

CELEBRATING
20
YEARS



SHOW PREVIEW

15TH - 17TH MAY
MESSE BERLIN

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I'm really excited about CCW 2018 – it's the 20th anniversary of the event and it's a great honour and privilege for TCCA to be organising it together with the Mark Allen Group. One of the new things about this year's event is that TCCA has taken on the responsibility for the conference programme – that's something we haven't done previously.

This time, we've gone for a completely clean approach, having a call for papers and an entirely independent non-biased and expert programme committee. They've built the whole programme, so it's a delight to be able to go on the website, see the programme, its diversity and the interesting presentations that are in store for us. They range all the way from basic TETRA 101 stuff to 5G network slicing and everything in between, making the programme as diverse and as inclusive as we possibly can.

We're very conscious of the problems that will be created if we let the industry fragment into silos, and we have tried to avoid that in the first day masterclasses. As a good example, we have a whole day masterclass, which started life under the name of non-PPDR communications. That's pulled in a lot of interest from people from transport, oil & gas, and utilities – everyone who is using TETRA today for their critical communications and tomorrow, and who may in the future use broadband, but who is not public safety.

One of the big draws for the event is the way that the industry is expanding. It's pulling in new entrants – new verticals and vendors and the latter predominantly are smaller players who are bringing new broadband-based solutions, be they apps or new devices. The whole railway community is

facing an end-date for GSM-R and actively participating in the 3GPP standardisation of critical broadband – it needs and wants to be a much closer player in the critical communications space.

I'm very pleased that we have new features such as the Technology Showcase Theatre, the Control Room Arena and the Drone Zone – what they can bring to critical communications is exciting. I'm also really looking forward to see how the whole programme is received and I'll be keenly watching visitors' reactions to it.

I should add that we're fully committed to making each event better than the last and as part of this, we'll have a comprehensive post-event review, where we'll go through what worked and what might not have worked so well, where we need to focus more or what we need to do differently, so that we can make CCW 2019 even better, even bigger and even more valuable to its participants.

Tony Gray
Chief Executive, **TCCA**





WHAT'S ON AT CCW 2018

FOR 20 YEARS CCW HAS BEEN ORGANISED BY THE TCCA, THE LEADING INDUSTRY ASSOCIATION, AND IS THEREFORE OWNED BY THE SECTOR. THIS PLACES THE BEST-INTERESTS OF ITS GLOBAL AUDIENCE AT THE VERY CORE OF ITS PURPOSE

Germany has the largest TETRA network in the world, and so Berlin will be the perfect venue for the 20th anniversary year of TCCA's flagship event. Here you will be able to reflect on the current trends in critical communications with the whole industry under one roof together with leaders, experts and solutions from around the world.

We invite you to Berlin to get hands-on experiences of the latest products and solutions in the CCW exhibition area. Expand your knowledge and grow your network at the conference, with senior speakers describing the most exciting developments and challenges. Those of you working on standards will have the opportunities to meet with colleagues as well as those working in parallel organisations and communities. Networking opportunities also include the International Critical Communications Awards evening on the 15th May and VIP networking party on the 16th May. Meet old friends and make new acquaintances.

It's an exciting time for the industry as we're in a time of transition and evolution. Broadband LTE networks have become widely available. The standards continue to be developed by 3GPP for mission-critical PTT, along with the other features that public safety organisations need if they are to use LTE for critical voice and data. The vendor community has already started the hard work required to create an interoperable and healthy ecosystem for this new technology. Recent progress in these areas, as well as the

challenges on the road ahead will include presentations and input from those working to make today's dreams tomorrow's reality, including Adrian Scrase, ETSI's CTO and Harald Ludwig, chairman of TCCA's Technical Forum. We will also be learning about the roll-out of the Emergency Services Network in the UK and FirstNet in the US, both of which intend to use LTE to support the work of public safety organisations and first responders.

TCCA selects papers on the projects and technologies that are



stretching the boundaries of what is possible and will provide delegates with ideas to take away and apply to their own organisations. Look out for presentations that will explore all the issues surrounding the migration to mission-critical broadband and its implications for both MNOs and public safety agencies, as well as discussions on how security and resilience can be maintained during this process of evolution.

The focus for day one of the conference is evolution, including mission-critical PTT over broadband,

5G in critical communications, and the work being done by 3GPP on standards. The second day continues on the theme of innovation and includes the North American FirstNet experience. The conference will also feature presentations showing how TETRA is being used in a wide range of sectors, including industry, transport, and utilities. Expect to hear about how CLP Power Hong Kong uses TETRA for voice and data communications and learn why TETRA is widely used for telemetry in utilities and other applications. The German 'Digitalfunk BOS' is the world's largest TETRA network and its current challenges and future evolution will be explored in both the BDBOS Tactical Day and in the third day's plenary session.

Arrive early on the 15th of May to benefit from three parallel pre-conference masterclasses covering MNO implementation, security, applications, broadband, and simulation and training. In addition, Robin Davis will be hosting a workshop focussing on innovation in the transport, utility and industrial sectors. At the same time Barbara Held will be running the BDBOS large scale event workshop.

Opening at 1pm on the 15th of May, the exhibition features the full range of TETRA systems, terminals and applications. Being able to

Critical communications today are high profile, evolving rapidly to meet the increasing safety and security challenges faced by contemporary civilisation. With a dynamic global community and an industry that is striving to stay one step ahead of end user needs, TCCA's Critical Communications World has taken a major role in building the activity that we are seeing today. CCW is the undisputed flagship event – a centre of excellence for those who make the most impact on critical communications worldwide, and for those who seek to join them in the future

MLADEN VRATONJIC
CHAIR, TCCA

experience the look and feel of a product or using an application for real provides you with a radically different insight than simply reading a data sheet. There are likely to be new product launches, carefully kept under wraps until the start of the event. Innovation in TETRA has been strongly maintained in recent years with new smarter and smaller handsets available with matching improvements in coverage, audio, and usability. We have also been witnessing the launch of combined TETRA/LTE smartphone-like radios. Germany is leading the way in the use of TETRA paging technology, so keep an eye out for manufacturers showing their latest products.

You can also visit the Technology Showcase Theatre in the exhibition area where suppliers will be talking about their most recent innovations.

Highly popular in 2017, the Finland Pavilion showed powerful applications for end users such as medical teams, Tero Pesonen and his Finnish colleagues plan to repeat and maybe extend this for 2018. The pavilion was also the venue for the signing of the Norway Finland Interoperability agreement.

Inter system interoperability (ISI) is a vital step in helping police and security forces deal with international crime and terrorism. The Nordic countries have led in ISI's roll-out, and you can expect to see any further ISI developments highlighted at CCW 2018.

You will also discover the dedicated command and control zone which will give you the opportunity to see and use the latest tools for improved operational effectiveness.



IT developments such as powerful processing, cloud computing, and analytics are all making this a fast-moving part of the critical communications environment. Transmitting and handling video is now central to operations and will increasingly come from mobile platforms over broadband links. This includes drones, and so CCW's organisers have set aside a dedicated zone to showcase the latest developments in drone technology and its use in a mission-critical context. Visit the connected vehicle zone to see how public safety agencies are making use of these as mobile command centres, to extend coverage, and to allow first responders to send and receive data and query databases to quickly identify offenders and stolen vehicles.

If you're now hungry for more details on what will be the best three days in this year's critical communications calendar, you don't have to go far as this preview has been carefully produced to give you everything you need to plan your visit. Keep right up to date with the web-site at www.critical-communications-world.com. However, if there's anything you're unsure about, please get in touch with the events team, they'll be happy to help you with any queries. We're looking forward to seeing you in Berlin and we wish you a safe and pleasant journey.



