Non-technical skills: the foundation for a fair safety culture

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ABSTRACT

This paper highlights three vital Human Performance (HP) themes that are required to generate and support Fair Safety Cultures. It is based on rail industry observations over five years as an external consultant. A specific cultural change programme with Southeastern Railways forms the basis of the case study. The three themes are firstly, a Train Operating Company's (TOCs) orientation towards and handling of error. Secondly, the use of accident investigations to establish understanding and learning to prevent recurrence, and thirdly, the knowledge, understanding and employment of Non-Technical Skills (NTS) for staff development, whereby, the NTS provides the armour and tools within a human resilience toolbox for frontline operators to handle the challenges brought by the United Kingdom's 21st century railway.

KEYWORDS

Error orientation, investigations, resilience

Introduction and background

This paper is the distillation and reflection on five years of personal experience gained in a wide range of privileged personal encounters within the rail industry. The paper references documentation from rail and several other safety critical industries. There are three key Human Performance (HP) themes vital in creating and maintaining Fair Safety Cultures:

- HP Theme 1: A Train Operating Company's (TOCs) handling of, and error orientation.
- HP Theme 2: Accident investigations used to establish understanding and learning to prevent recurrence.
- HP Theme 3: HP Staff training, specifically through Non-Technical Skills (NTS) knowledge, understanding and employment.

HP skills not only provide protection in safely handling chaotic and ambiguous situations, they also can assist in recognising climates and cultures. I have witnessed in the rail industry many of the cultural and flight safety mechanisms that were familiar from my own military aviation background. Whilst the ethos of 'getting the job done' is very apparent in rail, unlike in times of conflict and the circumstances of life or death, is there ever the requirement to risk lives just to get a train moving? Surely from a passenger's perspective it is far better to arrive late and safe than to suffer injury or death? Can such risk taking ever be justified, to meet a Key Performance Indicator (KPI), avoid a fine, or in the duty of customer experience provision?

Case Study – Southeastern Railway

Following the Rail Safety Standards Board's (RSSB) recommendation of human factors training to the rail industry (RSSB, 2008), Southeastern Railway approached PPWD Consulting Ltd (PPWD)

to deliver NTS training to their drivers. This project quickly moved into the design of a Fair Safety Culture Strategy with the main focus on NTS. The Strategy was a partnership, with responsibilities held by both companies. Specifically, PPWD delivered bespoke and role-targeted HP training to over 1200 personnel and provided support to the Senior Leadership Team through Operational Learning Reviews. For example: training integration with the management, how to lead and coach NTS, assessment methodologies, investigation analysis and report writing, plus improved data collection and the analysis of statistics, resulting in the development of standards, processes and procedures. Throughout the programme, personnel, functional and structural changes took place as well as increased engagement with representatives of the Union, frontline operators, Learning and Development (L&D) and Human Resources (HR) departments. Southeastern operational safety incidents have decreased, with years 2013 to 2017 being the lowest on record with 193 operational safety incidents, 11 of which were Signals Passed at Danger (SPADs).

2008 - 501 incidents, 25 SPADs.
2010 - 408 incidents, 28 SPADs.
2014 - 275 incidents, 29 SPADs.
2015 - 273 incidents, 17 SPADs.
2016 - 238 incidents, 16 SPADs.
YTD 2017 - 193 incidents, 11 SPADs.

Additionally, the reduction in incidents has provided management with more resources to engage on a one-to-one basis with drivers, especially post-incident and during investigations. This has resulted in greater engagement and understanding, which has enabled the development of bespoke and personal Skills Enhancement Programmes (SEP) aimed at meeting the needs of the individual.

The 21st century railway

There are two faces to the rail industry. The first faces the past and provides stability through compliance, 'on the job' training, traditional infrastructure, process, standards and a mix of political and passenger apathy, under-investment and memories of past glories. Whilst, the second faces the on-rush of passenger growth, public interest and investment with projects such as High Speed 2 (HS2), Crossrail, electrification, European Rail Traffic Management System (ERTMS), rolling stock and refurbishments. Add in the expectations of the millennial generation, and a complex mix of political, economic, social, technological, legal and environmental policies, blended with new levels of customer experience and ever more stringent Public Performance Measures (PPMs).

