



Visionaries 2016

Riding the Rails to the Future

— Expansion in Railway Systems Business —

The role of railway systems in the transportation infrastructure is attracting fresh interest, including major investments anticipated in the construction of high-speed railway systems in various parts of the world. Since it entered the UK railway market, Hitachi has been steadily expanding its operations in that nation, including enhancements to maintenance services, the winning of an order for a traffic management system, and the construction of a new production facility for rolling stock. Hitachi has also been striving in recent years to extend its activities to the global market, particularly countries in Asia, including taking action on standards compliance and developing advanced technologies. Hitachi is seeking to respond to increasingly diverse needs in its role as a general railway systems integrator with an extensive portfolio of technologies.

Achievement of Brand Presence in Europe

Hitachi's railway systems business in the UK, the birthplace of the railway industry, has progressed significantly since the 2000s. It is steadily establishing a foothold, including manufacturing and maintenance services for the Class 395 rolling stock that run on the High Speed 1 line connecting London and the Channel Tunnel, manufacturing and maintenance of rolling stock for the Intercity

Express Programme (IEP), construction of a new production facility for rolling stock, and winning an order for a traffic management system.

The Class 395 rolling stock that entered service in December 2009 were Hitachi's first order in the UK. Development of the rolling stock faced numerous difficulties that arose because of the significant differences between railway standards in Japan and the UK. As the project included a requirement to use parts and consumables produced in Europe,



there were frequent problems with matching these against Japanese-made parts. Nevertheless, thanks to the research and development divisions and factory engineers joining forces to find solutions, the project was completed successfully, with operation commencing about half a year ahead of schedule. Looking back on this time, Akira Horie (COO, Rail Systems Company, Hitachi, Ltd.), who was responsible for the electrical systems on the Class 395, made the following comment.

“I believe this project had a positive impact on the people of the UK and elsewhere in Europe and provided an opportunity for them to gain a tangible appreciation of Hitachi. Overcoming difficulties, the project established brand presence for Hitachi in the European railway market.”

The success of the Class 395 led to Hitachi winning the order for the IEP. A major project of the UK Department for Transport, the IEP will replace



The IEP involves the full replacement of aging rolling stock on the East Coast Main Line (ECML) and Great Western Main Line (GWML), the two main trunk lines in the UK.



Akira Horie

aging rolling stock on main trunk lines. In July 2012, Hitachi formally signed a comprehensive contract with the UK Department for Transport that included providing maintenance services for 27.5 years. Design of the rolling stock commenced in the autumn of that year.

Mr. Horie commented, “The knowledge we gained from the Class 395 fed through to the design of the rolling stock for the IEP. Firstly, we took great care in selecting locally sourced components, giving consideration to the compatibility between parts made in Europe and those made in Japan. Furthermore, to overcome the problem of the delays that would result from the swapping of rolling stock to deal with the fact that the line included both electrified and non-electrified sections, we chose to fit diesel engine generators to the Class 800 rolling stock for the IEP. To deal with the need to reduce noise and vibration when the diesel engine starts up on entering a non-electrified section, staff from Kasado Works and Hitachi Research Laboratory worked on countermeasures by conducting detailed measurements and analysis. Precise estimates of energy consumption were also produced, and the design engineers put a lot of effort into detailed studies of components to reduce their weight and achieve the required fuel consumption performance.”

Thanks to the efforts of a large number of staff, the first pre-production rolling stock for the IEP were completed in January 2015. Operating trials are currently underway, including running on a section of the actual track, in preparation for the commencement of commercial operation in 2017.



The new Rail Vehicle Manufacturing Facility built in Newton Aycliffe, County Durham. The layout is optimized for the production of rolling stock.

Seeking to Achieve Efficient High-quality Production at State-of-the-art Facility

The rolling stock for the IEP will be produced at the new factory in Newton Aycliffe, County Durham. Completed in September 2015, the new factory features a layout that incorporates state-of-the-art just-in-time (JIT) production techniques. In addition to fitting the entire production line into a single building, it is also designed to allow rolling stock without production problems to overtake rolling stock with production problems. This enables production to continue without halting the line if a problem occurs, ensuring that work in progress completes each step fully before proceeding to the next one. Darren Cumner (Manufacturing Plant Manager, Newton Aycliffe, Hitachi Rail Europe Ltd.), who manages operations at the new facility, explained as follows.

“The plant is capable of high levels of efficiency and quality with a smooth flow of products through the single production line where quality management practices have been established for each step in the production process. Utilizing information technology (IT) systems, we are also managing manuals and other documentation such as work standards, quality management, and production records.”