SPEAKER INSIGHTS

The quality of the conference at CCW 2018 comes from the seniority and experience of the speakers. In coming to the conference, we will be investing time and travel to expand our knowledge, and to take away learnings which we can apply to our own projects and systems. Let's hear from three of the speakers who will be presenting, and why they are eager to share their stories.

AGURRE AND AIR FRANCE: OPPORTUNITIES FOR FURTHER DEPLOYMENT OF A NEW DEDICATED LTE NETWORK IN 2.6 GHZ TDD BAND FOR AIRPORT OPERATIONS 16TH MAY, STREAM B

Florence Erpelding, AGURRE Representative, **AGURRE**
Christian Régnier, Head of Communication Solution Department, Air France KLM & Secretary, **AGURRE**



Christian Regnier from Air France tells us that "We are looking forward to sharing our experience of a private LTE network at Paris Charles de Gaulle and Orly airports, and the reasoning for taking this approach. We were having difficulties with Wi-Fi as a method for connecting airport services such as aircraft maintenance, baggage handling, security, and other operations. Back in 2012, we worked with ARCEP (France's Electronic Communications and Postal Regulatory Authority) to obtain the necessary radio frequencies for this private LTE network, and

we have now set up a much more reliable private LTE solution which has the bandwidth to handle video as well as other data. It has the potential for even greater integration of aircraft and airport operations in the future".

Regnier will be sharing a video of Air France's system as part of his presentation. Sharing this presentation will be Florence Erpelding, representative of AGURRE (Association des Grands Utilisateurs de Réseaux Radio d'Exploitation). This Association groups eleven key French economic organisations,

including Air France, who need broadband professional mobile networks so that they can improve their operations and the safety of their employees and customers. Erpelding tells us that "CCW is the place to be to meet with a vast range of organisations showing their innovative solutions and see these demonstrated. Use cases can be discussed with end users to understand the issues, problems and solutions. You will meet people from whom you will learn and are potential partners for future projects".



FIRSTNET THE STORY: REPORTS FROM THE AMERICAN PUBLIC SAFETY BROADBAND NETWORK 17TH MAY, STREAM C

Ed Parkinson, Director of Government Affairs & **Jeff Bratcher**, Chief Technology Officer

Ed Parkinson and Jeff Bratcher of the First Responder Network Authority (FirstNet) will be sharing with participants how they are working closely with public safety, local, state and federal governments to create public safety's first nationwide communications system. Bratcher explains that "In the US, there are currently more than 30,000 separate LMR systems used by public safety agencies; local and state jurisdictions manage nearly all of these systems but there is very little interoperability between them, which in a time of emergency could prove highly problematic".

Learning from the past issues of nationwide interoperability and needs of public safety, they will be telling us how the team overcame complex legal and technical issues to

establish the FirstNet network formed around 16 core objectives. They will describe these and the journey that resulted in the major achievement of all 56 states, territories and districts agreeing to opt-in to the FirstNet network.

Parkinson says "After a first of its kind competitive bid and selection process, AT&T was awarded the contract to establish the nationwide network for public safety. Public safety will not be forced to use the FirstNet network. Using a market and services driven approach, FirstNet and AT&T must earn each subscriber. Individual agencies and jurisdictions can assess the merits of the FirstNet network then decide how best to employ it to meet their unique communications needs. In the US, FirstNet and LMR systems

work in a complimentary fashion that gives public safety choices".

As FirstNet is just beginning its nationwide deployment, Parkinson and Bratcher will also share how the initial deployment and usage by public safety is going, as well as talking about what public safety organisations see as some of the key advantages of having their own dedicated wireless LTE network.

As many nations look to establish similar networks, the progress of FirstNet is a fascinating topic that fits well with the conference's focus on the evolution towards mission-critical broadband and offers a chance for participants to compare the US model with their own approach or that of other nations.



TRANSFORMING TRANSPORT FOR LONDON'S SURFACE RADIO SYSTEM 16TH MAY STREAM C

Dimitris Kaltakis, Consultant Infrastructure Architect

Critical communications includes operators and users in essential public services such as public transport. Thomas Brewster and Dimitris Kaltakis from Transport for London (TfL) will be telling us about the upgrade being made to the radio system on the largest bus fleet in Europe. Kaltakis tells us that "We are facing increasing demand in a highly congested major city, TfL had to upgrade their radio systems to provide additional capacity and new features. During the recent severe weather there were up to 70,000 calls a day across the bus fleet and to address this challenge, a new generation of radio systems for the busses will roll-out from the Spring of 2018."

You will learn how the decision to move to DMR Tier III was made, as well as how TfL is re-using frequencies, antennas, and real estate. This is a highly relevant case study for those planning and implementing communications solutions for transportation.

Brewster adds that "TfL have their eyes on the future and will talk about further advances they expect to make in about six years' time, when a new generation of bus control systems have been introduced requiring further data transmission capability with the control room. TfL is working with European partners on the European Bus Systems of the Future programme and expects to use the outcomes

to refine the new generation of urban bus systems".

Can you afford to not attend the CCW 2018 conference where you will experience a unique range of topic under one roof? See TETRA case studies from around the world, including public safety, major events, transportation, and utilities. Find out about the evolution of public safety communications, the innovative use of LTE, the promise of 5G, and the role of MVNOs. Your only problem will be choosing which presentations to include, and which ones to miss.

MASTERCLASSES

BECOME IMMERSSED IN MORE CONTENT THAN EVER BEFORE

15TH MAY 2018

09:30-12:30

PROTECTING YOUR CRITICAL COMMUNICATIONS

Trevor Evans, TCCA

13:30-16:30

MISSION CRITICAL MOBILE BROADBAND

Marc Balliet, Nokia
Philippe Agard, Nokia
Jason Johur, Ericsson

09:30-12:30

KEYS TO SUCCESSFUL PUBLIC PRIVATE PARTNERSHIPS AND THE IMPLEMENTATION OF MNO BASED CRITICAL COMMUNICATIONS

TJ Kennedy, Public Safety Network (Former FirstNet President)
Tero Pesonen, TCCA
Tapio Savunen, Airbus Defence and Space

09:30-16:30

BDBOS TACTICAL DAY: HOW TO MANAGE LARGE SCALE EVENTS

Dr Barbara Held, BDBOS

09:30-16:30

PUSHING THE BOUNDARIES OF INNOVATION ACROSS TRANSPORT, UTILITIES AND INDUSTRY

Robin Davis, Actica
Nick Smye, Mason Advisory

FREE TO ATTEND

13:30-16:30

INNOVATING TETRA FOR THE FUTURE

Malcolm Quelch, Sepura plc

13:30-16:30

LEADING EDGE CRITICAL APPS

Hannu Aronsson, Sepura plc
Tero Pesonen, TCCA



CCW 2018 CONFERENCE PROGRAMME

GAIN UNPARALLELED ACCESS TO AN AUTHORITATIVE CONTENT OFFERING
UP-TO-THE-MINUTE POLICY, INSIGHT AND INTELLIGENCE ALONGSIDE EXCLUSIVE
REAL-WORLD CASE STUDIES AND BEST PRACTICE ADVICE

16TH MAY 2018

STREAM A THE POTENTIAL

09:00-10:30 *PLENARY SESSION*

Government representative from **Germany**; Government representative from **Finland**;
RESULTS FROM THE FIRST MCPTT PLUGTESTS EVENT AND OUTLOOK TO THE SECOND MCPTT PLUGTEST EVENT
Adrian Scrase, CTO, ETSI; **Harald Ludwig**, technical forum chairman, **TCCA**

11:30-12:00

MISSION CRITICAL BROADBAND, A WIN-WIN APPROACH FOR CSPs, PUBLIC SAFETY AGENCIES AND GOVERNMENTS

Philippe Agard, Vice President, Public Safety and Defense Markets, **Nokia**

12:00-12:30

TOWARDS OPEN MCPTT ECOSYSTEMS: THE MCOP APPROACH

Dr Fidel Liberal, Coordinator of the Mission Critical Open Platform, **MCOP**

13:30-14:30

5G PANEL: WHAT CAN 5G BRING TO CRITICAL COMMUNICATIONS?