I assert that these headline grabbing infrastructure investments only go so far, and rather it is the investment in the people, the 'heroes' and 'glue' (Sandom, 2007) that ensure that the last layers of defence as in James Reason's Swiss Cheese model (Reason, 1997) are as free from holes as is reasonably practicable. I propose that the RSSBs 7 NTS Categories and 26 underpinning skills can be employed (RSSB, 2012), to provide the resilience for the frontline operators to safely handle the challenges posed by the 21st century railway. NTS form a part of competency management[1], and it ought to be evaluated, as opposed to assessed or examined. Examples from aviation of NOTECHs (Flin et al, 2008) make refreshing reading as do my own experiences of the military flying training programme, where the NTS equivalent, airmanship was seamlessly discussed with the technical skills of flying.

What is normal?

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[1]Rather than competency management, I'd prefer it to be termed competency training. Additionally, NTS competency management is an enduring developmental tool, which for effective management, requires coaching skills from the manager.

I assess normal rail operations, as operations involving continuous service recovery, where staff constantly re-establish a 'right time railway' from service disruptions. Beyond the technical, staff receive limited training to handle the stressors experienced and to manage both 'static' and 'dynamic' situations. Where the more common 'static' service is potentially an underload situation that requires disruption noticing and anticipatory skills mixed with a 'dynamic' mode and the requirement to handle out-of-course and emergency situations, where overload may be experienced; followed by service recovery to 'static' operations. Sub-optimal working conditions are the norm, and most organisations are resource light, leading to the high frequency 'always conditions'[2], these conditions often quickly fade to go mostly unnoticed. Operators are unconsciously edged towards the safety envelope boundaries, defences removed and risk increased. The always conditions must be managed to ensure that the low frequency catastrophic accidents, or 'never events'[3] (NHS, 2017), do not take place. The SHELL model shown in figure 1. shows the relationships that operators are required to manage. The arrows depict four relationships that each require different mind and skill sets to effectively manage, especially under times of stress: L-S, L-H, L-E and L-L.
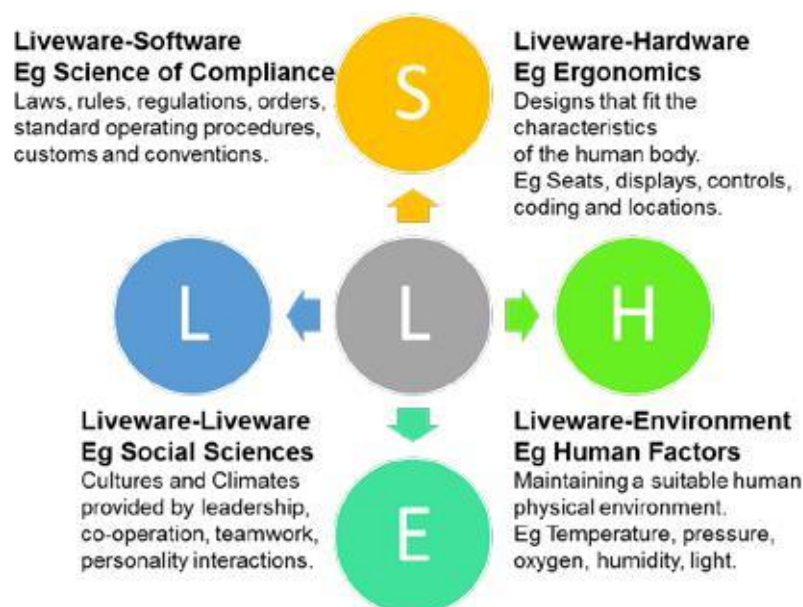

Figure 1: SHELL model of Human Factors in Aviation (Hawkins,1993 and ICAO, 2012).

I believe that operators must be 'agile' in order to manage these relationships effectively. The agile mindset originates within the military and *The Art of War* by Sun Tzu (Minford, 2002), a 5th century BC Chinese strategist. His ideas and concepts have been adapted into many contemporary warfare approaches. Agility can be defined as the individual possessing:

- **Adaptability** - Able to adjust or be altered for new conditions. Acclimatize, adjust, attune, become hardened, get used to, reconcile, alter, amend, change, transform.

- **Responsiveness** - Responding readily and with enthusiasm. Alert, alive, aware, interested, open, perceptive, receptive, sensitive.

- **Flexibility** – Able to change or be changed, to adapt to different circumstances. Accommodating, adaptable, cooperative, open-minded, responsive, willing.

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[2] Always Conditions – Whether optimal or not, these conditions are always present for workers to manage.

