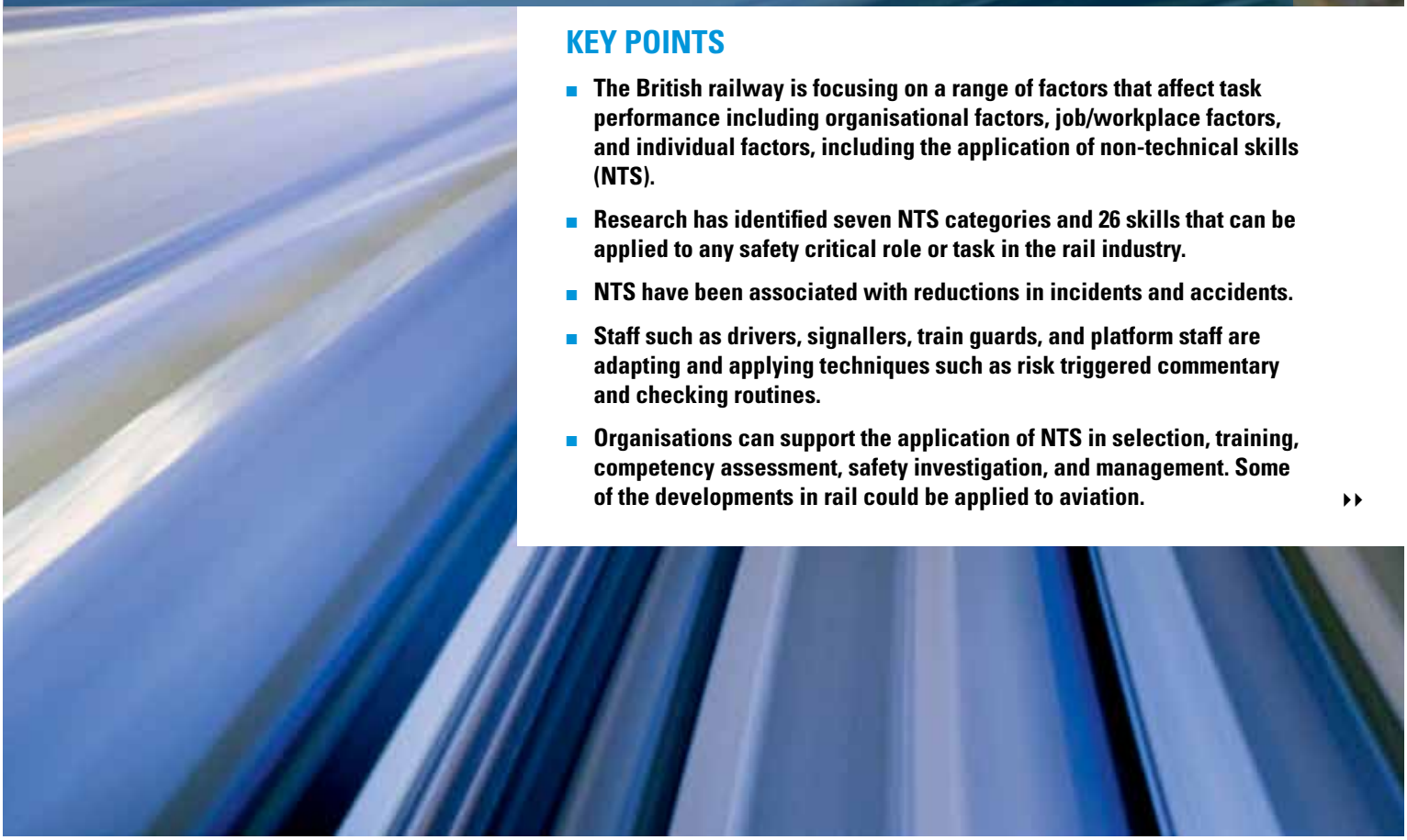
Following a series of accidents in the 1980s and 1990s, the British rail industry made major advances in human factors and safety. It is now among the safest in Europe, and rail is the safest conventional mode of transport in Great Britain. In this article, **Paul Leach and Philippa Murphy** describe the use of non-technical skills to help achieve marginal gains in performance.

