IN CASE OF EMERGENCY PRESS BUTTON "B" … OR IS IT "C"?

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BE MIEEE MIRSE

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SUMMARY

Emergency implies urgency. Not just urgency but abnormality. We have no difficulty dealing with what is normal, routine. However, when an emergency arises our systems are often found wanting.

Communication systems are not just collections of technology but are interactions between people, with technology interposed. The systems are inherently complex and over time they change: through changes in people, in organisations and in technology. The change may be subtle, an unnoticed drift from safe operation. Sometimes the change is only evident when an urgent, abnormal situation arises.

Incidents from around the world form the basis of this paper. In each of these incidents the communication system has failed those who depended on it in a time or emergency. In few of these incidents did the technology require repair: rather, a defect in the complex system of communication was exposed.

INTRODUCTION

> *"On approach to the level crossing, we had a full clear signal and when the train passed the track circuit I noted the activation of the level crossing lights. Everything appeared normal and the train was travelling between 96 and 100 km/hour. It was a dark overcast night with alternative heavy showers. On closer approach to the level crossing I observed a car's headlights approaching on the up side and was mindful that the car would need to stop at the level crossing. The horn was sounded. The car headlights disappeared prior to the level crossing.*
>
> *My attention was then returned to the level crossing and at about 100 meters from the level crossing I observed something and I said to [the co-driver] "what the f… is that"? At about twenty metres away I could make out wheels and saw that a semitrailer had rolled over at the level crossing. I got out of the seat and crouched down on the floor when the train struck the truck. [The co-driver] appeared to remain seated. For what seemed like an eternity there was crashing noise and various pieces of equipment thrown around the locomotive cabin. Eventually the train stopped."*

This sounds like the start of a paper for a level crossing conference. It could be, but what is different about this incident is the fact that the train controller knew a truck was lying on its side on the level crossing and knew that the train was about to hit it. The driver of the truck had contacted the Police to warn that it was on the crossing and the police had contacted the train controller.

Eight minutes were available for the train to be stopped. The train had a working radio, the train controller had a working radio. However, the train controller was calling the trailing locomotive of the train, not the drivers in the leading locomotive. A broadcast call was not made and backup systems were not used.

How could this happen? I believe that the causes of the incident lay in lack of training, organisational change, loss of corporate memory and the expectation that people could manage an emergency without prior rehearsal. A once safe system had become dangerous through myth and legend about its operation.

DRIFTING INTO FAILURE

Dekker [1, p70] analyses how we search for the broken component when things go wrong, with accident investigations often producing a catalogue listing components that were found to be broken and not broken. He challenges the assumption that there is a direct relationship between the broken component(s) inside the system, and the behaviour of the system as a whole. That identifying and fixing the broken components will solve the problem.

He suggests an alternative view [1, p74] that:

> *“we could also consider our system as something that is alive, as something that has all kinds of processes running through it at a variety of levels, which connect the various components in many complex ways. In that case, pulling the system apart and lifting the components out of it to examine them for their individual performance basically kills the phenomenon of interest. Broken components may not really explain a broken system.”*

This paper is built on the results of searches for broken components. It seeks to synthesise this collection of broken bits and pieces into an understanding of some aspects of the complicated systems created when humans communicate. An understanding of why these systems sometimes drift into failure.

Failure is always an option in complex systems, so too is adaptation for success. Dekker describes how complex systems will drift and adapt to new circumstances [1, p19]. A particular direction of drift may only be visible to an outsider, looking at the system in retrospect. To those on the inside, drift is invisible.

Drift occurs continuously, usually subtly. Fox [2] reviewed many Canadian incidents and accidents, examining the effectiveness of safety management systems. She cites several examples of workers creating “locally efficient practices” to get the job done. The practices are often a response to policies and procedures developed by organisations with the best of intentions, intended to mitigate safety risks but subsequently eroded under production pressures.

TECHNOLOGY DRIFT AND MIXED MESSAGES

Is the mobile telephone (cell phone) a potentially lethal device, a source of distraction, or is it a versatile solution to impromptu communication? Is it the last resort for communication in an emergency? Personal communication devices are now a part of life for most people aged 5 to 95 (or more!). However, their use is not without risk, particularly when the user’s attention is distracted from another, safety-critical task.