[3] Never Events – From the field of medical treatment, these are the kinds of mistake that should never happen.

- **Robustness** - Able to withstand difficult conditions, strong and healthy, determined and forceful. Athletic, brawny, fit, hale and hearty, powerful, strong, tough, vigorous.

(The Oxford Dictionary, 2002).

Agility is a trainable mindset supported by specific tools, tips and techniques found within NTS. These enable operators to notice, understand and mitigate the day-to-day risks encountered in delivering safe performance and it is this that becomes the NTS resilience toolbox for the 21st century railway, as discussed earlier.

HP Theme 1 - A TOC's handling of, and error orientation – human as hero or hazard?

"If you are convinced your organisation has a good safety culture, you are almost certainly mistaken. Like a state of grace, a safety culture is something that is striven for but rarely attained. As in religion, the journey is more important than the product. The virtue – and the reward – lies in the struggle rather than the outcome." (James Reason, 1997)

An organisation's error orientation creates either a blame or a fair culture. Therefore, accident report phrases such as, 'the purpose of this investigation is not to apportion blame, but to establish what took place', are often followed by 'driver/conductor/despatcher X failed to…'. The finger of blame has been pointed, fault found, and all that remains is to establish what happened only as far as person X is concerned, wrapped in a discipline or development plan. Rare are the reports showing the systemic failures within the organisation. Although subtle, there is a difference between 'driver errors' and 'errors by the driver'. Errors by the driver removes the wilful intention or violation, it acknowledges that despite the driver's training, experience, qualifications and best intentions, the subsequent acts may have been intentional but the resulting consequences were not. The twisting of human factors in to 'human error' penetrates deep into the psyche and erodes any opportunity for the establishment of Fair Safety Cultures (Dekker 2012, 2014). For drivers, this shift to remove intention alters the report's impact such that individuals identify with the incident and realise that it could happen to them.

The blaming of individuals significantly lowers corporate responsibility and anxiety but does little to prevent recurrence. Post-error blame judgements are incompatible with the establishment of a Fair Safety Culture. Blame sees the human as the problem - a hazard - and leads to simplistic cause and effect outcomes. It leads to the retraining, re-briefing and removal of the 'bad apple' to solve the problem. Fair cultures view the human as a hero, the 'glue' within systems, a resource operating in sub-optimal conditions, making things work. The investigator's role therefore ought to be limited to establishing understanding, learning and preventing recurrence. It is for others to make recommendations, apportion discipline, punishment, administrative action and development plans.

The Swissair 111 (TSCB, 2001) and Shoreham (AAIB, 2017) reports focus solely on understanding what took place, then extracting the learning to prevent recurrence. The reports balance technical and human factors, and view the system's cultural influences. The Swissair 111 report is often cited as the first example of non-attribution of blame. Of note is a section which describes the accident from the pilot's perspective and views the unfolding incident based on the data as it was presented to the pilots in the context of their available training, experience, procedures and equipment. The 'Tunnel' analogy (Sydney Dekker, 2014) is a fantastic way to remove many of the biases which twist perspectives during investigations. It is a method to establish why someone did what they did without prejudice and it works extremely well, plus it helps to create and maintain fair cultures. The inside tunnel view relates back to the training, assessment, supervision, management and post-incident handling that an operator receives, a cultural view of operators as 'hero' or 'hazard' (Sandom, 2007). Viewed as a hero, they ensure a right time railway runs safely, all the time, carefully balancing safety with performance under sub-optimal conditions, working hard to achieve

the KPIs and PPMs. Alternatively, viewed as hazards, the operator makes frequent human errors causing loss of service and then fails to meet the KPIs and PPMs. Has the lack of trust, respect and empowerment of operators led to the compliance-led processes and procedures that dominate the rail industry?

The Nimrod Review by Charles Haddon-Cave QC in 2006-9 by way of comparison to the Royal Air Force (RAF), summarised the main points raised in the following investigations, to show how poor we are at learning past lessons: NASA, Challenger (1986) and Columbia (2003) Space Shuttle disasters, Herald of Free Enterprise (1987), King Cross Fire (1987), Marchioness (1989), BP Texas City (2005). He remarked on the 1990's NASA policy of 'Faster, Better, Cheaper' which led to significant reductions in resources. This was paralleled with the MOD's Smart Acquisition policy of 'Faster, Cheaper, Better' to highlight how strategic policies designed and implemented physically and metaphorically at great distance often have unintended consequences. Here are the 12 uncanny, and worrying parallels between the organisational causes of the loss of Nimrod XV230 and previous losses.

