

VTEC's HSTs: life begins again at 40

Virgin Trains East Coast's £4.5 million refurbishment and overhaul of its High Speed Train fleet could be the final revamp for the workhorses as they approach 40 years' service and replacement by IEP trains. PAUL STEPHEN reports

RAIL Photography: PAUL BIGLAND

Forty years ago, one of the most iconic trains to ever grace the UK rail network first entered service. Designed by British Rail's technical centre at Derby, the Class 43 HST remains to this day the world's fastest diesel fleet with a 125mph maximum operating speed.

Much has already been written about the Class 43s' technical prowess and longevity, given that all but three of the 197 power cars built between 1975 and 1982 are still in full service in 2016.

Yet a cash-strapped British Rail had actually conceived the HSTs as a temporary fix between its most powerful main line locomotives (the Deltic had a top speed of 100mph) and the wider rollout of electrification once funding could be secured at a later date.

The trains' launch in October 1976 under the InterCity brand was accompanied by a memorable marketing campaign heralding that the 'age of the train' had arrived for passengers, and that they would benefit from the reduced journey times afforded by the faster power cars, and from the superior levels of comfort that could be enjoyed in the newly-built air-conditioned and spacious Mk 3 coaches.

In the post-privatisation era, that age is still here for a number of operators - including Great Western Railway (GWR) and East Midlands Trains (EMT), for whom the HST remains a key part of their fleets until electrification and new trains are finally

delivered on these arterial routes out of London within the next decade.

Electrification duly arrived on the East Coast Main Line between London and Edinburgh by 1991, along with a new fleet of 30 Class 91 electric trains. However, current operator Virgin Trains East Coast retains 15 HSTs (30 power cars plus two in reserve) to serve its routes 'off the wires' between King's Cross and far-flung destinations including Aberdeen, Inverness, Lincoln, Hull and Harrogate. Grand Central, CrossCountry and Network Rail lease the remaining HSTs.

The prototype HST 41001, delivered in 1972, is owned by the National Railway Museum and managed by the 125 Group, and is currently based at the Great Central Railway (Nottingham).

Unsurprisingly the fleet has required a great deal of technical and cosmetic improvement over the years to keep it running an intensive, high-speed service, and to offer an acceptable standard of travel for today's passengers.

By the turn of the century HST power cars had begun to develop an unwanted reputation for mechanical failure, and their original Paxman Valenta engines - renowned for belching thick smoke during acceleration and scaring small children with their high-pitched screaming noise - had to go. These have now been replaced by quieter and more fuel-efficient MTU 4000 series engines in all the '43s', bar the 24 power cars leased by EMT that are equipped with Paxman VP185s.



Power car 43308 sits in front of the rest of EC57 - the fourth HST to undergo refurbishment.



Inside the cab of 43257, which has recently undergone engine overhaul at Craigentenny. The power car entered service in July 1977.



At Craigentenny depot, Standard Class seats are stacked up, ready for unpacking and installation on EC57.

Between 2001 and 2006, GNER (then operator of trains along the ECML) embarked on its 'Project Mallard' to fit new interiors into its entire fleet of Class 91s and Class 43s. Other HST operators have followed suit, and a year later First Great Western updated its fleet of 52 HSTs and 400 carriages with new interiors and power sockets at Bombardier in Derby. WiFi is now also available throughout.

After taking over the East Coast franchise in March 2015, it is now the turn of Virgin Trains East Coast (VTEC) to spruce up its ageing

HSTs, as part of Project 21.

Announced in November 2015, the project entails £21 million being spent on VTEC's 30 Class 91 sets and 15 HSTs, to overhaul all 401 carriages and introduce Virgin Trains brand colours. Of that £21m, £4.5m has been allocated to exclusively refurbishing the HSTs. VTEC has also announced it is spending £16m on a separate project to re-engine all its HST power cars, now that the newer MTU engines have reached the 50,000-hour overhaul mark.

This is potentially a landmark occasion in the

“ The objective is that when the train leaves the depot for the last time it will be in top condition, and people will ask ‘why are you getting rid of them?’ ”

John Doughty, Engineering Director, Virgin Trains East Coast

illustrious story of the HST, and could prove to be the last major refurbishment undertaken by an operator before these trains reach the end of their lives.

That's because their future beyond 2020 is largely unknown. By that time both VTEC and GWR will have dispensed with the HST in favour of Hitachi's Super Express Trains that are being delivered under the Department for Transport's £6 billion Intercity Express Programme (IEP).

ScotRail has committed to taking 27 HSTs from 2017/18, leaving the remaining 47 currently leased by GWR and VTEC unaccounted for. EMT will dispense with its HSTs at a later date, now that Network Rail has committed to electrifying the Midland Main Line.

