SBRI: First of a Kind (FOAK) 2023 competition winners (HS2)

SBRI: FOAK 2023 High Speed Rail Systems Installation Demonstrations

Application Number	Project Title	Lead	Project Cost
10089790	Simplifying ERTMS Installation - ATLAS Solutions by Enable My team	MOBIBIZ LTD	£195,179
Public synopsis			
ATLAS Lens, EMT's solution for precise component positioning of ERTMS equipment, records geolocated video accessible via our web-based platform ATLAS. Machine learning automatically detects ERTMS assets, displaying them on a GIS map. Our Cable Tracking Device provides accurate line-side cable position during installation, transmitting centimetre-level accuracy multiple times per second.			
Public description			
Utilising a combination of the cutting-edge solutions, ATLAS and ATLAS Lens, as well as our newly developed cable tracking device, Enable My Team's (EMT) proposed solution will improve accuracy, speed, and reduce costs for installation of ERTMS related equipment. ATLAS and ATLAS Lens have been developed and rigorously tested over the past few years in close collaboration with Network Rail in the UK. These products have proven to be capable of being deployed as an effective, low-cost solution for capturing and processing lineside asset information. The system uses a combination of Lidar scanning and Front Facing Video (FFV) technologies integrated within our train-bourne ATLAS Lens hardware. Data is then automatically transmitted and processed via our web-based platform, ATLAS. All captured and processed data can then be easily accessed for viewing and interrogation via an easy-to-use interface that overlays key data on a GIS map. Underpinning ATLAS is EMT AIMS (Asset Information Management System). AIMS is our original and market-proven asset management solution that allows users to maintain structured data, validate against customisable schemas and templates, manage revisions and track changes, whilst building up a full auditable record of the data. The secondary component of EMT's solution involves the integration of our latest development, a smart cable tracking device capable or tracking and recording the route of newly laid cables to centimetre levels of accuracy. The device is designed to adapt to all common cable laying processes and does not disturb these processes or require any significant setup or adaption. Once deployed, the device can automatically capture the direct position of laid cable (single and multiple) and is not restricted by light conditions or require post processing of recorded data. A companion app is also available to both instantly review live positional data updated in ATLAS, as well as options to add additional metadata, photographic evidence, and verification. By combining these two solutions, EMT proposes a balanced and versatile system that can provide measured improvement to the accuracy and speed of installing ERTMS related equipment. The solution will also provide the added benefit of simplifying data management and mitigate safety risks through automation and reducing boots on the ground.			

Application Number	Project Title	Lead	Project Cost
10088314	Induction Forge Rail Welding for Slab Track	MIRAGE LTD	£194,155

Public synopsis

Advances in Induction heating technology has created an opportunity to displace antiquated rail welding processes with safer, stronger, more fatigue resilient welds. Industry 4.0 technology captures the critical data ensuring a good weld is produced. Game changing disruptive technology raising the standard for the UK & global rail industries.

Public description

This development is a "game changer" for the welding of Continuously Welded Rail (CWR). Powerful words indeed, and not our own. This descriptive was shared by the former head of TFL.

We've spent five years in product development and evolution, honing and perfecting our solution. We've now reached the point at which we're absolutely confident of 100% repeatability of welds, and delivering welds which are 20% stronger than the Network Rail slow bend test requires. Every time. Our welded rail joints have all the properties of the parent rail, including bend strength, micro structure, fatigue resilience that is better than the rail it is made from. Our solution offers a much needed step-change in safety for operators and track workers, completely removing the risk of exposure to uncontrolled chemical reactions (as with Alumino-Thermic Welding) or molten metal spray (as with Flash Butt Welding). It also ensures that there's a low risk of ignition to surrounding areas, a lower impact for trackside residents, and an enhanced environmental profile, with low emissions and zero waste to landfill. Which all makes it a genuine win for every stakeholder.

The Mirage Induction Rail Welder raises the bar significantly on the status quo, setting a new standard for excellence. Indeed, with further developments in grinding technology, we could make the entire weld-and-grind process spark free.

This is a very real and very significant opportunity, on a global scale. Our solution is being put through test bed trials and validation trials with a number of very significant global infrastructure owners. Its adoption will not only herald commercial success for us, but will provide a step-change for the industry as a whole. We'll see much higher levels of performance and safety, as well as environmental standards which utterly eclipse those offered by the existing technology.

