Problem Statement

The impact of introducing the European Train Control System on Sydney train crews

FW 18-02

Future Transport Workforce

Problem Description

Question	Response
Description of the problem and purpose of the proposed research	The European Train Control System (ETCS)* is the signalling and control component of the European Rail Traffic Management System (ERTMS). It was designed to replace multiple incompatible legacy train protection systems across the European railway network with different operational procedures. ETCS technology is implemented with standard trackside and train-borne equipment. This implementation typically involves increasing the levels of control from ETCS L1 (LS), ETCS L1 (FS) and ETCS L2. Currently, the most advanced deployed applications of ETCS technology (e.g. ETCS L2) involve wireless communication of movement authority directly to the train driver via onboard computers to a driver machine interface. This technology removes the need for lineside signalling. Hence, the technological advancements associated with ETCS have implications for improved safety, service and operational availability, and reduced maintenance costs (particularly with ETCS L2). The implementation of ETCS also provides the foundation for future technologies. ETCS technology will be introduced on the Sydney Metropolitan rail network from 2019 with the implementation of L1 (LS). Therefore, Sydney Trains/NSW Train Link have a stake in understanding the implications and applications of ETCS technology on operational staff. An important implication of ETCS is its impact on train crews (e.g. operator workload, cognitive load, different levels of monitoring). This impact is likely to be particularly pronounced during the protracted migration phase, and multiple transitions within a shift between L0, L1-LS, and L2 areas (e.g. operator workload, cognitive load, different levels of monitoring). Therefore, the purpose of the proposed research is to explore the implications and applications of ETCS technology on Sydney Trains/NSW Train Link crews. More specifically, this exploratory research will determine how the introduction of ETCS in other countries and other national jurisdictions can be applied to the introduction of ETCS on Sydney Trains/NSW Train Link, with particular focus on Sydney train crews. *ETCS is currently branded as the Digital Systems Project (DSP) within Transport for NSW (TfNSW).

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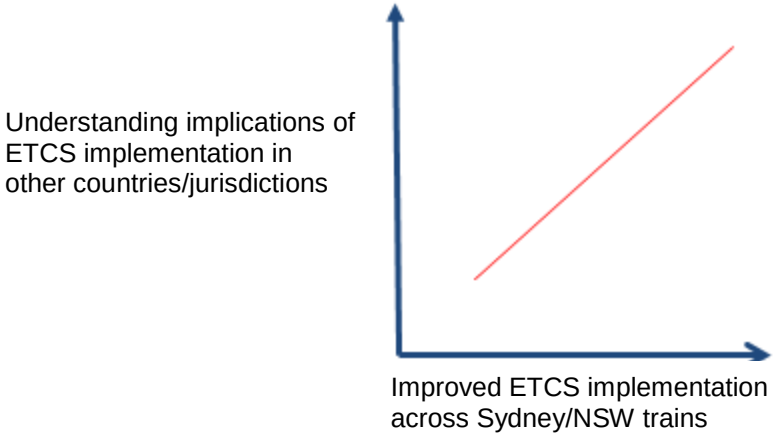
Hypothesis & Variables

Question	Response
For explanatory research, please describe a clear hypothesis with variables for testing **For exploratory research,** please describe how the proposed research will contribute to future explanatory research	The purpose of the proposed research is to explore the implications of ETCS implementation in other countries (e.g. Europe) and national jurisdictions (e.g. Adelaide) on the introduction of ETCS technology across Sydney Trains/NSW Train Link, with a particular focus on the impact of ETCS implementation on Sydney/NSW Train crews. It is hypothesised that understanding the implications of ETCS implementation in other countries and national jurisdictions will lead to improved ETCS implementation across Sydney Trains/NSW Train Link.  The purpose of the proposed research is to explore the implications of ETCS implementation in other countries (e.g. Europe) and national jurisdictions (e.g. Adelaide) on the introduction of ETCS technology across Sydney Trains/NSW Train Link, with a particular focus on the impact of ETCS implementation on Sydney/NSW Train crews. It is hypothesised that understanding the implications of ETCS implementation in other countries and national jurisdictions will lead to improved ETCS implementation across Sydney Trains/NSW Train Link.