Ezhipravai, AVP Technology, **Aricent**
Georg Mayer, Chairman, **3GPP Core Network and Terminals TSG (CT)**
Nada Golmie, Wireless Networks Division, **National Institute of Standards and Technology (NIST)**

14:30-15:00

PPDR MC MOBILE BROADBAND NETWORK SERVICES IN THE 5G ERA

Bram van den Ende, Project Manager, **TNO**

15:30-16:00

COMBINING CRITICAL COMMUNICATIONS WITH IOT AND BIG DATA ANALYTICS: NEW POSSIBILITIES

Manan Shah, Associate Director, **Arup**

16:00-16:30

MOBILE HYBRID TETRA THE USE OF LTE

Dr Michael Färber, Brigadier-General, Deputy Director-General for Cyber/Information Technology (CIT), **Federal Ministry of Defence (FMoD)**

16.30-17.00

HOW USERS CAN OVERCOME CHALLENGES OF TETRA AND LTE INTERCONNECTION

Nicolas Hauswald, Director of Sales & Marketing activity, **ETELM**

STREAM B THE LEARNING CURVE

11:30-12:00

USING IP NETWORKS AS A SECURE PLATFORM FOR CRITICAL COMMUNICATIONS

Peter Cox, CEO and Founder, **UM Labs**

12:00-12:45

AGURRE AND AIR FRANCE: OPPORTUNITIES FOR FURTHER DEPLOYMENT OF A NEW DEDICATED LTE NETWORK IN 2.6 GHZ TDD BAND FOR AIRPORT OPERATIONS

Florence Erpelding, AGURRE Representative, **AGURRE**
Christian Régnier, Head of Communication Solution Department, Air France KLM & Secretary, **AGURRE**

13:45-14:45

MEGA EVENTS: HOPE FOR THE BEST, PREPARE FOR THE WORST

Kim Camps, **Motorola Solutions Guangzhou Government**, speaker to be confirmed

Martin Benke, Vice President, **Motorola Solutions**

15:45-16:45

MCPTT PANEL: THE ROAD AHEAD

Chair Dave Chater-Lea, Vice President, **3GPP**
David Viamonte, Sales & Marketing Director, **Genaker**
Harald Ludwig, Technical Forum Chairman, **TCCA**
Markku Korkiakoski, Director, **Bittium**
Janßen, **Deutsche Telekom**

STREAM C THE PRACTICAL

11:30-12:00

A EUROPEAN WAY FOR CRITICAL INFRASTRUCTURE COMMUNICATION ON THE EXAMPLE OF SMART GRID

Dr Panagiotis Paschalidis, Senior Consultant, P3 Communications **GmbH**

12:00-13:00

GLOBAL PANEL: BROADBAND FOR PPDR

Chair TJ Kennedy, **Public Safety Network (Former FirstNet President)**
Ed Parkinson, Director - Government Affairs, **FirstNet, USA**;
Steve Watson, Deputy Director, ESN, **Home Office, United Kingdom**;
Minna Nyman, Head of Rakel & Command and Control Systems Office, **MSB**
Luke Brown, Assistant Secretary, Disaster Resilience Strategy, **Department of Home Affairs, Australia**
South Korea, speaker to be confirmed

14:00-14:30

3GPP ADVANCES IN CRITICAL COMMUNICATIONS

Erik Guttman, Chairman, **3GPP Service and System Aspects (SA)**

14:30-15:00

GENERATIONAL CHANGE: MISSION CRITICAL COMMUNICATIONS IN A HEAVY HAUL RAILWAY

Chris Reid, Senior Telecommunications Engineer, **Aurizon**

15:30-16:00

TRANSFORMING TRANSPORT FOR LONDON'S SURFACE RADIO SYSTEM

Dimitris Kaltakis, Consultant Infrastructure Architect, **Transport for London**

16:00-16:30

TETRA IN THE SCADA SYSTEMS AND CHALLENGES IN CLP POWER

Terrance Lai, Senior Telecommunications Manager, **CLP Power Hong Kong Limited**

17TH MAY 2018

STREAM A THE POTENTIAL

09:00-10:30 *PLENARY SESSION*

PAVING THE WAY FOR A SUSTAINABLE ECOSYSTEM OF CRITICAL COMMUNICATIONS **Francois Rancy**, Director, **Radiocommunication Bureau**
MODERNISING THE LARGEST TETRA NETWORK, **Thomas Scholle** Technology Director, **BDBOS**
CRITICAL COMMUNICATION IN NORWAY FROM TETRA TO COMMERCIAL LTE: WHAT IS THE BEST WAY FORWARD? **Tor Helge Lyngstol**, Norwegian Directorate of Civil Protection

11:30-12:00

INTEGRATION OF LTE IN MOBILE TACTICAL RADIO NETWORKS USING IEEE STANDARDS

Peter Sevenich, Head of Robust Heterogeneous Networks Group, **Fraunhofer Institut for Communication, Information Processing and Ergonomics (FKIE)**

12.00-12.30

MISSION CRITICAL BROADBAND VIA SERVICE OPERATOR

Timo Lehtimäki, CEO, **State Security Networks Group, Finland**

13:30-14:15

PANEL DISCUSSION: 5G NETWORK SLICING

Jurgen Rurainsky, Head of the international Standardisation Team, **BDBOS**
Erik Guttman, Chairman, **3GPP Service and System Aspects (SA)**
Dr Bruno Jacobfeuerborn, CEO, DFMG Deutsche Funkturm GmbH & CEO, Comfortcharge GmbH & Chairman, **Supervisory Board of 1NCE GmbH**.

14:15-14:45

EVOLVING CRITICAL COMMUNICATIONS MARKET: OPEN FOR GROWTH

Eric Davalo, **Airbus Defence & Space**

14:45-15:30

INVESTIGATION ON A REALISTIC SPEECH QUALITY TARGET FOR DIGITAL LAND MOBILE RADIO

Dr Ingo Forkel, Senior Consultant, **P3 Communications**

STREAM B THE LEARNING CURVE

11:30-12:00

HOW TECHNOLOGY WILL SUPPORT TOMORROW'S FIRST RESPONDERS

Paul Steinberg, Senior Vice President and Chief Technology Officer, **Motorola Solutions**

12:00-12:45

MNO PANEL: THE LEARNING CURVE

Chair Peter Clemons, **Quixoticity**
Gösta Kallner, Technology Director, **Ice Group**

13:45-14:15

THE ROAD TO GLOBAL MISSION CRITICAL BROADBAND TESTING AND CERTIFICATION CRITERIA

Harald Ludwig, Technical Forum Chairman, **TCCA**
Chris Hogg, Programme Manager, **Global Certification Forum (GCF) Ltd**

14:15-14:45

LTE DEVICE IN CRITICAL COMMUNICATIONS: ENSURING A RELIABLE ECOSYSTEM

Markku Korkiakoski, Director, **Bittium**

STREAM C THE PRACTICAL

11:30-12:00

FIRSTNET THE STORY: REPORTS FROM THE AMERICAN PUBLIC SAFETY BROADBAND NETWORK

Ed Parkinson, Director of Government Affairs, **FirstNet**
Jeff Bratcher, Chief Technology Officer, **FirstNet**
Nada Golmie, Wireless Networks Division, **National Institute of Standards and Technology (NIST)**
Shing H. Ling

12:00-13:00

PANEL DISCUSSION: OPERATORS HYBRID NETWORKS

Guy Duplaquet, **Ministère de l'intérieur**
Astrid, speaker to be confirmed
C2000, speaker to be confirmed