There have been several serious rail accidents attributed to cell phone use [3, 4, 5], resulting in the devices being banned on many railways. Except of course when the railway could find them useful, perhaps to overcome a deficiency in the railway communication technology. So an insidious drift takes place in the once carefully structured communication technology.

Broken bits of a system must be fixed. So various railways and regulators have introduced rules for when and how personal electronic devices may, may not or must be used. Moller [6] has provided an extensive review of the rules that have been applied and summarises the quite different approaches taken by different administrations. The approaches taken are interesting procedurally but one wonders whether they are realistic. The same administrators are actively using social media sites to communicate with passengers, perhaps making social media the most immediate source of information. Could an employee be tempted to look?

Sometimes technology changes are intentional, as in the following example from Japan[1]. However, in other cases there truly is drift, rather than analysis in application. People find themselves with all the technology but for want of a telephone number, lacking the ability to communicate.

[1] Quotations from investigation reports have been edited for brevity and clarity.

Japan [7]

> *Today, field personnel will take a photo of the accident scene with a cellular phone and send it to the train dispatchers. Despite using the latest technology, train dispatchers are dependent on the verbal information provided by field employees who have actually witnessed the accident. Train dispatchers work in a dispatching office, they cannot see what is going on in the outside world. Although we live in an information-oriented society, it takes much time to form a correct judgment, on which we base our decision, if we continue to use only radio and telephone apparatus to gain information from the accident site.*
>
> *What is just as important as gathering information is disseminating information. In a rail traffic disruption, most passengers will want to know why the trains are not moving and when the trains will start moving again. The train dispatchers' most important responsibility is to communicate information to station personnel and train crews. Today, the mobile phone information service allows passengers to gain information even before railway personnel.*

This process was introduced in Japan in 2004, an age ago in the use of personal electronic devices. It is in stark contrast to the levels of prohibition that apply in some organisations. Is it realistic to expect that railway personnel will work differently from virtually everyone else in our society?

Pakenham [8]

A train overran the end of the track, derailing and crashing into a building. The driver reported that he attempted to place an emergency radio call to Control but without success. He then made contact on a company-supplied mobile phone to advise Control of the incident. He subsequently used the phone to call the Pakenham railway station, receiving no response.

Aware there was a dislodged overhead contact wire lying across the train, the driver remained inside his cab until advised that the power was off. He later returned to the cab to activate the train's data recorder.

The failure of emergency communication received no further comment from the investigator and no recommendations were made in this regard. The company-supplied mobile phone became the only viable means of communication in this situation.

Lavington [9]

A train travelling at about 148 km/h rounded a curve and the driver saw that the line was obstructed by a fallen tree. He applied the emergency brake but the train collided with the tree. There were no serious injuries and the train did not derail. There was substantial damage to the driving cab and this resulted in the main control circuit breaker tripping. The train radio equipment connected to this breaker was rendered inoperative by loss of power and was inaccessible due to debris.

The first voice communication with the network controllers was around five minutes after the collision. The driver and assistant driver separately contacted different locations by mobile phone, as the driver did not have the telephone number for the relevant signal box. There was a working radio in the trailing locomotive but this was not used.

The actual location of train 1C84 was not established until 30 minutes after the accident. Although this did not affect the outcome of this accident, it could have caused a delay in the arrival of the emergency services, had their attendance been necessary.

The driver and assistant thought first to use their mobile telephone when the leading cab radio was not usable. Although this was a permitted action, the crew did not have the correct telephone numbers available. Even if they had used the radio system's emergency call feature the call would have been routed to a distant control centre, requiring the message to be relayed. Through all of these factors and the lack of position information in any message transferred, the location of the emergency situation was not established for 30 minutes.

Leigh Creek [10]

In more remote areas the consequences of not having functional communication systems can be fatal. A number of such instances are discussed in [11]. These incidents are more commonly reported in Australia, New Zealand and Canada. They are usually in remote areas, although the Waterfall collision [12] was in an outer suburban area. The mobile telephone, so often seen as a last defence, is only reluctantly written into the operational plans. It exists but the telephone numbers and information required to make use of it are not available: when really needed the approach fails the user. This was a key factor in the incident reported in the introduction to this paper: a mobile phone was the backup means of communication but the train controller did not have the phone number. The technological drift has led to failure.