There is little doubt that mechanically ➔

► the HSTs will continue to be in serviceable condition, and could still offer many more years of productive service for other operators. However, considerable expense will be required to make all sets compliant with PRM-TSI (Persons of Reduced Mobility - Technical Standard for Interoperability) regulations by the start of 2020. This will require the fitting of power doors to replace existing slam doors, universal toilets, passenger information systems and call-for-aid alarms. Wheelchair spaces are also required, as well as the conversion of existing toilets to controlled emissions toilets, to bring the vehicles fully up-to-date.

In the meantime, VTEC's refurbishment programme is now in full swing, and five enhanced HSTs have already re-entered service. To see the programme in action and to experience the finished result first hand, RAIL was invited to VTEC's HST base at Craigentenny (Edinburgh), before travelling home on the first set to be released back into traffic last December.

Located three miles east of Edinburgh Waverley in the Mountcastle/Portobello area of the Scottish capital, Craigentenny celebrated its centenary year of operation in 2014. Its association with HSTs began in 1978, when British Rail modernised the depot to service and maintain the HSTs allocated to the East Coast route.

Now run by VTEC, it also provides services for HSTs leased by CrossCountry, Grand Central and Network Rail, plus light maintenance for VTEC's 225 fleet. It also maintains Caledonian Sleeper's six Class 73s, and a wheel lathe facility is available to all operators.

In addition to cleaning and fuelling, power cars receive E, F and G exams at Craigentenny, and coaches undergo routine C4 and C6 examinations.

HST re-engining is also performed on site using heavy lifting equipment, although components are sent away for overhaul

HST power car fleet allocations

Great Western Railway	119
Network Rail	3
East Midlands Trains	24
Virgin Trains East Coast	32
Grand Central	6
CrossCountry	10
Scrapped*	3

*Power cars scrapped after crashes at Southall (1997), Ladbroke Grove (1999) and Ufton Nervet (2004).

Source: The 125 Group

to individual suppliers, including MTU in Germany.

At the depot RAIL meets VTEC Engineering Director John Doughty, who is responsible for all the operator's depots and the 570 employees based across them.

He explains: "I'm based in York, but I'm usually at Craigentenny about once a week, and at Bounds Green (in north London) once a week. Bounds Green is two locations really - the main depot for the '91s' and Ferme Park, which is more of a stabling point where trains just go overnight.

"We have those two depots but also Aberdeen Clayhills, which has some carriage sidings and looks after HSTs overnight. But all heavy maintenance for HSTs goes on here at Craigentenny.

"We also have contracts to buy in maintenance. For example, some of our trains go to Inverness, and we have a contract with ScotRail for access to their depot. There are lots of others, too, with EMT and Neville Hill, and access to Newcastle and Kirkcaldy."

The engineering and maintenance structure of Virgin Trains' East Coast operation is very different to its West Coast operation, which is completely contracted out to Alstom for its much newer Pendolino fleet, and to Alstom/

Bombardier for its Voyager family. The West Coast fleet is the larger of the two, with 46 Pendolinos running a day and 18 Super Voyagers, but the East Coast will catch up with the arrival of the IEP, which will be bi-modal to run on electrified and non-electrified parts of VTEC's network.

