VIEWPOINT Derel Wust

Smart trains on dumb track

Increased computing power and the growth of artificial intelligence provide an opportunity for a fundamental rethink of railway safety and train control processes, believes **Derel Wust**.

DEREL WUST

Derel Wust is the Founder and Managing Director of 4Tel Pty Ltd, an Australian software development company specialising in transport command and control technologies. A former radio engineering officer in the Royal Australian Air Force, he worked on defence and satellite projects before joining the rail industry in 1997.

'What we want to see is smart trains on dumb track', says Derel Wust, arguing that the traditional model of trains 'following instructions from the infrastructure' is an 'exceptionally expensive' way to run a railway.

'More than a century of relying on lineside signals has clearly influenced how train control technology has developed', Wust accepts. But the Managing Director of Australian train control and software specialist 4Tel feels that the computer-enabled methodologies now being deployed in other technology sectors — notably automotive, telecoms and banking — along with artificial intelligence and neural networking offer a 'golden opportunity' to invert this approach.

Over the past few years, 4Tel has been working with concessionaire John Holland to develop and deploy a cost-effective train control system for the 2400 km Country Regional Network in New South Wales, (RG 11.17 p35). Now used by around 70 train operators, this 'infrastructure-light' virtual block technology has been accredited to SIL-2. Centralised vital processors manage network occupancy, using the on-board train radio screens to display movement authorities, progress status and alarms.

The system piggybacks on public mobile phone networks for both broadband data and voice communications. No vital communications are needed, as safety is managed by the software applications. Wust draws a parallel with online banking. 'If you're midway through a transaction and you drop your mobile phone and it smashes, have you lost your money? The answer is no, because that transaction can only be authorised from the database, not the handset.'

Transfer of responsibility

Shifting to low-maintenance, digitally enabled train control has long been an objective, but in practice many railway operators and infrastructure managers are ultra-cautious when it comes to stripping out legacy systems. 'We are trying to remove the obsession with hardware specifying safety', explains Wust. 'One technology cannot take care of all the issues affecting a given section of railway.'

In the future, he suggests, ensuring train integrity should become the responsibility of the operator rather than the infrastructure manager. 'We believe in putting risk where it is best managed. In our view, it is the duty of the operator to manage their train as a condition of gaining access to the network.'

A similar view applies to broken rails. 'Track circuits are seen as fundamental to the detection of broken rails, yet as an industry we accept that they are inherently unreliable. Broken rails are a track maintenance issue, not a train control one. Put that responsibility on those teams.'

Towards an all-seeing eye

Explaining how increased computing power has supported development of 4Tel's slimline CBTC concept, Wust says 'our IT systems can handle all the data the trains generate for signalling and traffic management. The limitations on the CRN are physical — the time to pass through block sections, loop length and so on.'

Wust is concerned that the productivity gains accruing from the automation of other modes could hurt the rail sector, and 4Tel is now assessing converging technologies that could complement its CBTC functionality. He believes rail can piggyback on the systems being developed for autonomous road vehicles, but cautions that 'car technology will never simply turn up one day as mature applications for the rail sector. We have to adapt it and find what works.'

As an example, he says 'we are keen to adapt the image processing technology from autonomous cars. If you can interpret digital information effectively, you can be very safe.' 4Tel is developing artificial intelligence programmes able to detect changes and unexpected occurrences. 'We hope to reach a point where these tools could be built into an advanced driver advisory system and augment GPS', he says.

'An onboard unit knows its route and knows what a hazard would look like.' Visual images could be used to triangulate train location, identifying prominent structures and other trains. This would help to overcome an inherent weakness with commercial GPS, where the locational accuracy is not good enough to handle a multi-track environment.

Despite the success of Rio Tinto's AutoHaul project on remote 'closed-loop' lines in the heavy haul sector, Wust feels that driverless technologies are not yet suitable for open access mixed-traffic networks in the short to medium term. 'We are trying to help the drivers, not replace them', he insists. Pointing out that AI 'never gets tired' or loses situational awareness, he suggests that a combination of CBTC and intelligent DAS could help to eliminate the requirement for two-person crews.

Citing advances in machine learning, he says 'interpretation of data can determine safe operation. Every vehicle interacting with a given route will update the condition of the infrastructure in real time. Once one train knows a route, a thousand trains do.'

Such an 'all seeing eye' could eliminate the need for lineside train control systems, allowing commercial considerations such as speed and throughput to determine the physical shape of the railway and its fixed assets. Ultimately, he predicts, 'we will separate train control from infrastructure entirely. AI will change everything, and it is not 20 years away.' ■

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