Presidential address: Delivering change

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The inauguration of our new president for 2018-19, George Clark, took place during the Annual General Meeting of the IRSE held in April. IRSE News is pleased to share George’s Presidential address with you in this issue.

It is a great honour for me to serve as your president and to write this article. This institution continues to play a significant role in a modern railway industry that is facing huge challenges and exciting opportunities. At the Institution’s digital railway seminar last year, many were envious of those joining the profession now as it sees so many developments across the world. It is only right that this institution inspires, informs and develops engineers globally.

This is a year when change features large on the agenda of so many countries and major cities. In the UK whilst we debate the form of our future relationship with Europe, we have a transition from one national rail five-year plan to the next with over £50bn (€58bn, $66bn) to be invested in maintaining and upgrading our main line railway. Network Rail also embarks on a period of radical organisational change to ‘put passengers and freight users first’ and to address concerns about poor operating performance. Closer to home for me personally, in today’s economic climate, Transport for London faces unprecedented pressures to modernise and deliver ambitious transport strategies cost efficiently.

This is a global trend. In Sydney we see the arrival of the metro as this form of railway expands further around the globe. It has been over 20 years since my mentor and guide Eddie Goddard led the institution into the world of the metro and focussed on the challenges of providing an integrated high capacity railway system. I recall he often said the "S" in IRSE should be for "System", these challenges are still just as evident on railway delivery today as all too often railway systems (be they for railway, train or station control) and their complex interfaces are overlooked until too late in major infrastructure projects. This can often feel like they are a cause of failure, when in fact these systems are at the very heart of the railway and must be given adequate focus throughout the whole lifecycle to bring it to life, and deliver the major social and economic changes that transportation enables.

My career has been focussed on the world of metros and these intensive high-capacity railways have never been in more demand. The world-wide growth of cities has pushed so many to forge ahead with bold plans for metros, whilst those who already have them are driven to upgrade capacity. We have never faced higher social expectations and economic challenges, with global technology giants investing furiously in a race to bring transformational robotics, automation and artificial intelligence technology to everyday consumer products that must surely disrupt our traditional railway world.

In his presidential address last year, Markus Montigel clearly articulated the "Winds of Change" and how these will likely revolutionise the transportation system as a whole: calling us to “find an appropriate balance of ‘walls’ (maintaining the tradition of high safety standards) and ‘windmills’ (harvesting opportunities and increasing efficiency) in times of uncertainty”.

So, the theme of my presidential year in this changing world is "Delivering Change" and how this institution, with its thousands of dedicated professional members, can rise to meet the challenges and enable the opportunities ahead.
My career

A great pleasure of becoming president is the opportunity to reflect and reminisce on my career, and the many occasions where the work and opportunities offered by this institution have played a role. As is common in our industry, my journey started early as part of a transport industry family and formally began in 1976 with my signalling technician apprenticeship at London Transport. I was sponsored for my degree in electronic engineering and joined the Computer Development Section of London Underground where I first met my mentor over many years, Eddie Goddard.

Throughout 1980s I worked on programming the latest mini-computers in assembly language (efficient code as memory was a premium), delivering systems and initially training of the Piccadilly Line signal operators on powerful timetable editing and train control (a major change to many, including the use of qwerty keyboard entry) which used my first live real time signalling control systems software. Moving onto the Jubilee and Metropolitan lines, I progressed from coder to system designer/tester. I then moved into specification and assessment of new solid-state safety systems and their design acceptance by engineers and operators who were used to mechanical and deterministic machines. I also focussed on such specifications as part of a European initiative to harmonise interlocking principles across Europe, working with senior signalling engineers (two of whom are today IRSE council members) which was a great opportunity for my own development in learning signalling principles of all the major European main line railways. This illustrated the similarities as well as the challenges still facing Europe today as we seek to achieve the benefits of more standardised signal and control system products.

Delivering new technology into the railway was always a theme for me, so I leapt at the chance to join the Jubilee Line Extension Project in 1996, when it was at the heights of its challenges. Working with a small group of similarly minded delivery engineers led by David Waboso, I spent a very challenging four years in establishing and then delivering the systems needed to open the railway for the new millennium – a major project that provided many lessons in Systems Integration and railway systems delivery, that unfortunately we often see recurring today.

‘Delivery of Change’ is my presidential theme, and the new millennium saw me leading the delivery of the first moving block signalling system for London Underground’s Jubilee and Northern Lines. I had, I believe, a unique series of roles over seven years that began with adding my signature to the contract award recommendation, through its application design and finally to be the legal entity under UK law to authorise its use for public transport which was quite a journey.

Part of that journey for me was about responding to the change in demand which continues today (as shown in the graph below), albeit slowed by the current economic uncertainty. That could be a picture from many major cities around the world and shows why the institution has such a

On London Underground, as with many other railway systems, the rate of growth of demand for passenger journeys significantly outstrips the rate of growth in supply. The data for this chart comes from London Underground’s performance almanac.

key role in expanding the profession, creating a greater more effective community of engineers and unlocking resource constraints.