> *A Hirail derailed on the Leigh Creek Coal line. The driver, a track inspector, suffered a broken leg, back and other injuries, had crawled from the wreckage of his vehicle over the rail line to a nearby rail access road to wait for assistance in the rain, alone in a remote area.*
>
> *The only means of communication available to the track inspector were his CDMA and satellite phones but both had been disabled by the destruction of their aerials when the vehicle rolled over. Inquiries extended as neither train control nor works gangs had the correct satellite phone number because the one normally allocated to the vehicle was being repaired. Through this set of events and other factors, help in the form of a track gang working 23 km away, did not arrive for 5½ hours. The track inspector did not survive.*

Very similar circumstances are reported in [13], this time in New Zealand. In [11] the author argued that emergency response beacons should be fitted to locomotives (and hi-rail vehicles) and equipped with tilt sensors for automatic operation. A rail vehicle on its side is nearly always an emergency situation, possibly with disabled crew. No aircraft would be without an emergency beacon: few locomotives have one (although some Australian operators now fit them, albeit without automatic operation). Automatic emergency alarms, through an existing continuously monitored network, could and would save lives and reduce injury. There is a very mixed safety message from management to staff when such simple solutions are not provided.

Guelph Subdivision [14]

This report investigates a near miss in Canada. The circumstances are somewhat complicated and involve the use of both mobile radio and mobile telephone. In the relevant area the primary method of communication with and between trains is by cellular telephone. When using cellular telephones, communication between employees must comply with all of the formats and restrictions used for radio. This requirement includes starting all initial communications with train identification.

Employees were aware that these radio procedures must be used for work situations when communicating by cellular telephone. However, it was determined that a significant number of employees would often slip into inappropriate forms of speech (that is, deviations from radio rules) when using a cellular telephone. This was confirmed by an audit.

There were no formal requirements, rules, or procedures for crews to obtain cellular telephone numbers of other trains (or foremen) occupying track limits specified by the restrictions listed on a clearance. When obtaining clearances, several different methods were used to obtain the telephone numbers: some employees developed their own lists of telephone numbers; some relied on their memory of telephone numbers for the trains that they normally communicated with during their regular trip; some relied on company-distributed lists of telephone numbers; and some employees checked with the RTC for the appropriate telephone number.

However, cellular telephone numbers associated with particular trains will occasionally change and, at the time of the incident, there were no specific procedures in place to ensure that all required employees were informed of any changes.

The TSB investigation report includes an interesting analysis of the difference in communication styles between two-way radio and cellular telephone. Some characteristics of telephone communication are:

- *Cellular telephone is more supportive of informal, spontaneous communication.*
- *Cellular telephone communications cannot normally be overheard by other crews or by the controller. Since the speakerphone function is not normally used, only the employee using the cellular telephone can hear the relevant information. In these situations, other crew members would not be able to independently check the accuracy of the information communicated.*
- *Since cellular telephone communications are not normally overheard or recorded there is limited opportunity for peers, supervisors, or the regulator to monitor inappropriate use of the telephone.*

Grawlin Plains [15]

The train had collided with a vehicle on a level crossing. The crew were unable to contact Junee Control by radio because Junee was out of range. The driver of the locomotive had been provided with a mobile phone. However, the numbers for Train Control were not programmed into the mobile and neither were they available in printed form within the cabin. The driver therefore contacted a company representative and asked him to contact the emergency services. He also made a call to the Signal Box and requested that the signaller contact Train Control. Unfortunately, the signaller did not request, and was not provided with, the number of the CDMA phone being used by the crew. The Junee Train Controller, in a recorded conversation, expressed his concerns about not being contacted directly by the locomotive driver:

> *“I had a call from the signal box at 1513 that a light engine travelling from Wirrinya to Forbes has struck a car... I don’t know a lot, I am only getting it second-hand, he reckons that Orange Control has a handle on it, but they know nothing about it, the driver has contacted the signal box but I have no way of getting back to him....because the driver did not contact me, it is causing a few problems.”*

Asta [16]

Neither ATC (Automatic Train Control) nor train radios had been installed on the Røros line. The trains were equipped with mobile telephones and the only practical way for the rail traffic controller to contact the trains when they were en route between stations was by mobile telephone. Both trains involved in this incident had reported in their phone numbers to the rail traffic controller at Hamar, who went off duty before the accident took place. He had not added these numbers to the list that had been agreed on at the control centre. When the duty rail traffic controller realized that a collision was imminent, he could not find the mobile telephone numbers and could not contact the two trains.

