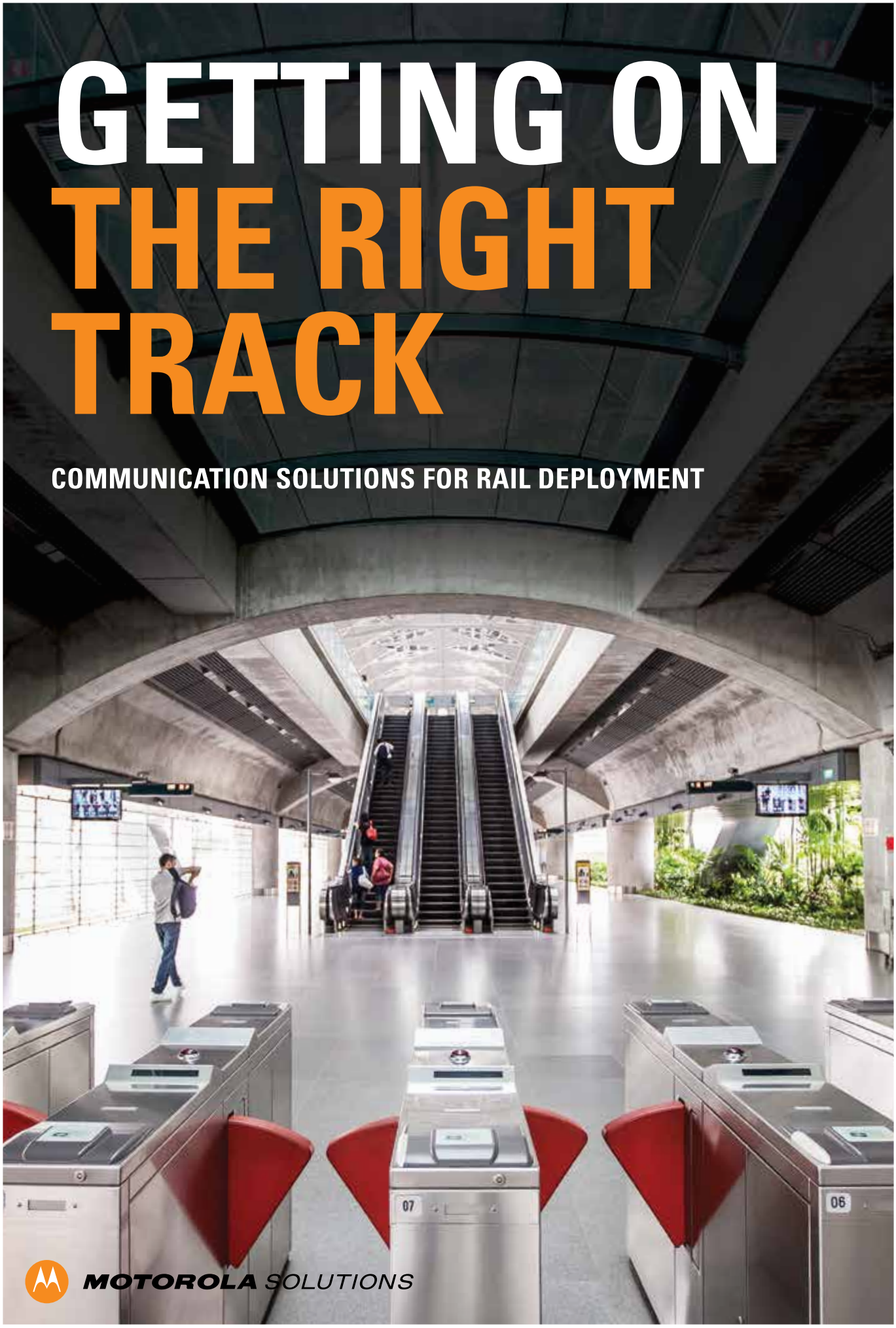
GETTING ON THE RIGHT TRACK

COMMUNICATION SOLUTIONS FOR RAIL DEPLOYMENT



MOTOROLA SOLUTIONS

IT'S ABOUT EFFICIENCY AND SAFETY

The challenge facing all long haul and mass rapid rail operators is the ability to transport goods and passengers to the scheduled destinations – safely and on time.

From operations to passenger management, Motorola Solutions' extensive knowledge of this industry enables us to better provide communication and information solutions that best fit your operations – allowing you to operate with higher productivity, greater safety with faster emergency response.