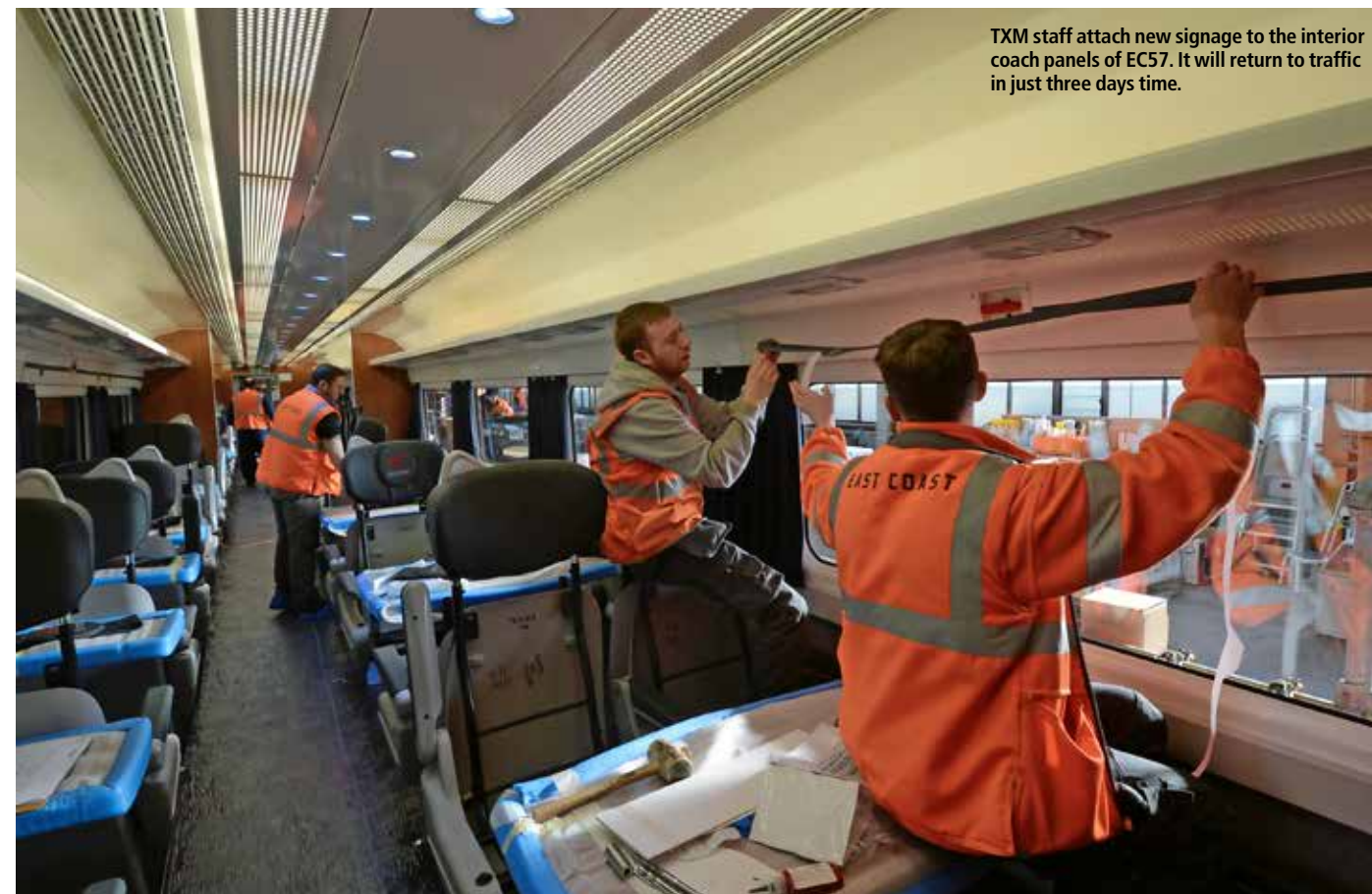
Although VTEC says it does not require any additional stock, the extra services it has committed to running from May will bring an added pressure to its existing fleet, making sure there is no let-up for the HSTs in their last years of service on the ECML.

From May 16 the operator will be running four more services from London to Edinburgh each way Monday to Friday, primarily by extending services that currently terminate at Newcastle. This will bring the service frequency from Edinburgh on the ECML to one departure every 30 minutes for most of the day, fulfilling VTEC's franchise commitment to introduce extra services between London and Scotland.

"We will have 65 IEPs instead of the 45 trains we have now," says Doughty. "Some of those are half-trains, but it is still a significant number of extra trains. And dependent on if we get the paths, our plan is to retain six of the '91' sets. The first IEP will be in passenger service in August 2018, and the last one in around March 2020.

"At the moment we run a service which is basically five trains per hour from King's Cross. That will become six by 2020, when we start running services to Middlesbrough and a more regular service to Lincoln. We've started running one train per day to Sunderland and extended one of the Edinburgh services to Stirling, so there is only a certain amount we can do now and a certain amount reliant on having a bigger fleet."

With VTEC only two years away from accepting the first IEP, at which point it will begin handing back its entire HST fleet to owners Eversholt, Porterbrook and Angel by December 2019, what is the business case for



TXM staff attach new signage to the interior coach panels of EC57. It will return to traffic in just three days time.

spending millions of pounds on Project 21?

Doughty replies that it forms a key part of the franchise commitment to offer additional passenger benefits, while they are also needed to generate revenue on the extra services VTEC will operate.

He adds that each VTEC HST accumulates over 300,000 miles a year by undertaking some of the longest diagrams in the country (from London to Inverness and Aberdeen), putting the fleet ahead of its rivals for endurance. The average diagram per HST on Monday to Friday is 1,012 miles, and it is almost 800 miles at weekends, implying that such heavy use increases the frequency that overhauls are required. The VTEC fleet is also the only one to pull nine-car trains nationally, further adding to the strain.

"When the current fleet finishes we will hand it back to the rolling stock companies. There are no definitive plans for after then, but I would be surprised if there weren't any operators to come forward as the fleet will be in top condition. It won't be a fleet falling on its knees, but will arguably be in a better condition than it ever has been because of the work we are undertaking.

