Tunnel Technology Solutions

WORLD LEADER IN UNDERGROUND TECHNOLOGY
MST Global

MST Global (MST) designs, manufactures, deploys and supports communication and safety systems for tunnel, mining and industrial applications.

With over 600 operational technology deployments worldwide, our surface and underground networks provide capability for various network based applications. Applications such as voice, video, data, tracking, tagging, proximity detection, emergency evacuation warning, time & attendance, asset utilisation, production measurement, emergency mustering and environmental monitoring.

MST has a 30 year history of successful end-to-end deployments where clear voice and data communications are required for construction and maintenance of tunnels, pipelines, railroads and other projects in extremely rugged and harsh environments anywhere in the world.

MST’s integrated communications technology infrastructure and applications allows the collection and insight into operational metrics which can be used to deliver the construction project ahead of time. Customers around the world trust MST solutions to help them optimise output, minimise cost and reduce risk.
Tunnel Technology Solutions Overview

This document provides a high level overview of Tunnel Technology Solutions that are suitable for any global tunnelling construction project. The document provides information on the following:

1. 48VDC Power Supply and UPS
2. Wireless Network Switch NS50
3. Wireless Access Point WAP
4. Air Quality Monitoring
5. Fixed and Wireless Telephony
6. IP Video Networks
7. Tunnel Antennas
8. Fixed Station IP Intercoms
9. Emergency Warning System
10. Fibre and Cable networks
11. Tag and Tracking Stations
12. Site Radio Networks
13. Leaky Feeder Radio Network
14. Personnel Lighting and Lone Worker Video
15. Tunnel Traffic and Key Asset Lighting
16. Proximity Solutions
17. Tunnel Dashboard Visualization Software

MST can provide some or all of the above solutions depending upon the project scope. These solutions are provided as a turnkey platform. A drawing of the systems working in unison is below:
1. Designed for tunnel projects to be fixed or relocatable

This portable or fixed power supply is built specifically for tunnel operations. Designed to power the MST NS50 Wireless Network Switch (information on the following page) this unit is a UPS, Fobot and Ethernet termination enclosure. With 100 Ah capacity this unit can power up to 28 x NS50. While its primary use is for underground tunnel communications, it also supports other applications such as low voltage automation and fixed telecommunication.

The ethernet connected eltek controller offers very comprehensive SNMP remote monitoring. This includes sophisticated battery health information, battery temperature, discharge rate, fuse status and historical database.
2. World leading underground ruggedized wireless network switch

The MST NS50 Network Switch will provide extensive wireless network coverage across all operating zones of the tunnel project. The NS50 consists of a managed fibre optic ethernet switch and up to two 802.11 b/g wireless radios. Its high bandwidth and low latency design enables multi-service applications to share the network infrastructure. This facilitates functionality such as VoIP, IP video streaming, remote PLC programming, mobile data acquisition, real-time vehicle diagnostics and asset/personnel tracking. The NS50 is designed for easy “plug and play” relocation by tunnel personnel, providing network coverage wherever it is required.
Wireless Access Point WAP

3. Versatile solution for connecting wireless devices to your existing wired network

An extension to the NS50 is the Wireless Access Point (WAP). The WAP is a PoE powered 802.11 b/g access point that has the intelligence of the NS50 but has only one radio and one Ethernet port. WAP’s are connected to NS50s via a single Cat5e Ethernet Cable when and where additional radio coverage is required.

Like all MST devices the WAP has been specifically designed for ease of deployment in an underground tunnel environment. The WAP is housed in an IP65 enclosure and is designed to be hung directly to the backs or side walls of the underground tunnel.

The NS50 in conjunction with the WAP are placed throughout the tunnel operations surface and underground areas to create an industrial grade wireless high speed network. An example of network design is pictured on the following page.
Air Quality Monitoring

4. Live monitoring of airflow, water through to gas via one network

MST offer tunnel construction projects a turnkey solution and the required maintenance services covering all regulatory air, water and gas monitoring. Depending on the project scope, our solutions range from site assessment, design and installation, to data acquisition, validation and reporting.

The edge monitoring devices all seamlessly connect back to the network control room via the MST network. This critical information can then enact emergency evacuation or simple awareness for operational management.
Fixed and Wireless Telephony

5. One voice platform for everyone for all aspects of the tunnel operation

Once the surface and underground tunnel networks have wireless coverage voice communications can be enabled over the network. Voice coverage is generally supplied by the NS50’s and WAP devices and any other Wi-Fi access point integrated to the platform. MST can bridge voice communications together to provide one simple platform for voice communications. This may include the site IP PBX, radio network or cellular 3G / 4G technologies.

One handset device option is the MST MP71 handset (pictured below). This is a simple and robust solution for (VoIP) communications in tunnel environments that can also bridge to the IP PBX or the radio network. The handset allows users to make and receive VoIP phone calls from any area of the mine covered by the wireless network and includes tunnel specific functionality including Push to Talk (PTT), emergency alarms and a battery life designed to last an entire shift. The phone also comes with an installed tracking device. The device has full messaging capabilities from the network control room to one phone user or all users for emergency notifications, productivity messaging and searching for key people or assets.
Pictured below are examples of other devices that can be connected into the MST one platform voice network with ease.
IP Video Networks

6. Industrial grade camera network for night and day operations

MST provide IP video networks based on each tunnel’s operational scope requirement. MST supply cameras with a number of capabilities – HDTV, wide dynamic range, infrared and light finder to name a few. MST cameras also provide advanced video analytics features, such as motion detection, audio detection and tampering alarm. The IP Video Camera Networks are fully integrated into the MST network and plug and play directly into the MST NS50 wireless network switch.
Tunnel Antennas

7. Custom designed antennas for enhanced performance

The tunnel construction sector is a diverse and complex industry by comparison to standard enterprise network performance. The size of the tunnel project and versatile working conditions lends a very unique working environment. MST have invested heavily in ensuring the best possible performance from its underground tunnel antennas to ensure maximum performance from its networks.

