all require a direct IP connection, either microwave or wired. Instead they can link one to another over the air, via the paging frequency. "So we have three sites now that aren't on microwave — they are a secondary ring," says Josh Humphrey. And he reflects: "The cost which it was going to take to add new towers and expensive P25 sites, and then to buy all those pagers — a $200 pager versus a $950 pager. Which one would you want to buy?"
The ability of Swissphone's system to communicate over the air-interface also means that all DiCal base stations can still be reached even if one or several IP connections should fail in a blackout. In that case, the network automatically detects the connection failure and sets off all base stations over the air-interface. This is one of the fallback levels of Swissphone's system, which is set up completely redundantly.
As a supplementary alerting system, to back up the paging network, the county has been using a commercial service which communicates with smartphones via a mobile app. But this will be soon replaced by Swissphone's s.ONE software, an application for alerting, monitoring and resource management, in conjunction with the s.QUAD pagers connected to the smartphones of firefighters. This hybrid option of the s.QUAD allows the firefighter to let the dispatcher know his availability and to acknowledge an alert.

Seamless start-up

The paging system went live after 30 days of shadow operation, having been integrated smoothly with the county's existing CAD system. Training was provided for operators and the users, including the county's many volunteer responders — who now carry Swissphone's simple-to-use s.QUAD message pagers — to make certain that they were comfortable with the new system.
For the dispatchers, the biggest improvement is in being able to target their messages, Humphrey believes. "They have the ability to select however many agencies are involved in that incident, select them all, give them the same message, send it once, not have to repeat that message multiple times over several minutes.... That speeds up the alerting process, which is the whole point of an alerting system.
"In the end, it works just like it was promised, and it's reliable and it's resilient and it cost less than everything else. It is exactly what we asked for, it does what it does and people now can see that there was no smoke and mirrors. That's exactly what it is."

Josh Humphrey, Emergency Management Director, Iowa County

SWISSPHONE

Swissphone Wireless AG
www.swissphone.com

5G AT RISK FROM SPECTRUM ACCESS

With less than one year to go until WRC-19, the GSMA has called for governments to support mobile industry spectrum needs.

The successful rollout of ultrafast 5G services relies on timely access to the right amount and type of spectrum in the next year, the GSMA has warned. As the race to launch 5G services intensifies, the GSMA highlights the need for governments, regulators and the mobile industry to work together to deliver widespread coverage, and the full potential of 5G for everyone.

According to the GSMA Public Policy Position on 5G Spectrum, governments around the world have started to auction spectrum for 5G networks, but variations in how much spectrum has been assigned, the onerous conditions imposed — and the cost of access to that spectrum — means the speed, reach and quality of 5G services could vary dramatically between countries.

Early-adopter countries will be the first to realise the significant benefits of 5G — from fibre-like mobile broadband speeds and smarter cities to autonomous cars and digitised factories — and stand to reap important socio-economic benefits including GDP growth.

GSMA Intelligence forecasts that there will be 1.3 billion 5G connections by 2025, but this will be dependent on operators gaining access to sufficient spectrum.

"Operators urgently need more spectrum to deliver the endless array of services that 5G will enable — our 5G future depends heavily on the decisions governments are making in the next year as we head into WRC-19," said Brett Tarnutzer, Head of Spectrum, GSMA.

"Without strong government support to allocate sufficient spectrum to next-generation mobile services, it will be impossible to achieve the global scale that will make 5G affordable and accessible for everyone.

"There is a real opportunity for innovation from 5G, but this hinges on governments focusing on making enough spectrum available, not maximising auction revenues for short-term gains."

The GSMA has outlined several key considerations for governments and regulators, including:

1. 5G needs wider frequency bands to support higher speeds and larger amounts of traffic. Regulators that make available 80–100 MHz of spectrum per operator in prime 5G mid-bands (eg, 3.5 GHz) and around 1 GHz per operator in vital millimetre-wave bands (ie, above 24 GHz), will best support the very fastest 5G services.

2. 5G needs spectrum within three key frequency ranges to deliver widespread coverage and support all use cases:

- Sub-1 GHz spectrum to extend high-speed 5G mobile broadband coverage across urban, suburban and rural areas and to help support Internet of Things (IoT) services
- Spectrum from 1–6 GHz to offer a good mix of coverage and capacity for 5G services
- Spectrum above 6 GHz for 5G services such as ultrahigh-speed mobile broadband.

3. It is essential that governments support the 26 GHz, 40 GHz (37–43.5 GHz) and 66–71 GHz bands for mobile at WRC-19. A sufficient amount of harmonised 5G spectrum in these bands is critical to enabling the fastest 5G speeds, low-cost devices and international roaming and to minimising cross-border interference.

4. Governments and regulators should avoid inflating 5G spectrum prices (eg, setting high auction reserve prices) as they risk limiting network investment and driving up the cost of services.

5. Regulators should avoid setting aside spectrum for verticals in key mobile spectrum bands; sharing approaches, such as leasing, are better options where vertical industries require access to spectrum.

"Governments and regulators have a major role to play in ensuring that consumers get the best outcome from 5G," said Tarnutzer.

"Once spectrum is allocated to mobile at WRC, licensing that spectrum at a national level, as history has shown, can take up to 10 years. Therefore, it is essential that governments take the right action now."

Online UPS range

The Helios Mars III Series High Performance Redundancy Online UPS range has a rack/tower convertible design.

Other features include: unity power factor; patented back-up runtime estimation; flexible battery configuration (variable number of batteries to best suit user requirements); easy parallel installation; frequency converter operation mode; smart ECO Mode 98% efficiency; generator compatible mode; full-time digital signal processor (DSP) control; LCD mimic panel; power range and runtime scalability for redundancy or capacity; optional high-capacity battery charger for extended runtime; optional galvanic isolation transformer module/MTBS box; and rack-mounted parallel/maintenance bypass switch solution.

Helios Power Solutions

www.heliosps.com.au

Core alignment fusion splicer and cleaver

The Fujikura FSM70S+ Core Alignment Fusion Splicer and Cleaver is suitable for various splicing needs, including applications with typical splice losses of 0.02 dB and 0.01 dB on single and multimode fibres respectively. It is available to rent from TechRentals.

The 70S+ Fusion Splicer enables simple manual operation with only four steps and automated tension test, wind and heater cover, 6 s ultrafast splice time, 14 s heat time and 20,000 splicer result storage. It has Bluetooth connection capabilities and an automated wind protector.

The CT50 Cleaver accompanying the splicer is applicable for up to 12-fibre cleaving. Its automatic cleaving blade rotates via wireless communication and has a blade life of up to 60,000 cleaves. It also has a wide cleaver opening angle, enabling easy fibre placement.

TechRentals

www.techrentals.com.au

MULTITECHNOLOGY MESH MAKES BUILDINGS TALK

A combination of several low-power wireless technologies has produced a mesh that's perfectly suited to indoor sensor networks.

An Australian company, using a wireless solution developed by the University of NSW (UNSW), is rolling out technology across the country that enables buildings to monitor themselves and report problems autonomously.

Known as EMIoT, the new wireless platform relies on LED exit signs as the backbone of a low-power meshed network that covers 99.9% of a building — even reaching underground carparks, pump systems and air conditioning. And WBS Technology, which is commercialising the technology, has installed it in more than 10 apartment complexes — the latest being at Castle Hill in the northwest of Sydney.

"All you need is to install the emergency lights, and they all automatically connect to each other, and that creates the network," said Dr Wen Hu of UNSW's School of Computer Science and Engineering. "The emergency lights can then be networked with other devices via various wireless technologies, including Bluetooth, which allows them to be controlled locally with a smartphone or via the internet from anywhere in the world."

Each exit sign or emergency light acts as a node in the network, passing information back and forth across a building. Once operating, other devices can be connected to the network — ventilation and pumping systems, security cameras and sensors, access doors to common areas and halls — enabling all of them to be controlled and monitored remotely.