Arresting the Drift

How can the same problem arise so frequently? Somehow we have drifted from having communication at the press of a button to having to know telephone numbers. This is certainly not a new issue and was recognised when the specifications for GSM-R were framed. The solution for GSM-R was to provide functional addressing, using the system software and hardware to determine the appropriate telephone number for the person being called. That is entirely possible if you have your own telephone network but is problematic in shared networks.

Without some automated and verified method of delivering accurate telephone number information to all involved, the use of cellular phones in emergencies will continue to be dangerous. (Dangerous in the sense that injury or damage that might have been prevented or minimised will still occur, for want of timely communication.)

This aspect of communication technology and its relationship with people is very complex. It is a part of an overall communication system that will continue to evolve and to do so very quickly. This should be a key consideration for every modern railway, a part of every safety management system.

ORGANISATION DRIFT - MEMORY LAPSE

A Cautionary Tale

In most countries the vertically integrated railway is a thing of the past. Multiple operators share tracks maintained by another entity and possibly managed by a third. Let’s imagine that this is your railway: it might well be!

Several communication systems are in use; probably designed by people who were made redundant some years ago, maintained by an external contractor and using equipment and technology that is obsolescent. When the primary communication system was designed the railway was vertically integrated and the system was designed to fit that mode of operation. Now the system is an awkward fit, possibly one of a number of different systems that have to be crammed onto rolling stock. No one really knows why design decisions were made, nor do they know the hazards that were considered and the risk mitigation strategies involved. A problem arises with some item of equipment, perhaps with an emergency call feature that seems irrelevant in the current operation. So it is disabled, the button left in place, and life goes on.

The train drivers have been taught on the job by more experienced drivers. The experienced drivers are experts in train dynamics and safeworking practice. Of course they don’t need to have any special skills or training in the operation of the communication system: that is something that they have done since it was installed! So myths and legends are created about how the communication system works, where it works and whether it works at all. These are passed on to trainee drivers with sincerity and conviction, but often without any accompanying accuracy. One day a driver presses that disabled button in an emergency, having been assured from repeated training that it will work. But it doesn’t. The driver has never actually pressed the emergency button (fearing the wrath of the train controller and consequent inexplicable delays). Indeed, the train controller has probably never received an emergency call and is not quite sure how to respond.

The equipment maintainer, train driver, driver trainer, train controller and perhaps a signaller are all competent, with certificates to prove it. They have all been through training and have regularly been checked as competent. But no one ever pressed the emergency button. No one knew that it did nothing. Not until someone’s life depended on it.

More often the button or function is there, operating and available, but unused.

Examples of this type of situation abound. Consider a group of incident reports from Australia [12, 17, 18, 19, 20, 21] and from the UK [22]. In [19] we read about a driver, suffering shock after derailing a passenger train, pressing the emergency call button on the train but not holding it for the necessary 1.5 seconds. The call attempt failed. He then tried to make a call on his mobile phone but could not find the correct number. The train guard using his mobile phone eventually established communication; in other cases passengers have performed the emergency function [12].

Has Twitter superseded the emergency button? We need to be very sure that accurate position and status information is provided to the railway controllers and emergency services in a timely manner. A fully loaded passenger train could generate sufficient mobile communication traffic to effectively create a denial of service attack on public networks in the vicinity of the incident.

Homebush [21]

Train 67-R passed a signal at danger and continued on the wrong route.

> *Train Area Controller did not notice that 67-R was proceeding along the ‘Down Goods’ line. However, a second controller who was reviewing the indication board, observed that 67-R had continued past*

> *Signal ST 164 without stopping and was travelling along the ‘Goods’ line. He also observed that freight service 5YN2 was on the same track, between Flemington and Homebush, and was moving towards 67-R.*
>
> *He immediately alerted the Area Controller for the Homebush Panel to this predicament. The Homebush Area Controller then attempted to contact the Driver of 67-R, by radio, without success. He then asked another Area Controller to contact the Driver of 5YN2 and to direct him to stop his train immediately while he continued to attempt to contact the Driver of 67-R. The Driver of 5YN2 responded to the direction he was given but the Driver of 67-R did not respond to the continuing radio calls.*
>
> *A number of other Area Controllers in the signal box then relocated to the balcony of the signal box and attempted to alert the Driver of 67-R using flags and hand lamps. However, the Driver of 67-R realised that he was on the wrong track before reaching the signal box and, having done so, brought his train to a stand adjacent to the Signal Box.*

There was another, simple solution to this communication dilemma. The area controller could have made a broadcast radio call, a call that would have been heard by 67-R, even though the driver had entered the wrong trip number on the radio. Vigorous waving of a flag is nowhere near as effective, but one has to be trained and rehearsed in the use of the radio. The area controllers had all been trained and rehearsed in using lamps and flags at some stage in their career. In a time of crisis they reverted to the system they best understood.