Nevertheless, achieving efficient high-quality production requires more than just a superior factory layout. Every effort is made to foster staff with a sincere approach to craftsmanship and reliable skills.

Mr. Cumner said, “We emphasize Hitachi Founding Spirit, which is based on the Values of “Harmony, Sincerity, and Pioneering Spirit”, and observe the behaviour of staff right from the be-

ginning of the recruitment process. When I was first introduced to these values, I recognized it as something that sets Hitachi apart from everyone else by valuing the dignity of workers. Based on this belief, we provide staff with the opportunity to acquire a high level of awareness in areas like quality improvement and customer satisfaction.”

In addition to nurturing steadfast attitudes, employees are acquiring and practicing advanced skills at a rapid pace, including the technical support from colleagues from the Kasado Works, which serves as a “mother factory.” Pilot production is currently underway, with full-scale production scheduled to commence from April 2016 after process testing.

Rolling Stock Maintenance with Full Use of IT

It is standard practice in the UK for the rolling stock supplier to also handle maintenance. The duration of Hitachi’s maintenance contract for the IEP is 27.5 years, which will have a very large impact in business terms.

This is another area where Hitachi is drawing on its experience from the Class 395. The key to this is use of IT, with progress having been made during the approximately six years since commencing maintenance of the Class 395 on “visualization,” which involves the collection of a wide range of sensor data, including not only data from major equipment but also all sorts of detailed data from peripheral subsystems such as doors and vacuum-insulated switchgear, and its off-board analysis to attribute meaning. Hiroaki Koiwa (Head of Signalling Engineering, Technical, Hitachi Rail Europe Ltd.), who works on rolling stock maintenance in the UK, explained as follows.



Darren Cumner



Hiroaki Koiwa



Through maintenance work on the Class 395, Hitachi has built up know-how about using the data collected by various sensors in efficient work practices.



North Pole Depot completed in March 2015. The construction of four such rolling stock maintenance depots along the ECML and GWML is planned as part of the IEP.

“Status monitoring based on data collection has many benefits, such as identifying the warning signs of faults from the mean open and close times for doors, for example. This use of IT not only helps prevent accidents, it also leads to lower maintenance costs.”

With the addition of bidirectional communications, the transfer of information such as reservations data from wayside to onboard systems is also planned in order to enhance services on the IEP rolling stock. Hitachi has also won an order from Abellio ScotRail of Scotland for the supply and maintenance of standard AT-200 commuter trains, and is looking in the future to build experience from the associated maintenance work and provide the resulting knowledge back to Japan. Predictive diagnostics, in particular, is seen as a key technology.

Mr. Koiwa commented, “Hitachi has a strength in big data analytics, identifying correlations with fault modes in large amounts of collected data and utilizing these in maintenance. I believe that the model whereby we use data analysis to create value by working as a group has applications in numerous fields, not just railways.”

Traffic Management System Incorporating Experience from Lines with High Traffic Density

The UK has also launched a project to improve efficiency by introducing an automated system for traffic management, a function that has been handled manually in the past. Traffic management under the planned system will consolidate roughly 800 signals facilities around the country into 11 sites. As part of this, Hitachi won an order in July 2015 to supply a traffic management system for Thameslink, a main commuting line that runs through London from north to south.

Hitachi supports the management of railway traffic in high-density networks such as those in the Tokyo and Kansai regions of Japan with a level of automation that is higher than anywhere else in the world. This latest order is the result of Hitachi working as a group to offer solutions based on these technologies developed in Japan. Susumu Hasegawa (Executive Chairman, Hitachi Information Control Systems Europe Ltd.), who works on the project, described it as follows.