ACHIEVING EXPERTISE THROUGH MARGINAL GAINS: A RAIL PERSPECTIVE



KEY POINTS

- **The British railway is focusing on a range of factors that affect task performance including organisational factors, job/workplace factors, and individual factors, including the application of non-technical skills (NTS).**
- **Research has identified seven NTS categories and 26 skills that can be applied to any safety critical role or task in the rail industry.**
- **NTS have been associated with reductions in incidents and accidents.**
- **Staff such as drivers, signallers, train guards, and platform staff are adapting and applying techniques such as risk triggered commentary and checking routines.**
- **Organisations can support the application of NTS in selection, training, competency assessment, safety investigation, and management. Some of the developments in rail could be applied to aviation.**

Britain's railway is vast and heavily utilised. We have 21,000 miles (about 33,600km) of track, 10,000 route miles (16,000km), 2,500 stations, 4,000 trains and roughly 216,000 employees. Demand for rail services is increasing; commuting by train has increased by 73% since 2002. There are 4,000 more services a day than in the mid-1990s and passenger journey growth since 1997/98 has outstripped that of France, Germany and Spain (Rail Delivery Group, 2017).

It is also very safe. No passengers or workers have died as a result of a mainline train accident for the last ten years (Department for Transport, 2017; RSSB, 2017).

This level of performance relies heavily on our people, especially those who work and operate the train (drivers and train crew – analogous to pilots and aircrew) and those who control the movements of trains (signallers and traffic managers – analogous to air traffic controllers). They must be able to perform safely and consistently across different scenarios, such as normal operations where tasks can be routine and repetitive, to degraded and novel situations were normal operating procedures may not easily apply.

Developing expertise is essential to achieve this level of performance and the rail industry continues to look for different ways to improve. One such approach is using non-technical skills to help achieve marginal gains in performance over time.

What are marginal gains and what is the role of non-technical skills (NTS)?

The term 'non-technical skills' (typically incorporated into crew resource management in aviation) is now common in many safety-critical industries. NTS combine cognitive and behavioural aptitudes and skills to describe how a person undertakes a task. A pilot or air traffic controller has procedures and checklists detailing the tasks and actions they need to undertake. The related NTS for these helps explain how a pilot or air traffic controller carries out those tasks. For example, how do they maintain situational awareness? What information do they consider when making decisions? How do they manage periods of high and low workload? What strategies can/do they use? When there is equal emphasis on how a task is carried out, as much as what the task is, learning, development and performance can improve.

NTS Category		NTS Skill
1	Situational awareness	Attention to detail
		Overall awareness
		Maintain concentration
		Retain information (during shift)
		Anticipation of risk
2	Conscientiousness	Systematic and thorugh approach
		Checking
		Positive attitude towards rules and procedures
3	Communication	Listening (people not stimuli)
		Clarity
		Assertiveness
		Sharing information
4	Decision making and action	Effective decisions
		Timely decisions
		Diagnosing and solving problems
5	Cooperation and working with others	Considering other's needs
		Supporting others
		Treating others with respect
		Dealing with conflict / aggressive behaviour
6	Workload management	Multi-tasking and selective attention
		Priorotising
		Calm under pressure
7	Self-management	Motivation
		Confidence and initiative
		Maintain and develop skill and knowledge
		Prepared and organised

Table 1: RSSB NTS list

Through our research we have identified seven NTS categories and 26 skills that can be applied to any safety critical role or task in our industry (Table 1).

The aim is to help staff and the organisations they work for understand human performance, the factors that affect performance and the techniques that can be applied to enhance performance. This increased level of awareness means people are better able to identify opportunities for performance improvement through 'marginal gains', which is an approach often used in sports, such as athletic cycling. Small, focussed, and incremental improvements over time add up to an aggregated, significant improvement.

For example, Team Sky spearheaded the concept of marginal gains in cycling, looking at the different aspects of cycling that could be improved – bike, technology, training, diet, rest, and cognitive factors. Our railway is adopting a similar philosophy by focusing on a range of factors that affect task performance.

What's the benefit?

The benefits of understanding and applying NTS are well known. On Britain's railway, NTS has been associated with reductions in red signals passed by drivers, incidents and accidents and errors during line blockages (RSSB, 2016). This is similar to some of the benefits seen in aviation. However, there are a number of factors that can affect our ability to apply NTS.

What affects our ability to apply NTS?

Based on our experiences working with rail organisations and looking at relevant rail incidents and accidents, a common set of factors seems to affect someone's ability to apply NTS effectively.

These include:

- individual factors (such as memory capacity, assumptions, distractions, workload, attention and perception)
- job/workplace factors (such as equipment design and usability of procedures)
- organisational factors (such as leadership, culture, and change management).

Our work on NTS therefore tends to focus on two areas:

1. techniques that individuals can apply to help them address the factors above, improve their application of NTS and achieve marginal gains in performance, and
2. approaches that organisations can take to increase the integration of NTS into their business, and help individuals identify and apply their techniques.

Figure 1: Model of risk-triggered commentary

What techniques can staff apply to make marginal gains?