"I worked on the VTEC franchise bid, and

investing in the HSTs was something we looked at. We couldn't take the view not to spend anything on them and let them get worse, because that doesn't fit in with the customer experience we want to provide.

"The existing trains are still forming the best part of half of our franchise period [ending on March 31 2023], so we considered that we couldn't allow them to deteriorate because it would have had a negative impact on the customer experience. The objective is that when the train leaves the depot for the last time it will be in top condition, and people will ask 'why are you getting rid of them?' So it is vital that we do this to provide what we consider an acceptable level of customer experience.

"The last time the HSTs had a refurb was the Mallard project, which was completed in 2007/2008. We are talking eight or nine years ago, which is the sort of life you would expect for an interior before it starts to look weary."

His view is echoed by VTEC Managing Director David Horne, who insists that investment in the HST fleet is vital because of the flexibility it offers the operator beyond the extent of ECML electrification. It is also part of VTEC's business strategy to grow patronage

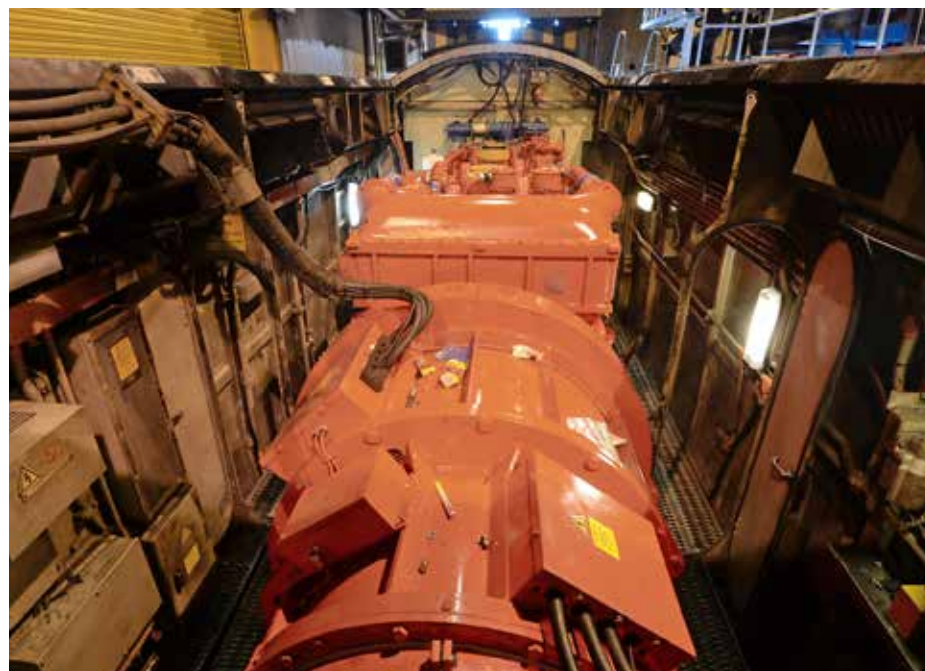
on these routes prior to the introduction of IEP (which will be able to carry 18% more passengers than the HST) by bringing additional customer benefits. As part of an ambitious franchise bid, Horne says it was simply not an option to rest on their laurels and wait for new trains to arrive.

"HSTs remain core to our fleet," he says. "They are critical to when we have engineering work diversions on the ECML, and in recent weekends we've seen them fully deployed so that we can provide as many services as possible via non-electrified diversionary routes, minimising the need to put customers in rail replacement buses.

"Without them we could not offer the direct services between Harrogate, Lincoln, Hull, Aberdeen, Inverness and London, plus the two extended routes we launched in December 2015 from Stirling and Sunderland to London.

"We decided that we could not wait until IEP to improve the experience we offer to our customers. I saw for myself when we took the first HST apart at Craigentenny before Christmas just how so many years of wear and tear were having an impact on the passenger environment. It's many years since these trains have had this level of work done to them, and you can see and feel that in terms of how the trains are presented today. This investment is important in growing the business ahead of IEP."

Before RAIL is shown the fourth HST set (EC57) to receive Project 21 treatment nearing the end of its refurbishment at Craigentenny, Doughty explains what the project brief was and the timeline for completion. Each ►



Above: Craigentenny depot marked its centenary year in 2014. The depot will service the new IEP fleet from 2018.

Left: An overhauled MTU 16V 4000 engine, freshly returned to Craigentenny from Magdeburg (Germany), where it was remanufactured by MTU.