14:00-14:30

EXPERIENCES FROM THE BIGGEST ITCS PUBLIC TRANSPORT IMPLEMENTATION IN EUROPE: THE GERMAN RHEINBAHN

Reinhard Renja, Project Manager, **Rheinbahn AG**

14:30-15:00

THE EVOLUTION OF SATELLITE COMMUNICATION FOR PUBLIC SAFETY: THE NEXT ELEMENT IN THE HYBRID STRATEGIES

Zoltan Wirth, VP, Head of Hybrid Networks, Secure Communications, **Airbus Defence and Space**



AURIZON CASE PRESENTATION:

Mission critical communications in a heavy haul railway

16th May, 14:30-15:00
Stream C

Chris Reid,
Senior Telecommunications
Engineer, Aurizon

MISSION CRITICAL COMMUNICATION

Meet DAMM at CCW 2018 - Stand E11

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TODAY**

DAMM IN RAIL

JOIN THE PRESENTATION & GET THE FULL STORY

Aurizon's scheduled rollout of the DAMM® secure digital radio network is ahead of time and on budget, with 77 of the required 79 sites now active and fully operational

DAMM has delivered comprehensive radio coverage to Aurizon's Central Queensland operation, along with seamless multi-site roaming, unrivalled one-to-many Push To Talk capabilities and a long list of data capabilities. As a result, Aurizon can now afford the opportunity to utilise the full features of their advanced and secure mission critical voice and data radio communication network.

As the prime contractor for the network design and rollout, Radlink Communications provided blanket coverage along 2,670 km of track in addition to Reveloc's digital radio management solution to provide a platform for custom applications. This included advanced facilities such as geo-fenced auto channel change, weather message alerts sent directly from

Weather Watch website. The system also tracks, maps and displays all active radios, their speed and radio signal strength.

Additionally, integration directly to Aurizon's private telephony network provides full duplex telephone calls via TETRA terminals in areas with no mobile phone coverage. Radio over IP gateways connected to the existing analog radio and dispatch console systems have been supplied, installed and successfully commissioned.

DAMM's communication hardware solution included the ruggedized and compact IP65 encapsulated BS421 outdoor base station in full redundant configuration to ensure durability in harsh environments.

Also key to the Central Queensland operation and ensuring a mission critical voice and data communication network is the decentralized nature of DAMM TetraFlex architecture. Decentralized by definition guarantees no single point of failure in the network.



DAMM is a world-leading provider of scalable, flexible and user-friendly digital radio infrastructure systems to industrial, commercial and public safety customers. Meet us at CCW Stand E 11 or visit us at www.damm.dk

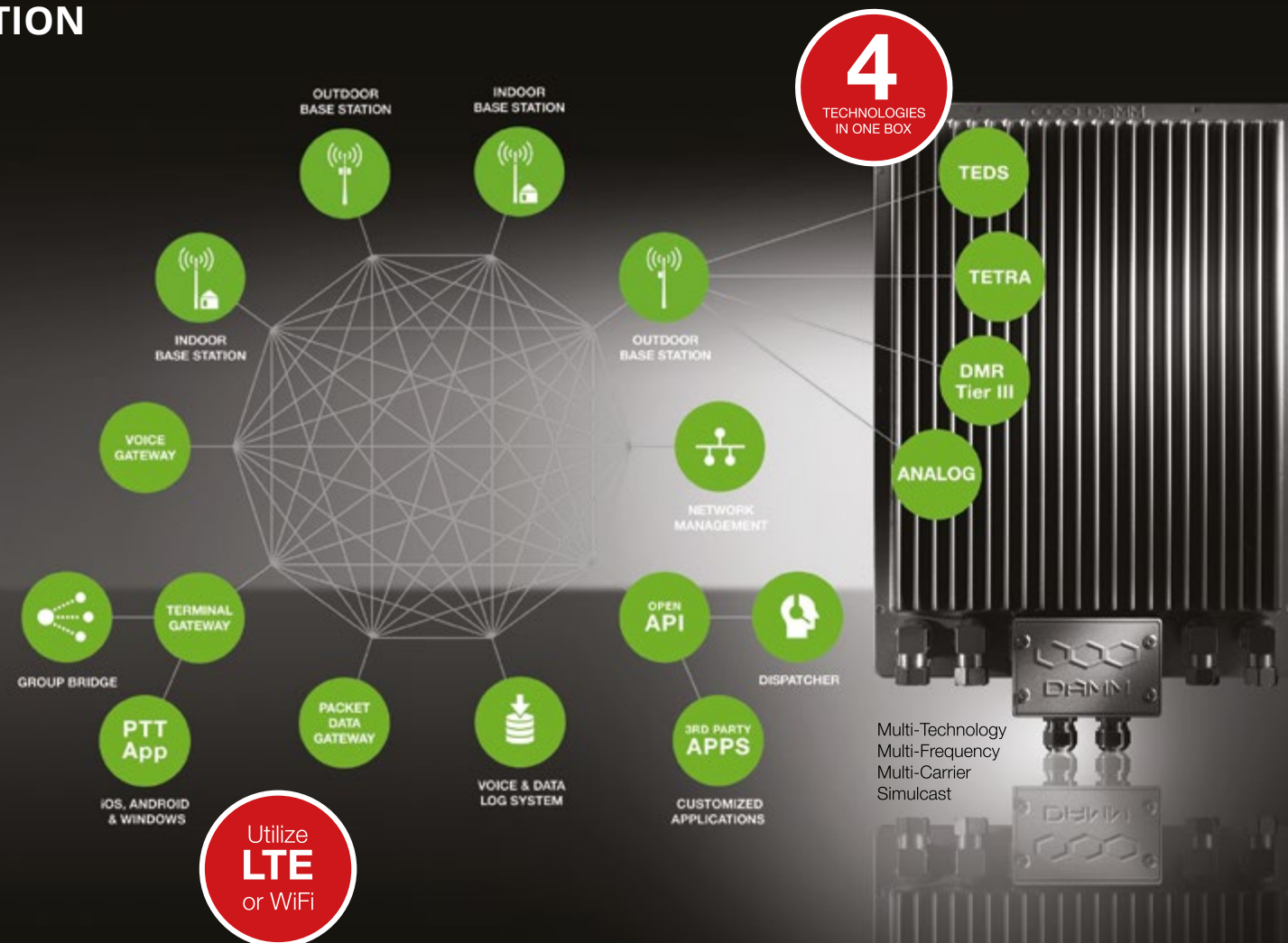
EXPERTS IN MISSION CRITICAL COMMUNICATION

SYSTEMS & SOLUTIONS

BREAKTHROUGH TCO

The move to great operations

DAMM offers three major ways to save:
lower maintenance costs, lower operating costs,
and interoperability with 3rd party apps.
DAMM offers the lowest possible cost of
ownership, in CAPEX and OPEX

BOOK
a meetingCCW
Stand E11**Lower maintenance costs**

Our plug-and-play setup is so easy your staff can do much of the work. DAMM's compact rugged base stations also keep maintenance costs down. For operations indoors and out, DAMM base stations keep on working. And redundancy means the DAMM network will not fail.

Lower operating costs

DAMM outdoor and indoor base stations deliver on the promise of energy efficiency to keep operating costs to a minimum. As the outdoor base stations do not use any backup batteries or generators, fewer refrigeration units are needed. In fact, they use so little energy they can run on solar power.

Open API = easy integration

As a global open standard, DAMM solutions allow a mix of 3rd party applications and equipment on the same system. We never bind you to a contract that restricts your use of other equipment or application suppliers, making it more cost-effective for you to adopt the tools you require.

Did you know?

Our flat distributed IP architecture and intuitive software work together to enable effortless self-configuring site expansion. You can add or integrate all network components, including base stations, dispatchers, network management facilities and external gateways – at any time – even while the system is in operation. Now across all technology modes, supported by the DAMM Multi-Tech Platform.