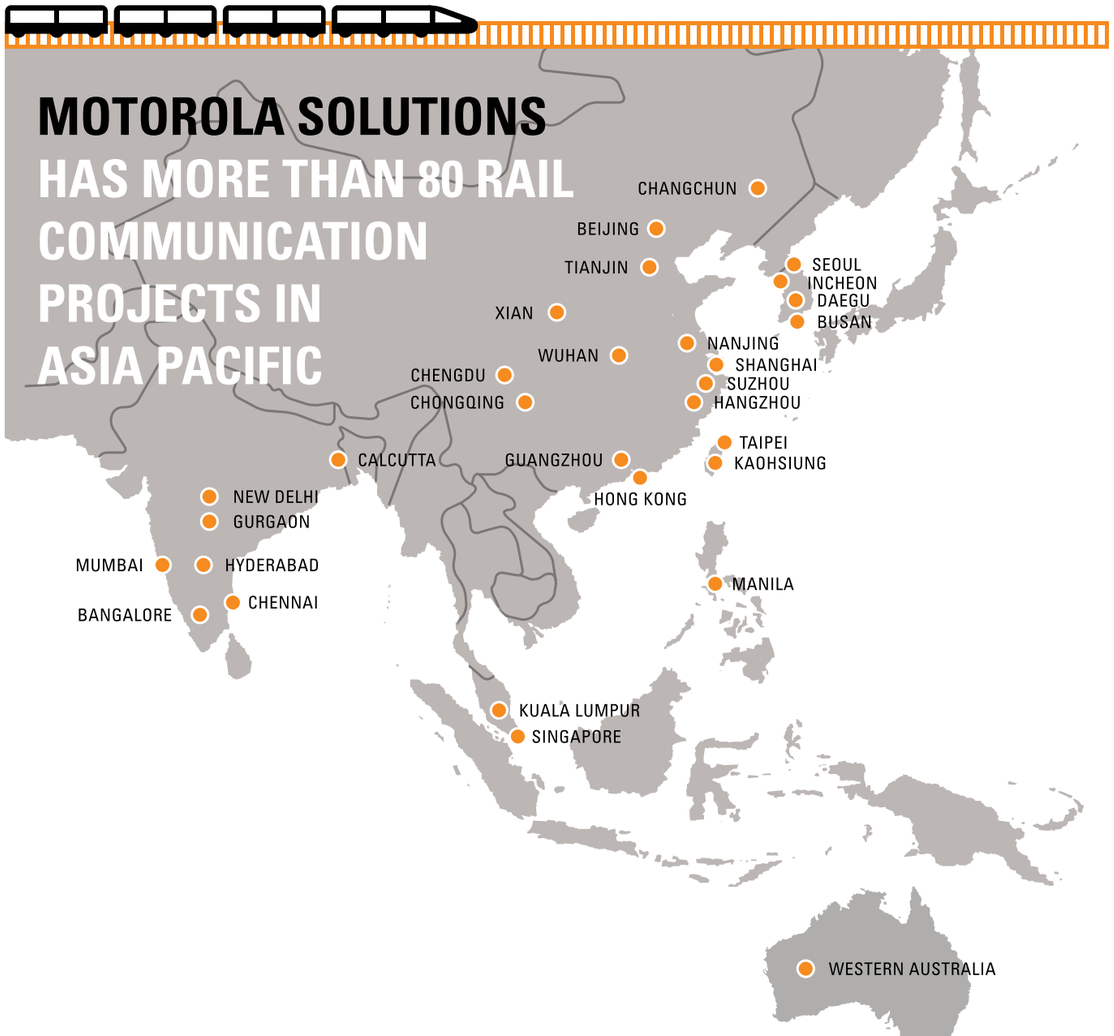
MOTOROLA SOLUTIONS
EXTENSIVE TRACK RECORD

A HERITAGE OF LEADERSHIP

Motorola's communication solutions continue to serve the rail industry since the 1970s, with dedicated Spectra railroad radios in the USA and Storno products in Europe. In Asia Pacific, Motorola accumulated vast experience implementing digital systems for railways. As of end 2014, Motorola has been awarded more than 100 railway projects worldwide out of which more than 80 are in the Asia Pacific region.

