

TRACTION MOTOR MONITORING

Forcing Function won a Phase I SBIR grant for *“Investigation of Traction Motor Failure Modes and Monitoring Methods”*.

Forcing Function assembled a team of experts who have experience working within the railway industry in the areas of railway engineering, maintenance, instrumentation and software analytics. This diverse team worked on initially determining traction motor failure modes and causes. Following this, we proposed the most effective monitoring and analysis methodology that can be used to instrument and process data from the traction systems.

Based on the above work, Forcing Function won a Phase II SBIR grant for developing a prototype system that could monitor motor vibrations”. During this phase, core technologies including energy harvesting, wireless communications, vibration signal capture using a MEMs sensor and signal analysis were proven on real world systems.



AUTONOMOUS INFRASTRUCTURE INSPECTION

Forcing Function and ADOJAM won a joint research grant through the TRB IDEA program. The work involved adapting ADOJAM’s core technology of UAV mounted sensors (LIDAR and GPR) to the scanning of railroad tunnels for detecting surface and subsurface defects - including cracks and moisture.

The topic for the research is:
“Railroad Tunnel Inspections for Maintenance and Replacement Prioritization Using Untethered Ground Penetrating Radar and LIDAR Capable Unmanned Aerial Vehicles (UAVs)”.

The work involves prototyping the product for scanning two Norfolk Southern tunnels in Virginia followed by post-processing of the collected data to characterize the tunnels and identify faults. We results were presented at the annual TRB conference in January 2020 in Washington DC.



TRACKSIDE RADIO NETWORK UPGRADE SURVEY

Forcing Function were contracted to provide specialist engineering and project management support for a project to upgrade the voice radio network along a major passenger rail corridor.

All existing 225 radio sites had to be surveyed to fully document the equipment in place, including existing space, power and fiber connectivity availability on site to support new radio equipment, shelters, tower etc. for the new system.

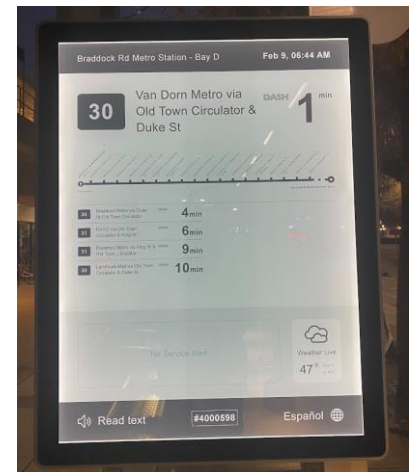
A survey process was developed using a mobile form designed by Forcing Function to standardize how data was collected in the field from technicians employed by the client. The data collected was analyzed and presented in drawings and a detailed report was submitted for each site.



Forcing functions project manager with the survey team members.

DIGITAL SIGNAGE FOR TRANSIT OPERATOR

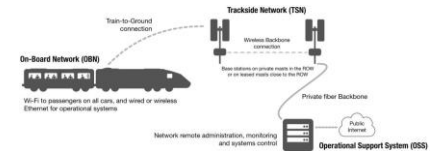
Forcing Function were contracted to develop a technical specification for an ultra-low power digital signage solution that could be deployed onto bus shelters within a major metropolitan area. The technical specification was used to procure and evaluate sample ePaper displays and integrate these with the transit operators GTFS and other existing Data Sources to display bus arrival information and other transit details at five sample bus shelters. The procurement, installation design, accessibility compliance, installation and evaluation were managed by Forcing Function. Detailed documentation was provided through the process and the comprehensive lessons learned were used to update the technical specifications for a wider procurement proposal.



TRACKSIDE DIGITAL RADIO NETWORK – NETWORK DESIGN

A California train operator was planning to implement a trackside radio network to provide broadband data communication to trains for both passengers and for operational applications. The trackside network was to utilize both new radio towers placed in optimal locations along the trackside and use existing fiber already in place along the trackside.

Forcing Function supported the concept design phase with the design of the end-to-end IP network (including VoIP applications) over both new and existing infrastructure. This was used to provide a basis for pricing the overall project and to identify key project risks and design considerations.



COMMUNICATION BACKHAUL DESIGN FOR DENVER PTC SYSTEM

Forcing Function were asked to support the design, deployment and testing of a new track side radio project being deployed to provide PTC communications for a new train line, with new rolling stock, operating in Denver (Eagle P3).

The new metro required a connectivity solution which could support the following operational applications and systems:

- Positive Train Control (PTC)
- Passenger Emergency Intercom (PEI)
- Closed Caption Television (CCTV)
- Maintenance Data System (MDS)
- Public Announcement and Visual Message Sign (PA/VMS) systems.

An innovative WiMAX solution was designed and tested to deliver a train-to-wayside communication network to meet the customer's expectations.

The creation of a secure, reliable radio network connection, with high levels of redundancy, required multiple parallel systems with foolproof failover mechanisms to ensure that the system remained operational despite any malfunctions.

This was facilitated through the creation of two private parallel radio networks ,where traffic got routed over the best available radio route. This combination of parallel trackside networks with multiple on-board radios and redundant routers along with LTE failover (if both radio networks failed) delivered a robust connectivity solution for the operation critical PTC messaging.