Before investing in a new radio communication network, make sure you download our white paper on decentralized architecture or meet us at CCW stand E11 to get your copy

**Get help from a specialist**

Book a meeting with the DAMM team of experts at CCW.

BOOK A MEETING:

Tel: +45 74 42 35 00

E-mail: sales@dammm.dk



DAMM
Critical communication made easy



BRAND NEW FEATURES FOR CCW 2018

ALONG WITH A FULL THREE DAY CONFERENCE PROGRAMME OVER THREE STREAMS WE ALSO HAVE FIVE NEW AND EXCITING FEATURES TAKING PLACE ON EXHIBITION FLOOR WHICH ARE FREE TO ATTEND TO ALL VISITOR'S

TECHNOLOGY SHOWCASE THEATRE

Located on the show floor, the Technology Showcase Theatre creates a buzz as leading technology providers entertain visitors with their innovative products and solutions. Organisers MA Exhibitions have used a rigorous application process to ensure that the presentations will be informative, engaging and relevant. With technology in this sector advancing at a phenomenal pace, with mobile broadband, UAVs and improvements in analytics software opening up new possibilities, the theatre is the perfect way to get up to speed with the latest developments and get a feel for how they could be implemented within your organisation to improve its service delivery or reduce its operational costs.



CONTROL ROOM ARENA SPONSORED BY FREQUENTIS

At the heart of any public safety operation is the control room and given its importance, the organisers of CCW 2018 have chosen to introduce a new feature – the Control Room Arena. This will offer a programme of presentations, demonstrations and Q&A sessions aimed at providing a view of the shifting face of emergency service control rooms.

The rapidly changing technology available for deployment is matched only by the evolving nature of the incidents which control rooms face across the globe. Both aspects pose significant challenges to operators, alongside increasing pressure for efficiency and a reduced budget. Visit the Control Room Arena to gain a better understanding of how a modern control room

operates including the integration of multi-agency assets and equipment, including live demonstrations from flying drones, connected vehicles and personnel on the show floor. You'll be able to take advice and guidance back to your control room to improve its operations. There will also be the opportunity to learn how investment in new technology and practices will help enhance your control room's efficiency, capability and resilience and make a tangible difference to users on their network.

NETWORKING BAR SPONSORED BY AIRBUS

There will be a networking drink reception at the end of Day 1 (15th May), ahead of the International Critical Communications Awards. This will provide the perfect opportunity for those important business and networking conversations that will help strengthen current relationships and build new ones. The Networking Bar is the perfect place to unwind and relax after a long day of learning, exploring, and attending some of the masterclasses.



DRONE ZONE



Drones/unmanned aerial vehicles (UAVs) are being used by agencies across the world, unlocking enormous potential for mission-critical and business-critical functions. At CCW 2018's Drone Zone, you'll be able to see the latest developments in drone technology with live flying demonstrations. Visitors will walk from the exhibition hall directly into the garden to view live UAV demonstrations. These can be linked to the Control Room Arena – allowing attendees to get a drone's-eye view and see how aerial footage can be used by control room operators.

The drones will be flying in the large outside space at the venue, feeding back live imagery and telematics to the pilot, the Control Room Arena and other locations. You'll be able to compare the solutions offered by different

providers and even watch the drone races we'll be putting on for your entertainment.

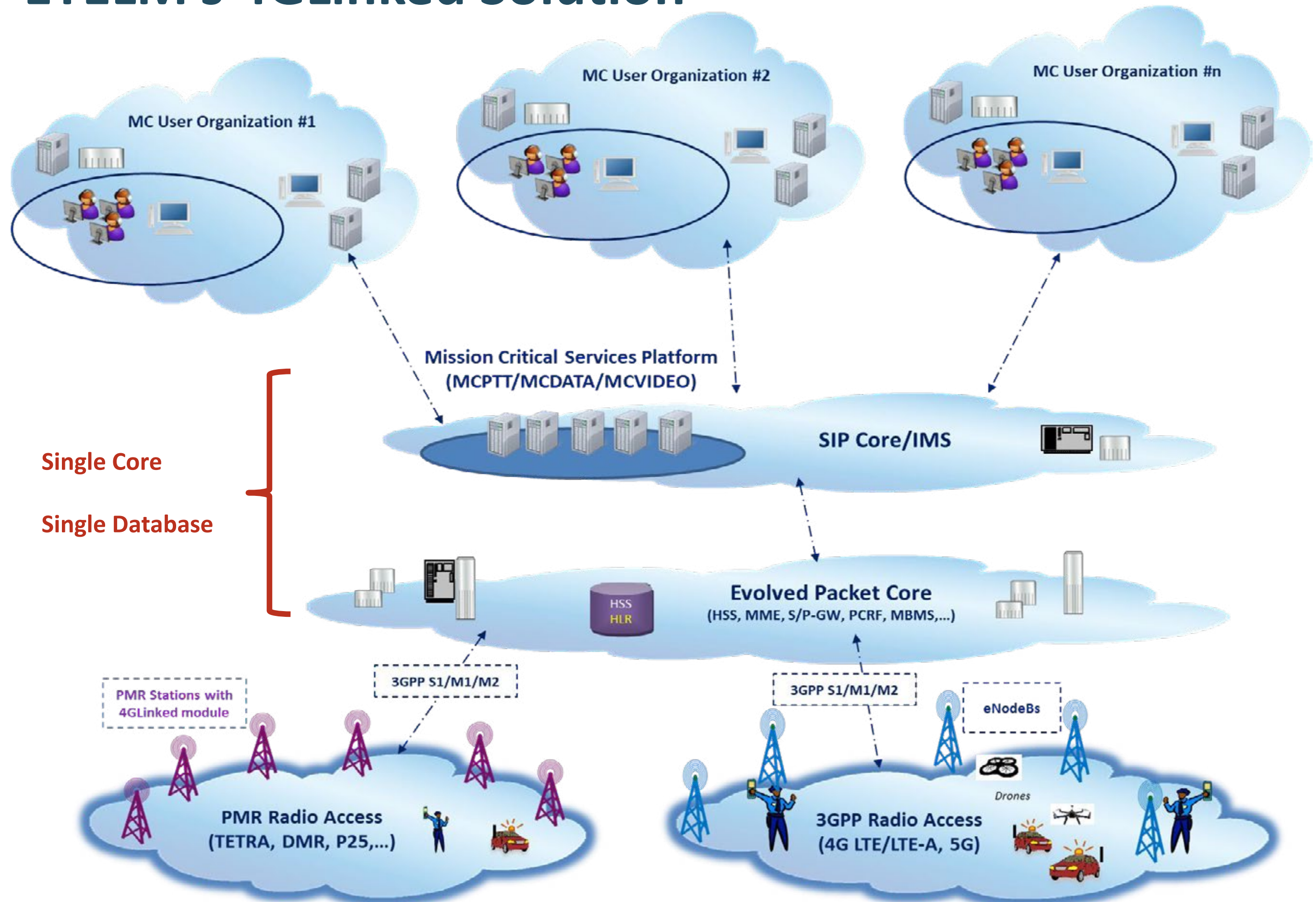
But it's more than just a spectacle. Through attending you'll gain an understanding and appreciation for the potential of this technology and how it could improve your organisation's operations, whether that's by making it easier to find missing persons in the wake of disasters, allowing the rapid deployment of cellular coverage, when the permanent sites are down, or to investigate a reported fault on a gas network before sending an engineer – the potential is enormous.

CONNECTED VEHICLE ZONE

This zone will showcase the latest in-vehicle capabilities across all critical communication agencies. Speak to experts on how to maximise in-vehicle capability and improve overall operational efficiency.