Our market leadership also allows us to lay claim to the following significant milestones in providing digital trunked radio solutions to the rail transportation industry:

- First APCO P25 system serving one of Australia's longest private freight railway – Western Australia
- First APCO P25 contract for a high speed rail – South Korea High Speed Rail
- First operational TETRA system for rail in the world – Malaysia ERL
- First TETRA contract for a high speed railway in the world – Taiwan High Speed Railway
- Longest passenger railway in the world - Taiwan Railway Administration
- Driverless metros - Copenhagen Metro, Shanghai Metro Line 10, Hong Kong Disney Resort Line



COMMUNICATION SOLUTIONS FOR RAIL DEPLOYMENT

WHEN YOUR OPERATION IS ON THE LINE
AND COMMUNICATIONS MUST GO THROUGH

Where train systems need to run smoothly without delays and where passengers reach their destinations safely, two-way communication is the solution that bridges the information flow between the station control and train.

VOICE COMMUNICATION

Motorola has a comprehensive range of two-way radios that is customised for professional use and characterised by excellent audio clarity, ease of use, reliability and durable performance. We also design, manufacture and distribute radio system solutions – addressing customer needs such as fast system access, wide area coverage and spectrum efficiency.

DATA COMMUNICATION

From fixed data to mobile data systems, data has played a significant role in providing timely access to critical information. Motorola's leadership in wireless data solutions has seen us provide thousands of data systems and devices to customers around the world - enabling them to address their communication needs beyond voice solutions.

INTEGRATING VOICE AND DATA

Using a digital platform, integrated voice and data systems enable you to enjoy benefits such as audio clarity, seamless voice and data transmissions as well as voice privacy. Motorola's leadership in integrated voice and data solutions with TETRA (TErrestrial Trunked RAdio), APCO P25 (Association of Public Safety Communications Officials Project 25), and DMR (Digital Mobile Radio) is second to none. We are intimately involved in the development of these digital solutions and have secured numerous customer contracts globally and in the Asia Pacific region.

Motorola is the only current TETRA supplier who was a founding member of the TETRA Association. Committed to leading the evolution of the TETRA standard since its inception, our fully standards-compliant Dimetra IP technology will ensure that terminals and applications from a broad range of industry vendors will be supported.

ASTRO 25 pulls it all together with multiple configurations and multiple frequency bands, customers have choices for trunked and conventional voice and data service. The architecture begins with a core system that manages command and control, radio access and interoperability with other networks. You can add capabilities in a modular fashion as needed.

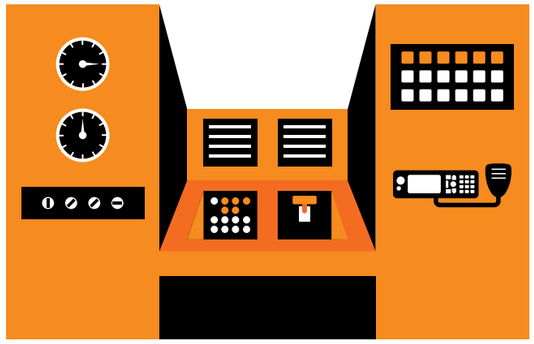
Our MotoTRBO is for business-critical operations where basic functionality can meet the voice and data needs of lower capacity rail operators. Similar to Astro 25, our TRBO systems can be a cost-effective alternative to the mission-critical systems.

FUTURE-READY FOR LTE - WIRELESS BROADBAND

Motorola's P25 and TETRA networks are future-ready for LTE, providing the foundation for a unified system that allows digital radio and LTE core components to be implemented seamlessly. With the state-of-the-art radio network, rail operators will have the necessary foundation to tap on LTE's wireless broadband in the future. The future-ready radio network built on a converged architecture will enable users to operate radio and broadband as a unified service, bringing the benefits of advanced multimedia applications to frontline personnel and communications centers. For instance, frontline personnel will be empowered with increased situational awareness, enhanced operational collaboration and greater productivity. Communications centers will benefit from real-time visual updates as an incident unfolds with intelligent video surveillance solutions.