This is a striking example of the consequences of the organisation losing its memory. None of the area controllers thought to make a broadcast or “all stop” call. None of the area controllers realised that this would overcome the problem created by the driver having entered the wrong trip number. The situation is very similar to the example in the introduction. A feature had been built into the equipment to mitigate the risk of being unable to identify or directly call a train; the organisation had forgotten to advocate its use.

CONFUSION

Confusion is often evident in stressful situations. People are suddenly required to perform an unrehearsed task in an unfamiliar set of circumstances. There may be many simultaneous demands for attention, each claiming equal priority but often no longer relevant. Some examples follow.

Summit Tunnel [23]

A passenger train travelling through the Summit tunnel struck a large amount of ice that had fallen from a ventilation shaft onto the railway track. The train was derailed and the driver was badly shaken but uninjured. Once the train had stopped the conductor tried to speak to the driver using the train’s cab-to-cab intercom but got no answer, so he went to the front cab. He found the driver standing in the cab. The driver had not heard the intercom because there were many alarms sounding in the driving cab as a consequence of the impact damage sustained by the front autocoupler.

The driver turned off the train’s engines and switched its headlights to give a flashing hazard warning indication. He also pressed the emergency call button on the train’s radio, but found that there was no signal. Apart from the confusion resulting directly from the collision, there was confusion in the minds of the train crew and the signaller/controller because communication attempt failed in this emergency. Even though the lack of coverage in the railway tunnel was presumably known to the organization, the people most directly affected were unaware that there could be no emergency radio communication.

Dryclough [24]

> *The train was travelling at 48 km/h round the curve when the driver noticed rocks on the line in front of the train. He applied the emergency brake and pressed the emergency button on the NRN radio.*

Both vehicles of the train derailed. The driver's emergency NRN call was answered by the operations controller. The driver initially gave the wrong location for the accident, stating that he had just left Summit tunnel instead of Bank House tunnel. This was due to the driver being shocked and disorientated by the accident. The controller subsequently established the correct location by speaking to the relevant signaller.

Lewes [25]

The signaller attempted to make an emergency call via the CSR [Cab Secure Radio] to stop train 2F21 before it crossed into the path of train 2D45. The CSR emergency stop facility has two buttons, one red and one yellow. If a signaller wishes to send an emergency stop message to a specific train, the red button is pressed. The system then asks for the signaller to input the train reporting number of the specified train and, once confirmed, the message is sent. If a signaller wishes to stop all trains within the area controlled by the signal box (or within a designated zone), the yellow button is pressed and, once confirmed, the emergency stop message is sent to all trains.

During the incident, the signaller intended to send an 'all trains stop' message, but pressed the red button on the CSR equipment in error. Thinking that the 'all trains stop' message had been sent, the signaller took no further action to stop train 2F21. The emergency message had not been sent to (or received by) train 2F21 as the CSR system was waiting for a train reporting number to be keyed in by the signaller.

The investigators considered this issue in some detail, with a useful discussion of the means of testing the competency of signallers in system operation. The discussion concludes:

Given that use of the CSR emergency equipment is comparatively rare, it is in general difficult for signallers to gain any practical experience. The training centre for signallers has a simulator, which enables the instructor to set up a range of operating scenarios for signallers to practise their skills. Operating scenarios involving use of the emergency CSR equipment can be simulated. Currently, the centre is not being used to assess signallers in use of the CSR emergency equipment during the training day every 13 weeks. The centre is rarely used by experienced signallers; its principal role is in training new signallers. The assessment of signallers in responding to emergency situations continues to be based on a set of theoretical questions.

