(KTZ), Kazakhstan passenger and freight rail operator company, is an essential part in the transport infrastructure development program in the country, defined for the period 2010-2014 and framed within the national strategic plan up to 2020.

The Kazakhstan geographical conditions, with vast areas without direct access to the sea, the production structure of raw materials and poorly developed road network, give rail transport an extremely important role in that strategic plan.

The company is facing a major challenge of modernizing their systems, rail infrastructure, locomotives and control and operational systems, which, for sure, will help to improve the competitiveness of Kazakh transport system for both passengers and freight transportation through the euro-asian international routes.
PROJECTS CONTEXT

Within this program of modernization, the first two projects planned by KTZ are described below:

**Uzen – Bolashak line**: Section of 150 km between these cities in the southwest of the country. It is the beginning of a long railway line linking Kazakhstan, Turkmenistan and Iran meant to enhance trade between the countries.

**Zhetygen – Khorgos line**: 300 km line linking two cities located close to the Chinese border. This railway will be important to promote political and economic relations between the two countries and establish a new access route between China and Europe.

Given the strategic importance of both lines, it was essential to provide them with **control systems** that would allow security and train speeds to be increased, and thereby reduce operating costs for freight transport. These railway control systems require the support of a **robust and reliable communications system**, which shall be based on radio technology in order to reduce the wayside equipment, which, given the characteristics of the environment it is difficult to deploy and presents high maintenance costs.

TECHNOLOGICAL CHALLENGE: ETCS OVER TETRA

Due to the many good references available in Europe, the railway signaling system chosen by the customer KTZ was ETCS (European Train Control System). A key aspect in the solution design was the selection of a communications system for supporting the signaling system. It was needed to find a safe, reliable, and cost efficient system to support at least the following requirements:

- To be based on an international standard that incorporates railway-related applications.
- Support for railway-specific services: Group calls, ambience listening, emergency calls, priority management, data transmission services, remote management and monitoring system, fast set-up and registration times, etc.
- Availability of equipment in UHF frequencies
- Integration of railway services into a single communications network
- High level of reliability, availability and quality of voice communications and data integrity
- Economic and technical feasibility (CAPEX)
- Low maintenance costs (OPEX)
- Capacity of the company providing the radio solution to adapt it and integrate it with the vendor of ETCS signaling system.

Competing against the current GSM-R technology mandatory in Europe, TETRA technology and specifically the TELTRONIC equipment were chosen to cover extensively the above requirements.

Kazakhstan’s national railway has been the first to rely on the implementation of an ETCS (European Train Control System) railway signaling system over TETRA, being the security level implemented equivalent to that defined in the standard as ETCS Level 3. In addition, with this solution, KTZ has available through a single communications infrastructure data services to support railway signaling and voice services for communications with drivers and maintenance staff.

PROJECT DEPLOYMENT

The solution deployed in both lines (Uzen- Boloshak and Zhetygen-Khorgos) is based on the NEBULA TETRA infrastructure. 100% Ethernet IP architecture provides high flexibility in the solution design, as well as an easy management and maintenance.

Every project is composed of a central node and several base stations which cover the train lines. Each train is equipped with an on-board RTP-603 terminal and accessories to manage voice and data communications. Furthermore, DT-410 desktop units have been supplied in order to manage communication with drivers and other walking users.

The extreme terrain conditions required a big effort from the TELTRONIC staff, who worked especially in the tasks of installation and deployment of the radio infrastructure.

On the other hand, TELTRONIC engineers and staff from the company responsible for the signaling system carried out a coordinated integration project, which consisted of several stages: analysis of alternatives, definition of interfaces and communication protocol, implementation and validation tests.

The validation tests were divided into two phases, the first of them in the laboratory, where the correct operation of the radio equipment was verified, and a second phase of testing in the tracks, which verified the behavior of the complete solution on the customer’s real scenario. The system was commissioned in June 2012.

CONCLUSIONS

TETRA technology is spectrally more efficient, has a greater range of functions, and is significantly cheaper than the commonly deployed technology in the European signaling systems, GSM-R.

With this project, TELTRONIC has proven TETRA technical viability to offer safe and efficient communications in the railway environment, providing voice, operational data (location, alarm and event management) and ETCS signaling data over a single infrastructure.

This experience may be applicable to other transportation environments with signaling systems based on different existing protocols such as ETCS, CBTC or PTC.

“The Kazakhstan railway implementation proves the ability of our TETRA technology to successfully handle voice and data communications in rail signaling applications,” said Jose M. Martin, Chief Marketing & Sales Officer of TELTRONIC.