Sensors as a service

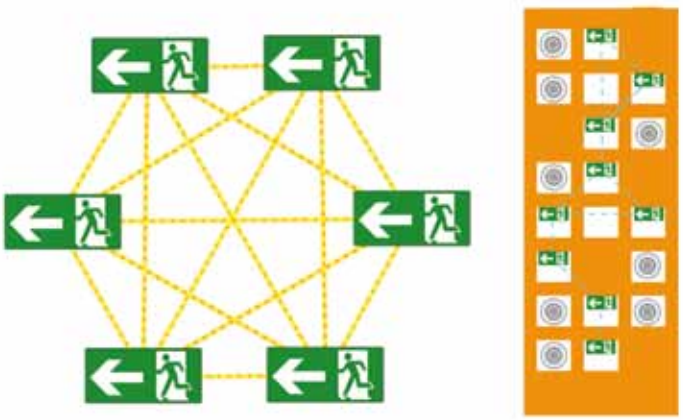
What's new is that WBS, an emergency lighting manufacturer in Sydney, is using the technology to transform itself into an entirely new business: instead of just making and selling emergency lights, it also offers 'sensors as a service'. For a fixed monthly fee, WBS provides a network of emergency and other lights that monitor themselves, react to their surroundings and to remote commands, and can have other devices added to the same network.

At the retrofitted apartment building in Castle Hill, lights in the underground carpark dim when there's no movement and brighten when there is, as do lights in hallways and common areas. If a light fitting fails, building managers know which one and how long it has been inoperative.

As the network expands, energy usage and the status of heating and cooling could be tracked, flow gauges report back on water usage and identify leaks, ventilation and pumping systems monitored remotely, and hot water systems checked for faults. Even residents trapped in an underground carpark would be able to communicate with building managers via an app.

Luke Gibbeson (WBS Technology) and Dr Wen Hu (UNSW) inspect emergency fire exit signs configured with IoT communications capabilities developed at UNSW.

Photo by Quentin Jones.



Smart building ecosystem

"We're actually creating a smart building ecosystem," said Luke Gibbeson of WBS Technology. "There're 14 buildings in this apartment complex, and we've installed a networked emergency lighting solution throughout them without any cabling and with no supporting network infrastructure.

"Our communications gateway looks like a standard exit sign, which relays other emergency lights communication to the cloud and acts like a normal exit sign — so it's a plug-and-play system. You can install in a new building or retrofit into an older one, like this one," he added. "As more IoT devices are installed, they can be added to the network, and all managed remotely via a cloud-based service, or locally through a smartphone app."

Meshed network

The collaboration between UNSW engineers and WBS Technology began under UNSW's TechConnect incubator program, funded the NSW Government's Boosting Business Innovation Program for small-to-medium enterprises. This led to an Australian Research Council Linkage project between the two, culminating in an Innovation Connections Grant funding the commercialisation of the technology developed by UNSW.

Originally, WBS approached UNSW about creating a network of emergency lights using Zigbee, a low-power, low-data-rate, close-proximity wireless network used by medical devices. However, emergency lights can often be in out-of-the-way places where communications are unreliable.

So Hu, working with A/Prof Salil Kanhere and Prof Sanjay Jha and a clutch of PhD students at UNSW's School of Computer Science and Engineering, including Jun Young Kim, worked on developing a meshed network of different communications technologies that could work seamlessly and provide a reliable network across a plethora of locations.

They eventually hit on a meshed combination of LoRa used by wireless sensors for healthcare monitoring: 6LoWPAN, a new internet protocol for small devices; and RPL, an experimental network protocol for point-to-point communications where stability and low data rates are an issue. They then created a gateway that bridges the different technologies with cellular telecommunications networks, enabling it all to connect to computer servers in the cloud. They then added Bluetooth to provide localised control via smartphones.

A product within two years

Within two years of applying for the initial TechVouchers funding and approaching UNSW as a research partner, WBS now has a commercialised smart building solution, and UNSW made valuable research progress in a new field.

"It's a great example of an enterprise with a technical challenge it needs to solve, and UNSW having the people with the knowledge and engineering nous to find the solution," said Prof Ian Gibson, Associate Dean (Industry and Innovation) at UNSW's Faculty of Engineering, who oversees industry collaboration. "In this case, the solution is set to transform WBS's business model, and create a new 'sensors as a service' market where none existed."

Hu now works as a part-time consultant for WBS Technology, while his student, Jun Young Kim, joined the company once he completed his PhD, and now manages the software development team that designs, implements and verifies its products. "At the end of the research, I was convinced that this was the best solution for the future of smart building services," he said. "You could say I helped create my own job."

Working with industry in this way was essential to get innovation out of laboratories and into the real world, said UNSW's Dean of Engineering, Prof Mark Hoffman.

"At UNSW, our students and researchers are not only embedded in an environment where emerging technologies are created," he said. "They don't just learn knowledge and skills, but how to work as teams, and innovate to solve open-ended problems. Our partnership with WBS Technology is a great example of this."

Radio Matters

The Radio Frequency Users Association of NZ Inc (RFUANZ) is a not-for-profit organisation with members who hold radio licences in New Zealand (power companies, local government authorities, transport operators, forestry companies and radio network operators) as well as those who have an interest in the radio communications industry (consultants, manufacturers and suppliers to the industry).

Established 23 years ago, RFUANZ's main purpose is to unite the industry with one voice, and to lobby government for more spectrum at a lower cost. The association's prime objectives are to protect the availability and access of spectrum in New Zealand; support, grow and enhance the radio communications industry in NZ; and to encourage the proper use of radio communications equipment.

Some of the challenges we face in 2019 include: policing the importation of illegal radios; overcoming the obstacles of using these cheaper radios within the industry; access to more spectrum; encouraging the uptake in the newly released G Band (174–184 MHz) in New Zealand; and encouraging uptake in our newly released NZQA Training program.

We recently held two successful breakfast forums in Christchurch and Auckland, with guest speaker Daniel Ephraty, Director of Sales Engineering at Siklu Communication (UK). Daniel's presentation included the cost-effective alternatives to fibre, being, Siklu V Band/E Band (60/70/80GHz) mmWave technology. Daniel also spoke of his 20 years' experience in wireless point-to-point systems, ranging from systems design, through implementation, product management, to presale. In the last three years he has specialised in E Band technology. He also shared his experience in mmWave technology installations and propagation properties, and reflected on how far the industry has come in the last eight years and what is happening in the overseas marketplace.

We had very favourable feedback about Daniel's presentations, and we would like to thank Dale Roberts (Go Wireless) for co-sponsoring these forums and arranging for Daniel to travel all this way. The RFUANZ committee is now looking at holding other such events; not only are they informative, but are an opportunity to network with others in the industry at a more localised level.

The committee invites you to attend our annual conference, held in conjunction with Comms Connect, in Auckland at the Sky City Convention Centre, 1–2 May. The RFUANZ AGM will be held on the first day of this conference, while that evening will see the exciting Awards & Gala Dinner night at St Matthews in the City (approximately 500 metres across the road from the conference).

The conference will be an opportunity to network with like-minded companies in the radio industry and learn from the many and varied forums the conference has to offer. This year sees the industry focusing more and more on more effective communications in the public safety sector as technologies and capabilities grow in order to improve first responder safety and operations across the industry. Please contact Debby Morgan (admin@rfuanz.org.nz) for further details. I hope to see you there.

Corey Weir
Chairman, RFUANZ

RFUANZ
Radio Frequency Users Association of New Zealand

Oscilloscopes

Keysight Technologies InfiniiVision 1000 X-Series oscilloscopes provide professional-level measurements and capabilities. They include a 4-wire serial peripheral interface (SPI) decode and remote connection via local area networks (LANs).

The intuitive front panel is easy to use and features built-in help, enabling users to quickly understand oscilloscope functions and improve overall test efficiency. 17 complementary training signals are preloaded to ensure rapid use of the advanced measurement and analysis capabilities. These training signals can also be used in conjunction with the free educator's training kit, which includes a comprehensive oscilloscope lab guide and oscilloscope fundamentals slide set.

The oscilloscopes are bandwidth-upgradable via software licence, enabling users to purchase the bandwidth needed, and upgrade as designs evolve in the future. The oscilloscopes are available at 70, 100 and 200 MHz of bandwidth.

Other features include custom Keysight MegaZoom IV ASIC technology which delivers 50,000 waveforms p/s update rate and 2 GSa/s sample rate; six-in-one instrument integration including a frequency response analyser (Bode plotting), function generator, protocol analyser, digital voltmeter and frequency counter, which saves valuable bench space; standard LAN connectivity enables multiple engineers to work on one instrument by connecting to the network via LAN and accessing an internet browser for remote control; and professional-quality measurements and software analysis capabilities including 24 automatic measurements, the gated fast Fourier transform (FTT) function and mask testing help quickly analyse and determine signal parameters.

