# Second Innovate UK 'First of a Kind' Project Win for One Big Circle
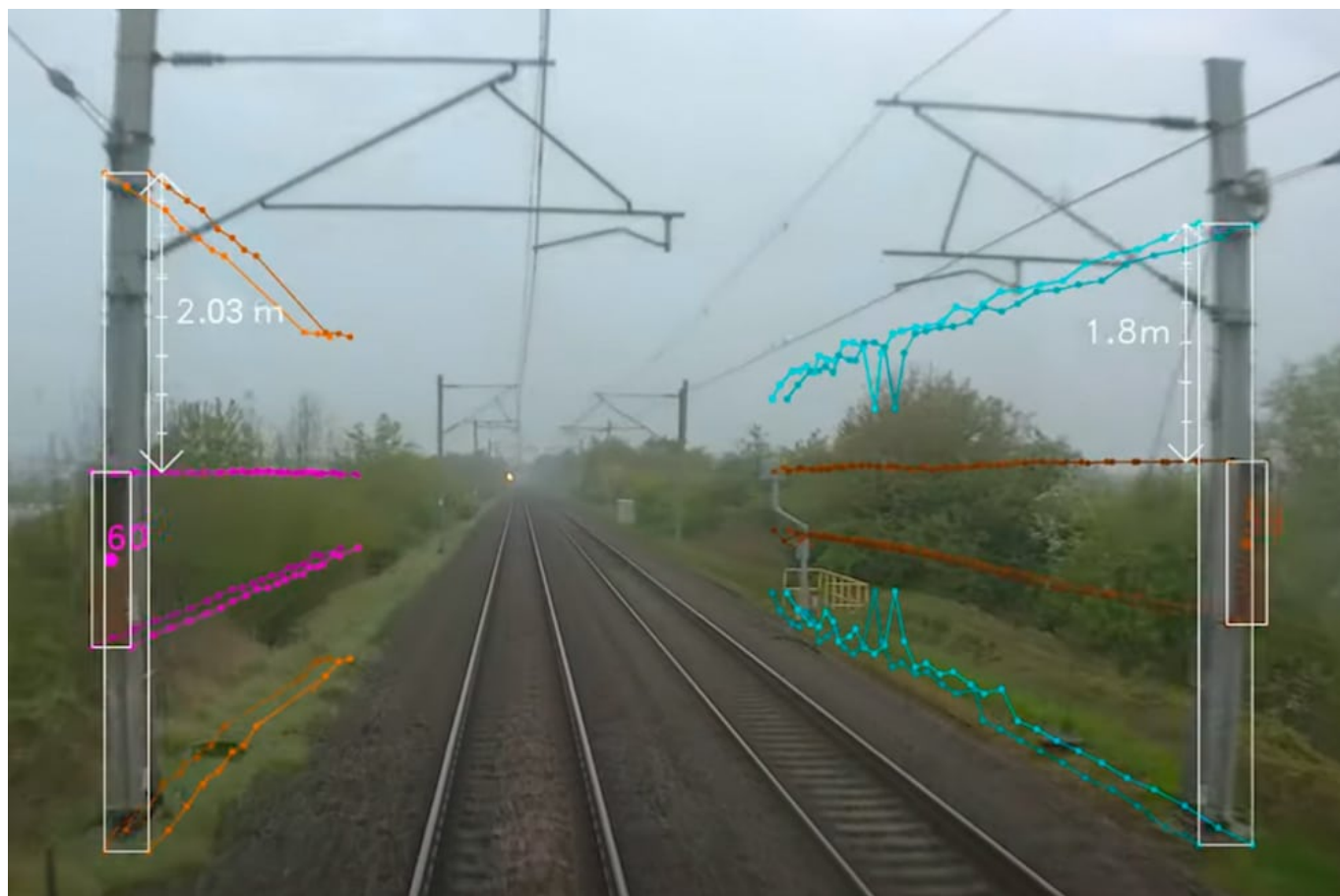
December 13, 2022



Bristol-based Video Intelligence SME One Big Circle has been announced as one of the winners of Innovate UK's 2022 'First of a Kind' (FOAK) competition, funded by The Department for Transport and delivered in partnership with Innovate UK KTN.

Providing a two-part collaborative delivery project with Network Rail and Angel Trains, One Big Circle's winning entry utilises their multi-award winning AIVR (Automated Intelligent Video Review) system, which facilitates rapid access to video footage captured by train mounted cameras – combined with third party instrumentation and analytical insight – to detect defined areas of interest across Overhead Line Equipment (OLE). Users can then gain contextual information with which to collaborate and communicate with colleagues, and drill down into detailed information from the instrumented and analytical systems. The project aims to use remote observation and Computer Vision Techniques to preserve and refine OLE maintenance against impactful weather changes.