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David Horne, Managing Director, Virgin Trains East Coast



1. Fixtures and fittings in all on-board toilets have been repainted, and new floor coverings laid.



Know your HST power car

Transmission: Diesel electric
Builder: BREL Crewe Works (1975-1982)
Total power cars built: 197
Weight: 70 tonnes
Power: 1,320kW at rail
Engine: MTU V16 4000 (originally Paxman Valenta)
Length: 17.364m
Width: 2.74m
Height: 3.906m
Maximum speed: 125mph
Maximum recorded speed: 148mph
Source: Porterbrook

► set should take less than two weeks to finish, although the final two of the 15 will take longer as they are ex-EMT and therefore have an older interior (they were not inherited from GNER and thus a recipient of Mallard refurbishment).

"The intention was for it to be a light refresh, but the scale of the work we have undertaken is more than you might expect. The sets look very different, contemporary and modern. We learned some lessons from the first set back in traffic [EC61], which we didn't quite get right, but overall it's looking pretty good.

"In terms of design, this is something tailored to the route. For instance, on the Great Western route there is a high proportion of customers on short-distance routes such as Oxford to London. The type of customer environment you need for that will be very different to the environment you need from London to Inverness, where you perhaps pay more attention to toilets, so our refresh is tailored to a longer-distance route and with what our customers would like.

"There's new seating in First and Standard Class, lots of new finishes, and we've brightened up the toilet areas with new pictures. We've also done some modifications to the universal access toilet doors, after much publicised occasions when the door opened because people didn't know how to lock them. There's new carpet throughout, which is a significant amount of work considering the amount of money we're spending (£4.5m).

"We want to have all the HSTs done by the autumn, and the Class 91 plan finishes in early 2017. We have to be careful after May, with withdrawing units from traffic during the new timetable and delivering our refresh at the same time."

“ Everything here is set up to get the job done as quickly as possible. People said that 21 days would be impossible, and we've got it down to 11.”

Phil Buck, Head of Fleet 125, Craightinny Depot

► EC61 was the first set to undergo refurbishment, being released back into traffic on December 31 2015. The time it takes to refurbish each nine-car set has been getting progressively quicker, with EC63 taking 20 days, EC51 13 days and EC57 just 11. EC60 is the latest set to return to traffic (March 6), and the target completion date for all 15 sets is by this September.

RAIL is shown around the depot by Phil Buck (Head of Fleet 125) and Paul Charles (Project 21's project manager). Operation of Craightinny will pass to Hitachi in August 2018, and work has begun to convert the depot to accept the first IEPs. Concrete foundations are currently being laid for a £5m carriage wash, track renewal will also be required, as will modification to the overhead wires and a new fuel delivery system. VTEC will become a customer at this time, and Hitachi is likely to retain the depot's HST handling facilities to offer servicing to operators including ScotRail.

One of three 265-metre roads in Craightinny's servicing shed has been set aside for Project 21, with ample vehicular access for just-in-time delivery of new fittings and for disposal of the old. VTEC has hired 41 contractors from TXM Group to complete the work, while many of the suppliers and

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John Doughty, Engineering Director, Virgin Trains East Coast

materials are resourced from within the UK to minimise transport time.

Leather for the newly upholstered seats in First Class is supplied by Andrew Muirhead in Glasgow, the powder-coating and painting of seat parts is conducted by Euro Spray in Fife, while Standard Class seat covers come from Sheffield and the carpets from Ripley (Derbyshire).

TXM's staff work in four teams in eight- to 12-hour shifts, taking two coaches per team, and with an additional team member working in First Class.

“Everything here is set up to get the job done as quickly as possible,” says Buck. “People said that 21 days would be impossible, and we’ve got it down to 11.

“Historically under BR this was a level four depot and the HSTs would have gone away to main works, but we undertake our own

work now. That’s one of the reasons we’re able to deliver a high rate of availability - 93%. Normally we only have one set out of traffic for maintenance or overhauls.

“Doing the refurb here avoids moving them to Wabtec or Bombardier and lost days. With our project we don’t lose control of the process, by keeping it in-house.”

RAIL steps aboard the train into a Standard Class coach that is in the latter stages of completion, having been stripped out eight or nine days previously.

The universal access toilets throughout the train now feature new shiny floor coatings and large murals of picturesque Scottish vistas. The new door control system includes a voice message telling passengers when the door is locked and unlocked.

