Project Details

Location
London

Contact Reference

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Contract Date
Start Date	End Date
June 2017	November 2018

Contract Value
£300,000



"We are really pleased to be working with PAULEY they have demonstrated intuition and innovation in developing and delivering an interactive and immersive training experience, which adds greatly to how NTAR will bring alive its training. PAULEY's technology is about transforming training into a solution that is far superior to what can be achieved in the classroom, a unique learning experience. When people tried the new material and Oculus Rift for the first time, it was a jaw-dropping experience".

Simon Rennie, General Manager, NTAR (National Training Academy for Rail)

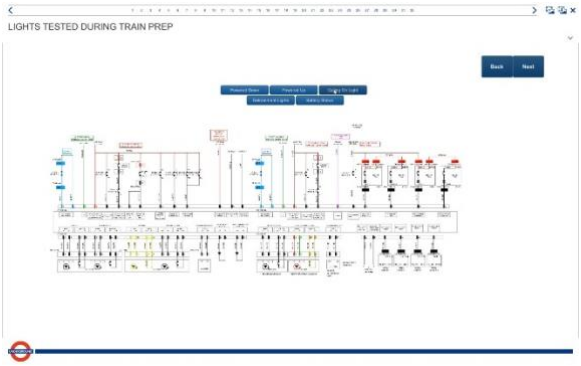
London Underground's mixture of new and aging rolling stock creates a complex mix of training and fault finding needs. The material provided by its many different suppliers all differ in communication and schematics drawing standards and it is the job of the trainers to disseminate the knowledge and understanding of this material in a clear and concise manner, while the engineers need to be able to understand the source material provided.

Scope	Part of NTAR Project	PAULEY Expert in field
Virtual Reality (Oculus Rift)		✓
Augmented Reality (Microsoft HoloLens)		✓
Blended Learning	✓	✓
Industry Leading	✓	✓
Multi-Stakeholder Collaboration	✓	✓
Live stream Data Feeds		✓
3D Asset Portal		✓

Project Delivery

PAULEY, together with National Training Academy for Rail (NTAR), developed an integrated next generation real–time training, fault finding and communication system for London Underground using modern technology including Microsoft HoloLens, touchscreens and tablet devices.

This interactive material is centred around PAULEY's dynamic schematics system, which digitises complex schematics and logic systems and creates useful real-time tools for the engineers and trainers. The resulting software is able to deliver training material in a class room, refresher training and material access via connected iPad's, as well as engineering fault finding assistance.



Course Material Produced

PAULEY created over 40 hours of interactive advanced digital learning courses which included a full 3D digital asset of a London Underground train. The learning covered all the technical systems that an engineer is required to cover as part of their training:

- Air System
- Auxiliary and Battery System
- Brakes System
- Carbody & Fittings
- Communications-based train control (CBTC)
- Closed-circuit television (CCTV)
- Customer Information System (CIS)
- Doors System
- Heating, ventilation, and air conditioning (HVAC)
- Power Supplies System
- Propulsion System
- Train Control and Management System (TCMS)
- Train Data Recorder (TDR)

The learning objectives were aimed at understanding how the various systems worked and interacted with other systems under normal operating conditions. It allowed learners to state and identify the System's Line Replaceable Units (L.R.Us). They could use the system's block diagram to identify the location of components on the train and were able to identify the symptoms of key failure modes and identify the appropriate strategies to address. This allowed them to interpret the T.C.M.S fault message code to correctly identify the necessary fault finding action to be undertaken. They could then state the diagnostic tools that should be used at the appropriate point in the fault finding process; and correctly utilise these tools and identify and undertake the appropriate test or tests (including V.M.I based testing procedures) to ensure the fault has been correctly identified. Once the fault was found they could conduct the appropriate test or tests to ensure that identified faults have been rectified and verify that replacement components are correctly configured.

Innovation and Value Added

London Underground previously delivered their training through traditional face-to-face classroom based learning and limited practical hands on training provided a more technical from of training, but these were costly, time consuming and took place in an unsafe environment. The integration of 3D rolling stock and dynamic schematics allowed the learning to gain a far greater understanding of the components and systems in far less time and in a much safer training environment than they are exposed to in a workshop or depot. The engineers were able to learn at their own pace and in the own time which enabled a more efficient way of learning.

Collaborative Approach

Through regular communication and reviews with London Underground subject matter experts PAULEY were able to produce learning content that delivered to their learning outcomes. They were involved in the design and development process which help the team manage their expectations and assisted the development team with the technical knowledge require to produce complex animations and detailed visual graphics to support the learning content.

Benefits realised

Through embedding interactive learning material, London Underground were able to find real cost savings in fault finding through savings in time efficiency as well as alleviating misdiagnosed faults. This has also been identified as potentially helping with their ongoing improvement of their mean time between failures.

The training department have also identified great benefits in knowledge retention and engagement. Students and users have reported an improvement in overall engagement with the source material and many have said that the software has improved their understanding of the material they are accessing, often making their job easier and more efficient.

A summary of the key benefits realised can be seen on the table below:

Benefits	
What	Direct Trainer Time
Rationale	Interactivity and quality of learning
Benefit	20% of contact time with rolling stock components
What	Safety (environment)
Rationale	Recreation of high risk systems and scenarios in a safe environment
Benefit	Accelerated learning, risk reduction
What	Operations impact
Rationale	Avoidance of interruption to live operations
Benefit	Service interruption risk and learning time pressure avoided
What	Maximised Learning
Rationale	mixed reality technologies improve learning experience
Benefit	Trainees better prepared to undertake challenging industry roles

Driving efficiencies

Through learning with interactive digital content and 3D assets the learner can understand the content much quicker and cost effectively that traditional learning. The digital learning courses were blended into the face to face training to increase the quality of learning that the engineers received.

Distribution of training material significantly reduced the costs as there is no requirement to produce paper-based content as this is now 100% digital. It has also saved on the maintenance and updates required to ensure the content is accurate and aligns with the latest standards. The reduction in time spent travelling and away from there day to day roles has meant that they are more productive working on the rolling stock that requires regular maintenances and fixes.

Summary

The creation of interactive digital learning enabled London Underground to deliver a more engaging and standardised training course. Learners we able to benefit from self-learning content where they could re-visit sections that they didn't fully understand in class or use the content as a refresher session before they took part in a maintenance or fault-finding task out in the field. The digital learning was very well received by London Underground and ensured that a cost-effective training programme was successfully delivered.