Keysight Technologies Australia Pty Ltd
www.keysight.com

VE-PG4 — Seamless Solution: Radio + IoT+ Multi-Protocol

At the recent Comms Connect Melbourne 2018 event, Icom (Australia) showcased a number of new demonstration units that we are working to bring out in the coming months. These ranged from our new mobile LTE unit to dual sim LTE hand held to our Satellite Transceiver.

One of the units on show that attracted a lot of questions and attention was our preview VE-PG4 RoIP (Radio over IP) Gateway unit. Many visitors to our booth asked what the differences were between this and the current VE-PG3 model.

The VE-PG4 is designed to provide a seamless communication solution over IP Gateway Linking Various Radio Systems and Protocols with LTE and IP Networks. This would allow users to interconnect various communications systems without limitations imposed by distance, security or technology.

The VE-PG4 offers a range of features which will include:

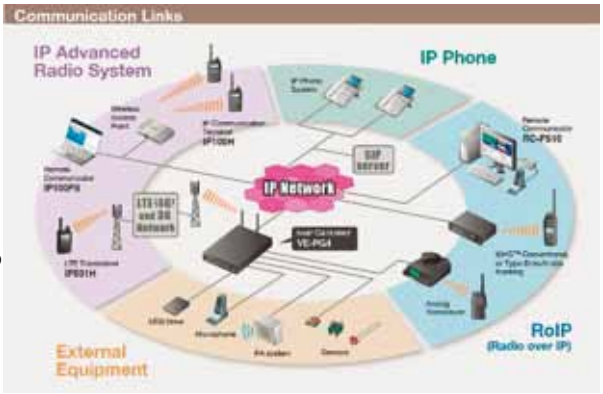
- LTE (4G) and 3G network connection[i]
- Wireless LAN transceiver controller built-in
- Telephone interconnection with IP Phone
- IDAS Conventional and Type-D multi-site trunking connection
- Analog radio system connection
- Base station operation with optional microphone
- Voice recording function to a USB drive[1]
- External equipment, sensor connection
- VPN router function
- Half-width 1U form design

The VE-PG4 functions as a bridge for radio network audio to an IP protocol (VoIP) and then interconnects this between those various devices on the network.

One of many of the great features of Icom's VE-PG4 is its ability to integrate digital and analogue devices with SIP and analogue telephone systems as the unit has built in RoIP, SIP gateway, IP router and IP PBX features.

Types of connections through the unit include:

- SIP Digital telephone Switch
- IP Phones
- PA System
- Analogue radio
- IP Radio System
- LTE Transceiver Systems
- Digital IDAS radio site



Examples of these functions in action are:

1. Radio Systems — Two radios are connected to each other over an IP network. For example, multiple manufacturing sites could be using our IP100H push to talk over Wi-Fi system to communicate then connecting through the VE-PG4 they could communicate to LTE units used by staff on the road as well as other sites using traditional analogue radios.
2. Bridge between technologies — The VE-PG4 can act as a bridge between analogue and digital. Allowing users of one system to talk to another system. It also allows a radio user to initiate phone calls to other users across the network who are using different protocols.
3. Connection to despatcher — A VE-PG4 allows for links between different communications systems. For example, a user could connect a VHF network with a UHF network. Or a marine frequency with an aviation frequency.

The number of probable applications that this unit could offer are limitless. We are aiming to have this product available in the coming months. If you would like to talk to us about your project please feel free to contact us on sales@icom.net.au.

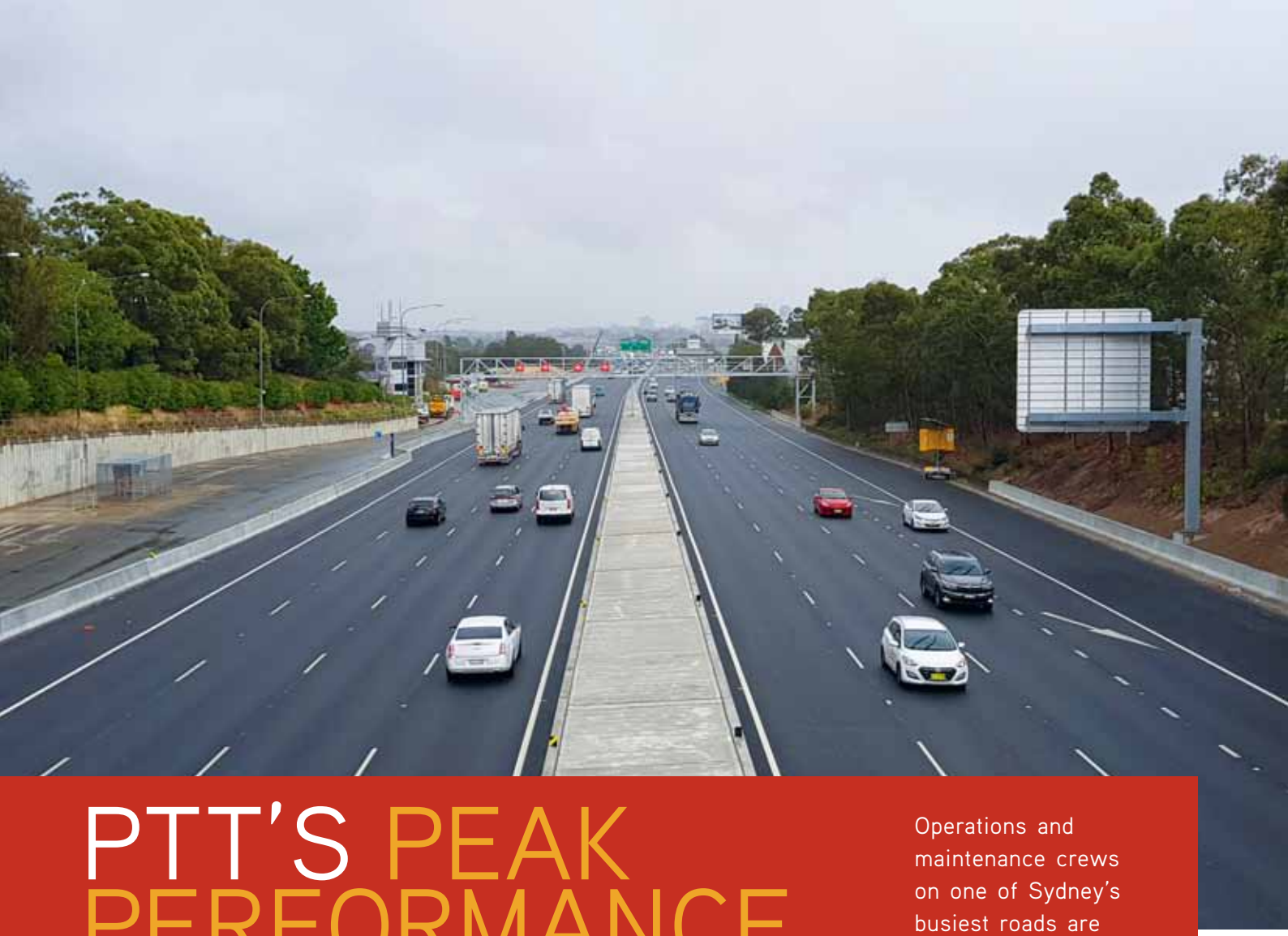
[i] A SIM card is required for this function.

[1] A USB is required separately.

ICOM

Icom Australia Pty Ltd

www.icom.net.au



PTT'S PEAK PERFORMANCE IN PEAK HOUR

Operations and maintenance crews on one of Sydney's busiest roads are staying connected with an off-the-shelf PTT solution.

In 2016, Fulton Hogan Egis O&M Pty Ltd was awarded the operations and maintenance contract for a major Sydney motorway, which was to begin in July 2017. This was a project that needed the right communication system to ensure its smooth running across all the teams involved.

As it was going to be operating on one of Sydney's busiest roads — subject to massive congestion in peak hour times as well as traffic incidents — the company needed something robust, so it looked at a range of solutions and providers.

According to Shane Couch, the company's Operations Manager, an IMPULSE Wireless PTT system was initially chosen as a quick solution, yet Fulton Hogan Egis was so pleased with the result that it has become a permanent fixture.