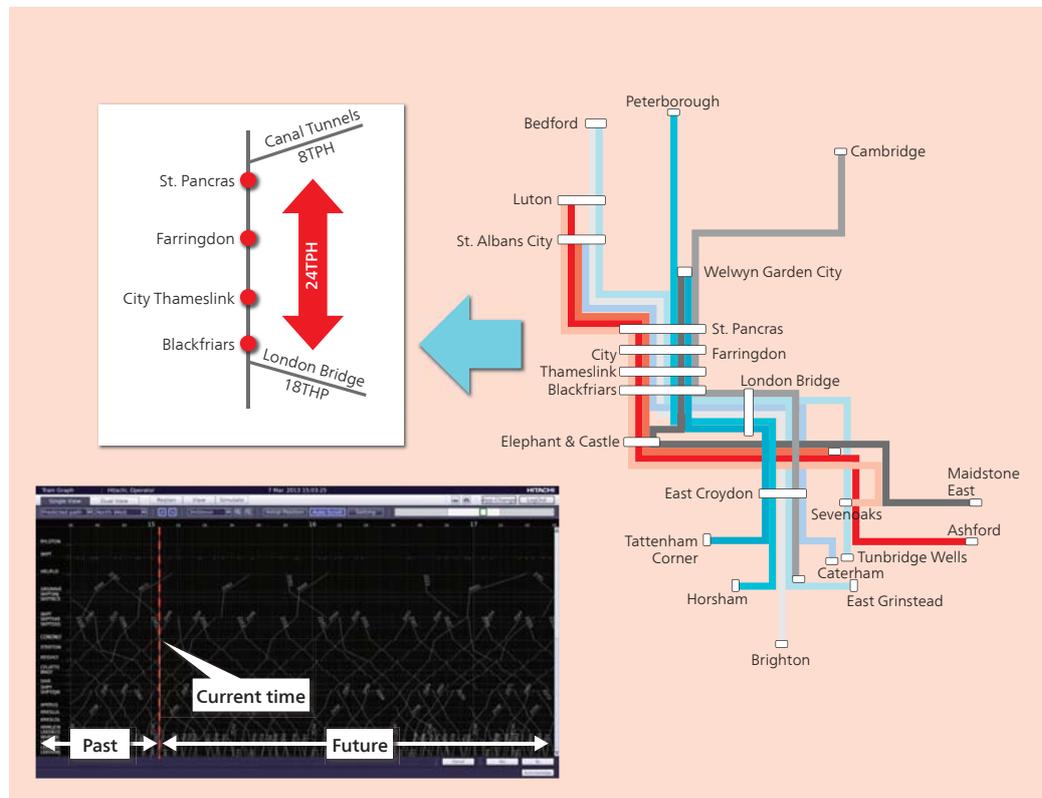
“The line plans to increase train frequency to 24 trains per hour (TPH) in 2018. As Japan excels at managing the operation of open intercity railway lines with high traffic densities, and Hitachi has provided support for this. The customer recognized Hitachi for this experience and other capabilities.”

As the Thameslink line includes a bottleneck where a number of lines converge, one of the challenges is deciding how to prioritize the routing of trains through this area when the schedule becomes disrupted. Hitachi was chosen for its extensive experience in solving such problems. Work is currently underway on finalizing the specifications, with one of the points at issue being how to adapt the Japanese system to the UK.

Mr. Hasegawa observed that, “The differences in thinking on safety are particularly important. Whereas the approach in Japan is to provide infrastructure to ensure safety based on a philosophy of prevention being better than cure, the tendency in the UK is to leave infrastructure as it is and ensure safety by establishing ways of dealing with it. Traffic management during schedule disruptions requires detailed consideration.”



Susumu Hasegawa



Outline of operation of the traffic management system for the Thameslink line. The system features train graphs that display train status and scheduled movements over a wide area. While complex control is required for the Thameslink Core Area bottleneck, the train graphs support decision-making by operators and optimize operation of the entire line.

System delivery is scheduled for 2017, with operation to commence in stages. Based on its experience in the UK, Hitachi aims to expand into the entire European market and to deploy passenger service and other information systems that use the traffic management system as a core. By incorporating functions that integrate with the European Train Control System (ETCS) and other signaling systems, Hitachi is also looking to provide systems that improve energy efficiency and take greater account of the environment.

Expansion into Global Market

Hitachi's railway systems business has been expanding into Asia in recent years, including Singapore, India, and Myanmar. Mr. Horie recounted progress on developing the global market as follows.

“When work on developing the global market got underway in earnest from around 2008, there were two hurdles that we needed to overcome, namely catching up with the European wireless technology used for signaling and complying with Europe's strict safety certification. Obtaining safety certification was particularly difficult, with it taking several years just to understand the standards and acquire detailed design information.”

One of the outcomes of overcoming these difficulties was signals business for a new freight

line between Delhi and Mumbai in India funded through a yen loan. Hiroyuki Hara (General Manager, Rail Systems Company, Hitachi India Pvt. Ltd.), who worked on the project in India, explained as follows.

“While India is a major railway nation with a total length of track said to extend 64,000 km, poor efficiency due to freight, commuter, and long-distance services sharing the same track is a significant problem. To improve the situation, an efficiency improvement project is underway to expedite freight services by shifting them to a new line, with Hitachi supplying a complete signaling system.”