“Since the first set, we’ve paid more attention to the toilets,” says Buck. “We’ve re-coated

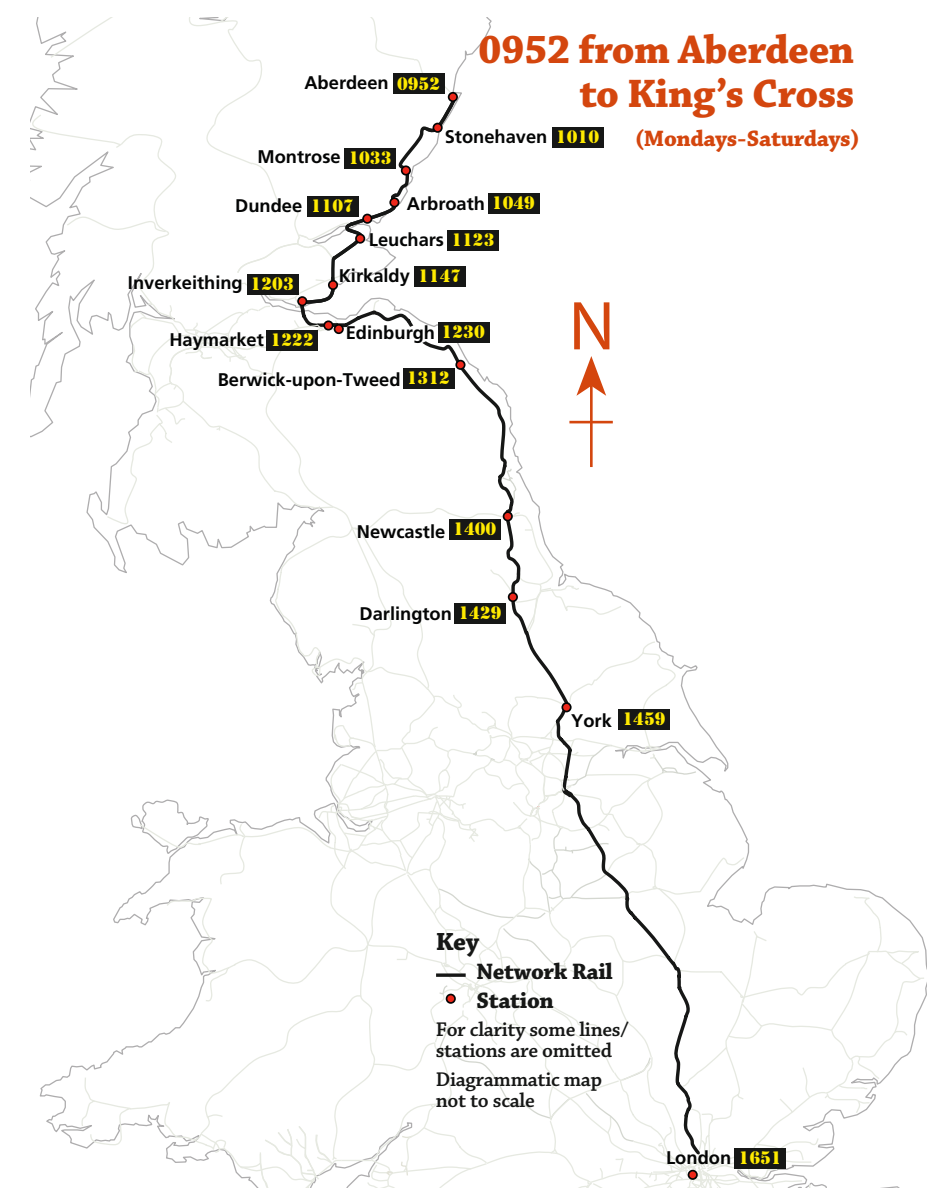
most of the components and installed new toilet seats, because the attention to detail in the first one was not good enough. There’s a different picture now in every toilet.”

A new thicker pile carpet lies in the vestibule areas, which is sufficiently abrasive to scrape the dirt from shoes before entering the saloon area.

In the saloon, the lighting strips installed during the Mallard project remain, but they have been extensively cleaned to remove the yellow tint that sometimes affected the levels of light in these coaches. Interior panels removed to install new power sockets have been cleaned and repainted white before being bolted back in.

Gone are the old seats, replaced with new ones in Virgin red colours, supported by the old seat frames and arms that are newly repainted. There is little in the way of Virgin branding, because of the short amount of time these coaches will remain in VT service, although the Virgin name does appear on route maps and other signage stuck to the doorway bulkheads.

Moving through to First Class, again there are new carpets and repainted side panels throughout. This time the seats have been replaced with leather, and the Virgin name is



Passengers find the few spare seats remaining on EC61, as it departs Edinburgh with the heavily reserved 1230 service to London King's Cross.



now present via removable leather bands on the headrests, making de-branding an easy job on handback. The tables have received new table-tops, and the legs have been powder-coated grey.

It is impressive that the coaches can be completely stripped, modifications made and a deep clean applied in only 11 days. TXM Group Engineering Director Bryan Bennett is delighted with the pace and quality of the project, telling RAIL: “When you look at an unrefurbished HST, it’s like night and day. Initially the plan was for six weeks per unit, but that didn’t fit in with VTEC’s new timetable, so we upscaled the manpower from 24 to 41.