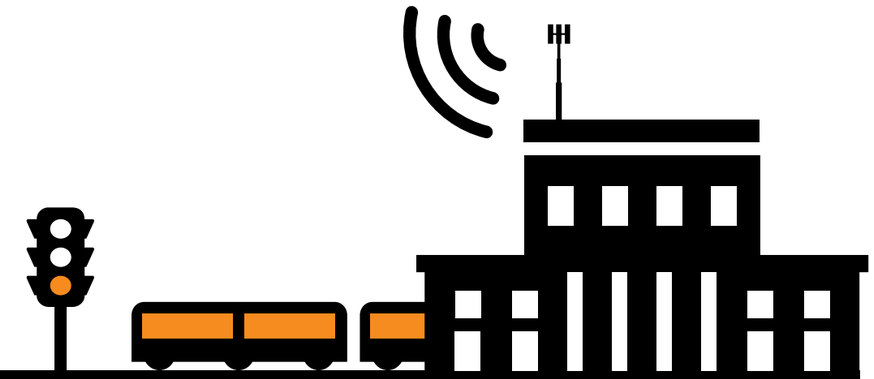
INTEGRATING AND MANAGING ACROSS YOUR COMMUNICATIONS PLATFORM

Motorola has a full staff of engineers to help you to in deciding which technology is best suited for your requirements, and in integrating these systems into your existing communications network. Comprising experienced project managers and engineers, our System Integration team offers world-class expertise in project, risk and system management, installation support and maintenance - enabling you to enjoy a seamless and integrated solution.



UNDERSTANDING YOUR OPERATIONS
WITH END-TO-END RAIL COMMUNICATION SOLUTIONS

Each customer is unique and it is critical that your solution best fits your operations – addressing departmental needs as well as seamlessly integrating into the larger operational system. From software applications to radio communications, front end to back-end systems, you can be assured that you will find the right solution - with Motorola Solutions.



OPERATIONS MANAGEMENT

MAIN LINE OPERATIONS

Efficient management of your train run numbers enables you to maintain close contact with the respective train operators – ensuring greater coordination with the train operators as well as enhancing the monitoring of your operations at any given time.

For the efficient and safe operations of the trains, critical train status information can be sent in real time to the control center.

SHUNTING YARD / DEPOT OPERATIONS

With heavy machinery and equipment constantly being moved around the work areas, equipping operational crew with a communication solution can expedite the coordination they require.

TRAIN CONTROL

In the absence of trackside signals, rail operators may consider relying on GPS (global positioning system) information to provide train location updates. The GPS data can be sent via on-board radio system to the control center for Automatic Train Location management. This will enable the line capacity to be optimised.

PASSENGER MANAGEMENT

PASSENGER INFORMATION SERVICE SUPPORT

Train borne systems such as the Passenger Information and Public Address systems provide passengers on-board with information support through display messages from the control center or through broadcast transmissions of up-to-date news.

PASSENGER EMERGENCY SERVICE SUPPORT

In emergencies, it is of critical importance that passengers have the service support needed to alert the control center for assistance.

FREIGHT MANAGEMENT

PRODUCTIVITY AND COST EFFICIENCY

Efficient management of goods and cargo enables you to provide customer confidence in your service - resulting in greater customer satisfaction.

As train systems become more complex and require more information to operate efficiently, many are turning towards an integrated solution approach to address these enhanced requirements.

CONTROL CENTER MANAGEMENT

COMPUTER-AIDED DISPATCH (CAD)

CAD systems combine both computer and mobile communications equipment, to dispatch information to train operators. Advanced CAD systems utilise both in-train radios and mobile data terminals, which enable more detailed and clearer messages to be communicated to the operator.

With the use of free text and status messages to replace some of the common voice commands, this solution ensures clarity and reduces errors.

AUTOMATIC TRAIN LOCATION (ATL)

Trains are equipped with computer terminals and radio modems to derive their location from the GPS satellite constellation and in turn transmit their location back to the command and control center.

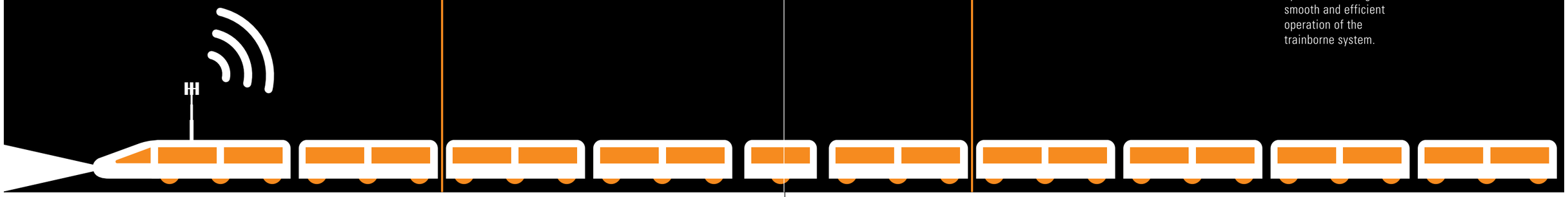
TRAIN CONTROL INTERFACE

Trainborne operations may require a series of information such as radio control, passenger information and train status, to be sent across the radio network to the control center for analysis and management.