The aim is to perform train management, ensure safety, and boost the efficiency of operations by installing electronic interlock systems, automatic train control systems, and traffic management systems like those in Japan.

“We intend to use the project as a beachhead and also get involved in conventional lines,” added Mr. Hara.

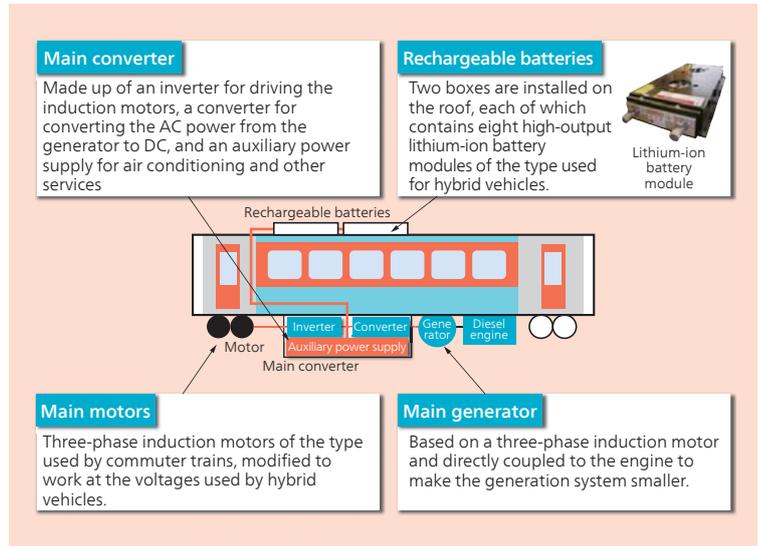
The problem with this is cost, and while the need is to build reasonable systems (in terms of cost) utilizing Indian-made components, subsequent global business opportunities are also in prospect. Hitachi has brought Ansaldo STS S.p.A, an Italian company with strengths in signaling technology,



Hiroyuki Hara



Planned route for new freight line between Delhi and Mumbai. Nearby, regional development schemes are being undertaken to provide predominantly privately funded infrastructure such as industrial complexes, distribution centers, and power plants.



Traction drive system and auxiliary power supply for hybrid rolling stock. The technology is seen as having widespread applications for reducing the environmental load of rolling stock that runs on non-electrified track.

into the group, and is seeking to expand its engineering business into other Asian countries from this base in India by utilizing its network and with participation by skilled Indian engineers.

The development of technology based on the diverse needs of the global market is also taking place for rolling stock. One example is how Hitachi has led the world in developing rolling stock with hybrid drive systems that combine lithium-ion batteries with diesel engines. Takashi Kaneko (Senior Engineer, Rolling Stock Electrical Systems Design Dept., Rail Systems Company, Hitachi, Ltd.), who was involved in this development, commented that, “We have been working on joint development with East Japan Railway Company and already have 29 units in operation in Japan running on non-electrified track. I believe it was Hitachi’s having battery technology it had built up over time that made this possible.”

Hitachi is also developing a battery-powered train (without a diesel engine) that runs on non-electrified track using power that is drawn from the overhead lines while on electrified track and stored in the batteries. All of these have widespread applications as technologies for reducing the environmental load of rolling stock that runs on non-electrified track.

Working toward Railway Systems that Satisfy Diverse Needs

One of the initiatives undertaken by Hitachi that demonstrates its role as a general railway systems integrator was the Ho Chi Minh City Urban Rail-

way Construction Project for which the contract was signed in June 2013. The contract involves a total of 11 different subsystems and a five-year maintenance service, covering many different areas in addition to rolling stock, including signaling systems, communication systems, electric power systems, ticket gates and vending machines, and platform screen doors. The project demands close collaboration with other organizations, including local government agencies and the construction company responsible for the civil engineering work, and Hitachi was also assisted by a Japanese railway company.

Mr. Horie commented that, “Topics for future railway system development are likely to include extensive use of wireless technology, automatic operation, the elimination of catenaries, use of IT, and improvements to information services. Our aim is to pursue business throughout the world by supplying solutions that are finely tailored to the various conditions that apply in different countries around the world, while also making use of open innovation practices.”

The value of railways has been under revision in recent years as a form of infrastructure for linking cities where there has been a rapid concentration of population, and as a means of transportation that places a low load on the environment. Furthermore, the more demand rises around the world, the greater the diversity of solutions sought by different regions. Hitachi’s endeavors will continue, targeting the form that transportation infrastructure should take in the future.



Takashi Kaneko