"It was essentially chosen as a short-term, 18-month solution because there was no complicated set-up or configurations. It offered an off-the-shelf product that required no expensive licensing fees," he said. "However, I envisage that this product will continue to be used in the long term."

The solution

For the motorway, Couch and his team use rugged and waterproof IP68-rated smartphones with Bluetooth remote speaker microphones. Wireless charging for the phones was also chosen to eliminate as many physical connections as possible and increase the longevity of the devices.

The control room uses a tablet and wired remote speaker microphone, which provides live location of users when they are in a PTT call. It also provides priority transmit interrupt/pre-emption capabilities to get a time-critical message out at any time.

The proximity to Sydney Olympic Park and the major events it hosts, combined with regular heavy traffic and incidents, places a heavy load on the carrier networks. However, Couch reports that from the beginning, IMPULSE Wireless PTT communications have remained reliable and unaffected, even during peak events. The performance of the IMPULSE Wireless system has been rock solid the entire time, thanks to devices that are fully compatible with Telstra 4GX, including the whole of Band 28.

The PTT solution has proven to be cost-effective to implement, completely user-friendly and very reliable. But that's not all. Couch mentioned that, besides the product itself, the final choice always comes down to the level of service provided.

"In the end, IMPULSE Wireless won because of their excellent service," Couch said. "I have recommended them now to a peer company."

Just like with any technology, it needs to be fit for purpose, meet the end user's precise needs, staff need to be trained and faults need to be managed. It's important to find an experienced supplier who can offer the right level of support to ensure the communication solution is reliable and effective.

IMPULSE Wireless

www.impulsewireless.com.au

Industrial IoT gateway

The EAC Mini EACFA20, from Winmate, is an Android-based Industrial IoT gateway with low power-consuming Freescale Cortex A9 i.MX6 processing and good expansion possibilities.

The expansion modules offer rich options for additional serial interfaces such as CAN Bus, DIDO, Wi-Fi and 4G LTE wireless connectivity, with more than 30 possible combinations. All necessary connectors allow the product to send data from manufacturing facilities directly to cloud servers, for extra reassurance on the recoverability of the user's data.

Highlights include a fanless cooling system, metal housing and range of various mounting options (including desk, wall, VESA, DIN-rail and pole). The gateway supports the Android 6.0 operating system, and its compact size (100 x 70 x 31 mm) and rich expansion options make the product suitable for a range of IoT, smart factory and machine automation applications.

Backplane Systems Technology Pty Ltd

www.backplane.com.au

Radio communication tester

The R&S CMX500 radio communication tester for 5G NR can be seamlessly integrated into an existing LTE test environment. It is also suitable for tests in 5G NR standalone (SA) mode.

The tester adds 5G NR signalling and RF testing to existing R&S CMW500 based LTE T&M solutions in labs. Users who already have a CMW500 or CMWflexx test system for LTE measurements can continue to use them and only need the tester as an extension box to perform tests on 5G NR signals. This set-up allows use cases to be tested in non-standalone (NSA) mode as specified in 5G NR option 3.

The tester measures the RF parameters of 5G NR transmissions and performs protocol tests. It has a modular design and a state-of-the-art, web-based user interface that makes it easy for users to configure the tester to meet their specific requirements.

Measurements in the FR2 range additionally require CMX HEAD30 multiband remote radio heads (RRH). The RRHs modulate the 5G NR IF output signal of the tester to produce RF signals in the millimetre wave range up to 43.5 GHz for 5G NR. The RRHs are connected directly to the tester and are easy to mount on the OTA test chamber.

Rohde & Schwarz (Australia) Pty Ltd

www.rohde-schwarz.com.au

In preparation for launch of the James Webb Space Telescope in 2021, the flight operations team recently conducted two critical and successful communications tests.

Credit: M. Estacion (STScI).

Credit: Northrop Grumman/NASA.

COSMIC COMMS

Engineers have successfully tested critical communications systems in preparation for the launch of NASA's James Webb Space Telescope.

When NASA's James Webb Space Telescope (JWST) launches in 2021, it will write a new chapter in cosmic history. This premier space science observatory will seek the first stars and galaxies, explore distant planets around other stars and solve mysteries of own solar system. JWST will be controlled from the Mission Operations Center (MOC) at the Space Telescope Science Institute in Baltimore, Maryland.

To prepare for launch, the flight operations team recently conducted two successful communications tests. The first simulated the complex communications among numerous entities in the critical period of launch through the first six hours of flight. The second demonstrated that the MOC could successfully communicate with the telescope.

A complicated dance

From the moment JWST launches, and through the first six hours of flight, five different telecommunications service providers located around the world will alternately convey command and telemetry data to the mission operations team in the MOC. The first exercise demonstrated the complex exchange among these facilities.

These different providers are needed because of the geometry of Earth in relation to JWST's orbit and altitude.

"Whereas most low-Earth missions can use TDRSS (the Tracking and Data Relay Satellite System) or some other kind of communications satellite in orbit around Earth to relay data, we are so far away that we have to use other facilities," explained NASA's Carl Starr, the Mission Operations Manager for JWST at NASA's Goddard Space Flight Center, Greenbelt, Maryland.

By six hours after lift-off, JWST will be about halfway to the Moon and six times higher in altitude than the geosynchronous Earth orbit (GEO) where TDRSS and many communications satellites dwell. When the telescope reaches its destination, it will be around 1.5 million kilometres from Earth — about 45 times farther away than GEO.

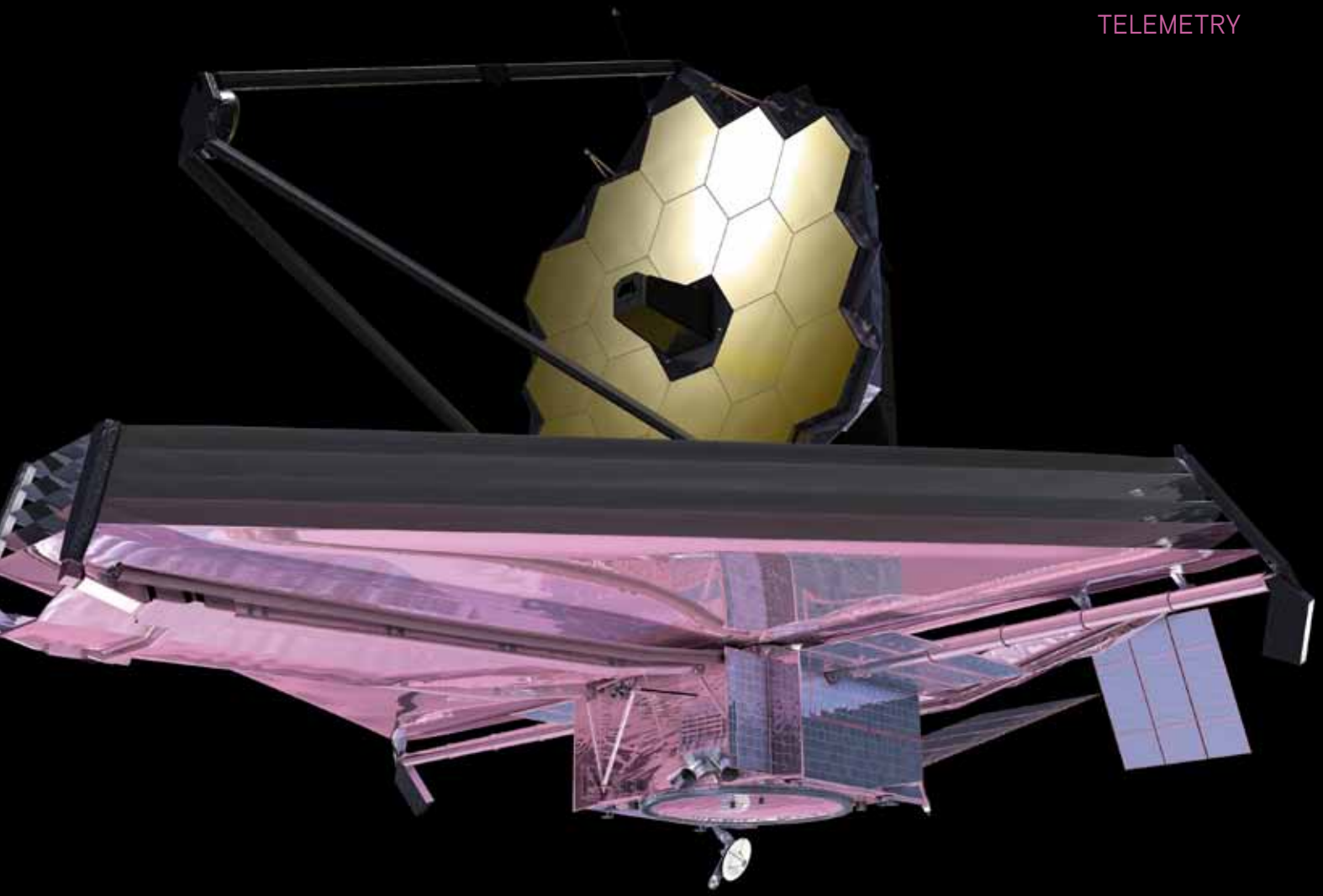
"It's a lot of going back and forth," Starr said. "You have to change configurations, you need a stable connection with JWST at each change, you have to establish the network connections, you have to process the data — and you have to do it multiple times with different stations and make it seamless.