ETELM's 4GLinked Solution



Seamless communications between users of different technologies

ICCA

INTERNATIONAL CRITICAL COMMUNICATIONS AWARDS
2018
15TH MAY 2018, BERLIN

SHORTLIST
NOW CONFIRMED

We are delighted to announce that the shortlist for the International Critical Communications Awards has been confirmed!

Congratulations to all of our 2018 shortlist. The winners will be announced at the ceremony on Tuesday 15th May at the Palais am Funkturm. To view the full shortlist and to book your place at the ceremony, please visit the website www.criticalcommsawards.com

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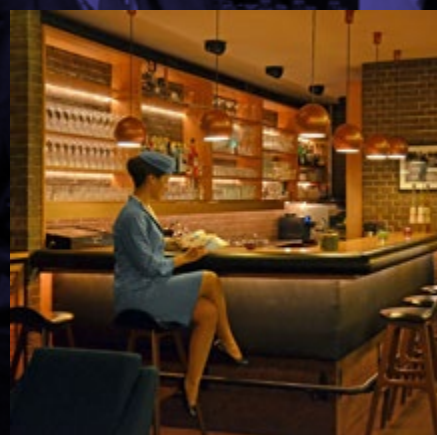


VIP NETWORKING PARTY

The VIP Networking Party will be taking place on the 16th May at the **PanAm Lounge, Berlin**. With complimentary food and drink join us to unwind after a full day at CCW while enjoying the 360 degree views of Berlin the lounge has to offer.

Network with colleagues in a relaxed environment while a live band plays in the background.

Transport will be available taking all VIPs from Messe Berlin to the PanAm Lounge – just don't forget your boarding ticket!



Advanced, Proven Communications. When It Matters Most.

Leonardo is a leader in mission-critical communications, with solutions in operation in over 50 countries, worldwide.

Based on state-of-the-art technology, the company's advanced, robust products and networks connect cities, critical infrastructure and transport every day and provide reliable communications in emergency conditions.

The company's technology has also been proven at a range of high-profile international events, including inter-governmental forums, Olympic Games and World's Fairs.

Inspired by the vision, curiosity and creativity of the great master inventor – Leonardo is designing the technology of tomorrow.

Visit us at CCW 2018, HALL 21B, Stand C30

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WELCOME FROM CCW HOST OPERATOR BDBOS

Berlin is a central place for culture, economy, politics and sports not only in Germany but worldwide. As such, Berlin hosts regularly large scale events related to all these areas. Therefore it is easy to see why Berlin has advanced know-how and expertise when it comes to managing Public Protection and Disaster Relief (PPDR) organisations' operations. The technological foundation for this is the TETRA-based nationwide public safety digital radio network, the 'Digitalfunk BOS'.

Germany's sixteen federal states and the Federal Government operate the 'Digitalfunk BOS'. The Federal Agency for Public Safety Digital Radio (BDBOS) is responsible for coordinating all strategic decisions. BDBOS ensures that the interests of more than 777,000 subscribers from public safety, emergency and disaster relief organisations are taken into account. BDBOS and its partners work closely together to maintain and improve the network's availability, which was ~99.97% over the last three years.

Berlin hosted some major events in 2017, including:

- The demonstrations on 1st of May (Labour Day) with ~4,500 'Digitalfunk BOS'-terminals involved.
- The German Protestant Kirchentag took place on the weekend of the 24th to 28th of May 2017 and including a visit by the former President of the United States Barack Obama. It took place at the same time as the finals of the German Football Association (DFB) Cup and up to 2,300 PPDR agents were involved in securing these events.
- The New Year's Eve celebrations with fireworks at the Brandenburg Gate and all over Berlin, where the Berlin Fire Brigade alone had 407 emergency and technical relief vehicles and carried out 1,580 operations.



The operations managers in Berlin and Germany's other major cities have consolidated their procedures through long experience, but technological and organisational improvements are always needed, so innovative solutions are being continuously developed. Some of these that have been tested and extensively proven in the 'Digitalfunk BOS' are as follows:

LOAD-BASED ASSIGNMENT OF CONTROL CHANNELS

The BDBOS opened up the possibility of using further control channels during missions. The BDBOS project manager, Christine Reinemann outlines: "The new technology checks the utilisation of the control channels in a base station automatically and selects the least-used control channel. This will be used for the next request. The function can now be used by all authorised offices of the different federal states in Germany, by setting the corresponding parameters for Secondary Control Channel (SCCH)-enabled terminals." This could significantly improve the efficiency with which the signalling capacity of the 'Digitalfunk BOS' is used.

REAL-TIME MONITORING

The 'Digitalfunk BOS' experts have also developed and implemented a Real-Time Monitoring System. It provides detailed information, figures, charts and data of all used and available resources in the 'Digitalfunk BOS'. This makes it easier for operations managers to decide during an event whether or not they need to free up more resources.

"The introduction of real-time monitoring is a key milestone for the advanced handling of any kind of situation, to secure especially large scale operations," says Sebastian Kaul, BDBOS Senior Expert for Network Operation.

SATELLITE-BASED MOBILE BASE STATIONS

A project for the integration of satellite-based mobile base stations to enlarge capacities during major operations was introduced and the first field tests have been successfully executed. During the project, ten mobile base stations were purchased and placed at strategically important federal police locations. Oliver Funke, BDBOS project manager and network planner says that "The new technology is relevant especially for ad-hoc operations, because it offers more flexibility in usage and shorter set up times regarding parameterisation and configuration."

BDBOS members as well as partners from German and international organisations will present their findings and solutions at the CCW 2018 conference and exhibition in Berlin. Additionally, BDBOS will host the "BDBOS Tactical Day" on May, 15th for PPDR end users and practitioners. Attendees will enjoy interesting and first-hand reports on how to manage large scale events. Both the CCW 2018 exhibition and the BDBOS Tactical Day are admission free and open to all interested persons.



COMPACT WITHOUT COMPROMISE

See the next generation TETRA hand-portable radio at Critical Communications World 2018 in Berlin.

The SC21 is a next-generation, high-performance, smart TETRA hand-portable radio.

Small and light enough to be lapel-worn, the SC21 is still rugged and robust enough to withstand the toughest workday challenges.

With crystal-clear audio and extended coverage, the SC21 offers all the benefits of a compact radio, with no compromise on performance.

Visit Sepura on stand B40 to see the SC21 at CCW in Berlin, 15-17 May.

To register to attend visit:
www.critical-communications-world.com

To find out more about the SC21, visit sepura.com/SC21

sepura
a hytera company

Going further in critical communications





EXHIBITOR HIGHLIGHTS:

WHAT YOU CAN FIND ON THE BUSTLING SHOW FLOOR



**MOTOROLA
SOLUTIONS**

Motorola Solutions has been helping governments, agencies and individuals to stay safe, be productive, and work smartly – for the past 90 years. Whether it's infrastructure, devices, software, or services, its close relationship with its customers plays an integral role in the constant innovation that transforms the way individuals do their jobs on a daily basis.

This commitment to innovation continues as Motorola Solutions invests to develop the next generation of innovative technology and services to address its customers' greatest challenges.

These challenges are greater than ever, with an increased security threat – both physical and digital. When this is combined with an emphasis on being more effective with less resource, it means that users are under even greater pressure.

Motorola Solutions knows that data has the potential to create safer cities, thriving communities, and more efficient and effective operations. But the power of data is unleashed only when it's converted into actionable intelligence, and is in the hands of those who need it, when they need it, so they can make the best informed decisions when and where it matters most. To do this, you need mobility. The company's mobile Intelligence framework harnesses data by unifying applications, networks, devices and services to transform critical operations and work processes.

At CCW 2018, Motorola Solutions will be showing solutions that are critical elements of its mobile intelligence framework, as well as its comprehensive range of devices and infrastructure to address the mission-critical needs of public safety and commercial organisations, on stands C10 & A20.