The FOAK competition is a Small Business Research Initiative (SBRI) which looks to target projects attesting to 'deliver high maturity demonstrations of innovations to the UK Railways.' The SBRI competition provides a significant opportunity for SMEs working to implement innovative projects within the rail

industry, and to show-case outstanding collaboration with rail organisations.

"Supporting this FOAK application was a no brainer from an Infrastructure Monitoring Programme perspective" says Kevin Hope, the Engineering & Technical Lead for Network Rail's Infrastructure Monitoring team; "it brings together the supply chain and enables new and emerging technology

to be tested against real-world challenges facing our route and regional customers. The FOAK competition particularly creates a real focus on pace of delivery, and well reflects how the winning entrants work dynamically to support industry-wide innovation."

Overhead Lines which provide electrification to keep trains running on the track rely on track-side tensioning assets which keep lines taut and safely suspended. Dramatic weather changes however can cause detrimental impacts to these tensioners, with extremely hot temperatures causing OLE wires to overextend and slacken which forces tensioners and the connected lines to sink. Severe service disruption, track closures, and in some cases dewirement can be the result of tension reduction, generating an array of safety risks and unforeseen maintenance costs.

"Unprecedented weather conditions in recent years have become a growing challenge facing OLE maintenance' comments Ndaba Moyo on behalf of the North-Western & Central region of Network Rail: 'In the NW&C region, we have set out a maintenance strategy that is focused on modernising how we as an organisation can use technology to shift from reactive to more predictive maintenance. We have had to think outside the box to find solutions that allow us to improve both performance and safety whilst reducing boots on ballast and workforce exposure to on-track hazards"

The winning project utilises One Big Circle's AIVR software to access existing footage collected from in-service trains, where highly trained Machine Learning techniques are engaged to automatically detect tensioners on rail routes and also ingest the temperature at the time of the run. Providing vital visual insight, the extent of tensioner drop can be continuously measured using Machine Learning and statistical analysis combined with temperature data as further footage is collected. AIVR's Machine Learning proficiency enables engineers to be rapidly alerted to any potential issues, reducing the need for manual preparation surveys, and allowing rail companies to plan and execute maintenance works before – rather than after – major faults develop.

Working with Angel Trains, the second component of the project also supports OLE resilience against weather changes using a novel video data collection method, initially onboard the NR Mentor measurement train and ultimately onboard a Class 390, to capture Corona discharge. The presence of Corona discharge is significant within OLE maintenance operations, indicating that future damage caused by ionisation (such as corrosion or collapse of the Overhead Line) is likely to arise. Corona discharge is exacerbated by elevated levels of humidity and air temperature changes; problematically, the discharge is undetectable to the human eye, making future failures extremely difficult to detect without the use of UV monitoring.

The project stipulates the deployment of a UV camera affixed to the top of the train to allow direct capture of Corona discharge along the Overhead Line. Using a combination of the UV camera instrumentation, locally measured temperature and humidity levels, statistical analysis and Machine Learning, levels of

Corona discharge on assets are automatically measured and classified within the AIVR platform. The project aims to help rail engineers make data-driven decisions to plan proactively and take preventative action against the 'invisible' risks facing OLE maintenance.

"We are excited to extend our collaboration with One Big Circle alongside Network Rail to enable a more efficient management of our railways" says Brian Reynolds, Product Manager at Angel Trains. "This innovative project makes it possible to easily view a vast amount of Network Rail's infrastructure at regular intervals. One Big Circle's Machine Learning algorithms allow automatic assessment of track side assets, making those in need of urgent maintenance attention easy to spot, to avert reliability issues and retain the railway's resilience for passenger and freight customers."

This year's competition is the sixth of its kind, with a total of twenty-four companies receiving support grants. One Big Circle has delivered a number of Innovate-UK KTN SBRI projects over the past three years, with a range of partners including Network Rail, The Manufacturing Technology Centre, and Avanti West Coast. The SME's technology solutions all harness video intelligence and Machine Learning to provide remote and rapid critical insight in challenging environments.

"The FOAK competition is a great catalyst for innovation as it brings industry challenges and potential digital solutions into sharp focus" says Emily Kent, one of the founders of One Big Circle – "This funding gives us the opportunity to be part of a crack team that works together rapidly to deliver intelligent OLE monitoring, providing one of the solutions that will help meet Network Rail's requirements."

*Photo credit: One Big Circle*