"And to make things even more complicated," Starr continued, "everyone we are talking about is in different places.

"You have the Space Network out in New Mexico, the Deep Space Network in California, and the European Space Agency's Malindi station in Kenya and European Space Operations Centre in Germany."

"It becomes a very complicated test to do, because no-one is in the same time zone — and all of that data comes in and out of this building," he added.

The test was a major step in demonstrating the flight operations capabilities and processes to support launch-day communications.



Computer graphic rendering of NASA's James Webb Space Telescope.

After the first day, the team moves to a normal set-up with just the three Deep Space Network terminals around the world.

"The teams were able to talk with the external entities, and prove the concept that we can manipulate the communications on the day of launch here in the building for the mission," Starr said. "We'll have other proficiency exercises later, but this was the first time that we did it, and it was very successful."

Talking to the telescope

No mission would be possible without communicating with the telescope. The flight operations team in Baltimore recently did that for the first time, talking to the actual JWST spacecraft on the ground while it was being integrated and tested at the Northrop Grumman facility in Los Angeles.

"We treated Webb as if it were a million miles away," Starr said.

To do this, the flight operations team connected the spacecraft to the Deep Space Network. However, since JWST isn't really in space yet, special equipment was used to emulate the real radio link that will exist between JWST and the Deep Space Network when JWST flies.

"We can command and control the vehicle now, and run tests with it from here, without having to travel to Northrop Grumman," Starr explained. "It really is making use of technology to stay on schedule."

It didn't really matter where JWST was during the test. "As far as we're concerned, it could be in the basement of this building, and we wouldn't know any different," Starr added. "You're just at your console, you've got a data line, your screen... it's all very much remote.

"I could imagine it must be how drone pilots feel. They're not anywhere near where their vehicle is."

During the exercise, the team executed non-operational commands and initiated a recorder playback. This important test demonstrated the flight operations team's ability to command JWST from the MOC in Baltimore.

Throughout most of commissioning, the MOC will be in constant communication with JWST. After commissioning, approximately 180 days after launch, the team will communicate for eight hours per day with the telescope. During that time, operators will send up packages of commands for the telescope to run autonomously and downlink the science data.

More tests to come

More tests will follow, but these were the first to show the MOC's successful communication with JWST and with the many command and telemetry service providers. The fact that these exercises were carried out flawlessly is a testament to the hard work of the flight operations team, as well as teams across the country and around the world.

The JWST is an international project led by NASA with its partners, the European Space Agency and the Canadian Space Agency.

BEAM ME UP

A new antenna evaluation method could help boost 5G network capacity and cut network design costs.

NIST researcher Jelena Senic drives a robot used to measure the performance of different antenna beam patterns. The mobile platform enables researchers to position a wireless channel sounder that includes (top to bottom) an array of 16 receive antennas, the receiver, timing circuitry, a signal digitiser and a battery for untethered field operations. Image credit: NIST.

Researchers at the US National Institute of Standards and Technology (NIST) have developed a method for evaluating and selecting optimal antenna designs for future 5G mobile phones, other wireless devices and base stations. The new method could boost 5G wireless network capacity and reduce costs.

Antenna beamwidth affects wireless system design and performance. NIST's new measurement-based method allows system designers and engineers to evaluate the most appropriate antenna beamwidths for real environments.

"Our new method could reduce costs by enabling greater success with initial network design, eliminating much of the trial and error that is now required," NIST engineer Kate Remley said.

"The method also would foster the use of new base stations that transmit to several users either simultaneously or in rapid succession without one antenna beam interfering with another.

"This, in turn, would increase network capacity and reduce costs with higher reliability," she added.

This is the first detailed measurement-based study of how antenna beamwidth and orientation interact with the environment to affect millimetre-wave signal transmission.

In the technique, measurements covering a broad range of antenna beam angles are converted into an omnidirectional antenna pattern covering all angles equally. The omnidirectional pattern can then be segmented into narrower and narrower beamwidths. Users can evaluate and model how antenna beam characteristics are expected to perform in specific types of wireless channels.

An engineer could use the method to select an antenna that best suits a specific application. For example, the engineer may choose a beamwidth that is narrow enough to avoid reflections off certain surfaces or that allows multiple antennas to coexist in a given environment without interference.

To develop the new method, the NIST team collected experimental data in a hallway and lobby of a NIST research building, using a special robot loaded with a customised channel sounder and other equipment. A channel sounder collects data that capture the signal reflections, diffractions and scattering that occur between a transmitter and receiver. Many such measurements can be used to create a statistical representation of the radio channel, to support reliable system design and standardisation.

NIST study results confirm that narrow beams can significantly reduce signal interference and delays, and that an optimised beam orientation reduces energy loss during transmissions. For example, the time interval during which signal reflections arrive (RMS delay spread) dropped dramatically from 15 nanoseconds to about 1.4 ns as antenna beamwidth was reduced from omnidirectional to a narrow 3°.

Future research will include extending the method to different environments and analysis of other wireless channel characteristics. The present research has been published online in *IEEE Communications Magazine*.

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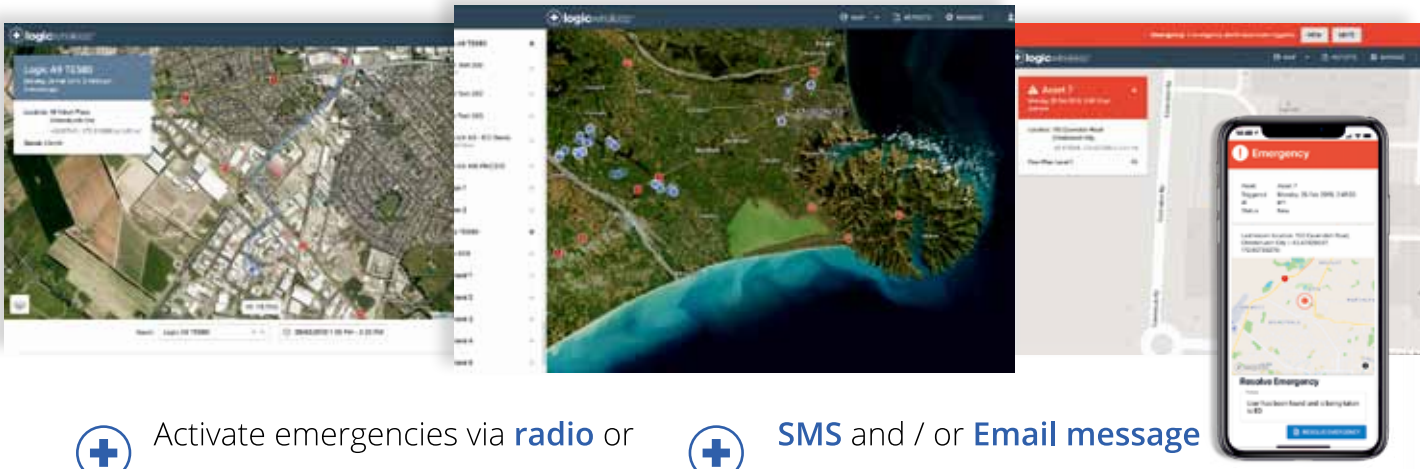

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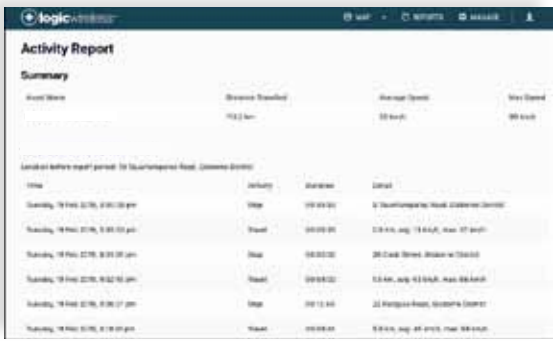

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SHORT-RANGE WIRELESS FOR SMART MANUFACTURING

New approaches are needed for short-range wireless solutions in smart manufacturing environments to avoid the risk of limited adoption.