Hexham [18]

The investigators of this incident made recommendations complementary to those following Lewes [25]. The railways are on opposite sides of the world but the loss of organisation memory; confusion in a crisis and lack of real understanding of the operation of the systems is no different:

Review training to ensure signallers and train controllers are competent to communicate effectively during an incident or emergency. This should include training in the application of every documented procedure that they may be required to implement in the course of their work (emergency or otherwise), before being permitted to do rail safety work. There is a need for SRA senior management to ensure that signallers and train controllers are suitably trained in emergency response procedures, including the capacity to think effectively in emergencies eg. recognising hazards other than those explicitly identified.

Require signallers and train controllers to undertake a higher level of training in communication protocols. This program should be supported by an on--going and robust monitoring and feed back system to ensure its continued success.

Review training to ensure train controllers are competent to operate the Countrynet system under both normal operating and emergency conditions. This should include driver training on the system

and observation of the system operation on the different locomotive classes. On-going verification of the train controllers’ competencies should be supported by an appropriate monitoring regime.

Overcoming Confusion

The Lewes investigators [25] recommended that the operator conduct a review of the approach used to assess the competence of new and existing signallers in their use of emergency equipment and amend it as necessary to ensure that the questions used probe a signaller’s understanding of how they would use the emergency equipment. They recommended that the operator should use the training simulator to test signallers periodically on their response to rarely experienced scenarios such as the need to stop all trains and specific trains in an emergency.

This is consistent with the recommendations from Hexham [18] and is a way of identifying drift in the technology, in the people and in the documentation of communication systems. With an appropriate safety culture in place both the trainers and the users will identify impractical or confusing instructions or procedures and fix the broken parts.

SOCIAL DRIFT - FORMAL LANGUAGE

Very often an investigation report will comment on informal language being used for safety critical communication [26, 27]. Sometimes the informal language leads to confusion or error, more often not. There is clearly a disconnection between the statements in the policies about voice procedures and what is done day by day. In many ways this comes down to being an issue of safety culture, although one has to consider the effects of the medium used. This is particularly the case when telephone communication is used rather than a radio broadcast.

CONCLUSION

Communication systems are not just collections of technology but are interactions between people, with technology interposed. The systems are inherently complex and over time there will be drift. Drift in technology, drift in people, drift in the environment.

A fundamental change in technology has taken place over the last twenty years, with pervasive use of personal communication devices. This change has created drift in railway communication systems, sometimes subtly, sometimes dramatically. Few, if any, railways have comprehensively dealt with the change. Indeed it is impossible to have dealt with the change; one must continuously deal with it.

Changes in railway structure and staff are continuing sources of drift in communication system requirements and operation. Unless these changes are recognised, assessed and resolved, the communication system will drift into failure.

Myth and legend are the manifestation of drift in personal understanding of systems. It is not sufficient to provide training once, with a “tick the box” check of competency every year. If we want people to be able to respond effectively, safely and promptly in emergency we must train and test them in a realistic environment. Making a successful emergency call must become as natural as waving a red flag!

REFERENCES

[1] Dekker, S. Drift into Failure. From hunting broken components to understanding complex systems, Ashgate, 2011

[2] Fox, K. How has the implementation of Safety Management Systems (SMS) in the transportation industry impacted on risk management and decision-making? MSc Thesis, Lund University, Sweden, 15 June 2009.

[3] National Transportation Safety Board, Railroad Accident Brief, Accident No DCA-09-MR-004, Boston Massachusetts, 8 May 2009. NTSB/RAB-11/06

[4] National Transportation Safety Board, Railroad Accident Report, Collision of two Burlington Northern Santa Fe freight trains near Clarendon, Texas, 28 May 2002. NTSB/RAR-03/01

[5] National Transportation Safety Board, Railroad Accident Report, Collision of Metrolink Train 111 with Union Pacific Train LOF65-12, Chatsworth, California, 12 September 2008. NTSB/RAR-10/01

[6] Moller J, Safety issues associated with the use of personal electronic devices. International Railway Safety Conference; Båstad Sweden; 2009.

[7] Asami S, The role and importance of train controllers in an emergency. International Railway Safety Conference; Perth, Australia; 2004.

[8] Office of the Chief Investigator, End-of-track overruns Metro Trains Melbourne, Pakenham and Sandringham Sidings. Rail Safety Investigation Report No 2011/03, 9 March 2011.