“To turn a nine-car set around in 11 days without reducing quality is unheard of in the industry, and the fact they are old units adds to the complexity. This is the most complex job we’ve done, but one of the most satisfying. The standard of work going out is very pleasing, and the units look a lot brighter. We move from strength to strength.”

It’s time to gauge the effects of the refurbishment on a set back in public service, and so RAIL heads north to Aberdeen for a night’s sleep before joining the 0952 departure

for King’s Cross the following morning. At over 523 miles and a scheduled journey time of six hours and 59 minutes, there’s plenty of time to take in the new customer environment and assess its visual impacts.

Power for the nine-car train comes from 43272 and 43306 on the rear, which had formed the 1400 King’s Cross-Aberdeen the previous day. It is one of four HST departures from Aberdeen, with three running to London and the last to Leeds.

The light-coloured internal livery helps the Mk 3 coaches look bright and spacious, while the new seat number signage (a continuous band running the length of the carriage at head height) makes seat reservations easy to find. The seat frames have not been changed, so there is no problem with legroom. In Standard Class the deep-cleaned flip tables (which so often let down the interior cleanliness of trains) is apparent, while many on the heavily loaded departure make use of the new power sockets for laptops and mobile phones.

At Dundee, RAIL is treated to a cab ride until Edinburgh, along some of the most scenic parts of the route and the mighty bridges



Phil Buck, VTEC's Head of Fleet 125, and Paul Charles, Project Manager of Project 21, oversee the refurbishment work being carried out by 41 contractors from TXM Group.

→ crossing the Tay and the Firth of Forth. This presents an unmissable opportunity to ask the driver what he thinks about driving these 40-year-old workhorses and the prospect of IEPs.

Steve Mitchell, from Rosyth, is one of VTEC's 332 drivers, all of whom are qualified to drive both HSTs and '91s'. He has been driving the East Coast route for the past 15 years, and before that spent 12 years with ScotRail.

"I'll miss the HSTs when they're gone. They feel like they're doing some work and are so reliable for their age. It looks like a high-speed train should do.

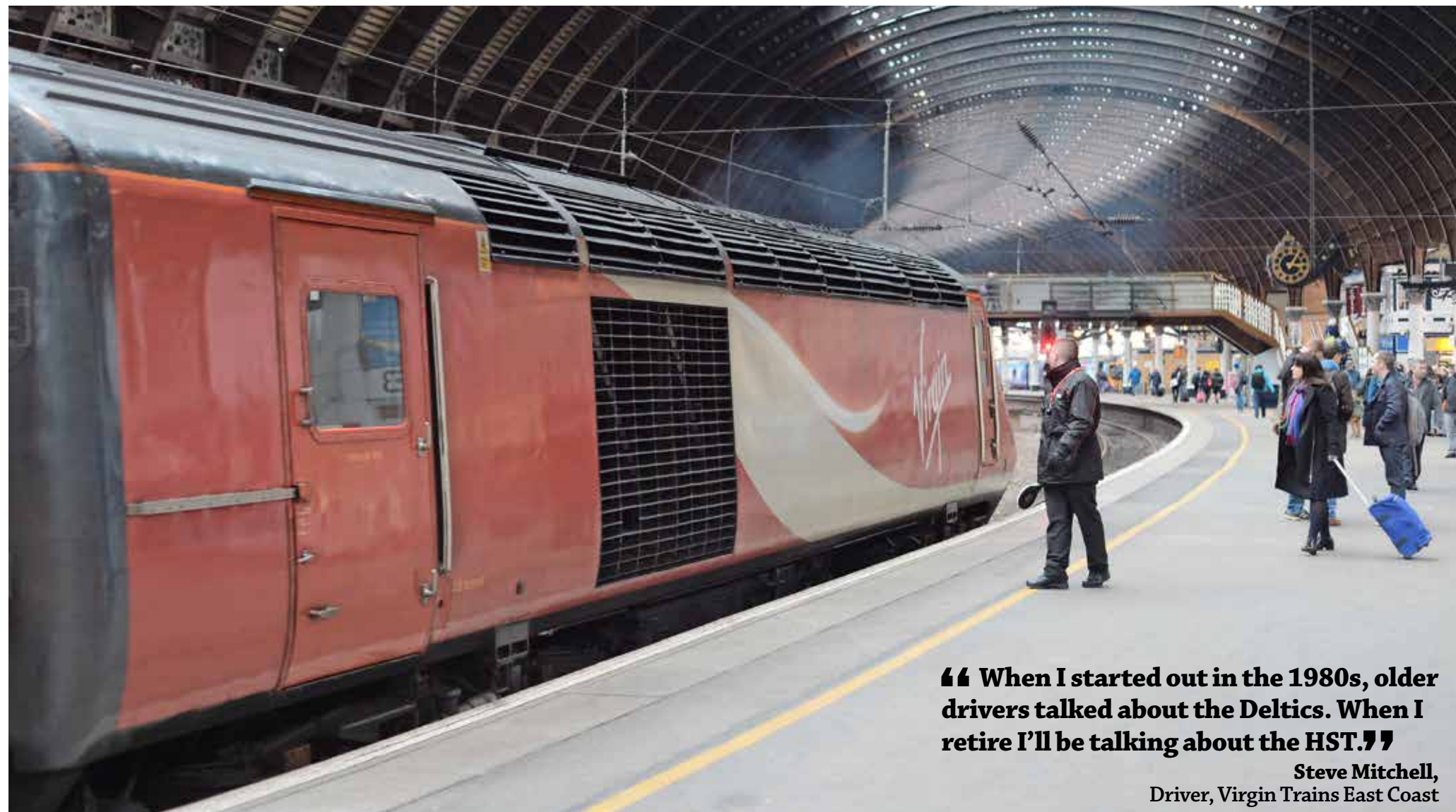
"It will always get you home, even if we lose one of the engines. The '91s' have a single point of failure at the pantograph, but we can switch engines if we drop one.