Short-range wireless connectivity solutions such as Bluetooth, Wi-Fi, 802.15.4 and (UWB) Ultra-Wide Band, among others, have a key role to play in enabling the Industrial Internet of Things (IIoT) across a wide range of use cases ranging from real-time location systems (RTLS) and asset tracking to industrial wearables, condition-based monitoring, augmented reality (AR) and robotics applications, according to advisory firm ABI Research.

However, the inherent diversity, complexity, technology fragmentation and more stringent ROI and KPI requirements of industrial environments are key obstacles which wireless solution providers must overcome to build scale across multiple use cases.

These findings come from ABI Research's Connectivity for the Factory Floor: Opportunities and Challenges for Wireless Technologies report.

"Though wireless technologies have made some inroads within industrial and manufacturing environments in recent years, wireless technologies remain relatively small and continue to face several challenges," said Andrew Zignani, Senior Analyst, ABI Research.

The industry is still very much in a nascent market phase — companies are still investigating how wireless technologies can enable increased productivity; what technologies and platforms should be used; how to maximise ROI; and how to realise the true benefits of connected systems. Many projects are still in pilot phases or limited to small-scale deployments, which can be difficult to scale up to a whole factory floor and larger environments.

"Wireless solution providers still need to convince industrial equipment providers and end customers that, despite the limitations of wireless technologies, they are worth investigating due to the enormous amounts of high-quality data and the additional value they can generate," Zignani added.

"Industrial solution providers are beginning to come around to wireless solutions for condition-monitoring applications and can see the value of RTLS solutions. However, it is likely to be a long-term transformation rather than an overnight success story."

In addition, many end users are not necessarily invested in a

long-term vision of the IIoT that leverages a certain technology but are predominantly concerned with fulfilling the needs of the OT department in the most cost-effective manner with immediate benefits to their operations.

Alongside this, industrial equipment is often controlled by a few key vendors who are balancing legacy equipment with increased digitisation. These vendors require solutions that are extremely reliable and that can be tailored to specific customers' needs rather than a one-size-fits-all approach. Wireless technology suppliers need to align their offerings with industrial customers' requirements rather than building their marketing messages based solely on speed, latency and coverage.

Wireless solution availability is also currently quite limited. Partnerships will need to be formed between wireless solution providers and key industrial suppliers to speed up and extend the available wireless solutions across many industrial use cases.

However, tailoring existing products to industrial markets can also be very challenging. For RTLS solution providers, translating existing technologies such as Bluetooth beacons to an industrial environment can be difficult, and often the cost of testing for optimal location infrastructure deployment in dynamic industrial settings with changing obstacles and interference can be higher than the rollout of the infrastructure itself.

It can also be very difficult to convince industrial customers to invest or accept new technologies. For customers with an existing Wi-Fi infrastructure, introducing them to Bluetooth or other connected sensor devices can be challenging due to the additional infrastructure requirements, therefore a Wi-Fi sensor can often be an easier sell.

> THE STRINGENT ROI AND KPI REQUIREMENTS OF INDUSTRIAL ENVIRONMENTS ARE KEY OBSTACLES WHICH WIRELESS SOLUTION PROVIDERS MUST OVERCOME.

Emerging Bluetooth condition monitoring solutions from ABB and BluVision, UWB-based RTLS deployments from Zebra, Sewio and Siemens, in addition to AR and VR deployments from GE, Boeing and Honeywell, among others, demonstrate this growing momentum, though the aforementioned challenges are hindering scalability.

"The enormous benefits that wireless technologies can help achieve, including predictive maintenance, condition monitoring, big data analytics, more flexible workforces, efficiency improvements, safety enhancements and many others will combine to produce increasing financial and production incentives that cannot be avoided," Zignani said.

"Wired technologies are simply not adequate to address all the multifaceted needs of the varied devices that will make up the IIoT and will be far too costly to implement.

"However, in order to be successful, short-range wireless technologies must build greater awareness; be easy to understand, implement, integrate and manage; have robust security and reliability; all the while having a clear value proposition and benefits to end customers if they are to be successful and build scale," Zignani concluded.

Modular high-density platform

The AFL ASCEND is a modular high-density platform designed for larger and more technical data centre environments. The platform consists of fibre housings, cassettes and assemblies.

The fibre housings offer flexibility, functionality and ease of use. Available in 1, 2 and 4RU sizes with densities of up to 144, 288 and 576 fibres, these fibre housings consist of front and back doors both hinged on the bottom. The back of the housing cover is removable for unobstructed access to all connector interfaces. With routing rings at the front of the trays, routing patch cords is easy, secured and organised.

Another key feature of the platform is the versatile cassette design. Providing a wide range of options, the cassette portfolio is one of the most comprehensive in the industry. The cassettes independently mount within the fibre management housings and trays allowing for ease of access and modularity. Cassette designs range from BASE-8 to BASE-24 and cover additional applications ranging from patch-thru connectivity to xWDM installation. Available in singlemode and multimode, the optical cassettes feature low loss MPO connectors and VFL compatible shuttered LC adapters. Splice cassettes include 250 μm pre-terminated single fibre pigtails and can be spliced directly to loose or ribbon fibre cable. Splice cassettes are compatible with all BASE-12 housings. Available in singlemode and multimode, fan out cassettes are pre-terminated plug-and-play breakout modules designed to transition a trunk cable into individual connector ports.

The platform also includes both trunk cable and patch cord assemblies. Trunk cable assemblies feature Microcore cable and the MTP PRO connector which allows for field reversible polarity and gender with no housing removal, exposed fibres or loose points. Available in 12 to 144 fibres in BASE-8 and BASE-12 configurations, trunk cable assemblies include an integrated cable mounting clip, which eliminates the need for additional cable clamps, securely positioning the incoming cable and eliminating stress during installation. Patch cord assemblies are constructed with Dual-Link cable and terminated with a field-reversible LC Uniboot connector, minimising the front-side cabling footprint and reducing the impact on airflow up and down the rack and between the racks.

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LMR master with TETRA over-the-air BER measurement

The Anritsu S412E LMR Master combines a high-performance spectrum analyser, vector network analyser (VNA) and signal generator with internally adjustable power. The instrument is suitable for land mobile radio (LMR) technicians and engineers engaged in field testing the RF performance of NBFM, P25, DMR (MotoTRBO), TETRA, NXDN, dPMR and LTE for commercial, public safety, maritime and critical infrastructure radio systems.

Anritsu has announced the introduction of TETRA OTA BER measurement for the LMR Master.

Traditionally, radiofrequency coverage measurements have been made by only measuring the power level of the signal of interest. A radio system was deemed to have sufficient coverage if the signal level of the transmitter was above a predetermined threshold. However, just because you measure high signal levels does not mean that the radio system is working as intended. High signal levels could be caused by interference. A better metric to measure is BER, which is calculated by comparing a transmitted sequence of known bits to the received bits and counting the number of errors. The ratio of how many bits received in error over the number of total bits received is the BER. This measured ratio is a good indication of signal quality. This is why over-the-air (OTA) BER measurements are highly desirable when making coverage measurements.

The main drawback to making OTA BER measurements is the requirement to transmit and receive a known bit sequence. In the past, this required that a TETRA site must be taken out of service. Many TETRA sites cannot be taken out of service even for short periods of time. The latest TETRA OTA BER measurement from Anritsu uses a proprietary method to estimate BER from a live TETRA base station's data stream without the requirement to take the TETRA site out of service.

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BROADWAY'S BRUSSELS MEETING PAVES THE WAY

On 23 January, practitioners from 16 European countries gathered to contribute to BroadWay, a European Union pre-commercial procurement (PCP) project which aims to pave the way for a pan-European mobile broadband network for public safety.