Hytera will showcase its vision for the future of communication solutions for mission critical users on stand E20. This includes broadband products and solutions as well as proven narrowband DMR and TETRA technology.

Special highlights of its presence at CCW 2018 in Berlin will include:

- Hytera's new Multi-mode Advanced Radios. They bring together narrowband and broadband functionality in one device, thereby combining secure mission-critical voice communication with fast and versatile data applications
- The DMR Trunking Cube is an especially powerful outdoor base station that supports up to eight carriers.
- New product launches to the European market with powerful new DMR radios and mission critical ad-hoc communications solutions e-Pak 100 and i-Mesh.

Products and solutions from the members of the Hytera Group will be on display, including those from Sepura, Teltronic, Norsat, and Sinclair. Visitors will be able to see the powerful Sepura radios and Teltronic's clever applications and train radio solutions.



The IHS Markit security and critical communications analyst team will be exhibiting at CCW this year. The team will be showcasing the latest research in LMR, private and Hybrid LTE, command & control and dispatch, public safety technologies and safe cities on stand B45. Jesus Gonzalez (senior analyst for critical communications broadband LTE) will be presenting at the technology showcase, Thomas Lynch (executive director security) will be presenting and contributing at the public safety Motorola Solutions round table, with Alex Richardson (safe cities & command & control manager) and Ryan Darrand (mobile radio senior analyst) also in attendance and open to discussions on the market. IHS Markit's key products in critical communications for 2018 include:

- Critical Communications Broadband LTE Intelligence Service
- Command & Control Intelligence Service
- Mobile Radio Intelligence Service
- Safe Cities Report
- Public Safety Technology Report



EETELM's 4GLink is a platform that connects both TETRA and LTE on a single core and single database. EETELM will be explaining how this unique platform works, what the benefits for the users are and where it has been deployed. Both LTE eNodeB (EETELM e-LBS) and LTE picocell (EETELM e-LBSp) which are fully designed by EETELM and optimised for mission-critical users will be showcased on EETELM's stand (D52).



Schnoor will be presenting its first all-IP TETRA cab radio solution on stand A12. All interconnections between cab radio components as well as those with onboard systems are done via Ethernet.

The radios were delivered for the ROTEM-built light rail vehicles (LRVs) supplied to the new Jakarta Light Rail Transit (LRT) network entering service in time for the Asean games this year. The cab radio solutions that will be shown will include those that do not rely on Ethernet, given the amount of rolling stock which has yet to migrate over to the IP world but still need to benefit from modern digital mission-critical communications. Examples of retrofit solutions, a particular area of Schnoor's competence, will be on display at its booth.

For the DMR world, Schnoor will demonstrate its smart DMR Simulcast solution, which has modern decentralised simulcast network architecture which does not need central synchronisation infrastructure. This also eliminates the headaches that are encountered when designing a fail-safe simulcast network that uses centralised synchronisation. In addition, a new DMR base station will be shown during the show.

While Schnoor provides DMR infrastructure, the company is not a terminal manufacturer. Distributor and antenna manufacturer Schomandl, a subsidiary of Schnoor, will launch the distribution of Excera DMR terminals in Europe at CCW 2018 and demonstrate these. Excera and Schomandl staff will be at CCW 2018 on a common booth.



In the world of automated messaging, handling simplex dialogue is routine. Managing multiple conversations simultaneously has been made possible by Boomerang's patented threaded technology, which is at the heart of the newly launched Boomalert and Boomerang Triage products. These allow the user to maintain several threads of messaging between the automated hub and the far end recipient. Messages can be sent, opened, replied to, and processed in any order.

At CCW, Boomerang will be presenting its set of applications, with a major focus on Triage. Both during its presentation and while exhibiting throughout the two days of the show on stand E81, you will be able to learn about all of the products and their features, along with experiencing them first-hand, using only your mobile phone.

Triage was devised after analysing the level of emergency calls being made to the '999' service that didn't warrant emergency status and were tying up call handlers. Triage was developed to address this, together with the proliferation of mobile phone users and the convenience afforded to callers using SMS as a means to communicate, as an SMS based tool to accept, analyse, direct, and resolve non-emergency contacts.



Sepura is delighted to be attending CCW in 2018 and is looking forward to demonstrating its latest solutions, on stand B40, including:

SC21 Hand-portable TETRA Radio

Featuring a wide range of functionality inherited from the ground-breaking SC20, the SC21 is small and lightweight, yet delivers class-leading performance. The SC21 is a compact radio, small enough to be carried in a pocket or light enough to be lapel-worn. However quality is not compromised at all; the SC21 features best-in-class audio, even in continuous heavy rain. Usability is enhanced by well-spaced keys and a large, sunlight-visible screen and the small streamlined case means it's also easily concealed for discreet or fully covert use and both forms will be demonstrated on Sepura's stand.

Accessories

Robust and reliable enough to meet your toughest operational challenges, Sepura's versatile and extensive range of accessories allows you to configure your terminals for optimal comfort and performance and the latest products will be on show.

Applications

Sepura's suite of applications is designed to save both field and control room users time and effort, by sharing data, images and critical information safely and quickly.



HOW TO BOOK

With more content than ever before (spread over four conference rooms), delegates are invited to book their preferred sessions. Hear key talks from ministers and leaders in the critical communications industry.

Registration to the Exhibition is free of charge. There you will be able to hear talks in the Technology Showcase theatre from exhibitors showcasing new technologies and visit the Control Room Arena, which will be showing a live critical control room with real-time video feeds from the Drone Zone.

REGISTER NOW BY VISITING WWW.CRITICAL-COMMUNICATIONS-WORLD.COM

		NETWORK OPERATOR/END USER	VENDOR
3 DAYS	Before 10th March	€ 850.00	€ 2,399.00
	Before 6th April	€ 950.00	€ 2,599.00
	From 6th April	€ 1,050.00	€ 2,799.00
2 DAYS	Before 10th March	€ 625.00	€ 1,799.00
	Before 6th April	€ 725.00	€ 1,999.00
	From 6th April	€ 825.00	€ 2,199.00
1 DAY	Before 10th March	€ 395.00	€ 1,099.00
	Before 6th April	€ 495.00	€ 1,199.00
	From 6th April	€ 595.00	€ 1,299.00

VIP TICKETS:

Become a VIP at CCW for just £250 for Users to gain exclusive access to the networking drinks on the evening of the 15th before moving over to the International Critical Communications Awards, at the Palais Berlin, for a night not to be missed. You are also invited to attend the VIP networking party taking place on the 16th May at the PanAm Lounge, Berlin.

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30 Hospitality
Hotels are using wireless technology in the battle to meet rising expectations

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RYAN DARRAND, SENIOR ANALYST II AT IHS MARKIT, EXPLORES SOME OF THE BIGGEST TRENDS IN THE EMEA REGION'S CRITICAL COMMUNICATIONS MARKET

Europe, the Middle East and Africa (EMEA) are some of the most digitised regions in the world, with the number of digital subscribers increasing year on year. There are now more digital LMR users in these areas than there are analogue users, and procurement of digital solutions continues to grow.

A significant contributor to the digitisation of the LMR industry in these regions is the adoption of TETRA by national public safety and security organisations in Europe, and more recently in the Middle East and Africa. Europe is the cornerstone of the global TETRA market, accounting for more than half of the world's TETRA users.

TETRA has been used for many years in Western Europe, with large national networks in countries such as the United Kingdom, Germany, Belgium, the Netherlands, and Scandinavia.

Despite the scale of this market, TETRA continued to grow in 2017, increasing shipments to EMEA by four per cent; outstripping growth of any other digital LMR technology in this region, despite a buoyant and diverse range of other LMR technologies.