Our focus now is on developing a Demonstrator which will help provide further confidence to adopt this process as the new standard, into the future.

Application Number	Project Title	Lead	Project Cost
10089740	Digitally Assured Tunnel Assets Installation System (DATA-IS)	I3D ROBOTICS LTD	£199,325

Public synopsis

Having developed an Automated Tunnel Robotic Installation Solution (A-TRIS) that automates the manual process of bracket installation within a tunnel environment, this project will develop a solution using data from A-TRIS to digitally assure each bracket 'at the point of installation' in a way that's integrated into the construction environment.

Public description

The fitting out of infrastructure tunnels for mechanical, electrical and communication services (M&E) has traditionally been installed manually in a labour-intensive manner. This manual process is time consuming, unproductive, costly and exposes workers to unsafe working environments and activities.

This partnership of Costain, Tunnel Engineering Services, i3D Robotics and the MTC have developed a prototype Automated Tunnel Robotic Installation Solution (A-TRIS) to demonstrate a robotics and artificial Intelligence (RAI) process, which fully automates the traditional process of (M&E) service installation of bracketry within a tunnel environment. In order prove market readiness and demonstrate how A-TRIS delivers installation efficiency and value for money it now requires integration into high-speed railway construction environments.

Project Aims

- Development of a 'live demonstration' system using digital data created by A-TRIS when installing brackets. This digital assurance validates each individual bracket 'at the point of installation' allowing full integration into a modern railway construction environment.
- The demonstration system will use each tunnel segment's unique identifier code (captured by the A-TRIS '3D-Vision' systems) to associate it with the 'as-built' tunnel model (originally created by a Tunnel Boring Machine) enabling updating of the relevant segment's asset lifecycle history held within the 'as-built' asset management system.
- In the same way, the demonstration software system utilises the bracket's unique identifier, associates it with the tunnel installation location further enriching 'as-built' asset management systems.

Outputs

The outputs from this demonstration software system validate a digitally assured Bracket Installation Test Plan, automatically populated with data created from the A-TRIS '3D-Vision' & robotics systems, during installation. This removes the need for subsequent manual assurance re-work at the point of commissioning and handover. In addition to this the following key outputs shall be demonstrated:

- Removal of tunnel operatives at installation
- Removal of costs and material waste associated with assurance re-work.
- Enriched tunnel asset data to optimise O&M for the operational railway.
- carbon footprint reductions.

Focus areas

- The main area of focus will be the demonstration of digital integration of A-TRIS into the construction railway environment to provide industry-wide benefits.

Innovation

The build and demonstration of this software system will prove the ability to use automated robotic installation of M&E services within tunnels in a way that is fully integrated into the construction railway environment. This will enable significant cost efficiencies through digital assurance 'at the point of installation', and by enriching tunnel asset data to optimise O&M for the operational railway.

Application Number	Project Title	Lead	Project Cost
10090898	HS2 pre-cast trackslabs: Panel Rectification System	Geokod Rail s.r.o.	£75,000

Public synopsis

Panel Rectification System is the ideal solution for guiding the positioning for concreted track without rails. It uses state-of-the-art measurement technology and modelling for precisely positioning modular pre-cast units (prepared off site). It works without the constraint of the need for prior completion of other parts of the track.

Public description

HS2 track systems will utilize pre-cast panels to optimize the construction process. The solutions for placing and positioning the panels are different to those for more traditional, less optimized methods of slab track construction. The key aspect with the proposed "Panel Rectification System" (PRS) is to have the highest possible measurement accuracy and fullest representation of the panel position in real-time. This will enable the most efficient adjustments ("rectifications") to the panel with least iteration to achieve alignment and rate of change tolerances commensurate with high speed track before pouring of the bonding layer.

Slab track brings significant benefits to the operations and maintenance phase of a railway such as HS2. However during construction the requirement is mandatory for right first-time, every time positioning with easy to follow checks, balances and reporting that clearly confirm that exacting tolerances have been satisfied. Without a complete solution utilizing best-in-class sensor technology the risks to on time delivery on a linear project with few degrees of freedom are too great. PRS is the culmination of over thirty years of experience on world class railway projects and provides an easy to learn, easy to use solution suited for use by technicians with relatively little experience.