"We are very happy to be here today with PPDR practitioners from all across Europe to present and discuss BroadWay. It really shows that practitioners today acknowledge the need for more cross-border cooperation and mobility," said Uwe Kippnich, representing the Bavarian Red Cross and Chair of the Practitioner Evaluation Team (PEVT).

With natural disasters, crime and terrorism crossing borders, European first responders need to be able communicate, share and access information regardless of their location.

Given the current climate and increasingly complex and diffuse threats, there is a clear need to enhance Europe's resilience and improve the capability of European first responders to cope with difficult crisis situations.

This is the challenge currently addressed by the BroadWay project... a team of 11 procurers from 11 European countries that have come together with the common challenge to procure innovation activity to enable a pan-European broadband mobile system for use by public safety responders.

BroadWay will follow a PCP process that will formally procure innovative designs, prototypes and a pan-European pilot system which will be carefully evaluated by two different entities throughout the project lifetime.

Those two entities are the PEVT, which will provide feedback about on-the-ground requirements, and the technical validation committee (TVC), which will ensure the quality of the pre-commercial solutions and how they address the BroadWay challenge.

At the time of the meeting, more than 60 innovative suppliers had expressed interest and were awaiting publication of the request for Tender (released in February).

The procured prototypes will be evaluated by the PEVT to ensure that the system will fulfil the needs of first responders. The PEVT will define real-world evaluation scenarios for the final pilot system and influence the scope of the BroadWay objectives as suppliers move beyond the design phase and prepare for the prototype and pilot phases of the PCP.

"I am happy to be part of the PEVT that will work with the Project consortium to develop a Pan European Mobile Broadband system for PPDRs. It is an ambitious project and deserves the full support and commitment of all emergency service stakeholders in Europe," said Finian Joyce, Fire Chief Officer and Secretary of the Federation of the European Union Fire Officer Associations (FEU).

The procured pre-commercial solutions are expected to be available in early 2022.

Image courtesy BroadWay.

SPRAY-ON ANTENNAS

Antennas made from MXene 'spray paint' could unlock the potential of smart, connected technology.

The promise of wearable devices, functional fabrics, the Internet of Things and their next-generation technological cohort seems tantalisingly within reach. Yet researchers will tell you a prime reason for their delayed arrival is the problem of seamlessly integrating antennas with shape-shifting and flexible 'things'.

But a breakthrough by researchers at Drexel University's College of Engineering could now make installing an antenna as easy as applying some insect spray.

Asia Sarycheva holds a sprayed-on antenna formed from a type of two-dimensional material called MXene.

In research recently published in *Science Advances*, the group reports on a method for spraying invisibly thin antennas, made from a type of two-dimensional, metallic material called MXene, that perform as well as those being used in mobile devices, wireless routers and portable transducers.

"This is a very exciting finding because there is a lot of potential for this type of technology," said Kapil Dandekar, a professor of Electrical and Computer Engineering in the College of Engineering, who directs the Drexel Wireless Systems Lab, and was a co-author of the research.

"The ability to spray an antenna on a flexible substrate or make it optically transparent means that we could have a lot of new places to set up networks — there are new applications and new ways of collecting data that we can't even imagine at the moment."

The researchers, from the college's Department of Materials Science and Engineering, report that the MXene titanium carbide can be dissolved in water to create an ink or paint. The exceptional conductivity of the material enables it to transmit and direct radio waves, even when it's applied in a very thin coating.

"We found that even transparent antennas with thicknesses of tens of nanometres were able to communicate efficiently," said Asia Sarycheva, a doctoral candidate in the A.J. Drexel Nanomaterials Institute and Materials Science and Engineering Department.

"By increasing the thickness up to 8 microns, the performance of the MXene antenna achieved 98% of its predicted maximum value."

Preserving transmission quality in a form this thin is significant because it would allow antennas to easily be embedded — literally, sprayed on — in a wide variety of objects and surfaces without adding additional weight or circuitry or requiring a certain level of rigidity.

"This technology could enable the truly seamless integration of antennas with everyday objects which will be critical for the emerging Internet of Things," Dandekar said.

"Researchers have done a lot of work with non-traditional materials trying to figure out where manufacturing technology meets system needs, but this technology could make it a lot easier to answer some of the difficult questions we've been working on for years."

Initial testing of the sprayed antennas suggests that they can perform with the same range of quality as current antennas, which are made from familiar metals but are much thicker than MXene antennas. Making antennas smaller and lighter has long been a goal of materials scientists and electrical engineers, so this discovery is a sizeable step forward both in terms of reducing their footprint as well as broadening their application.

"Current fabrication methods of metals cannot make antennas thin enough and applicable to any surface, in spite of decades of research and development to improve the performance of metal antennas," said Yury Gogotsi, Distinguished University and Bach professor of Materials Science and Engineering in the College of Engineering, and Director of the A.J. Drexel Nanomaterials Institute, who initiated and led the project.

"We were looking for two-dimensional nanomaterials, which have sheet thickness about a hundred thousand times thinner than a human hair; just a few atoms across, and can self-assemble into conductive films upon deposition on any surface. Therefore, we selected MXene, which is a two-dimensional titanium carbide material, which is stronger than metals and is metallically conductive, as a candidate for ultrathin antennas."

Drexel researchers discovered the family of MXene materials in 2011 and have been gaining an understanding of their properties, and considering their possible applications, ever since. The layered two-dimensional material, which is made by wet chemical processing, has already shown potential in energy storage devices, electromagnetic shielding, water filtration, chemical sensing, structural reinforcement and gas separation.

MXene materials have drawn comparisons to promising two-dimensional materials such as graphene. As described in the paper, the Drexel researchers put the spray-on antennas up against a variety of antennas made from these new materials, including graphene, silver ink and carbon nanotubes. The MXene antennas were 50 times better than graphene and 300 times better than silver ink antennas in terms of preserving the quality of radio wave transmission.

"The MXene antenna not only outperformed the macro and micro world of metal antennas, we went beyond the performance of available nanomaterial antennas, while keeping the antenna thickness very low," said Babak Anasori, a research assistant professor in the A.J. Drexel Nanomaterials Institute.

"The thinnest antenna was as thin as 62 nanometres — about a thousand times thinner than a sheet of paper — and it was almost transparent. Unlike other nanomaterials fabrication methods, which require additives, called binders, and extra steps of heating to sinter the nanoparticles together, we made antennas in a single step by airbrush spraying our water-based MXene ink."

The group initially tested the spray-on application of the antenna ink on a rough substrate (cellulose paper) and a smooth one (polyethylene terephthalate sheets). The next step for their work will be looking at the best ways to apply it to a wide variety of surfaces from glass to yarn and skin.

Images courtesy Drexel University/Kanit Hantanasirisakul.

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CHALLENGE IN THE COLOSSEUM

Six teams have each been awarded US$750,000 in a spectrum collaboration challenge that showcases the future of autonomous spectrum management.

On 12 December, the US Defense Advanced Research Projects Agency (DARPA) held the second preliminary event of the Spectrum Collaboration Challenge (SC2) — the world's first collaborative machine-intelligence competition to overcome spectrum scarcity.

Fifteen teams represented by members from across the academic, commercial and defence landscapes gathered at Johns Hopkins University Applied Physics Laboratory (APL) to pit their intelligent radio designs against each other in a head-to-head competition.

At the event's conclusion, six of the eight top-scoring teams walked away with US$750,000 each in prize money. While not all competitors received interim prizes, all 15 teams have an opportunity to move on to the next stage and compete in the 2019 Spectrum Collaboration Challenge grand finale, which will be held in conjunction with MWC19 Los Angeles, in partnership with CTIA, on 23 October, 2019.

The six prize-winning teams from the second preliminary event are:

- Zylinium, a team of independent researchers
- MarmotE from Vanderbilt University
- Sprite from Northeastern University
- Erebus, a team of independent researchers
- Gator Wings from University of Florida
- SCATTER from IDLab, an imec research group at Ghent University and University of Antwerp, and Rutgers University

"During the second preliminary event we witnessed a technological shift," said Paul Tilghman, the DARPA program manager leading SC2. "For the first time, we saw autonomous collaboration outperform the status quo for spectrum management."