The interfaces from the radio to the various trainborne components can be efficiently handled by the Train Control interface. The applications on the Train Control Interface consolidate the various interface commands to one that can be understood by the radio system - ensuring a smooth and efficient operation of the trainborne system.

VIDEO SURVEILLANCE

Frontline personnel will be empowered with increased situational awareness, enhanced operational collaboration and greater productivity. Communications centers will benefit from real-time visual updates as an incident unfolds with intelligent video surveillance solutions.



MOTOROLA SOLUTIONS
TRUSTED LEADERSHIP IN RAIL DEPLOYMENT

CASE STUDY:
TAIWAN HIGH SPEED RAIL

In 2007, the distance between Taipei and Kaohsiung became shorter. Since then, commuters take about 90 minutes to travel between both cities via the Taiwan High Speed Rail.

The selected communications system marked the world's first TETRA system used in the high-speed rail industry. Representing the latest in digital communication, this 380MHz system includes 30 enhanced base transceiver systems, 36 console positions, 180 mobile radios and over 260 portable radios.

Reliable and seamless voice and data services are provided by the Dimetra system and customized CAD (Computer-Aided Disptach) System.

CASE STUDY:
SHANGHAI METRO

A contract awarded by Shanghai Shentong (Group) Corporation to implement Motorola's TETRA digital trunked radio systems for Shanghai Metro's growing network of 13 operating lines over a period of 10 years marks the largest TETRA-based urban rail communications system in China and Asia. This TETRA-based private digital communications system is equipped with two full backup MSOs (Mobile Switch Office) that will be used to control and manage the entire private radio network. The system will also be seamlessly integrated with the 800MHz digital TETRA-based emergency response system based at the Shanghai Public Security Bureau. The integration between both systems provides wider network coverage for the Shanghai city area and is especially useful for first responders in mission-critical situations and emergency operations.

"Reliability, operational efficiency and safe operation were critical consideration factors. After careful evaluation, we decided on Motorola's dispatch communication system based on their proven track record in TETRA Motorola's advanced technology, the new private radio system will enable information and communication to be dispatched in a more effective and secure manner during our daily operations," said Zhu Husheng, Vice President of Shanghai Shentong Metro Co., Ltd.

CASE STUDY:
LONDON UNDERGROUND

When the London Underground Limited, LUL wanted to replace its radio and transmission services for the entire Tube network in 1999, the organization selected Motorola's TETRA system.

The system operates in the 380 - 400MHz band, and integrates the LUL Network of train, station and depot systems of 11 London Underground operating lines.

The accompanying Dimetra system supplies advanced data and voice communications, which enhances information flow. This in turn improves incident management and passenger information, ensuring a higher level of safety for its hundreds of million passengers that the Tube handles a year.

CASE STUDY:
KOREA TRAIN EXPRESS (KTX)

About 70% of South Korea's 51 million population live in Seoul and Busan and account for 66% of the country's commuter rail traffic. Projections showed that if rail capacity were upgraded to accommodate 15% more traffic, the existing Seoul-Busan route would reach maximum capacity within a decade.

Motorola took into consideration the high speed of KTX and the need for seamless communication, and provided a multi frequency, simulcast configuration that enables uninterrupted communications throughout the entire network.

KTX required clear audio quality over the air at speeds of up to 300km per hour as well as integrated voice and data sub-systems to deliver critical train data information for dispatchers. To meet this need, Motorola provided customised Mobile Data Terminals (MDT) and Computer-Aided Dispatch (CAD).

With Motorola's customised system, KTX can access train data information such as train run numbers, driver identification, train safety information and have voice communications control for operational efficiency. The Motorola Supervisory Control and Data Acquisition (MOSCAD®) system triggers alarms and report information to the control center in the event of system failure along the tracks.

Motorola provided an ASTRO® P25 network for secure and enhanced communications coverage over the track length of 250km between Seoul and Daegu since 2004. This marked the first deployment of a P25 digital trunked radio system for high speed rail in Asia Pacific.

Find out more about communication solutions for rail deployment. Visit
www.motorolasolutions.com

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