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Strategic Criteria & Alignment

Question	Response
Alignment with strategic theme	This Problem Statement is aligned with the Strategic Research theme of 'Future Transport Workforce'. This theme is focused on the evolution of skills and talents required for a Future Transport Workforce.
External driver of change analysis **Outline how the research will better position TfNSW to respond proactively to macro drivers of change**	This Problem Statement comprises a number of external drivers of change that present challenges and opportunities for TfNSW. **Political** The proposed research aligns with the NSW Government's Future Transport Strategy 2056, and has implications for policies and practices related to TfNSW's Future Transport Workforce. It is also a direct outcome of the Waterfall accident investigation. **Economic** By understanding the impact of ETCS technology on train crews, this research will identify solutions for successfully implementing ETCS across Sydney Trains/NSW Train Link. The implementation of L2 will improve line capacity and service density, thereby having a positive economic impact. **Social** The implementation of ETCS technology across Sydney Trains/NSW Train Link will have implications for train driver workload, flexibility and safety from an industrial relations perspective. In addition, L2 increases capacity and the services offered to commuters. **Technological** ETCS technology has been implemented across several international rail networks. Obtaining information from these networks regarding the impact of ETCS implementation on train crews has the potential to influence the introduction of ETCS across Sydney Trains/NSW Train Link. Ultimately, this focus will contribute to TfNSW's commitment to the *Future Transport Strategy 2056*.
Forward looking	In light of the planned implementation of ETCS technology on the Sydney metropolitan rail network from 2019, it is critical to understand whether the implementation of ETCS technology across international rail networks (e.g. Europe) can inform the introduction and transition to ETCS for Sydney Trains/NSW Train Link crews.
Potential research impact	By understanding the implications and applications of ETCS technology on train crews, findings from the proposed research will contribute to the current body of knowledge regarding the introduction of new train technologies and implications for future transport workforce.

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Technical Criteria

Question	Response
Innovation **Outline how the proposed research will result in new knowledge**	The proposed research is innovative because it seeks to improve the implementation of future rail technology. Findings will have significant implications for TfNSW's Future Transport Workforce.
Basis in completed research and/or observed practice	As noted above, the European Train Control System (ETCS) is the signalling and control component of the European Rail Traffic Management System (ERTMS).[1] ERTMS is a major industrial project developed in collaboration with the European Rail Industry,[2] the European Union, railway stakeholders and the Global Communication Platform for Railways.[3] The objective of ERTMS is to replace the different national train control and command systems across Europe to facilitate a seamless and interoperable railway system.[1] Advantages of this system include reduced maintenance costs and improved safety, reliability, punctuality and traffic capacity. Hence, the ERTMS system is now being implemented in several countries around the world (see ERTMS Fact Sheets[1]). The following websites provide valuable information about the implementation of ETCS technology. Of particular note, the Spark Rail Knowledge Hub is a *"free, interactive web tool for the rail industry to share and find key information and help drive innovation"*, including information regarding ETCS technology.[4] • European Train Control System: http://www.ertms.net • European Rail Industry: http://unife.org • Global Communication Platform for Railways: http://www.gsm-rail.com • Spark Rail Knowledge Hub: https://www.sparkrail.org • UK Rail Safety and Standards Board (RSSB Spark): https://www.rssb.co.uk • Community of Railway and Infrastructure Companies (CER): http://www.cer.be • European Union Agency of Railways (UIC): http://www.era.europa.eu
Feasible data requirements	This research will rely on access to international ETCS data, including such sources as: • European Rail Traffic Management System (ERTMS) • Community of European Railway and Infrastructure Companies (CER) • European Union Agency of Railways (UIC) • UK Rail Safety and Standards Board (RSSB Spark) • Association of the European Railway Industry (UNIFE)

[1] European Train Control System: http://www.ertms.net/

[2] European Rail Industry: http://unife.org/

[3] Global Communication Platform for Railways: http://www.gsm-rail.com/

[4] Spark Rail Knowledge Hub: https://www.sparkrail.org/Pages/SparkWelcome.aspx

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Level of Collaboration & Resource Requirements

Question	Response
Level of collaboration **Please select the level of collaboration required to complete the proposed research**	**1. 'Quick-Fire' Research** ☐ Intense bursts of research activity (e.g. under 8 weeks). Intended to make use of 'hackathon'-type environments, where students/researchers work collaboratively and intensely on particular problems involving data interrogation and visualisation.
	2. Undergraduate Final-Year Research ☒ Suitable for final-year undergraduate students (e.g. capstone, Honours) as part of the research requirements for their undergraduate degree (i.e. 1 to 2 semesters).
	3. Higher Degree Research ☐ Project may form whole or part of a postgraduate research degree (i.e. Masters, PhD), and contribute to new knowledge (i.e. 1 to 3 years).
	4. Major Collaborations and Funded Research ☐ Project may form the basis for a significant collaboration agreement between TfNSW and the relevant research institution, including major competitive grant funding (e.g. Australian Research Council funding with TfNSW as an industry partner).
Comments	This project is suitable for a final-year student to undertake as part of research requirements to complete their undergraduate degree (e.g. capstone).
Supporting TfNSW resources	TfNSW will provide access to data requirements and subject matter experts (up to 4 hours per week).

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