The lessons to be learned in the case of Nimrod XV230 are not new.

- The 'can do' attitude and 'perfect place' culture.   - Dysfunctional databases.

- Torrent of changes and organisational turmoil.   - 'PowerPoint engineering'.

- Imposition of 'business' principles.   - Uncertainties as to Out-of-Service date.

- Cuts in resources and manpower.   - 'Normalisation of deviance'.

- Dangers of outsourcing to contractors.   - 'Success-engendered optimism'.

- Dilution of risk management processes.   - 'The few, the tired'.

These examples demonstrate that there is a blend to management structures, policies, leadership styles, cultures and the employment of technology and performance indices which can either enhance or degrade safety. An over-reliance on compliance and continuing to repeat what has gone before, in the hope that it will produce a different outcome, is insane. Therefore, to get something new, we must do something new. The Nimrod Review stated the need for an Engaged Organisation and Safety Culture, which must possess the sub-cultures as advocated by James Reason (1997), namely: Reporting, Just, Flexible and Learning Cultures. These are often cited in addition to Informed Cultures and the Nimrod Review highlighted the requirement for a Questioning Culture. Where questions are perceived as vital in establishing understanding and for identifying assumptions, they lead to unearthing potential errors and mistakes before they happen.

HP Theme 2 - Accident investigations used to establish understanding and learning to prevent recurrence

To quote the philosopher and novelist, George Santayana, *'History is a pack of lies about events that never happened told by people who weren't there'*. Until we can reproduce the past and allow investigators to experience the accident for themselves, then an investigation's focus must be to establish understanding and learning, such that recurrence is prevented. Accidents occur within complex socio-technical super-systems, rare is a linear cause and effect accident chain apparent. Figure 1, the SHELL model (Hawkins, 1993), shows the complicated interactions and relationships for all actors in an accident. The quality and quantity of investigation data is often poor; Closed Circuit Television (CCTV), voice and imagery plus the quality of data recorder downloads (often designed for technical use) leaves rail investigators with an inadequate level of data. Those who have experienced investigations often find they have an enduring career focus on doing things right. It is one thing to have a cosy chat with internal investigators and another to witness warrant cards,

cautions, arrests, the impounding of documentation and suspension of personnel and activities, let alone the loss of life and injuries. The UK rail industry now has a generational gap from the last major accident and loss of life[4]. Additionally, many management levels contain those from non-rail and non-safety critical environments, who lack first-hand safety critical experience. Reason (1997) discusses a pendulum which swings between performance and safety. Lots of safety is done following an accident and as time passes, the pendulum moves towards performance. A cut here and a cut there, each one almost imperceptible when the system is studied, but each in its own way opens a hole in the defences of that organisation.

To paraphrase Harold F Dodge, a principal architect of the science of statistical quality control, "you cannot inspect or test quality into a product". The same can be said for humans. No matter how much supervision, assessment, testing, examination, box ticking, auditing and compliance management one does, those methods do not instil the attitudes, beliefs and values required for safe performance operations. The Columbia Accident Investigation Board (Haddon-Cave, 2006-9) emphasised the importance of identifying the fundamental 'organisational causes' of accidents rather than focusing merely on errors and omissions by individuals:

"Many accident investigations make the same mistakes in defining causes. They identify the widget that broke or malfunctioned, then locate the person most closely connected with the technical failure: the engineer who miscalculated an analysis, the operator who missed signals or pulled the wrong switches, the supervisor who failed to listen, or the manager who made bad decisions. When causal chains are limited to technical flaws and individual failure, the ensuing responses aimed at preventing a similar event in the future are equally limited: they aim to fix the technical problem and replace or retrain the individual responsible. Such corrections lead to a misguided and potentially disastrous belief that the underlying problem has been solved. The Board did not want to make these errors. A central piece of our expanded cause model involves NASA as an organisational whole."

The last line of safety defence is the frontline of operations. The frontline has a vested interest in safety as their own lives depend on it. There is the opportunity to be proactive and to provide the frontline with the knowledge, awareness and understanding, in the form of tools, tips, techniques and skills to, when required, stop the job, not because of, but despite the system.