During the tunnel construction phase there are usually a large number of remote surface building sites and underground work areas and stations. MST provide the constant communications necessary between surface and underground through our detailed design process.

Below is one of our most popular tunnel antennas that has been specially design for ease of installation. These antennas can be easily installed or relocated as required.
Fixed Station Intercoms

8. Emergency and Communication Fixed stations

MST provide IP intercom systems for the access control locations such as turnstiles and boom gates. These locations are serviced with an intercom / video solution that integrates with the MST network. Should a person require access but not have the appropriate card / tag for access to the site, the control room operator may be reached using an IP Intercom. Visual confirmation of identity can be obtained through the IP camera.
Emergency Warning System

9. Zone based or site wide emergency warning system

In order to facilitate a dedicated emergency alarm system, MST recommends as one option utilising the IP intercom system. It is envisaged that intercom help points be dispersed at regular locations within the tunnel construction.

These help points feature a single ‘Emergency’ call button. This button will call the control room location ‘master station’ or may be configured to alert a specific extension / telephone number. This will provide direct communication between the master station (Supervisor) and the IP Intercom that initiated the call.

Furthermore, each help point contains two relay outputs. These relays are able to be controlled by the master control. MST can enable the control of emergency strobe / sirens off selected help point units. These strobe sirens have configurable emergency tones and volume levels.

This type of solution is pictured below:
Fibre and Cable Networks

10. High quality fibre specific to tunnel designs

MST has been working within the tunnel, mining and utilities industry for fibre and cable solutions for many years. MST provide fibre optic solutions for many communication networks including enclosures, cable, cable assemblies and outside plant infrastructure.

MST provides a range of physical layer and active network solutions to meet the demands on carriers for bandwidth, reduced real estate and improved performance and monitoring.

Our NS50, rack and wall mount enclosures combine high density with easy installation and simplified maintenance. We also offer a wide range of network monitoring products for service assurance as well as customised pre-terminated cable assemblies.
Tag and Tracking Stations

11. Zone based tracking and access control solutions

MST provide a wide range of zone based tracking and access control systems. MST currently provide tracking and messaging systems to over 150,000 workers underground throughout the world. The MST solution is custom manufactured for tunnel construction and allows an employee to simply present their tag to the tag stations kiosk that will read the Tag ID. The employee can also then swipe their UID Swipe Card at the Kiosk. The monitor will display the employee’s details including a photograph retrieved from a database and if the association is correct the employee will receive positive audio and visual feedback indicating that they can proceed.

This simple verification process will assure a high degree of data integrity and accuracy to the tracking systems data. The Tag stations come in three different types enrol, in and out of the zone and seamlessly connected into the MST wireless network.

Following the initial enrolment, zones can then be established between work areas. These zone areas are then defined by IN and OUT zones for individual worker access and tracking. Both the machine tag and person tag are pictured:
12. Construction or Permanent Radio

MST provide site radio communications for the construction and operation stages. MST can hire radio solutions to customers for these periods or provide them as a purchase. Radios can be hired for portable or mobile (in vehicle) use. Temporary radio licenses can also be provided along with base stations and antennas solutions. MST provide both Motorola and TAIT radio systems. The MST radio networks can seamlessly integrate from the surface to the underground leaky feeder network and also be fully integrated with the VoIP and IP PBX platforms.
Leaky Feeder Radio Network

13. Leaky Feeder Radio linked to the surface

If the tunnel operations wishes to extend the current surface radio network into the underground operating areas of the tunnel the MST Leaky Feeder solution maybe a suitable solution for voice communications. The leaky Feeder radio network is supported by a Radio Head End supplied by MST.
Personnel Lighting & Lone Worker Video

14. Cap Lamp, Standard Tunnel Lamp and Lone Worker Video

MST have over 60,000 personnel lighting customers worldwide. This ranges from our own MST manufactured cap lamp and tracking tag through to the basic light weight tunnel worker light. In addition MST have a range of Lone Worker cameras. These cameras can be fitted to workers requiring live or recorded video over the MST network.
Proximity Solutions

16. World leading proximity solution designed and manufactured by MST

The MST Tunnel Proximity system can be used to provide a collision avoidance system for machine to person and machine to machine. The system provides high level of accuracy through its electromagnetic field generators to a person tag or machine tag. The solution provides 360 degree awareness for operators and can withstand harsh industrial and mining environments. The key system components are listed below:
17. All the MST systems can be provided with one single visualization platform

The MST approach for tunnel construction network architecture is based on provisioning the infrastructure for a number of disparate systems, then connecting them up with an ecosystem to be used within the total tunnel operating environment.

The MST Tunnel Dashboard Software (TDS) provides data aggregation and a reporting platform that will be at the core of the construction company network. Originally the TDS was conceived as a viewing platform for tracking information, it then became a management platform for multiple end-point devices such as phones, tags, data loggers, sensors etc. The solution now provides visualisation, positioning engine, rules engine and a reporting platform. This can be viewed on any secure internet enabled smart mobile device through to the network control room.
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