"You also want to be in one of these during high winds. It doesn't get any of the speed restrictions like the '91' [due to the added stress on overhead wires and the risk of wire

entanglement in the pantograph].

"I might like the IEP when I see it, but like anything new it will be strange at first and really simple to drive, like a giant Sprinter. When I started out in the 1980s, older drivers talked about the Deltics. When I retire I'll be talking about the HST."

The primary difference to the HSTs will be the replacement of separate power and brake sticks by a single combined control stick. The IEP will also be more responsive, requiring less time to build up power when moving off (thus further altering the driving experience). The IEP will also be bi-modal, avoiding the prospect of speed restrictions in high winds and providing diesel and electrical power sources should one be unavailable. The noise in the cab will also be much less, as diesel



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**Steve Mitchell,
Driver, Virgin Trains East Coast**

EC61 makes it way across the spectacular 2½-mile Tay Bridge, built adjacent to the piles of the first rail crossing that collapsed here on December 28 1879, claiming 75 lives.



VTEC 43306 prepares to leave York, forming the rear of EC61 on its non-stop run to London King's Cross.

generators are located beneath carriage frames, and not in power cars at either end.

Also in the cab Head of Operational Delivery Paul Lyon explains: "The IEP has lots of systems to assist the driver that we don't currently have. Acceleration is not the HST's strongpoint, but it's a grafter and really gallops when it gets going. They are hauling their heaviest loads ever, in their most intensive service. There are no easy jobs for the HST."

It is easier to appreciate the relative age of the HST when sitting in the cab. 43272 was introduced in December 1977 and is largely unchanged from its original design, with modifications bolted on to enhance its capabilities over the ensuing decades.

A forward-facing CCTV box sits on the drivers' desk, with other newer inventions including the OTMR box, GSM-R signalling equipment, Automatic Warning System and Timetable Advisory System (TAS), which gives the driver on-screen alerts at a distance of 4km (2.5 miles) and then 2km from station stops, tracking the performance of the train against its schedule.

At Edinburgh and Newcastle the train takes on more passengers. All available seats are filled and many have to stand. It's the Friday of half-term, and large groups of children and families do their best to settle, giving little thought to the refurbished interior surrounding them.

It's perhaps unwise to trouble those in the busiest coaches for their thoughts on the new

seats, when such a great many are unable to avail themselves of this convenience. Equally, those taken to sitting on the carpet look sufficiently uncomfortable, without RAIL asking them to venture an opinion on its aesthetics.

A small child drops crisps within the deep-piled floor of the vestibule area, and pulverises them with his feet in an action likely to draw despair from Messrs Buck and Charles back at Craightenny.

This serves to demonstrate the level of punishment that this hardy fleet of HSTs continues to take on a regular basis, more than vindicating VTEC's decision to improve their condition before phasing them out.

Despite the incremental improvements made to the customer experience, the HSTs are reaching their limitations for further modification as they enter their fifth decade of service.

We seem certain to see them in continued service beyond 2020, not only with ScotRail but also with other operators, but their time carrying passengers up and down the route of the *Flying Scotsman* is now almost up. Will we see the same level of affection for IEPs in 40 years' time? ■

Passenger seat reservations

0952 Aberdeen-King's Cross, February 19

Aberdeen	205
Stonehaven	10
Montrose	26
Arbroath	12
Dundee	91
Leuchars	33
Kirkcaldy	13
Inverkeithing	7
Haymarket	18
Edinburgh	144
Berwick-upon-Tweed	7
Newcastle	168
Darlington	18
York	58