HP Theme 3 – HP staff training, specifically through NTS knowledge, understanding and employment

Elite sports personalities are elite through a combination of talent and significant hard work. They employ specialists within their coaching team to broaden their knowledge base and to bring best practice to all aspects of their preparation and performance. These elements are as applicable to frontline rail operators as they are to sports personalities. Additionally, human endeavour would not be endeavour if, as a race, we had remained within our comfort zones. That is, compliance is not safety (RSSB, 2011), the status quo does not ensure safe operations; it is a fallacy, an illusory belief in a static unchanging environment. We must invest in the human to gain greater performance. Technological solutions absorb resources and in relative terms, investment in training is cheaper and more rapid. NTS are a proactive set of skills that enable operators to manage the SHELL relationships within their Personal, Social and Cognitive responsibilities. These are areas covered by the RSSB's 7 categories and 26 skill sets. Each skill set is underpinned by a personal and diverse range of tools, tips and techniques. Correctly deployed, these skill sets enable operators to raise their awareness and manage their physical, mental, emotional and spiritual wellbeing to meet demands and manage the SHELL relationships, even under times of fatigue, pressure and stress.

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[4] Outside of level crossings, Potters Bar 2002 is the last rail accident to involve loss of life.

Once honed, the 26 skill sets provide robustness to the operator, enabling them to handle changes in their environment and well-practiced NTS provide operator agility. Increased experience then develops safe working solutions within either chaotic and ambiguous non-standard, out of course, novel and emergency situations. One may not have the technical skills to solve the situation but one can have the understanding and performance skills to prevent the situation deteriorating - 'stopping the job' is the safe option. One could summarise NTS as the tools required to notice, solve and anticipate 'always conditions' whilst avoiding the 'never events'.

NTS Resilience toolbox

"...they define perfection as finding and fixing every mistake. Perfection is setting your ego aside and explaining to your team what you did wrong. Perfection is building a culture where your team is willing to expose every error, even those that could be hidden or ignored. Perfection is creating a team that competes over whose fault it is when a project fails or when goals aren't reached."
Dave Berke, Retired Instructor, US Naval Fighter Weapons School (Top Gun)

Figure 2 below is a composite model. It is based on a study of around two million incidents across 300 organisations and a diverse range of safety critical industries. The top five levels depict the 1-10-30-600-300,000 ratio for organisational incidents. Where 300,000 unsafe acts underpin each fatality. Organisations who focus on the 1-10-30 ratio, are reactive and often undertake safety training after incidents, whereas, proactive organisations monitor and invest in the 600 and 300,000 levels. They work to develop and improve safety by targeting behaviours and near-misses. Such proactive organisations show improvements in incident rates and possess generative safety cultures, with a maturity level which continually invests in safety and strives to adopt best practice, before the legislators mandate it.
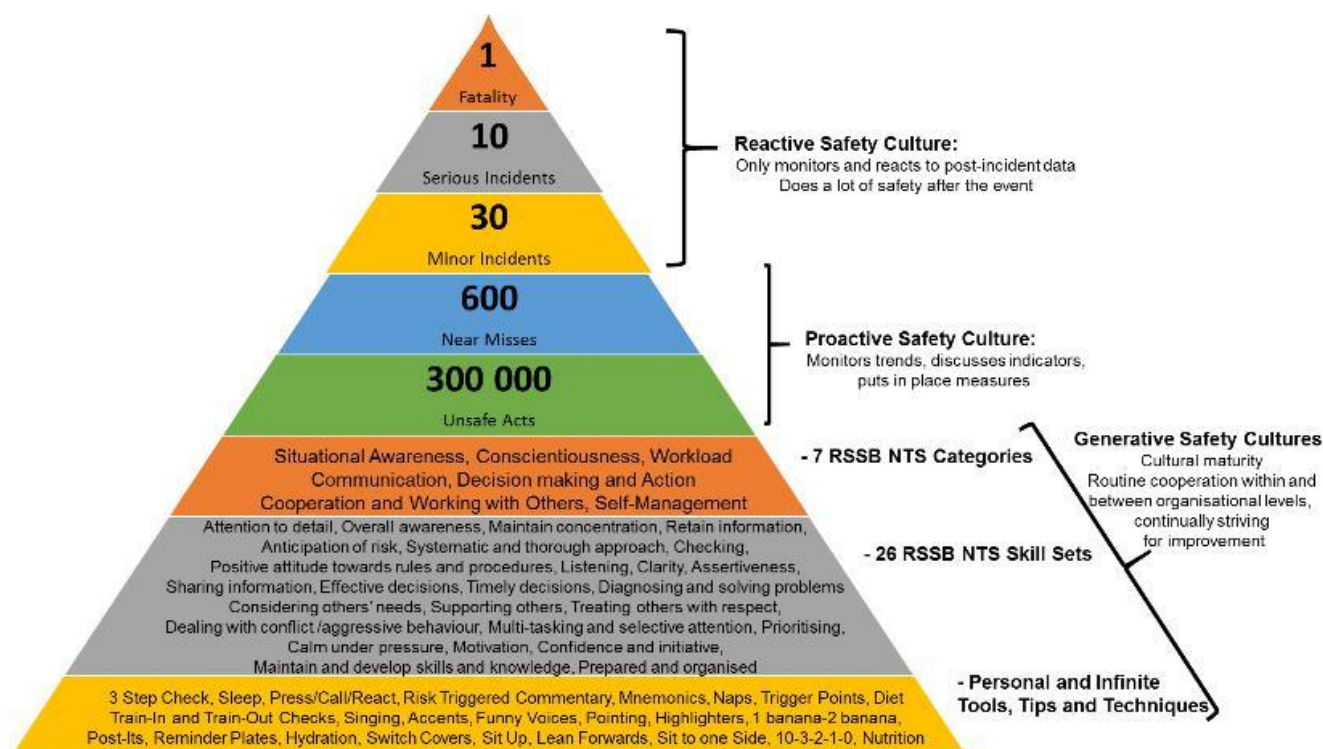