There is no one approach that everyone can apply to achieve marginal gains. However, there are a couple of techniques that staff such as drivers, signallers, train guards and platform staff are adapting and applying.

One example is risk-triggered commentary (Figure 1). This technique helps focus our memory so that critical information relating to risk for a given situation and/or task is maintained at the forefront of our mind. Risk triggered commentary involves recognising a risk and then speaking it aloud, along with the actions to take to mitigate the risk. The technique helps someone to 'sense check' what they are doing, and plan do to and can help to combat the effects of auto-pilot, low or high workload, distraction and incomplete or incorrect assumptions. The verbalisation is based on risks, identified through risk assessment and incident and accident investigation, so that it does not become a running commentary of each decision and action undertaken.

Another example is the short journey concept. This is a technique used by drivers to break down their route. Rather than conceptualising their route as one journey, they break it down into short journeys, typically station to station. For each short journey they focus on three areas – signal, speed and station stop (i.e., length of train and the platform stopping position). This approach can help to focus attention, manage working memory and reduce the possibility of distraction. The technique can also be used by any role where it is beneficial to break procedures or processes down into smaller chunks to help focus attention and concentration.

Staff have also developed their own checking routines to focus attention and combat the effects of assumptions, distractions, and 'auto-pilot' attention. For example, some people visually check monitors and screens from top left to bottom right (z scan). Others use 'point and call' when checking and scanning to help them remember important information and indications, especially when such information or indications suggest something unusual or abnormal may be occurring.

"Rail organisations are also starting to explore the concept of storytelling, where people's experiences are collected and turned into stories so others can learn from them."

What can organisations do?

There are a number of things that organisations can do to support the application of NTS and RSSB has developed resources to help rail organisations adopt these approaches (RSSB, 2016). For example:

- Critical NTS can be part of the staff selection criteria, with suitable tests selected to assess these.
- NTS can be fully integrated into technical training, competence standards and competence assessments, making it easier for staff to understand how these skills relate and enhance their technical skills and knowledge and the technical tasks they undertake.
- Incident and accident investigation can explore where a failure in NTS was a contributing factor, along with the factors that contributed to this failure.
- Leaders, managers, supervisors, trainer, assessors, and incident investigators can all be trained in NTS so they are better able to explain, promote and demonstrate these skills.

Rail organisations are also starting to explore the concept of storytelling, where people's experiences are collected and turned into stories so others can learn from them. For example, Network Rail collects stories from signallers who have had an incident. Each story describes how the incident occurred, how the person felt, the reason for the incident, the techniques they now use to help them apply NTS better and the benefits this has brought them. RSSB has also recently been exploring the use of storytelling for route learning. This is where routes drivers need to learn are depicted in story format to help them understand and memorise the route and determine the specific hazards and risks associated with a route.

What does the all mean for aviation?

Although NTS is already used within aviation, pilots, aircrew, air traffic controllers, and safety professionals can consult the RSSB NTS list to see if there are NTS that could be of use to help enhance performance. For instance:

- Staff and organisations could consider the factors that can affect someone's ability to apply NTS to determine the extent to which these are addressed within training, development and the techniques that staff already apply.
- Risk-triggered commentary could be applied to a range of aviation roles to help manage situations where tasks can be routine and repetitive, causing cognitive underload and degraded, and novel situations were cognitive workload can increase rapidly.
- Aviation organisations can check their selection, training, assessment, and incident and accident investigations to understand if NTS is being fully integrated into these areas and the extent to which organisational, job and workplace factors are considered and addressed to support human performance.
- Storytelling could be used in initial and refresher training as well as during development days, safety days and team/crew briefings.

There is no 'silver bullet' when it comes to safety management and improvement. But improvements at the individual, job, workplace and organisational level can help to achieve marginal gains in performance.

RSSB has a wealth of expertise, products and services that could be applied in aviation so please feel free to visit our website for more information and get in touch with us if you want to find out how to access them – www.rssb.co.uk.

References

Rail Delivery Group (2017). *In partnership for Britain's prosperity: The rail industry's plan to secure growth across our country.* Available at: https://www.britainrunsonrail.co.uk/files/docs/one-plan.pdf

Department for Transport (2017). *Rail factsheet*. November 2017. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/663116/rail-factsheet-2017.pdf

RSSB (2017). *Annual safety performance report 2016/17.*

RSSB (2016). *A good practice guide to integrating non-technical skills into rail safety critical roles.* Available at: https://www.rssb.co.uk/Library/improving-industry-performance/2016-07-non-technical-skills-integration-good-practice-guide.pdf

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