Overview

New control, command and signalling (CCS) systems are being deployed on Great Britain's railways. These come under the general heading of ERTMS (European Rail Traffic Management System), a family of technologies standardised across Europe. ERTMS consists of two major components:

- GSM-R (GSM for Railways), a rail-specific telecommunications technology based on GSM (Global System for Mobile communications) cellular systems
- ETCS (European Train Control System), a standard for in-cab control of trains

These technologies present unique opportunities and challenges for the industry. In particular, ETCS is radically different from the technologies it replaces, requiring a variety of new IT devices to be installed both on trains and at the trackside and revised ways of working for both installation and maintenance teams. Previous research (RSSB project T754 - Development of an industry defect recording and corrective actions system (DRACAS) for command, control and signalling equipment) suggests that there could be significant benefits in being able to track and share information across the rail industry, between train operating companies (TOCs) and freight operating companies (FOCs), the infrastructure manager, RSSB, and suppliers.

This research has investigated the costs and benefits to the GB railway industry of a shared Defect Recording and Corrective Action System (DRACAS) for new CCS systems. Discussion in this area at the meetings of the Vehicle/Train Control and Communications System Interface Committee (V/T C&C SIC) during the period February to April 2010, agreed that the benefits needed to be quantified and also needed to identify the cost to the industry of the 'do nothing' option. Four scenarios were considered by this research: good, where all TOCs/FOCs and the infrastructure manager are participating in a DRACAS; medium, where two-thirds of TOCs/FOCs and the infrastructure manager are participating; poor, where one-third of TOCs/FOCs and the infrastructure manager are participating; and do nothing, where there is no participation.
The findings of the research are summarised in Figure 1.

![Figure 1 - Net benefits of a shared DRACAS split by groups of duty holders over the period 2011 to 2030 at current values](image)

The overall conclusion of the research is that a shared DRACAS for new CCS systems, in which there is widespread participation from the industry, would result in significant net benefits to the GB rail industry. Conversely, failure to implement a shared DRACAS system will result in significant dis-benefits to the industry. The DRACAS rationale depends on fostering and improving the working relationships between the TOCs, FOCs and the infrastructure manager. The infrastructure manager needs to participate under all of the scenarios and its failure to do so would result in the equivalent of a ‘do nothing’ scenario.

The research found that although IT is important, it is the trained people and processes which comprise the DRACAS that are most crucial to its success; and the costs of planning and training are in most cases greater than the costs of implementing the supporting IT systems.

**Aims**

This research aimed to analyse the business case for implementing a shared DRACAS for new CCS systems (ie for GSM-R and ERTMS) on the railways of Great Britain.

In particular it examined:

- The potential benefits to TOCs, FOCs and the infrastructure manager of a shared DRACAS
- The potential costs to TOCs, FOCs and the infrastructure manager of a shared DRACAS
These benefits and costs are examined under a number of different scenarios, which vary mainly by the numbers of industry players who participate in the shared DRACAS.

The research findings have been developed and supported within an Excel work-book, modelling the period from 2011 to 2030.

Findings

The research makes the case that a DRACAS is a set of processes and suitably trained people, supported by an IT system. Although IT is important, it is the trained people and processes which comprise the DRACAS that are most crucial to its success.

The research finds that although GSM-R and ERTMS offer the promise of considerable improvements to the operation of the railways, they are more complex than any CCS system deployed on the railways until now. The failure modes of ERTMS are such that most failures will result in a 'dead train', i.e. a train that cannot move. These trains will cause delays to other services across the network. The increase in delay minutes resulting from not having a shared DRACAS is likely to cost the industry £415 million to 2030.

The research also finds that although the potential dis-benefits of not having a shared DRACAS are large, the potential benefits to the GB rail industry of developing a DRACAS are also considerable. A shared DRACAS will result in more efficient maintenance and repair procedures, a reduction in no fault found events, and intangible benefits arising from, amongst other things, an improved culture of cooperation on the railways.

The net benefits to the industry of implementing a shared DRACAS, in which the infrastructure manager and all TOCs and FOCs participate, is estimated to be £473 million (at current values), during the period 2011 and 2030. With total expenditure on implementing and managing the shared DRACAS in the same period estimated to be just under £24 million, the net benefits are potentially almost 20 times greater than the total investment needed to set up and manage the shared DRACAS.

The network effect of a shared DRACAS means that the benefits from it do not increase linearly with the number of participants: the benefits from very high levels of participation are exponentially high. It is suggested therefore, that the industry should recognise that some duty holders may find upholding their obligations for a shared DRACAS more challenging than others. Some smaller TOCs and FOCs in particular, may not be able to call on
significant internal planning, training and IT resources. Where this occurs, it is suggested that the industry as a whole should be prepared to step in and offer assistance to those with fewer resources.