Starting in early December, each team's radio participated in 105 matches against competitors in the Colosseum, a massive RF testbed that was developed specifically for SC2. The matches were held in a round-robin fashion where each radio network — working in groups of threes, fours or fives — had multiple opportunities to compete against every other radio design in the competition.

Roughly 400 matches were held in total to determine the final team rankings and the prize recipients.

During the PE2 matches, teams were put through six different RF scenarios designed to mimic the challenges that collaborative, autonomous radios will face in the real world. These scenarios challenged the radios to collaboratively mitigate interfering with an incumbent radio system, sense and adapt to the spectrum demands of high-traffic environments, handle the data demands of the connected soldier of the future, and more.

Image courtesy DARPA

> "PE2 SHOWED US THAT AI AND MACHINE LEARNING'S APPLICATION TO WIRELESS SPECTRUM MANAGEMENT CREATES A VERY REAL OPPORTUNITY TO RETHINK OUR CURRENT CENTURY-OLD APPROACH." — PAUL TILGHMAN, DARPA PROGRAM MANAGER

Each scenario was designed to pressure test various elements of the teams' approaches and, in particular, their ability to successfully collaborate with the other radios operating within the same environment.

"The six different scenarios were closely aligned to actual situations that our defence and commercial systems face in the field," said Tilghman.

"The Wildfire scenario, for example, replicates the complex communications environment that surrounds an emergency response situation, while the Alleys of Austin scenario was designed to mimic what's needed to help dismounted soldiers navigate and communicate as they sweep through an urban environment.

"This real-world relevance was critical for us as we want to ensure these technologies can continue to develop after the event and can transition to commercial and/or military applications," added Tilghman.

The sixth scenario of the competition was used to determine the six prize-winning teams. This scenario explored the essential question of the SC2 competition: can the top teams' collaborative SC2 radios outperform the status quo of static allocation?

Each of the six teams that received awards at PE2 demonstrated that their radio was capable of carrying more wireless applications without the aid of a handcrafted spectrum plan, while simultaneously ensuring four other radio networks operating in the same area had improved performance.

In short, each of these six radio networks demonstrated the autonomous future of the spectrum.

To aid with decision-making, teams applied AI and machine learning technologies in various ways. Some leveraged the current generation of AI technologies, like deep learning, while others used more conventional optimisation approaches. There were also a few teams that used first-wave, rule-based AI technologies.

"We're very encouraged by the results we saw at PE2. The teams' radios faced new and unexpected scenarios but were still able to demonstrate smart, collaborative decision-making. PE2 showed us that AI and machine learning's application to wireless spectrum management creates a very real opportunity to rethink our current century-old approach," said Tilghman.

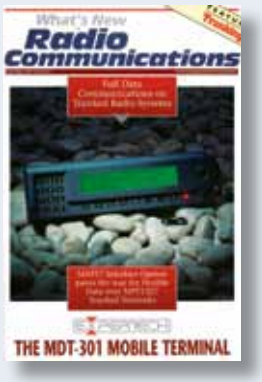
The competition now enters its third year and moves closer to the finale, which will be held at one of the largest annual technology and telecommunications shows — MWC19 Los Angeles. More than 22,000 attendees from the broad mobile ecosystem and adjacent industry sectors will convene at this three-day event to discuss the current opportunities and future trends shaping the industry.

The SC2 championship event will be held on the keynote stage of MWC19 Los Angeles on 23 October 2019.

At the conclusion of SC2's finale, three teams will be awarded US$2 million, US$1 million and US$750,000, respectively, for first, second and third place. The real prize, however, will be the promise of a more efficient wireless paradigm in which radio networks autonomously collaborate to determine how the spectrum should be used moment to moment, helping to usher in an era of spectrum abundance.

Backhaul

Take a trip down memory lane as we look at what was happening in the comms sector of yesteryear.



25 YEARS AGO. The cover of the Apr/May 1994 issue of *What's New in Radio Communications* featured the MAP27 Interface Option for the MDT-301 mobile radio terminal, supplied by Expertech. Using MPT1327 control channels, the unit could handle simple status messages, short and extended data messages, or full data calls. Trunked radio was the theme of this issue: we had Stanilite Electronics' Neill Hymans giving us a rundown on the growing field of open standard trunked radio systems, such as MPT1327 and the new APCO Project 25; Radio Systems Technologies' Frits Van Enk went in to bat for his company's eXeLink technology; and authors from Voice Data Systems and Schlumberger Technologies profiled their companies' offerings. Elsewhere in the magazine we reported on Rockwell Systems Australia being awarded a contract to supply the Civil Aviation Authority with an air traffic control communications system at Sydney Airport, using the company's DSN-300 digital switching gear. We also reported that Radio Frequency Systems' Chris Jaeger and David Cooke were to join the Minister for Communications, David Beddall, on a major industry delegation to Southeast Asia.

10 YEARS AGO. The cover of the Mar/Apr 2009 issue of *Radio Comms Asia-Pacific* featured the Motorola APX 7000 P25 multiband radios, which had both audio and data sides and delivered audio 50% louder than earlier Motorola P25 units. Inside the magazine, JRD Communications' Bob Rogers and Kemal Ajay reported on techniques to avoid interference in the overlap coverage areas of closely spaced base stations. And David Cox of Pacific Wireless Communications spruiked the benefits of the P25 standard, noting that there were five manufacturers offering P25 in Australia at that time.

Spectrum

Key messages about Australia's PSMB capability

"Australia has caught up to the rest of the world with public safety mobile broadband." That was the way Department of Home Affairs Assistant Secretary Luke Brown began his keynote presentation at the Comms Connect Conference in Melbourne last November. In his inimitable manner, he went on to explain the progress being made to provide Australia's public safety agencies with a public safety mobile broadband (PSMB) capability that meets the needs of these agencies, as determined by and agreed to by the state and territory governments.

Brown explained that these needs have been documented as high-level requirements and used in the PSMB request for information (RFI) released in late 2017. Likewise, the RFI took a functional rather than a technical approach to seeking information, which was subsequently used in the Request for Proof of Concept Proposals released in October 2018 (and which closed in late December 2018).

This course of action had been taken because traditional procurement processes will not work for this form of technology and service delivery, Brown said, and therefore both governance and procurement arrangements needed to be able to flexibly respond to rapid changes taking place in technology capabilities.

Brown said that the PSMB capability will be a federated model that will use a common core to provide the ability to accommodate different needs, implementation timings and budgets of the states and territories. And for the first time in Australia, a multivendor approach is being taken. Brown added that governments need to be more innovative in their planning procurement processes, in order to build partnerships that include skills development and training in the technologies. He also made the point that partnerships with countries developing a PSMB capability will be essential to the sharing of information and lessons learned.

Brown went on to say that governments have been late in discussions with standards development organisations and there is work to be done in 2019 to engage in the 3GPP standards process for mission-critical communications. He added that the 3GPP event hosted by the University of Melbourne Centre for Disaster Management and Public Safety in September 2018, facilitated the commencement of these discussions with 3GPP and that these types of events will continue to be supported. Brown acknowledged the work done by the University of Melbourne to identify the PSMB capability as a significant policy gap in Australia's emergency management capability.

Brown also said that the government was happy with the level of engagement with industry in respect to the PSMB Request for Proof of Concept proposals, and the results from the Proof of Concept trial will enable the states and territories to finalise their business cases to enable the PSMB project to proceed.

This year should see the establishment of a dedicated PSMB Project Management Team located within the NSW Telco Authority that will function on behalf of the states and territories, and an examination of the most appropriate form of PSMB governance arrangements. An approach to the market for the PSMB capability should be expected in the 2020–21 financial year.

In response to questions from the audience, Brown noted that there is no connection yet between the PSMB capability and Next Generation Triple Zero. The Department of Home Affairs is responsible for the PSMB capability and the Department of Communications and the Arts is responsible for Next Generation Triple Zero. He said that the government is taking very seriously the high-profile Triple Zero service outages that occurred in 2018. He added that, within the Department of Home Affairs, Emergency Management Australia is working on a national program for the public safety communications ecosystem, and that Australia will seek to leverage the excellent research work being done by the US Public Safety Research Program to support PSMB projects globally.

Geoff Spring is a Senior Advisor to the University of Melbourne Centre for Disaster Management and Public Safety, a member of the P25 Standards Steering Committee and a former board member of (then) APCO Australasia.











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