This brings me to my current role as TfL’s director of engineering, where I am proud to lead a fantastic team of over 1400 engineers who form a unified engineering function to efficiently serve all the delivery businesses of TfL (from roads to rail, from buses to ferries). It is an exciting opportunity to make a real difference to all forms of transport across London, whilst meeting that ever increasing demand for mobility.

Part of that team has delivered the first phase of the biggest ever moving block signalling project in London – the modernisation of the Hammersmith, Circle, District and Metropolitan Lines which entered passenger service in March 2019 between Hammersmith and Latimer Road, bringing the new signalling into the latest, and largest control centre on the Tube at Hammersmith.

It seems my whole career has been about delivering change.

**Engineers of change and innovation**

As engineers, we are catalysts and agents for the delivery of change and our skills have never been in more demand than they are today. We deliver new tools, techniques and technology systems to colleagues (e.g. fellow engineers in other disciplines, signalers and operators).

We lead in so many areas: data analytics, human factors and design, safety assurance and integration/commissioning. Today IRSE members and licence holders around the world are introducing the latest technology systems from Sydney to Copenhagen, Toronto to Hong Kong. In the UK we have seen the ERTMS solution with world leading ATO being introduced on Thameslink and increasingly across London Underground we are benefiting from technology delivering up to 36 trains per hour.

New technology is a key enabler to delivering change and always comes with its own inherent challenges and risks, but so often the wider people, process and interface changes are even more significant and the root cause of delays and cost. Not only must we deliver the required functional performance enhancements for system capacity and asset availability, but also significantly reduce the whole life cycle costs through radical changes to maintenance (e.g. through digital and virtual data driven approaches) and operation (e.g. GoA4 fully automated operation).

Of course, the unique challenges inherent in most railway upgrades is that they start from a base state that most other industries would class as ‘industrial archaeology’, with complex legacy interfaces that are rarely adequately understood, multiple party interfaces, all intricately interwoven with deeply established organisations, culture and processes. Invariably this all needs to be changed, whilst continuing to deliver intensive operational services with minimal disruption to the system being upgraded. Many industries face huge technical complexity and challenges, but few, if any, must contend with the full range of challenges faced by railway system engineers.

Increasingly the once clear lines between main line and metro control systems are blurring. Whilst there are common requirements to increase capacity on constrained infrastructure, traditionally a main line system would have one set of characteristics with fixed block multiple aspect colour light signals and the metro would have another with continuous ATP/ATO. But today we increasingly see mass transit rail, such as Thameslink or areas around Waterloo, but with main line technology. Crossrail is fundamentally a mass transit railway in the centre but operates on legacy main line systems on the outer areas. ERTMS and CBTC use common components and whilst both in high levels of performance are very similar, they have different requirements (e.g. interoperability for ERTMS or optimisation of capacity for CBTC).

From a supplier perspective, each CBTC supplier is seeking to optimise with their own commercial edge and adapt to the specific application whilst ERTMS drives a standardised approach.

Communications technology is fundamental to train control systems and evolves rapidly. Railways are not the first to implement this and should be able to learn the lessons from others who have gone before us, but equally rarely seem to. We need to break the pattern of current technology solutions by pushing at the door of concepts such as common shared networks and industrial clouds, with primary aims being quality of service, affordability and ‘cultural’ change to maintain pace with our travelling customer’s growing demands. This will be the subject of my first thought provoking seminar in September 2019, harvesting the open and frank opinions of the railway signalling industry which is vital to gaining traction on the rail operator’s future strategic direction.

**Delivering change – the need for a business case**

Last year Markus clearly illustrated for us how the cost of public transportation in Switzerland had increased at almost double the rate of consumer goods and almost triple the rate of road transportation.
Technologies such as ATO have been in use for decades on metro railways, but are now revolutionising service on main line services, such as London’s Thameslink project. Photo Siemens Mobility Limited.

But despite the powerful cost pressures on railways today and the disruptive potential of autonomous vehicles, data analytics and artificial intelligence to challenge fundamentals of the railway position in an integrated transport system, there is little evidence that the cost and time to deliver railway control systems and the transformational changes they enable is responding as quickly as is needed.

This is summed up by the journal headline “Affordable trains, expensive infrastructure” (Rail Engineer, 2018) [6], which describes how over 7000 new rail passenger vehicles are to enter service between 2014 and 2021, representing more than half the UK fleet. These orders are due to a combination of factors including cheap finance, lower manufacturing costs, franchise quality requirements and new trains having lower operating and maintenance costs. Over the years, the price of new trains hasn’t changed significantly (at today’s prices) but signalling costs have continued to rise with signalling renewal costs (signalling equivalent unit) having more than doubled over 10 years.