The key conclusions of the research for this project are:

- The need for a shared DRACAS is greatest for the introduction of new technologies on the railways, as opposed to mature technologies.
- A DRACAS consists of a set of processes, training, and information sharing and analysis, underpinned by an IT solution.
- The main benefit of implementing a shared DRACAS on the railways is that it will avoid a serious deterioration in performance which might otherwise be expected from the introduction of new CCS technologies.
  - ERTMS in particular could be a major source of delays if a shared DRACAS is not properly implemented.
- Other tangible benefits will include significantly reduced maintenance and repair costs.
- Because a shared DRACAS would involve a major culture change, there will be other, intangible benefits from the implementation of a shared DRACAS.
- The main costs of implementation will be in process design and training - IT costs will be less important.
- A shared DRACAS will help the railways introduce an appropriate preventative maintenance regime for new CCS technologies, rather than current regimes which waste money and are not suited to electronics-based and software-based systems.
- The difference in overall industry performance between a world where a shared DRACAS is widely used and one in which it is not is likely to be substantial.
- When properly implemented, a shared DRACAS is likely to produce benefits which are many times greater than the cost of the DRACAS.
- A shared DRACAS is a key component to facilitate the vision, expressed in the Rail Value for Money Study (VfM), of better asset management on the railways.
These in turn, lead to a number of proposals:

- The GB rail industry should implement a shared DRACAS for new CCS systems.
- The cross-industry team responsible for the implementation of the shared DRACAS should devote as much of its time to planning, training and process re-design among industry participants as to the introduction of an IT system.
- Each duty holder should have access to the shared DRACAS well before it has to implement new CCS technology.
- Participation in a shared DRACAS should be mandatory for duty holders and the industry should make it clear that it also expects its principal CCS technology and service suppliers to participate, and explain to them why. The industry should be prepared to provide assistance to smaller organisations (both duty holders and others) that may lack all the resources they need to effectively implement the shared DRACAS within their organisations.
- The industry should showcase the shared DRACAS for new CCS systems as an example of how it is acting on the recommendations of the Rail VfM study report.

**Deliverables**

This research has provided three deliverables:

- An Excel work-book - Costed business model for DRACAS
- A User Guide - to explain how to use the model
- A final report - detailing the findings of the research

The Excel work-book supporting the costed business model for DRACAS:

- Models the scenarios described above
- Allows user inputs on an individual basis from TOCs/FOCs, the infrastructure manager, and stakeholders
- Models the take up of DRACAS in support of the ERTMS and GSM-R programmes
- Provides analysis on the basis of delay minutes, maintenance and repairs, and safety metrics
- Allows user input of cost metrics
- Provides a visible benefits calculation summary
- Presents the results of the analysis on a per scenario basis
The User Guide explains how to use and populate the model, assumes no previous knowledge or expertise, and is intended to make the use of the model accessible to all.

The final report provides a high-level summary of the findings of the research, concept, methodology, conclusions, and recommendations for further roll-out.

These deliverables are available on request to RSSB members. The final report has also been published on the RSSB R&D website.

**Method**

The research involved the following steps:

- Identify stakeholders in railway communications
- Interview stakeholders about current and future communications requirements
- Develop the initial version of the model based on the first round of discussions
- Refine the model using additional input from stakeholders

As well as engaging with a range of rail organisations from GB and wider Europe, the research also considered lessons from the United States Army Air Corp and the Royal Air Force where similar systems have been implemented or in the process of being implemented.

**Next Steps**

The outputs of the research have been reviewed and accepted by the DRACAS working group and V/T C&C SIC. Both have commented on the exceptional value of this work.

Although much work has been done on previous RSSB sponsored projects to capture the benefits of a shared DRACAS for new CCS systems, (see related RSSB project T754 - *Development of an industry defect recording and corrective actions system (DRACAS) for command, control and signalling equipment*) it has never before been possible to do so in a quantified way. The largest overall benefit of the research has been to show that it will prevent a substantial deterioration in overall performance across the railways that would be likely to occur were a shared DRACAS not to be used.

This means that without a shared DRACAS, the introduction of GSM R, and, to a much greater extent, of ERTMS is highly likely to cause: very high delay minutes on the railways, high costs to the industry, and a great deal of inconvenience for passengers.
and freight customers. A shared DRACAS is therefore critical in allowing a smooth transition to new CCS systems.

Next steps are to formally present the findings of the research to the ERTMS Strategy Group in September 2011. In the light of the findings the V/T C&C SIC has given its full authorisation to follow on project T960 - Specification of a Defect Recording and Corrective Actions System (DRACAS) system architecture and process framework and work on this is expected to be concluded during the early part of 2012.

This work has been carried out on behalf of the V/T C&C SIC, supported by its sub-group, the DRACAS Working Group. These groups are working closely with the Vehicle/ Vehicle System Interface Committee, which is responsible for progressing work on Remote Condition Monitoring, a related system that is intended to provide primary information input to a future DRACAS.

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