France has a large Tetrapol installed base in the public safety and security domain, however TETRA has had success in the realm of non-public sector organisations particularly in the transportation sector; many of France's large transportation hubs such as airports, metros and bus systems use TETRA networks. Furthermore, Airbus DS have made significant investments into research and development into Long Term Evolution (LTE)

for Professional Mobile Radio; this investment will continue to see TETRA an integral part of the solution in the roadmap for mission critical broadband solutions for public safety organisations.

Also, Spain, despite having a national Tetrapol network, has several large regional TETRA networks – particularly in the transportation sector, giving Spain a formidable installed base of TETRA users.



Portugal has a national SIRESP national TETRA network that services public safety and security agencies across the country. There was pressure to modernise the network considering the communications problems during the summer of 2017 as its aerial lines could not withstand the forest fires.

Investment into TETRA is also veering further south and east. There has been significant investment into TETRA technology in Italy, since the Italian Ministry of Interior signed a €450 million contract with Finmeccanica, extending the TETRA PIT program to implement a TETRA-based mission-critical national mobile radio service for the Police Forces.

IHS Markit expect that investment into TETRA in the public safety and security domain will trickle down into business-critical industries as it has done with Aeroportie de Roma (ADR), and the investment program illustrates a firm commitment to TETRA for the next ten to fifteen years at least.

Cost Optimised Digital technologies have been very successful in Eastern Europe, deployed in both mission critical and business critical roles. However, TETRA has also been very successful in this region, and several TETRA networks have been installed in several countries including Hungary, Slovakia, Macedonia and Croatia; and these networks continue to expand. Modernisation of Hungary's national TETRA network EDR has recently taken place, with state of the art IP-based technology provided by Airbus DS; police forces in Croatia equipped border control busses with TETRA technology; while Slovakia opted to upgrade its national TETRA network at the end of 2017 and Bulgaria's TETRA network is also being upgraded, further increasing the commitment to TETRA in Eastern Europe. Furthermore, Moldova has signed a contract to build a nationwide TETRA network for its police forces, adding to the investment in TETRA in this region.

Demand for TETRA technology is also increasing in the Middle East and Africa, as double-digit growth was noted in 2017. Political unrest and instability and the requirement for physical safety and security in some regions have provided strong market drivers for robust communications infrastructure in parts of the Middle East and Africa. Lebanon, given its geographical location, its proximity to Syria and Israel, its ties to Iran through its Shiite community and the geopolitical implications of these

factors have all provided strong market drivers for communications investment. TETRA was procured by the Ministry of the Interior in Lebanon. Not dissimilar to other countries in the region which have experienced war, and the subsequent rebuilding of safety

(ISIL) in Libya, have provided the necessary conditions for investment in safety and security infrastructure in this region.

TETRA has also permeated other parts of the region, particularly in the public safety and security and transportation industries, with the procurement of TETRA communications at the King Abdul-Aziz International airport. Saudi Arabia has been a significant adopter of TETRA, along with public safety and security organisations in the UAE, Oman, and Iraq – which has been in a perpetual state of sectarian war since US troops withdrew from the country in 2011. Other moderate states such as Kuwait, Jordan and Bahrain have also witnessed significant investment in TETRA communications.

Thales delivered TETRA to Qatar's rail and Dubai's renewal of its Service Level Agreement for five more years of TETRA service to its metro lines. Ooredoo, a leading telecommunications company in the Middle East, also announced it will sell TETRA devices in Qatar.

The region has also seen the emergence of several private LTE networks for public safety including in Qatar and UAE which could pose as competition for TETRA in the medium to long term; however, IHS Markit projects that LTE will

be used as a supplement to TETRA – a tried and tested, established technology for public safety users; and several leading manufacturers have released hybrid LTE and TETRA convergence solutions as part of their portfolio.

Angola opted for a nationwide TETRA and LTE convergence solution in 2017 to service its public safety and security apparatus, ensuring the delivery of critical voice communications in conjunction with LTE's data rich features.

In summary, Europe, the Middle East and Africa has a thriving LMR market with digitisation gaining pace. The number of LMR users continues to grow year on year despite the emergence of LTE onto global markets. LTE has supplemented and will continue to supplement critical voice communications in many cases for years to come. IHS Markit projects that the Middle East and Africa will be the most digitised regions in the world by 2021, with more than 90 per cent of users converted to digital LMR technology.



IHS Markit will work in partnership with Critical Communications World 2018, providing a go-to independent analysis of the industry. IHS Markit are the world's leading source of information, analytics and expertise and global leaders in Communications and Security technologies.

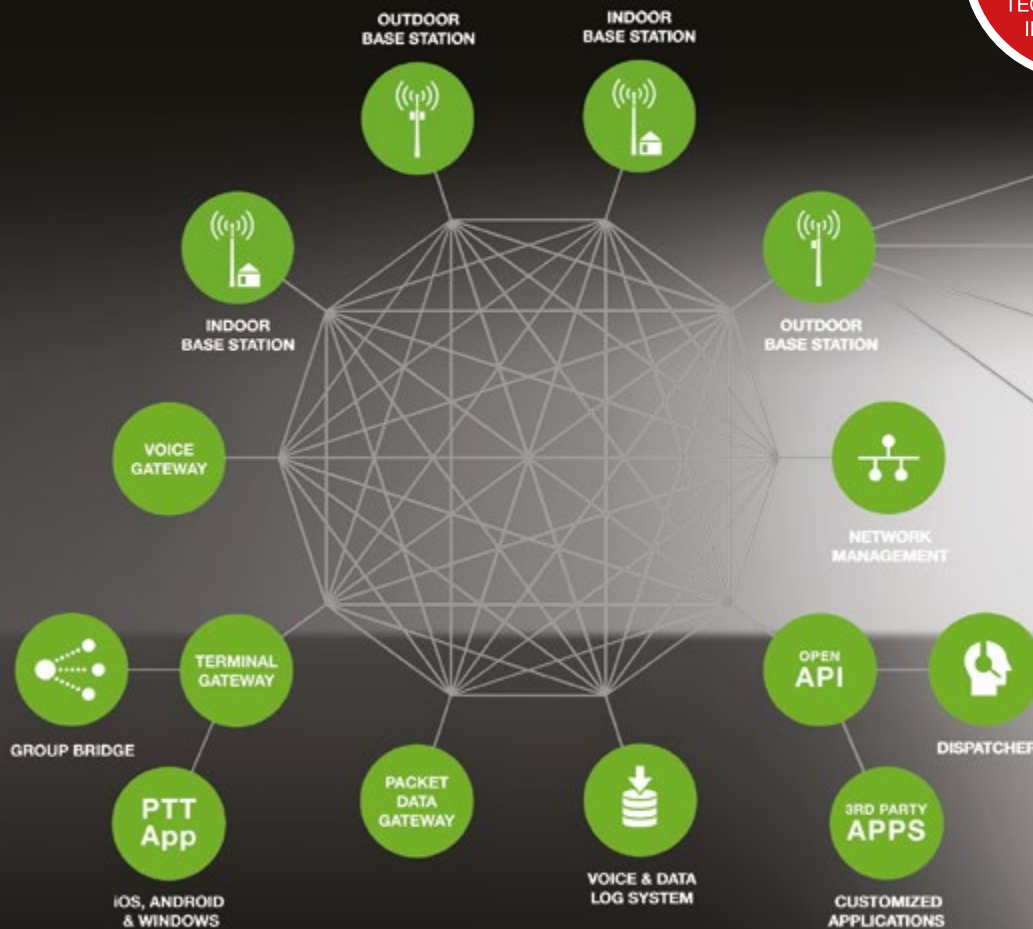
RYAN DARRAND
SENIOR ANALYST II
IHS MARKIT

and security in such states, Libya has been the recipient of strong investment in TETRA communications. The fragile power vacuum which ensued following the Arab spring, and the regrouping of Islamic State of Iraq and the Levant



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