The barriers to entry and change for rolling stock and ‘walls’ of safety standards are high, but perhaps seem relatively manageable when compared to the challenges railway control systems and their intricate interfaces are to operating railways and organisations. Professional engineering and innovation has an opportunity to deliver the improvements to create a more compelling business case for change, by challenging standards in organisations and exploiting newer technologies before implementation is overtaken by obsolescence. This is not only a challenge for client organisations, so many of our suppliers are global businesses working across industries, innovating and racing to market with the very same technologies that might disrupt rail’s traditional dominant position.

Delivering the future engineers of change

As an institution our challenge is to set our strategy to successfully respond to this changing environment, and whilst every president brings his or her own focus and emphasis to their presidential year, the president also provides continuity of purpose, and that is encapsulated in our five-year strategy (2015-2020) which is nearing its end. If you are not familiar with it, you can find it on the IRSE website, and we must now build upon this strategy, “The Winds of Change” and “Delivering Change” to feed into our new strategy. The existing strategy and its supporting implementation plan address key issues, including:

- Tackling the skills gap facing railway signal, control and communications engineering in many countries.
- Encouraging employers’ support for IRSE activities to help ensure that the Institution’s activities align with the needs of the wider industry.
- Enabling growth of the IRSE as a global Engineering Institution, to promote professional standards throughout the world.

These themes all remain highly relevant to today’s challenges and since the last strategy was set there has been a step change in the awareness of the role of diversity and inclusion. The diversity of our members roles is greater than ever before, as is the diversity of our skill sets and solutions we deliver. The moral imperative for diversity and inclusion is compelling: “People matter, and we all should have equal opportunity to develop, progress, and be rewarded and recognised at work. Organisations must ensure that their people management practices champion this fundamental principle” (CIPD, 2018) [5], but as our industry and the challenges it faces change, its stands to reason that diversity of thought and approach, and hence our people and membership, will be increasingly critical to generate the creativity and innovation required to face the future. But the challenge starts early as illustrated in “Engineering and Economic Growth: A Global View” (Cebr for the Royal Academy of Engineering, 2016) [4]:

In the UK engineering graduates make up only around 0.1% of the population and women only make up 22% of engineering graduates. We cannot expect a diverse workforce solving our future challenges unless we can attract a diverse range of children from all corners of the talent pool into subjects that will inspire and equip them to go on to be the engineers we need to tackle future challenges.

A great example here in the UK is The Transport Infrastructure Skills Strategy, the “Two Years On” report (Strategic Transport Apprenticeship Taskforce, 2018) [7] shows we need 50 000 people in rail by 2033. As shown in the figure overleaf, taken from that report, in the UK we have seen rising numbers of apprenticeships from transport employers, in contrast to the wider national trend in apprenticeship...
numbers this year, a trend we need to ensure is generally continued and specifically for railway control. The report notes that “existing staff will need greater systems engineering, advanced telecoms, software programming and crucially business change skill sets to help fully realise the benefits of a digital railway. Successful development will build upon the industry’s existing capability, and give the opportunity to boost exports”. Engineers delivering change.

But just attracting the people will not be enough and we also need to change the way we are working. We must expect that the way that engineers need to organise to deliver, and hence the skills they need to be equipped with, are also changing. Themes that I am sure will be explored through my coming technical lecture programme including the Danish lecture: Delivering change through the National ERTMS programme in November 2019 and Australian lecture: Delivering metro travel in Sydney in 2020.

Journey into the future

Another great pleasure of being president is the opportunity to recognise and thank all those who have inspired, guided and supported me in my career. There are too many to name everyone, but I am particularly grateful to Eddie Goddard and David Waboso CBE for their inspiration and wisdom as mentors and Mike Brown MVO for his constant support.

I have benefited from a hugely varied career and have taken the opportunities given to me. I am proud to have the opportunity to lead engineering across Transport for London having started there as an apprentice.

The world has always changed relentlessly, but it seems to me that the pace is accelerating. When I started my apprenticeship in 1976, the idea that railways could ever be challenged by other modes on cost, capacity or environmental impact seemed hard to imagine, however today it feels not only possible, but increasingly likely. If we stand behind the traditional walls of safety standards and do not harvest the opportunities that these winds of change present, there is a risk that railways could be rendered obsolete as technological and social transformation goes on without us.

So, our role as engineers is to deliver change as never before and there are so many good examples of engineering stepping up to this exciting challenge. To name but a few examples, we have the UK’s Year of Engineering, the Strategic Transport Apprenticeship Taskforce, the National Skills Academy for Rail, the Women’s Engineering Society, the Future Engineers exhibition at the London Transport Museum (irse.info/a0idv) and indeed my presidential year’s programme of events on Delivering Change. Please get involved and don’t forget the website, live streaming and international lectures as well as your local section.

At the IRSE we have a key role in promoting our profession and in providing the opportunity for those in it to develop their skills, harness the winds of change and continue to deliver change which will benefit society for decades to come. This is a truly worthy cause and one I am honoured to lead this year as your president.

References