[9] RAIB, Collision between train 1C84 and a tree at Lavington, Wiltshire, 10 July 2010. RAIB Investigation Report 08/2011; April 2011.

[10] Jowett R, An Accident, an Investigation and a case for change: A rail safety campaign by the Australian Rail, Tram and Bus Industry Union (RTBU). International Railway Safety Conference; Perth, Australia; 2004.

[11] Aitken JJ, You can get lonely out there. Conference on Railway Engineering; Darwin Australia; 20-23 June 2004. Available from http://jja.com.au.

[12] Ministry of Transport NSW, Waterfall 31 January 2003 Railway Safety Investigation Final Report. 24 December 2003.

[13] Transport Accident Investigation Commission, New Zealand. Hi-Rail vehicle 67425, derailment, near Fordell. 10 February 2003. Railway Occurrence Report 03-102

[14] Transportation Safety Board of Canada, Risk of collision between Goderich-Exeter Railway Company Train 518 and Via Rail Canada Inc. Train 87. Mile 72, Guelph Subdivision New Hamburg, Ontario, 6 June 2006. Railway Investigation Report R06H0013.

[21] Office of Transport Safety Investigations, Rail Safety Investigation Report, Fatal Level Crossing Collision, Grawlin Plains, 31 May 2005. OTSI File Ref 04085, 21 December 2005.

[16] Norges offentlige utredninger 2000: 30 Åsta-ulykken, 4. januar 2000 Hovedrapport Rapport fra undersøkelseskommisjon oppnevnt ved kongelig resolusjon 7. januar 2000. Avgitt til Justis- og politidepartementet 6 November 2000. English summary on Page 287.

[17] Australian Transport Safety Bureau, Derailment of Pacific National Freight Train 1SP2N and the Subsequent Collision of V/Line Passenger Train 8318, near Chiltern, Victoria, 16 March 2003. Rail Investigation 2003/002; June 2004.

[18] Transport NSW, Incident Investigation - Passenger train collision with derailed coal train at Hexham on 12 July 2002 - Final Report. December 2002.

[19] Office of Transport Safety Investigations, Rail Safety Investigation Report, Signal passed at danger by CityRail service 67-R resulting in an opposing movement, North Strathfield. OTSI File Ref 04315, 21 September 2007.

[20] Office of Transport Safety Investigations, Rail Safety Investigation Report, Freight Australia Limited Derailment - Bethungra - 22 December 2004. OTSI File Ref 03262, 28 April 2006.

[21] Office of Transport Safety Investigations, Rail Safety Investigation Report, Derailment of CityRail Passenger Service 37-K, Homebush 7 January 2009. OTSI File Ref 04421.

[22] RAIB, Near-miss at Hanger Lane junction 27 March 2009 RAIB Investigation Report 05/2010; March 2010.

[23] RAIB, Derailment in Summit Tunnel, near Todmorden, West Yorkshire, 29 December 2010. RAIB Investigation Report 16/2011; September 2011.

[24] RAIB, Derailment of a passenger train near Dryclough Junction, Halifax, 5 February 2011. RAIB Investigation Report 17/2011; October 2011.

[25] RAIB, Autumn Adhesion Investigation Part 2: Signal LW9 Passed at Danger at Lewes, 30 November 2005. RAIB Investigation Report 25 (Part 2)/2006; January 2007.

[26] Australian Transport Safety Bureau, Safeworking irregularity involving passenger train SN57 and train D231 at Moss Vale, NSW, 17 June 2010. Rail Occurrence Investigation RO-2010-006; January 2011.

[27] Jackson S, Inquest touching the deaths of Geoffrey John Johns and John Patrick Turner. Coroner’s Court, Singleton, NSW Australia; 13 March 2009

APPENDIX 1:

APPROVAL TO PUBLISH PAPER

I, John Aitken, of JJ Aitken & Partners Pty Ltd hereby give permission to the International Railway Safety Conference 2012 (IRSC 2012) to publish the paper titled:

In case of emergency press button “B” … or is it “C”?

To be presented at the IRSC 2012 conference to be held at the St Pancras Renaissance Hotel, London, England on 8 - 12 October 2012.

In the following media (tick as appropriate):

✓ Copied to memory stick for distribution to conference delegates

✓ Publish on the IRSC 2012 website

Signed: .....John Aitken.....

Date: ..... 12 September 2012 .....

Please return this form when submitting the final version of the paper.