Figure 2: Adapted version of the Safety Triangle (Heinrich 1959, Bird 1996 and Conoco Phillips Marine 2003)

The foundation for achieving reductions in incidents is in reducing unsafe acts and this is where the RSSB's 7 NTS categories are focused. Categories are not trainable, however, the 26 NTS skill sets

are, and more importantly, it is the design and adoption of an NTS Resilience Toolbox, comprised of personal tools, tips and techniques which reduce the unsafe acts and greatly mitigate the opportunity for incidents to take place. To mandate the contents of a person's toolbox is counterproductive and potentially dangerous. For example, beat boxing commentary driving may work extremely well for one driver and be a disaster for another. Bespoke design, facilitated by managers or instructors who deeply understand the HP elements of NTS, are required to coach operators with the filling of their toolboxes.

Conclusion - Human performance stages of development

Safety is performance; if a TOC experienced no incidents then I'm confident it would find it significantly easier to meet its KPIs and National Rail Passenger Surveys (NRPS). There would be a reduction in uninsured losses, and investigative and disciplinary management time could be re-invested in the leading and managing of their staff. Reductions in damage to credibility and reputation would place the organisation in a better light come franchise renewal. To arrive at such a position requires investment and an understanding that error is inevitable, and that these errors in frontline staff are not solely down to them, rather the error is a product of the system in which they operate. There are three key themes vital in creating and maintaining Fair Safety Cultures:

- HP Theme 1: A TOC's handling of, and error orientation.
- HP Theme 2: Accident investigations used to establish understanding and learning to prevent recurrence.
- HP Theme 3: HP Staff training, specifically through NTS knowledge, understanding and employment.

Operators ought to be viewed as heroes, required to problem solve, demonstrate agility in thought and action, and make sense of chaotic situations in adaptable manners to recover the rail service. This results in treating errors as just a normal part of high performing sub-optimal systems where the solving and anticipation of 'always conditions' whilst avoiding the 'never events' is routine. Investigations must be focused on establishing learning, understanding and preventing recurrence, combined with making staff robust by investing in their NTS. This results in frontline staff becoming more engaged, leading to the open reporting and discussions of near misses. Unsafe acts reduce, as do the number of near misses and in time, minor, serious and fatal incidents decrease, establishing and reinforcing the sub-cultures which form a Fair Safety Culture. NTS is a non-confrontational method of training. It consists of personal trainable pro-active skills, which hold equal status with an individual's technical skills within their competency management. NTS help to bring meaning to chaos, to make sense of one's surroundings and assist in problem solving. NTS are a Human Resilience Toolbox made up of seven toolkits each containing trainable skill sets. The 26 skill sets provide armour to frontline operators, this makes them robust, capable of handling the physical, emotional and psychological stresses and strains placed on them by the 21st century railway, to move trains and passengers safely and on time.

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